VG15021: Sowing success through transformational technologies

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Facilitators

Project VG15021 was led by Dr Jitka Kochanek from The University of Queensland.

Major findings

Project VG15021 was undertaken to determine whether a new plant growth regulator (PGR) could benefit the Australian vegetable industry in overcoming plant stress. The PGR that the project focused on was karrikinolide (KAR1), which was patented in 2005 but has not yet been made commercially available.

The project was able to validate the crops that are responsive to KAR1, and to determine the optimal dose to improve crop performance in stressful environments. It also resulted in the successful development of a prototype technology that can effectively deliver KAR1 and other commercial PGRs to plants.

The first step in the project was extensive interviews with growers, conducted face-to-face across south-east Queensland and New South Wales.

"We used these interviews to determine the key pain points for growers, so we could target our research to address their most pressing needs," lead researcher Dr Jitka Kochanek said.

"What we heard was that plant stress in the first two to four weeks of growth was a real killer for the industry, particularly heat waves at transplant. Other areas of concern were bolting in crops such as broccoli and disease in Solanaceae crops; therefore, we focused our research in these key areas."

In earlier projects, Dr Kochanek's team had developed a laboratory screening technique that could rapidly determine the effectiveness of plant growth regulators and other chemistries on plants. They used this technique to find the vegetable crops that were responsive to KAR1.

"Surprisingly, we found that over 90 per cent of levied vegetable lines tested were responsive to KAR1, including lettuce, carrot, capsicum, pumpkin, broccoli, cauliflower, sweet corn and baby spinach. We then grew plants on commercial farms and in glasshouses to validate these findings. We found that our screening technique predicted the active dose of KAR1 very effectively. This was a real win," Dr Kochanek said.

The testing found that KAR1 was a crop multi-protectant, which enabled crops to maintain normal growth under suboptimal conditions that harmed untreated crops. Effects included delayed bolting and improved yield quality for broccoli and, in capsicum, stronger plants with better structure and faster fruit formation.

However, the effects of KAR1 were highly dosage-specific, and even varieties within the same crop could vary in their optimal dose.

"If the dose was wrong, KAR1 simply did not work," Dr Kochanek explained.

"We also determined that the best way to apply KAR1 was via seeds; root drenches were too expensive and less effective than seed applications and shoot sprays did not work. Also, the compound was exceptionally expensive at $20,000 per gram, and it rapidly degraded in sunlight, making it cost-prohibitive to apply via conventional protocol.

"We then used some very clever bioengineering to develop a prototype to deliver KAR1 to plants effectively and at the correct dose. In 2019-2020, we validated our prototype in commercial production systems for lettuce variety (var.) Blackbelt, broccoli var. Aurora, capsicum var. Katana and tomato var. Rebel."

The prototype proved to be highly effective at delivering both KAR1 and a commercially available PGR.

"Just how effectively the prototype worked was very surprising," Dr Kochanek said.

"Every experiment we conducted with the prototype worked. We demonstrated that the prototype delivered such compounds 100 to 1,000 times more effectively than currently used technologies. This promises real cost savings on-farm. The prototype was designed to be fully automated and rapidly upscaled, which will result in further savings in labour costs."

Dr Kochanek said there is huge scope for developing the prototype and PGR compounds for the industry – for disease suppression, to improve crop tolerance to environmental stresses and to control growth in real time.

"We are keen to understand what industry sees as the main problems to solve and to work with them into the future to use these new technologies to solve those issues," she added.

Background

Karrikinolide was discovered by Dr Gavin Flematti at the University of Western Australia in 2004, who synthesised and patented the PGR in 2005. The compound was not made commercially available because it proved very difficult to apply to plants. It degrades in sunlight and crops require a very specific dose for it to be effective.

When the research team discovered this, project VG15021 became focused on developing a technology that would effectively deliver KAR1 to plants, at the correct dosage and in a cost-effective manner.

Research fellow Dr Santi Krisantini and PhD candidate Kenneth Tryggestad collect data in a commercial nursery in the Lockyer Valley. Image courtesy of The University of Queensland.

Acknowledgements

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Further information

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The final report for this project is available on InfoVeg. Readers can search 'VG15021' on the InfoVeg database: ausveg.com.au/infoveg/infoveg-database.

VG17000: Vegetable business benchmarking

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Facilitators

Project VG17000 was facilitated by vegetablesWA Building Horticulture Business Capacity Program Manager Bryn Edwards in partnership with Planfarm.

Major findings

Project VG17000 equipped growers with the tools to make data-driven business decisions by providing access to rigorous industry-level insights on the financial and production performance of the Western Australian vegetable industry. Project Facilitator, Bryn Edwards, said the project took its cues from a similar program used extensively in the broadacre sector.

"While primarily designed to improve the operational and financial performance of businesses, the information we have collated from the vegetable growers has also become a key source of trusted industry data for stakeholders ranging from industry bodies and state/local government to major financial institutions," Mr Edwards said.

Vegetable production profitability became the key focal point during the engagement process, with all communications, measures and metrics linked back to this. With a three-year average return on capital of nine per cent, Project VG17000 highlighted that the WA vegetable industry is capable of generating a positive return that is comparable with any other industry or investment type. It also confirmed that the most profitable growers were not necessarily the largest producers in terms of land area utilised.

"The most profitable growers were those achieving a higher income per hectare through increased saleable yield and a strong marketing focus, while keeping costs as a percentage of income below 65 per cent; three-year average was 72 per cent while the top 25 per cent average was 59 per cent operating efficiency," Mr Edwards explained.

Key to facilitating the project was the very 'hands-on' support: giving business owners a clear understanding of the data required and helping them to convert findings into tangible actions that would benefit their own businesses – for example, by lowering overheads or reducing operating costs. Participation rates grew over the three years, with the final year covering 30 per cent of WA's sold production.

Recommendations

The most significant challenge to project progress was that the assumed base levels of business and financial management maturity were overestimated.

"While the participants' skills and knowledge improved – particularly for growers who participated throughout the project life span – there was a disparity between those who engaged with the project and many of those that didn't," Mr Edwards said.

Funding has since been allocated to a new project, *Building Business Horticulture Capacity*, which aims to provide additional tailored business capacity training to individual growers over the next four years.

"Looking ahead, there is also an opportunity to review and broaden the lines of enquiry beyond farm profitability, to gain more detailed industry insights to inform broader risk and opportunity management – for example, labour and water use as well as natural capital and biosecurity measures," Mr Edwards said.

Facilitators also recommend capitalising on the Project VG17000 momentum by extending it to reach a tipping point of industry-wide management change that will install benchmarking and a more detailed data-driven decision-making practise as part of 'business as usual'.

"A three-year average is still short of a rolling six or 10-year average and the financial business management rigour that brings," Mr Edwards explained.

In a current commercial environment that commoditises business data and insights, continued support is recommended for the horticulture industry to collect and own the data that serves its industry, rather than leave it to larger outside corporate bodies to collate.

A catalogue of extension and grower engagement best practises that future Hort Innovation-funded projects can draw upon to support greater grower engagement and aid delivery of outcomes is also recommended.

Background

In 2017, Hort Innovation identified an informational gap for vegetable growers that provided the next level of useable detail down from the broad performance trends provided by annual ABARES surveys. Project VG17000 – conducted in WA – successfully delivered Australia's first three-year vegetable industry benchmark dataset using grower data from FY 2016-17, 2017-18 and 2018-19.

vegetablesWA has published three Industry Benchmark reports and has also produced the first set of three-year averages, as well as single year averages, across 42 key business performance measures and metrics.

Participating growers received an individualised benchmarking report specific to their business as well as a 'comparison' against industry averages and best in class performance. They were also given personalised support to convert findings into tangible actions. The information collated has also become a key source of trusted industry data for other stakeholders.

vegetablesWA Building Horticulture Business Capacity Program Manager Bryn Edwards.

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Further information

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