AUSTRALIAN
GROWER
2023 SPRING
VEGETABLES / POTATOES / ONIONS

Meet 2023 Hort Connection winners

Spinach – from seed to salad
Global Coalition for better fresh produce
Nutrition for better onion outcomes

AUSVEG
Empowering growers with Research, Insights and Innovation
PARTNERING WITH Hort Innovation · National Vegetable Extension Network · POTATO LINK Australian Potato Industry Extension Project

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3.0m - 6.0m Working Widths

VEGETABLE PLANTERS
2.5m - 6.5m Working Widths

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The projects National Vegetable Industry Communications Program (VG22000) and Accelerating the adoption of best management practices for the Australian onion industry (VN21000) are strategic levy investments under the Hort Innovation Vegetable and Onion Funds. Communication of research and development projects has been funded by Hort Innovation using the vegetable and onion research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture. *Australian Grower* is produced by AUSVEG Ltd and is free for all national vegetable levy payers.

AUSVEG WOULD LIKE TO THANK ITS LEAD STRATEGIC PARTNERS

syngenta

CORTEVA agriscience

Cover. Winner of the *2023 Horticulture Excellence Awards, Grower of the Year,* is Pirrone Bros based in Queensland. *See Page 20. Photo Andrew Beveridge.*

Australian Grower is the consolidated magazine comprising Potatoes Australia and Vegetables Australia, which was the most widely distributed magazine in Australian horticulture in the most recent reporting period.

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From the Editor

The signs of spring are in the air, with many growers turning attention to planting for the warmer months in the south, while in the north looking toward harvest ahead of the wet season.

This issue, the second as *Australian Grower,* we focus on spinach on the back of the 10th Spinach Conference held earlier in the year. We asked the questions: what are consumers looking for with spinach, what are the grower and production challenges and what potential is there for export?

Our continued commitment to bring information on vegetables, potatoes and onions continues with the results of the next milestone in onion basal rot and information on soil borne diseases.

For potatoes, we spoke at length with the Spud Sisters – an effervescent pair of women who show there is more to potatoes than meets the eye. Be sure to watch the video of our chat; you can't help being swept up in their enthusiasm.

The new format for the industry magazine continues to be accepted by industry and the material continues to grow in volume and quality. I hope that it provides you with an interesting and informative read.

The highlight for this issue is of course, Hort Connections. We bring you the results and have a chat with a couple of the Horticulture Awards for Excellence 2023 winners, as well as covering some of the speaker presentations. For those who attended, it proved to be an excellent opportunity to learn and network. My first experience of Hort Connections, it was amazing to see so many in the industry come together.

Happy reading and stay safe.
Deborah

Message from the Chair

The recent announcement of the merger between AUSVEG and Onions Australia concludes an extensive process to bring the two organisations together that will give onion growers a stronger voice and expand AUSVEG's representative footprint.

Having Onions Australia merge with AUSVEG marks a new era of growth and opportunity for the Australian onion industry, providing a robust platform for the future success of onion growers and the broader onion sector through its alignment with the broader vegetable sector.

The aim of the merger is to give onion growers, and the broader onion sector, a bigger platform from which to strengthen their future. As a result of the merger, onion growers will benefit from greater access to government and increased access to services in public affairs, as well as assistance from AUSVEG's team of experts across biosecurity, communications and extension, export development and event management.

AUSVEG is eager to ensure that the hard work and legacy of those who have been integral to the success of the onion industry so far is also acknowledged and continued to the celebrated by AUSVEG.

I would like to thank the Onions Australia Executive Committee for its assistance and cooperation moving through this process, and welcome members and onion growers to the AUSVEG family. I encourage all onion growers who want to learn more about the work that AUSVEG does to reach out to the team.

It was heart-warming to see so many growers make the journey to Hort Connections in June for our biggest ever event to date, with the largest range of speakers, exhibitors and networking opportunities for growers and the wider industry.

A special congratulations goes out to all the Horticulture Awards for Excellence winners and nominees, who were recognised by their peers for their efforts in their field, and contribution to our industry.

While AUSVEG is well-governed by its Grower Directors, the organisation also relies on its Skills-based Directors for advice and guidance. Many of you will know Simon Bolles, whose tenure on the AUSVEG Board concluded in July after eight years in the role. Simon was a trusted advisor on the Board, providing support and knowledge in leadership, finance, as well as acting as Interim CEO for nine months in 2016.

On behalf of the AUSVEG Board, I would like thank Simon for the invaluable work he has contributed to our organisation and industry during his time on the Board.

In Simon's stead, I am pleased to announce the appointment of Theodora Elia-Adams as Simon's replacement as Skills-based director.

Theodora brings to AUSVEG a wealth of experience and a stellar reputation as a strategic thinker in the corporate world and as a member for a number of other not-for-profit Boards around Australia. Her ability to draw on executive and board experience will be an invaluable asset to AUSVEG, and I look forward to working with her and the rest of our Board to advance the cause of vegetable, potato and onion growers.

Bill Bulmer
AUSVEG CHAIR

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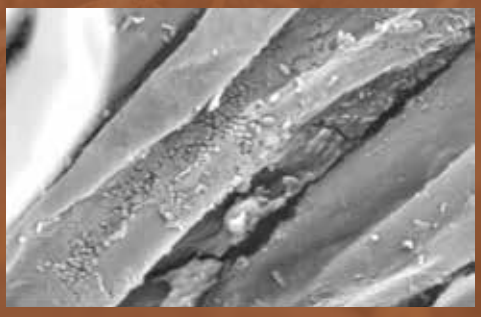

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Message from the CEO

Protecting food security and the future of the Australian vegetable industry is top of mind for AUSVEG. The past three years have been the most stressful and uncertain that the industry has ever experienced, and the toll is showing in our sector.

A recent sentiment survey conducted by AUSVEG revealed record-low morale among Australian vegetable growers, with labour challenges, policy changes, and rising operational costs major factors forcing growers to contemplate their future in the industry.

The survey highlighted that more than 30 per cent of Australian vegetable growers are now considering leaving the industry within the next 12 months. The survey also highlighted that 72 per cent are currently experiencing workforce shortages, and concerningly 45 per cent rate their future viability with current workforce shortages as 'poor to very poor'.

A separate survey from the Global Coalition of Fresh Produce demonstrates the challenges that are resulting in such low sentiment for growers. The survey highlighted that Australian growers have experienced some of the highest increases in costs of production in the world, with on average 37 per cent increases in production and operating costs. This includes more than 100 per cent increase in the cost of fertiliser, and more than 50 per cent increase in fuel and energy, building costs and packaging costs.

Growers across Australia worked every day for well over a year to cover significant worker shortages during COVID-19; many are still in the same position as they struggle to fill gaps in their workforce.

AUSVEG recently represented growers at the Senate Inquiry for Food Security to highlight these concerns to government. Vegetable growers just want to be able to grow healthy produce and remain competitive in an increasingly complex business environment.

The horticulture industry is a major contributor to not just the economy, but vital to the health and well-being of every Australian family. Horticulture's economic contribution was highlighted in the Hort Innovation-funded *Contribution of Australian horticulture industry* report, released in July.

The report noted that horticulture contributes $15.2 billion to the Australia's GDP, employing 64,500 workers. Not only this, but for every dollar of horticultural value add, a further 27 cents is generated into the economy.

More importantly, horticulture is forecast to grow by 22.5 per cent by 2030. For our members, that growth will be on the back of the challenges we have faced in the past couple of years, particularly around the cost of production and growers receiving a fair return for their product to remain viable and continue to produce the high quality fresh vegetables that Australian consumers need.

Michael Coote
CEO, AUSVEG

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industry update

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HORT CONNECTIONS WRAP UP

2023 breaks records!

Amid rising cost pressures and challenges to labour availability, the Australian horticulture sector came together in June for Hort Connections 2023, the largest horticulture conference and trade show in the southern hemisphere.

The Adelaide Convention Centre played host to this year's event from 5-7 June, which explored the theme of 'Knowledge for Growth' to ensure the industry is primed to take advantage of the next generation of research, technology and business innovation to grow the production and value of the horticulture industry.

Run by AUSVEG and the International Fresh Produce Association Australia – New Zealand, Hort Connections 2023 was a record-breaking show. More than 3,500 delegates attended the event to see more than 200 exhibitors and a line-up of 50 industry speakers. It was the largest attendance in Hort Connection's history, and a reflection of the central importance the show is taking on the horticulture industry calendar.

The three-day event was an opportunity for supply chain members, growers, researchers and industry stakeholders in the fresh produce and floral sector to network with their colleagues, and learn about the latest developments, trends and research in the industry from local and international experts.

Hort Connections 2023 was supported by 69 sponsors and industry partners, including the show's Principal Convention Partner Hort Innovation, and Major Partners the Australian Department of Agriculture, Fisheries and Forestry; Syngenta; Coles; Corteva Agriscience; Nutrien Ag Solutions; Business Events Adelaide; the South Australia Tourism Commission; the South Australia Department of the Premier and Cabinet; and the Adelaide Convention Centre.

Largest ever trade show

Hort Connections 2023 boasted more than 200 exhibiting companies from every sector of the industry, and the trade show continues to be a major drawcard for the event.

For exhibitors, the trade show offered businesses from across the Australian and global horticulture supply chain an unrivalled opportunity to make connections and do business with a targeted audience that included approximately 1,000 growers.

The trade show offered the chance to learn about new solutions from suppliers that understood delegates needs and business and to get hands on with the latest technology.

Hort Connections 2023 also featured a dedicated networking hour that saw delegates mingling with exhibitors during the trade show Happy Hour at the close of Day 2, sponsored by Nufarm Australia.

Leading trends from global experts

The Hort Connections 2023 conference program featured more than 50 expert speakers from around Australia, and as far afield as New Zealand, the US, Canada, Germany and the Netherlands.

Conference sessions covered a broad range of topics, including how to apply the latest R&D on farm, sustainability, marketing, labour, pest and weed management, automation, AI, traceability, farm capital, export growth, consumer trends, nutrition science and much more.

The program was headlined by keynote speakers that included the Hon. David Littleproud, Shadow Minister for Agriculture and Leader of the Federal National Party; food educator Stephanie Alexander; Mick Keogh, Deputy Chair of the ACCC; and Ron Lemaire, President of the Canadian Produce Marketing Association, among others.

Alongside the Hort Connections program the affiliated events, included Avocados Australia's annual forum Avo Connections 2023, AUSVEG's Annual Vegetable Industry Seminar, and the annual Diversity and Women in Horticulture networking event.

Delegates were also able to visit some of the best horticulture operations in the Adelaide surrounds on farm and retail tours, visiting farms in Virginia and the Adelaide Hills, local retailers and a potato trial at Langhorne Creek.

Perfection Fresh breakfast

The second day of Hort Connections kicked off with the Perfection Fresh Breakfast, where hundreds of industry members enjoyed a produce-focused breakfast and a presentation from guest speaker Gus Balbontin, the former Executive Director and CTO of travel guide publisher Lonely Planet.

High-profile plenary speakers

Several high-profile speakers opened the final day of the conference program during the Plenary Sessions, which were sponsored by Hort Innovation. Speakers included:

- Brett Fifield, CEO of Hort Innovation
- The Hon. David Littleproud
- A future trends discussion panel featuring Katie de Villiers of One Harvest, Martin Kneebone of Freshlogic, Max Teplitski of the International Fresh Produce Association, and Paul Turner of Woolworths
- Max Teplitski, Chief Science Officer of the International Fresh Produce Association
- Tony Hunter, Global Food Futurist at Future Cubed
- Stephanie Alexander, food educator and founder of the Stephanie Alexander Kitchen Garden Foundation.

Women in Horticulture

Like many agricultural industries, horticulture has identified the need to diversify the workforce and recruit more women as a priority. The annual Women in Horticulture event at Hort Connections 2023 brought together hundreds of delegates to learn how to attract and retain a more diverse workforce.

The event was sponsored by Boomaroo Nurseries, and was opened with a presentation by Diane White, Director of global professional services firm EY.

Diane spoke of the need to consider the business rationale for recruiting a more diverse workforce and the benefits it can bring to a company, such as broader skillsets and experience, and the opportunity to address labour shortages by recruiting from a larger talent pool.

Attendees also heard from award-winning behavioural scientist Milo Wilkinson, who took the audience on a journey through the neuroscience of positive thinking and using mental rehearsal to establish new habits.

Horticulture's best and brightest recognised

Australian horticulture's best and brightest were recognised at the 2023 Horticulture Awards for Excellence, presented on Wednesday 7 June at the Hort Connections Gala Dinner.

Capping off Hort Connections 2023, the Gala Dinner drew together more than 1,500 horticulture industry members to celebrate the significant contributions of the sector's leading growers, marketers, researchers and suppliers. The event was sponsored by J-Tech Systems and Naturpac.

The annual Horticulture Awards for Excellence are the industry's most prestigious honours, and cover a range of areas in horticulture, including recognising outstanding growers in multiple categories, as well as researchers, innovative agribusinesses and the industry's leading exporters.

The evening was opened by an address from the Hon. David Littleproud, International Fresh Produce Association Australia-New Zealand Chair Richard Byllaardt, and AUSVEG Chair Bill Bulmer.

2023 National Awards for Excellence Winners

Syngenta Grower of the Year

L-R: SA Primary Industries, Regional Development and Forest Industries Minister Clare Scriven, the Pirrone brothers and Syngenta Australia New Zealand Managing Director Paul Luxton.

Corteva Agriscience Young Grower of the Year

L-R: Nick Koch from Corteva Agriscience and Robert Arvier – West Pine Ag.

Bayer Researcher of the Year

L-R: Darren Wood from Bayer and Michael Rettke – SARDI

Butler Market Gardens Environment & Sustainability

L-R: Butler Market Gardens CEO Rick Butler and John Said – Fresh Select.

UPL Tech Innovation Award

L-R: Ian Cass, UPL Technology presents Matty Bloomfield on behalf of Kylie Hall – Hectre.

HORT CONNECTIONS HC ADELAIDE 2023

2023 Horticulture Awards for Excellence

Syngenta Grower of the Year
Pirrone Brothers

Corteva Agriscience Young Grower of the Year
Robert Arvier – West Pine Ag

Bayer Researcher of the Year
Michael Rettke – SARDI

Butler Market Gardens Environment & Sustainability
Fresh Select

UPL Tech Innovation Award
Kylie Hall – Hectre

E.E. Muir & Sons Community Stewardship
Allan McGann – drumMUSTER (AgSafe)

Hort Innovation Exporter of the Year
Frank Frappa – Premier Fresh Australia

Boomaroo Nurseries Women in Horticulture
Angela Ruffo – Tripod Farmers Group

VISY Industry Impact
Bruce Scott – Campbells Fertiliser

E.E. Muir & Sons Community Stewardship

L-R: Andrew Muir, E.E. Muir & Sons and Allan McGann – drumMUSTER (AgSafe).

Boomaroo Nurseries Women in Horticulture

L-R: Jo van Niekerk from Boomaroo Nurseries and Angela Ruffo – Tripod Farmers Group

Hort Innovation Exporter of the Year

L-R: Hort Innovation Chair, Julie Bird and Frank Frappa – Premier Fresh Australia.

VISY Industry Impact

L-R: VISY National Sales Manager Wayne Dunn and Bruce Scott – Campbells Fertiliser.

FROM THE BUREAU OF METEOROLOGY

Climate Outlook

AUGUST TO OCTOBER

Long-range forecast overview

- For August to October, below median rainfall is likely to very likely for most of Australia.
- For August to October, above median maximum temperatures are very likely for almost all of Australia.
- For August to October, minimum temperatures are likely to very likely to be above median for almost all of Australia.
- This forecast is influenced by several factors, including likely El Niño development, the potential development of a positive Indian Ocean Dipole, and record warm oceans globally.

Temperature

Warmer than median days and nights for Australia during August to October

- For August, above median maximum temperatures are likely for most of Australia, with much of the southern two-thirds of Australia very likely to exceed median maximum temperatures.
- For August to October, above median maximum temperatures are very likely (greater than 80% chance) for almost all of Australia.
- For August to October, most of Australia is at least twice as likely to experience unusually high maximum temperatures with chances increasing to more than four times as likely for much of western WA.
- For August, above median minimum temperatures are likely to very likely for much of the south-east and northern half of Australia.
- For August to October, minimum temperatures are likely to very likely to be above median for almost all of Australia, excluding some areas of south-east WA and south-east SA.

Rainfall

Drier than median August to October for large areas of Australia

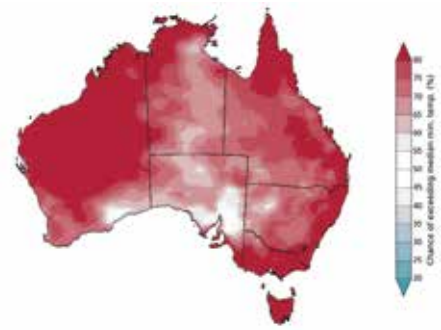
- For August, below median rainfall is likely for most of the southern two-thirds of Australia, excluding areas east of the Great Dividing Range.
- For August to October, below median rainfall is likely to very likely for most of Australia, excluding most of northern and central WA, northern Queensland, and coastal NSW.
- Areas of southern and eastern Australia are at least twice as likely to receive unusually low rainfall.

Climate influences

- The long-range forecast reflects known impacts from several significant climate drivers:
- **The El Niño–Southern Oscillation (ENSO) outlook remains at El Niño Alert.** The Bureau's climate model suggests further warming of the central and eastern Pacific is likely and will remain above El Niño thresholds until at least the end of the year. However, wind, cloud and broad-scale pressure patterns continue to reflect an ENSO-neutral state. El Niño typically increases the chance of below average winter–spring rainfall for the eastern half of Australia, as well as above average daytime temperatures for the southern two-thirds of Australia.
- **The Indian Ocean Dipole (IOD)** is currently neutral.
- **The Southern Annular Mode (SAM)** index is currently negative and is expected to return to neutral towards the end of July.

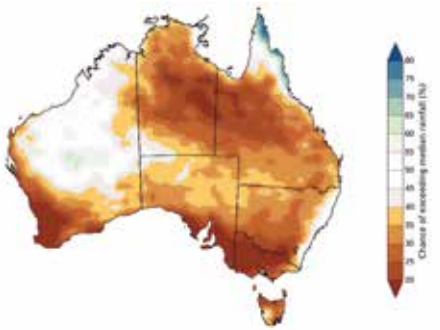
FIND OUT MORE

For the full outlook go to bom.gov.au/climate/ahead/outlooks/

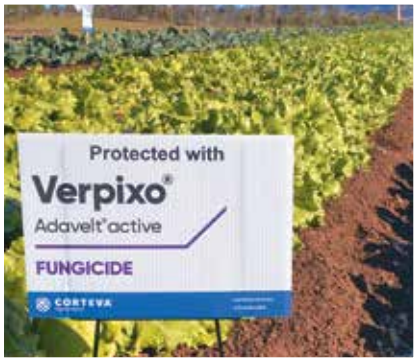


Chance of exceeding the median minimum temperature for August to October 2023

Chance of exceeding the median maximum temperature for August to October 2023



Chance of exceeding the median rainfall for August to October 2023



New fungicide offering power and versatility against challenging crop diseases

Trial data has demonstrated the outstanding performance of Corteva Agriscience's new fungicide, Verpixo® Adavelt® active, which offers a new mode of action to add flexibility and strength to resistance management strategies.

Verpixo is the first-ever picolinamide fungicide, bringing a novel solution for managing key diseases over a wide range of crops.

The unique structure of Verpixo, based on a naturally occurring compound found in soil bacteria, enables picolinamide activity across a broad spectrum of diseases and builds upon a family of chemistry first established by Corteva with the discovery of Inatreq™ active for use in cereal crops and banana.

Verpixo has been trialled extensively at various field sites including a strawberry farm on Queensland's Sunshine Coast which recorded an increase of up to 14 per cent in marketable yield, and a 12-15 per cent decrease in botrytis fruit infection.

Corteva Agriscience Horticulture Marketing Manager, Nick Koch, said while these results are from just one farm, they highlight Verpixo Adavelt active's efficacy in managing crop diseases.

"Results have been incredibly positive, the new mode of action, along with a short harvest withholding periods and low toxicity, gives growers the flexibility to successfully manage diseases in crops strategically throughout the year," Mr Koch said.

Along with the results from the strawberry farm, at a recent Elders Gatton Field Day in the Lockyer Valley, growers and agronomists were able to see the excellent disease control of Verpixo Adavelt active firsthand.

"The Gatton field site demonstrated Verpixo in leafy veg, cucurbits and fruiting veg and showed its efficacy on sclerotinia, powdery mildew, alternaria and botrytis," Mr Koch said.

Verpixo Adavelt active is registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) for use in strawberries, fruiting vegetables, leafy vegetables and cucurbits.

Corteva Territory Sales Manager, Adam Harber, said the Gatton trial site showed how Verpixo would suit many horticultural programs.

"In many cases existing chemistries are under threat of resistance so this will redefine custom fungicide programs to sustain healthier crops, better yields and greater value."

"Growers inspire us to innovate with purpose," Mr Koch said.

"We share this journey and want to help them navigate the complexity of plant disease by focusing on solutions. In this case, it's tough ascomycetes pathogens.

"To succeed we need to develop more flexible tools that support land stewardship and simplify crop management.

"This breakthrough solution is designed to meet those needs and give growers the freedom to grow."

Top L-R. Corteva's Adam Harber (left) and Nick Koch (centre) with Elders agronomist Greg Teske discussing Verpixo trial results. **Inset.** Verpixo® application in lettuce demonstrating outstanding sclerotinia control.

FIND OUT MORE
For more information, go to corteva.com.au

Modelling the economic contribution of Australian horticulture

Using a suite of economic models, recent research funded by Hort Innovation unpacked the value horticulture contributes to the Australian economy. The insights provide information to articulate impacts at a national, state and regional level to assist in decision making discussions.

The farm gate value of horticulture production was $15.2 billion in 2020-21, employing around 64,650 full time equivalent (FTE) staff. The value-added contribution is estimated to be $9.6 billion. When including the value of processing, the contribution climbs to $17.8 billion and employs a further 5,000 people, to add a further $10.2 billion in value-adding.

Further, for every dollar of horticultural value added, an additional 27.6 cents is generated into the rest of the economy through labour, land, and capital. Indirect employment also adds a further 21.3 jobs for every 100 horticulture related jobs.

The *Contribution of Australian horticulture industry* report was completed by the Centre for International Economics (CIE) as part of a multi-industry strategic levy investment.

The modelling for the project used a 'general equilibrium' framework to allow measurement of the flow effects for industry activities. This model was derived from a framework devised by CIE with detailed description of food value chains; the identification of 48 horticulture farming and processing commodities, and a regional module to drill down to a state level in 25 regions across Australia.

Of those regions, 10 were identified as contributing to two thirds of the overall horticulture contribution to industry.

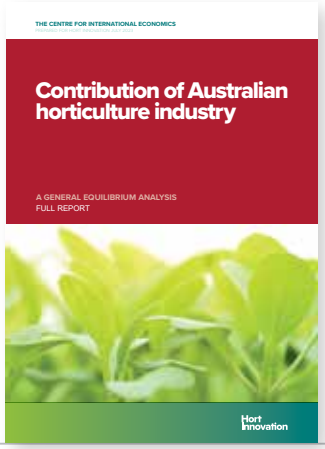
The largest – Mildura – is principally centred around table grapes and citrus. Melbourne was second with a combination of vegetable growing and processing. The 'Rest of Queensland' region (western half of the state) was third based on its nursery industry, followed by Shepparton (processed fruits & tomatoes).

Potatoes provide the greatest contribution for vegetables in terms of GVP (gross value production), and value-add and employment (as a standalone product), as shown in Table 1. Carrots, onions, broccoli, mushrooms and the capsicum family are also significant contributors.

Hort Innovation

This project was a multi-industry strategic levy investment in the Hort Innovation Apple and Pear, Avocado, Banana Cherry, Citrus, Fresh Potato, Mango, Melon, Mushroom, Onion, Pineapple, Processing Potato, Raspberry & Blackberry, Strawberry, Summerfruit, Table Grape and Vegetable Funds

Project Number: MT21010



Major vegetables by region

By deep diving into the data, the contribution of vegetables by region to the overall horticulture contribution is possible.

In the following tables, the contribution in 2021 is given, plus the projection to 2030 based on a modest average annual growth rate of 2.3 per cent (central scenario). Within the report, projections are also given for 2030 on a rate of 4.1 per cent (high) and 0.8 per cent (low).

Overall, it is estimated that the total contribution (value added in horticulture industry plus induced value added in other industries) of the horticulture industry to GDP in 2030 will be $15.85 billion, $18.87 billion and $13.91 billion, respectively, under the central, high and low scenarios.

TABLE 1. VEGETABLE PRODUCTION & PROCESSING ON A NATIONAL LEVEL

Vegetables	GVP ($m)	Value-added ($m)	Employment (FTE)
Potatoes	807.3	480.2	3651
Mushrooms	393.1	211.6	2832
Broccoli	258.9	126.0	1171
Carrots	256.0	125.5	1158
Capsicums, chilli, peppers	206.4	105.9	933
Onions	203.2	105.7	919
Lettuce	171.9	67.5	777
Peas & beans	143.5	103.4	649
Sweetcorn	117.1	54.5	530
Pumpkins	89.4	40.2	404
Cauliflower	63.1	32.9	285
Other vegetables	1301.4	611.3	5886
Processing			
Frozen potatoes	652.4	148.5	1371
Other processed vegetables	350.0	79.7	736

GVP: gross value of production refers to the total value of the produce
Value-added: refers to payments for labour, capital and land use
FTE: full time equivalent employees

Potatoes	GVP $m (2021)	GVP $m (2030)	Value-added $m (2021)	Value-add $m (2030)	Employment (2021)	Employment (2030)
Tasmania	275	326	0	0	0	0
WA	191	227	10	12	153	163
Brisbane	211.5	250.9	0	0	0	0
Adelaide	253	300	22	27	0	0
Rest of VIC	115.1	136.5	0	0	573	612
Mildura	10	11	480.2	569.6	520	555
Victoria	0	0	150.4	178.4	376	401
NSW/ACT	340	404	500	593	1,119	1,194
West & North TAS	0	0	145	172	0	0
Adelaide Plains	0	0	0	0	170	182
Potatoes **Frozen**						
Brisbane	652	778	0	0	0	0
NSW/ACT	548.6	654.4	125	149	1,958	2,231
Adelaide Plains	220	263	0	0	0	0
Rest of QLD	203.8	243.1	0	0	18	21
Adelaide	92.1	109.8	0	0	18	20
North & West TAS	89.9	107.3	0	0	0	0
Victoria	55.9	66.7	10	12	193	220
Queensland	51.8	62	46	55	0	0
Rest of SA	5	6	0	0	0	0
WA	0	0	149	177	0	0

Carrots	GVP $m (2021)	GVP $m (2030)	Value-added $m (2021)	Value-add $m (2030)	Employment (2021)	Employment (2030)
South Australia	0	0	50.8	63.1	447.1	507
Coffs Harbour	0	0	25.4	31.6	234.7	266.1
NSW/ACT	134.9	167.6	41	51	379	430
North & West TAS	0	0	20.6	25.6	0	0
Brisbane	0	0	19.7	24.5	195	221
Rest of VIC	13	16	15.2	18.9	140.5	159.3
Mildura	30.6	38.1	15	18.7	138.5	157
Adelaide Plains	51.9	64.5	1	1	0	0
Sydney	100.9	125.4	0	0	0	0
Victoria	42.2	52.5	0	0	1	1
Shepparton	26.3	32.7	13	16	118.8	134.7
Adelaide	25.3	31.4	0	0	0	0
Rest of VIC	12.8	15.9	15	19	141	159
Queensland	0	0	0	0	211	239

Onions	GVP $m (2021)	GVP $m (2030)	Value-added $m (2021)	Value-add $m (2030)	Employment (2021)	Employment (2030)
NSW/ACT	122	152	16	20	141	160
Adelaide Plains	96	119	13	16	3	3
Sydney	72	90	10	12	0	0
Victoria	25	31	65	81	438	497
Mildura	16	20	2	3	19	22
Shepparton	13	16	0	0	3	3
Adelaide	6	7	0	0	0	0
Rest of VIC	4	5	7	8	262	298
WA	0	0	10	13	88	100

CASE STUDY – Adelaide Plains

The region of the Adelaide Plains covers Murray Bridge, Lexton and down to the Limestone Coast.

- The total value of horticulture industry was $941.5 million in 2020-21, with a value-added of $587.9 million (5.2 per cent of Gross Regional Product (GRP)) and employment of 3,649 FTEs (4.5 per cent of regional employment).
- Citrus, potatoes, and almonds are the major horticultural commodities in the region, accounting for 23.2 per cent, 22.5 per cent, and 15 per cent, respectively, of the region's horticulture GVP.
- Onion is also significant, accounting for 10.2 per cent of the region's horticulture GVP, and the region produces almost half of the nation's total onion production.
- The horticulture industry in the region contributed directly $587.9 million to the GRP and induced another $170.3 million in GRP in 2020-21.
- The direct employment of the industry was 3,649 FTEs, with another indirect employment of about 1,002 FTEs in 2020-21.
- It is projected that the total value of horticulture industry in the region will grow by 29 per cent to $1.2 billion by 2029-30 under the Central scenario, with a range from $1.0 billion under the Low scenario to $1.6 billion under the High scenario.
- Total (direct and indirect) contribution of the industry to GRP is projected to be $795 million to 1.3 billion by 2029-30 while total employment contribution to be 4,683 to 7,129 FTEs.

	GVP 2021 ($m)
Apples	21
Summerfruit	25
Citrus	219
Grapes	25
Almonds	141
Carrots	52
Onions	96
Other vegetables	10
Frozen potatoes	220
Other processed vegetables	49

To read the report go to: **horticulture.com.au**/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/mt21010

PCA Conference 2023 raises the roof on protected cropping

Protected Cropping Australia
PCA 2023 BRISBANE
CONFERENCE 17 – 20 JULY
Growing our Future
PEOPLE. PLANET. PROFITS

The Protected Cropping Australia Conference 2023 had a record attendance as extreme weather drives more grower interest in going under cover.

With headlines over the past year filled with news of $12 lettuce and $10 heads of broccoli following severe weather events, the future role of protected cropping in the Australian vegetable production mix has only increased in importance.

That was reflected in the record-breaking numbers at the Protected Cropping Australia (PCA) Conference in Brisbane in July 2023.

The event attracted 620 delegates, nearly 200 of them growers, and 93 exhibitors, a record-breaking attendance for PCA's annual conference.

This year's event was opened by Queensland Minister for Agricultural Industry Development and Fisheries and Minister for Rural Communities, the Hon Mark Furner, who told delegates ongoing disruption to produce supplies due to extreme weather was driving more attention to protected cropping as a way to secure production.

"In recent years, global supply chains have faced major disruptions, whether from the COVID-19 pandemic, geopolitical instability or extreme weather events," said Minister Furner.

The event attracted 620 delegates, nearly 200 of them growers, and 93 exhibitors, a record-breaking attendance for PCA's annual conference.

"These supply chain disruptions have had a significant impact on food availability and affordability. Protected cropping systems can help shore up food supply by allowing growers to maximise production and provide protection from pests, disease and adverse weather."

New technologies such as protected cropping were central to Australia's continued growth in food production and the expansion of exports, the Minister told delegates.

There were plenty of new technologies on display on the trade show floor and being unpacked by speakers. Conference presentations covered both lower cost systems offering a pathway into protected cropping for open field growers, as well as the global cutting edge of high-tech protected cropping such as vertical farming systems.

"There has been a lot of new trends and developments at the conference this year, but of particular excitement to me personally is the focus on vertical farming and some of the new techniques that are coming out of that sector," said PCA CEO Sam Turner.

Top. Farming for our future panel.

Luna® Experience is now set to benefit vegetable growers

Tomato, capsicum, cucurbit and bulb vegetable growers are now set to benefit from a new effective fungicide option following new registrations for Bayer CropScience's Luna® Experience.

Following extensive trial work, vegetable growers now have access to a highly effective new fungicide option in a number of their crops. Luna Experience is now registered for control of gummy stem blight and powdery mildew in cucurbits, plus powdery mildew in tomatoes and capsicums, and suppression of white rot in bulb vegetables, including onions.

With the fungicide already registered and used in a wide range of crops, including selected fruit, pyrethrum, and tree nut crops, the effectiveness of Luna Experience is already widely known across the horticultural industry, but is now set to help even more growers - a win for both farmers and consumers.

Bayer's Market Development Agronomist for North Queensland Nick Matthews trialled Luna Experience at Bowen on a plot of rockmelons - a plant he says best shows the efficacy of the fungicide due to its susceptibility to gummy stem blight, which is a serious fungal disease that can affect all of the aboveground parts of cucurbit crops.

With conducive conditions for disease development experienced throughout the trial period, the trial showed that Luna Experience performed extremely well in comparison to the other fungicide options that have been available to the industry.

"The trial had two replicates with five treatments, comparing Luna Experience to three other local standards, plus an untreated," Nick says.

"All treatments had two applications, nine days apart. The untreated plots in this trial showed a high incidence and severity of gummy stem, showing up mainly as leaf lesions.

"All the treatments reduced disease incidence and severity, with Luna Experience displaying disease control as good as or better than the other treatments."

To confirm his findings, an interactive trial assessment was made, whereby a group of agronomists and growers delved into the trial and pulled apart the product differences that may not have been picked up with a superficial inspection.

They assessed each rockmelon plot without knowing the treatments and recorded their findings on an online platform.

"The results were uploaded and collated with others in the group, and the summary was fed back in almost real time," Nick says.

"This allowed the group to view and discuss the results with the knowledge they had contributed in an unbiased way to the data. The feedback on the gummy stem control was very positive."

With Luna Experience receiving the tick of approval from agronomists and growers, there's no denying it is set to be a game changer for industry.

As a co-formulation of fluopyram (SDHI, Group 7) and tebuconazole (DMI, Group 3), Luna Experience uses the power of two fungicide modes of action to not only control key fungal pathogens, but also reduce the chance of resistance buildup and preserve the chemistry.

Nick says the new registrations are well supported and backed by not only his trial work, but also findings from other trials that were conducted both in Australia and overseas, making Luna Experience a powerful new tool for farmers.

"Luna Experience is highly active against gummy stem blight, as seen in trial work in Australia and overseas," Nick says.

"This fungicide provides efficacy either better than, or equal to, other commercial fungicides, and the active ingredients work well together to control key diseases.

"With a 1 day domestic withholding period and up to three applications per year, it will help farmers grow their best produce yet."

Above L-R. Nick Matthews Luna® Experience in Bowen. Drone of crop.

FOR MORE INFORMATION
Visit **crop.bayer.com.au/products/fungicides** or contact your local Bayer representative or preferred distributor.

People in the spotlight

While the PCA Conference trade show floor was buzzing with people this year, it was the shortage of people working in the industry that was an important focus for this year's conference.

"The theme for this year has been 'Growing our future; people, planet and profits', and that really encompasses everything we're trying to do as an industry," said Mr Turner.

"It's really important to celebrate the people we have in the industry, but we're also trying to attract new people. That's a key focus for us at PCA, but also at the conference in general."

"Everyone's focused on finding people, retaining talent and training workers. That's of key importance for our growers, and finding good people to run the systems is not an easy thing to do, particularly in regional Australia."

While one of the big attractions of protected cropping is the capacity for automation to reduce the amount of labour required – with research into automation and robotics a big part of the conference program – the sector is still grappling with the same workforce shortage as the rest of the horticulture industry.

Contributing to this is the higher level of education and technical knowledge required for many roles in protected cropping and the time it takes to train up new staff, which was a common issue confronted by speakers and attendees at the show.

A buffer against climate variability

Interest in protected cropping systems has spiked in the Australian horticulture sector in recent years, prompted in large part by supply disruptions to field production.

With more frequent severe weather predicted due to climate change, and the potential for an El Niño year looking high in 2023/24, protected cropping is looking more attractive, and local greenhouse builders are backed up due to the demand, according to Mr Turner.

Also spurred on by climate change is the growing importance of sustainability.

"Arguably protected cropping's greatest advantage is growing more with less resources," said PCA Chair Matthew Plunkett.

"Sustainability will continue to be a critical focus for our industry, and we must ensure we tell our story in that sustainability space. Of course, profitable growers and businesses are also critical to sustain our growth."

Beyond the commercial benefits of reducing input requirements, sustainability is becoming ever more vital for marketing, both to attract consumers as well as investors.

"Sustainability and ESG [environmental, social, and governance] are becoming more and more important, not only for our growers and consumers, who are demanding more sustainable products, but also the international business landscape," said Mr Turner.

AWARD WINNERS

Young Achiever Award
Samuel Davies, Perfection Fresh

Industry Development Award
Olumuyiwa Akintola Elliott, Garden City Plastics

Grower of the Year Award
Josh Pirrone, Pirrone Brothers

Rick Donnan Memorial Award for Industry Excellence
Will Millis, Flavorite

PCA Chair's Award
Andy Swan, Crop Coir Fertiliser

Award Winners

The annual PCA Awards were announced at the opening of the event on 18 July 2023, recognising the best and brightest in the protected cropping sector.

"It's really important that we acknowledge and celebrate individuals in our industry who've made a significant contribution over the last two years," said Mr Plunkett.

Mr Plunkett also took a moment to recognise the passing of industry stalwart Rick Donnan.

"Rick was an industry pioneer, and a great mentor and friend to the PCA," he said. "To recognise Rick's contribution to the PCA and our industry, PCA have renamed the Outstanding Contribution Award the Rick Donnan Memorial Award in his honour."

Above. The PCA 2023 trade show boasted record numbers of visitors and exhibitors.

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GROWING A NATURE-POSITIVE FOOD FUTURE

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The inexperience advantage

Above L-R. Josh, Ross and Chris Pirrone. **Top.** Pirrone Brothers accepting the Syngenta Grower of the Year at the Hort Connections 2023 conference in Adelaide.

They started green behind the ears, but that's now turned to gold as North Queensland growers Pirrone Brothers rack up the awards.

In a farm office near Ayr in North Queensland, there's a shelf that's beginning to groan under the weight of all the awards being stacked on top of it.

North Queensland mixed crop operation Pirrone Brothers has been racking up the accolades this year in recognition of the third-generation grower's rapid pace of innovation and development.

In June, Pirrone Brothers was recognised as the *Syngenta Grower of the Year at the Hort Connections 2023* conference in Adelaide. In early July, Production Manager Josh Pirrone was awarded *PCA Grower of the Year* at the Protected Cropping Australia Conference in Brisbane. Later that same month, Pirrone Brothers was named *Fresh Produce Supplier of the Year* at the Coles Supplier Awards in Melbourne.

All these well-deserved awards reflect the reputation Pirrone Brothers has built as a pioneer in vegetable production in North Queensland.

While it's a third-generation business, Pirrone Brothers only delved into vegetable production 10 years ago. After nearly 70 years as a sugarcane farm, vegetables become the primary focus once the new generation of brothers, Ross, Josh and Chris, took over.

"Dad had seen the direction the sugar industry was going, and he didn't see a stable or enjoyable future in it," said Business Manager Ross Pirrone.

"He started mucking about with horticulture with the help of a friend that was doing it, growing some pumpkins, while myself and my brothers were out doing our trades,"

The three brothers had made careers for themselves off-farm: Ross as an engine reconditioner, Josh as a panel beater and Chris as a marine mechanic. As they started to take over the reins to the farm, they started experimenting more and more with vegetables.

"We started slowly, doing a bit of a trial, and we picked up some food service contracts supplying cucumbers and capsicums," said Ross.

"From there we saw the need for consistent supply, which led us into greenhouses, which then led to me doing a Nuffield Scholarship, which then led to us supplying Coles Supermarkets, which then led to us scaling up."

The lack of generational vegetable farming experience has made for a steep learning curve, but the Pirrone Brothers have turned it to their advantage, pushing the boundaries of what is possible for vegetable production in the Burdekin region unhindered by entrenched practices or assumptions.

"At the start we had no idea and we approached a few local growers," Ross explained. "Some were great, and others told us to go away. Funnily enough, they're the ones who copy what we're doing now."

While the brothers did find locally and in NSW who gave them invaluable support in the early days, as one of only a few protected cropping operations in North Queensland they have needed to break a lot of ground. That led to them working closely with the Queensland Department of Agriculture and Fisheries (DAF) on a variety of R&D projects.

"Our situation is different, so we had to work it out for ourselves, and it was just brutal for a good five to seven years of learning everything from the ground up," said Ross.

"In the last three to five years we've started piecing it all together, getting an idea of how we want to do it without the preconceived ideas that people have when they've been doing something for a long time."

Pirrone Brothers' history has also helped in some areas. After three generations surviving the razor-thin margins of sugarcane growing, the business had a focus on scale, mechanisation and, above all, efficiency that has translated well into vegetable production.

The brothers' father, Ross-Wayne Pirrone, ran the sugarcane operation with as much self-sufficiency as possible, and the family built and modified machinery themselves to eke out every possible opportunity for efficiency.

"They did everything themselves; they used to joke that the only other thing they could do was start an iron ore mine and make their own steel," Ross said of his father's generation.

"That led them to be more successful and efficient, and it set a good foundation with the farm layout and design to be able to scale for horticulture very well."

The new generation has followed in the same footsteps, with a dedicated fabrication and mechanic workshop on farm employing a full-time welder and a mechanical fitter. The three brothers' also draw on their original trades and tap into support from extended family members with engineering and computer aided design backgrounds.

The brothers erected their first greenhouse themselves using a 2000 square metre prefabricated kit. The primary aim of the greenhouse was to keep production running when seasonal conditions weren't suitable for field production, and it has been the home of numerous trials and research projects with DAF since it was built.

"It's still essentially a research facility that we produce out of," explained Ross. "It's our own version of a high-tech glasshouse, because we're solving the opposite problems of most people with greenhouses. They don't have enough light; we have too much. They don't have enough water; we've got too much. They don't have enough heat; we have too much."

The challenge now is scaling up. Pirrone Brothers is dedicated to sustainable, self-funded growth, rather than relying on external finance to grow quickly, but building new large-scale vegetable production infrastructure and protected cropping capacity comes with a big cost.

"We've been building the core infrastructure, whether that's management or physical packing sheds and cool rooms," said Ross.

"That's got to come first, but it's hard to build that at the same time as scaling indoor production. The scale [of open field cropping] we've got already has been pretty fast compared to a lot of growers. We've built this up in effectively five years."

"We have to do it full scale or forget about it. The capital cost is excessive up front, but long term it makes sense."

VICARIOUS LIABILITY AND EMPLOYERS:

Are Your Workers Sharing Accommodation?

CASE: CCIG INVESTMENTS PTY LTD V SCHOKMAN [2023] HCA 21
DATE OF JUDGEMENT: 2 AUGUST 2023 | **COURT:** HIGH COURT OF AUSTRALIA

Background

Mr Schokman was engaged as a food and beverage supervisor at Daydream Island and Resort Spa **("Employer")** in Queensland. Contractually, he was required to live in shared accommodation on Daydream Island. Mr Schokman shared accommodation with a co-worker, Mr Hewitt.

On 6 November 2016, Mr Schokman completed his shift and had drinks at the resort bar. He then returned to his room and went to sleep. On 7 November 2016 at 3am Mr Hewitt who had also been drinking returned to his room and in a state of semi unconsciousness mistakenly urinated over Mr Schokman instead of in the shared toilet.

Mr Schokman was immediately woken and subsequently inhaled and choked which led to the employee suffering a cataleptic fit because of the urine.

Mr Schokman sued the employer for breach of duty of care and vicarious liability. Both claims were dismissed in the Supreme Court of Queensland. However, on the matter of vicarious liability, this issue was the subject of appeal in the Queensland Court of Appeal. It was unanimously held on appeal the employer was vicariously liable because there was connection between employment and the employees' actions, due to the accommodation requirements.

Mr Schokman was awarded $431,738.88. This decision was appealed by the employer to the High Court of Australia.

High Court Decision

The High Court noted for an employer to be held liable for the wrongful act of an employee, the act committed needs to be in the course or scope of employment. In this case, the Court took into account the fact Mr Hewitt committed the wrongful act outside his hours of work and not at a work location. The only connection between the wrongful act and employment was the shared accommodation which in this case was deemed not to be a proper connection to employment.

As such the majority allowed the appeal.

Learnings

- Shared accommodation of employees requires specific attention from employers to minimise the risk of vicarious liability.
- Where accommodation is provided to workers, there needs to be clear parameters so employees understand obligations.
- To avoid risks associated with vicarious liability and shared accommodation employers need to ensure adequate workplace policies, processes and systems are in place regarding workplace behaviours. This requires effective communication.
- For employers to be vicariously liable the wrongful act needs to be committed in the course or scope of employment.
- There must be a close connection between the wrongful act and employment to meet vicarious liability criterion.

Vicarious Liability and Sexual Harassment

With the introduction of *Anti-Discrimination and Human Rights Legislation Amendment (Respect at Work) Act 2022* (Cth), employers have a legal obligation to undertake a positive duty to ensure 'reasonable and proportionate measures' are in place to eliminate sex discrimination, including sexual harassment.

Section 106 of the *Sex Discrimination Act 1984* (Cth) imposes a vicarious liability provision, whereby employers will be held vicariously liable if positive duty measures are not in place for the elimination of sex discrimination or sexual harassment **in connection with employment.**

It is anticipated, the meaning of **in connection with employment,** will have a far more expansive meaning than words such as 'in the scope' or 'course of employment' as highlighted in the above case. Therefore, a higher standard of 'duty of care' is likely to interpreted with sexual harassment and sexual discrimination. Employers need to be aware of this!

Summary

To avoid vicarious liability issues, employers need to ensure there are effective systems, policies and procedures in place to deal with conduct and behaviours whilst at work and importantly address out of hours expectations.

This is particularly important for those who have accommodation arrangements for workers.

NS8 Lawyers & Advisors specialise in the horticulture industry and would be pleased to assist you with any HR, Safety, Commercial or Compliance matters.

FOR MORE INFORMATION
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Above. Neil Salvador Director and Lawyer.

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Young Grower of the Year focuses on efficiency and sustainability

A focus on people, planet and production, West Pine Ag is primarily an agribusiness focused on high-efficiency, low-impact food and energy production and is led by the *2023 Corteva Agriscience Young Grower of the Year,* Robert Arvier.

An entrepreneurial first-generation farmer, Robert Arvier (pictured) was recognised for his innovation, commitment to excellence and sustainability and as a future leader for the industry.

Robert's business, West Pine Ag based in Penguin, on the north west coast of Tasmania is a diverse mixture of vegetable and crop production, consultancy and agrifood projects spanning 250ha across Tasmania and Victoria.

Born and raised in the Penguin region, Rob had always shown a keen interest in agriculture and completed a Bachelor degree in Agricultural Science at University of Tasmania, and a Masters degree in Agribusiness from University of Melbourne. In 2017 Rob was awarded a Nuffield scholarship focussed on the economic feasibility of sugar beet in southeast Australia.

A tenure with global agribusiness Lesaffre, taught Rob valuable business strategy and environmental management skills that have been integral to the success of West Pine Ag that was established in 2018.

As a farming enterprise start-up Rob has been conscious that West Pine Ag had to be economically viable while mindful of risk in climate and social licence terms from the outset.

"Every aspect of our business must be commercially viable and attractive to first tier lenders. If that debt is not serviceable, we have a problem, just like any other business, so it is vital to manage our risks.

"We are now finding that the markets and processes we work with recognise the need for shared risk modelling when it comes to crop production. We simply can't take the hit of full crop or seasonal failure. Diversification of the business has been absolutely crucial."

Of the businesses incorporated into West Pine Ag, two are focused on alternative energy sources and utilising molasses extracts.

These common theme of these project objectives is to utilise byproducts of agrifood processes for further applications. Straw stubble that would otherwise be burned in the paddock was pelletised and used as a biofuel for two Victorian hospitals.

The molasses extract will be utilised as an ingredient into stockfeed and fertiliser applications. Rob sees these projects as a way to increase value to farmers where previously those resources previously went unrecognised.

On farm, the Penguin property produces a range of vegetables – potatoes, onions, carrots and brassicas.

In a bid to reduce carbon emissions, Rob and the West Pine team are working on accounting methods to measure biodiversity metrics, soil moisture and local weather patterns to gain a baseline from which to improve their farming practices.

"Biodiversity is a tricky one and we are collaborating with people to understand the DNA of the soils and water resources so we can change our practices to do it better. We have also participated in a project lead by AgLogic and the Tasmanian Drought Resilience Hub to establish a weather station network. By putting those learnings into practice for both vegetables and crops we are moving away from the shovel and using data from what the soil is telling us."

Right L-R. Part of the West Pine team at the Awards – Rob Arvier, Hannah Lewis and David King.

"We were really excited to have been part of the program, and surprised to have won, given the field of incredibly talented people that were nominated this year, and what they are doing."

"From my side I think everything I've done from a business point of view is in collaboration. That award belongs not only to me, but also the entire group of staff across the businesses who have made that happen."

Rob credits the core group of 12 staff at West Pine Ag with pulling together to achieve such an outcome, but also acknowledged that without the support of other businesses and family, it could well have been different.

"Whilst I like to think I've given back to all of those people, as is the nature of collaboration, without their support and their belief that I would succeed, I wouldn't be here. Having those relationships early on were really, really critical to succeeding."

Rob's advice to the next young growers in horticulture is to foster collaboration, a formal education and practical experience. An understanding of the practical aspects of farming, combined with business management skills will enable future generations to create a successful farming enterprise.

Fresh produce consumption habits present tricky puzzle

BY CLAIRE HARRIS

Working towards food security while meeting consumer demands on the preparation and presentation of fresh produce is no easy feat, but International Fresh Produce Association Chief Science Officer Max Teplitski believes we have the necessary resources to do the job.

Dr Teplitski presented at Hort Connections 2023 in June and revealed eye-opening statistics about the state of play in the world of fresh produce consumption, prompting the need for systemic change.

He revealed that 70% of Americans are overweight or obese – with similar figures in Australia – and yet 37 million Americans live in households either uncertain of having, or unable to acquire enough food to meet their needs.

"Those who are most food insecure, also tend to be those who are most overweight and obese. We focus so hard on getting cheap calories, and often the cheapest form of nutrition," Dr Teplitski said.

"It's not a conversation about fruits and vegetables being too expensive – have you looked at the price of cigarettes lately?

"We need to flip the conversation, and instead of focusing on outcomes and impact, instead look at the root causes of the problems surrounding why we don't eat the recommended amounts of fruits and vegetables."

Dr Teplitski also revealed that 593 million hectares of additional arable land would be needed to feed a global population nearing 10 billion people, while figuring out how to deal with 11 gigatonnes of greenhouse gas emissions produced while feeding this rapidly growing population.

Group this with yield stagnation, a changing climate, and labour challenges, and the task of feeding the growing population is daunting, but Dr Teplitski said we have the tools at our disposal.

"Take the iPhone12 for example. The computational power that many of us have in our pockets, is 100,000 to a million times more than the supercomputer used to land people safely on the moon, and it's available at a fraction of the price," he said.

Looking to solutions, Dr Teplitski said urban agriculture and shelf-life extension were promising avenues.

"With urban ag such as indoor agriculture, when plants don't have to allocate resources to fight plants and diseases, or deal with droughts, they can invest all invest all their energy into better taste, better flavour, better product," he said.

Above. Dr Max Teplitski, Chief Science Officer at IFPA discussed the state of the industry future trends report at Hort Connections 2023. *Photo Andrew Beveridge.*

"We need to think about how to make urban ag compatible with existing supply chains.

"Shelf-life extension is also an exciting area of research and investment. Microbiome manipulations can allow for shelf-life extension, and we need smart system distributions of perishable foods. We're looking at the contribution of artificial intelligence to promote shelf-life extension as well."

Rethinking packaging of fruits and vegetables offers an array of opportunities in terms of influencing consumption choices, but Dr Teplitski said this was consumer-driven and sometimes contradictory.

"We've found consumers appreciate freshness and quality of packaged produce, and they see packaged produce as better value and safe to eat. Consumers want something more sustainable, with less packaging, but they also appreciate the benefits of packaging," he said.

Dr Teplitski said there were different 'buckets' of consumer demand, including the expectation for food to be exciting, permissibly indulgent, and available at all times and places, while there is also a rise in conscious consumption.

"Consumers want to vote with their pockets, with their dollars, for things they find to be impactful," he said.

According to Dr Teplitski, the biggest criterion influencing consumer choices is quality, followed by price, and then nutritional benefit, while environmental impact is also increasingly being considered as important.

"Consumers are so detached from the way of production of food, that they don't see an inherent value in how the crop is grown and produced. What they do see value in, is quality, price, and nutritional benefit."

Despite these three criteria driving consumer choices more so than how food is actually grown, Dr Teplitski said there was still high pressure to tell the story of food production well.

"With digitisation of the industry, consumers are on the way to wanting to know everything about their food, and within three to five years, they will want to know everything.

"Research shows consumers will scan a QR code once to make a decision about a brand, and once they learn they like a brand they will stop scanning. There is an advantage to telling the story once, and impactfully."

"We learned a lesson from the pandemic – as food industry professionals, we can't let others tell our story for us, the story of food is our story to tell."

Forward-thinking realists well-placed to grow agribusiness assets

BY CLAIRE HARRIS

While agricultural investment is a viable long-term strategy for growth, inflation has been the talk of the town across 2023, leading to a cost-of-living crisis squeeze felt right across the country. The 2023 AVIS featured a panel of leading agriculture investment experts to discuss the opportunities for investment in horticulture, and how growers can prepare themselves to capitalise.

Panelists at the Annual Vegetable Industry Seminar (AVIS) in June provided insight into how land remains a viable investment option even in the face of a financial squeeze.

Fresh Country Farmers Chief Executive Officer and Director Nick Gill said agricultural real estate was still in high demand.

"We're seeing agricultural real estate holding up, while CBD real estate is starting to be put under pressure, because people are not going into offices as much," Nick said.

"Land typically has always been a healthy investment and over the last forty to fifty years has kept up with inflation, plus extra margin."

He said agricultural advancements driving production often led to naturally increasing profitability on-farm.

"We've seen better and high-yielding varieties (developed and used), so if we're going to invest there is inherent growth that comes from that technology change."

Sustainability and Due Diligence

Cibus Capital Investment Director Damon Petrie said the company saw investing in businesses with a sustainable competitive advantage was highly beneficial.

"We have about 30 technology investments to date, ranging across water purification technology, alternative fertilisers, pest management techniques, system sensors, you name it, we've got it," he said.

"We're improving margins with this tech, which is ultimately de-risking a company, and often we're solving some sustainability issues. If you can improve things like soil health while doing this, you're also de-risking the company."

Top. AVIS presentation: Dan O'Donoghue, Damon Petrie, Jesse Manuel, Nick Gill, Rawdon Briggs.

Damon said Cibus Capital runs anywhere from six to nine streams of due diligence on investments – including institutional investors, investment funds and insurance. Cibus Capital has an extremely high degree of responsibility, and ensures fully reporting responsibilities back to those investors.

"Broadly speaking, our due diligence streams are financial/legal tax, technical understanding of workings of the business, understanding the landscape in which the business operates, then ESG," said Damon.

"We run all the streams in parallel, it can get overwhelming for a seller or someone looking to do a partnership with us. It is a seven year plan, and it can take a lot of time to do the planning and work through issues, but ultimately we're trying to form a new marriage with the party and it's important we get that right," he said.

Knowing your production and opportunity costs

In contrast, a typical start to finish on a transaction at Merricks Capital is 2-3 weeks, according to the company's Head of Private Credit Dan O'Donoghue.

"Because we're not exposed to the operating performance, we have a fixed cost on capital, we are less focused on the upside of productivity and optimising that piece," Dan said.

Dan said companies who 'really understand what they have' were a more attractive partner for Merricks.

"We look at 500 investment opportunities a year across our business to write 30 cheques, there is actually a lot of commonalities among those 30 people," he said.

"Those people get what they want, and they understand the true cost of their production, which factors in the cost of their debt, but also the opportunity cost if they don't do something.

"Farmers understand some aspects of the cost of their production, but a lot don't understand the true cost, because opportunity cost is hard to measure.

"If you look at the top performers in any industry or business, they really understand the opportunity cost of not doing something, which is a very positive way of looking at it, and generally we like to back people who are positive."

Colliers Agribusiness/Transaction Services national director Jesse Manuel said successful outcomes occur when a family or a business owner is wholly committed to a process, with all stakeholders completely aligned.

"Once you've worked out what transaction path you want to take, you can work out what asset we are looking to realise, who is the target market and likely buyers," he said.

"Once you have determined likely buyers, a lot of other assets of a sale process are quite easy to put in place – what strategy, what method of sale to attract the right target market, what process and timelines are we going to implement to allow those buyers to participate?

"Once the target market and process are determined, build a quality pack of data – historical records, details of staff, third party agreements, supply agreements etc. It can be a process.

"Starting that conversation early, and sharing ideas to get everyone on the same page is the key to the success of a transaction."

Hort Innovation VEGETABLE FUND

The Annual Vegetable Industry Seminar 2022-2024 (VG21003) is a strategic levy investment under the Hort Innovation Vegetable Fund.
Project Number: VG21003

Attracting and retaining a workforce

With staff shortages continuing to be a problem in horticulture, techniques for attracting new staff, and then keeping them is good for business and employees.

The Australian horticulture sector employs over 125,000 (for all hort - 60,000 is just for the industries AUSVEG covers) people across all facets of growing and production. Currently, the industry has a shortfall of some estimated 10,000 workers.

In a tough market to fill positions, businesses need to consider the best way to attract potential employees, but also understand why employees choose to stay.

"Attracting and Retaining a Workforce" has been published by AUSVEG after consulting with employers, growers, recruitment agencies to provide handy tips and ideas on ways to attract new staff, and how to retain them.

Make yourself known

Casual workers will often use social media and your website to find your business – what you do, where you are, and what your values are.

Word of mouth and recommendations on social media are a powerful tool to provide an opportunity for your employees to share what a day of work might look like and why they enjoy working with you.

What is the job

Advertising for staff, whether it is seasonal casuals or full time, needs to be clear on what the role is, what you will do each day, and what the responsibilities will be.

For casual staff, particularly those new to the industry, having a clear description and line of command takes the guess-work out of what is expected and who to report to.

Build a community

For horticulture, many businesses are regionally based. Understanding what your local town or region can offer in terms of community activities such as sport, local schools, accommodation, and social and cultural networks can make your job opportunity more attractive.

Within your business, a supportive management team and workforce can lead to a respectful environment that is safe and rewards achievement and encourages staff to participate and return next season.

Bring them back next season

Once employed and trained, a returning seasonal worker is invaluable to horticulture as they know what is expected of them. Giving them an opportunity to come back is up to the employee. Building a network through communication apps, keeping in touch during the off-season and giving a previous employee first option for an opportunity, not only builds a sense of loyalty, but also minimises the stress of finding a new staff member.

For more ideas and tips, download the document from **ausveg.com.au/ausveg-advocacy/**

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For more information, contact your local Nufarm Business Development Manager

SURVEY RESULTS

Student barriers to horticulture careers explored

An AUSVEG survey of agriculture educators has exposed a number of key perceptions primary and secondary students hold that are acting as barriers to the pursuit of horticulture careers.

As the long-running shortage of workers in the horticulture sector threatens to further worsen under new Federal Government workforce policy, AUSVEG has been expanding its efforts to attract young people to the industry.

Making horticulture an attractive career path for young people begins at an early age, but raising the industry's profile with primary and secondary school students is not a straightforward task.

Following the well-received launch of the *Growing a Career in Horticulture* booklet, AUSVEG conducted a survey in June 2023 to explore the most effective ways to attract school students to a career in horticulture.

The survey collected information and opinions from nearly 70 individuals working in or interested in agriculture education at all levels, including primary and secondary school educators, career counsellors, growers, students and associated industry bodies.

The results of the survey will help inform AUSVEG's horticulture education strategy, which is being developed by a newly established Horticultural Careers Reference Group made up of growers, educators, and other interested stakeholders.

A key aim of the survey was to explore the major barriers to students pursuing a career in horticulture. Several consistent themes emerged from responses.

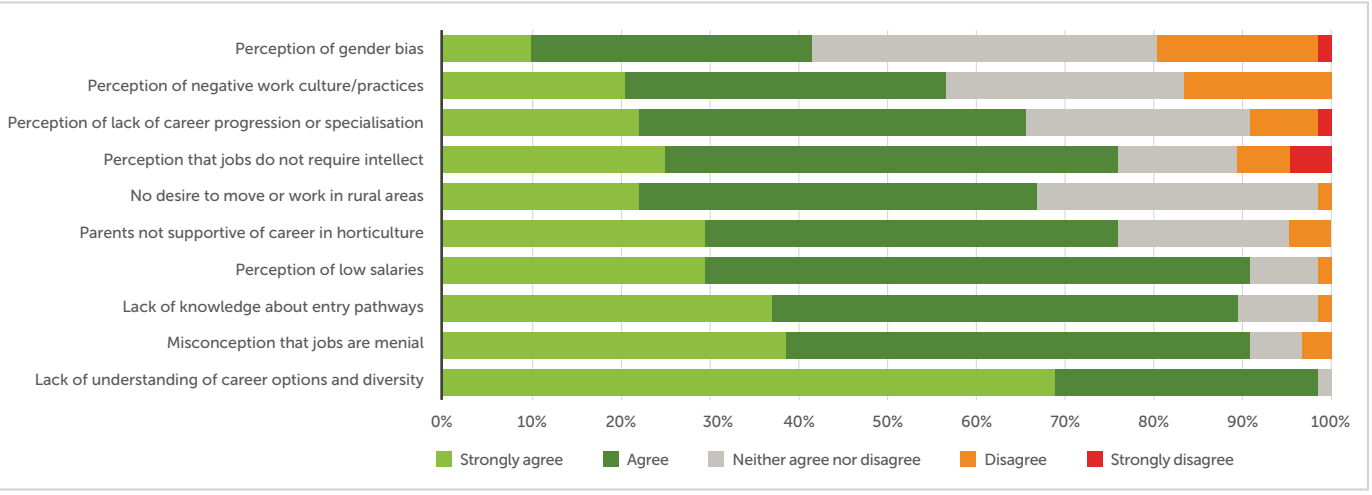
The old adage "you can't be what you can't see" was alluded to in numerous survey responses. Respondents reported that horticulture as a potential profession had a lack of visibility among primary and secondary school students. This was seen as a reflection of the same lack of awareness of the modern horticulture industry that exists in the broader public.

Both teachers and students were reported as having little understanding of the diversity of job roles in horticulture, and a misconception that horticulture roles were primarily manual labour, intellectually unstimulating and poorly paid.

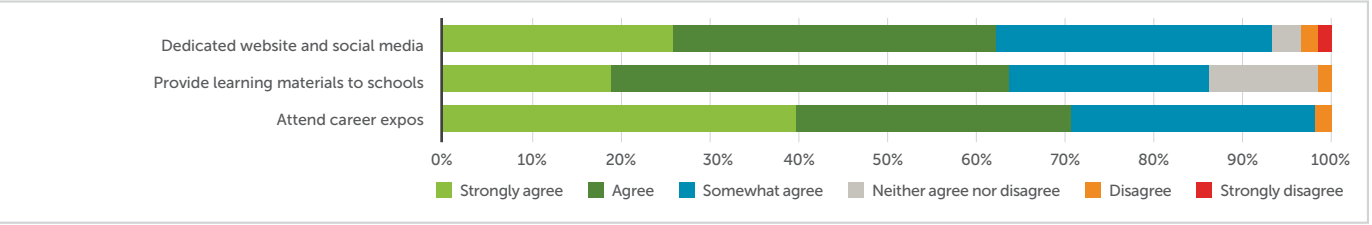
There was also a lack of clear entry pathways for students into horticulture. Respondents indicated this was partly a structural issue, with few farm businesses set up formally enough to show a clear career path, and partly due to geography and the travel time required for most urban students to visit farms for work experience.

Respondents pointed to several key areas where the horticulture industry could begin addressing these issues, such as attending career expos and having a dedicated website and social media presence to promote horticulture careers, which AUSVEG's Horticultural Careers Reference Group is now exploring.

MAJOR BARRIERS TO STUDENTS PURSUING A CAREER IN HORTICULTURE



BEST MECHANISMS TO ENGAGE WITH STUDENTS AND PARENTS



Another world first for the Burdekin

When the team at Rapisarda Enterprises in the Burdekin applied BASF's new Efficon® Insecticide on watermelon and pumpkin crops earlier this year, they were making the world's first commercial application of a product with a ground-breaking new mode of action.

Efficon's active ingredient, Axalion®, was only classified as the first and only Group 36 insecticide after the product had gained its historic registration in December last year.

"It was an amazing honour to be the first farm in the world to use Efficon," said Lynk McClelland, Rapisarda's chief melon grower. "It's working well, preventing aphid and whitefly numbers building up, and its new Group 26 chemistry will allow us to manage resistance in our insect populations."

BASF trial work has identified Efficon as exceptionally effective in controlling whiteflies, but for Lynk the new product's rapid control of aphids promises even greater benefits.

"Papaya ring spot virus (PRSV) is quite devastating on a crop through the winter months up here," he explained. "It's spread by aphids and Efficon has the ability to reduce salivation, which should reduce spread of PRSV so we don't have to worry about the production side of things. If we can produce more on the same inputs, that gets our efficiency up."

Another key advantage of Efficon is the excellent fit with IPM programs and very low impact on beneficial insects and pollinators.

"A robust IPM strategy is vital for what we're doing here," Lynk was quick to point out. "We have spiders, lacewings, ladybirds, all that sort of thing living through the crop and through the surrounding pastures, so we need to use soft chemistry that will look after those beneficial insects."

Efficon's world-leading first Australian registrations are to control both silverleaf whiteflies and greenhouse whiteflies in cotton, cucurbit and fruiting vegetable crops; green peach aphids and cabbage aphids in brassica and leafy vegetable crops; and cotton (or melon) aphids in cotton and cucurbit crops.

Those use patterns mean Efficon applications can be made before or after Versys® applications targeting the same pests. Coincidentally, the world's first commercial application of Versys Insecticide was also made on a Rapisarda crop.

As Lynk explained, the Burdekin is a great growing environment that supports very intensive cropping but also promotes high insect pressure.

"I love farming up here. This climate's fantastic for growing crops, but insects and diseases try to eat everything... Aphids and whitefly, they're an issue, as well as all the Lepidoptera species that continually attack the crop."

That constant pest pressure makes it the ideal area to really test out new insecticides. Versys quickly proved its value and continues to do so. Lynk expects Efficon to have an equally or even greater positive impact.

"Versys has been vital for us over the last five years to help control aphids and whitefly. It's still doing its job, but I'm looking forward to the new chemistry with Efficon also preventing the spread of PRSV."

Above L-R. Greg Haslam, Horticulture Crop Specialist, BASF Australia, Lynk McClelland, Chief Melon Grower, Rapisarda Enterprises, and Serge Usatov, Horticulture Portfolio Manager, BASF Australia

FOR MORE INFORMATION
head to: crop-solutions.basf.com.au/efficon

Looking after your mind and invest in yourself

Farmers are a pretty self-reliant bunch who can problem solve themselves pretty well out of anything. But when life throws events that are out of your control, your mental health can take a beating and it can be hard to find the way forward. ifarmwell is a tool aimed to help you navigate the negative or unhelpful thoughts and get back on top.

As a psychologist from a South Australian farming community, too often Kate Gunn had locals ask her about how they can help someone, or where do you find the resources and services for mental health issues.

Rural communities too often do not have the resources to provide mental health services and communities are often left to fend for themselves, or it is not addressed.

During her undergraduate research at university, it became readily apparent that even within the psychology profession, rural mental health was not always a priority or a subject for investigation.

"I had witnessed a lot of mental health issues in the farming community I grew up in, and even people with severe mental health issues were not always easily able to access appropriate help," said Associate Professor Kate Gunn.

"People would ask me time and again for advice, and I found that I was repeating the same information over and again – it was time to provide the information online in a farmer-friendly manner, that was free and readily accessible."

The launch in 2018 of ifarmwell gives farmers a set of tools to develop strategies for themselves to improve their mental health. The program includes practical ways of coping with difficult circumstances, thoughts and emotions and where to focus your attention and energy. It is useful not only for farmers that are feeling distressed, but also for those who wish to improve their abilities to cope with uncertainty.

"When we were designing ifarmwell, we did extensive research with farmers to understand why when exposed to the same levels of stress, some farmers coped okay, while others became distressed.

"The coping strategies you choose to use clearly made a difference. In particular, if farmers can accept and let go of the things they can't control like the weather or commodity prices, and focus on the things you can do something about, then they are significantly less likely to become distressed.

"It's not just farmers that face uncertainty in rural areas – agronomists and the vets are exposed to this a lot too".

"The strategies in ifarmwell will help you work out what you can and can't control, and how to make the most of life regardless of your circumstances."

The ifarmwell website contains factsheets that give practical ways to improve your wellbeing across a number of subjects including dealing with natural disasters, finances, relationships, grief, anger management and conflict.

To build strategies in to your life, it is recommended that farmers undertake the five modules provided. These can be done at any time, anywhere that suits with the internet, and usually in fortnightly 30 minute sessions. A module can be stopped at any time and returned to at a later date. It is also designed to adapt to the different types of farming for example, horticulture module imagery will be different to dairy.

Module 1: Taking stock of your current wellbeing and some practical strategies to get you started

Module 2: Thoughts are like bullies – how to spend less time 'in your head'

Module 3: Doing what really matters – to get the most out of a busy life

Module 4: Training your 'attention muscle' and focusing on the 'here and now' – a more pleasant, less exhausting place to be

Module 5: Putting it all together and moving forward.

"We know farmers spend a lot of time on their own, for example moving sheep or going up and back in the tractor. By doing the modules farmers will improve their ability to notice when they are getting caught up in their thoughts, and know how to turn their attention to something more useful. It is about building your attention muscle – that ability to turn your thoughts one way, and then back again. When you can let go of unhelpful trains of thought, and focus on things that are helpful, you will be far more productive."

As farmers work through the program, it is recommended that after each module to think about what has been learned and apply it to your own situation. The program will give reminders and prompts on things to think about, and when to move onto the next module. Participants can also go back to their toolboxes over time to remind themselves of their strategies, or to refresh.

"It can also be set up so that the farmer can nominate someone to be a supporter. That person will also get a message to say that the module is complete, and give suggestions on what to ask and to see how they are going.

"We find that by saying it out loud and talking about it, it cements the ideas and helps to bring about change in how farmers think about things and the strategies they decide to use. The farmer has a cheer squad, but no confidential information is shared with their supporter."

Kate and her research team at ifarmwell, based at the University of South Australia, have done extension evaluations of the program and found that working through the modules is associated with reduced stress and improved wellbeing.

"I would recommend that farmers have a look at the website and watch a testimonial video of a farmer who has done it. Farmers like to hear from other farmers. **If you think you might benefit from the modules, register, it is free.**

"In the first module there is some information gathering, so it can be a bit longer to complete, but with that information from there the program can be tailored to your specific needs. We know some farmers say they don't have time for this sort of thing, but if you can take charge of your mind, and where you put your attention, it is a very good investment of time."

For more information: ifarmwell.com.au

The ifarmwell website is not designed to be the only support for someone who is experiencing a crisis.

If you need immediate support, speak to a friend or family member you trust **and** speak to a professional.

To speak to a health professional:

- Make contact with your GP (if open).
- Present at the emergency department of your local hospital **and/or**
- **Contact one of the following:**

Lifeline

Phone **13 11 14**

Anonymous access to trained counsellors, crisis support and suicide prevention – 24 hours per day, 7 days per week. A local call cost applies to landlines (and may be higher for some home phone plans). Calls from mobiles are free. If you or someone you know is feeling distressed, you can chat with someone online at **lifeline.org.au** between 7pm and 12am (AEDT), 7 days per week.

beyondblue

Phone **1300 224 636**

For information and referral if you're feeling stressed or down – 24 hours per day, 7 days per week. A local call cost applies (and may be higher from mobiles). Alternatively, you can chat online at **beyondblue.org.au** from 3pm to 12am (AEST), 7 days per week, or email a mental health professional and get a response within 24 hours.

Suicide Call Back Service

Phone **1300 659 467**

Counselling for anyone affected by or considering suicide, including support and call back service in case of suicide risk – 24 hours per day, 7 days per week. A local call cost applies (and may be higher from mobiles). Counselling is also available 24 hours per day, 7 days per week at **suicidecallbackservice.org.au**.

Emergency Services

Phone **000** Satellite/GSM phones **112**

Supply chain fragility opens pathway to solutions

Issues with supply shortages for horticulture during the pandemic were felt across the globe. Rising costs of inputs, labour and market access were also a concern, giving rise to the creation of the Global Coalition of Fresh Produce to find common ground, a voice and solutions for the sector.

Ron Lemaire, Chair of the Global Coalition of Fresh Produce travelled to Australia to present at Hort Connections 2023 in Adelaide on the issues facing the industry sector and to share findings of a recent fresh produce survey that highlight the common pain points in the supply chain.

The Coalition is comprised of a group of associations from across the globe, including AUSVEG, who recognised that supply chain disruptions for fresh produce production and trade were exacerbated during the pandemic.

The aim of the Coalition is to ensure that industry has a global voice in a complex macroeconomic environment and to establish dialogue with industries affiliated with fresh produce – energy, shipping, packaging, fertilisers and retail. It is envisaged that by working at a global level, each peak body can increase dialogue in their local regions to support growers, packers and shippers and provide tools to give them the opportunity to improve their businesses.

"The first inkling that the global supply chain was under strain during the pandemic was the lack of movement for shipping containers, the lack of flow of product," said Ron.

"As time went on, issues with produce inputs began to emerge, such as access to fertiliser, pallets, fuel and seasonal workforces. These were major concerns here in Australia but were also felt right around the world.

"Shipping in particular was never a perfect system, but add in geopolitical issues, border closures and the cracks in the system got bigger and containers became stuck in some jurisdications, or shipping lines did not want empty containers on the back haul. Shipping logistics is a symphony that needs to play together, and it is still in a state of discord."

By engaging with international organisations such as the World Shipping Council, Ports Authorities and shipping lines, there is now data and clarity about where a ship and a container is at any given time. The Coalition is discussing how to create fast lanes and priority shipping models for perishable product.

"When a crisis occurs, such as a major weather event, the shipping industry is more than capable of responding, but often falls back into old habits. How do we implement those changes on a more permanent basis, and what regulatory pieces are needed to manage the system?"

Labour, packaging, fuel & energy

The pain points around labour, packaging, fuel and energy have always been a part of horticulture – it is the aim of the Coalition to identify the root cause of the issues and devise strategies for each coalition partner to use at a national level.

With inflation a common theme for consumers around the globe, Ron says that governments are beginning to listen to their electorate through the lens of food security for those who are more vulnerable in our communities.

"Interestingly, inflation overall has dropped for most countries, but food inflation has not. While cost of production has increased, the spending of consumers on fresh produce has remained low. Often after a crisis, consumers undertake 'revenge spending' where they want to go out and buy. In the past it might have been better food and higher end restaurants. With the pandemic, when food was relatively still available, the need to have 'better' fresh food is not the same. Consumers are now 'split brain spending', which means they are buying higher dollar value items such luxury fashion and cars."

Above L-R. Colin Chapdelaine, Canadian Produce Marketing Association, Lucy Gregg of AUSVEG and Ron Lemaire, Global Coalition of Fresh Produce discuss the challenges faced by the horticulture industry at Hort Connections 2023

The Canadian Experience

Colin Chapdelaine is the Chair of the Canadian Produce Marketing Association (CPMA), a not for profit organisation that represents members from farm gate to dinner plate to undertake marketing and advocacy.

As a grower, packer, importer and exporter, for fruit and vegetables, Colin's company was not immune to issues that arose during the pandemic. In particular, import/export became problematic.

Shipping containers bound for the West coast were stuck in ports and steamship lines diverted product to the East coast to alleviate the pressure. This produce which landed in the East, then had to be trucked back the West at additional cost, plus adding five days transit time, and significantly reducing the shelf life.

In addition, the cost of a shipping container increased fourfold, pallets were not available and packaging for tomatoes became scarce.

"At a local level, we had to deal with situations as they arose, but there is only so much you can do, and often in order to maintain a market, the increase in costs had to be absorbed, or risk losing the business altogether," said Colin.

"As we recover our markets and shipping routes, we are now far more efficient in our business, because we have recognised the weaknesses within our own systems, looked at the data and worked to remedy the situation."

The lack of pallets was another pain point felt around the world. With stories of hoarding, or caught within containers stuck on wharves, the lack of pallets became a significant issue.

Working with the Coalition, the CPMA stepped in to work across the supply chain of many industries to free up pallets, many of which were in warehouses holding bulk product that did not require pallets for storage. In addition, discussions were held with retailers to discuss other pallet formats beyond industry standards.

"The issue of pallets is good example of where organisations like CPMA and the Global Alliance can step in, help resolve an issue, and step out again," said Ron.

"Our role is to be a collaborative group while there is a need. The Global Alliance is purpose built, so when that purpose is no longer needed, there is likely to be other areas such as food safety and sustainability where we can be a voice for industry."

Feeling the crunch

The survey conducted by the Global Alliance, released in July 2023, gives a snapshot in time of how fresh fruit and vegetables was faring in 2023 compared to two years prior during the pandemic. Taking respondents from Europe, USA, Canada, Australia and Mexico the overall sentiment was that the selling price of produce had increased, but so too had the production costs, with many producers breaking even, or operating at a loss.

% INCREASE IN PRODUCTION AND OPERATING COSTS IN PAST TWO YEARS

	Europe	Canada	USA	Mexico	Australia
Fertiliser	64	41	58	28	107
Seeds	30	22	27	13	34
Crop protection products	35	21	29	19	34
Plant material	15	16	22	19	29
Water	14	48	10	20	25
Fuel/gas	42	46	39	25	56
Electricity	64	24	18	15	38
Cardboard	27	31	23	14	24
Pallets	41	35	33	22	18
Labour	22	18	15	15	17
Building costs	27	22	38	18	55
Machinery and equipment	19	20	22	12	3
Storage	26	16	17	10	21
Shipping	36	29	26	14	35
Audits/business management	19	18	13	10	57
Rents	16	22	18	12	18
Utilities	8	17	13	9	38

Europe

The majority of respondents indicated that their selling price had gone up over the past two years (by 11% on average); for those who saw their selling price decrease (mostly in Germany), the average fall was 19%. However, the large majority of European respondents indicated that their selling prices, even if it had risen, had not kept pace with rising operating costs.

Operators have been unable command higher prices for various reasons, including oversupply, decreasing consumption and lack of bargaining power. 56 percent of respondents are mostly breaking even, 16% are largely selling at a loss, and 28% generally make a profit on their transactions. Nearly all respondents state that their sales margins have declined compared to 2019 (by 12% on average) with only a handful of respondents indicating that their margins have increased (by 8% on average).

Canada

All respondents state that their selling price has gone up over the past two years (by 14% on average). However, for the large majority of respondents, the rise in selling prices has not kept pace with the rise in production and operating costs; only one fifth of respondents have been able to raise their selling price in line with rising costs. Operators have been unable to command higher prices for various reasons. The most cited reason is their lack of bargaining power with retailers, who reject price increases and in some cases even cancel purchasing orders if another supplier offers lower prices. Other growers state that they face stiff competition from cheaper imported produce grown under different policy and tax frameworks.

Slightly more operators are making a profit than breaking even; no respondents indicated that they are mostly selling at a loss. As many respondents have seen their sales margin increase (by an average 7%) as decrease (by an average 4%) compared to 2019.

Australia

Over 70 percent of respondents indicate that their average selling price has gone up over the past two years (by 12% on average); about one third of respondents state that their average selling price has gone up (by 25% on average). However, all respondents argue any rises in selling prices have not been sufficient to compensate rising production and operating costs. Operators have been unable to command higher prices for various reasons. The most cited reason is lack of bargaining power with retailers, who are unwilling to pay more and expect growers to increase the efficiency of their production.

Fourteen percent of operators indicate that most sales are made at a loss; 43% are mostly breaking even and 43% are mostly selling at a profit. Half of all respondents state that their sales margin has gone up in comparison to 2019 (by 10% on average); the other half indicate that their sales margin has gone down (by 14% on average).

USA

Rising labour costs are cited as one of the most pressing challenges. Nearly all respondents state that their selling price has gone up over the past two years (by 19% on average). However, for the majority of respondents (60%), the rise in selling prices has not kept pace with the rise in production and operating costs; only one fifth of respondents have been able to raise their selling price in line with rising costs.

Operators have been unable to command higher prices for various reasons. The most prominent reason seems to be competitive pressure from imported produce, which is not subject to the same food safety scrutiny as domestic produce and does not face the same cost pressure (inflation). This is coupled with operators' lack of bargaining power with retailers who refuse to increase prices in line with rising operating costs. Another reason cited is dampening consumer demand for fruits and vegetables. % on average); one third indicate that their sales margin has gone down (by 9% on average).

Mexico

A large majority of respondents indicate that their average selling price has gone up over the past two years (by 7.6% on average); however, for half of all respondents, this rise has not been sufficient to compensate rising production and operating costs. Among the reasons cited is pressure from the market.

A large majority of operators is selling at break-even point or at a loss; the only respondent who mostly operates with a profit is a shipping company. Half of the respondents have seen their sales margin fall in comparison to 2019 (by 10% on average), while the other half has seen their sales margin increase (by an average 8%).

"Looking into the longer term future, what we are seeing is that the rising costs in production has impacted on investment – capital investment, innovation, equipment and expansion. The figures also indicate that the profit margins have shifted, often toward the retailer, not the producer – we need to look at the why.

"Australia is in a unique position in that you are a net exporter of product, with a strong dynamic domestic market. As your regional markets re-open and full trade resumes, it will be interesting to see in another 12 months how the industry is progressing.

"It is clear that there is definitely pain felt by the industry from the survey results," said Ron. "And as a Coalition, we have a lot of work ahead of us to gain some rebalance for growers around the world.

"I am optimistic about what the Coalition can achieve and where we can take our dialogue to benefit growers around the world and what the fresh produce narrative will be."

Read the full results of the Global Alliance survey at producecoalition.net

A new dawn. A new standard.

New Miravis® Prime combines the strengths of proven fludioxonil (Group 12) and new pydiflumetofen (Group 7) to manage hard-to-control diseases.

These complementary active ingredients attack fungal pathogens in different areas of the plant. They target four different stages of disease development to effectively break the disease life cycle, while aiding resistance management.

There's a new dawn in protectant fungicide technology, powered by MIRAVIS. Miravis Prime. For further information talk to your local Syngenta representative or visit syngenta.com.au/miravis-prime.

Miravis® Prime

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IS YOUR CROP PROTECTED? SCAN HERE

vegetable fund update

This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation VEGETABLE FUND

Keep brassica vegetable pests pinned down.

BAYER

MOVENTO®

Diamondback moth
(Plutella xylostella)

Stop the pests wherever they're hiding in your brassica vegetables, with the two-way systemic action of Movento®:

- Protects the whole plant
- The only registered Group 23 insecticide
- Low impact to most beneficial species, when used as directed

With long-lasting protection, Movento can be effectively used as part of your integrated pest management program.

To learn more and download the Movento brassicas crop guide, visit crop.bayer.com.au/movento or talk to your local Bayer Crop Science representative.

Green peach aphid
(Myzus persicae)

Grey cabbage aphid
(Brevicoryne brassicae)

Silverleaf whitefly
(Bemisia tabaci biotype B)

Spinach on the global stage

The 2023 International Spinach Conference highlighted to delegates the extent of the industry on an international level, hearing from speakers on growing regions, consumption and the latest research to combat pests and diseases.

The global spinach industry starts with seed with Denmark, USA, Holland, Italy and France, the primary production areas for the world's spinach markets.

According to IndexBox, global spinach consumption rose by 5.4% in 2020 to 32 million tonnes, for a market value of $US39.6 billion, up 5.1% on the previous year. In Australia, Hort Stats shows that baby leaf (spinach, kale, silverbeet) produced 6,715 tonnes in 2022, with a retail market value of $AUD23.5m. At about 1,000 seeds per square metre to produce 1-1.5kg, the acreage of spinach is immense.

Research into pests and disease, and optimising yield continues to be a primary focus.

Well-respected Australian agronomist, Stuart Grigg spoke on production and consumption of spinach in an Australian context (read about spinach agronomy on *page 46*), while Jennifer Clarke, of the California Spinach Research Board highlighted that spinach volume trends as bulk and bunched continues to drive research in the US.

As in Australia, thrip, pythium wilt, mildew are major concerns, but so too are water management regulations, heavy metals such as cadmium, and sustainable packaging.

The organic market for spinach in the US is a major component of consumption, with 40,000 acres under production in the three main growing regions of California and Arizona across five counties.

Ramy Colfer, of True Organics based in the US, said that prevention of pests and diseases through crop rotation, beneficial insects and biocontrol were the only options available, particularly for pythium based diseases that have no treatments available under organic production systems.

Nitrogen management is becoming increasingly urgent in California's coastal regions and restrictions on fertiliser usage, according to Richard Smith from the University of California. The research showed that because of the short growing window and shallow roots, uptake of nitrogen needs to be in the upper soil profile. Californian is set to bring in new regulations regarding nitrogen, so effective use of nitrogen is vital.

Pest & Disease Research

Professor Jim Correll gave an overview of the common pests and diseases in spinach – downy mildew, damping off, pythium and *Stemphylium* in particular.

Taking a deep dive into the intricacies of seed production, Dr Lindsey duToit said that there are only a few locations in the world that have the dry, mild summers and long day length for production.

For the grower, the seed needs to give true spinach genetics, with high vigour for germination and free of pathogens. Hybrid varieties require two proprietary parent lines with differing susceptibility to spinach pathogens which also implies that isolation distances are needed between crops.

Fast germination enables young plants to establish a strong root system to withstand pythium. Dr deToit's recommendation was to avoid planting in cold soils, with little waterlogging and good soil preparation prior to planting.

Research has shown that crop rotations are an important part of production of spinach seeds and plants and recommended at 10-15 years. However, if the fusarium pathogens are under control, it can be reduced to 5-8 years.

Steve Klosternman of USDA – Agricultural Research Service has been researching downy mildew transmission, which is known to have airborne sporangium, that have the ability to survive six years at room temperature. In a controlled environment it was revealed that two different active oospore infected seed batches gave rise to downy mildew. The results provide evidence that oospore-infested plant debris in soil can cause downy mildew and further evidence of seed transmission of downy mildew in spinach via oospores.

PhD candidate Kayla Spawton studied the ecology and management of *Stemphylium* which causes leaf spot on spinach. Her research showed that *beticola*, *vesicarium* and *drummondii* were the pathogens specific to spinach. Cultivars with excellent resistance to vesicarium were identified for both fresh and processing spinach production. As a consequence, further study into the biology of the *Stemphylium* leaf spot is encouraging, for improved management of this re-emerging disease.

Above. Dr Lindsey duToit, Washington State University presents at the 10th Spinach Conference, hosted in Melbourne, 2023.

Latest spinach industry statistics

The data of production and consumption of spinach is often combined with other leafy vegetables such as kale and silverbeet. Interpreting the volume for spinach alone is not readily available.

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 spinach sector's performance during the financial year of 2021/22.

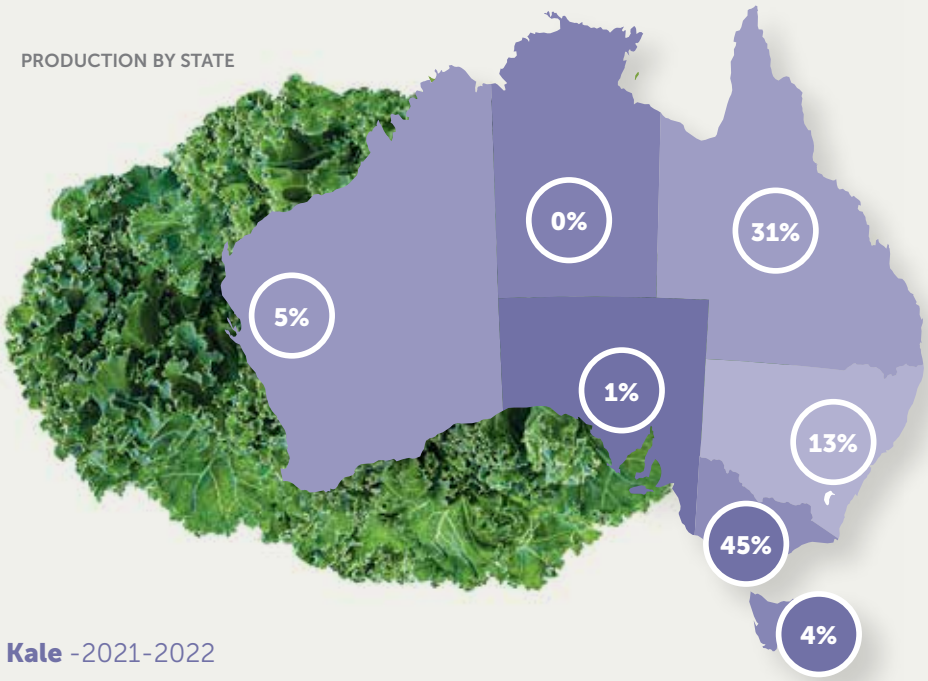
Fresh English Spinach / Silverbeet / Kale -2021-2022

PRODUCTION

	2022	2021	2020
Production (T)	6,715	6,925	7,080
Production ($m)	23.5	22.2	19.9
Supply per capita (kg)	0.23	0.24	0.24
Retail supply (T)	3,713	3,876	4,068
Food Service supply (T)	2,209	2,287	2,238

Source. Australian Horticulture Statistics Handbook

PRODUCTION BY STATE



Fresh English Spinach / Silverbeet / Kale -2021-2022

SEASONALITY BY STATE

State	Volume Tonne	Value ($m)	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun
VIC	3,027	$10.6m	H	H	M	M	M	H	H	H	M	M	M	H
QLD	2,113	$7.4m	M	M	M	M	H	H	H	M	M	M	M	M
NSW	852	$3.0m	M	M	M	M	M	H	M	M	M	M	M	M
WA	355	$1.2m	M	M	L	M	M	M	M	M	L	L	L	M
TAS	279	$1.0m			L	L	L	L	M	L	L	L	L	
SA	91	$0.3m	L	L	L	L	L	M	M	M	L	L	L	L

Availability legend ● High ● Medium ● Low ○ None

Source. AUSVEG

Spinach Export Data

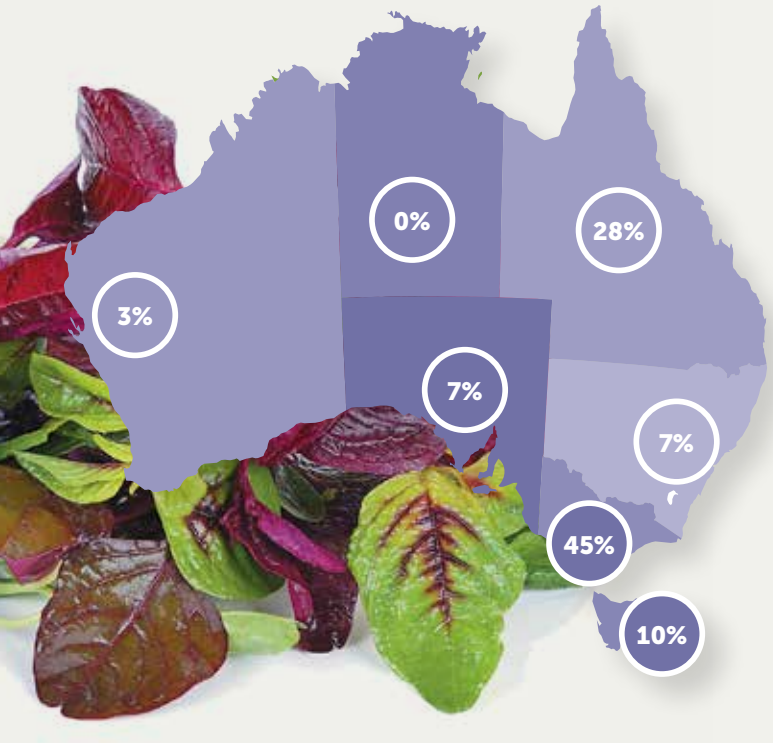
Products: 070970 (Spinach, New Zealand Spinach and Orache Spinach (Garden Spinach), Fresh Or Chilled)

TRADE PARTNER	2017		2018		2019		2020		2021		2022	
	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES
World	1,562,601	188	2,183,621	278	2,518,900	260	2,583,688	246	3,060,536	337	2,310,714	240
Malaysia	343,825	47	598,898	88	446,538	55	422,241	53	761,681	116	721,043	112
Thailand	209,593	13	228,947	14	449,056	26	439,464	30	367,464	30	535,790	38
Singapore	351,649	49	497,633	66	569,765	61	953,206	92	888,954	87	396,698	44
Hong Kong	329,689	45	456,130	60	464,481	59	304,560	32	634,114	69	239,645	22
New Zealand	13,700	2	114,750	23			90,712	5			136,151	3

Source. Australian Bureau of Statistics, IHS Markit

Fresh Leafy Salad Vegetables -2021-2022

PRODUCTION BY STATE

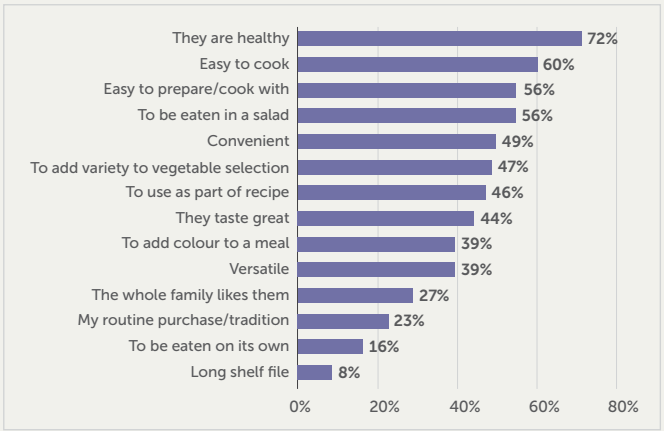


Fresh Leafy Salad Vegetables -2021-2022

PRODUCTION

	2022	2021	2020
Production (T)	78,495	74,571	67,628
Production ($m)	589.2	495.0	470.7
Supply per capita (kg)	2.57	2.86	3.00
Retail supply (T)	53,469	50,721	47,361
Food Service supply (T)	214.4	178.2	155.4

SPINACH - **TRIGGERS FOR PURCHASE**



Fresh Leafy Salad Vegetables -2021-2022

SEASONALITY BY STATE

State	Volume Tonne	Value ($m)	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun
VIC	3,027	$10.6m												
QLD	2,113	$7.4m												
NSW	852	$3.0m												
SA	355	$1.2m												
TAS	279	$1.0m												
WA	91	$0.3m												

Availability legend: High, Medium, Low, None

Source. AUSVEG

Solutions for human progress

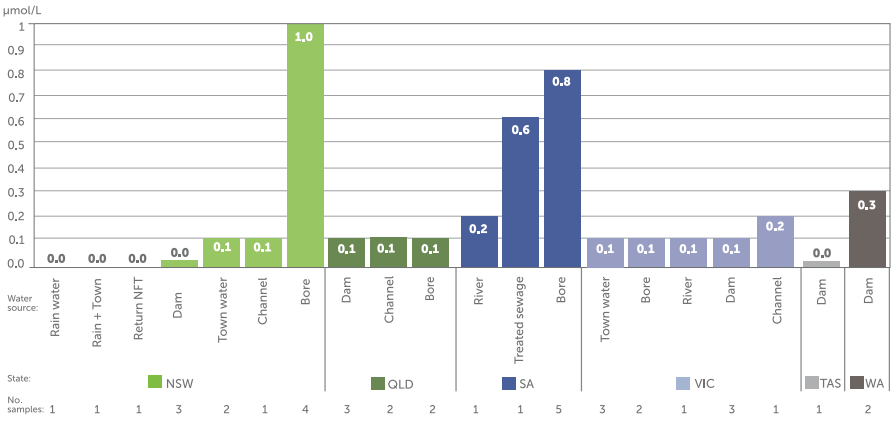
Benefits of Ultrasol®ine K Plus

Application of Ultrasol®ine K Plus (14-0-38) as source of nitrate, potassium and iodine in the nutrient solution of fruit trees ensures a readily available source of the beneficial plant micronutrient iodine for better root growth, flower development and fruit quality.

Irrigation water of main horticulture growing areas in Australia is too low in iodine.

In 38 out of 40 samples collected of irrigation water in 6 states of Australia, less than 1 micromole iodine per litre (0.127 ppm) was found. Rain, dam and river water contain little iodine, but bore well water iodine is highly variable, ranging from 0 (not detectable) to an exceptional 2.5 µmol/L.

Average concentration of iodine by state / source

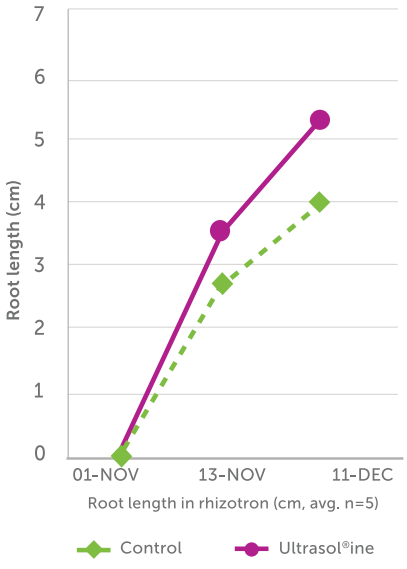


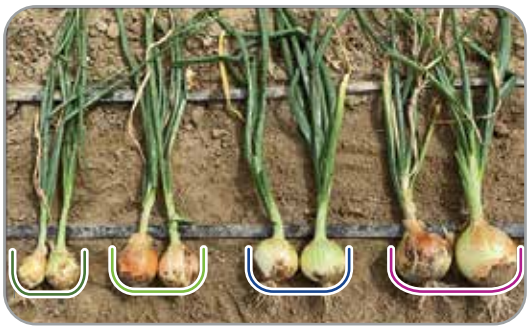
Agronomic advantages of Ultrasol®ine K Plus as source of iodine

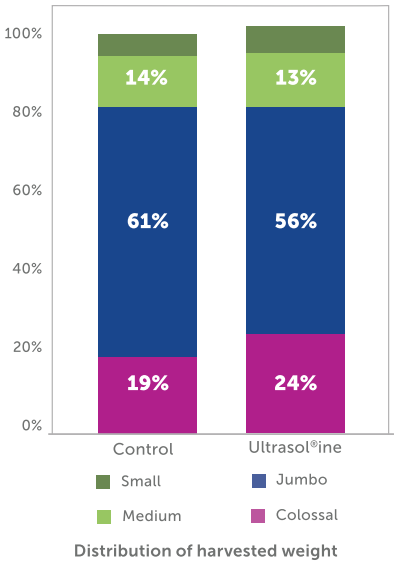
Ultrasol®ine K Plus ensures the presence of iodine in a micronutrient dose (1-10 µmol/L) in nutrient solutions. Iodine is beneficial for photosynthesis, root growth and resilience to stress. It supports the adaptation of plants to changes in the weather and stresses such as salinity or heat. SQM supports Australian agronomists to demonstrate the benefits of iodine for horticulture crops in Australia.

Increased root growth and bulb size

Good root growth early in the establishment of seeded onions was measured using rhizotrons installed in a farmer's field. Ultrasol®ine K Plus helped to promote bulb size in onions grown in an arid region in Peru, resulting in a 15% greater average bulb weight, with 24% onions in the colossal size class, compared to 19% in the control.







For more information contact:
spn-emea@sqm.com

The agronomy of spinach

Spinach for the most part is a tough, adaptable leafy vegetable, that can be grown year round in southern Australia, and seasonally in warmer climates, with a large number of varieties to suit production conditions, grower and processor requirements and industry segment.

Spinach is principally grown for the leafy vegetable market for use in salad mixes, cooking and smoothies, and harvested as baby leaves.

Traditionally, spinach was grown as a canning product, more akin to silverbeet, with the broader, tougher leaf cooked. The cartoon of Popeye eating canned spinach is well known as a marketing tool in the 1930s to promote the product. Today, very little canned spinach is consumed in Australia, some is consumed as cooked bunching spinach, a major product in China. Globally, baby spinach is the primary form of consumption. In Australia, consumption is around 95% baby spinach.

Leaves are normally picked up to 12cm long – two thirds leaf blade, one third stem with varieties categorised as either – flat, semi-savoy and savoy. The savoy describes the level of 'crinkliness' of the leaf. The more crinkly the leaf, the higher the savoy.

The flat leaf varieties, which are also typically more oriental (pointed and of Asian origin), have slightly more vigour, and better for winter production. For packaging, the leaves tend to stick together with moisture, possibly reducing the shelf life.

Conversely, the higher savoy varieties are typically better suited to summer and slower growing. However, the structure of the leaf can mean that it is more brittle and may become damaged in the packing shed. One area of focus for those involved in processing baby spinach is the tip of the leaf margin – pointed and flatter tips typically resist the splitting and result in a longer shelf life.

Spinach is grown in Australia in a range of mediums from sandy soils to clay, typically with a pH above 6.0 ($CaCl_2$) due to the crop's sensitivity to aluminium toxicity. Spinach is known to be an accumulator of nutrients and soil contaminants. During the 10th International Spinach Conference, presenter Richard Smith spoke on the endemic cadmium uptake in the US, challenges and management techniques.

Southern baby spinach crops are harvested at around 22 days in summer from seeding to harvest, and out to around 70 days in winter. Northern crops are typically only produced during the autumn to spring periods where they grow in around 45 days at the longest point of the production cycle

Spinach is a frost (and snow for that matter) tolerant crop, while summer varieties can cope with a 40°C summer. Humidity is a major production challenge where the damping off complex *(pythium spp, phytophthora, rhizoctonia* and *fusarium*) can attack root systems a various stages of crop growth

"Spinach is a somewhat weak, shallow rooted crop, it isn't able to tolerate wet feet," says agronomist Stuart Grigg, making it susceptible to adverse growing challenges.

"Nutrition uptake generally occurs from the top 10-20cm of the soil profile where spinach is able to accumulate nutrition. It is sensitive to nitrogen availability fluctuations requiring most of the crops nutrition in the last one third of the cropping cycle.

"Most growers will apply a base application of fertiliser, and perhaps a side dressing for longer term crops. For crops produced in 4-6 weeks, generally just one base application is all that's required."

Seeding is approximately 800-1200 seeds per square meter sown to give a yield in the order of 1-1.5kg of harvested leaf, taking 3-4 true leaves from the plant. Checking leaf numbers per plant at harvest is one method of assessing a varieties suitability in any particular growing slot.

The temptation is to plant multiple crops per year, but as Stuart pointed out, spinach is susceptible to diseases such as damping off. Research suggests that one crop every four years is recommended (which is unrealistic), however many growers will produce two crops per year, and rotate with crops such as lettuce, corn, celery, legumes and brassicas.

Pests and Disease of spinach

According to Stuart, the major concerns for spinach are downy mildew, the damping off complex and spinach crown mite. Damping off is becoming a problem globally and with the removal of seed coatings in the EU, it is likely to become a higher concern in Australia.

Damping off is due to soil borne diseases such as *pythium spp, fusarium, phytophthora* and *rhizoctonia* species, some specific to spinach.

Management is largely around seed treatments, soil health, varietal tolerance/susceptibility, and integrated crop management. Determining which pathogen is the primary cause is important, as some pathogens have similar symptoms presenting in the plant.

Crop rotation and cover crops are an option, but consideration needs to be given to plant trash, as pathogens such as rhizoctonia will thrive in the composting material.

"A lot of growers will rotate with lettuce and brassicas between spinach crops. Replanting spinach on the back of a spinach crop is not recommended as the plant produces an allelopathic response, which means that it releases a toxin to prevent other plants growing – including the spinach in the next cropping cycle."

Downy Mildew (*Peronospora effusa*) is the major production challenge for spinach crops globally largely due to the organic production focus in the US and Europe. With very few crop protectants available to producers, genetic resistance is the main focus which has lead to "The Race Race" – where breeding teams are racing to maintain varietal tolerance of pathogen genetic mutations. Breeding teams only have so many genes to work with to provide producers with genetic resistances – responsible use of these genes is important, as relying on genetic resistances alone is very risky and may not be sustainable. It's important to understand the pathogen to build a management plan – ideal temperature range for infection is 18-20°C.

Spinach crown mite is a significant challenge for spring and autumn spinach production in southern Australia, as mites live on decaying matter in the soil, while leaf miners tend to be more prevalent in the spring. Thrip is more of a warm season pest.

The major weed issues for spinach crops are stinging nettles which may induce an allergic or stinging response, and as shown in recent times, Datura (or false caster oil) which, as a young plant, looks very similar to spinach, can have serious health implications.

"Management of pests, diseases and weeds involves being proactive regarding soil health, being alert in this fast growing and dynamic crop, continually checking crops, carefully planning the best cropping rotation for your individual situation and constant engagement with the supply chain.

"Given a chance to establish well, spinach is quite a resilient plant, and will grow in some of the toughest conditions with good irrigation management," says Stuart.

For more information on pests and diseases *see page 48.*

SPINACH
Pests and Diseases

L–R. Leafminer Larvae. Anthracnose leaf spot in spinach. *Courtesy Stuart Grigg.*

DISEASES

Anthracnose

Colletotrichum dematium

SYMPTOMS

Small, circular, water soaked lesions which grow in diameter as they develop. Older lesions turn light brown, with tissues becoming thin and papery. Tiny, dark, spines (setae) eventually develop on the outer border of the lesions.

CONDITIONS

Leaves remaining wet for more than a few hours, cool conditions 10-20°C

Downy Mildew

Peronospora farinosa f. sp. spinaciae, Peronospora farinosa f. sp. betae

SYMPTOMS

Mottled, yellow areas appearing between the leaf veins. Soft, bluish grey mould can develop on the underside of the leaf, turning brown with age.

CONDITIONS

Cool conditions (10-20°C), especially with water on the leaves. The disease can spread during storage, but slowed at temperatures below 5°C.

Downy mildew in spinach. *Courtesy Stuart Grigg.*

Damping Off

Pythium spp, Aphanomyces spp, Phytophthora spp

SYMPTOMS

Pre-emergence damping off can cause brown, gelatinous rotting within the seed coat. If germination occurs, the crop is likely poor and seedlings are stunted, yellowing and wilted. Water soaked lesions appear on the lower part of the taproot or near the soil junction, which can result in excess branching of the root system.

CONDITIONS

Wet soil. Pythium, Aphanomyces and Phytophthora can survive in the soil for extended periods, in resting spores or plant trash.

Damping off in spinach. *Courtesy Stuart Grigg.*

Fusarium Wilt

Caused by *Fusarium oxysporum*

SYMPTOMS

General wilting of seedlings, foliage loses colour and eventually dies. Roots and vascular tissue turn black.

CONDITIONS

Acidic soils low in organic matter.

Wire Stem

Caused by *Rhizoctonia solani*

SYMPTOMS

Dry, sunken cankers with a sharply defined margin near the soil junction, soon after emergence. More advanced seedlings may send out new shoots below the diseased area.

CONDITIONS

Warm wet soils especially if combined with physical damage at soil level. *Rhizoctonia* can survive for long periods in the soil, on plant trash or as sclerotia.

Stemphylium Leaf Spot

Stemphylium botryosum f. sp. spinacia

SYMPTOMS

Small, circular to oval grey-green sunken spots, which enlarge in the centre and become papery as the disease progresses.

CONDITIONS

Warm (15-28°C), combined with high humidity. Seedborne.

Source: *Pests, diseases and disorders of babyleaf vegetables. A Field identification Guide. Jenny Ekman, Len Tesoriero and Stuart Grigg. Published by Horticulture Innovation Australia 2023.*

PESTS

Spinach Crown Mite

Rhizoglyphus spp

DESCRIPTION

Egg: round, semitransparent, barely visible to the naked eye, deposited between folds of new leaves

Nymph and adult: both reach 0.7mm long, all stages are semi-transparent with prominent long hairs and light brown legs.

DAMAGE

Emerging leaves and tissue are stunted and deformed, mostly during the spring when plant growth is slow

CONDITIONS

Cool, wet soil, rich in organic matter particularly in repeated crops.

Leafminer

Liriomyza chenopodii

DESCRIPTION

Egg: small, white cylindrical laid into the leaf tissue

Larvae: cream to yellow maggots up to 3mm long. Mature larvae drop to the soil to pupate.

Adult: small, black yellow fly about 2mm long.

DAMAGE

Females puncture leaves multiple times before egg laying, causing leaf spots. Developing larvae make feeding tunnels inside the leaves.

CONDITIONS

Common in spring and early autumn in southern Australia.

Thrips

DESCRIPTION

There are many species of thrip, and determining which is present can be difficult due to their tiny size.

Nymph*:* cream to yellowish, wingless, generally less than 1mm long.

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

DAMAGE

Silvering of the leaves, leading to leaf curl. The major risk is the spread of disease.

CONDITIONS

All crops may be affected especially during warm, dry weather. Feed on new shoots, and hide in the leaf axis of seedlings.

Above L–R. Crown mite damage in spinach. *Courtesy Stuart Grigg.* Leafminer - *extreme magnification.* Thrip - *extreme magnification*. **Below.** Spinach mite damage. *Courtesy Stuart Grigg.*

Hort Innovation VEGETABLE FUND

Source. *Pests, diseases and disorders of baby leaf vegetables. A Field Guide.* Jenny Ekman, Len Tesoriero and Stuart Grigg. Published Horticulture Innovation Australia 2023. This guide is funded by Hort Innovation using the vegetable research and development levy and contributions.

Spinach – from harvest to plate

Above. Alexandra Keith production agronomist Bulmer Farms.

Alexandra Keith is the production agronomist for Bulmer Farms in East Gippsland, with eight years' experience in spinach. AUSVEG spoke with Alex to see what is involved in getting spinach to the consumer.

Getting ready for harvest

In summer, the growth time of spinach, from seeding to harvest, is just 21-25 days. In winter this increases to eight weeks. The slowest growing varieties are grown in summer while the fastest growing varieties are grown in winter. During summer the aim is to slow down the spinach growth to ensure better shelf life. Throughout the year, we transition through different varieties, using approximately three different ones per time slot. We use multiple varieties per time slot to 'not put our eggs all in one basket' so to speak.

Our rotation between crops is dependent on the paddock and the time of year. Sometimes we will double crop, more so in winter when there is less disease pressure, but in summer we will try and do spinach, lettuce, brassica and maybe another lettuce, then a brassica before planting a cover crop. In part, the rotation depends on how much ground we have available.

The first step before harvesting is to check that the crop is ready. For this, you need to have four true leaves, all at the same height. This ensures maximum yield while reducing the amount of cut leaf. For baby spinach, the specification is 10-12cm long, of which two thirds of that is the leaf blade, one third stem.

Our spinach is machine harvested directly into crates. During the warmer months, once the spinach reaches the packshed it will be vac cooled to get the temperature down to 4°C as quickly as possible. From there it will go to the cool room waiting to be distributed to a either a processor or for use in our own wash line.

Quality Assurance

Throughout the crop cycle, part of my job is to check or scout the crops every week. This allows for early detection of potential problems, such as weeds, disease, pests, or nutritional issues. Prior to harvest, a final in field check is done. Once the spinach reaches the

SPINACH WASHLINE

REMOVING UNWANTED ELEMENTS

pack shed, a post-harvest assessment is performed by our Quality Assurance Team to assess the levels of defects. Some of the defects include presence of cotyledons, cut or yellow leaf, insect damage or weeds. We are Freshcare, HACCP and HARPs certified.

We try to minimise weeds with pre-emergent herbicide. In some instances, if the weed pressure is too high in a location, we will not harvest that section of crop. That doesn't happen very often though.

Foreign bodies like stones or previous crop residue on the ground usually don't get picked up during harvest because the blade is just above the ground. Once in the wash bath, a mixture of different bath and rollers helps to remove cotyledons and other foreign bodies. Anything heavy should sink, anything lighter should float and be caught by the roller.

Spinach is a great leafy vegetable to grow and eat. Like all crops, it has its own challenges and rewards, and keeps us on our toes.

Planning ahead

Shelf life is dependent on time of year and the variety. Generally, winter crops have a better shelf life than those grown during summer. Summer crops grow 'softer', because of the quicker growth rate. In most instances, we harvest and dispatch the same or next day.

During winter we need to be mindful of frost which will delay the harvest time. We will often harvest a day ahead if a frost is forecast so that we can still despatch on time.

Forecasting and planting schedules are based on what we plan to sell to market customers and processors. The market customers usually order on the day of despatch, the processor customers will give an indication the week prior and finalise their order the day before despatch. There is a fait bit of fluctuation in orders from day to day.

We plan and plant to have product available every week of the year. However, weather variations can cause a crop to grow faster or slower than same time the previous year creating a harvest gap. Or, weather events, such as a hailstorm can damage crops making them unharvestable, or excessive rain can prevent planting creating a harvest hap in the future.

Spinach seed production for the world

The production of seed for spinach is largely based in Europe, but with careful planning and trait selection, spinach can be grown around the world.

The unique combination of climate and day length of Denmark, makes the country the world's largest production site for spinach seeds, but the challenges do not end with rainfall, daylight hours and temperature.

According to Dr Lindsey duToit during her presentation at the 10th International Spinach Conference, the criteria for spinach seed production is a trueness to type based on genetics, germination rate, seed vigour, be free of pathogens and weeds and increasingly improved resistance to races of downy mildew.

Rijk Zwaan is the fourth largest producer of vegetable seeds, including spinach and grows seed around the world based on the vegetable, variety and seasonal markets, including Australia. By using a number of locations, the company can optimise growing windows, and minimise the risks.

The range of varieties grown covers flat leaf through to savoy, cooler to warmer seasons, plus the shoulder seasons between summer and winter. The flat spinach genetics originate with Asian parents, while the savoy is based on English Spinach lines.

Once a variety has been trialed and ready to commercialise, the production of the seed can take as long as two years.

"Once a variety is ready to be commercialised, seed production takes place in Denmark," said Annie Walch, seed specialist with Rijk Zwaan.

"Plants are grown-out to commercial volumes in a broadacre system. By doing that we can shorten the time to market by taking advantage of the different growing slots between the two hemispheres.

"Getting to commercial volumes can take 12-18 months, and then the cleaning, treating and packing process can take a further six months."

For many spinach seed companies, the emphasis on improving genetic traits has focused on resistance to downy mildew – a problem for all spinach growers around the world.

Top. Spinach conference delegates inspecting the Rijk Zwaan property at Bacchus Marsh. *Courtesy Stuart Grigg.* **Above.** Rijk Zwaan spinach varieties on show.

Annie Walch, seed specialist, Rijk Zwaan.

With the EU phasing out certain fungicides, and the significant organic production in the US, developing varieties that have greater root strength to resist soil borne diseases is becoming increasingly important.

For the seed production industry, the phasing out of fungicides in the EU makes it challenging to develop and retain certain varieties. The decision to keep a particular variety often comes down to market size whereby a smaller market which grows a variety using a fungicide such as thiram will be discontinued, or the genetics not advanced to newer varieties.

This may mean that global seed production companies will discontinue that variety for all markets, not just one.

"The spinach seed breeders have identified a number of genetic markers, so selecting plants with specific traits such as disease resistance makes it easier to create strong hybrids," said Annie. "For other traits where the genetic markers are not identified, trials in the field have to be performed to test that trait.

"The focus for the past five years has been on root strength and resistance to soil borne diseases. However, it can take as long as 10 years to fully develop a new variety from concept to commercialisation."

As a wind pollinated vegetable, one of the biggest challenges is variety isolation during seed production. In Denmark, where thousands of hectares are dedicated to spinach seed production, this is no mean feat. A minimum of two kilometres is needed between crops (including those of competitor companies). In Australia, plants are grown in protected cropping environments. However, the 2km isolation is still required. Trials using pollen cloth and parachute mesh proved to be ineffective at preventing cross-contamination, as the pollen grains are too small and stay viable for a considerable amount of time.

In addition, rotations for seed production, like leaf production need to be considered to manage soil borne diseases. A minimum of seven to ten years rotation is the practice in Denmark which also reduces the risks associated with volunteer spinach plants from previous crops.

Rijk Zwaan tests and certifies each crop of seeds for germination, genetic purity and seed health. For quarantine clearance into Australia, the seeds must also be provided with a phytosanitary certificate to show it is free of a large list of diseases. Compared to tomato seeds which are produced in protected cropping, spinach seed comes under tighter scrutiny because it is produced under broadacre systems.

"Spinach is a good indicator of soil health – it is the canary in the coal mine – in that it is quite susceptible to soil borne diseases. For our seed production in Denmark, getting the rotations, isolations and pathogen-free locations is vital to ensure a viable seed production industry for spinach growers around the world."

Soil Wealth ICP project continues to provide valuable insight

BY CLAIRE HARRIS

For nearly 10 years, the Soilwealth Innovative Crop Protection (ICP) project continues to provide key findings for Australian growers looking to improve their on-farm productivity, profitability and sustainability.

The project is an initiative managed by Hort Innovation, with the third iteration of the project having recently started and continuing through to 2028.

At the Annual Vegetable Industry Seminar in Adelaide in June, three active participants in the program gave insights into their involvements and learnings in the program to date, as part of a panel discussion.

The panellists were vegetable growers Jake Shadbolt (VIC) and Anthony De Ieso (SA) and Peter Wadewitz from Peats Soil and Garden Supplies (SA).

Anthony, who is based on the Adelaide Plains as the director and general manager of Thorndon Park Produce, said soil wealth was 'very important'.

"The cost of production is through the roof, so we need to be taking a step back and focusing on less inputs and actually looking at the base, what you're actually growing from," he said.

Anthony was involved in a compost trial at Thorndon Park Produce's Waterloo Corner property in 2019, with compost trials now underway at its Gawler River property.

"Being a vegetable grower, we're intensively growing and it's a 'crop in crop out' cycle. Soil is something that may get neglected at times because we are constantly focusing on making a quality crop in record time," he said.

"So being able to take a step back and look at things like how compost or how organic inputs can benefit the soil, that's the most beneficial thing to our business right now."

A major finding of the trial was the existing nutrient availability in the soil prior to fertiliser application, which ultimately led to an economic saving.

"(Until the trial), we had always just kept adding more and more fertiliser as per our normal growing practices. Because it was working, we didn't think about doing anything different," Anthony said.

"By participating in the trial and seeing what would happen if we didn't do something, we realised after soil tests that we didn't need to (keep adding fertiliser), we just needed to try to get these nutrients that were locked up, out.

"We discovered that less is more, and if you don't need to, don't. Just focus on having a healthy soil, because if you have a healthy soil, you'll have a healthy crop."

Anthony said incorporating compost into the production system helped to boost soil health, but the practicalities of application had presented some challenges. Palletised cultures proved to be a good way of inputting the organic matter.

Peter Wadewitz was involved in the compost trial, and said adapting compost to useable forms for farmers was vital. His business is now heavily focused on tailor-made custom compost blends, to suit individual farmers and their enterprises.

"A lot of it depends on soil, so you have to adapt those sorts of products," he said. "For example, potato growers grow so much in sand, so they're looking for anything that will add a little bit of clay to those products to help improve the cation exchange capacity."

For third-generation farmer Jake Shadbolt, taking soil type into consideration has been a key factor for soil health improvement.

Jake farms just north of Swan Hill, VIC, managing Scotties Point Farms alongside his father Peter and brother Ryan. The family grow pumpkins, beetroot, onions and broccoli.

"You don't directly see it in the physical cashflow of business, but you will start to see it in 6-12 months and ongoing from that point."

As part of the Soilwealth ICP program, Jake has been involved in cover crop and strip till trials for a number of years, with the aim of suppressing weeds in winter, and maintaining good soil health in summer.

"We aren't organic, but we did want to reduce chemical and fertiliser costs," said Jake.

"We get some pretty hot summers, and if we don't have a cover crop in between October and February, our sandy, loamy soil just turns to concrete and is impossible to work with to try to prepare our soil for winter."

The Shadbolts trialled growing summer oat crops to then strip till and carry out weekly broccoli plantings in the row spaces.

"We were trying to maximise plants per area, without sacrificing too much wheel track space but we ran into trouble with our planting spacings, our wheel tracks being too wide, tractors falling into rip marks and getting bogged," Jake said.

"We were damaging product, but it's always the case that a lot of challenges come with learning new things."

For the pumpkin crops, the Shadbolts trialled growing a ryecorn crop over autumn and winter, to then crimp roll, strip-till, plant, spray, irrigate, and fertilise before summer pumpkin planting.

"We had to change our rotations of our plantings for different crops to allocate six months of growing season to (the ryecorn crop), but over three to four years we've started to nail that process with the pumpkins," he said.

Jake said there was a tradeoff between growing a prosperous cover crop for soil health, without compromising cash flow.

"If we pump up our cover crop to be six to eight foot high, that's going to delay us by two to three weeks getting (a cash crop) in the ground, but you can see the figures improving in your soil test reports," he said.

"Your organic matter is starting to increase, your nitrogen is hanging in the soil better, and your soil is retaining moisture better through winter.

The Shadbolts have chosen to step away from the trials for the time being to focus on other projects, but Jake said there was every intention to resume the work in the near future.

"We have been able to do a bit of groundwork and we have two, three, four years of learnings that we can then launch back into and accelerate from there," he said. "We're definitely not going to give up on it, there are just a few things that need extra tweaking."

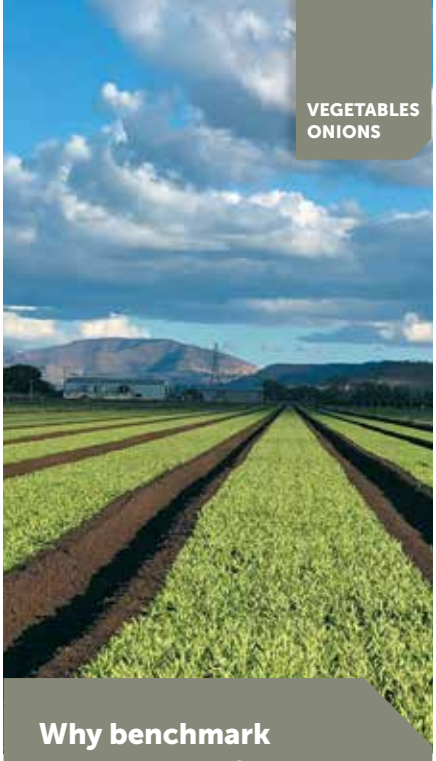
Anthony agreed that the 'tweaking' aspect of experimental work was inevitable, but always valuable. "Trial and error summarises our industry," he said.

"For us, all the trial and error led up to a pretty good program we have now using organic inputs, and we are returning a great amount of yield and profit on that crop. You don't make any progression unless you fall flat in the mud. Let results and product guide you with decision making."

FOR MORE INFORMATION
head to: soilwealth.com.au

Hort Innovation VEGETABLE FUND

The Annual Vegetable Industry Seminar 2022-2024 (VG21003) is a strategic levy investment under the Hort Innovation Vegetable Fund.
Project Number: VG21003



GROWERS

Get a free financial health check for your business

A new benchmarking program is underway to give Australian vegetable and onion growers access to clear, relevant information on the productivity and profitability of their business as well as the wider industry. This information will help new and experienced growers to assess the performance of their business over time, and identify areas for improvement.

There's no doubt that running a vegetable business in the current economic climate is a difficult and stressful task, but how often are you checking on the financial health of your business to assess how well it is weathering the storm?

We're not talking about a seasonal cashflow check-up and making sure there's money in the bank for next year, but drilling down into the fundamentals of what makes your business healthy, profitable and robust to remain financially sustainable year in, year out.

The National Vegetable and Onion Benchmarking Program (MT22009) is a new five-year project which aims to connect vegetable and onion growers with skilled farm business management consultants who will provide an independent financial review of your business, turn insights into actions and track the impacts on your business profitability.

The project is being led by Western Australian farm management consulting firm Planfarm, in partnership with RMCG, both of which have a long and successful track record supporting farm owners to build profitable and robust businesses in many agricultural sectors including grain, dairy and horticulture.

What to expect

Every year, participating business owners will receive one-on-one consulting sessions and an in-depth, personalised report which details the financial health of your business with a focus on production, cashflow, profit and balance sheet.

Businesses that choose to participate in the project are set to improve their profitability and resilience; something already experienced by Western Australian vegetable growers who took part in a pilot project that began before the current economic challenges.

Loose Leaf Lettuce Company owner Maureen Dobra participated in the pilot project in Western Australia for more than five years and recommends other growers to get involved in the current national project.

"The analysis and the one-to-one consultation pinpointed the financial strengths and weaknesses of our business and supported us to successfully negotiate better prices," Maureen said.

"While at times it could be confronting, it has now become part of our annual business management practice and is central to ensuring that the business remains profitable.

"In my view, every grower should seize this opportunity."

Confidentiality is key

In addition to working closely with individual vegetable business owners to drive increased profitability, the project will also generate a detailed industry benchmark analysis to identify the trends and dynamics at play across the sector that growers can either proactively leverage or actively manage within their business.

This will involve collating de-identified grower financial assessments to produce a common baseline of data so that vegetable and onion growers can see how their industry is tracking over time and the major profit drivers for different vegetable lines across Australia at both a state and national level.

Why benchmark your business?

- Understand the health of your business
- Understand how your business performance compares with others
- Identify what factors of production you can influence to increase productivity
- Assist with decision making and future planning for your business
- Understand how the industry is performing as a whole
- Access regional and national industry-wide benchmarks to monitor your performance over time.

How can you be involved?

To participate in the project, fill out an **Expression of Interest** form at: surveymonkey.com/r/veg_onion_benchmarking_EOI

FOR MORE INFORMATION
Contact Planfarm Project Manager Steff Carstairs on 0428 712 852 or **steff@planfarm.com.au.**

Hort Innovation VEGETABLE FUND
Hort Innovation ONION FUND

This project has been funded by Hort Innovation using the vegetable and onion research and development levies and contributions from the Australian Government.
Project Number: MT22009

Knowledge for sustainable growth

PETER MELVILLE, NATIONAL HORTICULTURE CATEGORY MANAGER, NUTRIEN AG SOLUTIONS

This year's Hort Connections focussed on the theme 'Knowledge for Growth', a mantra that we follow at Nutrien Ag Solutions. It is something which is embedded in our trusted agronomists servicing the horticulture industry Australia-wide. Our team of about 4,000 people are passionate about the agriculture industry and using their skills and knowledge to support their clients to grow.

While the industry is aiming to become a $20 billion industry over the next six to seven years, transitioning that ambition to reality requires careful navigation of new market opportunities alongside changing market requirements. This is one of the reasons Nutrien is making significant investments to better service our horticulture customers from supply chain support, agronomic support and now finance support.

Sustainable Custodians

Over recent years we have seen a far greater emphasis put on the term 'sustainability' both globally and domestically. More pressure is coming in the way of government policy and from consumers, however throughout these discussions over the better part of the last decade, the 'practical' grower reality of these conversations has been missing.

We believe growers have always been great custodians of the land. It has always been in the best interest of the grower to care for and improve their farmland for the sustainability of their property, but also for the sustainability and profitability of their business.

When we think about using our knowledge to grow sustainably it's more than just achieving an environmental outcome. It needs to be linked to the realities of farming, science and ultimately centred around productivity and profitability on farm.

To do this, Nutrien is continuing to invest in our business to make sure we are ready for what is around the corner. Nutrien has a team of 10 staff dedicated to finding sustainable solutions that growers can leverage to gain a financial return.

Innovate, build and technology with data

Nutrien Ag Solutions Head of Commercial Sustainability David Stanko, *(pictured)* presenting at Hort Connections, leads Nutrien's efforts to innovate, build and adopt technologies that measure, monitor, and improve the environmental impact of agriculture across our customer footprint.

Nutrien, like growers, are strong believers in using data and information to drive better decision making, and it is no different when it comes to sustainability.

We currently have a range of pilot programs in operation across the country which are looking at measurements for Carbon Neutrality, generating a farm emissions baseline and better measurement of soil health. While also looking at on farm solutions in low carbon canola, sustainable use of nitrogen and a low environment impact program in potatoes.

But while we are investing heavily for what might be around the corner and working to ensure our customers are ready to capitalise on future opportunities, we are also invested in the here and now.

We look forward to sharing more of our sustainability program and insights at Hort Connections in 2024!

Nutrien Ag Solutions

FIND OUT MORE

For more information about Nutrien please visit **nutrienagsolutions.com.au** or contact **Peter Melville peter.melville@nutrien.com.au**

Vegetable and melon industry priorities shape new demo sites

The Soil Wealth and Integrated Crop Protection (Soil Wealth ICP) project works with growers to put soil management and plant health research into practice. *Soil Wealth ICP Phase 3* (MT22004) is a strategic levy investment under the Hort Innovation Vegetable and Melon Funds. This article explores the project's overarching plans for a new network of demonstration sites around the country, including confirmed sites in Victoria and Queensland.

Putting theory into practice on a demonstration farm

Phase 3 of Soil Wealth ICP has set an ambitious target to establish 14 demonstration sites for the duration of the five-year project; 10 in vegetable regions and four in melon regions.

The demonstration sites play a vital role in advancing agricultural practices and technology and serve as practical showcases for innovation.

These sites facilitate the adaptation of existing practices and technology to suit specific commercial farm conditions, ensuring they can be applied in a practical way. Additionally, the demonstration sites promote grower champions and offer coaching opportunities, inspiring practice changes not only on farm but also across the region and beyond.

Moreover, the sites act as focal points for farm walks, training sessions, case studies, and a wealth of other resources and communication channels, facilitating knowledge exchange and driving progress in the agricultural sector.

All sites are managed by the Soil Wealth ICP team who provide technical expertise, maintain relationships, and ensure continuity across all demonstration sites.

Currently the project has three confirmed vegetable sites in Tarwin and Skye (VIC), and Lockyer Valley (QLD), with additional locations in progress throughout Australia including Tasmania and South Australia.

The melon demonstration sites will focus on priorities of the melon industry, with information on the sites shared through various communication channels including the Soil Wealth ICP website and close linkages with Melons Australia communications.

Diverse topics explored

Several topics, identified as a priority for the ongoing economic and environmental sustainability of the industry, will be investigated in either a 'core' or 'case study' site.

Core sites include farms where a practice or technology has not been implemented by the host grower. In these cases, the host grower is interested but may 'not know where to start' without the support of the Soil Wealth ICP team. These sites are typically longer multiyear investigations of high complexity.

Case study sites include those where a grower is implementing a practice and would like to explore some next steps with the support of the Soil Wealth ICP team.

In all cases, results and other outcomes will be communicated with growers and industry.

Topics may include:

- Nutrient use efficiency
- Cover crops and minimum tillage
- Integrated pest management (IPM) adoption and thresholds
- Precision agriculture and variable rate application
- Reducing waste including plastic mulch alternatives
- Soil health and soil biology.

Linkages with VegNET

The vegetable demonstration sites will strategically align with each of the 10 VegNET regions, emphasising a regional approach that caters to the unique needs and preferences of local growers.

Valuable insights gained through meaningful discussions with VegNET Regional Development Officers (RDOs) will guide the focus of the trials to address the unique priorities and areas of interest within each region. These conversations have also helped identify potential growers for involvement in the initiative. To ensure maximum impact and practical application, the demonstration sites will be situated on commercial farms whenever feasible.

FOR MORE INFORMATION

for Soil Wealth ICP demonstration sites, contact:
Carl Larsen, RMCG on 03 5441 4821 or
carll@rmcg.com.au
Kelvin Montagu, AHR on 0421 138 019 or
kelvin.montagu@gmail.com

Hort Innovation VEGETABLE FUND

Hort Innovation MELON FUND

This project has been funded by Hort Innovation using the vegetable and melon research and development levies and contributions from the Australian Government.
Project Number: MT22004

Soil Wealth ICP focuses on addressing growers' specific interests and regional issues, fostering knowledge exchange, elevating sustainability, and improving soil and crop health across the industry.

LOCKYER VALLEY

Getting the most out of organic nitrogen

The demand for sustainable agriculture practices has been growing steadily, prompting growers to explore alternative methods to meet their crops' nitrogen needs. Traditional synthetic nitrogen fertilisers, once widely relied upon, are losing favour due to their increasing costs and substantial greenhouse gas emissions during manufacturing.

In response, growers are turning to organic nitrogen sources as a more environmentally friendly and cost-effective solution. However, while the general principles of nitrogen mineralisation from organic sources are well known (for example, the impact of soil temperature, moisture, and organic carbon: nitrogen ratios), managing organic nitrogen to meet crop demands remains a challenge.

To support growers interested in adopting organic nitrogen sources, the demonstration trial at Mulgowie Farming Company in Queensland's Lockyer Valley will:

- Monitor seasonal soil nitrate and ammonium levels and how they relate to soil temperature and moisture under different organic nitrogen sources (compost and legume cover crops) and management practices
- Trial practical ways of managing organic nitrogen sources to better match vegetable crop needs.

In June 2023 the Mulgowie team planted a faba bean cover crop ready for ongoing treatments and monitoring, which will be followed by a sweet corn crop.

Over the coming months, soil temperature and moisture probes, installed in various treatment areas, will be monitored. Ongoing soil sampling will measure changes in nitrate and ammonium levels over time.

Treatments include:

- Faba bean crop incorporated green
- Faba bean crop terminated with herbicide and left brown on soil surface
- Faba bean crop harvested for grain
- Fallow (control)
- Areas with and without compost

Stephanie Tabone from the Soil Wealth ICP team is excited to be working with Mulgowie on the demonstration and thanks the team for their involvement.

SKYE

More 'oomph' to sandy loam soils

Soil Wealth ICP team members Camilla Humphries and Jed Clark were in the field recently, taking soil samples at the Skye demonstration site in Melbourne's south-east.

The team will work closely with growers Rick Butler and Dale Creed from Butler Market Gardens to improve the health and structure of the site's sandy loam soils.

Cover crops will be trialled to address key issues for the site including soil-borne disease pressures and increasing competition from weeds.

It is hoped the trial will:

- Increase productivity and profitability of the farm's Asian brassica, spring onion, parsley & coriander crops
- Increase nutrient availability to cash crops
- Reduce the amount of synthetic fertiliser inputs to provide a natural source of nitrogen
- Complement the farm's current compost program.
- The trial will get underway in October 2023 with a summer cover crop.

TARWIN

Maintaining soil carbon in celery, spinach and leeks

Schreurs & Sons hosted the Soil Wealth ICP Koo Wee Rup demonstration site from 2018-2022 and recently expanded their growing operations to Tarwin in Gippsland.

The new Tarwin demonstration site will align closely with the project's 'carbon and climate' theme as it looks to maintain soil organic carbon at the property, which is gradually being converted from pasture for cattle grazing to vegetable production (predominately celery, spinach & leek).

Soil Wealth ICP team members Camilla Humphries and Carl Larsen will work with growers Adam Schreurs and Greg Hall from Schreurs & Sons, with support from agronomist Stuart Grigg. The site will use a combination of compost, green cover crops and minimum tillage to improve soil structure (organic matter), nitrogen and phosphorus while out-competing weeds.

A winter cover crop was sown using minimum till practices, ahead of celery and spinach plantings and cultivation.

FOR MORE INFORMATION

Contact project leaders: Dr Gordon Rogers on 02 8627 1040 or gordon@ahr.com.au Dr Anne-Maree Boland on 03 9882 2670 or anne-mareeb@rmcg.com.au

Hort Innovation Strategy 24-26 can be found on the Hort Innovation website.

HORT INNOVATION UNVEILS **STRATEGY 24-26**

Powering high industry growth, export and sustainability priorities

Released in late July, the strategy was informed by feedback from growers across the nation through farm visits, surveys and advice garnered through industry advisory panels and meetings. The strategy also considers the strategic investment plans of 37 levy-paying industries and growth projections for the $16 billion horticulture sector, revealed in resources such as the recently released *Contribution of Australian horticulture industry* report.

Providing a roadmap for Hort Innovation investments over the next three years, the Strategy is anchored on the grower-owned research and development corporation's vision of 'A prosperous and sustainable Australian horticulture industry built on innovation'.

Hort Innovation chair Julie Bird said the strategy reflects horticulture growers' priorities, and the organisation is fully committed to working with industry to achieve its objectives.

"The value of Australian horticulture is projected to surge by up to 22.5 per cent by 2030," she said.

"Equipping growers with the necessary tools to manage this remarkable growth is of utmost importance. We are attuned to the needs expressed by growers, and Hort Innovation is actively adapting to address them.

"We have a new strategy and a new structure that supports Australian horticulture to grow more, sell more, and get bang-for-buck from levy investments. These changes position us to get ahead of key issues in partnership with industry and to work together on larger, transformative projects."

Above L–R. Hort Innovation CEO Brett Fifield, Chair Julie Bird spoke with growers about the forthcoming Strategy

Strategy 24-26 outlines Hort Innovation's instrumental role in advancing Australian horticulture through:

- **Enhancing and safeguarding the supply of Australian horticulture:** including partnering with industry to address its sustainability priorities and support social and environmental stewardship. Spearheading world-class innovation and fortifying the industry against potential disruptions in the supply chain are also key.
- **Accelerating local and global demand for Aussie fruit, vegetables, nuts, nursery plants and turf:** including driving efforts to access and expand high-value markets, stimulate consumption, provide data-driven decision-making tools, and explore innovative approaches to utilising waste for generating new revenue streams.
- **Maximising and diversifying the investments Hort Innovation makes on behalf of growers:** including building strategic partnerships to deliver bigger, bolder investments, a new flexible investment framework for research partners and continuing to partner with industry to deliver impact at scale.

Hort Innovation chief executive officer Brett Fifield said the new strategy builds upon Hort Innovation's progress over the past year, and emphasised a thriving internal culture and removing operational complexities.

"We have made changes internally, including a new Industry Service and Delivery team which consolidates our partnerships, adoption and investment work," he said. "We have also restructured our business so that production-related R&D and sustainability work are in the same team, and our biosecurity R&D projects sit alongside our international trade efforts.

"In partnership with industry, these changes position us to get ahead of key issues and work together on larger, transformative projects."

In the past financial year, Hort Innovation invested close to $160 million into research and development and marketing initiatives that benefit levy payers.

Projected high industry growth, an appetite for expanded trade and increasing sustainability priorities have driven the new Hort Innovation Strategy 24-26.

SPECIALISED VEGETABLE MACHINERY AND GROWING EXPERTISE FROM THE GROUND UP

The right tools for the job, comprehensive support, and expertise to keep your business growing.

To improve yield and profitability you need specialised tools, and the best advice and back-up. At Landpower Vegetable Centre we provide a full range of vegetable cultivation, separating, harvesting, handling, transportation and preparation equipment from GRIMME, SPUDNIK and ASA-LIFT to support you and provide better harvest outcomes.

vegetablecentre.com
Landpower Vegetable Centre

LANDPOWER
Vegetable Centre

Understanding how your Levy works

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

The R&D Levy is payable on potatoes, vegetables and onions that are produced in Australia. 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.

How are levy investment decisions made?

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

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

What is the Strategic Investment Plan?

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

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

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

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

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

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

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

R&D LEVY RATES

Potatoes

48cents PER TONNE

Unprocessed Potatoes

Vegetables

0.485%

of the gross sale value at the first point of sale

Onions R&D AT

$2.90 PER TONNE

marketing at $1.00 per tonne

Hort Innovation POTATO – FRESH FUND

Hort Innovation VEGETABLE FUND

Hort Innovation ONION FUND

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

LEVY-FUNDED COMMUNICATIONS PROGRAMS

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

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

	OUTCOME 1	OUTCOME 2	OUTCOME 3	OUTCOME 4
	Extension and capability	**Industry supply, productivity & sustainability**	**Demand Creation**	**Business Insights**
ONIONS 	Increasing knowledge, attitude, skills, aspiration (KASA) and practice for grower and industry profitability and sustainability through use of best practices and innovation • Maintaining and improving industry cohesiveness, with most businesses and the industry supply chain actively engaged • Growers, value chain, media and governments being well informed on industry initiatives and achievements as a vital part of regional communities and networks • Increased on-farm use of R&D outcomes which will build a stronger, more resilient industry, in addition to improved networks and cross-industry collaboration • Proactive strategic and evidence-based decision-making in businesses and for industry on investment, priorities and risk management.	Developing fit-for-purpose sustainable pest and disease management strategies • Biosecurity awareness and preparedness • Continuous improvement in soil health • Improved input management that reduces costs while maintaining yield and quality • Proactively monitoring potential crop protection regulatory threats and having access to a broader suite of effective, socially acceptable and environmentally sound crop protection solutions.	Broaden consumer awareness so that onions are more top of mind and purchased more frequently • Develop strong relationships across the supply chain with a shared goal to grow the category • Identify and prioritise domestic and international market niches (market segmentation) where there is demand and growth potential for competitive supply of quality Australian onions.	Achieving the outcome will involve reliable baseline data and analysis to provide insights and understand current and emerging trends. Key investments will support the provision of consumer knowledge and tracking, trade data, production statistics, and forecasting, benchmarking and independent reviews to enable better decision-making process at industry level and individual businesses.

What is the Annual Investment Plan?

While a SIP provides an oversight of investment over the next five years, the AIP explains how levy funds are going to be invested over a 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 industry is investing against their SIP outcomes
- Details on current investments across R&D.

Where do investment ideas come from?

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

How are investments prioritised?

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

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

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

How are investments progressed?

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

How to keep track of investments

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

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

Current Projects
Hort Innovation Vegetable, Onion and Potato Funds

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

CODE

O Onion P Potato V Vegetable M Melon

O Optimising chemical and cultural control of onion white rot VN20007

KEY RESEARCH PROVIDER: ARVENSIS

What's it all about?

This investment is developing a more effective integrated disease management strategy for control of onion white rot. Onion white rot is a highly destructive fungal disease of commercial onion crops. This project seeks to improve current control methods for the disease, as well as identify new methods that can be used to combat onion white rot.

The research will incorporate:

- Development of a pre-plant soil DNA test to identify disease risk prior to planting
- Identification and development of natural germination stimulants to reduce disease inoculum levels prior to planting
- Optimisation of spray timing and dose rates of current fungicides
- Identification of new fungicides and biological controls for onion white rot.

The project team will work closely with the onion industry to extend any new findings to onion growers. Regular updates will be provided to industry, as well as trial sites visits later on in the project to demonstrate the integrated onion white rot management program developed.

O Epidemiology and management of fusarium basal rot in onions VN20006

KEY RESEARCH PROVIDER: THE UNIVERSITY OF ADELAIDE

What's it all about?

This investment is developing an integrated pest and disease management (IPDM) strategy to reduce the impact of fusarium basal rot in onions. Infection of bulbs in the field has resulted in substantive losses in storage from this soilborne disease, however the epidemiology of the disease is not well characterised which limits capability to develop an appropriate management strategy.

In order to develop a best practice, cost-effective IPDM strategy, this project will improve understanding of the pathogen and its epidemiology, and evaluate the use of chemical, biological and chemical controls.

O Onion nutrition education program for health professionals and the food service industry VN20002

KEY RESEARCH PROVIDER: BITE COMMUNICATIONS

What's it all about?

This investment is delivering evidence-based information about the health benefits of Australian onions to health and food service professionals in Australia. On average, Australian adults consume just three grams of onion per day. In contrast, consumers in the United States and Europe consume twice as many onions as Australians. In order to close this gap, initiatives to educate health professionals and the food service industry are key as they are significant influencers of consumer food behaviour.

This project will extend previous research conducted by levy-funded project Australian onions nutrition literature review (VN18002) and the Onions food service farm tour and education pilot (VN18000) by communicating the nutritional benefits of onions to health professionals, food service professionals and industry stakeholders.

OVM Multi-industry export program Vegetables, Onions and Melons MT21009

KEY RESEARCH PROVIDER: AUSVEG

What's it all about?

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

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

The export program comprises the following activities:

1. Export skills and capability development
2. Market planning and market entry
3. Market engagement and trade facilitation
4. Market intelligence and trade expansion
5. Trade policy, protocol and risk management
6. Communication and industry engagement
7. Assistance, advice and resource development
8. Export strategy implementation

VEGETABLES
POTATOES
ONIONS

Current Projects
Hort Innovation Vegetable, Onion and Potato Funds

CODE
O Onion P Potato V Vegetable

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

OPV Industry Minor Use program Onions: VN16000. Potatoes: PT16005. Vegetables: VG16020

KEY RESEARCH PROVIDER: HORT INNOVATION

What's it all about?

Through these projects, levy funds and Australian Government contributions are used to submit renewals and applications for minor use permits for the onion, potato and vegetables industries as required. These submissions are prepared and submitted to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

For more information on minor use permits, and to see a list of all permits for the horticulture industry visit Hort Innovation website. The permit list is updated on a quarterly basis.

All current minor use permits for the industry are searchable at **portal.apvma.gov.au/permits**. Permit updates are also circulated in Hort Innovation's Growing Innovation e-newsletter, which levy-paying members receive monthly.

O Accelerating the adoption of best management practices for the Australian onion industry VN21000

KEY RESEARCH PROVIDER: AUSVEG

What's it all about?

This investment ensures the onion industry is equipped with the information and resources they need to adopt best management practices. Onion growers will be brought into the existing VegNET 3.0 program for the vegetable industry to support increased awareness and adoption of R&D.

VegNET is a nationally-coordinated, regionally-delivered extension program that increases the industry's awareness of and engagement with best practices in high-priority areas. The program has regional development officers (RDOs) in ten key vegetable-growing regions around Australia.

A vital component of the program is the establishment of five regionally-based onion grower groups in Tasmania, Queensland, New South Wales, Western Australia and South Australia. The relevant RDO will work with each group to identify regionally-specific issues facing onion growers and work with them to host seasonal activities, including demonstration sites, field days, and grower walks.

A wide range of communications outputs will also be delivered to onion growers, including:

- The quarterly *Vegetables Australia* magazine, with 36 pages of dedicated onion content
- The *AUSVEG Weekly Update e-newsletter*, with onion content
- A range of onion-focused content such as videos, podcast, case studies, factsheets, media releases and social media.
- An annual disease alert poster.

O Enhancing the usability of onions VN22001

KEY RESEARCH PROVIDER: THE GROWTH DRIVERS

What's it all about?

This investment is providing the onion industry with short and long-term recommendations to increase the use of onions in the foodservice sector.

The project team will engage with key suppliers and users of onions in the foodservice sector to evaluate their current use of onions and any barriers to using more onions. They will also scan relevant global research on successful strategies to overcome these barriers.

VO National vegetable and onion benchmarking program MT22009

KEY RESEARCH PROVIDER: PLANFARM

What's it all about?

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

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

P Australian potato industry communication and extension project PT20000

KEY RESEARCH PROVIDER: APPLIED HORTICULTURAL RESEARCH

What's it all about?

Beginning in 2021, this investment is tasked with supporting Australian potato growers in adopting improved practices on-farm and keeping up to date with the latest industry news, information, resources and technologies.

The project delivers a nationally coordinated but locally implemented program which employs regional delivery partners who provide specialist skills and knowledge to the industry. The role of the regional delivery partners is a broad one, with all activities geared towards improving the circulation and uptake of information within the industry.

As well as extension activities, the project produces key communication channels for the potato industry, including a hard copy quarterly R&D magazine, online webinars and podcasts, social media, and a dedicated website to host industry resources.

VO Nuffield Scholarships VG14065

KEY RESEARCH PROVIDER: NUFFIELD AUSTRALIA FARMING SCHOLARS

What's it all about?

This project provides funding to support Nuffield Scholars in the vegetable industry, with one Hort Innovation scholarship being awarded each year of the project's life from 2016 onwards.

Nuffield Scholarships are a chance for Australians in agriculture to grow their practical knowledge and a broad variety of skills, while heading overseas to study a topic related to their industry.

Application opportunities are advertised in industry channels each year.

V Management strategy for serpentine leafminer, *Liriomyza huidobrensis* MT20005

KEY RESEARCH PROVIDER: QUEENSLAND DEPARTMENT OF AGRICULTURE AND FISHERIES

What's it all about?

This project is developing and delivering targeted R&D specifically for serpentine leafminer in response to the incursions detected in late 2020.

The project is building on the initial work of recently completed RD&E program for control, eradication and preparedness for vegetable leafminer (MT16004).

Areas of work include:

- Identifying and monitoring parasitoids
- Refining development and validation of surveillance and diagnostic protocols
- Using predictive forecasting to manage and assess the risk of serpentine leafminer
- Delivering an industry communication program
- Developing an industry management plan, grower guides and industry focused workshops.

V Consumer behavioural data program MT21004

KEY RESEARCH PROVIDER: NIELSEN

What's it all about?

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

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

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

V National Bee Pest Surveillance Program: Transition Program MT21008

KEY RESEARCH PROVIDER: QUEENSLAND DEPARTMENT OF AGRICULTURE AND FISHERIES

What's it all about?

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

The program will conduct surveillance for 13 pests that impact honey bees (mites and beetles), and pest bees that could either carry hitchhiking parasites or could themselves cause detrimental impacts to honeybees. The program activities include upgrading sentinel hive arrays, strengthening relationships with surveillance operators and more. The surveillance is designed to enable the early detection of high-priority pest incursions that can impact on honey bees, providing the best opportunity for successful pest eradication.

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

V Co-developing and extending integrated *Spodoptera frugiperda* (fall armyworm) management systems for the Australian vegetable industry VG20003

KEY RESEARCH PROVIDER: QUEENSLAND DEPARTMENT OF AGRICULTURE AND FISHERIES

What's it all about?

This project will support the rapid co-development of an integrated fall armyworm management strategy that will deliver better outcomes for those regions currently affected by fall armyworm as well as for those regions that may experience an incursion in the future.

This investment seeks to provide the support needed by the Bowen, Bundaberg, Burdekin, Gumlu and Lockyer Valley vegetable industries, their advisory networks, support industries and researchers to capture, develop and use their experience of managing FAW on-farm in 20/21 and 21/22 seasons.

Through this investment, the vegetable industry will work closely with researchers to identify management gaps and trial a range of strategies on-farm. Outcomes from these trials will be shared with the Australian vegetable industry and will inform future fall armyworm research investments. This investment will work closely with project **Identifying potential parasitoids of the fall armyworm, *Spodoptera frugiperda,* and the risk to Australian horticulture (MT19015).**

VO VegNET 3.0 VG21000

KEY RESEARCH PROVIDER: AUSVEG

What's it all about?

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

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

onion fund update

This project has been funded by Hort Innovation using the onion research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation ONION FUND

AUSVEG and Onions Australia announce strategic merger

AUSVEG and Onions Australia, which represent the interests of Australian vegetable, potato and onion growers, have announced a strategic merger that will see the onion industry joining with AUSVEG. The move will expand AUSVEG's representative footprint and provide it with a stronger voice to better advocate on behalf of vegetable, potato and onion growers.

The union, a result of thorough industry consultation and a resounding vote from Onions Australia members, signifies a new era for the onion sector, which will benefit from stronger support from increased levels of support in advocacy and industry service delivery.

The merger will leverage the combined strengths of AUSVEG's robust advocacy capabilities and service delivery and Onions Australia's legacy and interest in the betterment of the onion sector, benefiting onion growers and stakeholders across Australia.

"Having Onions Australia merge with AUSVEG marks a new era of growth and opportunity for the Australian onion industry, providing a robust platform for the future success of onion growers and the broader onion sector through its alignment with the broader vegetable sector," said AUSVEG Chair Bill Bulmer.

"We recognise the legacy of the Onions Australia brand, with its decade's long history of representing the Australian onion sector. It is our intent to continue to recognise the dedication of those who have been instrumental in the history of Onions Australia and to build on this legacy to uplift the services and advocacy available to onion growers.

"The decision aims to maximise member benefits and promote industry-wide success for the broader vegetable, potato and onion sectors. I look forward to working more closely with the onion sector to help it achieve significant success in the future."

According to Onions Australia Chair Darren Rathjen, the merger ensures that the onion sector maintains a significant voice within the broader vegetable and horticulture industry and that onion growers have access to greater levels of services and expertise.

"In light of a changing industry landscape and a need to secure industry representation and advocacy for onion growers, the Onions Australia Executive Committee sought an opportunity to bolster our ability to meet the needs of the Australian onion sector," said Mr Rathjen.

"In response to the wishes of our industry through a formal member vote, the Executive Committee has taken the decision to merge with AUSVEG. This decision is a strategic one aimed at building a stronger future for Australia's onion sector, ensuring that our members' concerns are addressed promptly and efficiently by AUSVEG.

"Moreover, this merger is an affirmation of our shared commitment to the betterment of the onion industry, which shares significant similarities and overlap with the vegetable sector.

"I would like to take this opportunity to personally thank our Executive Officer Lechelle Earl, who has been a dedicated member of Onions Australia for more than a decade and has served the onion industry well during her time with the association. Even during the recent challenges with the COVID-19 pandemic, Lechelle has been a tireless advocate for the onion sector, and we wish her well with her future endeavours.

"Onions Australia looks forward to working with AUSVEG on this new journey together. As Chair, I sincerely thank Onions Australia members for their ongoing dedication and trust."

Federal Agriculture Minister Murray Watt welcomed the move and said he looked forward to continuing to work with the industry.

"Particularly at a time when food security is front of mind globally, it's so important that Australian agriculture has strong industry-led advocacy, to help grow the sector and also support farmers and the production chain," Minister Watt said.

"It's been a pleasure working with Onions Australia and I look forward to continuing that important work through AUSVEG."

Grower levy investment processes, which are managed by Hort Innovation and Plant Health Australia, with oversight from the onion sector through industry mechanisms such as the Hort Innovation Strategic Investment Advisory Panels, will continue.

As part of this transition, all onion levy- paying growers will have an expanded suite of resources and benefits, including:

- **Expanded Voice:** AUSVEG's dedicated public affairs team and its strong network with Federal Ministers and various government departments ensure that onion industry members' interests are represented with vigour.
- **Increased access to services:** Onions Australia members can now take advantage of AUSVEG's diverse resources in advocacy, public affairs, political engagement, communications, extension, biosecurity, and export development.
- **Enhanced Brand Presence:** The Onions Australia brand will continue to flourish, with its specific content and services maintained in industry publications and online.

Transition-related activities are already underway. Further details about the merger and transition will be communicated to Onions Australia members and onion growers going forward.

Onions project for onion growers

The Onions Communication and Extension Project (VN21000) is well underway with the national needs analysis completed and grower groups established in key onion growing regions.

The project aims to equip the onion industry with the information and resources they need to adopt best management practices, working with existing VegNET RDOs.

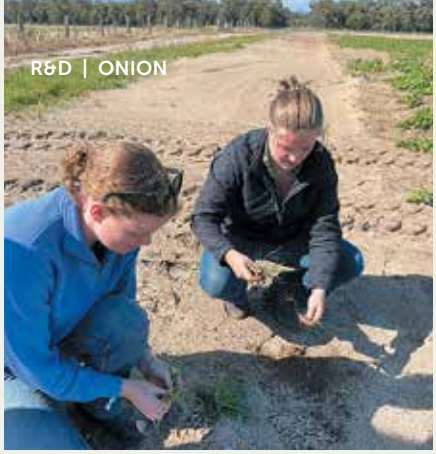
A vital component of the program is the establishment of four onion regional groups in Tasmania, Queensland, Western Australia and South Australia.

AUSVEG and VegNET will work toward:

- Regional Grower Groups meetings three times a year
- Demonstration sites in the key regions
- Field days / grower walks / masterclasses / workshops
- Research scans on topics chosen by grower groups
- Factsheets, podcasts and videos and case studies.

Growers in Victoria and New South Wales have been aligned with South Australia, Queensland or Tasmanian activities based on their needs and conditions. Focus areas have been chosen by grower groups which have guided the planning of activities and outputs of this project. A calendar of activities is currently being completed for 2023-24.

Top. Shakira Johnson and Grace Winkler of AUSVEG, meet with Katrina Hill WA VegNET RDO and Larry Maiolo LIM Produce. **Left.** WA onion grower group meeting.



Ryegrass Herbicide Resistance

In August, AUSVEG visited onion growers in Myalup including LJM Produce, Castro Farms, Ivankovich Farms, Patane Produce and Galati Bros. During these visits ryegrass samples were collected for herbicide resistance testing as part of Western Australia's focus areas.

A grower group session was also held where growers discussed their issues and finalised the focus areas for this project.

The regional focus areas are:

South Australia
Herbicide resistant ryegrass, mechanisation for weed control and the relationship between field nutrition and storage quality (particularly basal rot).

Queensland
White rot and downy mildew, soil health and nutrition and relation to storage quality and the best storage options for Queensland conditions.

Tasmania
Group A herbicide resistance, white root rot and fusarium and mechanisation for weed control in Tasmanian conditions.

Western Australia
Herbicide resistant ryegrass, nutrition and soil health building in sandy soils and water use efficiency and monitoring.

As part of the next stage of planning, grower groups are planned for South Australia, Tasmania and Western Australia to discuss weeding machinery options for trials in 2024. Ryegrass testing is also planned for South Australian, Victorian and New South Wales onion growers. Research scans will also be completed to further inform future activities.

Left. Grace Winkler (AUSVEG) and Lauren Patane (Patane Produce) check ryegrass samples.

Hort Innovation ONION FUND

FIND OUT MORE

For more information on the Onion project, contact Grace Winkler **grace.winkler@ausveg.com.au**

This project has been funded by Hort Innovation using the onion research and development levies and contributions from the Australian Government.
Project Number: VN21000

Good nutrient management for onion crops guide

The Onion Project has developed a guide or onion growers on nutrient management to aid with production of high-value crops.

The *Nutrient Management for Onions in Australia* is aimed at growers and crop advisors to understand the nutrient needs and budgeting of onion crops. It provides an overview of onion growth and nutritional needs for onion growth and root development,

Within the guide, consideration of how soil types affect nutrient availability and uptake is given; crop monitoring; and fertiliser nutrient composition and concentration applications. The final section provides recommended approaches to managing onion nutrition through soil testing, application of nutrients based on growth stages, plant testing and knowing the regional variations.

Key points

- The nutrient requirements of onion crops largely depend on a range of factors, such as variety, plant density, production environment, pest and disease pressure, soil fertility, approach to fertiliser and soil amendment use, and irrigation management.
- Nutrient budgets have to take the amount of plant-available mineral nutrients in the topsoil into account and consider that onions may acquire nutrients mainly from the top 30cm of soil but can explore up to 60cm soil depth, if there are no rootzone restrictions, e.g. pH change, compaction, water logging.
- Published research data on onion nutrition and nutrient removal suggests that, on average, 120 to 140kg nitrogen (N), 22–26kg phosphorous (P) and 150kg potassium (K) per hectare would have to be available for uptake from soil reserves, soil amendments and fertilisers together. Given P dynamics in different soils, P inputs commonly must be applied at several times that of the removal rate.
- As an example, 60 tonnes of onion bulbs harvested per hectare may remove more than 100kg/ha of nitrogen (N), around 20kg/ha of phosphorus (P) and 120kg/ha of potassium (K).
- Much of the research into onion nutrition dealt with single elements – e.g. N, P, K, S or Ca – or is focused on a limited group of nutrients such as N:P:K or trace metals.
- There is limited independent research available on the use of soil amendments that are available in Australia, and trials are commonly run with 'traditional' fertilisers such as urea, DAP, MAP or muriate of potash and sulphate forms of trace elements.
- Many 'fertiliser recipes' are based on regional experiences, and thus on certain soil, climate and crop rotation conditions. Most publications fail to describe all or some of these conditions, even omitting the variety used and yield level. Therefore, 'recipes' should be used with caution, as a guide only.

Hort Innovation ONION FUND

FIND OUT MORE
If you would like a copy of the guide, contact Grace Winkler grace.winkler@ausveg.com.au

The Onion Project has been funded by Hort Innovation using the onion levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.
Project Number: VN21000

Onion growth and nutrient needs overview

Knowing how onion plants grow is important for developing an effective nutrient management program. The table below provides an overview of growth stages and general requirements at each stage.

CROP STAGE	DESCRIPTION	DEMAND CREATION	BUSINESS INSIGHTS
Preplant	Final planning for the onion crop well ahead of seeding	• Onions require a firm, fine seedbed and friable soil structure (no compaction). • The potential rooting depth is 75cm; 75% of after and nutrient are taken up from the top 30cm of topsoil. • Organic matter improves soil condition, air and water volumes and nutrient holding capacity for onions.	• Soil (nutrients, diseases), water testing, preplant and in season nutrient budgeting/planning based on test results. • Seed testing for germination % and disease. • Soil preparation, (after timely termination of cover crops, if used) pre-plant fertiliser application, addition of soil amendments (if used).
Planting	Seeding	• Nitrogen is easily lost via leaching or denitrification in wet soils. Therefore, applications at planting should only cater for the time until first topdressing. Soil reserves should be considered when determining N-applications.	• Ensure there is adequate phosphorus (P) and some nitrogen (N) applied as a broadcast, banded or fertigation, if feasible.
Germination/ emergence	Radicle and flag leaf emergence	• Onions can germinate at low temperatures, but >10°C is best for uniform crops.	• Irrigation to ensure even germination while ensuring that the soil is never waterlogged. • Phosphorus (P) and calcium (Ca) must be available to the young roots from the soil solution. Liquid products may be suitable to ensure there is enough soluble P and Ca in the soil solution.
Establishment	1-2 true leaves develop	• Slow growth to the 3-leaf stage	• Very low nutrient needs, herbicide damage, low soil temperatures or soil acidity can slow growth down further. • Note that this can look like nutrient deficiency, but it should not be 'fixed' via applying fertilisers.
Leaf (vegetative) growth	3-4 true leaves develop	• Leaf growth rate increases with temperature. Maximum leaf growth rate is at around 27°C. • Onion root growth from the basal plate matches leaf growth.	• Seedling vigour plays a crucial role in the development and quality of bulbs, whose size depends on the number and expansion of green leaves at bulb development. It is therefore important to not set crops back during that time, including via herbicides.
Early bulb initiation	4-7 true leaves (leek stage); from the 4th leaf onwards, the neck starts to thicken	• Most onion varieties initiate bulbs after the 6-8 leaf stage. Bulb initiation occurs in response to increasing day length. Major onion types differ in the minimum day length needed to initiate bulbing. • The leaf bases (called a 'bulb scale' in botanical terminology) form the onion bulb 'rings.' • The minimum day length needed for bulbing is much shorter for early, over-wintering onions, than for spring seeded varieties. • Temperature and light spectral quality also affect the onset of bulbing, to a lesser degree compared to day length. Once day length initiates bulbing, the higher the temperature, the earlier bulbing will occur. Densely planted onions have more shaded leaves and begin bulbing earlier because of altered light spectral quality.	• It is important that all nutrients are available and in balance. It is worth checking this via sap testing early during this stage. • Apart from nitrogen, additional nutrients may be required such as phosphorus (P) and potassium (K). Both can either be side dressed or applied to foliage (e.g. together with a compatible fungicide). • Trace elements can be applied to foliage.
Bulbing	8-12 true leaves, bulbs develop to around twice the size of the neck; the plant reaches close to maximum height; the growth stage is called bulbing when the bulb diameter reaches twice that of the neck		• A period of rapid nutrient uptake starts with bulbing. Well growing onions crops may take up around 100kg per hectare of nitrogen, potassium, and calcium by this stage, and substantially smaller amounts of sulphur, phosphorus, and magnesium during that time. • From initial bulbing to harvest, nutrient uptake into leaf tissue decreases, while nutrient uptake into onion bulbs increases substantially. • No more nitrogen should be applied to soils after bulbing. While nitrogen is still taken up, the rate of N uptake drops consistently between bulbing and maturing.
Bulb development/ growth	Leaf number and leaf area stays the same. Leaves elongate and bulb grows in diameter	• In a good crop, dry matter accumulates at a rate of 100 to 200kg per hectare per day during the peak growth period.	• The onion plant has the highest demand for water and nutrients during bulb growth. Calcium is critical at bulb development for cell structure and improve shelf life. Ideally, all required nutrients are available from the soil at this stage to support bulb growth.

Managing soil borne diseases in onion crops

The main soil borne diseases in onions include damping off, white rot, basal rot and pink root. Prevention and management can often be improved via managing soil health to increase plant resilience.

The soil environment includes good and bad fungi, nematodes and microbes. Soil borne diseases are plant pathogenic soil microorganisms that attack the plant roots; they are part of the overall soil environment. In most cases, soil borne plant diseases can survive in the soil for a long time without a host plant present.

The zone in the soil where most of the disease activity occurs, surrounds the roots, where the biology and chemistry are affected by plant secretions, and in onions it is the rhizosphere surrounding the roots up to 5mm distant.

According to Dr Len Tesoriero, understanding the soil environment and the factors that can affect its health are an integral part of managing diseases to control their spread in the soil.

Pests such as insects, can potentially move spores from plant to plant increasing the spread of the disease. However, insects can also cause physical damage to the plant, creating stress and weakening the plant health, or providing a wound for diseases to enter.

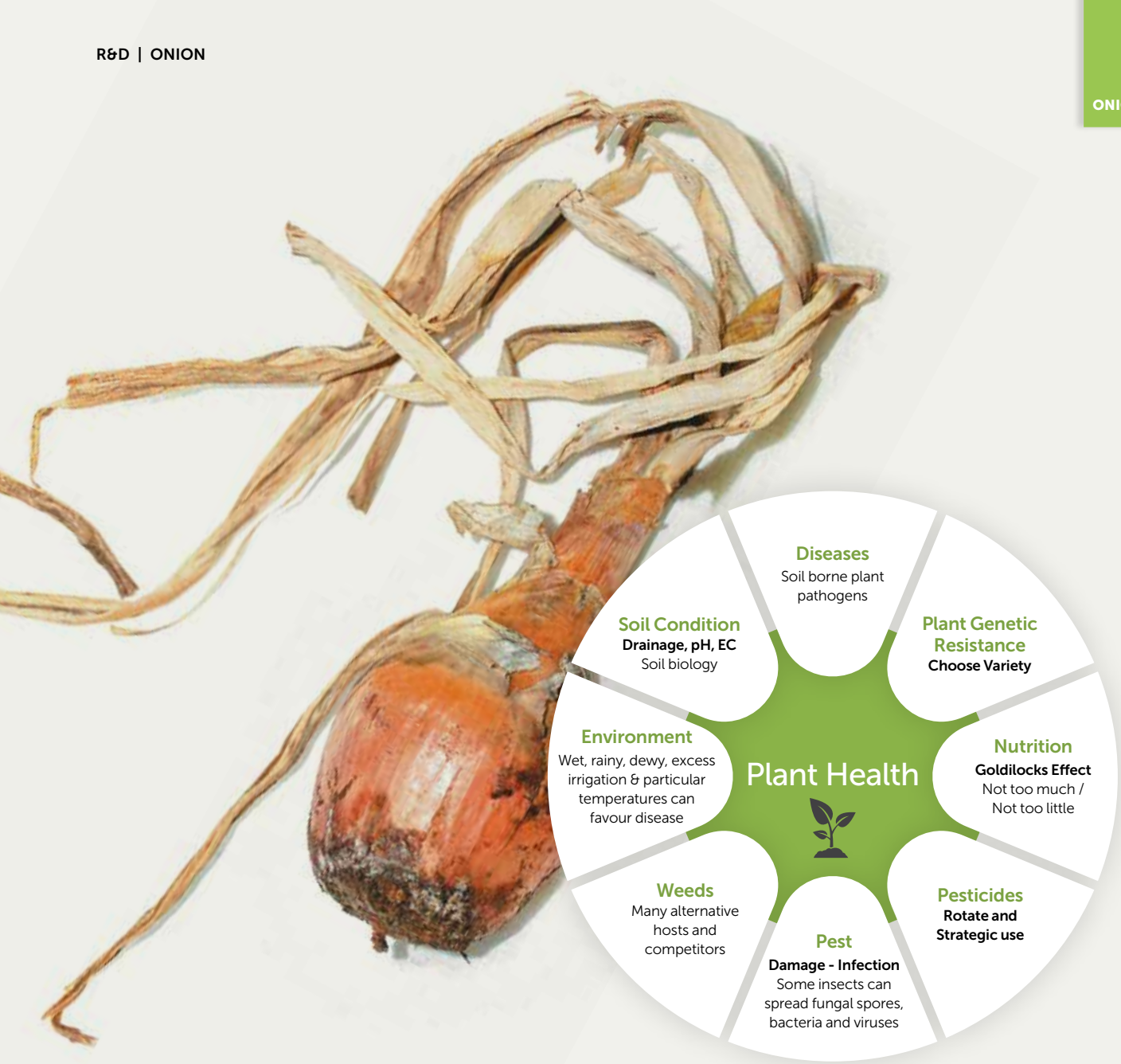
"The Goldilocks effect relates to nutrition – you want to have not too much, nor too little," said Dr Tesoriero. "For some diseases, the form of nitrogen fertiliser can be a factor. We know that ammonium-based fertilisers favour infection and disease severity caused by Fusarium oxysporum. So gradual applications of lower doses or use of nitrate-based fertilisers is less likely to cause severe basal plate disease of onions."

When plants are stressed such as through too much or too little water, heat or wind, pathogens are more likely to attack, commented Dr Doris Blaesing.

To give the onion plant a better fighting chance, choose varieties that have greater genetic resistance to soil borne diseases. The use of sentinel plants that have lesser resistance, can also be a useful method of determining and monitoring the extent of a soil borne disease. Using soil DNA testing is the best way of finding out whether a soil borne disease risk exist in a paddock.

"Many weeds are in themselves hosts to soil borne pathogens, so care needs to be taken to remove them and allow time for the population to die down before

Above. *Sclerotinia cepivorum* white rot onion. Source. **gd.eppo.int**



INTERACTING FACTORS AFFECTING PLANT HEALTH
DISEASE EPIDEMIOLOGY

planting again through longer rotations, and fallow beds," Dr Tesoriero. "Cover crop choice also needs to be carefully considered, as many crops are also hosts for pathogens."

Soil conditions and environment play their part in soil borne diseases. By understanding the optimum conditions for plant pathogens such as soil and air moisture, temperature and pH, tactics such as delayed planting, knowing when to stop irrigating, and plant spacing can be employed to lower the occurrence and spread of specific pathogens. It is also known that some pathogens form complexes where one will work in tandem with another such as in pink root which is caused by ***Setophoma terrestris*** but is also often associated with common soil borne pathogens ***Pythium*** and ***Rhizoctonia***.

"An example is a Tasmanian onion farmer who late in the season had no weeds, the soil was still fluffy and achieved consistent yields across the fields because of the soil health management for his site," said Dr Blaesing.

"Most soil pathogens like moist soil, so minimum tillage, good organic matter and cover crops with long rotations will all help to lower the risk of soil borne diseases."

Above. Basal rot in onion.

Common diseases in onions and their management

White Rot

PATHOGEN	*Schlerotium cepivorum*
OCCURS	Pre-emergent, early leaf
LIFESPAN	Long term
ENVIRONMENT	Cool, wet soils 14-18°C

More common in spring onions, white rot is caused by Sclerotium cepivorum which forms small black bodies which are the schlerotia of the fungus. It can survive for many years in the soil and prefers cool and wet soils, ideally in a temperature range of 14-18°C.

MANAGEMENT

- Farm hygiene is the priority – it can be transported via infected soil on farm equipment
- Keep the nutrition balance with manganese and copper availability
- Fungicides – Hort Innovation project VN20007 is currently investigating the efficacy of two new fungicides for White Rot
- Cover crops and rotations – will increase soil microbial diversity, but long rotations between onion crops is required as it can survive for more than 25 years
- Increased plant spacing – tightly packed plants allow for easy movement between plants.

Black Mould

PATHOGEN	*Aspergillus niger*
OCCURS	Post harvest, storage
SYMPTOMS	Physical damage or bruising through the stalk
LIFESPAN	Long term
ENVIRONMENT	High humidity >76%RH, High Temperatures (>30°C in field; >24°C in storage)

MANAGEMENT

- Withdraw irrigation 21 days prior to harvest to prevent moisture build-up, which can escalate infection significantly
- Avoid bruising or mechanical damage to the bulbs to reduce infection points
- Dry or cure the bulbs at 36% RH and at 38°C
- Fungicides can be applied (fludioxonil + cyprodinil)
- Application of copper prior to harvest can be beneficial to reduce storage rot.

Pink Root

PATHOGEN	*Setophoma terrestris* (previously called *Phoma terrestris* or *Pyrenochaeta terrestris)*
OCCURS	Post harvest, storage
SYMPTOMS	Wilting, yellowing and brown tip of leaves, soft bulbs
LIFESPAN	Short term – 3 years
ENVIRONMENT	Warm temperatures (24-28°C)

MANAGEMENT

- Long crop rotations in the order of 3-6 years. This pathogen has a range of host plants including pumpkin, bean, carrot and pepper families, as well as many legumes, maize, millet and sorghum. It is also known to form disease complexes with root pathogens such as pythium, rhizoctonia and fusarium.
- Harvest before the soil temperature gets to 30°C
- Avoid plant moisture stress – regular and less irrigation
- Soil fumigation may be helpful.

Basal Rot

PATHOGEN	*Fusarium oxysporum* and other *Fusarium* spp
OCCURS	Young seedlings
SYMPTOMS	Yellow to light brown discolouration around the base of the stem, wilting, death
LIFESPAN	>10 years
ENVIRONMENT	Temperatures (5-15°C), damp, cool, compacted soils

MANAGEMENT

- Raised beds or well drained soil
- Treat seeds/seedlings with a registered fungicide
- Host plants carrying Fusarium are wide including legumes and most vegetable crops
- Avoid using excessive amounts of ammonium forms of nitrogen, with a balance of Ca and Zn if needed
- Avoid plant damage, including mechanical, insect, nematode and herbicide injury
- Soil fumigation may be helpful.

Hort Innovation ONION FUND

FIND OUT MORE

Watch the webinar visit soilwealth.com.au/resources/webinar-recordings/soilborne-disease-management-in-onions/

This project has been funded by Hort Innovation using the onion research and development levy and funds from the Australian Government.
Project number VN18003

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Crop monitoring to understand the drivers of fusarium basal rot development in onions

The project *Epidemiology and management of fusarium basal rot in onions* (VN20006) is developing an integrated pest and disease management strategy to reduce the impact of fusarium basal rot in onions. This requires an understanding of the pathogen, disease development and impacts of grower management.

To gain insights into the drivers of disease development twelve centre pivot irrigated crops were monitored in the 2022 planting season in South Australia. Incidence of fusarium basal rot in these mid to late season crops ranged from nil to 55% at harvest. Drivers investigated included inoculum, soil moisture, nutrition, soil biology and variety and there are some characteristics in common from the sampling areas with high levels of fusarium basal rot (*Table 1).*

In the monitored crops, the level of infection at harvest was measured with SARDI's DNA test for *Fusarium oxysporum* f. sp. *cepae,* and was strongly related to the incidence of fusarium basal rot observed. This indicates that this is the dominant pathogen causing the disease (*Figure 1*).

In some crops, incidence of rotted bulbs further increased when placed in ambient storage conditions for three months; disease progression under these circumstances can be slowed by cool storage below 4°C. DNA testing of a composite sample of the roots and basal plates of 100 bulbs at harvest was able to predict which samples would have fusarium basal rot develop during ambient storage, even when observed incidence was low or nil at harvest (*Figure 2*). For these samples, DNA testing provided a better indication of fusarium basal rot developing in storage than observed rotted basal plates at harvest.

Top. Typical rot development caused by *Fusarium oxysporum* f. sp. *cepae* in the field. *Image courtesy Michael Rettke, SARDI.*

Hort Innovation ONION FUND

This project is funded by Hort Innovation using the onion research and development levy and funds from the Australian Government.

TABLE 1 Associations found between incidence of fusarium basal rot and monitored parameters in 12 crops.[#]

CROPS WITH LOW INCIDENCE	CROPS WITH HIGH INCIDENCE
Inoculum	
• Fusarium basal rot not observed in previous crops • Fumigated prior to planting	• Known history of fusarium basal rot • Confirmed infection early in crop

Prior occurrence of fusarium basal rot in a paddock indicates a disease risk for the next crop, especially if it occurred less than 4 years ago. Disease risk is likely related to the level of inoculum in the soil. However, using the soil sampling and testing procedures investigated so far, the DNA test developed for *Fusarium oxysporum* f. *sp. cepae* is not sensitive enough in soil to provide an accurate indication of disease risk. Some paddocks have a higher disease risk than expected from knowledge of previous crops.

Soil Moisture	
• Good drainage	• Periods of high/excess soil moisture

Soil moisture probes were installed to compare locations within and between crops. Prolonged excessive soil moisture early in the crop was associated with high levels of infection in crops grown in pivots where inoculum was present. This high soil moisture early in the crop was due to unseasonably high rainfall and site-specific drainage characteristics, rather than over-irrigation.

Infection can occur early in crops. Last season, in sites where high levels of disease developed, infection was present in composite plant samples tested at the 5-7 leaf stage. In some crops where disease developed, infection of plants was present prior to the 3-4 leaf stage. Infection was not visually apparent at these stages of crop development in the composite samples tested. Infection by *Fusarium oxysporum* f. sp. *cepae* was also confirmed in selected individual plants that were showing leaf dieback and browning around the basal plate at the 3-4 leaf stage.

Monitoring within crops showed the incidence of fusarium basal rot was generally elevated by high soil moisture levels in the upper soil profile compared to areas where soil moisture was closer to optimum. High rainfall/storm events have been associated with high incidence of disease, though this was not observed in monitoring sites where this occurred last season and requires further investigation

Nutrition	
• ↑ Calcium levels • ↑ Soil effective cation exchange capacity (ECEC)	• ↑ Total nitrogen content in harvested bulbs • ↑ Sodium levels

Soil nutrient analysis was conducted on samples taken soon after planting and tissue nutrient analysis performed on bulb samples after harvest. These associations indicated above between fusarium and plant nutrition are not unexpected. They, along with weaker associations found with other nutrient levels, warrant further investigation of their importance to management of infection and disease development.

Soil Biology	
• ↑ Arbuscular *mycorrhizal fungi* (AMF) detected on roots at harvest	• Levels of AMF low or below detection

Biologicals are commonly applied to onion crops with the aim of promoting soil and root health. DNA testing was used to quantify levels of six groups of AMF and two groups of Trichoderma on composite root tissue samples at the 3-4 leaf, 5-7 leaf and harvest growth stages. The tests utilised do not identify specific species present. AMF populations which can be beneficial to onions may also assist the plant's resilience to disease. Our results support these associations. Trichoderma group A and group B were detected in some samples. Species of Trichoderma including strains of *T. harzianum* (group A) and *T. viride* (group B) have been reported elsewhere to reduce the incidence of fusarium basal rot

Variety	
• Lower susceptibility	• Susceptible

Development of disease was consistent with expectations of the disease susceptibility of varieties planted. Direct comparisons were not made between varieties in the same plantings.

[#] These observations and associations are based on monitoring 12 crops in the 2022 planting season in South Australia. The findings require further investigation to establish if cause and effect relationships exist between these parameters and the incidence and severity of fusarium basal rot.

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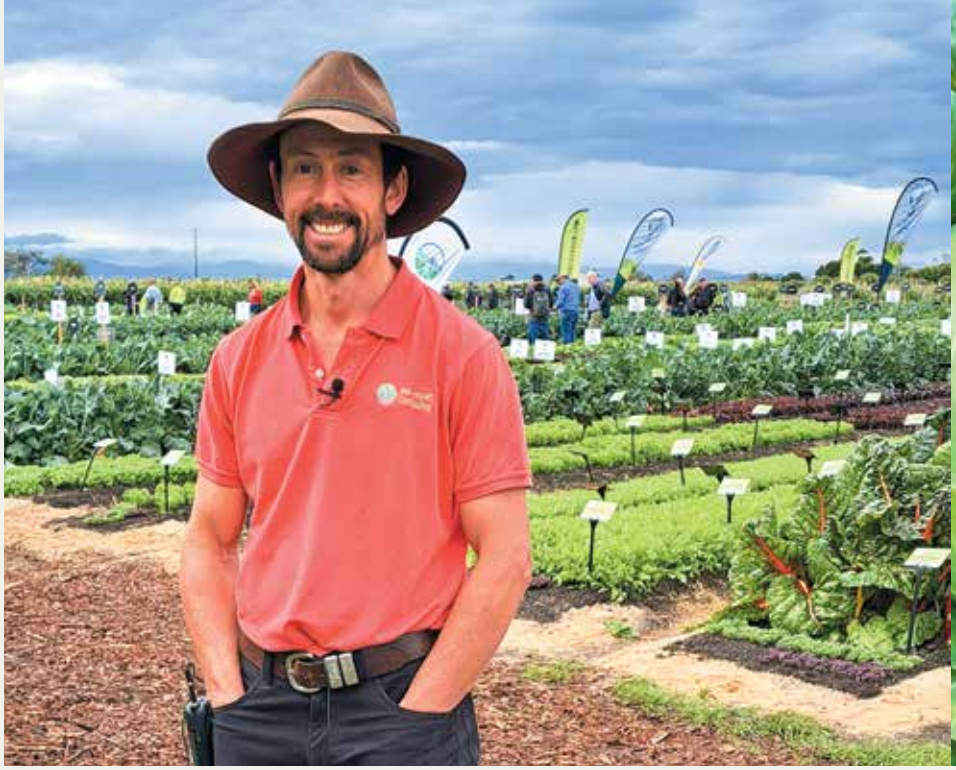

Clean crops require the right tools used the right way

Vegetable growers tackle many challenges in their crops and insect pests are always one of the major ones. Insect pests can reduce yield and quality of produce and growers know the importance of integrating a range of management strategies as well as rotating insecticide modes of action to manage resistance. Syngenta strives to develop innovative solutions to support growers which includes developing new modes of action and providing industry-leading technical support of products.

Syngenta Technical Services Lead, Dr Shaun Hood said growers are really spoilt for choice with Syngenta's range of insecticides that includes SIMODIS®, MINECTO® Forte and PROCLAIM® Opti.

"SIMODIS® insecticide is a novel mode of action Group 30 that offers reliable, robust and extended efficacy against difficult to manage pests in our key horticultural crops," said Dr Hood.

"SIMODIS® is registered for three key insect groups – Lepidoptera, thrips and mites, in vegetables including cucurbits, fruiting vegetables, bulb vegetables and brassicas."

"It has excellent residual activity, is highly compatible with other products and is an exceptional miticide. SIMODIS® is also a great rotation option for managing resistant diamondback moth (DBM) populations."

Stuart Grigg is an independent agronomist based at Ballan, Victoria with clients growing various vegetables including brassicas and alliums. Mr Grigg was involved in early commercial trials with SIMODIS® insecticide at Werribee South and recalls seeing great results with DBM in brassicas.

"We compared SIMODIS® to a standard insecticide program and an untreated control. The DBM control in the SIMODIS® treatment were comparable with standard practice," said Mr Grigg.

"I thought I can easily find a fit for SIMODIS® in brassica programs as it's a great alternative to Group 3 and Group 28 products. It's good to have another mode of action."

Mr Grigg said using products like Bt (Group 11) and the diamides (Group 28) early in the crop when the DBM pressure is high means growers can utilise SIMODIS® for later in the crop.

"In brassicas SIMODIS® is a good option from button stage onwards. This timing minimises the impact on beneficials and with a control window of up to three weeks, it keeps the crop clean through to harvest," said Mr Grigg.

"SIMODIS® is another tool on the belt and it's a really good tool. It's a robust product - the high UV stability means you can apply it in a range of conditions."

"It's good to know you have SIMODIS® up your sleeve for later in the season."

Above. Independent consultant, Stuart Grigg, Victoria: *"SIMODIS® is another tool on the belt and it's a really good tool. It's a robust product"*

Syngenta Technical Services Lead, Dr Shaun Hood reviewing the efficacy of SIMODIS® insecticide in tomatoes at *GrowMore Gatton, 2022.*

Dr Hood said MINECTO® Forte is another solution for cucurbits and fruiting vegetables and is also a good rotation option for chewing and sucking pests in these crops. It moves into the leaves via translaminar movement and protects both upper and lower leaf surfaces. This stops pests from feeding almost immediately to maximise yield and quality.

"MINECTO® Forte tackles whiteflies and aphids, as well as mites, thrips and Lepidoptera, so it actually compliments SIMODIS® really well," said Dr Hood.

"The optimised co-formulation of MINECTO® Forte is an advantage as it widens the pest spectrum, keeping it simple for growers so they don't need complicated tank mixes."

"MINECTO® Forte is registered for multiple pest species that can overlap or occur at the same time. Growers can be confident that they've taken care of all their key pests with just the one product."

In regions where fall armyworm is a threat, PROCLAIM® Opti insecticide is now registered for fall armyworm in all states and territories in sweet corn.

"PROCLAIM® Opti is a Group 6 insecticide that is selective for Lepidopteran pests and is highly compatible with IPM programs. The translaminar movement means the active ingredient is locked inside the plant, offering effective residual control for up to 14 days," said Dr Hood.

"PROCLAIM® Opti is also registered for DBM in certain vegetable crops so is a great resistance breaker for controlling larvae that are no longer susceptible to other chemistry."

Dr Hood said responsible stewardship of products underlies everything they do at Syngenta. Technical support and training for products is a priority so that resellers, agronomists and growers understand how to be good stewards of existing and novel modes of action.

"Stewardship is more than just rotating modes of action for resistance management. It's also adhering to the label directions, as well as managing spray drift and preventing off target effects, through appropriate nozzle selection and maintenance and calibration of spray equipment," said Dr Hood.

"What's the most expensive insecticide application you'll do? The one that doesn't work."

"Using the right product at the right stage of the pest and the crop and following label recommendations gives growers the best possible chance of early, effective and sustainable management of insect pests."

FIND OUT MORE
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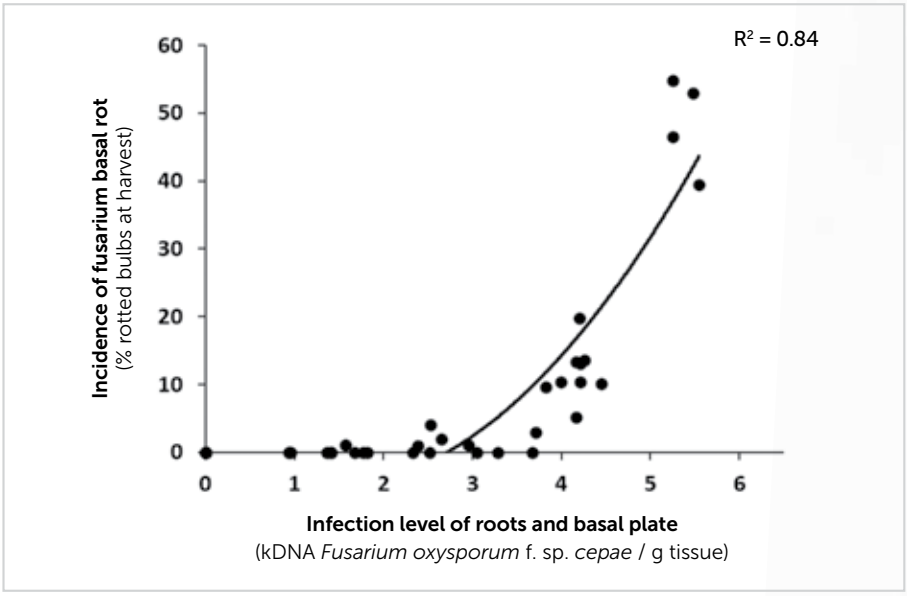
CONTINUED FROM PAGE 79

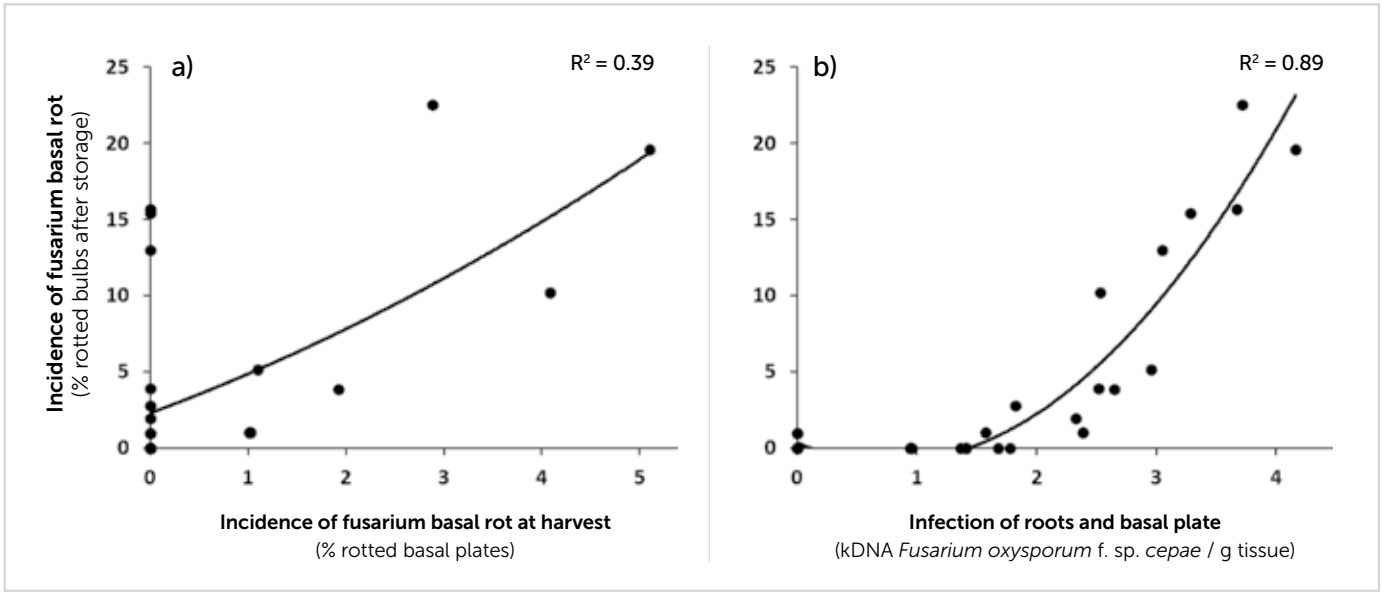
Targeted monitoring of crops will be undertaken in the 2023 planting season in South Australia to build on these first year findings, along with cause-and-effect trials to investigate source and level of nitrogen application, and simulated high rainfall events to investigate soil moisture impacts.

FIGURE 1. A Relationship between *Fusarium oxysporum* f. sp. *cepae* infection levels of root and basal plate samples with incidence of fusarium basal rot of bulbs at 12 monitoring sites.



Basal rot bulb cut open.
Image courtesy Michael Rettke, SARDI.

FIGURE 2. Comparison of (a) visual assessment with (b) DNA testing conducted at harvest to predict disease development after 3 months ambient storage. Sites had less than 5% incidence fusarium basal rot at harvest.



export + trade update

A successful return of the **Reverse Trade Mission in 2023**

Reviving Connections

The Reverse Trade Mission Showcasing Australia's vibrant Vegetable, Onion, and Melon Industries

With the world working towards economic recovery post pandemic, the highly anticipated Reverse Trade Mission (RTM) made a comeback in June 2023. The program ran from 30 May to 6 June, culminating with Hort Connections, with the aim to restore international trade connections and regain export momentum for the vegetable, onion, and melon industries.

The 2023 RTM welcomed 40 international delegates from Indonesia, Thailand, the Philippines, Taiwan, Japan, South Korea, United Arab Emirates, Singapore, and Malaysia. These nine markets have had a long standing trading relationship with the Australian vegetable, onion, and melon industries, further emphasising the importance the role the inbound trade mission has for grower-exporters.

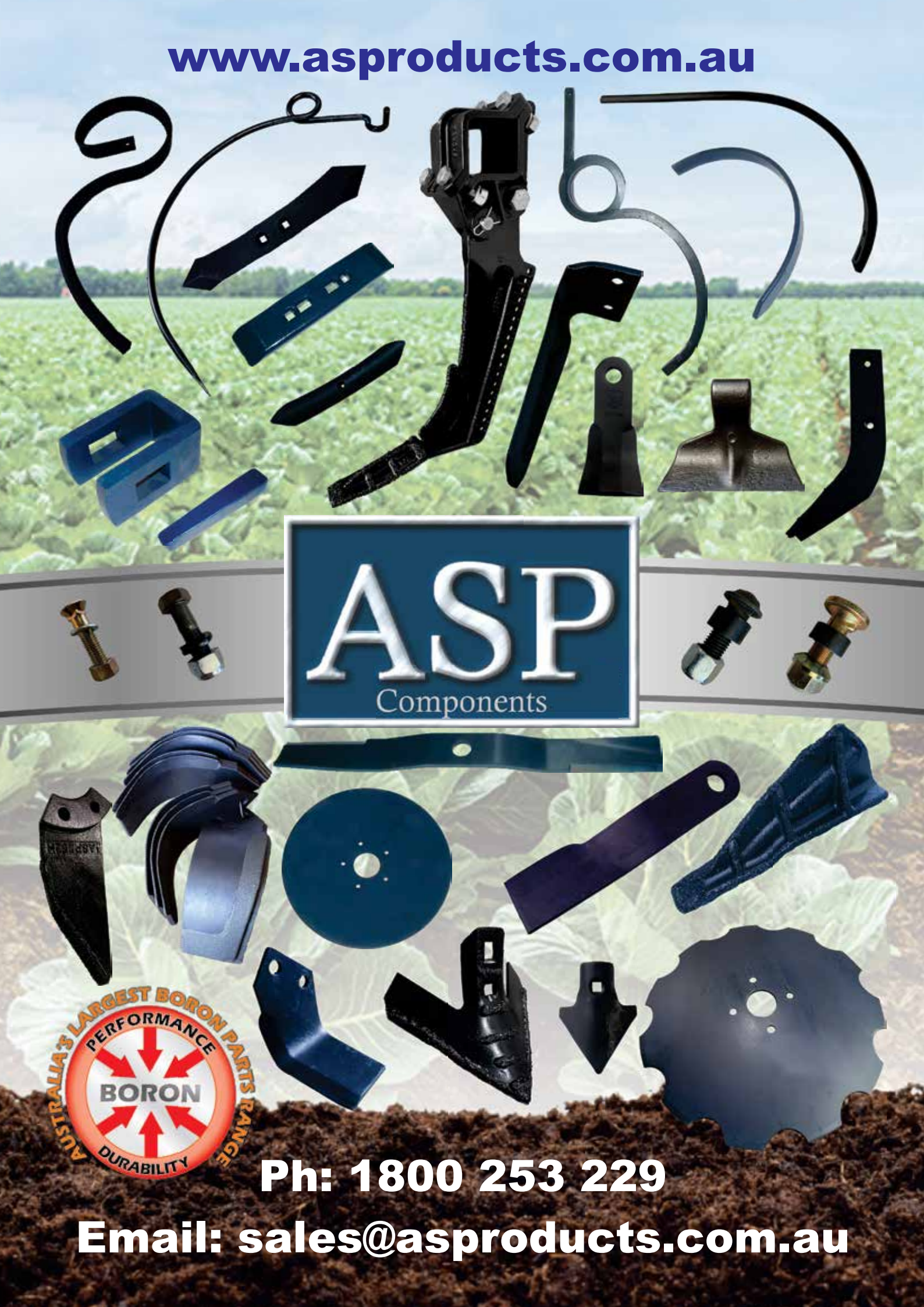
Since its inception in 2013, the Reverse Trade Mission has become an important event in the calendar of Australia's vegetable industry. For nearly a decade, the RTM has been instrumental in building robust connections between domestic vegetable growers and international buyers, facilitating a dynamic exchange that fuels export growth and innovation.

Each year, the RTM welcomes a cohort of funded international delegates on an educational 5 to 7-day journey, delving into the diverse horticultural production regions spread across the Australian landscape.

This inbound trade mission provides the horticultural industry unique opportunities to showcase the Australian horticultural production capabilities as well as Research and Development (R&D) innovations that underpin Australia's ability to produce some of the freshest, highest quality vegetables to international buyers from various export markets. It also serves as a bridge between Australian vegetable growers and a broad spectrum of international buyers from diverse export markets, allowing for a direct and meaningful exchange of ideas, insights, and expertise, as well as the forging of long-lasting business relationships.

The 2023 RTM is funded through the Hort Innovation Vegetable, Onion and Melon Funds and was supported by Western Australian Department of Primary Industry and Regional Development (DPIRD) and South Australia Department of Trade and Investment (DTI).

Above Day 1 (L) Rohan Prince, Director of Horticulture and Irrigated Agriculture, DPIRD and Michael Coote, CEO of AUSVEG welcome delegates to the Reverse Trade Mission.
Left Day 2. Delegates sample premium carrots at Sumich. *Images courtesy Brisbane Event Photographer.*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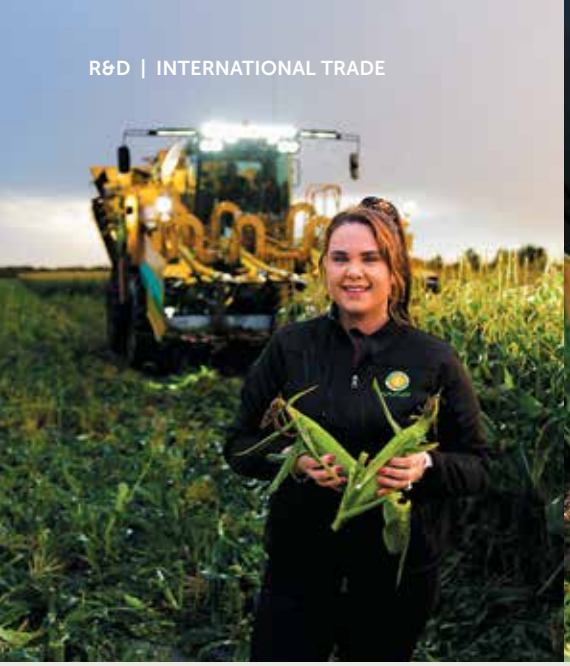
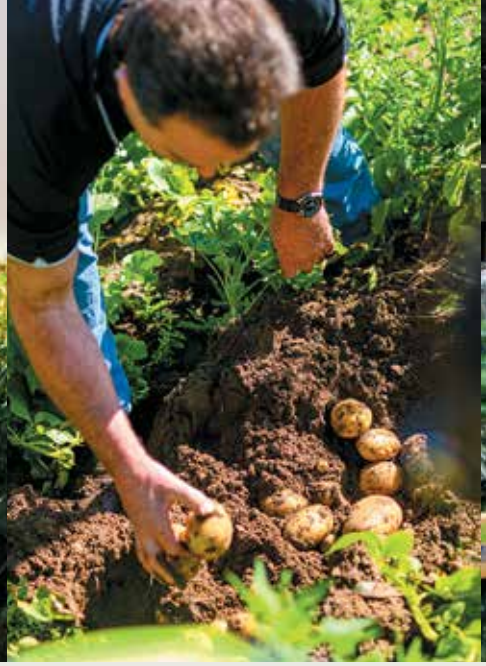




Western Australia Visits
A wealth of experiences and produce

The RTM delegation embarked on an educational journey to visit nine horticultural producers spanning across Western Australia and South Australia.

The RTM commenced with a Welcome Reception hosted by AUSVEG and DPIRD, with AUSVEG CEO Michael Coote and Rohan Prince, Director of Horticulture and Irrigated Agriculture, DPIRD welcoming delegates and emphasising the importance of collaboration between the peak industry body and state governments, to create a united front to drive demand from international markets and achieve shared success in export growth.

Embarking on its journey north of Perth, the Reverse Trade Mission's first stop was The Loose-Leaf Lettuce Company. With a 40-year history of market gardening on a 150-acre property, the family business grows and processes fresh cut salads in Gingin. The delegates were received by owner Maureen Dobra, where the group was shown their latest innovative harvester and a tour of the site's packing facility.

The second stop of the visits was Sumich, which is a renowned grower, packer and exporter of carrots, onions, celery, potatoes and other fresh produce and one of the country's largest producers and exporters. The Sumich team showed the group the premium quality carrots that are grown and their state-of-the-art packing facility.

The final stop of the day was to West Australian Corn Grower, where Domestic and Export Sales Associate and Quality Assurance Manager Sara Orr, showed the delegates corn harvesting. The delegates were also greeted by the team for corn tasting, getting onto the harvester at display, and learning more about sweetcorn.

The next day saw the group travelling down south of Perth, with two farm visits organised near Myalup. Starting off the second day of the RTM was Patane Produce, who grow carrots, onions, potatoes and broccoli. Michael and Pennie Patane, owners of Patane Produce and their team provided a tour of their packing facilities and a short trip to their potato fields, finishing up with a scrumptious curated lunch using produce from the farm.

The group then travelled to Capogreco Farms, one of the Australia's largest producers of melons. Capogreco Farms Director of Marketing Dane Capogreco provided an overview of the business to the buyers as well as offering melon tastings to buyers in their respective markets. While the melon productions have been shifted to Broome, the buyers were amazed by the orange candy variety.

Showcasing the best of South Australia

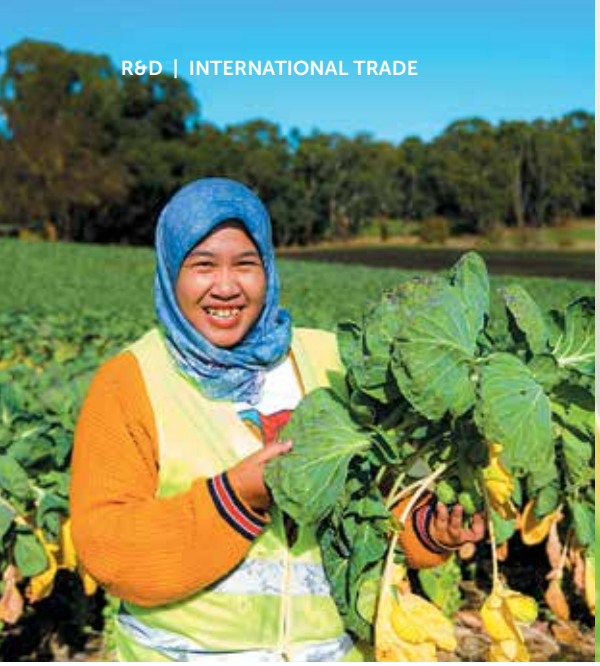
After the conclusion of the Western Australian farm visits, the RTM delegates then travelled to South Australia, to visit some of the best producers in Australia. Kicking off the travelling day into South Australia, the group visited 4 Ways Farms in Virginia, where General Manager Kingsley Songer greeted the group and provided a tour of their packing facilities.

The second stop of the day was Farmer Group, where the group was shown the newly built potato packing facilities which is expected to be in full operation in the coming months and a small, delightful afternoon tea showcasing the finest produce and beverages of the region.

The day concluded with a Welcome to SA Dinner hosted by AUSVEG and South Australia DTI, with AUSVEG Chairman Bill Bulmer and South Australia DTI Director of Trade Tim White welcoming delegates into South Australia and highlighting the high quality of produce that will be on display during the South Australian leg.

The next day of the RTM focused on some of the state's biggest Brussels sprouts producers. The first farm visit of the day was Eastbrook Vegetable Farms, also known as Samwell and Sons. The family-owned business has a long history in growing Brussels sprouts, with the group greeted by Eastbrook Vegetable Farms Director Leigh Samwell and Scott Samwell, who provided a quick overview of their business, operations as well as

Above L-R. Day 2 The very best sweetcorn harvested with export and sales manager Sarah Orr at West Australian Corn Grower. **Day 3** Michael Patane of Patane Produce checking the potatoes at Farmer Group, SA. **Day 4** Delegates try Lebanese cucumbers in the 4Ways packing facility. *Images Brisbane Event Photographer.*



morning tea. The delegates were shown Brussels sprouts harvesting, with a chance of getting their hands dirty and boots muddy, ending with a full guided tour of the packing facilities.

The final stop of the day was Hay Valley Vegetables, also known as AE Cranwell and Sons. Hosted by Post Harvest Production Manager Erin Cranwell, the group travelled down to the beautiful Angas Plains region and was provided with a short video presentation of the business as well as packaging of their product. The group was also shown the latest machinery addition of a Brussels sprouts harvester.

AUSVEG Fresh Produce Showcase

The 2023 RTM concluded with the AUSVEG Fresh Produce Showcase, a highlight event for international businesses who participated in the week-long program. Grower-exporters from the Australian horticultural industries, including vegetable, onion, potato, melon, stone fruits, apple, and banana industries showcased their products to international buyers and significant business interest was generated as a result of the event.

The AUSVEG Fresh Produce Showcase event provides growers from across the country the opportunity to display their produce to leading international buyers. The event was held on Monday 5 June, with more than 30 vegetable and fruit grower-exporters displaying and showcasing their product to the RTM delegates from across nine markets.

Delivered by AUSVEG and supported by Hort Innovation and South Australia DTI, this year's AUSVEG Fresh Produce Showcase had a dedicated South Australian producer region, further highlighting the importance of export for the region.

Positive Trade Outcomes and working towards the *Vegetable Industry Export Strategy 2025* Goal

The inbound trade mission received positive feedback from delegates, who appreciated the opportunity to meet growers and visit farms in key horticulture production areas of Western Australia and South Australia. Some immediate trades have commenced after the RTM with most of the delegates indicating they expect significant trade to occur as a result of their participation. The majority of the delegates would welcome the opportunity to attend similar trade development initiatives in the future.

Above L-R. Day 5 Harvest time for Brussels Sprouts at Eastwood Farms, SA. **Day 7** Discussing options with Schreurs during the Fresh Produce Showcase. *Images courtesy Brisbane Event Photographer.*

International Trade Events 2023-2024

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	Date	Location
Gulfood	19 – 23 Feb 2024	**Dubai World Trade Centre** DWTC
Foodex Japan	5 – 8 Mar 2024	**Tokyo Big Sight**
FHA F&B	23 – 26 April 2024	**Singapore Expo**
Reverse Trade Mission	End of May/June 2024	Various Location in Australia
FHA F&B	25–28 April 2023	**Singapore Expo**
AUSVEG Fresh Produce Showcase	June 2024	**Melbourne,** Victoria

Hort Innovation MELON FUND

Hort Innovation VEGETABLE FUND

Hort Innovation ONION FUND

FIND OUT MORE

Please contact Andrea Lin, International Trade Specialist, AUSVEG **andrea.lin@ausveg.com.au** or +61 3 9882 0277

The Multi-industry Export Program is a strategic levy investment under the Hort Innovation Vegetable, Onion and Melon funds.

Project Number: **MT21009**

Promising outlook for export diversification potential

BY CLAIRE HARRIS

The horticultural industry has faced a number of export-related hurdles in the past few years, yet data is showing access into international markets is well on the rebound and on the cusp of diversifying into new areas.

Speaking at Hort Connections 2023 in Adelaide, Hort Innovation Trade and Biosecurity Research and Development General Manager Mila Bristow said there was a 'relentless pursuit' to provide the world with Australia's fine produce.

With key investment themes of market development, export capability and market access, Hort Innovation currently has more than $58 million of active investments in projects supporting Australia's horticultural trade. On top of this is a further $68m of active investment and biosecurity initiatives to safeguard the industry from potential threats.

"Australia's hort industry has faced headwinds over the past couple of years, due to weather events, COVID, and uncertain trading environments, but the industry has demonstrated resilience and we've seen a rebound in exports," Dr Bristow said.

Horticultural exports grew 2.4 per cent from December 2021 to December 2022, to a combined export value of $2.5 billion. This figure is made up of an export value of $1.2 billion of fruit (5pc decrease on previous year), $1.1b of nuts (15pc decrease) and $262m of vegetables (9pc decrease).

"Despite those declines and softening, because of the increase in value, the overall growth of exports and export value is demonstrating rebounding export performance for Australia's products overseas."

Australia exports horticultural products to more than 30 countries, with about 33pc or $827m of horticultural exports headed to China. Vietnam, Japan, Hong Kong and Thailand round out the top five export destinations.

Dr Bristow said the rising demand for Australia's horticultural produce in South East Asia will continue to assist with export recovery, provided new markets are developed in the region.

"With strong income growth in the (south east Asian) region, we've seen an increase in domestic demand for nutritious foods," she said.

"Importantly, there is a relatively low percentage of agricultural land in our Asian market and near neighbours compared with the world average and what we have here in Australia, which is a promising sight for growing food input needs for the region."

In order to gain an accurate insight into potential export opportunities for various overseas markets, Hort Innovation – with the assistance of Kantar Insights – has completed a study into consumer demand for horticultural products across a number of international markets.

Specifically, the study unpacks the consumer attitudes, fresh produce shopping behaviour, and consumption habits of 4000 medium to high-income consumers across 13 markets. China was not one of the markets included in the study, with the study hoping to show the potential for diversification away from the core market.

The 13 priority markets analysed in the study include Japan, Singapore, Hong Kong, Korea, Malaysia, Taiwan, Indonesia, UAE, Vietnam, USA, Qatar, UK and India.

The report has been completed, and will be rolled out to industry before the end of the year.

"We have a richness of information of more than 2000 pages of highlights of insights about how our fruit, vegetables and nuts were purchased, consumed, valued and perceived," Dr Bristow said.

"For each of our priority commodities, we have evidence about strategic priority markets that our industries could target, and how to win in those markets, including the top things to get right, and why this all matters to consumers in each of those markets."

Above. Mila Bristow, Hort Innovation gives an export overview at Hort Connections 2023. *Image Andrew Beveridge.*

FOR MORE INFORMATION
Contact Mila Bristow at
mila.bristow@horticulture.com.au

Minor Use Permits

The below minor use permits were issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA). This information is circulated as part of Hort Innovation's Growing Innovation e-newsletter, which members and interested horticulture participants receive monthly.

Permit ID	Description Chemical / Crop / Pest or use	Original Date Issued	Expiry Date
PER14077v3	Eco-oil (botanical oil)/Greenhouse and hydroponic capsicum, cucumber and lettuce/Silverleaf whitefly	01-Oct-2013	31-Jul-2028
PER89185v2	Mainman 500 WG insecticide/Bulb vegetable/Thrips	06-Aug-2020	31-Jul-2025
PER88558v2	Imidacloprid/Chilli peppers/Silverleaf whitefly	04-Sep-2020	31-Jul-2026
PER82039v4	Bifenthrin/Cabbage, Chinese cabbage and cauliflower/Symphylids	20-Nov-2015	31-Jul-2028
PER93099v1	Vayego 200 SC (Tetraniliprole)/Avocado/Fruit spotting bugs, garden weevil and lepidopteran pests including loopers and leaf rollers.	08-Jun-2023	30-Jun-2026
PER12506v8	Dimethoate/Eggplant/Queensland fruit fly and mediterranean fruit fly	08-Jun-2023	30-Jun-2026
PER89216v2	Ranman 400 SC fungicide/Parsley/Phytophthora soil fungus	12-Aug-2020	30-Jun-2025

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

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

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

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

Inspections provide peace of mind for food safety, compliance and traceability

Statistically, the risk of a foreign object in our food may be small, but the ramifications for growers and the supply chain for a food recall can be enormous. Using inspection systems is an insurance policy that can be easily adopted by growers and packers.

Below. A detection unit is incorporated into a potato packing line. **Bottom.** Calibration of metal detectors to recognise different metal types and size, is an important part of the detection system.

The number of food recalls for vegetables in recent years has been relatively small, but the effect on business and reputation can be far reaching, not just for the grower and packer for whom the incursion occurred, but for the greater industry sector in question.

A foreign object in fresh produce can range from metallic objects such as broken machinery pieces, cable ties to insects. Finding the proverbial needle in the haystack is dependent on assessing the risk, and using the right tools for inspection.

Assessment of the risk of a foreign object through protocols such as HACCP, will identify points in the grower/packer process line where contamination is likely to occur. For most growers where produce is harvested and packed by hand, the risk is likely to be fairly low. When machinery and packing products are used, the risk may increase.

In retail, the supplier specifications may require that growers and packers include inspection points as part of the grower/customer contract, or a statement of risk assessment that concludes that the risk is low, and inspection is not required.

The most common forms of product inspection systems are x-ray and metal detection. Metal detectors will look for items that contain metal such as nails, parts of machinery (including aluminium or stainless steel equipment) or even the car keys.

X-ray is better suited to 'seeing' irregularities that may be foreign objects as the result of a contamination, such as plastic in a bag of carrots, stones in the onions, or snails in leafy salad vegetables.

"Inspection systems are normally incorporated into the pack and weigh line of the packing shed – the last point where there is any handling of the produce," says Julian Horsley, A and D Australasia.

"It may be required for compliance for a particular customer, or it may be necessary if a risk assessment indicates that there may be a hazard.

"Either x-ray or metal detection will normally satisfy the inspection requirement, so which system is chosen is dependent on what the foreign object is likely to be."

The size and type of the foreign object also needs to be considered. For example, a metal detector for potatoes and spinach which have a high iron content, will trigger the detector, so it is necessary for the equipment to be programmed to detect metal levels above that of the vegetable. As a consequence, it may be difficult to detect small pieces of metal.

X-ray detectors take a 'photo' of the vegetables but are more effective if the produce is in one layer, as subsequent layers may obscure any objects – particularly objects that have a high moisture content.

"Plastic has a very low density (SG), which means if it is amongst several layers of vegetables, it may not be detectable. If the produce goes through the x-ray in smaller pack formats with less layers, such as 1kg bag of carrots, it has a better chance of detection and the product rejected."

"Most packing sheds rely on inspection by hand to look for blemishes - larger foreign objects are likely to be picked up at that point. However, if it then goes through a packing machine, and a piece of machinery breaks, the metal detector will pick it up before it is shipped to the distribution centre or the customer.

"It really comes down to the risk assessment. A large piece of metal in a bag of potatoes is certainly not an ideal situation for the consumer and a poor reflection on the brand, but the risk to human health is likely to be low. However, a small metal spring in pre-made mashed potato with a high risk of being consumed certainly needs to be screened prior to sale."

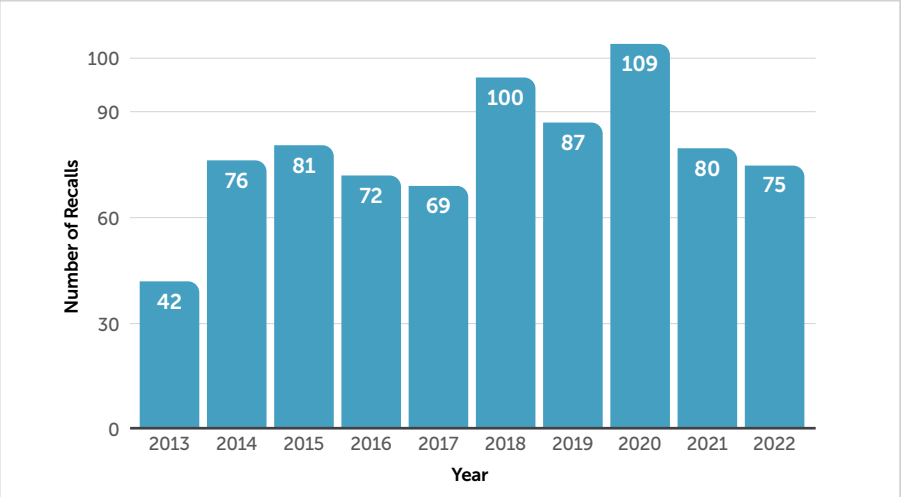
The case of the needle in the strawberry punnet

The strawberry needle incident in September 2018, which became a police investigation for sabotage, did highlight the need for growers and packers, and

FOOD RECALLS BY YEAR AND CLASSIFICATION 2013–2022

Reason	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Biotoxin	2	3	15	5	4	2	3	3	1	1
Chemical/ contaminant	0	1	0	1	1	2	5	6	4	10
Foreign matter	7	14	7	7	9	16	5	11	5	11
Labelling	2	1	2	2	1	6	1	2	3	2
Microbial	12	26	12	21	9	20	30	27	19	18
Other	0	1	3	2	3	4	8	8	8	4
Packaging fault	3	3	3	1	7	4	4	2	2	0
Undeclared allergen	16	27	39	33	35	46	32	51	38	29
Total	**42**	**76**	**81**	**72**	**69**	**100**	**87**	**109**	**80**	**75**

FOOD RECALLS BY YEAR 2013–2022



the greater industry to assess their risk of foreign objects in produce and how to manage consequences of an incursion.

With one act of sabotage, followed by several 'copycat' incidents, the needle in strawberries case highlighted that many growers had no inspection equipment in place for foreign object detection. In addition, how the incident affected strawberry growers in the wake of the incidents highlighted that handling of media, traceability and consumer confidence needed to be reviewed.

"Many of the larger commercial growers were able to continue with business as usual, as there were detectors used routinely, with regular audits and calibration carried out as part of their HACCP and risk assessments.

"However, for smaller, often family- based operations, many have a check weigh system in place, but had not incorporated x-ray or metal detection into the packing line, and consequently investigations took longer to complete, impacting their productivity and reputation with customers."

Being able to trace a particular punnet or bag of produce assists with the rapid identification of a product's origins. Investment in barcode and QR code technology at the point of packaging, not only can show the date it is picked, but potentially who picked it, the paddock it was from, and from a marketing perspective, the provenance of the product. For industries such as wine, cherries and beef, traceability also provides a level of protection against food fraud.

There is no doubt concern for public health is top of mind when detecting for foreign objects in our food. When it comes to how a recall is handled, and the communications required to alert consumers, the strawberry needle case highlighted that social media in particular can be harmful to the industry.

Poorly handled communications can mean that the entire industry is affected by the recall, with consumers not purchasing that product for an extended period of time, and the producer's brand experiencing a lack of trust. It can also extend across all growers of that particular fruit or vegetable, creating a much larger distrust by consumers.

"A detection system won't necessarily provide efficiency improvements, but it is an additional insurance policy should a contamination event occur, to protect your business and your reputation."

FOOD RECALLS DUE TO FOREIGN MATTER BY TYPE

Foreign matter	%
Plastic	30%
Metal	27%
Glass	19%
Other	12%
Rubber	3%
Multiple	1%
Wood	0%

Food Recalls

According to FSANZ, 791 recalls were undertaken between 2013 and 2022, with 75 just in 2022. Most of the recalls are precautionary and initiated by food businesses to ensure that potentially unsafe food is removed from distribution and sale.

Fruit and vegetables accounted for 73 food recalls, the second highest category. Processed foods which include long-life packaged food and manufactured items with multiple ingredients, recorded the most at 150 incidents.

FOR MORE INFORMATION

For more information and protocols for food recalls, consult the FSANZ website: **foodstandards.gov.au/industry/foodrecalls/Pages/default.aspx**

VEGETABLES
POTATOES
ONIONS

Pest and disease risk busters
Biosecurity Plan 101

On-farm biosecurity requires the implementation of efficient farm practices that protect crops from the introduction of pests and disease and supports specified market access requirements. Biosecurity practices also facilitate preparedness and early detection of a pest or disease incursion. This helps to minimise any crop and economic losses that may occur from the resulting reduction in the quality or yield of produce.

Early detection of any endemic or exotic pest or disease increases the probability of successful containment, eradication, or management before it has time to adapt, establish, and spread.

An on-farm biosecurity plan should outline all the necessary practices and procedures and the frequency required to minimise the risk of pest and disease introduction or dispersal.

For a plan to be effective, it needs to be tailored to your farm and include (but is not limited to) staff training, surveillance, and record-keeping practices.

Top. Rose boot cleaning at Boratto.
Above. Foot bath at VicVID.

Staff training

Staff members may not be aware of potential pests and diseases or how easily they can establish and spread if introduced. Staff training is an important aspect of an on-farm biosecurity plan and it is recommended that it is included in the staff induction process and regularly updated and reviewed.

Staff require training on:

- Effective hygiene practices;
- Possible pathways or vectors for introduction of pests and diseases;
- How pest and disease can spread;
- Crop monitoring for specific signs and symptoms;
- Daily checklist and staff record keeping requirements;
- Required actions and reporting.

Visual representation such as displaying posters that outline the steps for correct hygiene or crop monitoring procedures helps remind staff and visitors of the importance of on-farm biosecurity.

'Come clean, Go clean'

Staff, contractors and seasonal workers employed on multiple properties must under-stand the possibility of spreading pests or disease from one farm to another. Personal items such as clothing, footwear and gloves, as well as tools such as pruning shears, or machinery and vehicles act as vectors and appropriate hygiene procedures are required each time they enter and exit a property.

Surveillance

On-farm surveillance involves looking for the presence and population levels of pests and diseases. Conducted regularly, it enables early detection and response to new incursions. Surveillance also helps to determine the population levels and movement of managed pests, diseases, or beneficial insects. This can include the use of sticky, pheromone, or light traps.

Knowing what pests and diseases are commonly found in your area will help you identify anything that might be new or exotic.

'The value of sentinel plants'

Sentinel plants provide an early warning for the presence of pests and diseases and help to identify and sustain beneficial insect populations. They are usually placed at the most likely entry points to a property or region and are regularly monitored. Their location should con-sider the possibility of wind, water, and people acting as vectors for pest and disease transmission.

Recording the absence of pests or diseases can be just as important. It facilitates the 'evidence of absence' data collection required by some of Australia's domestic and export markets. Where required, industries and governments must prove that the specific pest or disease of concern is not present in the crop, plants, or plant material being exported. Failure to provide evidence of absence may lead to import restrictions or additional phytosanitary procedures imposed.

Participating in a surveillance network with neighbours and industry will inform you about potential biosecurity risks and help determine the most appropriate and effective course of action.

Record keeping

Accurate record-keeping enables traceability and acts as a reference point or evidence. Records can also be used to identify areas of potential biosecurity risk when developing and reviewing on-farm biosecurity practices.

Records should include:

- Pest and disease monitoring and surveillance activities;

- Movement and introduction of plants, plant materials, and produce;
- Vehicle and machinery cleaning;
- Staff training;
- Visitors' information;
- Farm inputs/outputs;
- Chemical usage.

'Trace back, Trace forward'

Keeping records of purchases, certifications, and sales will help to quickly identify the source and potential spread of any pest and disease incursions on your property.

Always request and record certification before introducing new plants or plant materials including seeds onto your farm.

If you suspect a new pest or disease on your farm:

- Mark the area;
- Take photographs of the suspected pest, disease or affected plant(s);
- Collect or contain suspected pests if possible;
- Stop the movement of people and equipment in/near the affected area;
- Wash hands and use appropriate sanitary measures on any clothing or footwear that may have been in contact with affected plant material or soil;
- Do not move or transport affected plant material unless advised by your relevant state government department;
- Report it to the exotic plant pest hotline.

EXOTIC PLANT PEST HOTLINE
1800 084 881

FOR MORE INFORMATION
or assistance with your Farm Biosecurity Plan contact:
Shakira Johnson at: **shakira.johnson@ausveg.com.au**
Rosalie Daniel at:**rosalie.daniel@ausveg.com.au**

Nutrien Ag demonstrates commitment to biosecurity best practice

Of late, biosecurity seems to be the trigger word for many organisations, with the word plastered across signs on farm gates, banded around in press releases and endlessly written in communications updates. But what does biosecurity actually mean? for Nutrien Ag Solutions Ayr the world biosecurity is a commitment to x, y, and z.

For Eilis Walker and the fee-for-service team, this commitment to biosecurity starts well before getting onto farm, when, in the early hours of the morning vehicles are washed down, carpets vacuumed and washdown declarations signed before entering growers' properties.

On farm, the team change boots over to a pair that is used only on that property and applies a diluted spray of Virukill to the boots to kill any pathogens that may be on them from the previous visit. Once boots are cleaned the team then proceeds to the farm manager's office to check in and write down the blocks that need to be inspected.

When crop checking begins, inspections are undertaken from youngest planting to oldest planting to reduce the risk of transmitting viruses and diseases. The team carefully walks through the field taking note of pests and diseases that their recommendations will target. One of the most significant viruses the team looks for is Papaya Ringspot virus, which can be transmitted via contact with clothes and boots to the next plant. Maintaining an awareness of this virus is of utmost importance to the team as transmission from plant to plant can reduce the productivity of plants.

Once a block has been finished the team takes time to remove mud from their boots to not spread soil, weed seeds, and pathogens from block to block.

The importance of these tasks has been reinforced by the Nutrien Ayr branch undertaking accredited washdown training with Belinda Callanan from TH9 Outdoor Services. Ryan Cranitch. Branch Manager at Nutrien Ag Solutions Ayr, stated that the course provided 'practical biosecurity training that has greatly helped Nutrien Ag Ayr to manage the risks involved in entering primary production enterprises.'

From this training, Eilis and the fee-for-service team implemented a box containing essential biosecurity items including a brush to remove excess mud from boots and sanitiser to disinfect footwear and equipment.

New tech the key to unlocking on-farm monitoring challenges

BY CLAIRE HARRIS

Laborious and lengthy tasks are becoming as simple as the tap of a phone, thanks to data collection technologies with the ability to improve accuracy and decrease on-farm risk.

Bitwise Agronomy Chief Executive Officer Fiona Turner is an example of a tech juggernaut leading the charge on rapid data collection, through the company's development of GreenView – a cutting edge crop analysis technology that can 'see' horticultural crops in the same way as humans can.

Presenting at Hort Connections 2023 in Adelaide, Fiona said GreenView uses an off-the-shelf GoPro camera attached to existing farm machinery to capture video footage while a grower is doing other jobs, for rapid analysis online upon returning to the office.

The footage only needs to 'see' five per cent of total fruit on a tree to show a result, with a visibility factor used to then apply a statistical approach to determine overall fruit counts for trees.

"When you're back online, you upload the footage into our portal, and we've taught our AI to see like a botanist and viticulturalist. We can count, measure, look at different phenological stages, and we can do it all at scale and high accuracy, at superhuman speed," Fiona said.

"For example, if you were counting a blueberry bush, a human can generally count eight blueberry bushes a day, yet in one hour, our tech can count over 2,000 blueberry bushes."

The output of the GreenView analysis is an array of overviews, interactive maps, block-by-block comparisons and interactive maps to subsequently assist growers with decision-making.

Despite the speed of data analysis and data collection, Fiona said the tech was designed to be used alongside the real-life expertise of growers.

"This isn't a magical tool, there are things AI doesn't know yet about the plants, so it's really about working with the growers," she said.

"The tech is not making growers redundant; it's just helping them to work more efficiently."

About three and a half years into product development, GreenView has been used primarily in berry crops to date but is expanding to be used by growers of mini cucumbers, tomatoes and grapes.

As well as being used in different crops, Ms Turner said there had been a large focus on extending the capabilities of the program, particularly the analysis of different phenological stages to aid future decision making. Data and insights can be gained within 12 hours of onboarding GreenView.

"Over the last two years, we've been working hard to integrate growing degree days and temperature and weather data into our predictions," she said.

"We now have a feature where we can look back at what has happened on the farms and in the tunnels, to analyse that data to see how many growing degree days or what heat limit it takes to ripen fruit, and we can apply that going forward as well.

"We can look at predicted temperatures for the next two weeks and then predict out how that's going to affect what we're going to be picking."

Above. Fiona Turner, Bitwise Agronomy Chief Executive Officer presenting at Hort Connections 2023. *Image Andrew Beveridge.*

Left. Guy Davidson, Onside Customer Service Director, presenting at Hort Connections 2023. *Image Andrew Beveridge.*

Rapid management of on-farm visitors

Onside, a New Zealand based company has also recognised that onboarding and rapid data collection is a priority for the safety and management of on-farm visitors.

The Onside app is a digital check-in for visitors on properties, to show farm owners the location of workers and visitors in real time. Farmers also have the option to set customisable questions for visitors to complete as part of the check-in process, to ensure jobs can be done safely and efficiently.

Having been around for six years, Onside has now mapped more than 15,000 properties, worked with over 5,500 rural businesses, and has amassed over 70,000 app users, according to Customer Service Director Guy Davidson.

"Onside works across every rural sector, we started in the dairy sector but horticulture is now our biggest sector," Guy said during his presentation Annual Vegetable Industry Seminar in Adelaide, June 2023.

"The value we provide makes it really easy to get adoption within industry, that's just because we co-develop everything with farmers and growers. We're constantly asking what would make the system better and more useful and use that to drive our roadmap.

"We're not expecting everyone to be biosecurity experts, we just want to give people the info they need, and active notifications they need, to be aware how not to spread pests and diseases round the sector."

Allowing for benefits in the operational, communications and compliance spaces at an on-farm level, Guy said the app was also beneficial for biosecurity at a broader level.

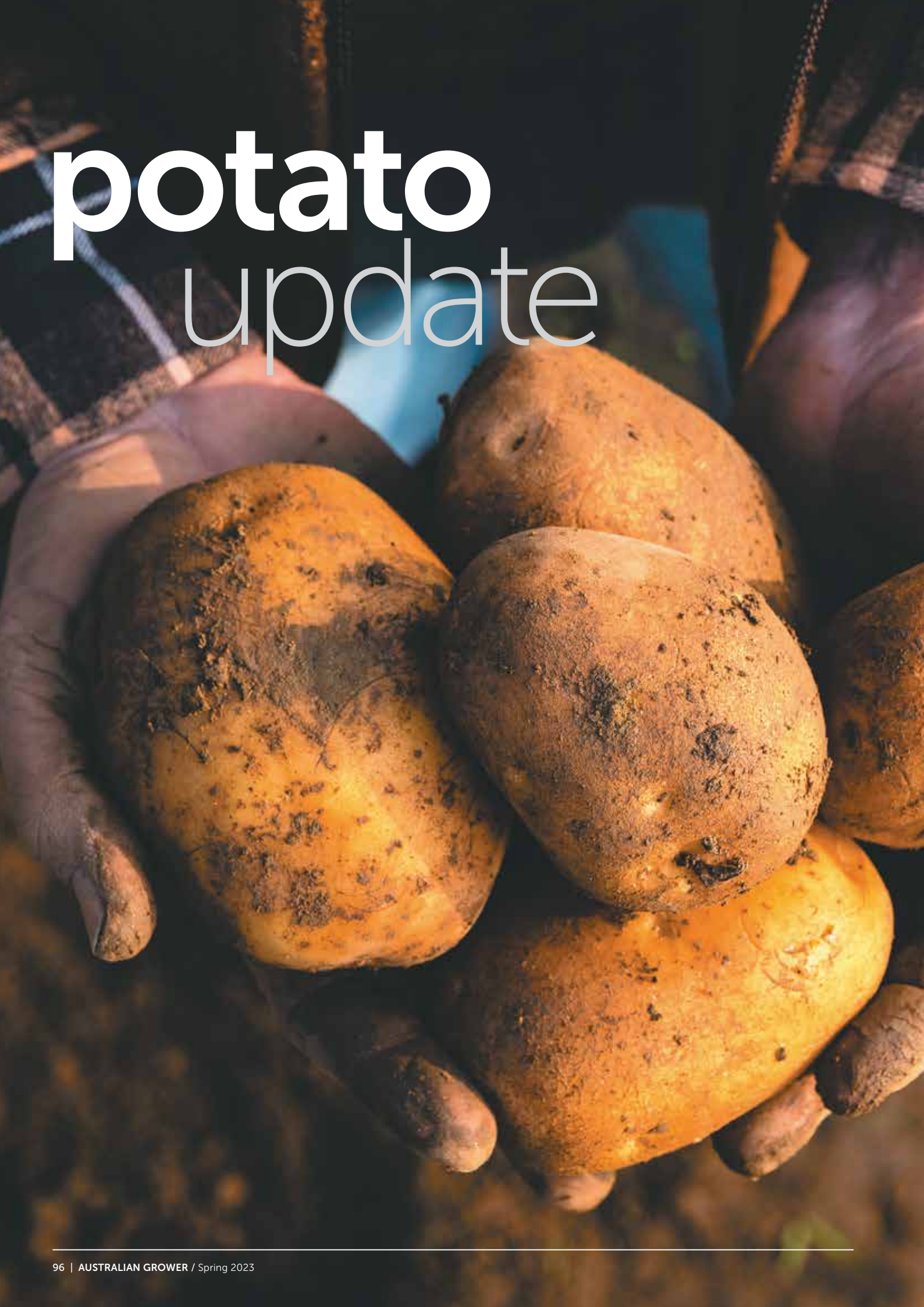
"The intelligence of Onside can help with traceability, preparedness and response at an industry or government level," he said. "You have a situation of many producers mapping properties, people signing in and out, and every time someone checks in, it creates a connection, and all those connections at scale can create networks.

"Networks can feed in to work out how a rural network moves, so you can work out how a pest and disease might spread through a network. Industries can then boost their biosecurity preparedness and surveillance and response time if something was to come into the network."

FOR MORE INFORMATION

Contact Fiona Turner at **fiona@bitwiseag.com** and Guy Davidson at **guy@getonside.com**

potato update



KUBOTA
IMPLEMENTS

TOP CHOICE

THE START OF A SUCCESSFUL CROP

RM2005 SERIES
3-5 Furrows

RM3005V SERIES
3-6 Furrows

RS7005V SERIES
6-8 Furrows

Kubota's RM3005V 3 Furrow Reversible plough is everything Adam Bremner was looking for. "In our operation, the reversible plough pays us back in time & efficiency. With the Auto-reset system it allows you to start at one end of the paddock and keep going to the end, you don't have to lift the plough out of the ground as you go along– which saves time and money," Mr Bremner said.

Adam Bremner
Wombat Forest Organics, VIC

KUBOTA.COM.AU

For Earth, For Life
Kubota

Message from the CEO

There's no doubt that times are extremely tough for potato growers, with high costs of production, stagnant prices and many other issues impacting the viability of growers in the sector.

AUSVEG recently conducted a survey that found that more than 30 per cent of Australian growers are considering leaving the industry within the next 12 months. This is supported by recent research by the Global Coalition of Fresh Produce that highlighted Australian growers have experienced some of the highest cost of production increases in the world, with an average 37 per cent rise over the past two years.

Potato growers in the Ballarat region of Victoria are also significantly impacted by the protracted Western Renewables Link project that could see growers have high voltage powerlines cut through their properties and impact their productivity through loss of crops and land for rotation.

The AUSVEG team attended a recent tractor rally in front of Victoria's State Parliament, where growers, landholders and others affected by the project protested the lack of planning and consideration that landholders and farmers were receiving from the Government and the Australian Energy Market Operator (AEMO).

One of the strongest messages from the rally was the considerable impact on the mental health of those involved. There have been hundreds of growers and landholders who have had sleepless nights for years as a result of the project; people have required medical care and local medical services have noticed increases in stress-related medical issues. The human toll of this project must be recognised by government and AusNet.

On a more positive note, it was pleasing to see Tasmanian potato grower Robert Arvier win the Corteva Agriscience Young Grower of the Year at this year's Hort Connections.

Robert is the Managing Director and co-founder of West Pine Ag, an irrigated vegetable grower on the north-west coast of Tasmania producing potatoes, onions, carrots, and brassicas. Robert has been a vocal champion of sustainable farming practices, leading the way through adoption of renewable energy and carbon reduction opportunities for farms in particular.

Robert has become one of the industry's leading advocates for sustainable farming practices, setting an example for other growers and bringing to life some truly exciting initiatives. Be sure to read more about Robert on page 24.

I am pleased to welcome the *PotatoLink* publication back into the *Australian Grower* magazine. The R&D publication is produced by Applied Horticultural Research as part of the Hort Innovation-funded PT20000 *Australian potato industry communication and extension project*. You can read more from the *PotatoLink* team on page 122.

AUSVEG was saddened to learn of the passing of industry stalwart Max McKenna in June. Max was a highly dedicated potato industry member who will be known to many of our readers, and he will be sorely missed. You can read more about Max's contributions on page 100.

Michael Coote
CEO, AUSVEG

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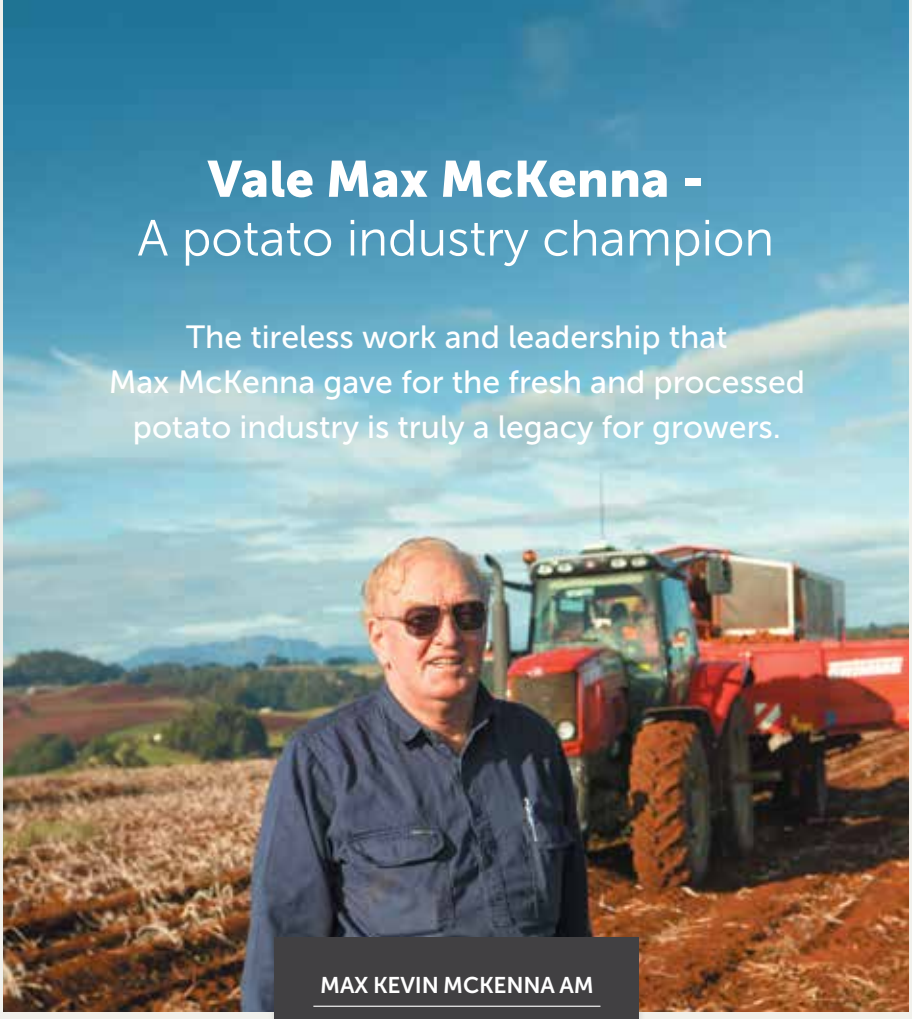
Vale Max McKenna - A potato industry champion

The tireless work and leadership that Max McKenna gave for the fresh and processed potato industry is truly a legacy for growers.



MAX KEVIN MCKENNA AM

20.1.1946 – 14.6.2023

As a potato grower in the Ulverstone region of Tasmania, Max was well recognised by industry for his dedication to ensuring growers had a voice.

The list of his achievements and positions on various boards and councils is long and distinguished, and testament to his level of commitment to the industry.

As a life member of the Tasmanian Farmers and Graziers Association (TFGA), the association's CEO Hugh Christie, said "Max's dedication and tireless leadership helped the industry navigate many challenges, such as lower prices and tough contract negotiations, he played a crucial role in holding the sector together through difficult times.

"His contributions to the potato industry and agriculture more broadly were formally recognised by many organisations. In 2003 he was presented with Simplot Australia's Award for Services to the Tasmanian Potato Industry, highlighting his significant impact on the sector."

In addition, Max was awarded an Order of Australia for his services to agriculture in the late 1980s and recognised by the Australian Vegetable and Potato Growers Federation, Simplot Ulverstone Potato Growers Group, and Tasmanian Farmers and Graziers Vegetable and Potato Councils further demonstrating the esteem in which Max was held within the agricultural community.

On reflecting on Max's life, Wayne Cornish who was chair of Australian Potato Industry Council (APIC) and Potato Growers Australia at the time, said that Max was heavily involved with APIC and in the early years of AUSVEG's development. His advocacy saw the establishment of a research and development fund, and the introduction of a potato grower levy.

This levy fund, was the precursor to the current levy system, serving the industry to research issues such as diseases like powdery scab and improving productivity.

"The introduction of a levy at the time was difficult, and Max spent many hours travelling the country to speak with growers about the benefits that it would bring for R&D," said Wayne.

"Max's ability to be calm and level-headed and work with growers at their own pace to understand the levy system and what it would bring, was invaluable.

"Not only did Max as a grower understand the potato industry from a grower and processor perspective at a local level, but he traveled extensively overseas to learn firsthand how the potato industries operated elsewhere. He was keenly interested in learning what technology was available and the latest production techniques and apply them here. Bringing that knowledge home to improve the potato industry here, is to his credit."

Chairperson of the TFGA Vegetable Council Nathan Richardson said Max McKenna's contributions to the potato industry and his unwavering dedication to agricultural representation in Tasmania have left a lasting impact, making him one of the most highly regarded figures in the Australian farming community.

Mr Richardson said, " Max worked tirelessly on the potato front for decades and during a time when the grower base had nearly 300 growers and almost as many views on how things should be handled. Max took it on his shoulders to work toward solutions when the industry faced tough times.

"I'd have to say that if Max hadn't made the decisions he did, our whole ability to form committees to negotiate prices and meet with processors would've unravelled completely over time, providing the foundation for collective negotiations across not only potatoes but other crops as well.

"His ability to portray the state of play and what needed to be done for the grower was faultless and completely unselfish. Max McKenna is a legend of the Tasmanian potato industry," he said.

"Max was a fair man, who believed strongly in equity and justice, he was a stickler in that regard which meant that he was more than capable of negotiating on behalf of the growers," said Wayne.

"But after a hard day of talks, he knew how to let his hair down and enjoy a meal with you, he was a wonderful fellow to be around. I respected him tremendously. There was only one Max Mckenna and his legacy that he has left for the industry and Tasmania is something that will last forever."

John Deere prioritises horticulture with purchase of Smart Apply Inc

John Deere has further cemented its commitment to horticultural in the high-value crop sector across Australia and New Zealand, through its acquisition of US precision spraying company, Smart Apply Inc.

John Deere has partnered with the Indianapolis-based Smart Apply since 2020 to provide growers with access to systems that help reduce chemical use, airborne drift and run off, which in turn supports maximisation of high-value crop yields and meeting sustainability objectives.

John Deere Production System Manager, Stephanie Gersekowski, said the acquisition aligns with the company's focus on helping high-value crop customers offset the rising cost of chemicals through precision spraying products and data capture.

"Smart Apply developed the Intelligent Spray Control System™ which helps to achieve up to 93% less chemical runoff and up to 87% reduction in airborne drift, while reducing chemical use by an average of 50%," Ms Gersekowski explained.

"We know the impact the rising cost of chemicals is having on agricultural businesses and this technology has been expressly developed to ensure producers are only using what they need, which in turn can also reduce their water use by 50%.

"Growers can now choose to share their Smart Apply data with John Deere Operations Center™ farm management software, which unlocks another level of insights and expert support."

"Both John Deere and Smart Apply recognise the importance of high-value crops and are committed to investing in innovation and technology that best solves producers' problems," Smart Apply President and CEO, Jerry Johnson, said

Software captures data to be shared with Operations Center™

Using sophisticated LiDAR (light detection and ranging) technology to sense the presence of individual trees and vines, the Intelligent Spray Control System™ provides horticulture producers with an add-on kit for tow-behind air-blast sprayers that automatically adjusts spray volume based on foliage density, and automatically stops spraying between trees and rows.

The proprietary, GPS-enabled software captures a broad spectrum of data while it sprays, documenting the date and time of spraying, overall spray volumes, chemical savings, tree counts, canopy volume, health of individual trees or vines and hectares sprayed.

This precision data can now be shared with John Deere Operations Center™ to provide growers with a deeper understanding of orchard or vineyard productivity, profitability, health and sustainability.

'Exciting' new cab tractors bring new digital capability

Ms Gersekowski said the investment in Smart Apply was indicative of John Deere's prioritisation of precision management and efficiency for high-value crop producers.

"One of the most significant new product releases for the high value crop sector will be our John Deere 5ML Series of cab tractors due to arrive in Australia later this year," she said.

The low-profile cab gives more power and digital capabilities and has two front-axle configurations on offer for working widths from 180cm (71 inches) to 155cm (61 inches). The 5ML Narrow tractors come equipped with programmable LED lighting, a front hitch to ensure operators can use heavier implements and a front PTO for added versatility. A new Limb Lifter kit can be added to gently move away low hanging branches, reducing the potential for damage to trees and tractor.

"The 5ML brings a new level of technology to John Deere tractors include JDLink™ — an industry exclusive in this class — to track machine data remotely," Ms Gersekowski said.

"Combined with Smart Apply precision spraying technology, it offers solutions for Australian horticulture producers to help them meet the challenges of reducing input costs, meeting sustainability targets and achieving more with less.

Above. John Deere has acquired Smart Apply, the company which developed Intelligent Spray Control System™. **Inset.** John Deere Production Systems Manager, Stephanie Gersekowski.

FIND OUT MORE
For the latest news and product launch information from John Deere, see your local John Deere dealer at dealerlocator.deere.com

Farmers rally on Victorian Parliament in protest of the proposed VNI-WRL high voltage transmission line project

Hundreds of farmers, landholders and concerned community members from the Ballarat and western districts of Victoria protested on the steps of Victoria's Parliament House, with more than 40 tractors and trucks raising awareness of the impact the high voltage transmission line project will have on prime agricultural land in the state.

Top. Tractors roll past Parliament House in the Stop the Towers Tractor Rally.
Above. The Naked Farmer, MC for the protest.

Victorian farmers, landholders and community members descended on Victoria's Parliament House in Melbourne on Tuesday 15 August for the 'Stop the Towers' rally, in response to the proposed VNI West and Western Renewables Link transmission projects.

The rally featured tractors and trucks making the journey to Parliament House in response to the proposed VNI West and Western Renewables Link projects.

Speakers during the rally included Federal Nationals Leader David Littleproud, Deputy Leader of the Victorian National Party Emma Kealy, Liberal Members for Western Victorian Region Joe McCracken and Bev McArthur, and VFF president, Emma Germano.

Ms Germano said that most farmers were in favour of renewable energy, but not at the cost of food security.

"We shouldn't be asking for permission to farm on our farm. We shouldn't be asking the government to value the beautiful soil, water, and environment we farm in. We are asking the government to stop and get it right and plan with us," said Ms Germano.

Both Mr McCraken and Ms McArthur have given their support to the Moorabool and Central Highlands Power Alliance, who organized the rally, calling for the state government to stop the project and reassess the plan in collaboration with farmers and growers.

Impact on farmers

Farmers Kevin Maher from the Ballarat district, and Jason Barrett from St Arnaud, also gave their personal perspectives at the rally of what the impact is likely to be on their respective farms.

Kevin Maher can trace his family's farming back to the 1860s as a potato farmer in the Ballarat district and understands that the unique soil and climate is ideal for potato farming. He said that the region produces around a third of the potatoes for the Australian chip market, and to lose the land to transmission towers and lines would have significant impact on farming families and the local economy.

For Jason, the proposed route will cut through his prime land for crop and livestock production, as well as sensitive native habitats. As a sixth generation farmer, he is concerned not just for his family's legacy and livelihood, but that of the local environment.

About the project

The proposed high voltage transmission lines, the Victoria to New South Wales Interconnector (VNI West) and Western Renewables Link (WRL), which until earlier in 2023 were two separate projects, have now been combined into one.

The project is for 500 transmission towers to be erected to carry the high voltage lines west of Melbourne toward Ballarat and onward to near St Arnaud. With each tower, a 100m easement is required.

The Australian Energy Market Operator (AEMO) says the project is necessary to carry electricity around the states as more renewables are brought online such as solar and wind farms.

For farmers along the route, including many potato farmers in the Ballarat region, the transmission lines will impact the ability to farm productively with restrictions on machinery height and land area for harvest and crop rotations.

The region already has transmission lines and towers for 220kV power. Suggestions have been proposed to upgrade the current infrastructure, or as an alternative, going underground. Upgrading the existing infrastructure is referred to as Plan B and is based on an assessment by industry veteran Simon Barlett and Victorian Energy Policy Centre's Bruce Mountain.

The Victorian Farmers Federation has launched a petition calling for an immediate halt to the planning and construction of both projects.

To find out more, visit vff.org.au/ people-power-sign-our-transmission-petition/.

Issues of concern for farmers

- Loss of productive land under the transmission lines and easements
- Loss of productive land for crop rotation to mitigate pest and disease pressures
- Inability to operate farming machinery under the lines (max height for machinery is 4.3m – irrigation booms are 7m)
- Disruption to farm infrastructure such as irrigation and fencing
- Interference from the lines on GPS systems such that drone technology, self-drive equipment may be hindered

Fire risks

- In the event of a fire, aerial fire fighting cannot be used
- CFA crews will not be able to access the land underneath the lines to combat fires

Environment

- The route passes the Wombat State Forest, Lerdederg State Park and extensive natural habitat and water systems.

Above L-R. Kevin Maher, Ballarat potato farmer is concerned about the impact that the high voltage transmission lines will have on potato productivity. Emma Germano, president of the VFF says government shouldn't be valuing our food security against energy

PotatoLink R&D Forum at Hort Connections 2023

BY GEORGIA THOMAS, WA POTATOES

On June 5, potato industry stakeholders from around Australia met in Adelaide ahead of the Hort Connections Conference for a Potato R&D Forum delivered by the PotatoLink extension program.

The forum hosted over 50 people and included seven latest research and development presentations. Topics included digital remote monitoring, mobile drip irrigation, data mapping, pests and diseases, and soil nutrient mapping.

The presentations highlighted the rapid development of new technology in farming and the need to stay informed. These innovations impact various factors, including on-farm practices, monitoring, and traceability.

Henry Hyde spoke about Smart Farming, where growers can use carefully managed digital remote monitoring tools to improve economic and environmental outcomes on-farm.

The project involves integrating sensor data, weather forecasts, and biophysical models, which are then collated and analysed to enable users to make decisions regarding business operations. In horticulture, this includes soil moisture and irrigation management, nitrate runoff, and other automated operations and record keeping.

Tim Neale continued the high-tech discussion in his presentation about Precision Agriculture, stating that the increased affordability of satellite imagery is now making it more competitive as an option compared to drones. The high-resolution satellite imagery is already helping farmers to assess soil types and drainage issues, manage crops and undertake yield mapping to assess overall on-farm performance.

On the topic of biosecurity, Professor Calum Wilson provided an exciting update on the completed project PT17003 where researchers developed a 'rapid cultivar screen' for Powdery Scab. The new screening protocol can reduce testing time from months to weeks. As a result of the project, new resistant varieties are now also being trialled.

For all the presentation details and links to speakers and projects, please visit potatolink.com.au/resources/potatolink-rampd-forum-2023.

Following the presentations, the delegation headed to a field event at Langhorn Creek, where additional local growers joined the event. The field walk showcased the comparison of physiologically young seed and old seed in two paddocks using different treatments. The old seed was more susceptible to blight and had more foliage and less tubers.

The visit wrapped up at the Langhorn Creek football club, where all the remaining visitors enjoyed a BBQ and networking. The day was a fantastic opportunity for stakeholders and growers from across Australia and overseas to meet and catch up on life in the potato industry.

Above L-R. Field event at Langhorn Creek. Late blight. **Left.** Old seed.

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Spud Sisters have got their eyes on beautiful potatoes

For the consumer buying a potato, the idea that different varieties are better for different uses is not well understood. The knowledge that some can be pink, purple or yellow adds a whole level of complexity but the Spud Sisters make it simple.

Pink fir apple potatoes are fingerlings, so are kipflers. And so are Midnight Pearl and Crimson Pearl, but one is dark purple the other has pink spots.

For a potato that holds it shape in salads and soup, use a waxy, creamy potato such as Nicola or Tasmanian Pink Eye, but if you want to make the best homemade chips use a floury, fluffy type such as Coliban, Sebago or Yukon Gold.

For the Spud Sisters this is a typical conversation with customers at farmers markets, or chefs in high-end restaurants.

Third generation potato farmers in the Ballarat district, Kerri and Catherine have potato in their genes.

What started as taking a few potatoes from the family farm to other families in Melbourne at the local kindergarten has evolved into a full scale business. The Spud Sisters now supply a wide variety of waxy, fluffy, all rounders and gourmet potatoes to hospitality and farmers' markets.

"As kids on the farm, we would help with picking the potatoes, listening to what dad had to say," said Kerri.

"You absorb things about the potatoes when you are young and it stays with you as an adult. When dad suggested I take them to other families at kinder, he would say 'take these, they're beautiful spuds'. Despite thinking that no one would want dirty spuds, I did and eventually orders from our neighbours developed into a business that now supports my family and Catherine's."

Kerri and Catherine discovered very quickly from feedback from chefs and farmers markets that people did not really understand the differences between the types of potatoes, and how to use them. Some may perceive 'floury' potatoes that have been in cool store too long as 'pasty' and won't use them. Often, it meant that the starches had turned giving a sweeter taste, and a different texture.

When explaining the difference between waxy and floury, the Spud Sisters use cooking styles to illustrate the point – waxy potatoes if you want to do a salad or curry, floury if you want potato and leek soup.

Above. Catherine and Kerri are the Spud Sisters.

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"Nature is perfect in its imperfections, it is part of the charm of these varieties."

A waxy potato has more moisture content and doesn't absorb quite as much water when cooking, so holds its shape. Floury potatoes are drier and will break down more readily. In addition, each variety has its own flavour profile, Catherine says that by trying a few different ones, everyone has their favourite potato.

"We want more people to know about potatoes and understand the potatoes. It is one of the lovely things with farmers markets and talking to chefs, we get direct feedback and they get a real understanding of the difference between the waxy potatoes and the floury potatoes, and able to talk to our customers.

"Once we explain the different varieties and their uses, people want to know. For a restaurant, if they specialise in regional food, then for a Gippsland restaurant, they want a Gippsland potato. The story behind the potato is also gaining momentum."

Above left. Waxy, floury, all-rounders and fingerlings are all available, and in a variety of colour. **Above right.** Some of the Spud Sisters labels.

Growing to meet market demand

Kerri describes the farmers who grow for them as a patchwork, so that hospitality and farmers' markets have a range of varieties that dovetail with the season.

"Chefs talk to each other about the different potatoes – some will have personal favourites; others will cook the same variety in a different way.

"We have such an international melting pot of chefs, that demand different types of potatoes, who might prefer the purple for how it looks on the plate, compared to someone who wants a traditional Peruvian potato. This year the pink fir apple potato was in higher demand than we anticipated, and we sold out, but a kipfler can be used just as well."

The farmers and agronomists who provide the potatoes appreciate that the Spud Sisters understand at a farming level what is involved in growing such diverse varieties. Some, such as Andean Sunrise can be a lot more labour intensive than others, or cannot be held in cold storage.

Meeting orders for hospitality requires planning well in advance. The Spud Sisters work with a number of growers around Victoria and South Australia to source the unique varieties, but often with limited acreage. Once a harvest is sold, there is no more until next season.

The seed potato growers are based around Tasmania, Ballarat and South Australia, and it is usually at least generation two tubers that are used, so predicting what the customer wants in two to three years' time can be challenging. Conversely, varieties that are nearing the later generations such as Wilwash and Blackwood Gold will be gradually phased out. Newer varieties such as Gatsby, a later generation of Sebago which has better disease resistance, retains the profile of the Sebago.

"I would say to anyone who is thinking about growing niche varieties plant a few rows, and take a few samples door to door to farmers' markets and hospitality," says Kerri.

"If there is demand, then it is worth putting in more rows for next season, knowing you have a home for them.

"For those varieties that are problematic and need to be hand-picked, or can't be cool store, you can charge a more premium price. There is often a trade-off – the ones that are easier to manage from harvest or in the restaurant, won't attract the premium price, but you may be able to plant and sell more.

"So many of these varieties would fail the supermarket specifications because of their shape, the lumps and bumps.

"Nature is perfect in its imperfections, it is part of the charm of these varieties."

ON-FARM BIOSECURITY

Study into the real costs and benefits for growers

On-farm biosecurity is becoming an increasingly important topic of conversation. Whether you've heard about it or experienced it first-hand, a pest incursion has devastating impacts to businesses, growing regions and markets.

Australia's biosecurity system – and its implementation at all levels – is critical to protect our farms, environment, communities and economy from the world's most invasive pests, weeds and diseases. It's also key to supporting international market access.

On-farm biosecurity is a vital support pillar to the national biosecurity system. It involves activities to protect a property from the entry and spread of new and established pests, such as:

- Routine farm hygiene
- Pest monitoring and management
- Reporting for obtaining or retaining business continuity
- Trade and market access.

While there is a broad understanding that on-farm biosecurity benefits growers, there are costs and barriers to introducing effective practices. As little research has been done to quantify these benefits and costs, a new project is underway to close the current gap in knowledge.

New research to uncover answers

Led by RM Consulting Group (RMCG) and La Trobe University, a PhD student will conduct an economic analysis of a range of biosecurity practices available to melon and vegetable growers.

The PhD student will work closely with growers, industry organisations and researchers to 2026. They will aim to quantify the everyday costs and benefits of on-farm biosecurity initiatives and examine the opportunities and challenges of implementing these activities on melon and vegetable farms.

The results will be shared with industry and provide tangible evidence to help growers make more informed decisions to increase the level of biosecurity practices on farms across Australia.

This will ultimately help to reduce the spread of new and established pests on vegetable and melon farms, minimise the need for pesticides, improve compliance with quality assurance programs and market access requirements, and support long-term profitability for growers.

FIND OUT MORE

If you would like to be involved in the project or for more information, contact La Trobe University Senior Lecturer Dr Tim Clune at **t.clune@latrobe.edu.au** or 02 6024 9853.

Hort Innovation MELON FUND

Hort Innovation VEGETABLE FUND

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

Kantar analysis of export demand for vegetables

The recent Kantar analysis developed for Hort Innovation on potential for export markets for levy funded fruits, nuts and vegetables shows that for some markets are willing to pay a premium price for tasty, nutritious and easy to prepare product from trusted sources.

The project aimed to provide a consumer-led perspective on the export opportunity of Australian produce based on consumer attitudes and values, and shopping behaviour. It gives a strategic lens on which markets represent the strongest opportunity, and those with opportunities for future growth regions, but not confined to current export arrangements.

When assessing the most attractive export markets for leafy veg, two key axis were evaluated:

- **Attractiveness** – how attractive is the opportunity in the market for leafy veg, based on how often a consumer purchased, likelihood to pay premium price and market access
- **Addressability** – how addressable is the opportunity, through the likelihood to purchase Australian product, ability to command the premium price, market access.

Within the attractiveness and addressable matrix, Strategic priority, low hanging fruit, low priority and long term play shaped the market opportunities.

- **Strategic priority:** shows high attractiveness and addressability, giving a strong overall export opportunity
- **Low hanging fruit:** low attractiveness, but high addressability, low export opportunity but easier to release
- **Low priority:** low attractiveness and addressability giving a low export opportunity
- **Long term play:** high attractiveness but low addressability, is a moderate export opportunity, but has higher potential for investment.

Summary of Strategic Priorities – LEAFY VEGETABLES

Indonesia, Hong Kong, India and Vietnam were found to have the greatest strategic potential based on market access, income per capita and a willingness to pay up to 1.5 times more for a premium Australian product.

	Indonesia	Hong Kong	India	Vietnam
Strategic Implications	Indonesia is a highly addressable market for Leafy Vegetables given its high import appeal and market access	Hong Kong is also highly addressable. Penetration and higher income per capita boost this market opportunity	India has a significant population, so despite lower relative penetration, there's opportunity	Vietnam, despite lower penetration, has higher claimed premium appeal and moderate market accessibility
Attractiveness	• Penetration is moderate vs. other markets, but 2 in 3 consume Leafy Vegetables weekly • High (#2 ranking) willingness to pay 1.5x more	• High Leafy Vegetable penetration (84% consume weekly) • Moderate willingness to pay 1.5x more, but higher income per capita country	• Relatively low penetration of Leafy Vegetables vs. other markets • Moderate willingness to pay 1.5x more	• Relatively low penetration of Leafy Vegetables vs. other markets • High (#1 ranking) willingness to pay 1.5x more
Addressability	• High Australian import appeal • Moderate premium appeal vs. other commodities in Indonesia	• Moderate Australian import appeal • High premium appeal vs. other commodities in Indonesia	• Moderate Australian import appeal • Moderate premium appeal	• Moderate Australian import appeal • High premium appeal

Through a leafy vegetable consumption lens, India, Hong Kong Vietnam and Indonesia showed a greater consumption of the product, usually for lunch or dinner as either part of a salad or as part of the main meal. Tasty, nutritious and easy to prepare where identified as the key drivers for consumption, and usually eaten in the home with family.

In terms of consumer preference, the four key markets identified that fresh, free of pesticides and sourced from a safe and trusted producer were a priority.

Freshness	**51%**
Free from pesticides	**31%**
Safe & Trusted	**30%**
More flavour	**23%**

Driving export growth of Australian leafy vegetables

1. **Focus on strategic priority markets:** where a willingness to pay a premium price; leverage high appeal in markets such as Indonesia and India; drive incremental growth into Hong Kong and Vietnam by increasing appeal.
2. **Deliver core consumer needs:** tasty, fresh, health, nutritious and easy to prepare.
3. **Leverage premium advantage:** maximise the premium opportunity with the delivery of fresh produce from a tructed and safe source.
4. **Reduce consumption barriers:** address the perception that leafy vegetables is expensive and bruises easily to minimise the purchase of alternatives.

Summary of Strategic Priorities – ONIONS

For Australian onions, three strategic priority markets were identified – India, Indonesia and UAE.

	India	Indonesia	UAE
Strategic Implications	India has a significant population, so despite the low income per capita, the high penetration of onions(nearly two thirds of people consume weekly) make it an attractive opportunity. The claimed willingness to spend on quality and high Australian appeal a further potential upside	Indonesia also represents an attractive opportunity given the high penetration and combined claimed willingness to pay more and likelihood to buy Australian	Consumers in the UAE claim to be willing to pay for premium quality and Australian imports of onions. Coupled with the strong penetration of this vegetable and the affluence of the nation, this market is a strong opportunity for export
Attractiveness	• Moderate penetration of onions vs. other markets, but still 2 in 3 people consume weekly • Third highest claimed willingness to spend more on onions • An attractive market given population size, despite low income per capita	• Penetration in line with India: lower vs. other markets, but still nearly two thirds of the population are consuming onions weekly • #1 ranking country for claimed willingness to spend 1.5x premium quality	• Moderate penetration vs. other markets but, again, nearly two thirds of the population consume weekly • The UAE is a more attractive market given ts affluence (vs. India & Indonesia), thus it also ranks highly on willingness to pay for quality
Addressability	• High likelihood to buy Australian • Highest ranking willingness to pay a premium for onions (vs. other commodities) in India	• Moderate likelihood to buy Australian • Moderate willingness to pay a premium vs. other vegetables	• Strong likelihood to buy Australian (#3 rank) • Strong willingness to spend on premium

The study found that while Australian onions have moderate appeal overall, consumers in India, Vietnam and the Middle East are more likely to buy imported product from Australia. For markets in Malaysia, Japan, Korea and the UK, penetration of onions can be as high as 70%.

Consumers in the strategic markets are likely to consume onions once a week at around 60%, across all main meals as in ingredient in cooking. It is perceived to be tasty, and quick and easy to prepare and consumed in the home with family.

Reasons to eat onions

Tasty	**57%**	**Quick and easy to prepare**	**18%**
Healthy & Nutritious	**39%**	**Strong, intense flavour**	**17%**
Indulgence	**38%**	**Free from pesticides**	**33%**
Enhance the flavour of a dish	**23%**	**Last longer**	**23%**

How to drive export growth in Australian onions

1. **Focus on strategic priority markets:** where consumers pay a premium for quality product and open to Australian onions. Leverage the high appeal to drive incremental growth.
2. **Deliver core consumer needs:** in terms of strong and intense flavour, with taste, quick and easy, healthy onions.
3. **Leverage premium advantage:** maximise the premium opportunity of fresh onions free of pesticides that last longer.
4. **Reduce consumption barriers:** provide good quality to reduce the temptation to choose other vegetables.

Kantar analysis of export demand for vegetables

Summary of Strategic Priorities – POTATOES

For Australian potatoes, the key markets identified for the greatest strategic potential were Malaysia, Indonesia, UAE and Hong Kong.

	Malaysia	Indonesia	Hong Kong	UAE
Strategic Implications	Potatoes have the strongest penetration in Malaysia vs. the other priority markets. There is also a strong claimed willingness to spend and high Australia appeal	Despite moderate market penetration, the moderate claimed appeal of premium and Australian potatoes makes Indonesia a potential opportunity for export	Despite being a moderately attractive market in terms of market size and potato penetration, Hong Kong is highly addressable and Australian appeal is strong	The high per capita income of the UAE and claimed willingness to spend more on potatoes makes this market an attractive opportunity
Attractiveness	• High penetration of potatoes, #3 ranked country, behind only the US & the UK (86% consume weekly) • •Highest claimed willingness to spend more on potatoes	• Moderate market penetration • Second highest claimed willingness to spend more on potatoes	• Below average market penetration, but still 1 in 2 people consume potatoes weekly • Strong claimed willingness to spend more on potatoes	• Moderate market penetration • Strong claimed willingness to spend more on potatoes
Addressability	• Moderate appeal of premium quality potatoes vs. other commodities • #3 ranking country for Australian appeal of potatoes	• Moderate claimed appeal of premium quality potatoes • Moderate Australian appeal	• Moderate claimed appeal of premium quality potatoes • #1 ranking country for Australian appeal of potatoes	• Moderate claimed appeal of premium quality potatoes • Moderate Australian appeal

Consumption of potatoes in the UK and USA is high, and much lower in Vietnam and Taiwan, however, some markets ranked as more addressable due to the ease of trade, market risk and value chain competitiveness.

In Malaysia, potatoes are consumed at least one per week (71%), while Hong Kong, Indonesia and UAE are nearer to 57%. Potatoes are usually consumed for lunch and dinner, as an ingredient in cooking. Perception is that potatoes are tasty, quick & easy to prepare, and consumed at home with family. As a snack consumption of potatoes is usually between lunch and dinner.

Reasons to eat potatoes

Tasty	**58%**	**Nutritionally dense**	**13%**
Quick & Easy	**52%**	**Fresher**	**41%**
Physical & Mental Energy	**45%**	**Free from pesticides**	**32%**
Filling	**26%**	**Safe & Trusted**	**23%**

Barriers to consumption of potatoes is the perception of high carbs.

How to drive export growth in Australian potatoes

1. **Focus on strategic priority markets:** where markets are willing to pay a premium (eg Malaysia, Indonesia, UAE, Hong Kong, and leverage the appeal across the markets.
2. **Deliver core consumer needs:** such as taste quick and easy and improving physical and mental energy. Ensure Australian potatoes are nutritious and filling.
3. **Leverage premium advantage:** deliver potatoes that are fresh, free from pesticides and from a trusted and safe source.
4. **Reduce consumption barriers:** address perceptions that potatoes are high in calories and poor quality.

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

This project has been prepared independently by Kantar for Hort Innovation and is funded through the Australian Government's Agricultural Trade and Market Access Cooperation (ATMAC) program with Hort Innovation levy contributions from the Almond, Apple & Pear, Avocado, Blueberry, Cherry, Citrus, Dried Grape, Fresh Potato, Lychee, Macadamia, Mango, Melon, Olive, Onion, Raspberry & Blackberry, Strawberry, Summer Fruits, Sweet Potato, Table Grape and Vegetable industries.
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Setting up the potato season for success

There are many factors that can determine the success of a season, which should be considered before a single potato is planted. Crop protection measures will be an important part of most paddock plans, with discussions between growers and their advisors crucial in getting it right.

Syngenta Territory Sales Manager in Tasmania, Wayne Richardson, said under-standing the weed spectrum, paddock history, soil nutrition, seed quality and soilborne disease levels is a critical part of that discussion. "This planning helps growers to target weeds with the right product at the right stage and combine seed and in-furrow treatments to optimise disease control, setting the season up for the best possible chance of producing high quality premium potatoes" he said.

Syngenta's potato portfolio includes a comprehensive range of herbicides, fungicides and insecticides to assist growers achieve their crops full yield and quality potential.

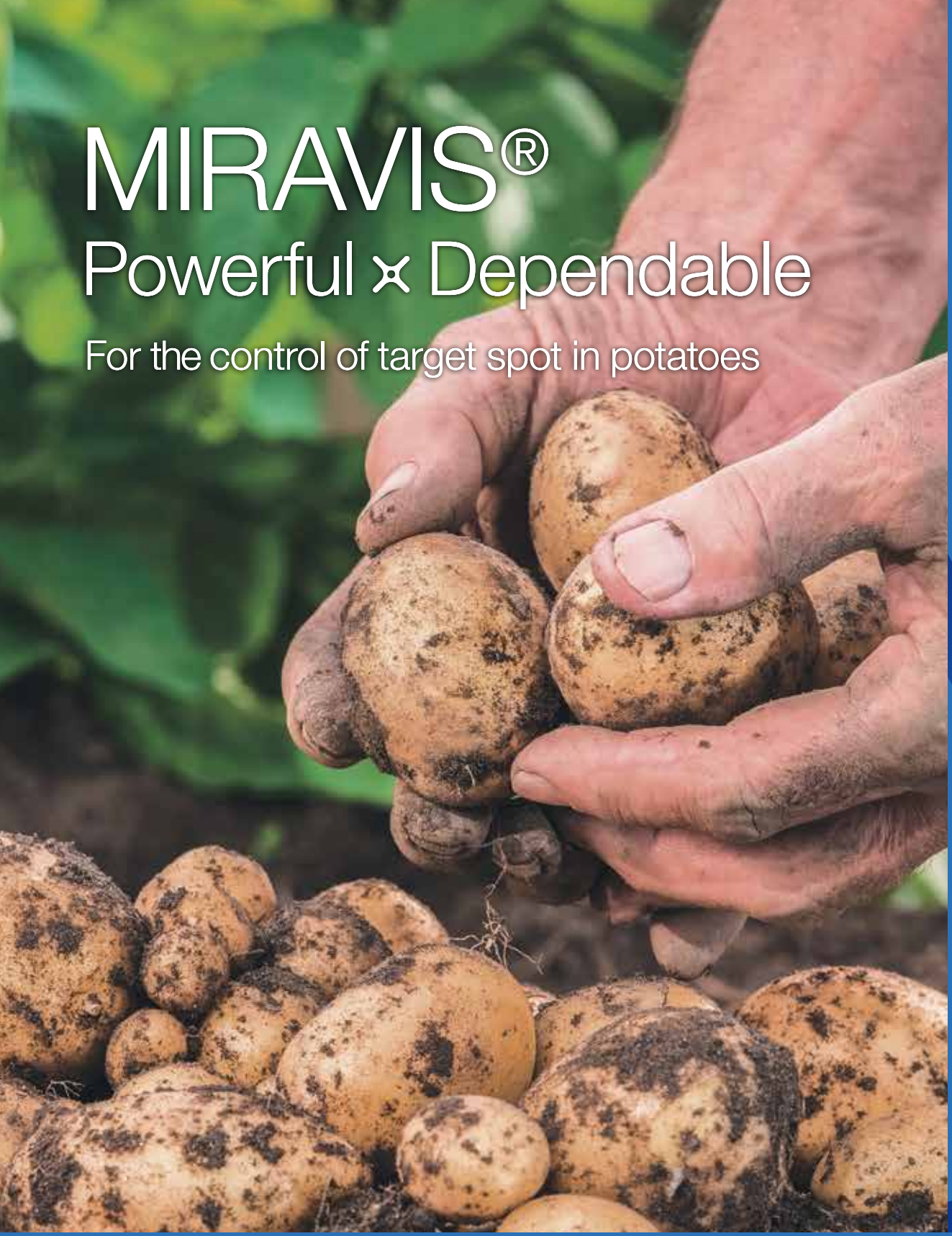
Herbicides are a critical component for weed control prior to planting. Every 10% in weed biomass incurs a 12% decrease in yield[1], so it is important to target any potential weeds early. Potato crops can be very sensitive to herbicides, so pre-emergent herbicides applied after planting but before shoots emerge are critical to target weeds before they emerge. Pre-emergent herbicides with soil activity must be applied before full potato emergence to avoid crop injury.

If weeds are present, post-emergents can offer a quick knockdown and knowing the weeds is just as important to decide if a **selective** herbicide is needed or a **non-selective** for knock downs. Many foliar herbicides are non-residual, having little or no soil activity and are quickly deactivated in the soil.

Syngenta's non-selective herbicides for use as knockdowns pre-planting include SPRAY.SEED® 250 (Group 22) and GRAMOXONE® 360 PRO (Group 22). GESAGARD® herbicide (Group 5) can also be used from pre-plant to planting and controls a range of early competing annual grasses and broadleaf weeds.

Above. John Cresswell of Ringarooma, TAS, with Syngenta Territory Sales Manager, Wayne Richardson, mid-season, checking how the crop is progressing.

1 Nelson, D. and Thoreson, M. (1981) *Competition between Potatoes and Weeds. Weed Science*, 9, 672-677.



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IS YOUR CROP PROTECTED? SCAN HERE

Wayne Richardson with Syngenta Technical Services Lead Dr Brandy Rawnsley, demonstrating ideal planter set-up during a Syngenta Potato Partner Academy field walk.

"SPRAY.SEED® 250 (Group 22) is a great option for pre-planting for fast and effective knockdown of annual grasses and broadleaf weeds. It is rainfast within 30 minutes which makes it highly flexible," said Mr Richardson.

"GESAGARD® offers both contact and root activity and should be applied in late autumn/winter to actively growing weeds, but before the potato crop has emerged. It offers residual control for 6 to 8 weeks to aid in good crop establishment."

Once the crop is planted, Syngenta's BOXER GOLD® herbicide (Group 15) offers excellent early control of common weeds found in many potato growing regions.

"BOXER GOLD® is a selective pre-emergent herbicide that is effective against annual ryegrass, including Group 3 resistant populations, as well as a range of tough to manage broadleaf weeds like fat hen, fumitory, capeweed and certain nightshades," said Mr Richardson.

"Apply BOXER GOLD® once per crop, anytime from post-planting but no later than 25% crop emergence. Best results are achieved when applied as soon as possible after planting and when irrigation or rainfall incorporates BOXER GOLD® to a depth of 3 to 5 cm within 7 days of application."

"BOXER GOLD® can be tank mixed with SPRAY.SEED® 250 if a knockdown is needed post-planting."

FUSILADE FORTE® herbicide (Group 1) is a reliable inclusion in any potato spray program. "FUSILADE FORTE® is a post-emergent herbicide specific to a wide range of annual grasses in crop. Apply to actively growing grass weeds up until potatoes are 15 cm or less in height" advised Mr Richardson.

As with weeds, knowing what you are dealing with is crucial to effective management of potato diseases. Growers can look at the cropping history of the paddock and get both seed and soil tested so they understand the disease risk associated with different pathogens.

"PREDICTA™ Pt is DNA-based testing that gives growers a comprehensive understanding of their risk levels for all the major soil-borne potato diseases as well as nematodes, so they can make decisions about how to manage those risks.," said Mr Richardson.

Syngenta's market leading combination of seed treatment and in-furrow fungicides delivers comprehensive early control of seed and soilborne fungal diseases in potato crops.

"The seed treatment VIBRANCE® Premium fungicide is a robust option if seedborne risk is high. It combines two active ingredients from two modes of action – Group 7 and Group 12 and is the broadest disease spectrum potato seed treatment on the market," said Mr Richardson.

The liquid formulation of VIBRANCE® Premium adheres to tubers, providing uniform coverage and early control of black dot, black scurf, Fusarium dry rot (seedborne), gangrene (seedborne) and silver scurf. It also suppresses common scab.

"VIBRANCE® Premium can be applied either as seed is downloaded into storage after harvest to provide excellent storage disease control, or just prior to planting as a traditional seed treatment following label recommendations to ensure even coverage of tubers," said Mr Richardson.

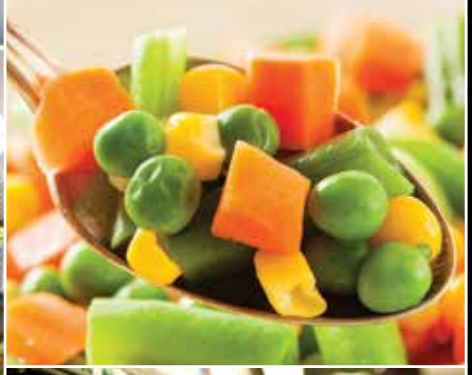
In-furrow fungicides AMISTAR® 250 SC fungicide (Group 11) and RIDOMIL® Gold 480 SL fungicide (Group 4) offer a complete zone of protection to provide insurance against potential soil-borne diseases.

"Use AMISTAR® 250 SC in-furrow at planting for control of black scurf and suppression of silver scurf. Spray nozzles need to be mounted so the spray is directed into the furrow as a 15 to 20 cm band just before the seed is covered. Use higher rates where testing shows high disease risk," said Mr Richardson.

"RIDOMIL® Gold 480 SL is a reliable liquid formulation registered for in-furrow use to control pink rot which can be devastating to most crops in Tasmania. It can be combined with AMISTAR® 250 SC for one pass control of pink rot, black scurf with activity on silver scurf as well."

Seed and in-furrow treatments should not be applied if conditions or seed quality favour bacterial rots as these diseases may be aggravated if seed comes into contact with additional moisture. Make sure you read label directions for any new updates.

FIND OUT MORE
For more information please contact your local Syngenta representative or visit **Syngenta.com.au**/potatoes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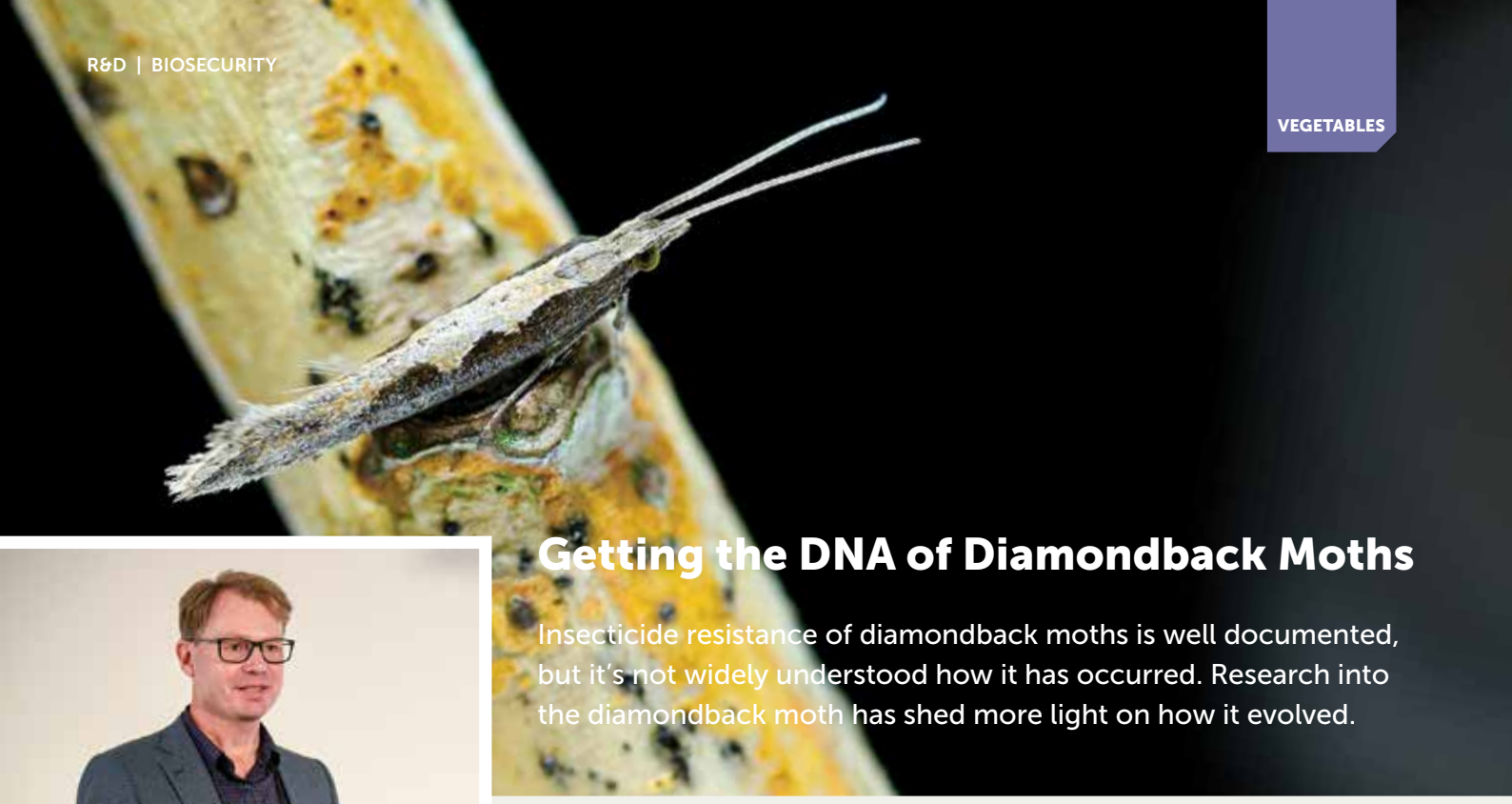

Getting the DNA of Diamondback Moths

Insecticide resistance of diamondback moths is well documented, but it's not widely understood how it has occurred. Research into the diamondback moth has shed more light on how it evolved.

Inset. Dr Simon Baxter at Hort Connections. *Photo Andrew Beveridge.*

Diamondback moth is a common pest of brassica crops – broccoli, cabbage, cauliflower, as well as canola and mustard. A heavy infestation can cause severe defoliation reducing yield. When a new form of insecticide is launched onto the market, diamondback moth is often the first to develop resistance, such that increasingly there are very few insecticides that effectively control the pest.

According to the Grains Research and Development Corporation (GRDC), moderate to high-level resistance for diamondback moths in Australia occurs for synthetic pyrethroid, organophosphates and carbamate. In addition, there have been reports of increasing tolerance to emamectin benzoate, spinetoram and more recently diamides. The biological insecticide *Bacillus thruingiensis* (Bt) still provides a level of control.

The female can lay around 100 eggs in a lifetime, laid in clusters along the veins on top of the leaves. A typical lifecycle can occur 8-12 times a year, depending on the conditions. The larval stages are 1-12 mm long, have black hairs and 'wriggle' intensely when prodded. The larvae feed on the leaves, making 'feeding windows' or holes. As flowers develop, the larvae move to the floral buds, flowers and pods. Pupae are typically 10mm long, starting green, and becoming darker with maturity.

The moth has recently developed resistance to the diamide group of insecticides in some regions of Australia, which were introduced into the Australian market in 2008. The mechanism to kill the moth is described as a lock and key strategy, whereby the insecticide is the key and locks onto an insect protein, creating cellular problems that ultimately results in death of the insect. A number of countries around the world have seen resistance develop to diamides, but Australia is a relative latecomer.

Diamides are particularly useful, as they are considered 'soft' on beneficial insects such as parasitoid wasps. Dr Simon Baxter, a lecturer at University of Melbourne lead research into the diamide resistance in diamondback moth, through funding from FMC, Syngenta and University of Melbourne.

Distribution of diamide resistance in diamondback moths

Insecticide resistance is caused by a genetic mutation that prevents diamides from interacting with the moth protein. It may only be 1 moth in a population of 1000 that can survive a diamide spray, but with successive generations, the mutation spreads and number of moths can grow rapidly. With continued pressure from insecticide use, the resistance continues to expand.

"Resistance to diamides was first reported in the Lockyer Valley in 2018. We sequenced the entire genome of a resistant moth, which helped identify the exact mutation which helps them survive" said Dr Baxter.

"This receptor is involved with muscle movement and channels calcium in cells – the same one that diamide locks onto to inhibit calcium flow. The mutation is enough for the protein to function well enough to transport calcium, so that the moth can move its muscles to fly, without the insecticide binding."

In 2014 and 2015, Dr Kym Perry of South Australian Research and Development Institute (SARDI) collected moth samples from around the country to study how insects were moving around the country. Dr Baxter and Dr Perry reverted back to the original sample of 2014, to discover that this resistance mutation had not occurred in those populations – and that it was probably unique to the Lockyer Valley.

A more recent survey in 2021 and 2022 showed that low levels of resistance in about 3% of samples were beginning to emerge in diamondback moth populations in other states of Australia. In the Lockyer Valley about 90% of the population carried the resistant gene. Further genetic sequencing revealed that the mutation in the Lockyer Valley population, had spread to other locations in Australia. "We've now found diamondback moth from many parts of Australia, including Tasmania and Western Australia which all carry exactly the same genetic mutation, which means the insect is mobile and moving around."

Diamondback moths are known to fly and/or be carried on the wind. It is also possible that eggs and larvae could be transported on vegetable produce. The moth prefers drier, warmer conditions – rainfalls of more than 5-8mm in a 24 hour period can dislodge and drown larvae. It is unlikely then that controlled chilled shipping conditions would be conducive to diamondback moth survivorship.

"In the laboratory with a controlled environment we can model how fast the resistance is developing. We have seen that in the Lockyer Valley, it has taken about 35 generations to reach the level it is currently. In the field, that may occur within 3-4 years.

"In other regions with differing climatic conditions, the resistance frequency may take longer to emerge."

The science behind the ryanodine receptor

Genes are broken down into small parts called exons, which encode the information that ultimately goes in the proteins. The ryanodine receptor gene, has around 130 exons, forming one of the biggest proteins in diamondback moths and essential to their survival.

Dr Baxter suspects that only one amino acid is needed to change for it to develop resistance to diamide insecticides and still to be able to channel calcium for muscle function for the moth to survive.

"It is possible that this particular mutation has been around for a very long time, but it is more likely a recent development. With continued use of the same insecticides, and rapid increase in populations, it has enabled the mutation to evolve quite quickly.

"One thing we often assume when it comes to insecticide resistance, is that there is a fitness cost involved. The gene has evolved over time to work quite efficiently but the mutation may come at a cost, however at the moment we don't know if there is a cost.

"One avenue of research is to model whether if we stopped spraying diamides what effect that might have on the fitness cost, how long the mutation takes to decrease in population, so that perhaps, diamides may increase again efficacy with time."

VEGETABLES

KEY ACTIONS

1. Monitor for conditions conducive to diamond back moth
2. Monitor and record the presence of diamondback moth larvae
3. Rotate insecticides with different modes of action
4. Consider integrated pest management options.

Integrating pest management into diamondback moth control

"Vegetable and broadacre farming is an extremely complex business, and we are working to understand how insecticides function, and what will work in the future.

"I would encourage growers to follow best practice for pest management in their area and be aware of insecticide product labels and seek advice."

MORE INFORMATION
Visit **agric.wa.gov.au/**broccoli/diamondback-moth-insecticide-resistance-management-vegetable-brassicas

Elders agronomist tackles huge DBM problem

Elders agronomist Greg Teske shares how he reined in some of the 'highest resistance' to diamondback moth (DBM) in Australia.

Based in Gatton, Queensland, Greg is a long-standing part of the Elders business, after first starting work for Primac over 24 years ago.

His experience in horticulture is extensive, with specialist knowledge across a huge range of vegetables, including potatoes, brassicas, leafy vegetables, fruiting vegetables, cucurbits and alliums.

In 2016, at the Hort Connections event in Brisbane, Greg was approached by grower Matt Crust who enquired about controlling DBM in brassicas. That conversation was the start of a brilliant partnership, and an amazing success story in crop protection.

At the time, Matt was losing an estimated 30 per cent of his brassica crop to the destructive pest. He and another agronomist in the region had gone to significant lengths to manage the problem, but nothing seemed to work. He even had some of the DBM larvae tested at a local university.

"The results showed we had some of the highest resistance to DBM in the country," Matt said.

"At that point, we were considering drastic measures, just to gain back control."

In their desperation, the Crusts contemplated investing in expensive machinery, and even shifting their Mount Sylvia-based farm to a new location.

That's when Matt turned to Elders for help. When Greg came on board, the problem was out of control, and the pressure was on to fix it.

"The Crusts had huge numbers of DBM, and a high level of resistance to a lot of chemical actives, particularly in Group 28," Greg said.

"I decided to start with a completely different group of chemistry, we didn't end up using any Group 28, and I told Matt he would just have to trust me and we would have to work together as a team.

> **"It's all about the right product, and the right timing, it all has to come together in a package."**

From there, Greg started a targeted spraying program. Visiting Matt's property at least once a week, he took note of the local temperature, colour and stage of the DBM eggs, and would advise Matt of when and what to spray.

"Matt was great to work with, because at the end of the day, I could say 'these are the actions I need you to take' and I could trust that he would get it done," Greg said.

After just the first year, it was clear that Greg's strategy was working, and Matt was only losing around 1 per cent of his crop – down from 30.

"I felt a lot of pressure in the first two years working with them, but even with that, we cut their crop losses right back and they started to have a much more saleable product."

By the time they got to their fourth year of working together, the DBM population had been brought down so far, Greg reverted to much softer forms of chemistry.

"As soon as we could, we cut out all the old, hard chemistry," Greg said.

"We started using chemicals called *BTs* (*Bacillus thuringiensis*), which are not harmful to beneficial insects, so our program was allowing the beneficials to build up again."

Matt was delighted with the results, explaining that "within a season, we were seeing good results across all lines".

"While DBM is still around, it is not an issue for our business anymore," he said.

"We are delighted with these results, and would highly recommend Greg for his services."

Elders agronomists will work with you to maximise your yield. Reach out to your local Elders branch today.

Above. Queensland grower Matt Crust (left) alongside Elders horticultural agronomist Greg Teske.

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Visit elders.com.au

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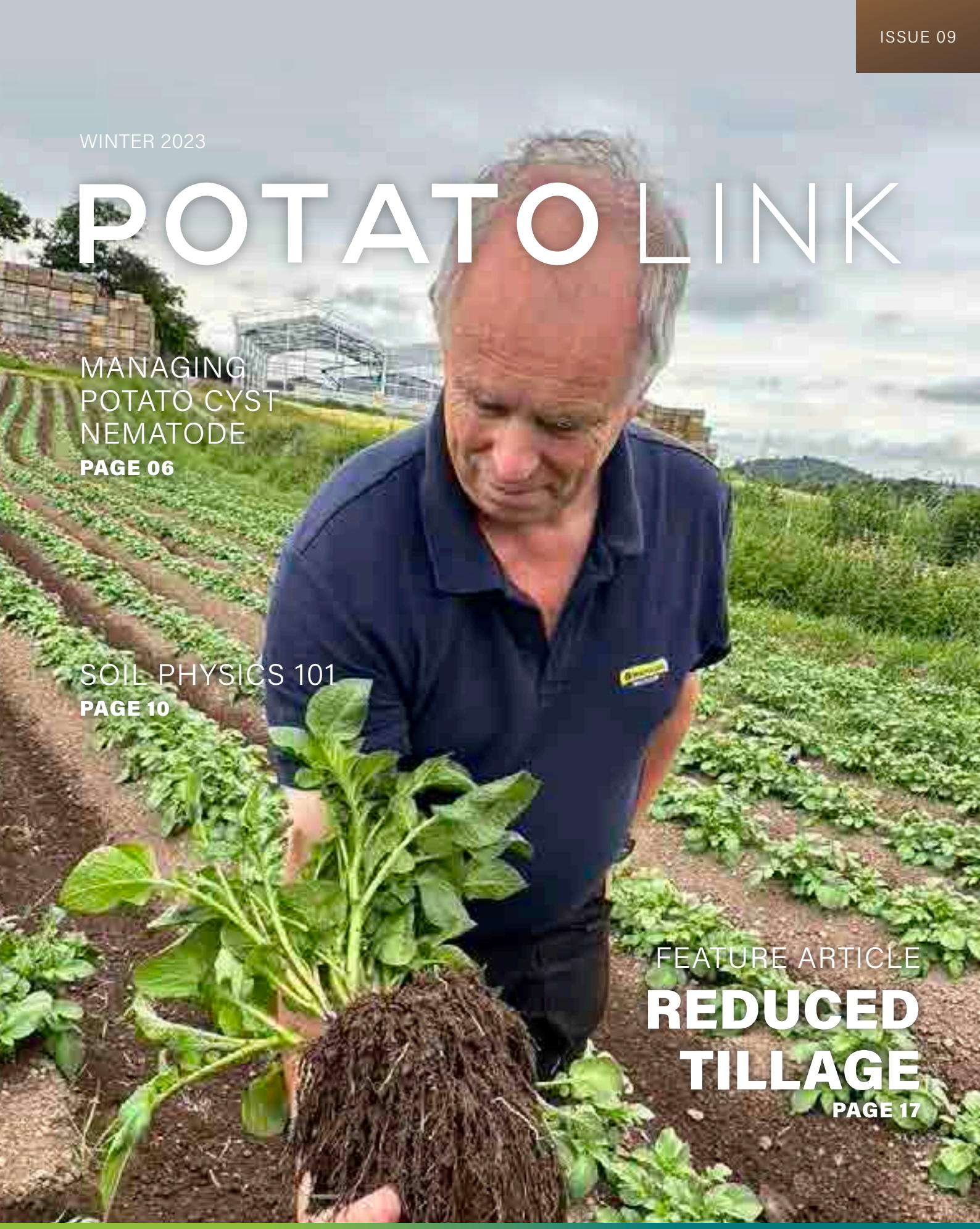

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POTATO LINK
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AUSTRALIAN POTATO INDUSTRY EXTENSION PROJECT

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Cover: *David Pate, from Wester Meathie Farm Scotland, shows off his superb soil structure. See p10. Photo by J. Ekman*

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Correction notice

PotatoLink Issue 8

Minor changes have been made to the article *Seed potatoes: A special feature.*

Read correction notice here

http://bitly.ws/PQB3

MANAGING POTATO CYST NEMATODE (PCN)

Potato cyst nematodes (PCN) are undoubtedly one of the world's most significant potato pests. PCN have major impacts on production in many parts of Europe and are in plague populations in some parts of Africa. So far Australia has escaped major impacts from this pest. However, forewarned is most definitely forearmed. Dr Jenny Ekman reports.

Figure 1. Globodera rostochiensis cysts on potato roots. Image: K. Walker

Potatoes are directly impacted by two species of potato cyst nematodes (PCN); the golden (*Globodera rostochiensis*) and the pale (*Globodera pallida*). PCN are particularly hard to manage because of their rapid multiplication and persistence in the soil. Moreover, at less than a millimetre long, PCN are not easy to see in soil or on roots.

Despite potentially devastating consequences on yield, symptoms are frequently subtle; the crop can just look a bit sickly or fail to thrive. With no visible pest or disease, farmers may think there is a problem with the seed, the crop needs more fertiliser, or there is some other issue.

LIFECYCLE OF PCN

The problems start with juvenile nematodes. Juveniles not only suck nutrients, but also cause physical damage to potato plants. They bore through feeder roots, leaving a trail of open wounds and destroyed cells behind them. Such wounds provide easy entry points for bacterial and fungal diseases.

Once within the vascular system the young PCN induce formation of a syncytium. This enlarged feeding structure fuses together hundreds of cells. Protected by a thickened outer wall, this feeds the nematode until it matures.

Once close to maturity, female nematodes burst through the root surface, mate with males, and then die, their body forming a cyst on the plant root. These are about the size of a grain of sand, almost impossible to see with the naked eye on roots, let alone in soil.

Figure 2. PCN eggs inside a cyst and juvenile PCN emerging from an egg. Images: U. Zunke, University of Hamburg, Bugwood.org

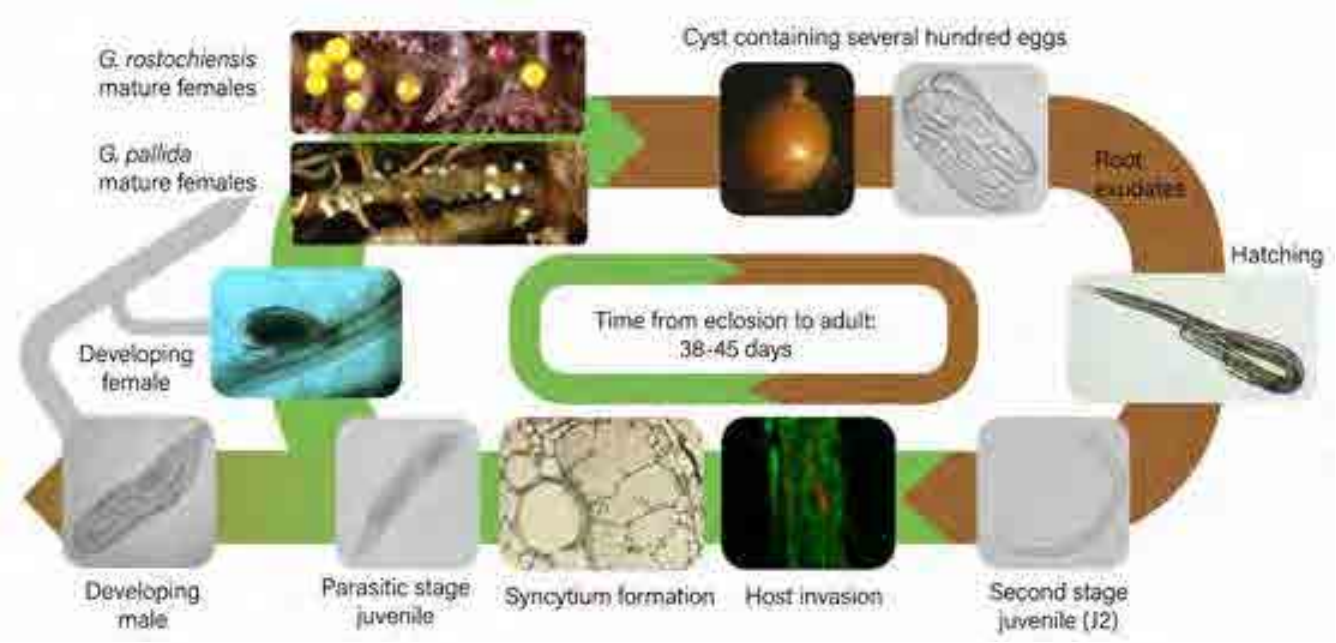


Figure 3. Life cycle of PCN. From Price et al., 2021[2].

The cyst contains up to 500 eggs. When the potatoes are harvested or the plant dies, the cysts are left in the soil. They can potentially remain dormant for at least 10 years and possibly longer, only developing in response to chemicals exuded from the roots of certain Solanaceous plants – including potatoes.

Exposure triggers a change in the outer layer of the cyst, allowing water to permeate and kickstarting metabolic activity. After using their stylet to escape the cyst, young nematodes swim through the soil along a gradient of root chemicals, finding and puncturing a suitable root and starting the cycle again.

IMPACTS OF PCN

Professor John Jones is now head of the Cell and Molecular Sciences Department at the James Hutton Institute in Dundee. However, his research passion is the genomics and host-parasite interactions of nematodes, particularly PCN. Much of his work has focussed on the factors that stimulate development of dormant cysts in the soil, as well as the proteins produced by PCN that suppress potato plant defence mechanisms.

Understanding these factors will help to develop strategies that control PCN under field conditions. "We have been working a lot in Africa, because they have terrible potato cyst nematode problems there. Kenya, Uganda, Rwanda, and likely other countries as well, have big problems," states Professor Jones.

Figure 4. Professor John Jones has spent more than 25 years researching plant parasitic nematodes, particularly PCN.

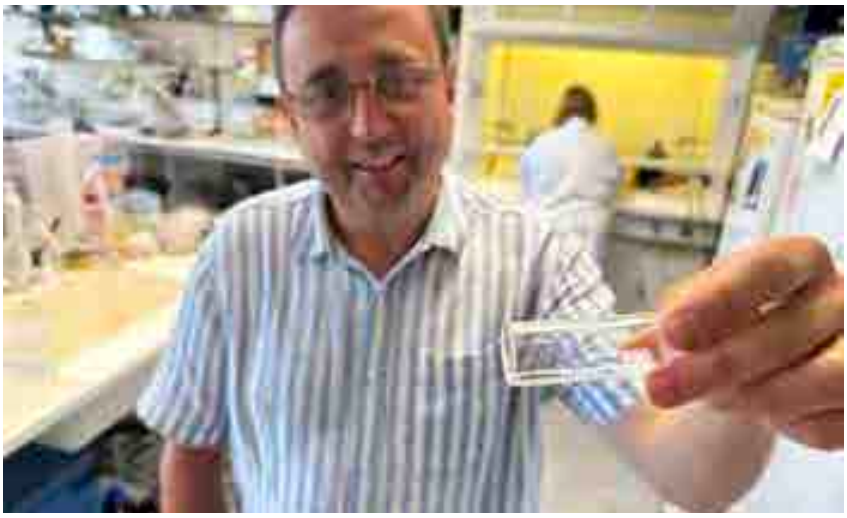


Figure 5. Although only the size of a pin head, exposure to potato root exudates can still trigger development and emergence of nematodes 10 years or more after the cysts were formed.

"Potatoes are really important in that part of the world because they are one of the few crops that smallholders grow both as food for themselves and for cash. Unfortunately, they grow multiple crops a year, with no real rotation and no winter break, so nematode populations can explode. In some cases, they may even abandon the land and clear more forest, which is clearly undesirable."

Both golden and pale PCN are found widely in Scotland, as well as parts of Europe. Golden PCN is thought to have been introduced to New York State on the muddy tyres of equipment returning after WW1, while pale PCN is present in part of Idaho as well as Newfoundland, Canada. In all these areas, spread has been contained through survey and certification requirements.

Similarly, Australia's strict quarantine regulations mean that we have prevented spread of this pest. The golden potato cyst nematode has been detected in a few, clearly defined regions of Victoria. These areas are subject to plant quarantine requirements, with permits required to move host materials. Golden PCN has previously been detected in Western Australia but now considered eradicated from that state. Pale PCN has never been detected in Australia and is more often a pest in cooler to temperate climates.

While Australian farmers appear to be managing the problem well, Professor Jones argues that there is no room for complacency. "The time to hit nematodes is when populations are low. If you have a small population but grow a susceptible potato variety you will very soon have an extremely high population. Moreover, while we can control golden PCN well with the H1 ('Hero') gene – which is present in resistant varieties – the problem is that these varieties aren't necessarily the ones consumers want."

MANAGING PCN IN SCOTLAND

One of the key control measures to managing PCN is preventing spread in the first place. This means ensuring that seed potatoes are PCN free. Any detection of PCN not only renders the seed crop unsaleable but takes land out of seed production for many years.

Detections of golden and pale PCN are therefore a major challenge for Scottish seed producers. The pest is projected to cost the local potato industry £125 million by 2024. With virgin land running out, PCN could potentially end the Scottish seed industry within the next 25 years unless new mitigation strategies are found[1].

Recognising the urgency of this issue, the Scottish Government is now funding a major project examining ways to manage PCN. The project aims to improve understanding of how some varieties tolerate PCN, as well as identifying critical genes associated with resistance. Outcomes will include IPM tools for growers, accelerated

1. Toth I. et al. 2022. Year one project report. Delivering a sustainable potato industry for Scotland through management of potato cyst nematode (PCN). http://pcnhub.ac.uk/publications

2. Price JA, Coyne D, Blok VC, Jones JT. 2021. Potato cyst nematodes *Globodera rostochiensis* and *G. pallida*. Molecular Plant Pathology 22:495-507

breeding programmes and better understanding of the costs and benefits of different approaches.

One of the keys is further developing PCN resistance and/or tolerance. While these may appear the same, tolerance and resistance are quite different things.

Dr Phil Burgess, together with field officer Kerry Leslie, is running field trials developing management strategies for PCN. He explains: "Resistant varieties can still be quite badly affected by PCN. However, the juvenile nematodes can't form feeding sites (syncytia) in the roots, preventing them reaching the adult stage. As a result, the population could be reduced from, say, 30-50 eggs/g soil to less than 2 eggs/g soil following a crop of potatoes."

"In contrast, a tolerant variety can still grow and yield well in the presence of low levels of PCN. This may seem a good strategy in the short term, but populations will inevitably increase unless the tolerance is combined with resistance. You could easily end up with 500 eggs/g soil or more the next year. Eventually, even the most tolerant variety will be unable to grow under this pest pressure."

The field trials are being run at Barnyards Farm near Forfar, the property of third-generation potato grower Neill Smith. Neill first realised he might have a PCN problem when yields started to decline despite good growing conditions. He suspects that populations had been building up over time, especially when short 4-year rotations were used in the 1970's.

Both golden and pale PCN are found on the 400 acres (~162ha) Neill uses to grow potatoes, with pale PCN the most common. While there are some varieties (Amanda and Elland) that are highly resistant to pale PCN, they are not well accepted by the market. As a result, he also grows non-resistant varieties in fields with undetectable or low nematode populations.

He also uses the granular nematicide fosthiazate (Nemathorin®) to control

Figure 6. Dr Phil Burgess (left) and grower Neill Smith inspecting a range of PCN resistant varieties at the field trial site

PCN. However, the future of this chemical is uncertain. Another nematicide (Vydate®) has already been withdrawn. In Australia there are no nematicides registered for control of *G. rostochiensis*.

What remains is an IPM approach using a range of control strategies. These include:

- Growing resistant varieties, noting that most varieties are resistant to either golden or pale PCN, with few resistant to both.
- Cover crops, particularly oil seed radish (*Raphanus sativus*). This is sown in spring, topped in early summer, then sprayed off and incorporated before preparation of the ground for potatoes.
- Application of maleic hydrazide to the growing crop. This reduces sprouting, limiting growth of potatoes left in the soil after harvest.
- Planting winter wheat (instead of spring barley) as a rotation, allowing effective control of volunteer potatoes.
- Minimum six year rotations between potato crops.

Even though a cover crop costs him a year of spring barley, Neill is convinced this is worthwhile. "The system gives me good control of free-living nematodes, as well as reducing PCN," comments Neill.

"It's an investment in the future of the farm, as nematodes are a bigger worry than the short-term cost of missing a year's cropping."

Dr Burgess, with project partners, Scottish Agronomy, is trying some other, novel approaches as well. One is the application of chitinous soil amendments. These are made from crustacean shells combined with woodchips. "Our hypothesis is that these will shift the microbial balance in the soil towards organisms that feed on chitin. PCN cysts are chitinous, so this should reduce persistence of eggs in the soil," he explained.

"We are also growing tomatoes, which may seem a surprising choice for Scotland! However, we are not growing them for fruit, but rather for their root exudates, which should trigger emergence of PCN in the soil. PCN can't reproduce on this particular variety of tomatoes, so this should crash the population."

PCN isn't currently a major problem in Australia. However, it just takes one tourist's muddy boots to introduce this significant pest to new areas, or to bring *G. pallida* into the country. Understanding the different varieties, growing techniques and other control strategies means that our industry will be prepared if and when any such incursion occurs.

SOIL PHYSICS 101

Soil health, defined as the sustainable capacity of soil to support vital living systems, often focusses on soil biology. While the role of microbes, critters and organic matter is well-documented and indisputable, we cannot only focus on the inhabitants and ignore the house. Soil structure (the house) is also critical for soil health. By Paulette Baumgartl

KEY POINTS

- Taking care of the physical properties of soil is crucial for sustainable and profitable potato farming.
- Soil physics examines the abiotic characteristics of soil and how solid, liquid, and gas components interact.
- Soil composition is key - the proportion of fine particles determines how the soil behaves.
- The composition and characteristics of soil aggregates significantly influence interactions among soil, water, and gases.
- Soil texture and structure determine the water-holding capacity and infiltration rate of the soil, impacting its ability to provide water to plants.
- **Field capacity** is the maximum amount of water that a soil can hold
- **Permanent wilting point** indicates the lower limit where water becomes unavailable to plants.
- The range between field capacity and the refill point is known as the **readily available water (RAW)** zone, which is essential for optimal plant growth.
- Infiltration, runoff, and erosion are influenced by various forces such as gravity, adhesion, cohesion, and capillary rise.
  - **Adhesion** and **cohesion** allow soil to retain water within its pores
  - **Capillary rise** enables water movement upwards in narrow spaces, particularly in clay soils.
  - Monitoring **infiltration rates** provides valuable information about soil structure and the impact of soil management practices on water movement into the soil.
- **Compaction** occurs when external forces press soil particles together, reducing pore space and increasing soil density.
  - Factors like clay content and moisture level influence the ease of compaction.
  - Compaction limits root penetration, reduces water-use efficiency, reduces nutrient retention and availability, increases fuel consumption and decreases machinery effectiveness.
  - Compacted areas can be restored through mechanical and biological approaches.

Coyne et al. (2022) compared a soil ecosystem to a neighbourhood; soil physics concerns itself with the infrastructure (aggregation) and services (aeration, hydration), while soil chemistry focusses on the catering. Microbial residents interact with, and shape, both the physical and chemical properties of the soil they inhabit.

Understanding and managing the interacting components of soil health - physical, biological and chemical factors - is essential to create robust and productive soils that are able to sustain commercial potato production.

The following article examines some aspects of soil physical properties and how they impact agricultural practice (and how agricultural practices impact soil physical properties).

SOME BASIC THEORY FOR A COMPLEX TOPIC

Soil physics studies the abiotic characteristics of a soil ecosystem and how they interact. These include the solid, liquid and gas components of the soil, referred to in science as soil phases. The interaction among these phases determines the behaviour and functionality of soil, and therefore the soil's ability to support life.

A well-structured soil under a cover crop at Mulgowie Farm in Queensland's Lockyer Valley

Soil solids include mineral and organic particles. Typically, soil solids occupy 50% of the soil volume, however solids can range from 40 to 70%.

Mineral particles are grouped into fine (sand, silt and clay, less than 2mm) and coarse (gravel, stones etc and greater than 2mm) fractions. The proportion of fine solids determines soil texture and, ultimately, the way the soil behaves.

Organic materials, including living fungi and plant residues, together with ions such as calcium, glue and bind mineral particles together to form aggregates. The composition and characteristics of these aggregates has a large impact on soil, water and gas interactions.

Soil aggregation and structure

Soils can be grouped broadly into structureless and aggregated.

Structureless soils lack visible aggregates. They are dominated by sand or clay, limiting bonding and/or resulting in poor water infiltration.

Structured soils consist of distinct aggregates that can be characterised by their shape and size.

A well-structured soil has sufficient pores (good pore volume) of differing sizes (good pore size distribution) between and within aggregates. This allows water and air to enter easily. Structured soils drain easily, while still holding enough moisture to maintain plant growth.

Poorly structured soil lacks aggregates and has few pores between soil particles.

Aggregation begins when tiny, highly reactive clay particles interact with organic residues. These bind larger sand and silt particles together to form microaggregates. Fungal hyphae and fine plant roots then bind soil micro-aggregates together into the macro-aggregates visible to the naked eye (Figure 1).

The remaining 50% of soil is pores, which are filled with water or gas. While the amount of liquid in soil can vary between <1% (completely dry) to approximately 50% (saturated, with all pores filled with liquid), in ideal conditions liquids occupy 25% of the total volume of soil, with the remaining 25% of pores filled with air.

Soil chemistry and soil structure

Just as soil biology will impact the physical structure of a soil, so too can soil chemical properties, particularly sodicity and salinity.

As the name suggests, sodicity is the presence of a high proportion of sodium relative to other cations. As sodium salts are leached through the soil, a high proportion of sodium (Na) ions (relative to other cations) remain. Some soil tests show and compare the CEC with sodium (Na^+) levels to determine whether soils are sodic.

Excess sodium weakens the bonds between soil aggregates, leading to dense, cloddy and structureless soils. Sodicity can lead to dispersion at the soil surface, causing crusting and sealing. This then impedes water infiltration and accelerates erosion.

Salinity, measured by electrical conductivity (EC) levels for salts (sodium chloride, calcium and magnesium bicarbonates) can have similar effects on soil as sodicity. High salinity disrupts the soil's osmotic potential, inhibiting the plant's ability to uptake water and nutrients.

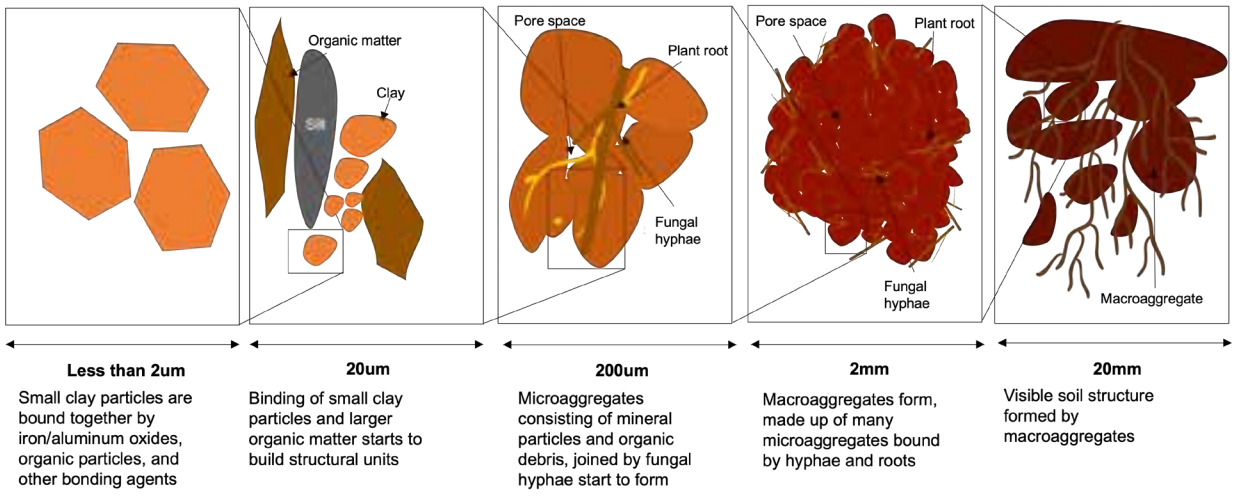


Figure 1. Aggregate formation across different scales. (Adapted from Brown et al (2021) under a creative common licence)

SOIL PHYSICS AND WATER MANAGEMENT

With their relatively shallow root zone, potatoes are very sensitive to water stress. Too much water increases disease and reduces quality, while too little water reduces productivity, yield and nutrient uptake.

The relationship between water and soil structure determines how much water is available to the plants it supports.

Like sponges, soils can only hold a certain amount of water, and absorb water at a certain rate, depending on their texture and structure.

Measuring soil water is a useful tool to understand the condition of the soil at each stage of irrigation and crop use: from **saturation point** (when all pores are filled with water, leading to anaerobic conditions, run-off and ponding), to **field capacity**, **refill point**, and finally **permanent wilting point** (Figure 2).

The maximum volume of water that a soil can hold is called field capacity, while the lower limit is the permanent wilting point, whereby the only water remaining in the soil is unavailable to plants (also known as hygroscopic water).

After saturating rain or irrigation, there is a continuous rapid downward movement of water due to gravitational force. The rate at which the water moves through the soil is related to the soil structure and texture (i.e., drainage is faster for sandy soils compared to clay soils).

After some time drainage becomes negligible. This is when the soil has reached **field capacity**. Over-irrigation that exceeds field capacity will result in drainage and/or deep percolation, wasting water.

As a plant cannot use all of the water held in the soil, irrigators must calculate the water that can be readily removed from the soil by the plant. This is called **readily available water (RAW)** and is the zone for best plant growth between **field capacity** and the **refill point**.

RAW, (measured in millimetres per metre (mm/m)) indicates the depth of water (mm) held in every metre (m) of soil depth that can be taken up by plants. RAW varies with soil type, crop, rooting depth and irrigation system and can be calculated for the total profile depth, or just the depth of the plant's effective rootzone.

Information on how to determine RAW can be found here http://bitly.ws/KZy7

The **refill point** occurs when plants have removed all RAW. The refill point is when used water needs to be replaced.

Soil moisture probes can help determine water-holding capacity and the point at which the soil profile should be refilled.

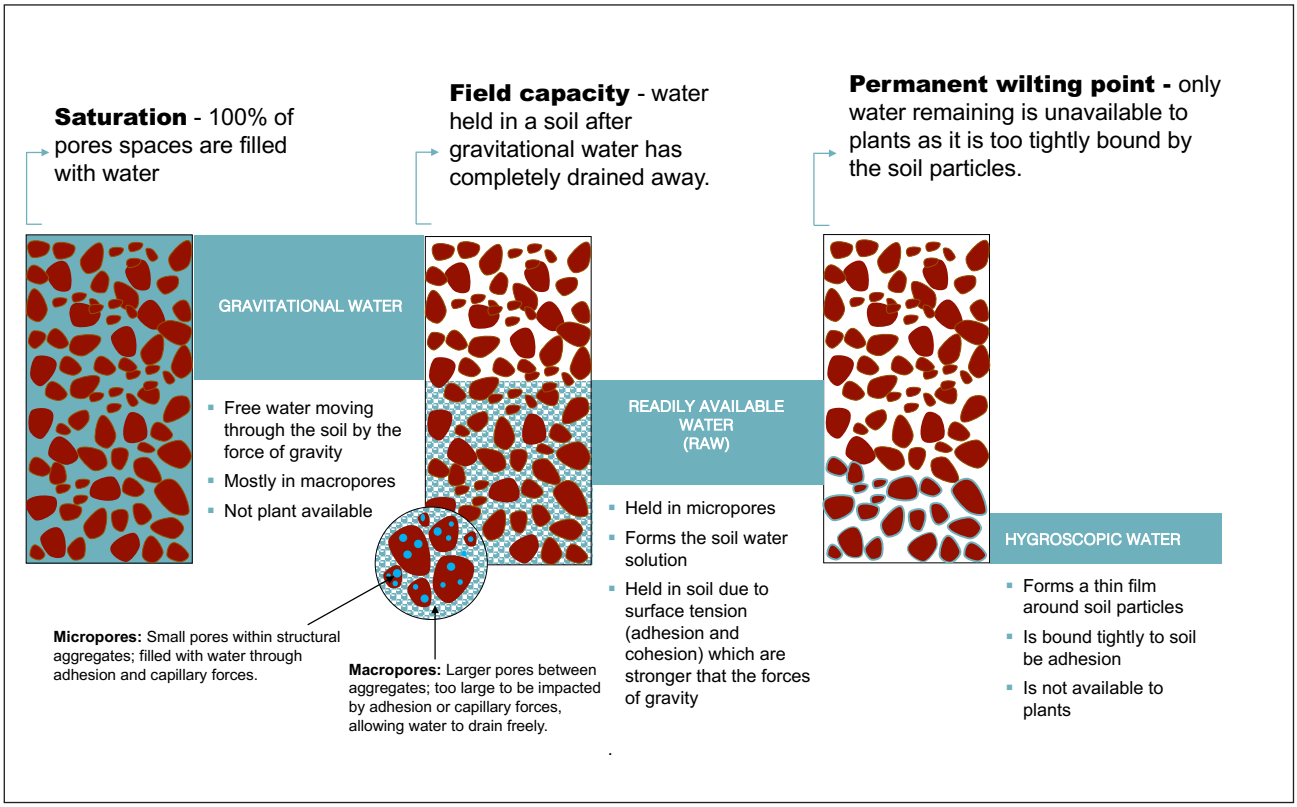


Figure 2. The different forces at play moving and holding water through the soil.

Infiltration, run off and erosion.

Gravity is not the only force at play as water travels through a soil matrix.

Adhesion, cohesion and capillary rise also play a role, impacting infiltration and how much water is available to plants.

Adhesion, the stronger of the two forces, describes the attraction between water and solid particles. Cohesion is the attraction between like materials, in this case water to water.

These forces make it possible for soil to hold on to water. Without adhesion and cohesion, water would simply drain out of the soil pores.

Capillary rise - the upward movement of a liquid through a narrow space - is another important physical phenomenon at play in the soil. As clays have smaller pores, capillary rise is higher, which is why a clay soil can also hold onto more water.

The infiltration rate is the rate at which water enters the soil and is measured by the depth (in mm) of the water layer that can enter the soil in one hour; it will vary with soil texture and structure. It is usually measured by a field test using a cylinder or ring infiltrometer.

In dry soil, water infiltrates rapidly. This is called the initial infiltration rate. As water fills the pores, infiltration slows, reaching a steady rate or basic infiltration rate.

If the amount of water entering the soil is more than what it can absorb at the time, the excess water will run off the surface. This **runoff** causes water erosion by carrying and redistributing soil particles down the slope and creating rills or gullies.

Soil management practices that degrade soil structure can adversely affect infiltration capacity, making monitoring of infiltration rates a good indicator of their impact on water movement into the soil.

Figure 2 illustrates the main forces acting on the different 'types' of water in soil as it moves through the soil profile. Figure 3 illustrates the movement of water in the soil profile.

Waterlogging

With a relatively shallow root system, potatoes have a low tolerance to waterlogging and anaerobic conditions.

While waterlogging cannot always be prevented, improving drainage of water away from the crop and improving the soil's physical structure can help the soil 'protect' itself against excessive water.

The best way to identify waterlogged areas is a visual assessment. If the surface is wet the soil is likely to be waterlogged.

However, sometimes the surface may appear dry but be waterlogged underneath. It is worthwhile to dig and examine what is happening beneath the surface. Dig a couple of holes to about 30cm - if water flows into them the soil is waterlogged.

For more information on managing waterlogging, read more in PotatoLink Issue 8 (http://bitly.ws/RujS)

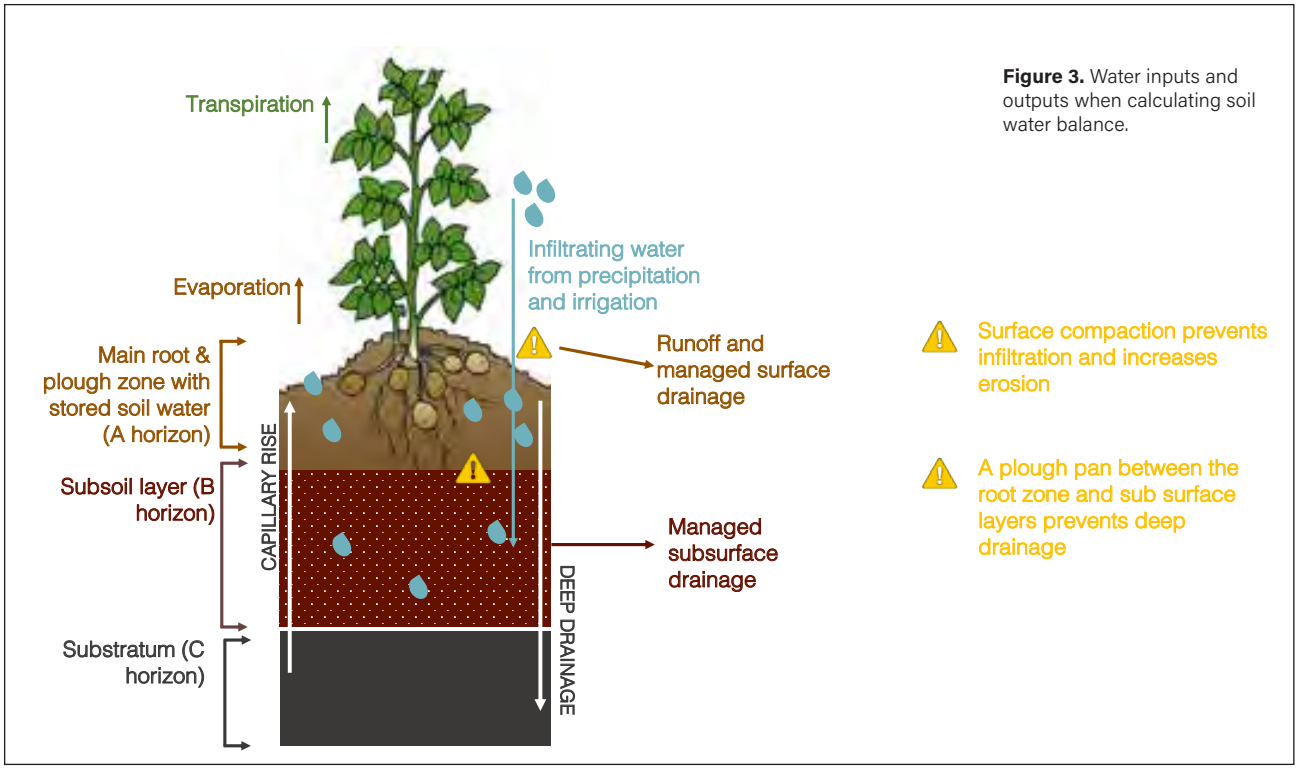


Figure 3. Water inputs and outputs when calculating soil water balance.

MAINTAINING GOOD VENTILATION

Soil holds a mixture of air and other gasses in the macropores. These should comprise the remaining 25% of the total soil volume. The composition and movement of gasses in soil are dynamic.

Pores provide a pathway for gasses to move through the soil. In the root zone good aeration is required to allow plant roots to respire, taking in oxygen and releasing carbon dioxide.

Anaerobic conditions, often a result of waterlogging, have many consequences:

- Reduces the ability of plants to take up nutrients.
- Limits the soil's biodiversity, as microbes need good aeration to efficiently cycle organic matter and nutrients.
- Lenticels on tubers become puffy and swollen as the tubers struggle to get enough oxygen.
- Plants are more susceptible to infection from a range of fungal and bacterial pathogens.
- Results in a build-up of carbon dioxide and ethylene, impacting growth.
- Leads to nitrogen loss through de-nitrification.

Not only are air and water dynamic parts of soil, but both are often inversely related. Maintaining the balance between aeration and soil water availability is a critical aspect of soil management.

SOIL COMPACTION

Compaction is caused by applying stress, for example from heavy machinery traffic, to a soil with a moisture content wetter than its plastic limit (see break out box). When soil particles are pressed together by external forces, bulk density increases and soil porosity decreases. The result is an increase in mechanical resistance or strength of the soil.

Many soil properties affect how easily the soil compacts. These include clay content, due to its ability to hold water.

Compaction has many adverse impacts on potatoes including:

- Plant roots are unable to penetrate compacted layers to access water.
- Water-use efficiency is greatly reduced; rain or irrigation water is unable to penetrate the compacted layers to re-fill the subsoil, increasing run-off and evaporation.
- Compacted soil requires more fuel to cultivate.
- Machinery can become blunt and less effective.
- Fertiliser efficiency is reduced as compacted soils provide few surfaces to retain and release nutrients for crop growth.

While most compaction occurs in the top 20–30cm of the soil, repeated tillage at the same depth can form a hardpan—a dense, impenetrable layer beneath the tilled soil.

Symptoms of surface compaction include:

- Surface clods that are hard to break apart.
- Water ponding in tracks and headlands
- Wheel tracks with a smeared appearance
- Soils that appears to have no structure.

RESTORING COMPACTED AREAS

Avoiding compaction by reduced tillage, controlled traffic, and avoiding, as much as possible, tillage when the soil is wet, is obviously preferable,

Top: compacted soils. Bottom: soil from under cover crops (left) versus intense cultivation (right)

however it is not always practically possible.

Compacted areas can be restored or managed with both mechanical and biological approaches.

Biological management takes time, using cover crops with different rooting patterns that can break through the soil.

Cultivation when the soil is dry will also hasten the natural breakdown of clods. However tillage needs to be shallow to avoid compaction of deeper (and usually wetter) soil.

It is therefore important to check the soil moisture profile in relation to cultivation depth. Only cultivating dry soil ensures that it will fracture rather than smear.

Deep ripping breaks up compacted soil layers mechanically using strong tines working down to 35-50cm depth. These loosen hard layers of soil.

Before deep ripping, it is important to consider tine spacing, working depth, use of shallow leading tines or discs, soil moisture content, timing and soil type.

More information about the science of deep ripping is available here (http://bitly.ws/KZyk).

CONCLUSION

Potato cultivation, by necessity, is a constant cycle of building up a soil structure then smashing it down, undoing years of good, regenerative work.

Moreover, rarely will soil have exactly the same structure and other properties across all paddocks, complicating management further.

Being aware of the physical properties of soil in each paddock can help avoid destructive practices. It can also help identify and implement regenerative soil management strategies, keeping the potato farming enterprise sustainable and profitable.

PLASTICITY

The plasticity of a soil is its ability to deform without cracking and it is an important characteristic of fine-grained soil, especially clay soils.

At the lower plasticity limit, the soil will crumble when rolled into threads of 3.2mm in diameter.

To assess if your soil is suitable for vehicle traffic or cultivation, perform the following test:

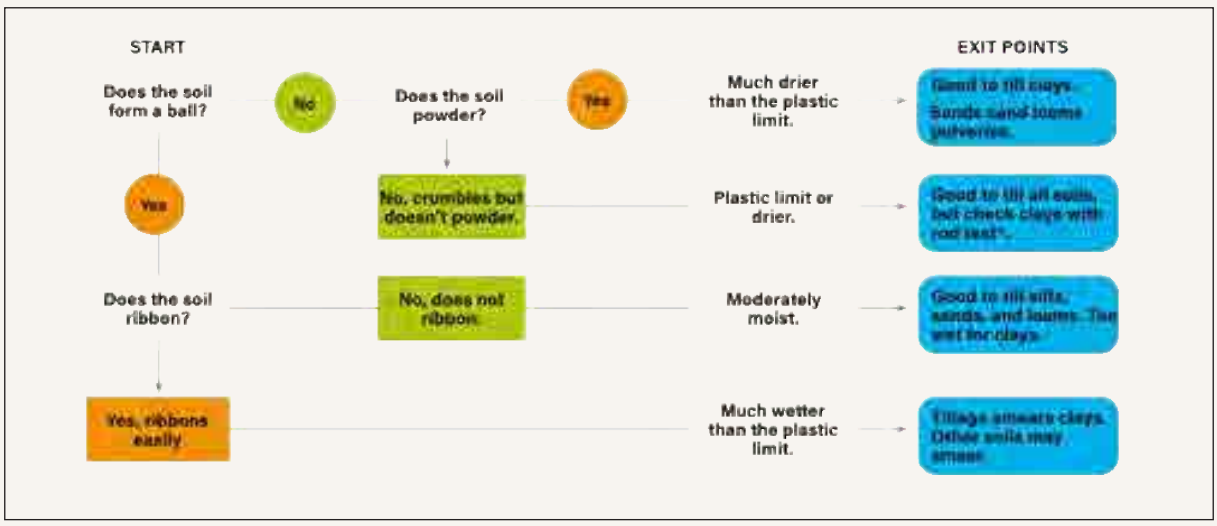
1. Rapidly squeeze a small lump of soil into a ball.
2. Attempt to roll the soil ball into a 3mm diameter rod.
3. If you can easily make a cohesive rod, the soil is too wet and should not be worked with machinery.
4. If you cannot make a rod at all, the soil is only suitable for cultivation if it is clay. If it is loam, this indicates that the soil is too dry to cultivate.

5. If you can make a crumbly rod, the water content should be suitable for cultivating all soil types.

Soil moisture test for tillage. Source: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0020/127280/Cultivation-and-soil-structure.pdf

The ribbon test is used to estimate soil texture and the amount of clay in a soil. NSW DPI have a useful step by step guide here https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/164615/determining_soil_texture_using_-ribboning_technique.pdf

*Rod test described in the five point step.



CLAY AND ORGANIC CARBON

Keeping carbon stable in the soil is important to improve soil health. The ability of the soil to do this depends on its physical, chemical, and biological properties. Clay minerals, which are the most reactive particles in soil, play a big role in storing organic carbon (OC).

Clay soils are good at protecting OC from microbial breakdown. The clay particles and aggregates physically protect the organic matter. The organic materials can stick to clay surfaces, get covered by clay particles, or get buried in small pore spaces of clays. This makes it hard for microorganisms to break them down.

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REDUCED TILLAGE IN POTATOES

By Stephanie Tabone, Ryan Hall

KEY POINTS

- Reduced tillage can involve reducing:
  - Tillage intensity
  - Number of passes
  - Depth of tillage
  - Area disturbed, *or*
  - Complete removal of tillage from a system
- Reduced tillage is often paired with other regenerative agriculture practices such as
  - Cover cropping and pasture rotations
  - Use of compost and biofertilisers
  - Inclusion of livestock in the rotation
  - Controlled traffic
  - Promoting biodiversity
- Most of the case studies outlined in this article have focussed on reducing the number of passes prior to potatoes, combined with other regenerative practices
- Consider your unique farming system when trying reduced tillage, including rotations, crop residue management, soil type and climatic conditions
- Try reduced tillage on a small area to compare it with your conventional practices.

Reduced tillage agriculture has emerged as a sustainable and innovative approach to farming, offering numerous benefits to both farmers and the environment.

By minimising soil disturbance, reduced tillage practices promote soil health and conservation, leading to improved water infiltration, increased organic matter content, and enhanced nutrient retention. This approach also reduces soil erosion, conserves valuable topsoil, prevents nutrient runoff, and improves water use efficiency. These benefits can lead to improvements in yield, quality, and margins for growers over time.

However, for potato growers there are some challenges. Weed control can become more difficult without regular soil disturbance. Disease and pest management can also be impacted, as crop residues are not buried, potentially increasing disease carryover and pest survival.

Despite these challenges, some potato growers around the world are turning to reduced tillage, usually in combination with other regenerative practices, to improve and /or maintain soil health.

WHAT IS REDUCED TILLAGE EXACTLY?

Reduced tillage can be a reduction in intensity of tillage, the number of passes, tillage depth, area disturbed or the complete removal of tillage in a system. While reduced tillage has long been embraced in grain cropping systems, the uptake among potato growers has been slower as production systems often involve significant tillage to prepare the soil for planting.

Tillage serves multiple purposes including weed management, loosening the soil for planting and harvesting, and making nutrients more available. While tillage can appear to be a prerequisite for growing a good potato crop, there is a rising number of producers who are deviating away from conventional tillage.

CASE STUDIES AND RESEARCH

There are many challenges in adapting reduced tillage to potatoes, however an increased awareness of the importance of soil health and soil conservation worldwide has emphasised the need to consider more environmentally sensitive approaches. Over the past decade a number of studies have examined the impact of reduced tillage on yield and disease pressure, as well as soil quality parameters.

This article shares some examples of growers who have incorporated reduced tillage into their farm practice and research seeking to quantify outcomes when tillage practices are altered.

AUSTRALIA

Garry Kadwell (*Delicious* Magazine Producer of the Year, 2020) grows potatoes near Crookwell in NSW on his family farm *Fairhalt*. After taking over the family property and transitioning to potato production, Kadwell noticed that his soil biology was gradually degrading.

Of the nearly 300ha farm, 32% is set aside for conservation. The remaining hectares produce seed stock potatoes, gourmet potatoes, fat lamb production, and occasionally lucerne/silage fodder production.

Kadwell applies a minimum 5-year cycle management regime to each parcel of land on the property. Potatoes are not planted more often than one year out of every five, with the other four years involving crop rotations of lucerne and pasture grasses.

The changes

With a family history of conservation on the property, Garry was open to practice change to improve the soil health, incorporating the following changes to his farming system:

- An increase in the length of rotations
- The introduction of pastures into rotations, including legumes
- Consistent application of compost
- Rotational grazing of fat lambs to maintain ground cover
- The transition to a one-pass system to reduce tillage

The results

There has been a significant increase in tonnage/ha of potatoes since 2010. Yield has risen by a remarkable 20%, at the same time as maintaining high levels of soil carbon.

While this is the result of applying a number of regenerative farming practices, reduced tillage is a key part of this system. Fairhalt provides an Australian example where reduced tillage equals better potato production.

Soils for Life have conducted a comprehensive economic and ecological assessment, which is publicly available (https://soilsforlife.org.au/garry-kadwell-fairhalt/).

Mallee Sands of Southern Australia

Studies by the CSIRO have shown that use of minimum tillage in South Australia's Mallee region not only reduces erosion risk but supports improved soil nutrition through improving soil carbon and beneficial soil microorganisms.

A significant volume of Australian potatoes are grown in the mallee region on light sandy soils typically low in clay.

The area's Mediterranean climate, including winter rainfall and strong prevailing winds, combined with the sandy soils creates a significant erosion risk. Airborne soil and sand can cause cause abrasion damage to growing potato crops, increasing disease risk. Erosion can also sometimes expose shallow potatoes, resulting in greening and postharvest grading waste.

CSIRO has shown that minimising tillage of the light, sandy soils of South Australia's mallee region can reduce erosion

Limiting tillage can reduce erosion risk, protecting both current and future crops.

Fairhalt Farm, showing one of the functioning wetlands that filter water runoff from the property.

NETHERLANDS

Grower Jeroen Klompe, a leading innovative regenerative farmer from the Netherlands, grows potatoes and a range of other horticultural and grain crops south of Rotterdam in the Netherlands.

Klompe grows 12 different potato varieties across 85ha (of 368ha property) for baking, baby, fresh retail, and food service markets. The diverse rotation also includes red onions, shallots, green protein crops such as kidney beans, brown beans and soya, and combinable crops including winter and spring wheat, buckwheat, oats, oilseed rape and flax, plus grass for seed.

His property hosts the Klompe Farm trials, showcasing a wide range of experimental regenerative practices, including biofertilisers, compost tea, lane cropping, biodiversity margins and strips, no till and more. Working with universities and researchers, the trials generate data on the effects of regenerative practices. These results are complemented by the farms own records – recording the adaptation of farming practices, yields, the effects of the weather on the different plots and so on.

The changes

To avoid planting into compacted soil, Klompe adopted a 3.08m working width controlled-traffic farming system: crops are never sown where machinery has trafficked.
Preparation for potato crops starts straight after the previous wheat crop. The straw is chopped and mulched and organic fertiliser – either compost or solid manure – applied.

If any remedial work is required for the soil, such as drainage maintenance, it is carried out at this point, while the ground is dry.

A cover crop is direct drilled and grown over winter. The species for the cover crop are chosen with a specific purpose in mind. This could mean planting a biofumigant for disease management, or a legume for increased soil nitrogen.

Jeroen Klompe planting into a mulched cover crop and ridging

When mature, the cover crop is mulched and cut. The potato crop is then planted directly into the cover crop residue using a one-pass system. A rotator is used to mix the cover crops and the upper surface of the soil. After the potato seed tuber is planted, the ridges are made in a single action.

Micronutrients are applied as necessary following plant sap analysis. The aim is provide the correct nutrition for crop growth and quality, but also to reduce the use of blight fungicides.

Current reductions in blight fungicide are primarily driven by decision-support systems based on moisture sensors within the crop, weather forecasting and blight detection. However copper, zinc and calcium can all play a role in improving blight resistance.

The results

Klompe has made many observations while slowly increasing the area of reduced till from about 5ha five years ago to almost half of his potato production area today.

One of the key benefits has come from combining reduced till with cover cropping. Higher organic matter has increased infiltration rates and soil water holding capacity.

Reducing the amount of irrigation applied is another way to reduce risk from blight.

Klompe hopes that the use of biofertilisers will promote growth of beneficial fungi and bacteria on the upper parts of the plant. These could potentially compete with *Phytophthora*, also reducing blight risk.

One negative is increased populations of slugs and wireworms. While damage is minor, up to 2% of the potato crop has been impacted. Klompe's agronomist advises that a balance with natural predators will keep the pest problem under control once the system adjusts, . Patience is key!

Klompe says: "In the system we are using, it's not one thing – it's the combination of lots of small things that makes the change extremely strong."

He adds that the ultimate goal is to grow the same yield but using fewer inputs.

"But we are learning that sometimes it is better to accept a slightly lower yield with a higher margin, than a higher yield and a lower margin."

To read more https://www.soilheroesfoundation.com

Wageningen University has been studying reduced tillage for many years. In 2021, the university hosted an open day outlining some of the impacts of reduced tillage on potatoes.

They noted that transitioning to reduced tillage involves some significant changes to farm operations. These include changes to crop rotation as well as management of cover crops to reduce residues as the soil adjusts.

The study

Two studies conducted by Dimitrios Drakopoulos and team at Wageningen University focused on organic potato production. The research explored the impacts of different tillage systems and fertilisation regimes on soil health and potato production (Drakopoulos et al. 2016, Drakopoulos et al. 2018).

Specifically, they assessed the impacts of a rotary hoe to 10 cm (reduced tillage - RT), compared to a rotary hoe to 10 cm followed by a mouldboard plough to 30cm (standard tillage - ST) at various weeks after planting (WAP).

Some results

- The use of RT resulted in higher soil bulk density during the first seven WAP compared to ST, while both tillage systems had similar values at the end of the growing season (13 WAP).
- Over time, soil bulk density values diminished for RT, while increasing for ST.
- The type of fertiliser had no effect on soil bulk density.
- Use of RT improved some soil quality parameters, such as earthworm activity (2–3 times higher with use of RT compared with ST at 4, 8, and 13 WAP).
- Use of RT negatively affected other parameters, with increased soil bulk density proving detrimental in terms of tuber bulking and final yield (Drakopoulos et al. 2016).
- However, over time negative effects on yield may diminish. Soil structure under RT improves due to increased depth and frequency of pores. These are created by the activity of soil biota, such as earthworms, insects and other soilborne organisms.
- As shown in the figure below, concentrations of soil mineral N (NO^{-3} and NH^{+4}) showed similar decline patterns for both tillage systems during the potato growth period (Figure 1).
- However, soil mineral N values in the top part of the rootzone (0-15cm) were significantly higher in the RT system, especially at 4 and 8 WAP
- In contrast, the bulk of soil N was in the mid to lower parts of the root zone (15–30cm) for ST.
- The study demonstrated that soil structure, drainage and soil biology all benefited from reduced tillage.
- While yield was slightly reduced, the researchers suggest yields will return to previous levels once the system adjusts.

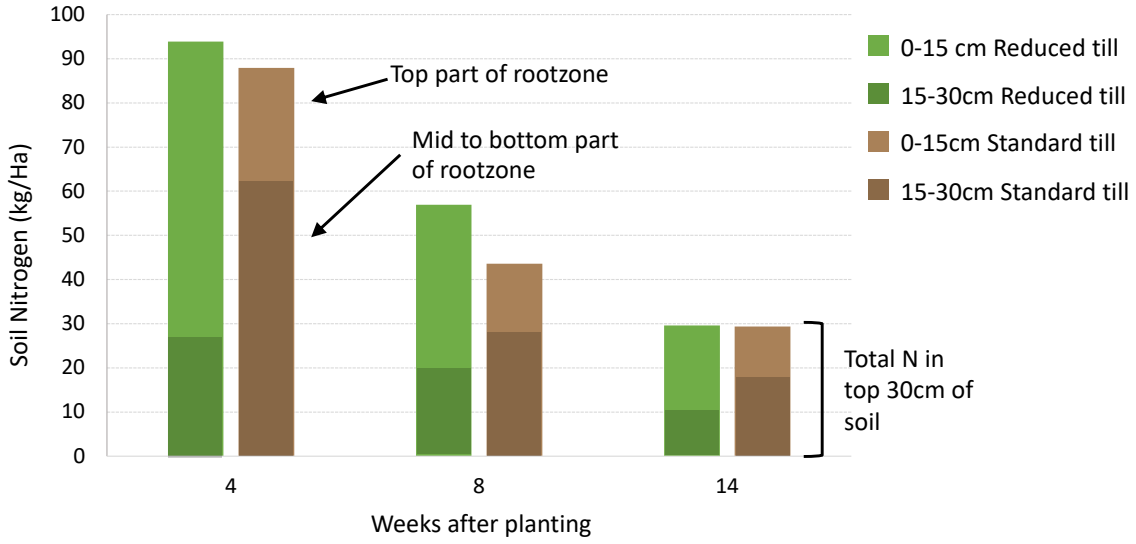


Figure 1. Influence of tillage practice (reduced tillage; standard tillage) on soil Nitrogen held in the top 30cm of soil, split into top (0-15cm) and mid (15-30cm) parts of the rootzone. Data recorded 4, 8 and 14 weeks after planting.

UNITED STATES OF AMERICA

A joint research project by the United States Department of Agriculture and Oregon State University trialled a reduced tillage system in a three-year rotation of sweet corn/ sweet corn/ potatoes. The objective was to develop a reduced tillage system for potatoes using existing field equipment with minor modifications.

The study

The reduced tillage system reduced the total number of passes from nine down to six and soil disturbance operations from seven to four. This retained crop residues as well as requiring less passes with machinery. This translated into savings in time, labour, fuel, and capital (Table 1).

Most of the soil disturbance in the reduced tillage system was caused by the bed splitter, planter, and harvester.

Table 1. Timing of field operations and equipment used in the 2003-2004 tillage trials at Paterson, WA/ Trials conducted in a three-year rotation (sweet corn/ sweet corn/ potato).

OPERATION	CONVENTIONAL TILLAGE	REDUCED TILLAGE
Residue management	Flail chop corn residues	Flail chop corn residues
Pre-planter fertilisation	Valmar™ spreader	Valmar™ spreader
Primary tillage	**2 passes** JD8760™ &13′ Sunflower™ chisel-chopper-packer	**None**
Mark-out	13-shank bed splitter	13-shank bed splitter
Plant	6 row Harriston™ pick planter	6 row Harriston™ pick planter
Drag-off	6 row rodweeder	**None**
Dammer Dike	Dammer diker	Dammer diker
Harvest	3 row potato harvester	3 row potato harvester
Total Passes	9	6

The results

- Compaction was noted as a short-term negative in the reduced tillage system, with an increase in bulk density from 1.2 g/cm^3 to 1.5 g/cm^3. However, over time the bulk density reduced.
- Yields from the conventional and reduced tillage systems were not statistically different, with conventional tillage yields higher than reduced in some years and reduced tillage higher than conventional in others.
- The main benefit noted by the researchers in the reduced tillage system was the reduction in erosion due to residue retention. Damage caused by blowing sand in the conventionally tilled plots was mostly absent in the reduced tilled plots.

For more information:

Extended report 2005
http://bitly.ws/PQ9M

Summary 2013
http://bitly.ws/PQ9S

Potato emergence from conventional tillage (left) and reduced tillage (right). Picture taken following a period of high winds. Photo by M.Seymour USDA-ARS.

CANADA

Agriculture and Agri-Food Canada study

A 10-year study by Martin Carter and team at Agriculture and Agri-Food Canada in the late 1990s and early 2000s investigated different tillage treatments on sandy loam soils (Carter et al. 2009).

The conservation tillage system consisted of one pass with a chisel plough (15 cm deep, with 36 cm sweeps) prior to planting potatoes.

The conventional tillage consisted of mouldboard ploughing (20 cm deep), followed by two or more passes (10 cm deep) with a disc and harrow prior to planting potatoes.

Both the conservation and conventional tillage treatments received the same in-row cultivation for ridging (hilling), fertiliser, pesticide applications and harvesting operations.

The Results

- Contrasting with other results, conducting reduced tillage in a three-year rotation resulted in the lowest bulk density of all treatments.
- Soil organic carbon, total nitrogen, and particulate carbon and nitrogen all increased with reduced tillage.
- Of the studies conducted by Carter's team, no significant impact was observed on yield or quality (Carter et al. 2005, Carter et. al 2009).

Grower Panel

In May 2022, the Canadian potato congress held a grower panel session with three prominent Canadian growers; Harold Perry, Homer Vander Zaag and Chad Berry, each starting to implement reduced tillage practices on their farms.

The main drivers for adoption were to build carbon, reduce erosion and to support fumigation practices for disease management. Cover crops were already used by the growers. Reduced tillage was seen as the next step to achieving their goals.

The changes

Their styles of reduced tillage differed.

- Harold Perry has changed his practice from conventional autumn tillage to direct ridging. Ridging used to involve 2-3 passes to loosen the soil for hill formation in autumn, which was then left fallow. Now, Harold sows an early cover crop to get good growth before winter. In spring the potatoes are planted directly into the stubble in one pass, followed by a schmieser packer to promote good seed to soil contact. This approach has helped him to build carbon and reduce soil erosion, while also promoting soil biology.
- Homer Vander Zaag was facing issues with common scab and early dieing syndrome. To solve this issue he fumigated, however this required minimum soil disturbance. After practicing reduced tillage and the associated benefits, he developed a system capable of undertaking tillage, fertilisation, herbicide application, and planting in one-pass. The one-pass system was a success, offering similar results to a two-pass system and improvements in labour efficiency and soil conservation. However, it did increase the complexity of planting. Moreover, the reduction in tillage meant he had to increase application of grass herbicides. Homer observed that reduced tillage was better suited to lighter, warmer soils, with a controlled amount of organic residue.
- Chad Berry has a soil type that easily erodes. A no-till farmer of grain since the 1990s Berry has been reducing his tillage in his potato crops over the years. While erosion is a major factor leading him to reduced tillage, soil health and biology were also important. A recent demonstration on his farm trialled direct seeding potatoes into canola stubble, which offered two less tillage passes prior to planting. The results showed a reduction in fuel use with no impact on potato yields, specific gravity, disease, or other quality characteristics. Although emergence of direct seeded potatoes was delayed by several days, this did not translate into delays in harvest timing.

All three growers noted that the recent regenerative agriculture pledges by the processors have reinforced their practices. With these pledges, growers may see more support for transitioning to practices like no-till.

Click here to learn about Homer Vander Zaag's operation: http://bitly.ws/PQa8

Click here to learn about Chad Berry's experiences: http://bitly.ws/PQab

Harold Perry conventional autumn ridging (left) compared to direct ridging and planting (right).

SUMMARY OF OBSERVATIONS

Positive

- No consistent trends or changes in yield between reduced tillage and conventional tillage
- Increase in water holding capacity of soil
- Improved soil structure
- Improved drainage of soil
- Increase in soil biology
- Increase in soil carbon
- Reduced erosion
- Increase in root proliferation in topsoil
- Nutrients concentrated in the top 15cm of soil
- Increase in earthworm activity

Negative

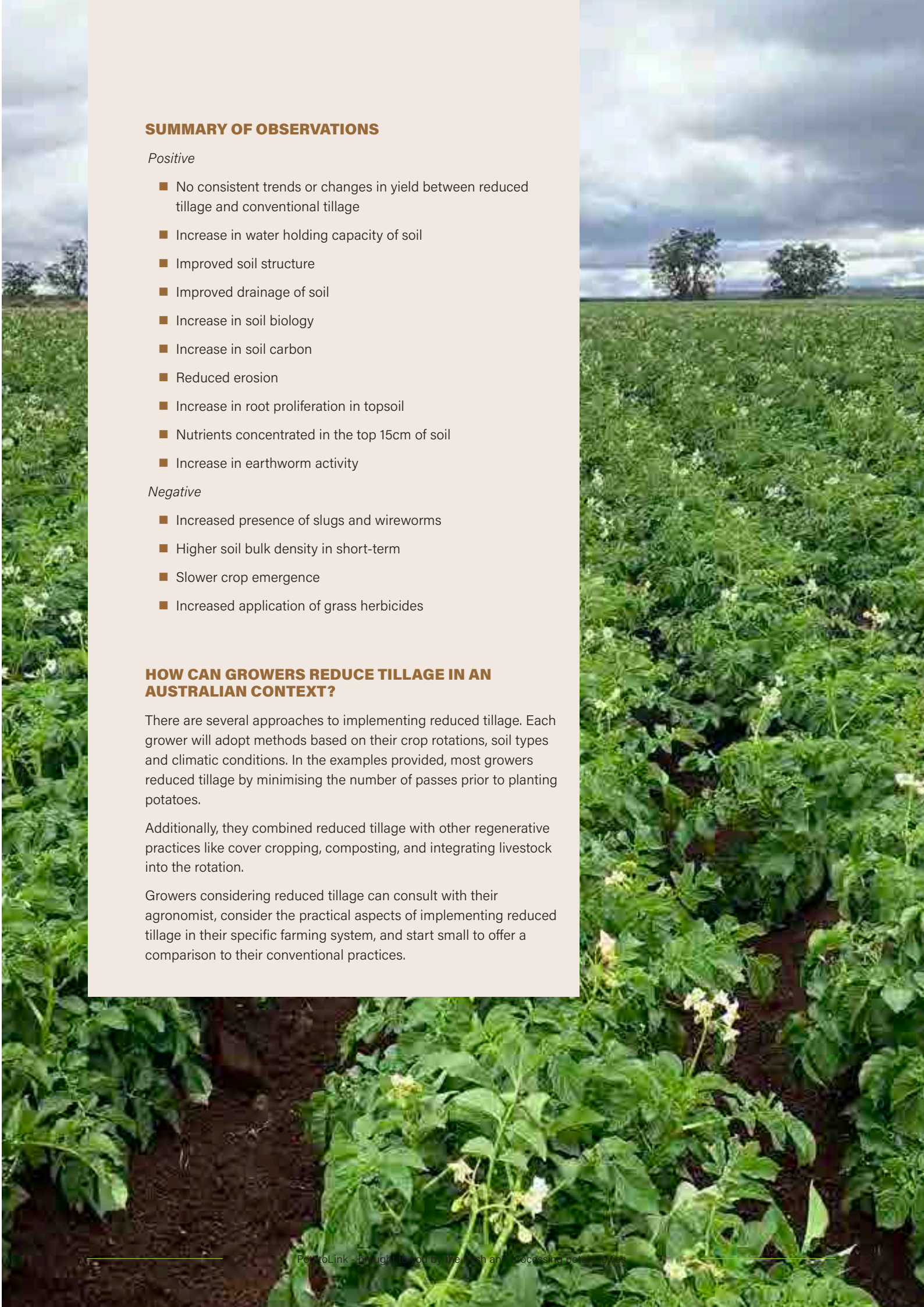
- Increased presence of slugs and wireworms
- Higher soil bulk density in short-term
- Slower crop emergence
- Increased application of grass herbicides

HOW CAN GROWERS REDUCE TILLAGE IN AN AUSTRALIAN CONTEXT?

There are several approaches to implementing reduced tillage. Each grower will adopt methods based on their crop rotations, soil types and climatic conditions. In the examples provided, most growers reduced tillage by minimising the number of passes prior to planting potatoes.

Additionally, they combined reduced tillage with other regenerative practices like cover cropping, composting, and integrating livestock into the rotation.

Growers considering reduced tillage can consult with their agronomist, consider the practical aspects of implementing reduced tillage in their specific farming system, and start small to offer a comparison to their conventional practices.



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Quintero, M. and Comerford, N.B., 2013. Effects of conservation tillage on total and aggregated soil organic carbon in the Andes. Open Journal of Soil Science, 2013.

OTHER RESOURCES:

Garry Kadwell's Fairhalt- a regenerative agriculture case study from Crookwell, NSW- https://soilsforlife.org.au/garry-kadwell-fairhalt/

Growing potatoes without plowing- https://www.thecropsite.com/news/17975/growing-potatoes-without-plowing/

How to grow potatoes using minimal tillage, Jeroen Klompe- https://www.fwi.co.uk/arable/establishment/how-to-grow-potatoes-using-minimal-tillage

Low tillage potato trial showed no impact on yield and quality- https://www.potatopro.com/news/2021/low-tillage-potato-trial-showed-no-impact-yield-and-quality

2022 Ontario Potato Conference, 3 Experiences with minimum tillage on potatoes- https://www.youtube.com/watch?v=f8h4jY6D-_k

Reduced tillage in a three year potato rotation- https://landresources.montana.edu/soilfertility/documents/PDF/reports/Nutrient%20Digest_Winter%202013.pdf

Reducing Tillage but Not Quality- https://spudsmart.com/reducing-tillage-but-not-quality/

MANAGING LATE BLIGHT IN POTATOES USING A PREDICTIVE FORECAST MODEL

– A new initiative by AuSPICA

In response to a recurrence of late blight in some parts of Australia, AuSPICA, in collaboration with US expert, Emeritus Professor, Dr Steve Johnson, have developed an SMS alert system. The message, sent to members, contains spray recommendations with the aim of preventing the establishment of late blight.

By Jack Mueller[1], Prof Steven Johnson[2] and Dr Nigel Crump[1].

[1] Australian Seed Potato Industry Certification Authority (AuSPICA)

[2] Visting Scientist and Emeritus Professor Dr Steven Johnson University of Maine USA

Corresponding email: Jack.Mueller@auspica.org.au

AN INTRODUCTION TO LATE BLIGHT

Late blight, caused by *Phytophthora infestans*, is an oomycete or water mould, a fungus-like microorganism that can have a significant economic impact on the potato industry. The first visible symptom of late blight is dark brown spots on leaves. These irregular shaped lesions will develop further until the plant is killed or desiccated prior to harvest[1]. A lighter green halo will form around the lesion on the leaves (Figure 1), whilst the underside of infected leaves develop milky-white spores under moist conditions (Figure 2).

These symptoms will help distinguish late blight from other common diseases such as target spot *(Alternaria spp.)* and/or *Botrytis*.

Figure 1. (Left) Typical symptoms of late blight on upper foliage of a potato plant.

Figure 2. (Right) Underside of the potato leaf showing sporulation of the late blight pathogen.

The importance of late blight monitoring and management is demonstrated by how quickly late blight can spread. Once established and under the right environmental conditions, the pathogen will spread quickly in ring-like patterns in the crop. Ultimately the disease can progress, causing the entire crop to come to an early death, resulting in yield loss. Furthermore, spores can be spread locally by wind and infect surrounding potato crops[2]. For this reason, late blight is an industry-wide problem, requiring an industry-wide response.

LATE BLIGHT OCCURRENCE

The 2021/22 season saw the reintroduction of late blight in potato crops as a major concern in some potato production areas.

Seed crops where late blight was at its worst resulted in early death of the plants, preventing visual inspections as well as leaf sampling for PVY

testing. This resulted in some seed crops being unable to qualify for AuSPICA certification labels.

Commercial potato crops were also impacted, with crop defoliation and in severe cases early crop death occurring in potato crops infected with late blight causing yield loss.

HOW WE ARE RESPONDING

In response to the previous season, AuSPICA with the assistance and expert advice of Professor Steve Johnson, worked to implement a spray recommendation system. The aim of the system is to prevent the establishment of late blight in crops. This work is funded by the AuSPICA Knowledge hub program through its membership.

Dr Steve Johnson visited Australia over the summer and during this time worked closely with AuSPICA to introduce a model of his own design, targeting the Thorpdale and Ballarat regions. These regions were used to develop the forecast model and test it under field conditions. The future plan is to identify other areas where the model can be used.

The model, used in conjunction with rainfall data recorded by the Bureau of Meteorology, can provide spray recommendations.

The recommendations are then sent via SMS to seed growers and AuSPICA Knowledge hub members. The message will recommend either a 'protectant spray' or a 'translaminar or systemic spray' to be applied at earliest convenience, otherwise no spray will be recommended. The model, time of year, days since spraying, and presence or absence of late blight in the region are all factors contributing to the final recommendations delivered by the AuSPICA certification officers.

The use of this model by AuSPICA Seed Certification Officers commenced following a meeting with growers in Thorpdale in December 2022, with a similar meeting held in the Ballarat region. At this meeting the need for a response to late blight, the way in which the model will run, timing of recommendations, and grower concerns were all discussed. In the time since the meeting in December, ten spray recommendations have been sent to seed growers and Knowledge Hub members in the Gippsland region, whilst the Ballarat region has only received four recommendations.

LATE BLIGHT IN SEASON 2022/23

The 2022/23 season saw the expected return of late blight in potato crops which were not subjected to an appropriate pesticide spray program.

Late blight has also been seen in areas this season that did not have the presence of late blight noted in the 2021/22 season.

However, growers that reacted to SMS recommendations sent by AuSPICA noted significant improvements in the longevity of their crops.

COMMENTS FROM DAVID HOTCHKIN OF HOTCHKIN POTATO GROWERS

"I've had the following thoughts on the late blight modelling developed by Dr Steve Johnson and AuSPICA.

We've been using this formula the past few years ourselves to economically control the disease. We've found that we can accurately predict when the disease is likely to affect our crops, and therefore be able to better target when to spray, and with which group of chemicals to spray, to prevent crop damage. Sometimes using this formula means that we don't spray for periods of time, meaning obvious savings and a better environmental situation.

Traditionally we have two main parts of the season when our late blight risk is at its highest in Thorpdale.

Firstly, from early November to the middle of January. If we have cool wet weather over a significant period during this part of the year, our early crops can collapse suddenly, substantially reducing yield and solids. Without early prediction and targeted spraying, the economic loss for us at this time of year can run into a six-figure sum.

The second high risk period in Thorpdale is from about middle of March through to the end of the growing season late into April. Again, cool wet conditions favouring late blight at this time of year can lead to significant reduction in yield and solids if targeted spraying to prevent the disease from taking hold has not occurred.

In summary, I have found that the Experimental Modelling works for our business.

Of most importance is the judicious use of fungicides and together with the informed knowledge of the appropriate environmental conditions, this can be used to prevent late blight establishing in a crop. We do not want to wait until symptoms of late blight develop in the crop, but rather use protectant fungicide chemistry strategically to prevent disease development in the crop. Once established in a field late blight becomes difficult to manage, particularly when the weather is favourable for the disease.

Overall benefits from the late blight forecast model include fewer spray applications than previously used for late blight and more appropriate use of chemistry modes (protectant, systemic and translaminar) to better manage late blight in potatoes. Ultimately saving money with using the right chemistry, at the right time, to achieve the right result.

For more information about AuSPICA and membership contact:
auspica@auspica.org.au or
Jack Mueller
jack.mueller@auspica.org.au

To sign up for future SMS spray recommendations:
Visit the AuSPICA website www.auspica.org.au or call the office 03 5962 0000 and sign up to the Knowledge Hub.

REFERENCES;

1. UNECE Standard S-1 concerning the marketing and commercial quality control of Seed Potatoes – UNECE Guide to Seed Potato Diseases, Pests and Defects, United nations, 2014

2. https://www.agriculture.gov.au/biosecurity-trade/pests-diseases-weeds/plant/potato-late-blight

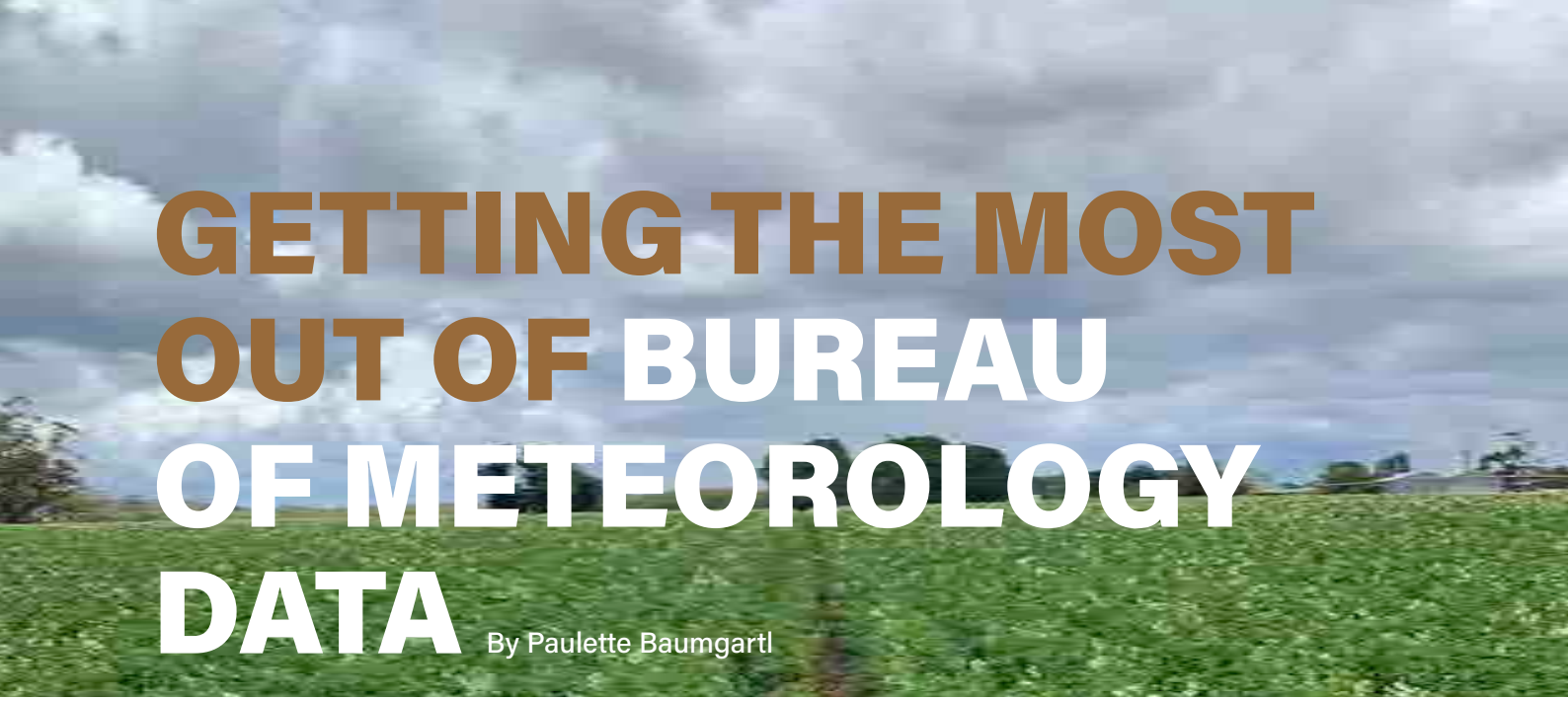
COMMENTS FROM DAVID HOTCHKIN OF HOTCHKIN POTATO GROWERS (CONT.)

I also believe AuSPICA sending out messages to its members based on the late blight Modelling Tool is great way to assist growers making their spraying decisions. During the growing season, growers tend to be very busy, and don't always have the time to keep an eye on everything, so to have Jack in the background keeping an eye on the Model and sending regular messages has been helpful. My belief is that our industry can be well served using this kind of technology, and the messaging is an important part of its uptake.

I also believe this type of messaging could be used to assist growers to better control other pests and diseases. Late blight has been particularly prevalent the last two seasons, but Target Spot is another disease not well controlled a lot of the time. We could have a hot dry year next year and run into problems with potato moth which is also not well controlled at times because of poorly targeted spraying. Hopefully this type of messaging system can be extended to other pests and diseases, such as these.

My hope is that AuSPICA can further develop this messaging technique to assist its members with pests and diseases as they arrive with the different seasons. Further development could assist pest and disease management challenges that arise with the various climatic changes that come our way from time to time.

I also hope that growers take up membership with AuSPICA to help them run these programs, because good information costs money.



GETTING THE MOST OUT OF BUREAU OF METEOROLOGY DATA

By Paulette Baumgartl

Australia's Bureau of Meteorology website (bom.gov.au), with its associated app, is one of the most well-known websites in Australia. The status of the Bureau of Meteorology among Australians is testament to the importance of weather and climate in a country famous for its extremes.

Behind the weekly temperature and rainfall forecasts, and the much-loved radar, sits an abundance of data, both raw and interpreted. If you know where to look, this data can be a useful decision-making tool.

In a recent PotatoLink online training webinar, Agricultural Segment Lead Rachel Davis and Senior Meteorologist Jonathan How guided participants through the website's many functions and useful features to help growers understand, react, and respond to their local weather.

THE BUREAU AND PRIMARY INDUSTRIES - SOME BACKGROUND

With a directive to generate more than $300 million in new economic and social value for the agricultural sector, the Bureau of Meteorology supports the agricultural industry by ensuring that weather, climate and water products meet the needs of the sector.

One output of this agenda is *Forewarned is Forearmed* (FWFA), a five-year project that concluded in 2022 aimed at helping farmers and agricultural value chains to proactively manage the impacts of extreme weather events.

Farming in one of the most variable climates in the world means that extreme weather events and climate variability have a significant impact on agricultural production and income.

KEY POINTS

- The Bureau of Meteorology provides weather observations and historical data dating back to the 1800s.
- This data helps in understanding climate patterns, optimal planting windows for crops, and potential risks associated with weather events.
- Average condition maps illustrate rainfall, temperature, sunshine, cloud cover, wind patterns, cyclones, storms, and bushfire occurrences. They are useful for quickly understanding typical weather patterns in a specific area.
- Nowcasting provides real-time weather information for the immediate future, ranging from the next minute to the next hour. Users can access the radar and satellite viewers to track rainfall, storms, cloud cover, and wind patterns.
- Forecasting uses advanced models to provide weather forecasts for the coming weeks, months, and seasons. The MetEye tool allows users to access comprehensive forecasts for specific locations and provides insights into the probability of rainfall occurring.
- Futurecasting involves seasonal and long-range forecasts. The Climate and Past Weather section offers climate outlook maps and tools to assist in decision-making for sectors like agriculture.
- The Bureau's website provides navigation instructions to access historical data, recent observations, nowcasting tools, and forecasting tools. Users can visit the specific sections under the Climate and Past Weather category to access the desired tools and information.

Watch the training session and access the links to the key tools here (http://bitly.ws/PQam).

The outcomes of FWFA include new forecast products, all freely available via the Bureau's climate outlooks website and described in more detail on p 31.

The agricultural sector can also look forward to more tailored tools in the near future, including:

- Climate Services for Agriculture (CSA) – a partnership with the Future Drought Fund and CSIRO – which will provide famers with climate information for their local area to help them better prepare for climate risks (read more here, http://bitly.ws/IuiM).
- Agri-Climate Outlooks (ACO) – a partnership with Agricultural Innovation Australia and CSIRO – which examines seasonal risks and opportunities at farm and commodity scale (read more here, http://bitly.ws/IuiW)
- ObsCheck, a weather quality control service to check private automated weather stations and unlock value from non-Bureau weather observations.

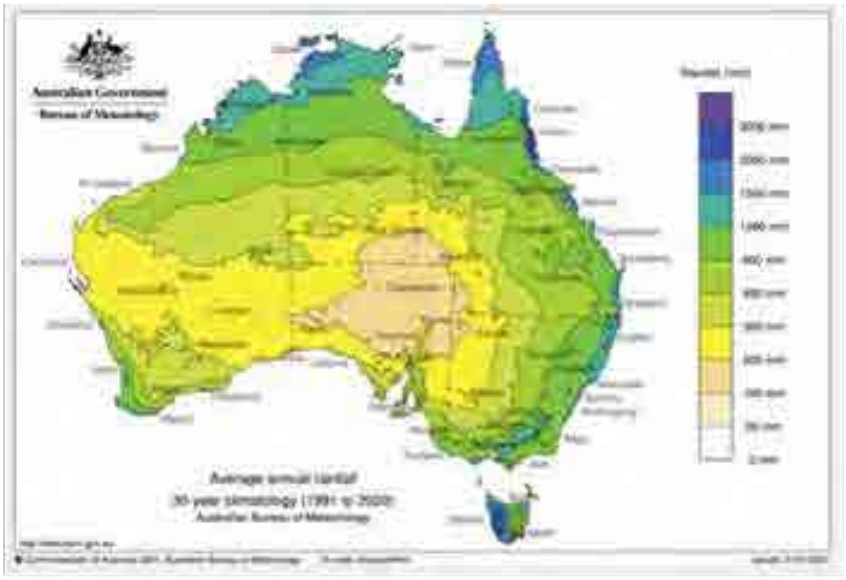
HISTORICAL OBSERVATIONS

When discussing weather, 'historical' refers from one week ago to the beginning of recorded weather records. The Bureau houses an extensive collection of weather observations and historical data on their website, dating back to the 1800s for some locations.

Historical data is particularly valuable if you find yourself in a new area. By accessing this data, you can gather essential insights about the climate patterns and conditions of the region, providing data, for example, to determine the optimal planting window for crops and understand potential risks associated with weather events.

Find historical data here (http://bitly.ws/PQIw)

In addition to the Bureau's tabulated data archive, the website contains a multitude of average condition maps. These provide a visually comprehensive overview of the aggregated weather conditions in a specific area. The maps encompass a range of parameters, including rainfall, temperature, sunshine, radiation, cloud cover, humidity, evaporation, wind patterns, cyclones and storms, and bushfire occurrences.



Example of the climate maps available. Options exists to select month and state. Image source: screen shot shared via the BOM Creative Commons Licence

Average condition maps serve as a valuable tool for gaining a quick overview of the typical weather patterns and characteristics of an area. The maps can be found here: http://www.bom.gov.au/climate/maps/averages/

RECENT OBSERVATIONS – YESTERDAY TO LAST WEEK

Each state and territory in Australia has its own dedicated **recent observations page**, which records the data from the Bureau's automatic weather stations throughout the country. The BOM app also has observations for the past 72 hours.

Most weather stations report their data every 30 minutes, providing regular updates on temperature, humidity, wind speed, and other relevant parameters. However, some stations may only report once a day, so it is crucial to keep this in mind when accessing the observations.

Not all stations accurately represent the microclimate of specific properties

Factors such as local topography and vegetation can significantly affect weather patterns.

Rainfall measurements are recorded by an extensive rain gauge network which comprises a combination of Bureau-owned and privately-owned stations.

How to find recent observations

Website: BOM home page → click on your state or territory on the map of Australia → middle column, click the first link 'All observations' → In the left column (Latest Weather) choose latest observations, observations via clickable map then navigate to

Example of recent observations as displayed on the BOM app. Image source: screen shot shared via the BOM Creative Commons Licence

the weather station closest to your property.

Phone app: Search your location at the top; select 'past' on the bottom menu

NOWCASTING – NOW TO A FEW HOURS AHEAD

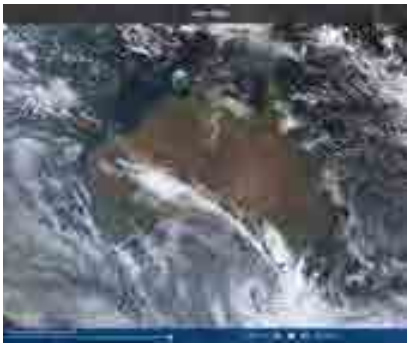
Nowcasting provides real-time weather information for the immediate future, typically ranging from the next minute to the next hour. This becomes particularly important during significant storm outbreaks or periods of extreme or catastrophic fire dangers when a wind change is anticipated.

The **radar** (http://www.bom.gov.au/australia/radar/) is the most accessed nowcasting tool, beloved by urban and rural Australians alike, and is used to view and track rainfall and storm events.

The Doppler radar (denoted by the black diamond symbol) can also capture smoke and insect swarms under some conditions.

Another essential tool is the **satellite viewer** (http://satview.bom.gov.au/), which displays fresh images every 10 minutes. While a fast internet connection is necessary, this tool plays a significant role in providing visual information.

Additionally, the BOM app offers a satellite tool that provides images every 90 minutes. While it may not capture new storm developments, it extrapolates existing weather patterns to predict their future behaviour and movement.



Satellite view of Australia, updated every 10 minutes: screen shot shared via the BOM Creative Commons Licence

Positioned below the radar on the website, the satellite tool offers users an astronaut's view of weather patterns. By correlating information from these tools, individuals can make informed decisions relating to weather. For example, anticipate the arrival of a cold front by observing cloud movement on the satellite view and track current storms using the radar.

It is important to note that not all clouds result in rainfall. It is therefore beneficial to switch between the radar, which shows rainfall intensity, and the satellite tool, which provides insights into cloud cover and storm formation. This analysis aids in accurately assessing rainfall prospects.

Warnings are another integral part of nowcasting, providing timely updates and guidance.

The Bureau's website also features a **rainfall viewer/update tool**, which visually displays the latest rainfall data on a map. Users can zoom in to their specific area, and the tool covers a daily period up to three years. Additionally, users have the option to view the data in a tabular format for a more detailed analysis.

Find the rainfall tool here

(http://www.bom.gov.au/climate/rainfall/).

FORECASTING AND FUTURE CASTING – NEXT WEEK TO NEXT SEASON

Have you ever wondered what lies ahead in the coming weeks, months, or even seasons? Weather

Visual presentation of recent rainfall. Image source: screen shot shared via the BOM Creative Commons Licence

forecasters rely on advanced modelling techniques to provide insight into future weather patterns. In Australia, the Bureau uses the Australian Community Climate and Earth System Simulator (ACCESS) model, specifically developed by their scientists to cater to the unique needs of the Australian climate.

These models are continually refined and improved over time, ensuring that the forecasts generated are accurate and reliable.

MetEye (http://www.bom.gov.au/australia/meteye/) provides a summary of these predictions. By default, the tool displays wind information but can be customised to show other parameters of interest.

Met eye map displaying wind forecasts. Image source: screen shot shared via the BOM Creative Commons Licence

Users can zoom in on specific locations or search for a particular area to obtain a comprehensive forecast for the next seven days, offering useful insights on whether the conditions will be suitable for on-farm activities like planting, spraying, irrigating, and harvesting.

The percent chance of rain displayed in the forecasts represents the likelihood of precipitation based on the consensus of various weather models. This information offers valuable insights into the probability of rainfall occurring in a specific area.

Future casting looks ahead to seasonal and long-range forecasts. These forecasts play a vital role in decision-making in agriculture. The Bureau's Climate and Past Weather section offers climate outlook maps, empowering users to gain a deeper understanding of future climate trends and anticipate any potential extreme weather events.

Climate outlook maps visually illustrate the modelled three month forecast. Image source: screen shot shared via the BOM Creative Commons Licence

Within the Climate and Past Weather sits the outcome of the **Forewarned is Forearmed** project. This provides additional tools to help producers prepare for extreme weather conditions.

The **Chance of Extremes** function enables users to determine the severity of dry periods by comparing historical records, helping to plan and mitigate potential risks. Similar analysis can be conducted for temperature data, and three-day rain events with rainfall probability maps displaying the likelihood of exceeding 3-day rainfall totals, ranging from 15mm to 75mm in the weeks and fortnights ahead.

For those interested in the **accuracy of the model's forecasts**, the Bureau offers an accuracy map. Generally, the model exhibits higher accuracy during winter months, providing users with a reliable estimation of future weather conditions.

How to find the forecasting tools

BOM homepage under → Climate and Past Weather →long range forecast.

EVAPOTRANSPIRATION

The Bureau offers evapotranspiration forecasts via its Real-time Data Services, which are subscription-based services.

Registered users can access the evapotranspiration grids, based on the Australian digital forecast database, via an FTP (file transfer protocol) system (Product ID IDBZ0003, Product Name, ADFD Evapotranspiration Grids – Australia (state-based) – Bundle).

The gridded evapotranspiration forecasts are updated twice daily, and include one to seven day forecasts.

More information on this service is available at http://reg.bom.gov.au/reguser/reguser.shtml

A service catalogue and charges for registered users at http://reg.bom.gov.au/other/charges.shtml

A user guide can be downloaded at http://reg.bom.gov.au/catalogue/Gridded_Evapotranspiration_User_Guide.pdf

Modelled data on evapotranspiration is also available through the Bureau's free to use **Australian Water Outlook** (https://awo.bom.gov.au/products/historical).

This interactive website offers comprehensive information on various components of the landscape water balance, including soil moisture, runoff, evapotranspiration, and precipitation across Australia.

The Australian Water Outlook allows users to access information over different timescales. For historical data, daily gridded outputs of precipitation, soil moisture, runoff, and deep drainage are available from 1911 until the previous day.

Seasonal forecasts, covering a range of 1 to 3 months, provide monthly outputs for root-zone soil moisture, evapotranspiration, and runoff. These forecasts are updated monthly to provide the most accurate information. Additionally, the website offers projections of changes in precipitation, soil moisture, evapotranspiration, and runoff for aggregated periods extending until the end of the century.

These projections are based on different greenhouse gas concentration pathways, multiple Global Climate Models (GCMs), a downscaled Regional Climate Model (RCM), and are corrected for bias.

THE BUREAU'S DATA ARCHIVES

Access for past weather and climate information is available from the Bureau's vast data archives, including data on temperature, humidity, rainfall, air pressure, sunshine, wind speed and direction, cloud and visibility.

Much of the information is free to download, although some charges may apply for specific services.

More information is available here:

http://reg.bom.gov.au/climate/data-services/

For any questions on the tools outlined, please contact agriculture@bom.gov.au

IMPACT OF SEED SPACING ON POTATO YIELD AND SIZE:

A demonstration by PotatoLink

Potato growers know that seed is an expensive input not to be wasted. Yet inefficient planting and spacing, including skips and doubles, can be costly. Optimising seed spacing provides a real opportunity to minimise inputs while maximising yield. To evaluate the economic impact of poor planter performance, PotatoLink conducted a demonstration on the impact of seed spacing on potato yield and size.

Figure 1. Example skips and doubles, 21.12.22

Planting seeds further apart than intended, for example when spaces are skipped, is a poor use of paddock space and leads to an uneven crop, with varying plant and tuber sizes. Uneven crops need uneven inputs and water, which quickly becomes a management headache.

Doubles, in contrast occur, when two seeds are dropped in the same space, leading to competition for nutrients, light, and space, and ultimately also an uneven crop (Figure 1).

There are many factors that can influence successful, even planting including:

- Speed of the planter - 5.8-6.1 km/hr is ideal
- Seed uniformity
- Seed shape
- Cut versus whole seed
- Planter functionality
- Best practice, for example planter should always be calibrated prior to planting

Generally, the optimal seed spacing distance is determined by several factors. Seed age, variety, end use market (for example seed crop vs processing crop), and disease management (for example closer space results in smaller tubers which helps with the management of hollow heart) all need to be considered.

THE DEMONSTRATION SET UP

For this trial, potato processing variety FL 2215 tubers were planted in November 2022 on a paddock that had a long history of growing lucerne crops (Figure 2). Seeds, planted in November, enjoyed an ideal growing season.

The soil was light textured. It was the first time that the paddock was planted with potatoes, so volunteers and disease did not present a problem. *A Grimme 6 row* planter was used with spacing set to 26cm between seeds and a planting speed of 6km/hr.

To assess seed spacing variability and the efficiency of the planter, the team opened the furrow after the planter had planted the crop (on the same day of planting) to confirm the actual distance. Space between seeds was manually measured and recorded. By

Figure 2. Planter on day of planting – 21.11.22

Figure 3. Demonstration layout, precision spacing, demonstration area (22 cm spacing left row, 30cm spacing right row) – 21.12.22

Figure 4. Crop at flowering in demonstration area

way of comparison, a small test area was then planted with three different seed spacings: 22cm, 26cm, and 30cm, which could then be compared to the control (26cm by the planter) (Figure 3 and 4). Please note this demonstration was not a replicated trial.

The crop and demonstration area were grown under usual conditions, with data collected from the demonstration as the crop neared harvest. Data collected included:

- Number of plants
- Number of stems per plant
- Number and size of tubers (<40mm, 40-60mm, 60-90mm, >90mm)
- Weight of tubers from the control (machine planted) and demonstration (hand planted) areas

RESULTS

The degree of variance of the planter was assessed by analysing a 10m row. On average, the planter planted at the desired rate (26cm) of seed per hectare. However, the average deviation between seed spacing was 8.8 cm or 33%. The Potato Manual provided an example where a spacing of 25cm should have 40 seed pieces within a 10m area. It suggests that +/- 2/40 seed pieces (5% variability) in 10m is an acceptable variability. The planter performance, including planting speed, has room for improvement, and economics justify it.

In this demonstration, the 30cm spacings returned the highest **yield**, outyielding the closer spacings (26cm and 22cm) by around 4% for this variety (Figure 5). All precision plantings outyielded the planter. However, it is important to note that tubers <40mm and >90mm were excluded from yield calculations as they are not accepted by the processor. Also, yield from the '26cm planter' was calculated from a low number of repetitions.

Tuber size by count revealed a greater number of larger tubers in the 30cm and 26cm spacings, highlighting that bigger spacings returned larger potatoes. 30cm = 61% at 60-90mm, 22cm = 54% at 60-90mm (Figure 6)

The 30cm spacings also returned a greater average number of tubers per plant (Figure 7). 30cm = 11 tubers/plant, 22cm = 9 tubers/plant - which concurs with expectations.

Also as expected were the results for Tubers/m (Figure 8). Total tubers per metre was greater for 22cm = 39 tubers, compared to 30cm = 37 tubers - i.e. smaller seed spacing = more plants in a given space = more total tubers.

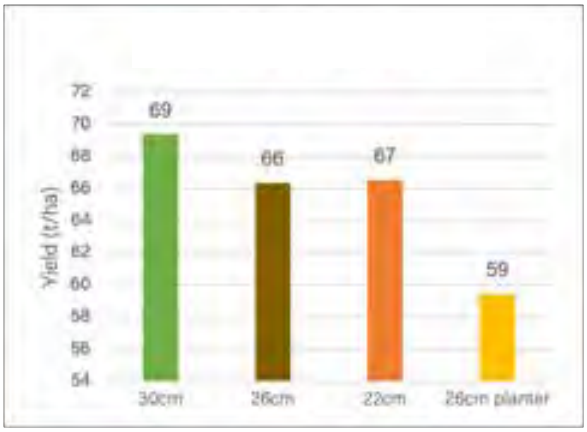


Figure 5. Marketable yield

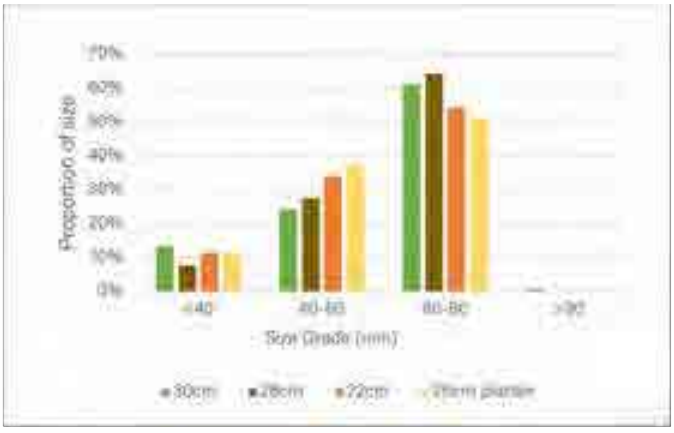


Figure 6. Tuber size at different spacings

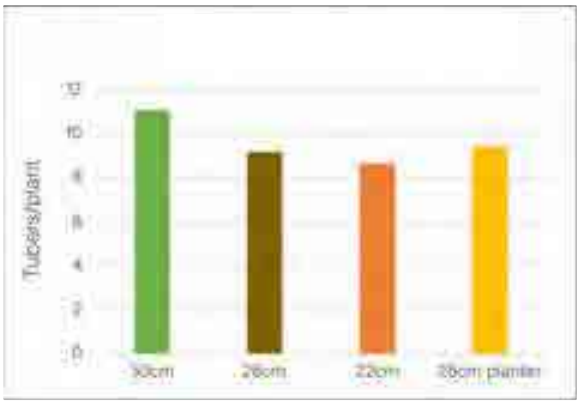


Figure 7. Tubers/plant

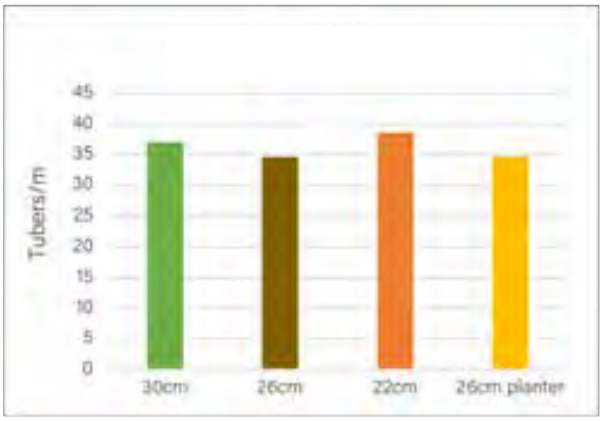


Figure 8. Tubers/metre

THE ECONOMIC BOTTOM LINE

Calculations in Figure 9 are based off an average seed size of 65g, costing $1000/tonne of seed.

For this particular crisping variety in this situation, 30cm spacing returned the best yields, greatest tuber size and lowest cost of seed/ha.

The 59t/ha of yield obtained in the 26cm planter area of the demonstration was lower than the 64t/ha predicted by the grower, highlighting the importance of seed spacing on potato yield and size. An increase in seed spacing can significantly reduce the overall amount of seed required and cost, however it is important to consult with your seed supplier on the optimum spacing, as it will vary from variety to variety.

The Potato Manual suggests calibrating the planter before planting and conducting regular in-paddock checks to ensure seeds are placed at the correct spacing in the row. This can help to reduce costs and improve yields and quality.

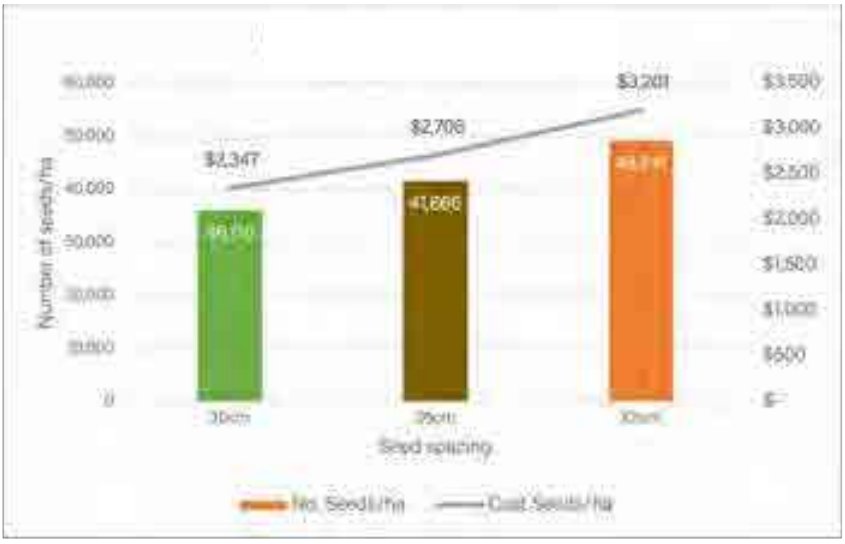


Figure 9. Number and cost of seed/ha

EYES ON THE WORLD

RECENT ADVANCES IN POTATO RESEARCH AND INNOVATION

The effect of concurrent elevation in CO_2 and temperature on the growth, photosynthesis, and yield of potato crops

Lee YH, Sang WG, Baek JK, Kim JH, Shin P, Seo MC, Cho JI

PLoS One. 2020 Oct 21;15(10):e0241081. doi: 10.1371/journal.pone.0241081.

WHAT IS IT ABOUT?

In 2016, global CO_2 concentrations passed 400 ppm for the first time since the Pleiocene Era, 3 million years ago. This was a time when forests retreated, giant ground sloths grazed on spreading grasslands, and the first humans stood up on two legs and surveyed the savannah around them.

CO_2 now stands at 419 ppm and rising.

The effects of high CO_2 on plant growth has been a research focus since the 1990s. Potatoes today are growing with 25% more CO_2 than they were then.

One of the positive impacts of high atmospheric CO_2 is that it is easier for plants to assimilate carbon. It also reduces 'stomatal conductance' – that is, the amount of water plants lose by keeping their stomata open to capture CO_2.

Much early research focussed on wheat and rice. High CO_2 was found to increase yield – mainly due to an increase in grain size, rather than number – but also to reduce nutritional value. However, grasses (C4 plants) are already more efficient at getting carbon than plants such as potatoes (C3 plants). This suggests that the effects of high CO_2 on potatoes could be greater than those on grain crops.

This South Korean study from 2020 examined how elevated temperature and/or CO_2 concentration impacted potato plants. The researchers used controlled chambers that allowed them to regulate temperature and CO_2 levels under daylight conditions.

The plants were exposed to normal temperatures, normal temperatures elevated by 4°C, increased CO_2 (800ppm), and elevated temperature and high CO_2 combined.

The researchers measured various plant parameters including stomatal conductance, chlorophyll concentration, and nutrient uptake. They also analysed CO_2 gas exchange rates to determine the rate of photosynthesis and carbon accumulation in the plant. Yield, including both the total number of tubers and size range, was also recorded.

WHAT WAS CONCLUDED?

Plants grown at elevated day/night temperatures of 25°C/19°C had lower stomatal conductance and reduced photosynthesis. As a result, they were smaller than those grown at 21°C/15°C. Effects were strongest during the late stages of growth, as daily temperatures rose.

Unsurprisingly therefore, higher temperatures significantly reduced yield. Each plant averaged only 6.4 tubers weighing a total of 342g, compared to 10.2 tubers weighing 502g when plants were grown under the ambient temperature range.

Increasing atmospheric CO_2 to 800ppm (combined with ambient temperatures) also reduced leaf chlorophyll and stomatal conductance (and potentially, therefore, water use). Despite an increase in mid-size tubers (30-80g), total yield was not significantly affected.

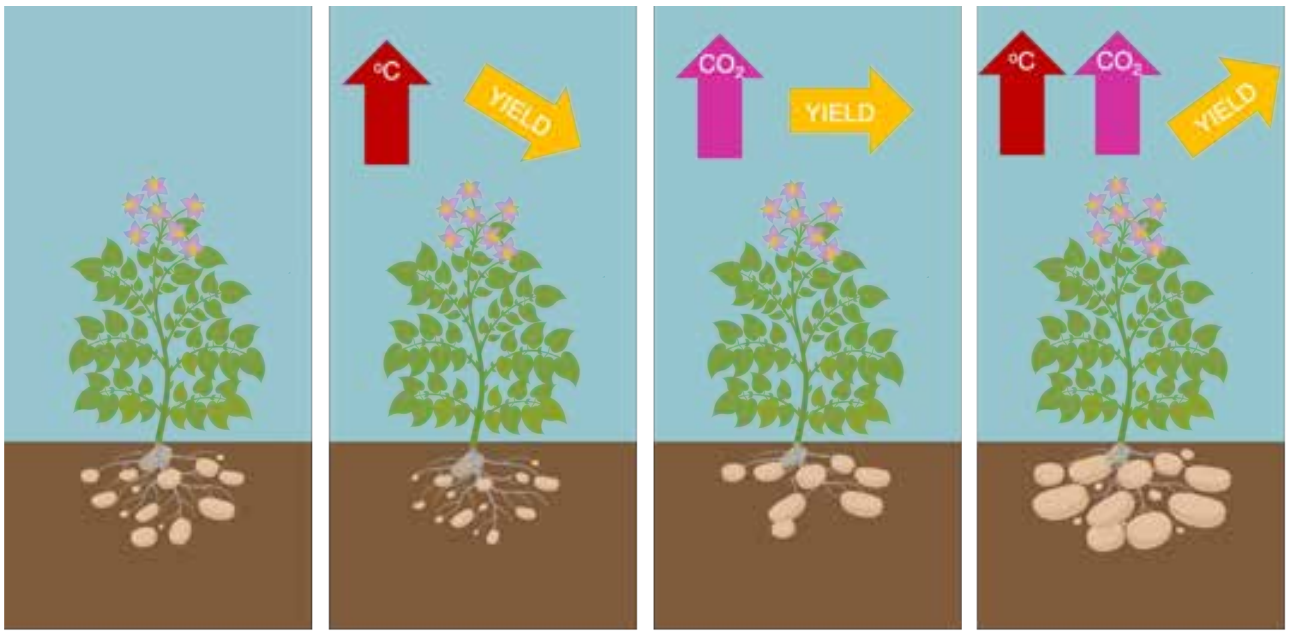
However, the most dramatic effects occurred when high CO_2 was combined with high temperatures. These conditions significantly increased growth, development, and photosynthetic rate during tuber formation and bulking. The result was a 20.3% increase in tuber yield, with a total of 604g/plant. This was mainly due to larger tuber size rather than an increase in the number of tubers/plant.

Despite increases in the C:N ratio, there is some evidence that the efficiency of nitrogen use increases as CO_2 rises. Unfortunately, elevated CO_2 also affected nutrient concentrations, reducing chlorophyll, magnesium and phosphorus levels in the plants.

Although mineral concentrations in the tubers were not measured, these results are consistent with previous work finding lower nutritional quality in grain crops grown under high CO_2.

Overall, the study suggests that the negative impacts of high temperatures on potato growth and yield, especially during the later stages, are mitigated by high levels of CO_2. When the two occur together, the balance between source (CO_2) and sink (tuber) means there is a positive effect on potato productivity and quality.

This is not to say that climate change is good for potatoes. Increased frequency and severity of negative weather events is going to challenge our ability to grow all crops. Moreover, high temperature will inevitably create major challenges for growers, as will the dry conditions that often accompany heat. However, this study does demonstrate the adaptability of the potato plant, and its ability to make the most of the atmosphere around it.



NORMAL TEMPERATURE (21/15°C), AMBIENT CO_2 (CONTROL)

AMBIENT CO_2, ELEVATED TEMPERTURE +4°C (25/19°C)

NORMAL TEMPERATURE, ELVEVATED CO_2 (800ppm)

ELVEVATED TEMPERATURE, ELVEVATED CO_2

DISPATCH FROM ... VICTORIA

This issue, our dispatch comes from PotatoLink regional rep Stuart Grigg in Victoria.

EVENTS

Professor Andy Robinson from North Dakota State University visited the Ballarat region to conduct a presentation and field walk with growers on weed management and herbicide damage. Despite the wild, wet, and cold weather, forty-five brave growers and industry representatives participated in the event. The discussion during the field-walk included more general concerns regarding the impact of the cool and short summer on this year's yields, as well as the delay in planting due to a wet winter and the dry summer, which put pressure on irrigation resources.

Trials on the local Quinlan property (thank you Tom and Neville), included one on mycorrhizae treated seed, harvested in late April. Local growers attended the field-walk to observe any visual differences and discuss the results, which will be shared in future PotatoLink communications.

Additionally, a second study was carried out on the Quinlan Farm on remote moisture sensing probes, which highlighted the importance of monitoring soil moisture after a rain event.

An Integrated Pest Management (IPM) trial was conducted to study the benefits of 'bug-scouting' for economic thresholds versus regular pesticide added in a tank mix.

The trial resulted in a zero-pesticide application in one season without any loss of yield.

CHALLENGES

Growers in the region cite the current costs of production a major challenge. The added uncertainty of the short and cool summer could make this a difficult year for some local growers... but everyone is spudermistic!

EXTRA RESOURCES

- Case study Mycorrhizal fungi at the Bolwarrah Victorian demonstration site (http://bitly.ws/Ruim)
- Feature article Managing herbicides and herbicide injury (http://bitly.ws/Ruiq)

CONTACT

For more information about PotatoLink activities in Victoria, contact Stuart

stuart.grigg@potatolink.com.au

HORT INNOVATION PROJECTS

Project name	Code	Lead organisation	Description	Fund	Start and end date
Potato industry minor use program	PT16005	Hort Innovation	Used to submit renewals and applications for new minor use permits for the potato industry.	Fresh & Processing	Ongoing
Australian potato industry communication and extension project (PotatoLink)	PT20000	Applied Horticultural Research	Supports growers in adopting improved practices on-farm and communicating new information, research and technology.	Fresh & Processing	08/12/2020 – 30/11/2025
Management strategy for serpentine leafminer, Liriomyza huidobrensis	MT20005	Queensland Department of Agriculture and Fisheries	Delivering targeted R&D specifically for serpentine leafminer in response to the incursions detected in late 2020.	Multi fund including Fresh & Processing	19/03/2021 – 30/11/2023
Regulatory Support & Response Co-ordination	MT20007	AKC Consulting Pty Ltd	Provides key information regarding domestic and international pesticide regulation	Multi fund including Fresh & Processing	30/06/2021 – 01/07/2024
Consumer behavioural data program	MT21004	Nielsen	Provides regular consumer behaviour data and insight reports, through the Harvest to Home platform (www.harvesttohome.net.au)	Multi fund including Fresh	20/01/2022 – 20/11/2026
Feasibility/scoping study: Surveillance and diagnostic framework for detecting soil-borne pathogens in vegetable industries	MT21016	NSW Department of Primary Industries	Examining the potential to develop a national surveillance and diagnostic framework for soilborne pathogens of vegetable crops including potatoes	Multi fund including Fresh & Processing	11/10/2022 – 31/08/2023
Generation of data for pesticide permit applications in horticulture 2022	ST22001, ST22003 and ST22004	Agreco, Eurofins Agroscience Services and Kalyx	The generation of pesticide residue, efficacy and crop safety data to support label registration and minor use permit applications and renewals made to the APVMA.	Multi fund including Fresh	16/05/2022 – 15/12/2025
People development strategy for the vegetable, potato, onion, and banana industries	MT22002	RMCG	Building a People Development Strategy to guide future investment in building capacity and capability within a range of industries including potatoes	Multi fund including Fresh & Processing	12/12/2022 – 01/07/2023
Horticulture trade data	MT22005	IHS Global	Provides Hort Innovation with a subscription to the Global Trade Atlas Database.	Multi fund including Fresh & Processing	14/12/2022 – 01/12/2025

Potatoes Australia Ltd is proud to host the

12th WORLD POTATO CONGRESS (WPC 2024)

Adelaide, Australia, 23 - 26 June 2024

The next World Potato Congress will be hosted by Potatoes Australia in June 2024.

The congress gathers potato professionals from all over the world to meet and share ideas and knowledge.

World Potato Congress Inc. is a non-profit organisation supported by a group of volunteer directors representing potato jurisdictions around the world.

GET INVOLVED

Information on sponsorship opportunities, registration, social events and tours, exhibitors and a preliminary program is now available.

Scan the QR code for more information.

POTATOES AUSTRALIA

The Voice Of The Potato Industry Value Chain

WPC 2024

ahr applied horticultural research

Hort Innovation POTATO – FRESH FUND

Hort Innovation POTATO – PROCESSING FUND

POTATO LINK
AUSTRALIAN POTATO INDUSTRY EXTENSION PROJECT

vegnet update

VegNET is funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government.

National Vegetable
Extension Network

NATIONAL

REAG - Regional Extension Advisory Group

Did you know that in every region there is a VegNET Regional Development Officer (RDO) there is a Regional Extension Advisory Group?

Should I know about this group? Yes, absolutely you should know about this group.

What's a Regional Advisory Group?

The Regional Extension Advisory Group (REAG) oversees the development and implementation of the Regional Extension Strategy and annual plan. This works to ensure the VegNET program meets the needs of the vegetable industry in your region.

The REAG maintains a strong connection with the VegNET Regional Development Officers to ensure the project remains dedicated to achieving its intended outcomes. This involves participating in biannual assessments of progress and the efficacy of the Regional Extension Plan implementation by meeting face to face or online.

REAG Members who are they?

Regional Membership of the REAG is at the discretion of the RDO. The proposed members for the REAG include:

- Growers who represent a diverse range of the regional grower community, who are not exclusively from the committee or Board of the delivery partner.
- Technical advisors - Local researchers and agronomists.
- VegNET RDO.

Any relevant documents, and an agenda is distributed ahead of meetings giving industry plenty of time to get an overview of what will be discussed. Minutes and action items are documented and shared by the RDO promptly after meetings. A quorum represented by a minimum of five members is required for decision making so while it would be great to have all members in attendance we can accommodate when not everyone is available.

Overseeing Innovation Fund Concept Proposals

The VegNET Innovation fund is a project funding mechanism designed to address regional and national extension priority areas by providing funding to develop programs of regional importance and cross-regional relevance. The REAG works with the RDO to develop potential concept proposals including the design, project and financial management, and evaluation.

Innovation funds are released by Hort Innovation twice per year to be specifically used to address national priority areas as identified by the RDO and the National Coordinator from collated regional prioritisation.

The following outlines the roles and responsibilities of REAG members.

REAG

Role/Responsibility

- Oversight of implementation of Regional VegNET project
- Endorsement of regional strategy and annual plans
- Assisting RDO in administration of innovation fund, including prioritisation of projects, project refinement, ongoing project oversight and outcome reflection.

RDO

Role/Responsibility

- Project delivery / Risk Management
- Financial Management / Reporting
- Communications / Secretariat for REAG

REAG Members

Role/Responsibility

- Make time commitment to attend REAG meetings as scheduled
- Actively participate in discussions regarding project oversight and innovation funds.

If you are a vegetable grower that is interested in learning more about the REAG or the Innovation Fund, please get in touch.

LOCAL RDO CONTACTS

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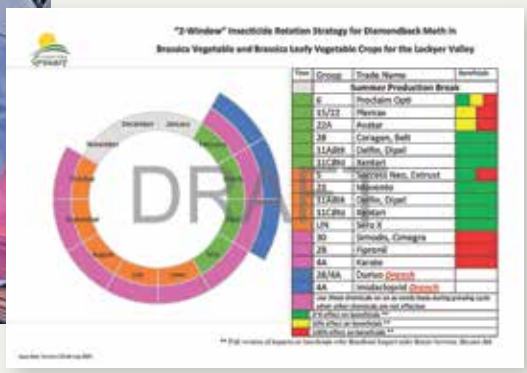
VegNET 3.0 is a strategic levy investment under the Hort Innovation Vegetable Fund.
This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government.
Project Number: VG21000

Hort Innovation VEGETABLE FUND



Top. The agronomist group discussing the Strategy at the first meeting. Above. Draft Strategy.

VEGNET SE QLD LOCKYER VALLEY

Regional Update

Diamondback moth and new chemistry strategies

The introduction of new chemistries to the market for diamondback moth means a new strategy for our region. Local agronomist Greg Teske, growers and DAF met to devise the way forward.

Chemical Resistance – DBM specifically

Due to the high value of produce grown in the Valley, it is critical that growers are vigilant in their approach to pest management and employ methods which are both effective and sustainable.

One of the biggest production challenges for brassica growers in the Valley is the control of Diamondback Moth (DBM). From the late 1980s there have been cases of insecticide resistance and since that time growers have employed an integrated pest management (IPM) approach to pest control.

Chemical resistance was first noted in Queensland in the mid 1980s.

The first IRM (integrated resistance management) program was initiated in the late 1980s.

Late 1990s new chemicals were registered and the first 2 window rotation strategy employed.

By 2006, 40% of growers followed the strategy, but with the release of Group 28 chemicals, many growers reduced or stopped using the softer option *Bt's,* as the Group 28 options were more effective.

In 2017, growers began reporting poor spray efficacy in brassicas targeting Diamondback moth. 2018 significant resistance to chemicals in the Lockyer Valley was noticed particularly to the Group 28 Insecticides by agronomists and growers.

Insecticide resistance testing validated growers' concerns with Diamondback moth showing increased tolerance to all IPM compatible pesticides registered in brassicas apart from *Bts.*

A series of initiatives led by industry to address the problem included development of an Insecticide Resistance Management Strategy and monitoring and evaluation of the adoption of the program.

Survey results showed 100% of industry were aware of the Insecticide Resistance Management Strategy.

2018 the first Lockyer Valley DBM IPM was introduced. In 2020 this was revisited and improved with a 2-window approach ratified by CropLife Australia. This year new chemicals have become available, with the IPM strategy revisited. Further testing for chemical resistance of DBM are planned.

Greg Teske (Elders) has been an agronomist in the Lockyer Valley for 25 years. He has a deep understanding of the crops and the issues which face the vegetable growers in the Lockyer Valley. He has been involved in previous discussions around Diamondback Moth and insecticide resistance and rotation strategies.

Greg was interested in reviewing the work done by previous RDO in the Lockyer Valley on chemical resistance. The previous work had not been reviewed by the local agronomists for many years, due to the difficulties of arranging face to face meetings with local agronomists, new agronomists in the area and the introduction of new chemistries.

A working group was established to review the previous chemical scheduling in the Lockyer Valley at meetings for agronomists to discuss the previous plan and the new plan.

Onboard the plan is Syngenta's Robert Vitelli, with the view to utilizing Durivo, with limited access for the nursery industry. Further meetings with agronomists will work toward a system of communication between agronomists, growers and DAF including the likes of Withcott Seedling and Boomaroo Nurseries. Any new program is yet to be ratified by CropLife. The plan outline is shown in the Draft Strategy.

FIND OUT MORE
Contact Darren Brown, Lockyer Valley Growers on 0456 956 340 or email ido@lockyervalleygrowers.com.au

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This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government.
Project Number: VG21000

VEGNET
WIDE BAY BURNETT

Regional Update

Wouldn't it be nice to manipulate the ripening process of field grown fruit?

Capsicums and Chillies

There are many factors that play an important role in the ripening process of capsicums and chillies, including climatic conditions. Cooler months tend to see a delay in the ripening of field grown fruit and warmer months generally accelerates ripening. Due to these uncontrollable conditions in field grown produce, it would be a game changer for growers to have more control on the timing of ripening. Market demand is all year round for the produce, therefore having control of supply into markets will be advantageous for both growers and consumers.

The Wide Bay Burnett Region is one of the largest growing regions of capsicums and home to Australia's largest vertically integrated chilli producer. Other growing regions across the nation will also benefit from further research into controlled ripening of marketable fruit to maximise returns, thereby supporting overall increased economic outcomes for all producers.

There are many benefits to being able to control the ripening speed of marketable fruit. This includes:

- Uniformity of crop
- Shorter cycles of crop (reducing farm inputs which will see a cost saving f or producers)
- Greater control of picking schedules
- Consistent supply of product to retailers
- Better post harvest quality (shorter ripening times may have positive influence on internal rot symptoms and other post harvest quality issues)
- Reduction of organic waste streams

Further research into products which may assist in manipulating the ripening process is of great interest for producers across the Wide Bay Burnett and Southern Downs growing regions. This issue is being pushed from the ground up and the VegNET Regional Development Officer will be continue working with Hort Innovation into how this piece of work could complement their existing research projects (VG17012).

Hort Innovation are currently working with Applied Horticulture Research looking at the physiological and environmental impacts on Internal Rot symptoms. If you would like to know more about the current Internal fruit rot of capsicum (VG17012) project please visit the Hort Innovation website - **horticulture.com.au/growers**/help-your-business-grow/research-reports-publications-fact-sheets-and-more/vg17012/

Many growers from across the Wide Bay Burnett region have already put their hand up to be part of any trial work around the manipulation of ripening and current internal rot research. The VegNET Regional Development Officer will be continue working with Hort Innovation, Applied Horticulture Research and growers to support the development of further research in this space.

If you would like to take part in one of the Wide Bay Burnett VegNET trials, or have an issue you would like to discuss, please contact your Regional Development Officer Jessy Logan.

FIND OUT MORE

Contact Jessy Logan, Bundaberg Fruit and Vegetables Growers on 0407 366 797 or email **VegNET@bfvg.com.au**

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Hort Innovation VEGETABLE FUND

VEGNET
WIDE BAY BURNETT
Regional Update

Top. Head of Sales Christian Patterson and Head of Customer Accounts Prudence Powell with the Escavox device in a box of chillies.

Bundaberg trial puts the heat on pre-cool priority

Growers frequently pay the price for many of the breakdowns in the supply chain with their produce being rejected or downgraded due to failures in the cold chain from farmgate to the retailer.

While these rejections and downgrades can be for many reasons, the cold chain plays a significant role in protecting and prolonging the shelf life of the produce and has the potential to exponentially reduce the amount of organic waste produced in the supply chain.

All fresh produce has a limited shelf life and as such, time and condition of the produce from paddock to plate is critical for consumers to maximise the use of their purchase. All produce from the moment it is harvested, begins to degrade, which is continually mitigated during the supply chain journey to ensure the produce is delivered to the consumer as fresh as possible.

The VegNET program partnered with Bundaberg Fruit and Vegetable Growers and supply chain intelligence provider Escavox to deliver cool chain monitoring trials utilising real-time tracking systems.

By deploying smart tracking devices with consignments as produce leaves the farm, Escavox enables farmers, and their supply chain partners to see what is happening to the produce as the journey progresses in real-time. Displayed on a dashboard on their PC or mobile device, the information helps food producers understand their operations better so they can improve performance, resulting in fresher quality, lower costs, strengthened revenue protection and reduced waste.

The trial saw six local vegetable growers participate and undertake live data tracking of their produce during transport, from farmgate to a metropolitan market or supermarket distribution centre. Vegetables tracked during the trial included cucumber, zucchini, capsicums, eggplant, snow peas, sugar snap peas, lettuce and assorted leafy greens. The six growers were supplied with up to 30 trackers each with a minimum of six trackers per vegetable type. The trackers used had high-tech features including the collection of real-time cold chain data, including, temperature, humidity, movement and light exposure.

Escavox head of sales Christian Patterson said, "Bundaberg's wide range of produce and the VegNET trial provided a great opportunity to demonstrate the flexibility of our devices to the region's farmers".

While most of the produce being monitored had shorter journeys, primarily into the Brisbane metropolitan area, the sampling area covered as far north as Townsville down to Melbourne, as well as tracks to smaller metropolitan areas including Newcastle and Nambour in Queensland. These variations of transport and depot holding periods were between six and 72 hours of data for a single track.

The trial in Bundaberg showed variable supply chain performance. Two major temperature issues were responsible for poorly performing supply chains; the first being failure to adequately pre-cool produce before dispatch and second was 'warming loads' while in transit.

Escavox head of customer accounts Prudence Powell said, "Of the tracks with the top three scores (classified as perfect, excellent and good), 85% were successfully pre-cooled."

"These tracks still experienced temperature fluctuations in-transit. However, because they were pre-cooled, these fluctuations did not significantly impact the produce," she said.

"When pre-cool failure is observed, it is difficult to remediate the temperature damage caused regardless of how good the temperature control might be for the remainder of the journey."

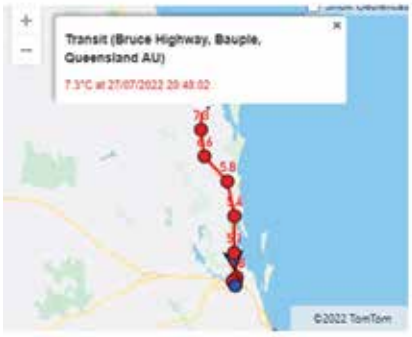
During the trial there were two notable findings:

1. The shipments that were precooled prior to transport arrived with better quality than those that failed to pre-cool prior to shipment. This highlights the critical role pre-cooling plays in maintaining food quality before it is dispatched on transport.
2. Continuous cool chain monitoring from Escavox not only supported any claims with real time evidence of tracking, but it also helped some producers reduce their transport insurance costs. This shows that temperature tracking data can help protect growers when there are cool chain disruptions after the produce leaves their farm gate.

The findings from the trial supported the need for growers to invest in pre-cooling to give their produce the best chance of staying fresh on the supply chain journey. The region's growers are now better prepared to implement better policies and procedures to counteract issues that have been highlighted during the trial.

The VegNET project and Bundaberg Fruit and Vegetable Growers would like to thank all growers who participated, and Escavox for allowing us to utilise their technology and expertise during the trial.

If you would like to take part in one of the Wide Bay Burnett VegNET trials, or have an issue you would like to discuss, please contact your Regional Development Officer Jessy Logan.



Track by leg for device

Top. Escavox device in box of zucchinis. Above. Example of live tracking data showing produce not being chilled at correct temperature prior to leaving facility.

FIND OUT MORE
Contact Jessy Logan, Bundaberg Fruit and Vegetables Growers on 0407 366 797 or email VegNET@bfvg.com.au

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VEGNET FAR NORTH QUEENSLAND

Regional Update

Growers Meeting

Bowen Gumlu Growers Association (BGGA) and Bowen Department of Agriculture and Fisheries (DAF) were recently invited to attend the July Far North Queensland growers meeting hosted by president Jo Moro. The meeting held in Mareeba covered a wide range of regional issues including water management, pest and disease issues, sustainable farming, and plastic waste. Many growers attended the meeting along with representatives of Biosecurity Queensland, FNQ Food Incubator and Mareeba and South Johnson DAF.

BGGA RDO discussed improving sustainable farming practices using biodegradable mulch as an alternative to single use polyethylene mulch. The polyethylene mulch is currently the only available option, which incurs large tip fees. While there was initial hesitancy due to the quality of previous degradable mulches trialled in the region, the growers understood the importance and improvements to the quality and lifespan of the biodegradable mulch and were happy to take the sample rolls to conduct on farm trials. Seven vegetable farmers from Dimbulah and Mareeba took sample rolls and will conduct farm trials over the next three months on a variety of vegetables including sweetpotato, capsicum, chilli, cucumber and zucchini.

Dr Ramesh Puri, (DAF) extension officer discussed the new Fall armyworm (FAW) extension project and asked growers to give a firsthand account of the crops and impact that FAW has had in the region during the past season. Based on the discussion with the growers and agronomists, FAW in the Tablelands has primarily damaged sweetcorn and maize crops. Once these crops are harvested, FAW have also been seen in peanut and sugarcane crops although the damage has not been significant. Fall armyworm is currently controlled through a heavy spray regime in the region with little in the way of biological controls. Maize and sweetcorn are predominately grown in the Tablelands as important crop for the dairy industry.

Growers and agronomists were all enthusiastic to participate in collecting samples for further analysis should they find FAW on other vegetable crops. The growers felt that FAW is currently controlled but are concerned about the ongoing use of the same class of chemistry to control FAW could accelerate insecticide resistance. David Shorten, Extension officer at BGGA also mentioned that the growers must work together to manage this pest as it hosts in multiple crops for survival. Dr Ian Newton, DAF entomologist at Mareeba discussed some good progress on a fungal biopesticide (*Metarhizium sp.*). Early research results are showing promising levels of mortality against FAW. Biosecurity Queensland discussed a recent outbreak of Guava Root Knot Nematode (GRKN) and the steps that the growers could undertake to get free confidential soil samples should they suspect that damage to crops is not a result of a nutrient deficiency or farming practice.

Dr Puri and I visited a wide range of farms discussing the impact of FAW in the region and steps that are being undertaken to tackle this insidious pest. We met with agronomists who showed us firsthand how devastating the pest has been on sweetcorn and maize with a considerable number of growers moving to other crops. Agronomists are recommending a variety of silicate, chemical and biopesticide products to supress the impact of FAW in the Tablelands. David and Ramesh were hosted by Fabian Gallo managing director of HTM Complete specialists in agribusiness solutions in farm automation, including irrigation and fertigation technology. The farm visits showed how digitisation of farming practices can have a significant benefit to growers both in terms of time saving through automation and interaction with agronomists in the field identifying real time pest and disease outbreaks. These AgTech solutions show how far the industry has gone in the past five years and shows the future of the industry through smart digital on farm solutions.

Above L-R. Irrigation tech from HTM Complete. Melon Crop. **Inset L-R.** Joe Moro (President, FNQ Growers), David Shorten (Bowen Gumlu Growers Association, VegNET RDO) and Dr Ramesh Puri (Extension officer, DAF).

FIND OUT MORE

Contact David Shorten, RDO, Bowen Gumlu Growers Association on 0419 429 808 or email **rdo@bowengumlugrowers.com.au**

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Hort Innovation VEGETABLE FUND

VEGNET
NEW SOUTH WALES

Regional Update

Soil health extravaganza to assist growers to improve soil and increase knowledge

NSW VegNET Regional Development Officer (RDO), Sylvia Jelinek has been working closely with the Australian Chinese growers' in Greater Sydney to host a series of tailored workshops on soil. The workshop topics ranged from soil biology education in the field to the basics of soil improvement management using tried and tested techniques and tools facilitated by the Soil Wealth and Integrated Crop Protection (ICP) team. Cover crops, low tillage and soil health monitoring are all on the menu for this well engaged group of growers.

STEP 1 Establishing needs and assistance

VegNET NSW teamed up with the Soil Wealth ICP team to extend and deliver education in soil improvement. A dozen Australian Chinese growers had their soil tested to examine soil properties and have a baseline analysis for recommending soil improvement methods. The soil test participants were invited to a workshop in April at the Local Land Services Demonstration Farm (The Hawkesbury Riverfarm) located in Richmond Lowlands. The workshop was facilitated by Dr Kelvin Montegu from Colo Consulting and Stephanie Tabone, from Applied Horticultural Research (AHR) both of whom are involved in the Soil Wealth and ICP project.

Topics covered were 'Why is soil health important?', 'How to interpret soil tests', and 'Cover crops to improve soil health'. With the rising costs of fertiliser and other farm inputs, growers are keen to challenge their traditional on-farm systems to improve growing of healthy crops and decrease their input expenses. Feedback from the event showed that seven of the nine growers surveyed expressed willingness to try cover crops on their farms for the first time.

STEP 2 Show time – soil improvement with organic matter

In early June, VegNET NSW hosted an Australian Chinese Vegetable Growers Field Day at the Hawkesbury Riverfarm where over 50 eager growers attended with their families. The field day was held in collaboration with the Soil Wealth and ICP team and the support from Golden Harvest and the Australian Chinese Growers Association of NSW. Rotating workshops were held on soil health and nutrition, cover crops field walk, and pests and diseases in leafy brassicas.

Kelvin Montagu ran an infield workshop that focused on organic matter and its impact on cultivation practices. To demonstrate the topic's relevance, a tractor with a rotary hoe was displayed (commonly used tool for farm cultivation), allowing participants to see the negative impact on cultivation and soil health. Kelvin recounted that "the workshop emphasised the importance of organic matter in enhancing soil health, and highlighted various ways to improve organic matter levels, and how it can be lost".

Stephanie Tabone led a workshop on the foundations of healthy soil, including good structure, drainage, microbial diversity and nutrient availability. Growers were introduced to the concept of cover crops and how to select varieties to meet individual grower needs based on their soil types, environment, crop rotations and farming systems. Stephanie reported "the sessions investigated suitable cover crop species, optimal establishment timing, biomass levels for weed control, and managing cover crop termination and residue levels".

Sylvia Jelinek held a pest and disease management forum at the integrated pest management station. Growers had open discussions about what their significant pests and diseases were on their farms and discussed cultural, biological and chemical control options for treating common pests and diseases of leafy brassicas. Growers gained insights into correctly identifying pests and learned where, and how often, to examine plants for indicators of infestation with guidance on the resources available to assist.

STEP 3 Future focus for cover crop adoption

Half the growers surveyed on the day of the event said they would likely change farm practices. Three quarters of respondents want to learn more about Soil Health and Cover Crops. Many expressed enthusiasm to explore planting cover crops in areas usually left fallow between planting/growing seasons, seeing the potential benefits to their growing systems, and reducing their farm inputs.

Hosting the event at Local Land Services Demonstration Farm (Hawkesbury Riverfarm), growers are able to learn so much more in an interactive, hands-on environment. With the encouragement and support from Local Land Services' NSW VegNET team and the Soil Wealth and ICP team, the next steps will be to take the keen participants on a cover crop journey and assisting them with planning and establishing cover crop trials on their farms.

FIND OUT MORE

Contact Sylvia Jelinek on 0427 086 724 or email **sylvia.jelinek@lls.nsw.gov.au**

VegNET 3.0 is a strategic levy investment under the Hort Innovation Vegetable Fund.

VG16078 Soil Wealth and Integrated Crop Protection is a strategic levy investment under the Hort Innovation Vegetable Fund.

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Project Number: VG21000, VG1607

Hort Innovation VEGETABLE FUND

VEGNET VICTORIA NORTH, WEST AND SOUTH-EAST

Regional Update

The Victorian Vegetable Industry on show for students and overseas visitors alike

With the ability to travel internationally there has been interest in learning from vegetable producers in Victoria. This interest in the industry has extended to students as well.

New Zealand Vegetable Growers tour Victoria

In May 2023, the VegNET – Victoria (North, West and South-East) project was able to support a group of New Zealand vegetable growers as they visited and discussed the similarities and the differences between production and supply systems in each country.

The group of 26 consisted of New Zealand growers, agronomists and other industry participants associated with the Dominion Federation of NZ Chinese Commercial Growers.

Beginning the Victorian leg of their journey, the group were welcomed to Tripod Farmers in Bacchus Marsh by Angela Candeloro and Frank Ruffo with a tour and discussion of their packing facilities.

To showcase vegetable production systems and continue the supply chain investigation, the group continued to visit with Adam Schreurs of Schreurs and Sons, and Glenn Favero of Favero Gardens.

While some of the growing and supply chain conditions differed from those the New Zealand group were familiar with, there were shared challenges including the challenge of increasing costs and meeting market requirements that were shared between the two regions.

Visiting the Melbourne Markets in Epping was a great way to conclude the tour.

Vegetable Industry showcased for Agricultural Business Students

In the winter of 2023, a bus load of agricultural business students disembarked at the Boomaroo Nurseries site in Lara, ready to learn about one of the important components of the vegetable industry. With students originating from a wide array of agricultural backgrounds, for many in the group this was a first glimpse into the vegetable industry, providing a snapshot of the challenges as well as the opportunities that exist in the industry.

The group of 38 students are currently studying in their third and final year at Marcus Oldham college, near Geelong in Victoria. Touring both the vegetable seedling and Greenlife facilities the scale and complexity of the industry located almost on their doorstep was an eye opener from some in the group.

Travelling to Werribee South, the group were met by Catherine Velisha and Mark Pullin from Veg Education to continue to build knowledge of the supply chain and local vegetable production.

A visit to Fresh Select and discussion about brassica production with the farm manager, Shane Sutherland. This final visit also allowed time for the students to build their understanding of the production system and to have questions answered.

Leading the tour, agronomy lecturer Andrew Etherton reflected upon the day, saying "While students generally had a good understanding of broadacre cropping or livestock industries, many had little understanding of aspects of the vegetable industry including the challenges of wastage, quality control and timeliness of harvest.

A sincere thank you to the businesses who offered an insight to their businesses, allowed students to take away from the tour an appreciation of the challenges vegetable growers face in the production and supply of quality products. Many students commented on the tour saying that it exposed them to areas of vegetable production they were unaware of or had never considered in the supply of vegetables to consumers".

Above L-R. Tripod Farmers with Adam Schreurs. Catherine Velisha from Velisha Farms together with a selection of the Marcus Oldham students in Werribee South.

FIND OUT MORE

Contact VegNET – Victoria (N, W and SE Regions) RDO Danielle Park on 0432 324 822 or email **danielle.park@ausveg.com.au**

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Hort Innovation VEGETABLE FUND

VEGNET GIPPSLAND

Regional Update

The 10th International Spinach Conference

The 10th International Spinach Conference was brought growers of the Southern Hemisphere for the first time. The International Spinach Conference and its organisers have been dedicated to the exchange of information across the international spinach community.

Organisers Stuart Grigg and Andrew Bulmer of EGVID were the masterminds behind the event coming to Melbourne, with Food & Fibre Gippsland's Bonnie Dawson and AUSVEG Victoria, along with the generous support of Gold Sponsor Bayer: Vegetables by Seminis and partners Hort Innovation and Agriculture Victoria.

Event chairperson Stuart Grigg said that the organising committee were excited about the unique opportunity the conference presented for Australia's spinach industry to learn from international partners and researchers. Presenters and delegates travelled from the USA, New Zealand, the Netherlands, France, Japan, Denmark and Spain to attend this year's Conference.

The Conference featured a jam-packed program including presentations and forums hosted at RMIT University, along with a networking cruise on the Yarra River and a spinach grower field day in Bacchus Marsh.

The Conference was officially opened 1 May, 2023 by Hort Innovation's General Manager of Production & Sustainability R&D Anthony Kachenko. Anthony said "the International Spinach Conference showcased innovation from the Australian spinach industry to the world. The event has opened doors for the Australian vegetable industry to collaborate globally to address future research and development opportunities."

The local Gippsland spinach industry remains at the forefront of spinach production in Australia with twelve Gippsland businesses along the supply chain represented at the Conference, including six key spinach growers from the area.

Session moderator and highly acclaimed researcher Professor Jim Correll from the University of Arkansas lead the delegation through a diverse range of presentations throughout the morning, from pest and nutrient management in the paddock, to consumer preferences on the super–market shelf. Michelle Sands from New Zealand shared the challenges of striking the right balance between environmental management and profits, while Ramy Colfer spoke about the significant organics sector in the USA. Silver sponsors International Fresh Produce Association and One Harvest both piqued the interest of delegates, who presented on food safety and sales performance respectively.

The afternoon session focused more on diseases, with presenters addressing the latest research into downy mildew, stemphylium, damping off and white rust, with multiple presenters emphasising the need for green crop rotations to mitigate disease. Highly respected plant pathologist Dr Lindsey duToit from Washington State University spoke on disease management in spinach seed crops in the Pacific Northwest USA. The presentations generated a lot of questions and discussion amongst the attendees as diseases in spinach are an ongoing topical issue for many growers.

Delegates at the field day at Boratto Farms in Bacchus Marsh saw around 150 different seed varieties and treatments displays from the Conference's Gold and Silver sponsors – BASF/Nunhems, Enza Zaden, Fairbank Seeds, Lefroy Valley, Rijk Zwaan, Syngenta and E.E. Muir & Sons. Boratto Farms generously put on a cooked breakfast and coffee to soothe any sore heads from the night before and to fuel any further technical discussion before the end of the Conference.

Many thanks to all the presenters and attendees who travelled from around the world to be at the event, and to the Organising Committee and sponsors who made it all possible, and such a success – until next time, keep eating your greens!

Bonnie Dawson and Emily Scott, VegNET Gippsland

Above. Group photo in the spinach seed trails at Boratto Farms, Bacchus March.

Inset. Prof. Jim Correll from the University of Arkansas welcoming delegates to the 10th International Spinach Conference in Melbourne.

FIND OUT MORE

Contact Emily Scott, Food & Fibre Gippsland on 0455 214 102 or email **emily.scott@foodandfibregippsland.com.au**

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Hort Innovation VEGETABLE FUND

VEGNET TASMANIA

Regional Update

Herbicide resistance testing in Tasmanian vegetable cropping

With anecdotal evidence of herbicide resistance appearing in Tasmanian vegetable cropping systems, VegNET Tasmania undertook a pilot testing program to find out more. The results were shared with growers and advisers in a cross-industry workshop in late June 2023.

A growing problem

Growers and agronomists in Tasmania have suspected an increase in herbicide resistant ryegrass for many years. Herbicide resistance reduces the effectiveness of herbicide applications, leading to crop losses and reduced productivity and profitability.

This anecdotal evidence, combined with a lack of formal measurements of resistance types and levels in vegetable rotations, led VegNET Tasmania to organise resistance testing. The aim was to provide growers and agronomists with concrete data to better inform their decision making about herbicide applications in their vegetable cropping rotations.

For the pilot program, samples were taken from 14 vegetable production properties across the state after summer crops were harvested in early 2023 and fresh ryegrass germination had occurred. Each paddock was sampled by collecting seedlings from across the germination to provide a representative picture of how resistant the ryegrass population was in the paddock.

These samples were tested against three active ingredients used in herbicides, Clethodim, Fluazifop and Glyphosate, by Plant Science Consulting in South Australia. Clethodim and Fluazifop are both Group 1 herbicides (formerly Group A), while Glyphosate is a Group 9 herbicide. All are commonly used in vegetable rotations in Tasmania.

Results

Given the small sample size and the approach to actively target paddocks suspected of having herbicide resistance, it was no surprise that 13 of the 14 paddocks sampled recorded resistance to Clethodim and Fluazifop. However, only four paddocks recorded resistance to Glyphosate.

It is important to note that if the survey had been completed as a random paddock survey, fewer findings of resistance would have been likely.

This pilot survey shouldn't be considered as representative of all vegetable properties and ryegrass in Tasmania, simply evidence of what we found when we tested for resistance in paddocks with a suspected issue. However, it should encourage vegetable growers who have problems controlling ryegrass to get resistance testing done to implement a suitable spray program.

EXPECTED RESISTANCE

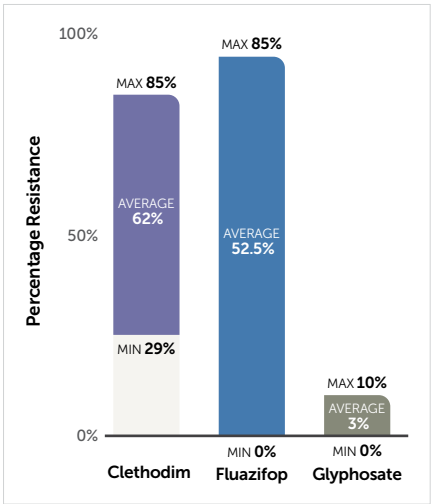

FIGURE 2: Range of suspected resistance results by herbicide (% based on grower expectations)

TESTED RESISTANCE

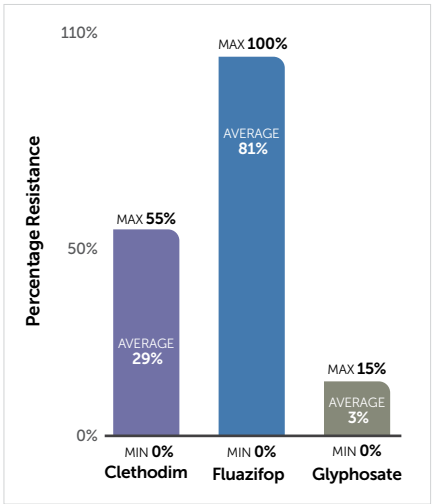

FIGURE 3: Figure 3: Range of actual resistance results by herbicide (% resistance)

Above. Figure 1: Ryegrass was collected while still only seedlings

Figure 4: Peter Boutsalis presenting to a full house at the VegNET cross-industry workshop.

As one paddock was found to have no resistance levels at all, the minimum resistance found was 0% for each herbicide. Notably, Clethodim had much lower levels of resistance than the growers expected to see in their ryegrass populations.

In general, growers were close in their assessments of the percentage of Glyphosate resistance levels. Fluazifop estimates and test results were much more divergent. Overall, growers mostly underestimated their resistance levels to Fluazifop. With Clethodim on the other hand almost every grower overestimated their resistance levels, with only two growers underestimating their results.

These results showed that there is no one size fits all approach to address poor results from a herbicide application. While you may suspect resistance it may be the result of ineffective application (e.g., timing and coverage). Resistance testing equips growers to deal with the actual problem that they are seeing in their paddocks, rather than treating something that may not actually be the issue or unknowingly increase resistance with a herbicide program.

Cross-industry approach

The pilot testing results were shared as a part of a cross-industry workshop at the end of June. VegNET Tasmania was joined by Peter Boutsalis from Plant Science Consulting, who provided details about the mechanisms of resistance and the testing process that he undertook in assessing our ryegrass samples. The workshop also featured one of our growers discussing how he has used pre-emergents in his cereal crops to help reign in resistance issues on his property. One of the agronomists from the ryegrass seed industry briefed us on how the ryegrass seed certification works and the benefits of certified seed.

FOR MORE INFORMATION
see the below resources

Big 6 + 3 Factsheet

tasfarmingfutures.com.au
/s/Big-6-2022-08-24.pdf

WeedSmart

weedsmart.org.au

Plant Science Consulting

plantscienceconsulting.com.au

A key driver of the workshop was to bring together agronomists and field staff from across the spectrum of crops grown in rotation with vegetables in Tasmania. A workshop activity was held to examine the WeedSmart resistance control strategies and how they can be applied in Tasmanian cropping systems. The aim was to encourage discussion and learning from and by other industries and emphasise that weed control should not be a crop by crop recipe approach, but instead a whole farm management strategy.

FIND OUT MORE
Contact Ossie Lang, RMCG on 0430 380 414
or email **ossiel@rmcg.com.au**
VegNET 3.0 is a strategic levy investment under the Hort Innovation Vegetable Fund.
This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government.
Project Number: VG21000

Hort Innovation VEGETABLE FUND

NORTHERN TERRITORY

VEGNET NORTHERN TERRITORY

Regional Update

Tours, conferences and soil health

The recent quarter is one of the busiest times of year for the Northern Territory vegetable sector. The VegNET 3.0 project in the NT has had a large focus on protected cropping this year as a result of rising industry interest.

The project has been working with a vegetable grower in the Acacia Hills region of the NT to deliver a simple hydroponics trial site growing cucumbers and snake bean. Cucumbers is the most popular vegetable to grow hydroponically in the NT, however the trial for snake beans in hydroponics aims to overcome issues with fusarium, soil borne disease which impacts snake bean crops greatly. The jury is still out at this stage regarding the success of snake bean grown in shade houses amid concerns the crop may not have the desired level of sunlight. The trial has brought many learnings so far which are being documented to share with other growers who are interested in growing hydroponically and well as farm visits to the trial site.

Above. Hydroponic Tomato Farm tour.

In July the VegNET 3.0 project through the Innovation Fund, took six NT vegetable growers to the 2023 Protected Cropping Australia Conference in Brisbane. This conference was a great opportunity for growers who were either already doing protected cropping or interested in moving their business into protected cropping in the future. Through obtaining grower feedback several attendees mentioned they met with potential suppliers, gained knowledge in the potential for protected cropping in their region and engaged in knowledge exchange with other growers.

The VegNET 3.0 project has also been busy in the soil health space running trials on the impact of composting and spreadable microbes on soil. We conducted soil tests on several vegetable farms prior to either compost or microbe application and then a few months after application. Both spreadable microbes and compost both improved the CEC of the soil and the compost increased the organic matter composition of the soil. By increasing the CEC the soil's ability to hold onto essential nutrients and provide a buffer against soil acidification increases. Increasing organic matter assists in maintaining soil structure, the supply and retention of nutrients, soil life and water retention.

Looking ahead, the project is gearing up to deliver a second industry tour through the Innovation Fund to take vegetable growers and industry stakeholders to attend a Farm Value-add Industry Tour in Cairns in October 2023. The objective of the tour is to raise industry awareness of the opportunities to increase productivity and profit margins through value-add products. The industry tour also aims to provide networking opportunities for growers and industry stakeholders in the food-tech and value-add production space.

NT trip to Thailand

In April, the NT VegNET 3.0 RDO, a second NT Farmers staff member, seven Growers and an Agricultural Consultant headed to Thailand for a weeklong industry tour on vegetable and tropical fruit production. The tour could not have taken place without the long-standing relationship between NT Farmers and the Department of Agriculture Extension (DOAE), Bangkok who kindly took the participants to farms, businesses, markets and DOAE head office.

The farms visited included asparagus, tropical vegetables, mangosteen, mango and durian farms across central Thailand.

There were many takeaways specific to each commodity visited however there were some overarching points that have seen production and profitability increases for the Thai farmers and agricultural industry in Thailand.

Right. Official meeting with the DOAE in Bangkok.

1. Cluster Farms (Cooperatives)

Thailand vegetable and fruit production is predominately made up of small-scale farmers. Due to small yields, the farmers have low bargaining power when it comes to price and limited market access to sell their produce. Over the years with the assistance of the DOAE, farmers created 'cluster farms' to sell their produce as one. Across different cluster farms have consistently increased market opportunities and sale price through improving produce quality, gaining accreditations, and increasing their bargaining power to receive a better price. For some, it has enabled them to improve the quality of produce, share equipment and reach better markets.

2. Managing your soil is a necessity.

During the trip there was a regular reminder when on these farms that soil management is not a niche interest of some growers, it is seen as a basic management requirement. Composting and compost teas were used on several vegetable farms. One farmer that is part of the Organic Asparagus Growing Farmer Group in the Muang District makes his compost and compost tea with ingredients including rice husk and cow manure. The consensus during the tour was that composting and compost teas were essential for their farm management not an optional extra.

3. Investing in your extension organisations

DOAE is one of 15 departments of the Ministry of Agriculture and employs over 950 people working in Agricultural extension. The investment in extension staff to support farmers was evident throughout the tour. DOAE's focus is to provide agricultural services, research and importantly, to assist farmers to have the capacity to improve their productivity and profitability. A major initiator and driver in the creation and adoption of the cluster farm model across the country is due to the support and assistance from the DOAE. Thailand is ranked 10th in global food export - the extension officers who can work to bring farmers together, to grow to market specifications, and to sell as a cluster farm, ultimately selling an improved product for a better price.

Above L-R. Some of the PCA23 Industry tour attendees. NT Farmers Biosecurity Officer Tisha Tejaya enjoying the fruits of the Durian Farm. An organic asparagus farmer showing the participants how to grade asparagus.

FIND OUT MORE

Contact Mariah Maughan, Vegetable Industry Development Officer, NT Farmers Association on 0417 618 468 email **ido@ntfarmers.org.au**

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Hort Innovation VEGETABLE FUND

WESTERN AUSTRALIA

VEGNET WESTERN AUSTRALIA

Regional Update

VegNET input efficiency project – Grower evaluation & Adaption

VegNET WA has expanded engagement and responded to sparked interest from growers to trial biomineral and soil microbe systems use, practice, applications, costs, and system adaption.

Commonly it is peer to peer conversation that leads the grower to this system. Similar crop lines or soil types; benefits and cost input savings are often the driver for a trial in undetermined crop and soil type.

A recent farm trial in Elleker in the Great Southern region supported through VegNET, provided practical agronomic advice pre-trial -mid and post-trial, diagnostics, soil and leaf tissue, nutritional analysis linkage to product suppliers and a final field investigation analysis and report for the business to define trial results to business application and adoption practice ongoing.

The farm has decided to implement the system across this season's crop production based on bottom line value and the numerous additional environmental and crop health benefits the grower observed.

To gather relevant data, the grower collected soil and leaf tissue samples, made field observations and completed crop monitoring and yield assessments.

TABLE 1: TOTAL NUTRIENT APPLICATION RATES

Treatment	N kg/ha	P kg/ha	K kg/ha
Conventional	87.6	36.5	109.5
Biomineral	50	35	23

The Biomineral system proved more efficient and profitable than conventional methods, yielding quality results with lower nutrient inputs. Soil carbon and nutrition levels were also favourable.

TABLE 2: SOIL ORGANIC CARBON LEVELS

Treatment	Baseline %	Post Harvest %
Conventional	4.11	2.61
Biomineral	3.02	3.73

The Biomineral treatment resulted in a significantly higher nitrogen use efficiency (>30%) compared to the conventional treatment. This can be attributed to the controlled release format of the bio-mineral fertiliser formulation combined with the introduction of free-living nitrogen fixing bacteria.

The Biomineral system practice has displaced the use of water soluble synthetic fertilisers across a wide range of fruit and vegetable line crops due to growers realising the following potential benefits:

- Reduced input and production costs;
- Increased profitability;
- Enhanced product quality, driving market demand;
- Extended product shelf life;
- Increased water and nutrient use efficiency;
- Improved soil fertility and health.

Vietnamese translation of biosecurity videos

Farm biosecurity involves pre-emptively preventing and controlling pests and diseases from entering a production area, anticipating their seasonal arrival or natural spread. It proves valuable during government-mandated farm quarantines and supports applications for 'pest-free place of production' accreditations by showcasing adherence to robust biosecurity measures.

VegNET WA has launched a series of biosecurity videos that have been translated into Vietnamese. The videos were produced by VegNET WA through vegetablesWA and Hort innovation, in partnership with AUSVEG, APC and DPIRD.

Video Topics

Six main pathways for pest and disease spread:

- vehicles and equipment
- staff and farm visitors
- packaging bins and pallets
- waste and weeds
- farm inputs
- wind.

To learn more about biosecurity, visit ausveg.com.au/app/uploads/2021/12/Final-pdf-standard-pest-and-disease-preparedness_compressed.pdf

To watch the video visit youtube.com/playlist?list=PLAURTKEm4kHSuaz112O_UOmXPYMY4FHXe

Scan to view

FIND OUT MORE

Contact contact Katrina Hill on 0427 373 037 or email **katrina.hill@vegetableswa.com.au.**

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Project Number: VG21000

Hort Innovation VEGETABLE FUND

VEGNET SOUTH AUSTRALIA

Regional Update

Grower education and engagement opportunities

VegNET and AUSVEG SA are working collaboratively to bring a range of events to growers, offering them opportunities for education and engagement. VegNET and AUSVEG SA are excited to launch an innovative and exciting emerging leadership program for horticulture. The Emerging Leaders Program is funded by the *VegNET 3.0* Innovation Fund and is being delivered in collaboration with AUSVEG SA.

The Emerging Leaders Program aims to provide young and emerging growers with a range of valuable opportunities to enhance their skills, expand their network, and foster collaboration within the horticulture industry.

Supported by VegNET and AUSVEG SA the program will provide an opportunity for emerging leaders in industry and the supply chain to build networks and knowledge to support the next generation of leaders in our industry. This will bring together and support around 15 key leaders from the younger generation of growers in South Australia, with the goals of improving leadership, peer communication, sharing knowledge and cross-industry networking.

The aim of the program is to build and grow a cohesive cohort of emerging leaders who support one another and direct the program of events as required.

The project will foster our next generation of leaders and build business capability by enhancing the overall succession of the industry, and ensuring a sustainable future for the sector in the state.

The Emerging Leaders Program kicks off on 5 October with an Industry Immersion Tour to Parilla Premium Potatoes for a visit to the largest potato packing facility of its kind in the Southern Hemisphere. Please get in touch with South Australian VegNET RDO, Peta Coughlin, if you want to know more or would like to join the program.

The next event on the calendar for Spring is a Production Field Day being held on 26 October in the Northern Adelaide Plains region. We will be joined by Flux Robotics for a demonstration of their precision sprayer and mechanical weeder, as well as TriCal for all the latest in targeted fumigation options in intensive horticulture. We will also provide an update on our key biosecurity initiatives, such as our Serpentine Leaf Miner monitoring program and the Beet Cyst Nematode test development project.

The Business Masterclass Program will commence again in September with a workshop on Planning for Growth, which will include presentations on marketing for wholesalers and an introduction to business planning. The program will continue in 2024 with two key workshops in March on energy efficiency/carbon management and negotiation skills.

Above L-R. Emerging leader Anthony De Ieso, Grower/Manager at Thorndon Park Produce, REAG Committee Member. Mark Pye, Director, and Renee Pye, General Manager of the Pye Group. Parilla Premium Potatoes will host the Industry Immersion Tour to see their state-of-the-art packing facility. Emerging leader, Aussie Kev, Operations Manager/Grower at LVE Produce, REAG Committee Member.

Working collaboratively on biosecurity solutions

The team has been working collaboratively with a range of stakeholders on several biosecurity initiatives:

- Collaboration with Biosecurity SA to develop a state-based monitoring program for Serpentine Leaf Miner to ensure our ongoing area-freedom claim and provide additional confidence of market access to local producers.
- The VegNET Innovation Fund program to support growers on the Northern Adelaide Plains affected by Beet Cyst Nematode has now commenced. The project will develop a diagnostic test for next season and support commercial trials into management practices. Further information will be available as the initiative progresses.
- Supporting the Soil Wealth ICP team on a demonstration trial aimed at improving crop health by reducing pests through an integrated pest management approach with the adoption of preferably native insectaries. The trial was developed in response to the feedback from key industry stakeholders on an already identified need, and is being supported by Paul Pezzaniti from Platinum Ag and Steve Coventry from Bugs for Bugs. The trial is set to commence in September and regular updates will be provided.

FIND OUT MORE

Contact Peta Coughlin, AUSVEG SA on 0409 029 745 or email **peta.coughlin@ausveg.com.au**

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Project Number: VG21000

Hort Innovation VEGETABLE FUND

R&D / VEGNET
CASE STUDY

Spend more on testing to save more on inputs

Case Study

National Vegetable Extension Network
TASMANIA

Introduction

Soil testing is an integral part of cropping operations and helps to ensure that nutrition is applied as crops require it. It allows growers to customise the supply of macro- and micro-nutrients that are critical to achieve the best results for the crop.

This testing is often completed on a full paddock basis; for example, taking a sample following a zig zag pattern or diagonal path across the paddock for subsampling. The subsamples are then combined for a single test and the result is used to determine the average nutrient requirements for the whole area.

While this approach will generally provide an acceptable overall result, it is limited in accounting for the variability that can be found within a paddock. Testing for average nutrient levels across a paddock can lead to parts of the paddock either being under or over dosed with fertiliser. This results in varied crop development and suboptimal yield and quality.

Oversupplied, wasted fertiliser can impact soil health and disappear into the atmosphere (nitrogen volatilisation or denitrification) or leach into waterways.

Grid sampling can be used to better recognise where there is paddock variability and develop a variable rate nutrition approach to reduce the variability across a paddock.

Applying a sampling grid at Sisters Creek

Michael Nichols manages 165 hectares at Sisters Creek in north-west Tasmania. His cropping rotation includes onions, potatoes, peas, poppies, wheat and corn. Alongside the cropping Michael has agroforestry plantations, fattens beef steers and consolidates and dries grain from local growers for supply to local dairy operations.

Michael first came across grid sampling at the Agfest field days. Before using grid sampling and applying a variable rate approach to nutrition management, Michael observed considerable variability in his crop growth and yields.

“Before commencing this program, we would see a (within field) yield variation of around 40 per cent,” he said.

In Michael’s case, grid sampling is a bit of a misnomer. While he has split his paddock into sampling areas, they rarely follow a grid pattern.

“When people hear ‘grid sampling’ they assume that the paddock is split with straight lines into smaller boxes without taking into account the characteristics of the paddock. We split our paddocks based on the characteristics of the land, often the topography in our case, so our ‘grid’ is nothing like what people expect,” he explained.

Key messages

- **Most paddocks have variable soil conditions, often in fertility or pH. Applying fertiliser inputs at the same rate across the whole paddock will therefore produce a variable crop.**
- **Grid sampling – or splitting a paddock into smaller areas for testing and applying fertiliser based on results – reduces the variation and allows for lower rates of inputs to be applied in areas that don’t need it and more where it is needed. The resulting even crop also provides other benefits that assist in crop management and even maturity at harvest.**
- **VegNET Tasmania worked with a grower in the north-west of the state who spent more on his soil testing to save on inputs in his cropping program and harvest better crops.**
- **While this approach can result in increased costs for testing, this is more than made up for with lower fertiliser costs and more even crops.**

Hort Innovation VEGETABLE FUND

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AUSVEG RMCG

Spend more on testing to save more on inputs

Michael's sampling is conducted taking two composite samples per hectare. The analysis includes potassium, calcium, magnesium and phosphorous along with soil pH. Armed with this information, Michael plots his variable applications of fertilisers and lime to even out variations.

Throughout the growing season, Michael also uses a similar approach with the application of nitrogen inputs. In this case Michael uses in-season normalized difference vegetation index (NDVI) imagery to see variation in the paddock between the areas of lighter and darker foliage. He then adjusts his application rates to back off where growth is more vigorous and bolster those areas that are underperforming. He checks that the poorer performing areas are not due to pests, diseases or irrigation issues before applying the variable fertiliser rate.

Tasmanian grower Michael Nichols on-farm. (Source: Landcare Tasmania)

Improving grower productivity, profitability and preparedness

With increasing pressure on input costs, the most immediate success of this approach has been the ability to reduce fertiliser inputs without sacrificing yield. Michael has reduced his overall fertiliser applications to as low as a quarter of the recommended rates in some areas.

"While we spend more on our testing, this approach is more than paying for itself in reducing our fertiliser usage," Michael said.

While the savings in fertiliser have been a headline benefit, the reduced crop variability has proven beneficial in other ways. The more consistent crop progress has made spray application, nutrition and other crop management decisions easier and more effective due to the reduced variation in crop stage and vigour.

Michael has also observed a reduction in disease incidence. The areas that previously had high nutrition loads, lush growth and other favourable disease conditions have reduced and the disease pressure has lessened as a result.

Next steps

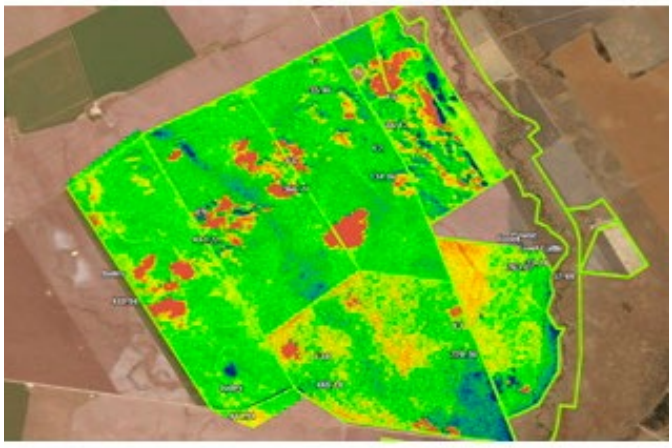
Michael is looking to explore other areas where a grid sampling method could produce better outcomes. These include:

- Disease pressure (sampling using PREDICTA Pt tools pir.sa.gov.au/research/services/molecular_diagnostics/predicta_pt)
- Sap testing to support nutrition planning (agvita.com.au/nu-test/)
- Soil moisture probes to support irrigation planning.

For each of these areas, a single test or result from across a paddock would generally inform crop management decisions. The expectation is that by increasing the amount of information available on in-field variability, Michael will be able to better manage the inputs he applies to the crop while achieving consistent yield and quality results.

VegNET Tasmania will be working closely with Michael to trial these additional approaches and communicate the outcomes from this work.

A further consideration for reducing in-field variability is to observe water infiltration and drainage, especially in flatter paddocks and soils that do not drain well (e.g. duplex soils). If some areas are lying wet or seem to be too dry, a drainage plan should be prepared and implemented to even out soil moisture conditions.



Whole farm view of crop variability based on NDVI index. (Source: Chris Dowling, Back Paddock)

Hort Innovation VEGETABLE FUND

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AUSVEG RMCG

AUSVEG State News

VICTORIA

Established in 1923 as the Vegetable Growers Association of Victoria, this year AUSVEG VIC celebrates 100 years of serving Victorian vegetable growers.

This remarkable history is captured on our honour board, listing 35 Presidents and 22 Life Members who have dedicated their time and efforts to benefit the Victorian vegetable industry and its growers over the years.

Today we advocate for vegetable and potato growers, and membership is free for all Victorian growers.

"I am extremely proud of the VGA's history and the work that has been done in the past.

This year our Annual Awards for Excellence Dinner was overwhelmingly supported and was the pinnacle centenary event.

AUSVEG VIC was elated to bring the 2023 Vegetable Innovation days to Catani, and is looking forward to further events in the future," said current President Paul Gazzola.

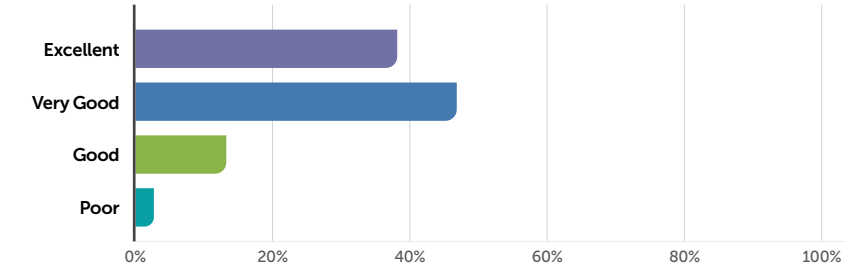
VicVID 2023 Survey Results

Feedback captured following the Victorian Vegetable Innovation Days event highlighted the overwhelmingly positive response to the 2023 event.

Responses were collected from vegetable growers, industry representatives, demonstration site holders and sponsors of the event.

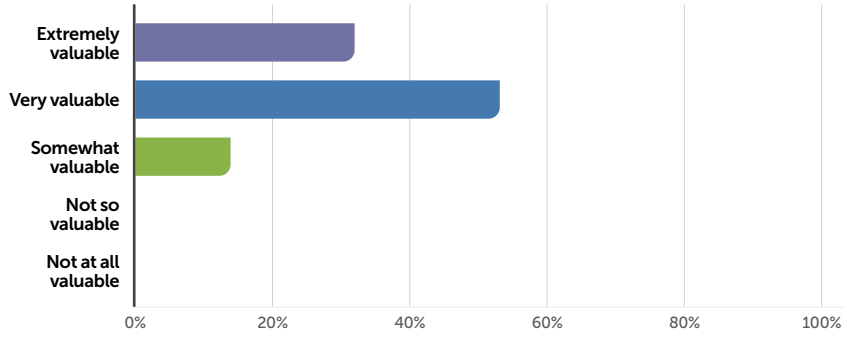
The overall rating for the event showed 38% of the responses found the event to be excellent and 46% found it very good.

Q1. Overall, how would you rate the Victorian Innovation Days held in 2023?



The demonstration sites featured at the two-day event were a stand out success, with 54% finding them very valuable and 32% finding them extremely valuable

Q2. How would you rate the Seed and AgChem/Fertiliser Demonstration sites at VicVID23?



Joy Pedersen
AUSVEG VIC Executive Officer
Phone. 0413 760 776

NORTHERN TERRITORY

The 2023 dry season is well underway with producers sending high-quality produce to the Sydney and Melbourne market twice a week.

The season so far has not come without its challenges. Although growing conditions have been reasonably good in the NT, vegetable prices have not, with some crops seeing as much as a 50% reduction in prices.

The Northern Australia Food Futures conference was held in Darwin in May this year and saw more than 500 delegates a 3-day conference. The conference, run by NT Farmers is Australia's leading conference on agriculture development in the North and is integral in driving expansion and placing northern agriculture on the national agenda. The conference added a new event this year which was the Agri-Tech showcase where delegates including local growers attended an afternoon of demonstrations and talks in the latest agricultural technology.

The Northern Territory Government has recently released the Northern Territory agribusiness 2030 strategy with sights set to achieve a $2 billion sector by 2030. The launch of the strategy provides clear strategic direction and shared vision with government and industry to increase sustainable agribusiness in the NT. The launch of the agribusiness 2030 strategy highlights the Northern Territory's commitment to growing the agricultural sector, underpinned by strong research and policies.

Mariah Maughan
Vegetable Industry Development Officer
Phone. 0417 618 468

TASMANIA

Another spring has sprung and we are off and running in Tasmania.

Again we see very good demand for all types of vegetables to be grown for the various outlets. Growers and processors are looking forward to a more favorable spring planting season this year.

During autumn and winter there were plenty of opportunities for growers to attend seminars and workshops that provided valuable information when it came to soil health, crop research findings, new technology, machinery, farm safety or to just give the tractor a good once over.

To remain competitive and profitable we must be the best educated and most willing to adopt efficient practices that make our industry stand out for the better. If we're not doing it and having a go then ultimately someone else will decide for us how we will be farming in the future.

Many Tasmanian farmers are investing heavily in their own research to become the best example of land stewardship. If we all play a part in showcasing our industry to the rest of the country it will hold us in a good position if the world markets return to previous agendas of using Australia as a dumping ground for inferior, subsidized, low cost produce.

One thing that has changed since Covid came along is the recognition that we need to grow and manufacture produce in Australia. While other markets are still jumpy, think of fuel and fertiliser, it is the rise in land prices in Tasmania that has soared to new levels. This one aspect alone is a common talking point and is now a significant part in calculating a gross margin for the crops we grow.

Water schemes are continuing to be built in the state with many reaching the economic threshold with ease. All up, Tasmania is faring well.

What many consider a problem though is the lack of willing workers coming into the agricultural scene. Our sector is in stiff competition still with the lure of working out west or getting a government job or most recently the rise in the unemployment assistant payments. Settings will need to change if we are to keep growing food and feeding the country.

On the supermarket shelf I would say we are now seeing the outcomes of scrapping piece rate work and other onerous government labour laws that have increased the cost of production. In my opinion, the majority of Australians voted for a particular direction of government and higher prices on the supermarket shelf are unfortunately a result of that. As individuals we must continue to support our state and national agricultural bodies so that we have a say and it gets heard.

Nathan Richardson
Chair - TFGA Vegetable Council
Phone. 03 6332 1800

AUSVEG State News

QUEENSLAND

Dear Growers, love from the Ekka,

What a wonderful, eye opening, colourful, crazy, and grounding nine days QFVG had at the Ekka in August. Touted as the event where city meets country, it was also the event where growers met consumers, politicians met anyone and everyone they could, and we met tens of thousands of advocates of fresh produce.

After a very long hiatus away from this event (no one can tell us how long, but the guess is decades), we decided it was time to go back and ensure horticulture, and even more so our growers, are first and foremost in the minds of consumers. After all, how can Queensland's biggest agricultural event not include horticulture?

'Meet a farmer' at the Ekka was the theme and we took it literally. Every day we celebrated a different commodity and growing region with growers generously giving their time to talk 'shop'. Citrus, bananas, vegetables, berries, pineapples, apples, macadamias, avocados, and tropical fruits each had a day to engage the public. In person they answered thousands of questions, sharing their knowledge and passion for what they do. Consumers were curious, engaged and overwhelmingly supportive of growers.

As way of example, a very small selection of discussions which took place include: how to peel a mandarin properly, why bananas are harvested green, why certain sizes of produce are only available in retail, how do you pick a ripe pineapple or avocado and how does vanilla grow? Taste testing was extremely popular with 10,000 mandarins, samples of new varieties of citrus, 150kg of apples, 3,000 samples of avocado, countless snacking carrots, hundreds of bananas and thousands of macadamia nuts being given to consumers to try. Ekka goers certainly like a free sample however more importantly, it also gave us a chance to engage the public in some genuine conversations.

Our 'Dear Grower' message board was set up with the intent of gathering consumer insights, good, bad, or indifferent, to share with our members. Our sector is under immense pressure from multiple angles, and we need to understand how that is impacting the people we feed. What eventuated was thousands of messages of overwhelming support, understanding of the challenges, and appreciation of the hard work that goes into every piece of fruit, vegetable or nut grown.

These inspirational messages of support, encouragement and understanding brought an overwhelming awareness that our growers don't have to do this alone. Growers have an army of supporters; we just need to mobilise them.

Above. A visitor adds a message to the 'Dear Grower' board.
Photography: Scribbly Inc Photography.

Rachel Chambers
QFVG CEO
Phone. 07 3620 3844

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