Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

WA Agricultural Research Collaboration
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WA Horticulture Science Forum 2026

Research Snapshot Project Summaries

Introduction

A collaboration between the Department of Primary Industries and Regional Development and WA Agricultural Research Collaboration, this forum brings together researchers, industry representatives, growers, government agencies and stakeholders from across Western Australia to share knowledge, showcase current research activities, and explore opportunities to strengthen the future of the state's horticultural industries. The WA Horticulture Science Forum provides a valuable platform to increase awareness of the breadth of research underway across commodities, regions and organisations, while fostering collaboration and discussion around emerging challenges and opportunities.

To maximise the number of projects presented during the forum, presenters have been allocated a short "research snapshot" format. While these presentations provide a concise overview of each project, the summaries contained in this booklet offer additional context and information to support a deeper understanding of the research being showcased.

This publication has been compiled as a companion resource for forum participants and includes project summaries, key objectives, outputs and industry relevance for each presentation. Attendees are encouraged to refer to this booklet throughout the day to gain further insight into the research being presented and to identify areas of interest for discussion with presenters and fellow participants.

The forum is not only an opportunity to share research outcomes, but also to strengthen connections between industry and research, identify common priorities, and help inform future research directions that will support the productivity, sustainability and resilience of Western Australia's horticulture sector.

We hope this booklet enhances your forum experience and encourages meaningful conversations, knowledge exchange and collaboration throughout the day and into the future.

GOVERNMENT OF WESTERN AUSTRALIA
Department of **Primary Industries and Regional Development**

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Contents

Genetics and Breeding

Influence of clonal selection on Cabernet Sauvignon performance in Margaret River

Industry/ Commodity	Wine Industry
Researcher(s) / lead organisation	Richard Fennessy, DPIRD
Partners / funders	Wine Australia, Wines of WA, Howard Park Wines
Dates of commencement and completion	2021 - 2025
Project stage	Demonstration

Problem or opportunity addressed / addressing

Cabernet Sauvignon is one of Western Australia's most important winegrape varieties, contributing approximately 40% of the state's red wine production and almost 50% of red grapes crushed in Margaret River. Despite this importance, vineyard plantings have historically relied on a narrow genetic base, predominantly clone SA126 and the Houghton selection. This limits growers' ability to optimise vineyard performance, adapt to climate variability, diversify wine styles and manage increasingly compressed harvest periods. The project addresses the opportunity to evaluate numerous Cabernet Sauvignon clones and provide evidence-based recommendations to support more resilient, productive and profitable vineyard systems.

Summary of project

A replicated Cabernet Sauvignon clonal trial was established in Margaret River in 2019 using field-grafted vines at Howard Park Wines' Leston Vineyard. Twelve commercially available clones originating from Western Australia, South Australia, Bordeaux and California were evaluated over four growing seasons (2021–2025). The project measured key phenological stages, yield components, vegetative growth, berry characteristics and wine composition, while small-lot wines from each clone were produced under standardised winemaking conditions. Statistical analysis was used to identify significant differences in vineyard performance and determine how clonal selection can be used as a practical tool to improve vineyard resilience, productivity and wine style outcomes.

Expected or current outputs

Current outputs include:

- A four-season dataset describing phenology, yield, bunch weight, bunch numbers, vine balance and wine chemistry for 12 Cabernet Sauvignon clones.
- A technical report and research poster summarising project outcomes.
- Identification of significant differences between clones, including yield variation from 4.3 to 7.1 kg per vine and harvest timing differences of up to eight days.

- Practical guidance for growers on clone selection to match production goals, site characteristics and climate adaptation needs.
- Industry extension through presentations, publications and engagement with growers, nurseries and industry bodies.
- The project has demonstrated that clonal selection can influence productivity, vine balance, acid retention, harvest timing and operational logistics, providing a foundation for informed planting decisions.

Industry relevance and adoption pathway

The results have immediate relevance to Western Australia's wine industry, particularly in Margaret River where Cabernet Sauvignon contributes significant economic value. Findings provide growers with locally generated evidence on the performance of alternative clones under commercial vineyard conditions.

Adoption pathways include incorporation of results into new vineyard developments, reworking programs, clonal diversification strategies and nursery propagation programs. Multi-clonal plantings offer a practical strategy for managing climate-related risks, improving harvest logistics, enhancing vineyard resilience and tailoring wine styles to market requirements. Engagement with wineries, nurseries, WAVIA, Wines of

Western Australia and DPIRD extension networks provides a clear pathway for industry uptake.

Next-stage questions

Future research questions include:

- How consistent are the observed clonal differences across other Western Australian wine regions and different soil types?
- Which clones deliver the strongest sensory and wine quality outcomes when assessed by formal sensory evaluation?
- How do clone and rootstock combinations interact to affect productivity, water use efficiency and climate resilience?
- Which clones perform best under projected climate change scenarios, including higher temperatures, water limitations and extreme weather events?
- Can clonal diversity reduce production risk and improve economic returns at the whole-vineyard scale?
- Are there opportunities to identify and commercialise additional locally adapted Western Australian Cabernet Sauvignon selections?

These questions will support development of climate-resilient, high-performing Cabernet Sauvignon production systems for the future.

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Growing robust avocados

Industry/ Commodity	Avocado
Researcher(s) / lead organisation	Lead by QDPI with DPIRD involvement: Declan McCauley, Amit Khanal, Asad Ullah, Dario Stefanelli
Partners / funders	Hort Innovation
Dates of commencement and completion	October 2022-November 2026
Project stage	Applied

Problem or opportunity addressed / addressing

Fruit mineral nutrition and fruit quality.

Summary of project

Fruit calcium plays an important role in avocado quality and postharvest performance. This project investigated practical approaches to increasing fruit calcium and improving fruit robustness.

Gypsum applications increased fruit calcium content and improved fruit quality at one trial site. Benefits were most evident when fruit were harvested later and fungicides were not applied, indicating that good harvest timing and fungicide use can mask calcium-related effects.

Soluble calcium applications provided a faster alternative to gypsum. Calcium nitrate applied from flowering until shortly after fruit set consistently increased fruit skin calcium concentrations across two seasons and was the most effective treatment tested. Calcium thiosulphate and Albina also increased fruit calcium but were less effective.

A fruit transpiration study identified a key period for calcium uptake. Avocado fruit water loss, used as an indicator of calcium movement, increased for approximately seven weeks after fruit reached 8–10 mm diameter before declining, highlighting a critical window for calcium fertilisation.

Expected or current outputs

- Defined the benefits and limitations of gypsum for improving fruit calcium.
- Identified practical soluble calcium strategies to rapidly increase fruit calcium.
- Refined the timing window for calcium applications to maximise uptake and fruit quality.

Industry relevance and adoption pathway

Improving fruit calcium can enhance avocado quality and resilience, particularly when other quality drivers such as harvest timing or fungicide use are suboptimal. Findings have been communicated to growers through the Australian avocado extension program, providing practical recommendations for industry adoption.

Next-stage questions

- Further validation of the fruit calcium uptake window.
- Investigation of calcium uptake pathways associated with foliar products such as Albina.
- Better understanding of calcium release dynamics from gypsum.
- Evaluation of other cell-wall-strengthening nutrients, including silicon.
- Development of strategies to safely reduce fruit nitrogen levels, another major driver of fruit quality.

Contact details

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Metabolic regulation of inflorescence development and fate in grapevine

Industry/ Commodity	Grape
Researcher(s) / lead organisation	Pragya Poudel, Michael J. Considine, John A. Considine, Kadambot H.M. Siddique
Partners / funders	Cooperative Research Centre for Developing Northern Australia
Dates of commencement and completion	March 2024 and February 2028
Project stage	Early research

Problem or opportunity addressed / addressing

The research project explores the opportunities and limitations associated with viticulture expansion to Northern Australia. Though, grapevine shows plasticity to climate, Vitis vinifera was domesticated in a temperate climate, expansion to the tropics is associated with high-temperature stress and a lack of photoperiodic variation, which affect floral initiation and development in grapevine - processes that are critical to yield. This research elucidates the role of temperature in regulating grapevine floral development in low-latitude climates.

Summary of project

Table grapes are Australia's most valuable horticultural commodity; however, limited seasonal availability means Australia is a net importer for several months of the year. The opportunity to fill this gap by expanding production in northern Australia is currently limited by poor yields, which are associated with warmer temperatures during critical development periods. This research aims to elucidate the effect of elevated temperatures on inflorescence initiation and development in grapevine. The research will employ anatomical, histological, biochemical, and genetic approaches to determine the impact of elevated temperature during two critical stages of reproductive development: inflorescence initiation in season 1 and inflorescence development during budburst in season 2. This research provides valuable insights on bud anatomy and histology which will be instrumental to elucidate the syndrome of inflorescence development in two climatically distinct locations in Western Australia. Overall, this work will provide foundational knowledge to boost yields and enable viticulture expansion in northern Australia, as well as address future warmer climate scenarios in southern Australia.

Expected or current outputs

Field investigations across climatically distinct Western Australian sites: Broome, Carnarvon, Swan Valley,and Hamel, using microscopy imaging, revealed that temperature imposes an upper threshold for reproductive initiation. Buds from the tropical Broome site exhibited significantly lower fruitfulness and less developed floral initials compared to the other sites, under a common genotype and similar production methods. Further controlled environment experiments during budburst suggested that increasing temperature reduces inflorescence mass, which might be associated with carbon depletion at higher temperatures.

Industry relevance and adoption pathway

The combination of field and controlled environment studies, together with the incorporation of phenotypic and molecular approaches, will provide critical information on the temperature regulation of grapevine floral development. This will serve as a knowledge base for viticulture expansion in Northern Australia and for warmer climate change scenarios in Southern Australia in the future.

Next-stage questions

Further research is needed to characterise the timing of key developmental stages like IP initiation and other major reproductive events, and identify the causal factors – including temperature, light, nutrient reserves, and endogenous plant hormones that affect inflorescence initiation, differentiation, and development, and evaluate the genetic potential of existing and early maturing table grape cultivars suited to northern Australia.

Contact details

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Discovery and validation of molecular markers associated with chilling requirement and budbreak timing in Australian apple germplasm

Industry/ Commodity	Apple (Pome Fruit)
Researcher(s) / lead organisation	Asra Marashi (PhD Candidate); The University of Western Australia (UWA); Australian National Apple Breeding Program (ANABP)
Partners / funders	The University of Western Australia (UWA); Australian National Apple Breeding Program (ANABP)
Dates of commencement and completion	Feb 2026-Feb 2030
Project stage	Early research

Problem or opportunity addressed / addressing

Climate change is reducing winter chill accumulation in southern Australia, threatening the ability of apple trees to satisfy their chilling requirements and achieve normal budbreak and flowering. This creates a need for breeding apple cultivars better adapted to warmer winter conditions. The project aims to identify genetic markers associated with chilling requirement and budbreak timing that can accelerate the development of climate-resilient apple varieties.

Summary of project

This project investigates the genetic factors controlling chilling requirement and budbreak timing in apple.

Phenotyping will be conducted across ANABP germplasm and breeding populations using field observations and controlled-environment experiments. Genetic analyses will focus on validating previously identified genomic regions, particularly the major budbreak QTL on Linkage Group 9 and the candidate gene MdPRX10. The project will develop and evaluate molecular markers that can be used in marker-assisted breeding to identify low-chill adapted germplasm at an early stage of breeding.

Expected or current outputs

- Improved understanding of the genetic basis of chilling requirement and budbreak in apple
- Validation of genomic regions and candidate genes associated with low-chill adaptation
- Development of molecular markers for marker-assisted selection
- Peer-reviewed publications and industry presentations

- Recommendations for incorporation of validated markers into ANABP breeding activities.

Industry relevance and adoption pathway

Validated markers will allow breeders to identify seedlings with favourable low-chill alleles before field evaluation, reducing breeding costs and accelerating the development of cultivars adapted to future climatic conditions. Outcomes will support the Australian apple industry by improving breeding efficiency and resilience to declining winter chill.

Next-stage questions

Can marker-assisted selection reliably improve breeding efficiency for low-chill adaptation?

Are additional genomic regions beyond the major LG9 locus important for adaptation to warmer winter conditions?

How transferable are previously reported low-chill markers to Australian breeding populations?

Contact details

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Characterising Cripps Pink apple and its mutants using advanced genetic and genomic tools

Industry/ Commodity	Horticulture – Apple (Malus domestica), Pink Lady®/Cripps Pink cultivar
Researcher(s) / lead organisation	Md Golam Azam, PhD Candidate, UWA Institute of Agriculture,The University of Western AustraliaHackett Professor Kadambot H.M. Siddique — Principal Supervisor, Director and Chair, UWA Institute of Agriculture Dr Sultan Mia — Co-Supervisor, Research Scientist, Australian National Apple Breeding program, Department of Primary Industries and Regional Development (DPIRD) Associate Professor Michael J. Considine — Co-Supervisor, School of Molecular Sciences, UWA
Partners / funders	The University of Western Australia (UWA Institute of Agriculture); Department of Primary Industries and Regional Development (DPIRD); Australian Government Research Training Program Stipend Scholarship; John Cripps Horticulture HDR Top-Up Scholarship
Dates of commencement and completion	Commenced: February 2024 | Projected completion: before May 2027
Project stage	Applied

Problem or opportunity addressed / addressing

Apple (Malus domestica) is a globally important crop, with 2024 production reaching 97.88 million tonnes worth approximately Int$ 46.2 billion. In Australia, apple production totalled 293,731 tonnes (Int$138.6 million), with Cripps Pink the leading cultivar at 41% market share (ahead of Gala at 23% and Granny Smith at 18%). Developed in Western Australia in 1973 from a 'Lady Williams' × 'Golden Delicious' cross, Cripps Pink is marketed worldwide as Pink Lady® and is prized for its crisp texture, tangy-sweet flavour, and long storage life.

Numerous spontaneous somatic mutants (sports) of Cripps Pink, including Yellow Cripps Pink, Rosy Glow, Ruby Pink, Lady in Red and Barnsby, have emerged and been commercially licensed, differing mainly in skin colour and pigmentation. However, the genetic basis of these sport phenotypes remains poorly understood to date they have been characterised only morphologically and physiologically, with no comparative genetic or genomic studies conducted against the parent cultivar. Cripps Pink is also a key breeding parent internationally (e.g. 'WA 64'/Sunflare™ in the USA, 'Ruixue' in China, 'Bernina®' in Italy),yet high-resolution genomic resources for the cultivar have remained limited — no chromosome-level, haplotype-resolved genome assembly existed for Cripps Pink or its mutants prior to this project. This gap constrains breeders' ability to verify sport identity, understand the molecular basis of colour variation, and develop trait-specific DNA markers for marker-assisted selection.

Summary of project

This project delivers a comprehensive genetic and genomic characterisation of Cripps Pink and its colour somatic mutants, structured across three experiments:

- Haplotype-resolved, chromosome-level, gap-free reference genome assemblies of Cripps Pink (Primary, Hap1 and Hap2), generated using long-read (HiFi) and Hi-C sequencing. These assemblies form the foundation for downstream genetic and breeding applications.
- Comparative genomics of Cripps Pink against five colour somatic mutants (Yellow Cripps Pink, Rosy Glow, Ruby Pink, Lady in Red, Barnsby) via whole-genome resequencing, with reads mapped independently to both haplotypes of the reference. This haplotype-aware framework enables identification of allelespecific SNPs, InDels, structural variants, transposable-element-associated polymorphisms, and loss-ofheterozygosity regions linked to pigmentation traits.
- Transcriptome analysis comparing Cripps Pink and Yellow Cripps Pink across fruit developmental stages, to identify genes and expression patterns underlying colour and quality differences (integrating metabolomic and proteomic data at the mature fruit stage).
- Together, these experiments will clarify the molecular basis of somatic mutation and fruit colour variation in apple, and lay the groundwork for trait-based DNA markers to accelerate marker-assisted breeding.

Expected or current outputs

- Haplotype-resolved, gap-free Cripps Pink reference genome (Primary, Hap1, Hap2), publicly deposited (NCBI BioProject/GenBank, Zenodo)
- Catalogue of allele-specific SNPs, InDels, structural variants and transposable-element polymorphisms distinguishing Cripps Pink from its five colour mutants
- Candidate gene set and expression profiles underlying fruit colour and developmental differences between Cripps Pink and Yellow Cripps Pink

Industry relevance and adoption pathway

As Australia's leading apple cultivar (41% market share) and a major international breeding parent, genomic tools for Cripps Pink have direct value to the pome fruit industry: verifying the genetic identity of licensed Pink Lady® sports (protecting plant breeder's rights and brand integrity), informing which sports carry independently useful trait combinations, and providing trait-linked DNA markers that breeders can use for marker-assisted seedling selection — shortening the time and cost of developing new apple varieties. Outputs are being developed in partnership with DPIRD, positioning findings for direct uptake by WA's apple breeding and extension programs.

Next-stage questions

- Functional validation of candidate genes identified for colour/pigmentation traits (e.g. via expression or gene-editing studies)
- Extension of the haplotype-aware variant-calling framework to a broader breeding population beyond the five characterised mutants
- Integration of transcriptomic findings with metabolomic and proteomic data to build a fuller picture of the anthocyanin pathway differences

Contact details

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Understanding the mechanistic basis of salinity tolerance in Capsicum genotypes and mediation by heat and phosphorus stress

Industry/ Commodity	Capsicum and chillies
Researcher(s) / lead organisation	Joe Liew
Partners / funders	
Dates of commencement and completion	16/02/2026- 17/08/2029
Project stage	Early research

Problem or opportunity addressed / addressing

Capsicum and chillies are some of the most salt-sensitive crops. Therefore, salinity is a major constrain in their cultivation and profitability in Western Australia, where salinity is a widespread issue, including Carnarvon, the primary producing region. However, the traits and processes that confer salinity tolerance in capsicum and chillies are poorly known. The scarce number of studies investigated salinity as an isolated factor, so their applicability is questionable in Western Australia, where heat risk is highly relevant and an increasing threat in the face of climate change. Another additional layer of stress is lowphosphorus soil, which is naturally the case in Western Australia and there is an interest in reducing fertiliser input to minimise leakage into and conserve natural landscapes. Therefore, there is currently an unaddressed need to understanding mechanistic basis of salinity tolerance in the face of heat and under low-phosphorus soil, so that more effective breeding direction and agronomic practices can be developed to improve capsicum and chillies cultivation and profitability in Western Australia.

Summary of project

Capsicum and chillies have great potential in becoming a cash crop in Western Australia. They can generate great profits not only as raw commodities but also from their secondary industries. For example, the food processing (e.g. seasonings and salsas), the nursery (e.g., ornamental chillies like the Twilight Rainbow chilli), the gardening, and even the pharmaceutical industry (e.g. capsaicin, the spicy molecule, as a pain reliever). Stress tolerance in capsicums and chillis is limited, and the combined stress studies are extremely rare, and the stress combinations that most concern Western Australia are completely lacking.

My PhD research addresses this research gap by investigating the mechanisms underlying capsicums' and chillies' response and tolerance to three characteristic environmental constraints of Western Australia, which are soil salinity in the face of heat and under low phosphorus soil. My research aims to explore at three levels of biological organisations, starting with physiology, then drilling deeper into cellular dynamics and genetics. Scientifically, this multi-level approach will provide a comprehensive understanding of the processes and interactions that make a tolerant variety. From a practical point of view, this framework is to allow my discoveries to be accessible to growers, the government, and businesses and allow these bodies to work together. Growers can use my physiological findings to identify tolerant genotypes using visual observations or using instruments commonly available. Then, the government and businesses can explore the cellular and genetic implications on the sustainability, scalability, economic outcomes, and resource use of grower-recommended varieties, and discuss with the growers to finalise decisions on the most suitable varieties to grow, specific to different locations, and inform breeding directions. Therefore, the purpose of my research is to contribute to the prosperity of and an attractive trajectory for Western Australian capsicum and chilli industries. My research also has positive conservation and cultural implications. It will allow us to achieve high yield and profit from capsicums and chillies using less desirable land, thus allowing us to allocate our best land to the essential cereal crops, namely wheat and barley. Lastly, chillies are culinary delights in many cultures. Therefore, the expansion of Western Australian chilli production and secondary industries will inevitably foster international collaborations with chilli-loving countries and benefit WA's economic growth.

Expected or current outputs

My research will establish the physiological basis of tolerance to combined heat and salinity stress in Capsicum, and determine how phosphorus availability modifies these responses. By integrating ion flux measurements, plant physiology and molecular analyses, it will identify the key physiological traits underpinning stress resilience, including ion homeostasis, water relations, photosynthetic performance and nutrient use efficiency. These findings will provide a mechanistic framework linking physiological performance with gene regulation and transporter activity, enabling physiological traits to be used as robust selection criteria. The project will also generate practical knowledge to optimise phosphorus management under multiple abiotic stresses in Western Australian production systems.

Industry relevance and adoption pathway

Western Australia's horticultural industry is increasingly exposed to high temperatures, saline irrigation water and phosphorus-limited soils, all of which constrain chilli productivity and profitability. This project will provide a physiological understanding of how these stresses interact, allowing growers to improve crop performance through evidence-based nutrient and irrigation management and the selection of appropriate rootstocks for grafting. The identified physiological indicators of stress tolerance will provide rapid screening tools for breeding programs and guide the development of grafting strategies that combine stress-tolerant root systems with commercially desirable scions. Adoption will occur through collaboration with Western Australian growers, breeding programs and extension services, supporting more resilient and sustainable chilli production systems.

Next-stage questions

In the future, we should investigate if the tolerance traits identified in this project behave similarly and confer the same outcomes under field conditions across Western Australia. Any differences between field and controlled-environment findings should be explored for the physiological, cellular, and genetic bases, and discuss how breeding and agronomic practices should be revised. We should also investigate the effects of additional stresses that are also relevant to Western Australia, such as drought. The focal stress of this project is salinity, but other stresses should be investigated as the focal stress in the future. Lastly, capsicums and chillies are known to be very disease-prone, so their interaction with pathogens and their immunity should be investigated.

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Service supply chain

Industry/ Commodity	Avocado
Researcher(s) / lead organisation	Amit Khanal, QDPI
Partners / funders	Hort Innovation
Dates of commencement and completion	June 2022 - May 2026
Project stage	Early research

Problem or opportunity addressed / addressing

This study was conducted with the aim of assessing the how rate of ethylene production is affected in Hass avocado by the different cold storage durations.

Summary of project

Ethylene is central to avocado ripening and postharvest quality regulation, but limited information exists on how cold storage duration impacts its production over time. This study investigated ethylene production rates in commercial ‘Hass’ avocados stored at 5 °C across multiple durations (0, 6, 13, 15, 17, 20, 27, and 34 days), comparing them against non-stored controls at 5 °C. Ethylene levels were measured prior to storage and every second day throughout shelf life. Preliminary findings reveal that the overall magnitude of ethylene production diminishes as cold storage duration extends, providing critical insights for postharvest management.

Expected or current outputs

1. Ethylene production rates in 'Hass' avocados mapped across varying cold storage durations (0–34 days at 5 °C).
2. Optimised cold chain protocols for ethylene-management interventions in supply chains.

Industry relevance and adoption pathway

Output of this study is valuable in optimising cold chain protocols and informing decisions on the timing of ethylene-management interventions in commercial supply chains...

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Smart phenotyping for efficient apple breeding

Industry/ Commodity	Apple / Horticulture (Pome fruit)
Researcher(s) / lead organisation	Dr Sultan Mia – Department of Primary Industries and Regional Development (DPIRD), Western Australia Australian National Apple Breeding Program (ANABP)
Partners / funders	Hort Innovation Australia, University and research partners including UWA, Murdoch University, QUT
Dates of commencement and completion	2025-2029
Project stage	Early research

Problem or opportunity addressed / addressing

Apple breeding requires evaluation of thousands of seedlings and advanced selections for complex traits including fruit quality, yield, flowering behaviour, disease resistance and tree architecture. Traditional phenotyping is largely manual, labour intensive, time consuming and affected by observer variability.

Digital technologies including imaging, artificial intelligence (AI), automation and data analytics provide an opportunity to transform apple breeding by enabling rapid, objective and scalable measurement of traits, improving selection efficiency and accelerating the development of improved cultivars for Australian growers.

Summary of project

This project aims to develop and integrate digital phenotyping approaches into apple breeding pipelines to improve the speed, accuracy and scalability of trait evaluation.

The research combines high-throughput imaging, computer vision, machine learning and genomic approaches to automatically measure important breeding traits such as flowering intensity, fruit number, fruit size, shape, colour, canopy characteristics and fruit quality.

Digital phenotypes will be integrated with genomic data to support data-driven breeding decisions and improve genomic selection accuracy, accelerating genetic gain in apple improvement programs.

Expected or current outputs

- Development of AI-based tools for automated apple trait measurement.
- Digital datasets linking orchard images, phenotypes and genomic information.
- Improved methods for high-throughput assessment of breeding populations.
- Reduced reliance on manual phenotyping.
- • Improved selection accuracy for fruit quality and agronomic traits.

- Framework for integrating digital phenotyping into future apple breeding workflows.

Industry relevance and adoption pathway

Digital phenotyping will provide Australian apple breeding programs with faster and more reliable methods to identify superior cultivars with improved fruit quality, productivity and resilience.

The technology has direct application in commercial breeding programs by reducing phenotyping costs, increasing selection efficiency and enabling earlier identification of promising breeding lines.

Future adoption pathways include integration with orchard robotics, automated imaging platforms, genomic selection models and precision horticulture systems.

Next-stage questions

- How can digital phenotyping improve prediction accuracy for complex apple traits?
- How can AI models be scaled across different growing environments and seasons?
- How can digital phenotypes be integrated with genomic selection to maximise genetic gain?
- How can these technologies support faster delivery of improved apple cultivars to industry?

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Production and climate resilience

On farm water demand in SW WA

Industry/ Commodity	Avocado, Apple, Wine grapes, Truffles, potato, water
Researcher(s) / lead organisation	A/Prof Julia Easton/Centre for Crop and Disease Management, Curtin University
Partners / funders	Food Agility CRC, DPIRD, Southern Forest Food Council, SWAN Systems
Dates of commencement and completion	October 2019 to June 2026
Project stage	Applied

Problem or opportunity addressed / addressing

Water availability is a critical constraint on agricultural productivity and regional resilience in south-west Western Australia. Declining rainfall, increasing evaporative demand and growing competition between agricultural, environmental and community water needs have highlighted the limitations of water planning approaches that focus primarily on supply. This research addresses a major gap by quantifying demand-side water use, linking irrigation volumes to crop performance, costs of production and profitability.

Historically, water planning has focused on the supply side—how much water is available in rivers and storages. This project addresses a critical gap by quantifying how much water is required to produce food, linking water use to crop performance, economic outcomes and regional value. This demand side perspective is essential to:

- Support balanced decision making between agricultural, environmental and community water use
- Improve irrigation efficiency and farm business resilience
- Provide a defensible evidence base for water allocation

Summary of project

The On-Farm Water Demand (OFWD) project was designed to address the gap in defensible data on the demand side of water allocation for food production in the Warren-Donnelly catchment in south-west WA.

The project was developed to provide farm businesses, community, industry and government with credible information on crop water demand, and an independent authoritative data set representing the demand side of water allocation in the Warren-Donnelly catchment, WA. The Warren and Donnelly river basins, an area of almost 6,100 km², are located in the south-west of Western Australia. Water allocation planning in this region is managed through the Warren-Donnelly Surface Water Plan, details on the plan are available on the Water Resources webpage (search WA water resources Warren Donnelly in your internet browser).

More than 80% of the catchment is covered by State forest, National park and nature reserve. The towns of Manjimup and Pemberton are located within the plan area.

The Southwest of Western Australia faces major, immediate issues relating to water access for irrigation. The area is impacted by climate change with increasing extreme heat events and decreasing rainfall, particularly during the months from April to October . Forecasts indicate further impact of climate change on vapour pressure deficits and evaporation. Traditionally, water planning has focused on the supply of water. In contrast, this project focuses on the demand side—quantifying how much water is used in food production and the value generated from that use. This approach supports a more balanced understanding of water use, recognising the need to maximise the value of available water while considering crop systems, farm businesses and community expectations.

This industry-led project enables agrifood producers to link water use with key business drivers, including yield, cost of production and profitability. By providing access to consistent, high-quality data, the project outputs will support improved decision-making at both farm and catchment scales, contributing to the long-term sustainability and resilience of the regional economy. The project has provided seasonal water use data for agrifood production (5 crops: avocados, apples, truffles, wine grapes and potatoes) in the Warren-Donnelly catchment in the southwest region of WA near Manjimup and Pemberton. The data has been aggregated with sub-catchment scale land use, landform data and weather observations to estimate actual water use at a scale equivalent to water supply calculations. Cost of production were also collected as part of the project, to assess net profit per megalitre applied. This in turn provides data on the net benefit of irrigation to farmers, the Western Australian economy and the flow-on benefits to the community.

Expected or current outputs

- Research framework for aligning irrigation monitoring with public data and crop classification modelling to estimate catchment scale irrigation deficits
- Industry owned dataset of average (and range) of irrigation practice for 5 crops over 4 years, coupled with crop production measures
- Curated dataset of publicly data (weather observations, multispectral satellite imagery, catchment and subcatchment boundaries)
- Research code for processing public and on-farm datasets for estimating crop water requirements and irrigation deficits (tabular and map-based format)
- Research code for seasonal review of irrigation practice (irrigation applied vs crop water demand) and benchmarked water productivity (t / Ml) and water profitability ($/ML)
- Research code for calculating simple water balance on-farm.
- SWAN Systems impact module
- Crop Classification machine learning model for identifying crop type in the catchment (avocado, apple, truffle, wine grapes)
- Case study booklet

Industry relevance and adoption pathway

The OFWD project demonstrates that data driven, demand side understanding of water use is essential for improving irrigation performance, supporting farm profitability, and enabling more balanced and transparent water planning. It has developed several outcomes that are relevant for industry:

Farm business outcomes:

- Growers improved irrigation practices through better alignment with crop demand
- Benchmarking and seasonal review enabled comparison with peers and identification of performance gaps
- Increased confidence in decision making and adoption of digital tools were widely reported

Next-stage questions

Journal publication - Water Dynamics in SWWA Agriculture: A Comparative Assessment of Four Crop Varieties.

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Novel microbiome technologies to increase profitability for Australian horticulture

Industry/ Commodity	Potatoes, tomatoes, avocados
Researcher(s) / lead organisation	Kirsty Bayliss / Murdoch University
Partners / funders	Hort Innovation, Future Food Systems CRC, Ecogrowth, Melville Park, Murdoch University
Dates of commencement and completion	2022-2026
Project stage	Applied

Problem or opportunity addressed / addressing

This project investigated the role of microbes in supporting crop growth and yield, particularly when crops are threatened by biotic or abiotic stresses. The aim is to identify microbes that might be developed into microbiome-based products, to increase yield and profitability for growers.

Summary of project

Hypothesising that healthier microbiomes mean more productive plants, the project team has been identifying the microbe strongly associated with healthier, higher-yielding plants in popular Australian horticultural crops, with the aim to harness them to grow more productive crops in the future.

A microbiome is the collective term for a group of microorganisms in a specific environment. Much like the gut microbiome being important for human health, plants also have a microbiome that contributes to their health and tolerance to different stresses.

Our goal is to identify a range of microbes associated with increased production and yield, especially in the face of environmental and disease stresses. We will then select those microbes most closely associated with healthy crops and use them to increase the crop yield and profitability for Australian growers.

Expected or current outputs

Results from our most recent trial on tomatoes will be presented, demonstrating the impact that selected microbes can have when applied to the crop, including increased yield.

Industry relevance and adoption pathway

Microbiome-based products would reduce the need for chemical applications while increasing the yields of popular fruit and vegetable crops.

Developing such products would lead to more cost-effective, sustainable production and bigger, better crops, resulting in greater profits for Australian growers and greater volumes of healthy fruit and veg for consumers.

Next-stage questions

The next steps are to determine a commercialisation pathway for the microbes we have demonstrated have significant benefit to tomato growers, field trials to confirm microbes that are relevant to other crops, and development of end user protocols for growers.

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Supporting potato productivity during future heatwaves by applying readily available calcium

Industry/ Commodity	Potatoes, tomatoes, avocados
Researcher(s) / lead organisation	Sumitra Saha
Partners / funders	Hort Innovation
Dates of commencement and completion	2024- 2025
Project stage	Applied

Problem or opportunity addressed / addressing

Heatwaves during tuber initiation are becoming more common in Western Australian potato-growing regions. Heat can significantly reduce yield, tuber quality, and profitability. As temperatures continue to rise, growers need cost-effective and sustainable ways to maintain productivity. This study examined whether applying readily available calcium during the growing period could mitigate the negative effects of heat stress at the tuber initiation stage and improve potato yield and quality.

Summary of project

Two field trials tested the effect of readily available calcium application on the heat stress response of the heat-tolerant cultivar Nadine and the heat-sensitive cultivar Royal Blue. Trials were conducted during normal potato-growing conditions or during summer heat. Episodic heat stress was imposed at tuber initiation using portable heat tents that captured ambient solar heat to mimic future climate conditions.

Calcium was applied to the root zone before heat exposure. Tuber yield and quality were assessed to determine whether calcium application could improve potato performance during heat stress.

Expected or current outputs

Heat stress during tuber initiation reduced yield and tuber quality compared to non-stressed plants, resulting in yield losses of up to 25%. The application of readily available calcium at tuber initiation improved plant performance during heat stress in both cultivars. Compared with heat-stressed plants that did not receive calcium, yield increased by 22% in Nadine and by 35% in Royal Blue. When compared to the calcium control, the yield increase ranged from 2% to 7%. Calcium-treated plants also produced higher marketable tubers and had higher calcium content in the tuber peel. The most pronounced response to calcium application was observed in Royal Blue.

Industry relevance and adoption pathway

Calcium application during tuber initiation demonstrates potential as a practical management strategy for maintaining potato productivity during heat stress. The greatest benefits observed in the heat-sensitive cultivar Royal Blue suggest that susceptible cultivars may benefit most from this strategy.

Next-stage questions

This study shows the potential of calcium application to support potato production during heat stress.

Further research is required to confirm these findings across growing environments and potato cultivars before recommendations can be made for industry adoption.

Contact details

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Evaluating on farm water and nutrient recapture in Western Australia production systems

Industry/ Commodity	Irrigated horticulture / Protected cropping and open-field horticulture
Researcher(s) / lead organisation	Neil Lantzke, Valeria Almeida Lima, Jane Brownlee, DPIRD
Partners / funders	Hort Innovation / DPIRD
Dates of commencement and completion	2025-2028
Project stage	Demonstration

Problem or opportunity addressed / addressing

Irrigated horticulture faces increasing pressure from rising water and fertiliser costs, declining water availability, and nutrient losses that reduce production efficiency and contribute to environmental degradation. Current production systems allow valuable water and nutrients to leach beyond the crop root zone, representing both an economic loss to growers and a risk to surrounding waterways. This project addresses the opportunity to recover and recycle these resources, improving farm productivity, resource use efficiency, and environmental sustainability.

Summary of project

This project aims to develop and validate an innovative nutrient and water recycling system for irrigated horticulture by capturing leached irrigation water and nutrients below the crop root zone using geomembranes, storing the leachate, and reapplying it to crops. The project will evaluate the system's technical performance, environmental benefits, and economic viability, with the goal of improving water and nutrient use efficiency, reducing production costs, and supporting the sustainable growth of the horticulture industry.

Expected or current outputs

This project will establish a pilot research site and a commercial on-farm demonstration to validate a nutrient and water recycling system for horticulture under both experimental and commercial conditions.

Findings will be shared with industry through field days, presentations, videos, publications, and a practical grower manual, supported by a benefit–cost analysis to demonstrate the economic viability and facilitate adoption of the technology.

Industry relevance and adoption pathway

This project addresses key challenges facing the irrigated horticulture industry, including increasing fertiliser and water costs, declining water availability, and stricter environmental regulations relating to nutrient losses. By recovering and reusing leached water and nutrients, the technology has the potential to improve water and nutrient use efficiency, reduce production costs, and minimise environmental impacts while supporting the long-term sustainability and resilience of horticultural production.

Research sites will validate the technology under real production conditions and provide opportunities for growers to observe the system firsthand through field days and extension events.

Next-stage questions

- Can the nutrient and water recycling system be successfully implemented at commercial scale while maintaining crop productivity and quality?
- What are the long-term impacts of repeated leachate recycling on soil health, salinity, and nutrient availability?
- How many times can irrigation water be recycled before water quality limits its reuse?
- What are the risks associated with pathogen accumulation, and what management practices are required?
- What is the economic return on investment under different horticultural production systems?
- What design specifications and operating guidelines are needed to enable widespread grower adoption?

Contact details

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Smart sprays

Industry/ Commodity	Horticulture tree fruits, frost, water
Researcher(s) / lead organisation	Prof Daniel Murphy Murdoch Uni
Partners / funders	GRDC and looking for Hort partners
Dates of commencement and completion	2025-2028
Project stage	Demonstration

Problem or opportunity addressed / addressing

Within the Bioplastics Innovation Hub at Murdoch University we have in collaboration with GRDC developed Gen 0 SMART SPRAYS for water harvesting (surface water movement) and as a leaf sticky spray for delivery of chemicals, fertiliser and biologicals. We are also looking at ice proteins for frost protection. These sprays can also be functionalised with UV blockers. We are interested in exploring opportunities to extend this research and spray technology into horticulture. For example we are starting a project this week with United Nations FAO in Thailand looking at a spray to coat mangoes to protect from fungal pathogens and to alter UV levels.

Expected or current outputs

Biodegradable environmentally green sprays that do not leave a plastic legacy in soil or water.

Industry relevance and adoption pathway

New technology that may benefit horticulture.

Next-stage questions

Keen to explore opportunities for expanding this work from Broadacre into horticulture.

Contact details

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Minor warming may result in major changes in production

Industry/ Commodity	All tree crops
Researcher(s) / lead organisation	Michael Considine UWA / DPIRD
Partners / funders	CRCNA/ Fresh Produce Group/ Bloom Fresh International
Dates of commencement and completion	Commenced 2022 ongoing
Project stage	Early research

Problem or opportunity addressed / addressing

Negative effects of climate warming on crop production.

Summary of project

Agricultural research has heavily invested in the consequences of heat stress, however small changes in ambient temperature are having major changes on crop production. Despite decades of phenology data showing climate warming affects the timing of production, we still know nothing about how this occurs, and as a result how to respond to this as an industry.

Through re-analysis of public data, this study illustrates the impact of ambient warming on grapevine growth, and maps a pathway for dissecting the key genetic controls.

Expected or current outputs

Key outputs will be:

- training of the next generation of horticulture scientists to be ready to respond to climate warming.
- identification of the major genetic factors controlling maladaptive responses to climate warming in grapevine.
- mapping a pathway to translate genetic analysis of climate warming from annuals to perennial tree crops.

Industry relevance and adoption pathway

Greatest and postgraduate training, new markers for genetic improvement, new knowledge to prime research on agronomic management of climate warming.

Next-stage questions

- Which canonical temperature sensors predominate in the control of warm temperature growth responses in grapevine?

- How much genetic variation in this trait exists with existing varieties, including rootstocks?
- Given the timeline required for genetic improvement in perennials such as grapevine, apple, stonefruit, citrus, how can we fund a cross-sector approach to make a strategic start on this challenge now?

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Narrow Orchard Systems for future climates

Industry/ Commodity	Pome and stone fruit
Researcher(s) / lead organisation	Asad Ullah, Dario Stefanelli, Ian Goodwin, Alessio Scalisi, Tim Pitt, Kevin Dodds
Partners / funders	Hort Innovation, Agriculture Victoria, DPIRD WA, NSW DPIRD, UQ, SARDI, Pomewest, BSI NZ
Dates of commencement and completion	June 2023 – Oct 2028
Project stage	Early research

Problem or opportunity addressed / addressing

Pome and stone fruit orchard design is at a pivotal stage of development. While dwarfing rootstocks have enabled the widespread adoption of high-density planting systems, there remains considerable debate over the optimal canopy architecture, particularly whether narrow two-dimensional (2D) fruiting walls or wider three-dimensional (3D) spindle canopies deliver the best long-term outcomes. Current orchard designs are also constrained by machinery dimensions and fruit bin sizes, which dictate row spacing and require taller tree canopies to achieve commercially acceptable yields. An alternative approach is to reduce row spacing and tree height to approximately 2-2.5 m, enabling all orchard operations to be carried out safely from the ground without ladders or elevated platforms.

Summary of project

The project aims to develop orchard systems that maximise yield, fruit quality, climate resilience, and the efficient use of labour and other resources for pome and stone fruit production. The proposed design uses narrow row spacings of 2.0–2.5 m, with trees planted at 2 m intervals within rows and trained as narrow two-dimensional (2D) multileader canopies. This configuration promotes more uniform light distribution throughout the canopy, improving fruit quality while maintaining tree establishment costs comparable to current high-density orchard systems. Tree height will be limited to approximately 2-2.5 m through the use of highly dwarfing rootstocks, providing safe and efficient access for pruning, thinning, and harvesting without the need for ladders, thereby reducing workplace hazards and improving labour efficiency. This narrow orchard system (NOS) offers significant advantages beyond improved worker safety. Its simplified canopy architecture is well suited to robotics, automation, precision sensing, and targeted crop protection technologies, while also reducing labour requirements, energy use, and the overall inputs needed for efficient orchard management.

Expected or current outputs

The project will provide knowledge that supports an industry transition to:

- Safer orchards that attract a labour force.
- More profitable orchards due to lower operating cost (e.g., energy, labour).
- Uniform orchards that consistently produce high yields of quality fruit.
- Accelerated adoption of robotic and sensing technology.
- Climate resilient and environmentally sustainable orchards.

Industry relevance and adoption pathway

Industry adoption will be accelerated through the establishment of commercial demonstration orchards across major growing regions, enabling growers to evaluate the performance and economic benefits of the system under local conditions. The project is working closely with growers, nurseries, consultants, machinery manufacturers, and industry organisations to refine orchard designs and management practices, ensuring the system is practical, economically viable, and compatible with existing production systems. Extension activities, including field days, technical publications, training videos, and decision support tools, are facilitating knowledge transfer and supporting widespread adoption.

Next-stage questions

The next stage of the project will focus on evaluating the long-term performance of narrow orchard systems (NOS), including their effects on productivity, fruit quality, orchard longevity, and economic returns over the life of the orchard. Research will also investigate the irrigation, nutrition, and crop load management strategies required to optimise system performance across a range of climates, production environments, and cultivars. This work will provide the knowledge needed to refine NOS management practices and support their successful adoption across Australia's diverse pome and stone fruit growing regions.

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Maximising carrot packout

Industry/ Commodity	Carrot
Researcher(s) / lead organisation	Falko Mathes, Ivan Rojas Daza, Neil Lantzke, DPIRD
Partners / funders	SARDI, QDPDI, Hort Innovation
Dates of commencement and completion	October 2025 – October 2028
Project stage	Early research

Problem or opportunity addressed / addressing

The project aims to maximise the packout of high-quality carrots by improving on-farm production and handling practises. Specifically, the project focuses on minimising carrot splitting, a phenomenon that occurs during certain times of the year, and soilborne diseases, which cause stumping and forking of carrots as well as unsightly lesions.

Summary of project

The "Maximising Carrot Packout" project consist of three stages. During stage 1, grower interviews were conducted across all major Australian production areas to identify the main causes affecting carrot packout. National R&D priorities were identified with harvest splitting as the highest research priority, followed by stumping and forking of carrots caused by nematodes and/or Pythium, and "black scabby lesions" with a hitherto unknown cause in third place. Stage 2 of the project includes crop monitoring to better understand defect causes. This will be followed by a research program aiming to improve current management practising to ultimately increase carrot packout. Finally, extension and adoption activities will be conducted during stage 3.

Expected or current outputs

The project outputs to date are a literature review on current issues affecting carrot packout. Future outputs include case studies detailing the results of the monitoring and research activities, best management practice guides, and a tool predicting when splitting may occur.

Industry relevance and adoption pathway

Carrots that do not meeting market specification have a major impact on farm profitability. This project therefore directly addresses key challenges identified by the carrot industry. Grower-led on-farm trials and the dissemination of trial results to the broader industry via webinars and field days will facilitate adoption of developed management practices.

Next-stage questions

What is the extent of the nationally identified packout issues? Which novel chemical and/or biological control options as well as management practices can help increase packout rates?

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Investigating the control of fruit drop in mango to support solution for northern and Western Australian growers

Industry/ Commodity	Mango
Researcher(s) / lead organisation	Haider Ali
Partners / funders	Edith Cowan University and Cooperative Research Centre for Developing Northern Australia
Dates of commencement and completion	December 2026
Project stage	Applied

Problem or opportunity addressed / addressing

Mango production in Western Australia is constrained by poor fruit set and excessive early fruit drop, with up to 90–98% of initially set fruit being lost before harvest. This significantly reduces yield and grower profitability. Current management practices provide inconsistent results because the physiological mechanisms controlling fruit set and retention under Australian growing conditions are not fully understood. This project aims to develop science-based pre-harvest management strategies that improve fruit retention and productivity through targeted application of plant growth regulators and nutritional treatments.

Summary of project

This PhD project investigates how pre-harvest foliar applications of selected plant growth regulators and nutritional compounds regulate fruit set, fruit retention, yield, and fruit quality in mango. The research evaluates compounds such as 24-epibrassinolide, Perlan®, tryptophan, putrescine, AVG, cobalt sulphate, sucrose, and boron at different developmental stages in the cultivars Kensington Pride, Honey Gold and R2E2 under Australian conditions.

In addition to measuring fruit set, fruit drop and yield, the project examines changes in fruit quality, including sugars, organic acids, phenolics, antioxidants and other biochemical traits, to better understand the physiological mechanisms underpinning improved fruit retention.

Expected or current outputs

The project has generated promising results showing that selected plant growth regulators, ethylene inhibitors and nutritional treatments can improve mango fruit set and/or fruit retention. However, treatment effectiveness depends strongly on the concentration used and the phenological stage at which the treatment is applied.

The expected outputs are:

- Identification of effective treatments for improving fruit set and reducing early fruit drop.
- Determination of the most suitable application stage and concentration for each treatment.
- Improved understanding of how plant growth regulators, ethylene inhibition and nutritional interventions influence mango reproductive development.
- Recommendations for increasing fruit retention, yield and fruit quality in ‘Kensington Pride’ and ‘R2E2’ mango.
- Scientific publications, industry communications and practical information to support future commercial validation.

Industry relevance and adoption pathway

Poor fruit set and excessive early fruit drop are major constraints to consistent mango yield and grower profitability. This project directly addresses these constraints by evaluating practical preharvest spray treatments that could potentially be incorporated into existing orchard management programs.

Treatments that consistently improve fruit set or retention will be prioritised for further validation under commercial orchard conditions. The adoption pathway will involve confirming the optimum concentration and application timing, assessing consistency across cultivars, seasons and locations, evaluating yield and fruit-quality benefits, and considering treatment cost, registration status and practical compatibility with existing spray programs.

Results will be communicated through collaboration with growers and industry partners, field demonstrations, workshops, industry publications and scientific papers.

Next-stage questions

The next stage will focus on the following questions:

- What are the optimum concentration and application stage for each promising treatment?
- How consistent are treatment responses across mango cultivars, seasons, orchards and production regions?
- How do the treatments influence carbohydrate availability, hormonal regulation, ethylene production and fruitlet abscission?
- Can selected treatments be combined or sequenced to improve both fruit set and subsequent retention?
- Do improvements in fruit number translate into higher marketable yield without negatively affecting fruit size, maturity or quality?
- Are the most effective treatments economically practical and suitable for integration into commercial orchard spray programs?

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Insects and disease

PIPS 4 Profit - Integrated pest and disease management

Industry/ Commodity	Apples/Pomefruit
Researcher(s) / lead organisation	Jen Riseley Agriculture Victoria, Pomewest/DPIRD
Partners / funders	HortInnovation
Dates of commencement and completion	January 2024 - June 2028
Project stage	Early research

Problem or opportunity addressed / addressing

The insect pest Ceratitis capitata or Mediterranean fruit fly is a pest of trade concern to WA orchards, especially those maintaining export relationships with international markets. Insect pressure from townsites, unmanaged orchards and areas of natural habitat contribute to crop protection costs for growers by way of spraying and monitoring. Biocontrol agents such as predators and parasitoids can present a non-toxic, self-dispersing option to reduce pest pressure from these sources.

Summary of project

PIPS 4 Profit – Integrated Pest and Disease Management is a national R&D program investigating the feasibility of different biocontrol methods in Australian orchards.

The WA project is evaluating the feasibility of classical biological control of Mediterranean fruit fly by releasing and establishing the Australian native parasitoid wasp Diachasmimorpha kraussii close to the Donnybrook townsite. After an initial release in January 2026 the parasitoid was found again in March 2026, indicating mating was occurring in the field. Another release is planned in 2027, with the project examining orchard practices that will favour establishment of the parasitoid.

The project is also evaluating the feasibility of augmentative biological control of Light brown apple moth by using Australian native parasitoid wasp Trichogramma spp.

Expected or current outputs

- Baseline pest monitoring data in WA orchards for Mediterranean fruit fly and Light brown apple moth.
- Multiple biocontrol agent releases.
- Increased grower confidence in IPDM decision making, improved industry knowledge of biocontrol.
- Understand important factors for species biodiversity, plant health and orchard economics for IPDM practices.

Industry relevance and adoption pathway

Regulation in Europe and other nations has left fewer chemical options for controlling insect pests in those markets. Producers in WA are always looking for a range of control options in the event a pest becomes resistant to a chemical option or the product is unavailable. Some locations such as public areas and rivers are unsuitable for chemical control.

Communications plan outlines industry articles, videos, industry regional roadshows to communicate project progress and outcomes to WA and national industry. Economics data to calculate return on investment for biocontrol and IPDM activity in WA orchards.

Next-stage questions

If establishment in WA orchards is feasible, what orchard practices increase predator/parasitoid survival?

As climate conditions warm, how will pest dispersal and behaviour change in WA orcharding regions? Will parasitoids also survive in these environments?

Contact details

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Long-term management of soil-borne pathogens for vegetable production in Carnarvon

Industry/ Commodity	Vegetable industry
Researcher(s) / lead organisation	Giao Nguyen/DPIRD
Partners / funders	This project is driven by internal research funding, co-financed by commercial vegetable seed companies, and supported by in-kind contributions from the Carnarvon grower community.
Dates of commencement and completion	February 2026 – August 2027
Project stage	Applied

Problem or opportunity addressed / addressing

Soil-borne disease problems in Carnarvon vegetable systems, with emphasis on tomato production.

Summary of project

Root knot nematode (RKN) (Meloidogyne spp.), fusarium wilt (Fusarium oxysporum f.sp. lycopersici) and fusarium crown and root rot (Fusarium oxysporum f.sp. radicis lycopersici) are critical soil borne pathogens for vegetable growers in Carnarvon. RKN are soil-borne, worm-like animals that attack the roots of vital crops like tomatoes, capsicum, and zucchini. These nematode attacks damage root zones, lowering the plants' natural resistance and creating direct entry points for Fusarium fungi, which can survive in the soil for years without a host. Once inside, the fungus builds up in the vascular tissue, blocking the flow of water and nutrients. Infected plants look unthrifty, stunt, and yellow. They suffer severe wilting and dieback at the critical 4–5 truss stage during flowering, drastically reducing fruit set and overall yield. Because these pathogens act synergistically, effective control measures must target both simultaneously.

While control options like crop rotation and chemical treatments exist, standalone tactics carry major drawbacks. Plant resistance is highly effective against pathogens, but it must be balanced with commercial traits; stacking too many disease-resistant genes into a single variety often compromises final yield and fruit quality. Alternatively, growers frequently rely on chemical fumigants to remove the pathogens from the soil. However, fumigation is not a foolproof solution; improper application leads to poor control, fosters pathogen resistance, and destroys beneficial soil microorganisms, leaving crops highly vulnerable if pathogens survive or re-emerge.

To address these challenges, this project will evaluate an improved, integrated management strategy to comprehensively tackle soil-borne diseases. The trials combine pre-plant fumigation to knock down initial pathogen baselines, post-fumigation nematicides to safeguard early root development, and organic soil amendments to restore vital microbial health. By testing this multi-tiered approach on both resistant and susceptible varieties, the project demonstrates how growers can sanitize their soil while still prioritizing high-yielding, premium-quality tomatoes, ultimately establishing a sustainable, long-term control framework for Carnarvon's vegetable industry.

Expected or current outputs

The final objective of this project is a holistic solution for managing soil-borne pathogens in Carnarvon vegetable production, specifically targeting Fusarium wilt and nematodes. The research timeline and progress to date include:

- 2022: Trial data validated that tomato varieties with the Fol 3 resistance gene effectively control
- Fusarium wilt, though the interactive effects of nematode pressure on yield were not assessed.
- 2026 (Current): Ongoing trials are evaluating the co-application of fumigants and nematicides. Preliminary data indicate the combined approach significantly outperforms fumigation alone. This phase concludes in September.
- 2027 (Planned): Baseline assessments have begun on the soil colonization dynamics of organic amendments inoculated with Trichoderma and Mycorrhizae, ahead of a rigorous evaluation next year.

Industry relevance and adoption pathway

This study aims to address the critical soil-borne disease challenges facing the local vegetable industry in Carnarvon, making it highly relevant to the interests of local growers and industry stakeholders.

Local farmers highly welcomed the 2022 research findings regarding the use of disease-resistant tomato varieties. Growers actively seek information on resistant crop varieties through the annual variety trials, which are conducted collaboratively between the Carnarvon vegetable research team and commercial seed companies.

Once all trials are concluded, the research team will host a field day to demonstrate the final outcomes to local growers, highlighting the efficacy of combining fumigants, nematicides, and organic soil amendments.

Next-stage questions

Future research directions will evaluate commercially available microbial-enriched organic amendments to identify the most effective formulations for suppressing persistent, long-term soil-borne pathogens.

Furthermore, the project will establish the optimal integration strategy combining host plant resistance with chemical inputs. This approach aims to maximize crop yield and quality while safeguarding and enhancing soil fertility.

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Developing chemical ecology tools for Polyphagous Shot-Hole Borer management

Industry/ Commodity	Urban forestry and amenity trees
Researcher(s) / lead organisation	Wei Xu/Murdoch University
Partners / funders	WAARC
Dates of commencement and completion	2025-2028
Project stage	Early research

Problem or opportunity addressed / addressing

The polyphagous shot-hole borer (PSHB) is an invasive beetle–fungus complex threatening Western Australia's urban forests, horticulture and natural ecosystems. The beetle attacks hundreds of tree species, causing tree decline and mortality, while current management options are limited because infestations are difficult to detect and effective attractants or control methods are lacking. This project aims to use chemical ecology to identify the cues that guide host location and beetle behaviour, providing a foundation for improved surveillance, early detection and sustainable management of this emerging biosecurity pest.

Summary of project

This project investigates the chemical ecology of the polyphagous shot-hole borer (PSHB) to support the development of sustainable management strategies for this invasive pest in Western Australia. The research examines how beetles locate and select host trees by identifying host-derived volatile compounds and characterising beetle behavioural responses. The project also establishes laboratory bioassays and the first stable PSHB colony in Western Australia to enable testing of attractants, repellents and other behavioural management tools. The findings will underpin improved surveillance, early detection and environmentally sustainable management of PSHB, helping protect urban forests, horticultural industries and natural ecosystems.

Expected or current outputs

Identification of volatile cues associated with PSHB host selection; laboratory behavioural bioassays; establishment of the stable PSHB laboratory colony in Western Australia; candidate attractants and repellents for surveillance and management; scientific publications; industry presentations; and practical recommendations for improved detection and sustainable management.

Industry relevance and adoption pathway

This research will provide the scientific foundation for improved PSHB surveillance and sustainable management in Western Australia. Findings will be shared through collaboration with DPIRD, UWA, local governments, arborists and industry, together with workshops, extension activities, scientific publications and industry presentations. This project will support the future development and adoption of chemical ecology-based monitoring and management tools for this important invasive pest.

Next-stage questions

- Which host-derived volatile compounds are the most effective attractants for PSHB?
- Can repellents or push–pull strategies reduce PSHB attacks on susceptible trees?
- How do host tree chemistry and fungal symbionts influence beetle host selection?
- Can laboratory findings be translated into effective field-based surveillance and management tools?
- How can chemical ecology be integrated with existing biosecurity surveillance and management programs to improve early detection and response?

Contact details

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Managing insecticide resistance in chilli thrips through integrated pest management (IPM)

Industry/ Commodity	Berries, table grapes, vegetables, citrus
Researcher(s) / lead organisation	Kiran Mahat, Julia Grassl/DPIRD
Partners / funders	CRC SAAFE
Dates of commencement and completion	Commencement August 2026, End August 2030
Project stage	Applied

Problem or opportunity addressed / addressing

Chilli thrips is an emerging pest of significant concern to the Western Australian horticultural industry. Although the pest has been present in the Kimberley region for approximately 20 years, it was not previously recorded as causing major economic damage. However, the first report of significant crop damage in commercial horticulture was received from Perth metropolitan area and the Swan Valley table grape industry in early 2021. Since 2022, severe infestations have also been reported in the berry industry, with increasing reports from other horticultural sectors such as table grapes, vegetables, citrus and ornamentals. The pest is now well established in metropolitan areas and continues to spread into regional production zones, posing an escalating threat to horticultural industries.

Chilli thrips are very difficult to manage due to their broad host range, rapid reproductive cycle, cryptic behaviour, and strong capacity to develop insecticide resistance. Although, insecticides remain the primary management tool, there is currently no information on the efficacy of commonly used chemistries against WA chilli thrips populations. Furthermore, there is very limited knowledge and tools available for the sustainable management of chilli thrips in Western Australia. This project will therefore address these critical gaps and help generate information to develop an integrated pest management strategies against this pest.

Summary of project

This project will develop knowledge and strategies required for sustainable management of chilli thrips.

The project will:

1. Quantify insecticide resistance in Western Australian chilli thrips populations using laboratory and molecular tools.
2. Undertake field surveys to identify and understand the seasonal abundance of various biological control agents of chilli thrips.
3. Improve management strategies of chill thrips by evaluation and integrating biological control with other appropriate strategies such as banker plants and

intercropping systems which will help enhance the effectiveness of biocontrol agents and also support their population.

Collectively, the project outcomes will help improve chilli thrips control, reduce reliance on insecticides and delay the development of insecticide resistance.

Expected or current outputs

1. Improved understanding of field insecticide resistance levels in WA chilli thrips through laboratory bioassays and molecular techniques. This will provide growers with the information needed to select the most effective insecticides, implement evidence-based resistance management, and preserve the efficacy of available chemistries for control of chilli thrips.
2. Enhanced knowledge on the identity and seasonal dynamics of key chilli thrips biological control agents.
3. Improved knowledge on the effectiveness of biocontrol agents in suppressing chilli thrips by integrating various techniques such as banker plants/intercropping.

Industry relevance and adoption pathway

This research will provide industry and growers with the knowledge and tools to improve chilli thrips management through informed insecticide selection, effective resistance management, and the adoption of integrated pest management (IPM) strategies.

Findings will be disseminated through industry workshops, field days, demonstration trials, factsheets and webinars to enable growers to adopt improved chilli thrips management practices.

Next-stage questions

Some of the key next-stage research questions include:

1. How can integrated pest management (IPM) strategies be optimised across different horticultural production systems?
2. How can conservation biological control be enhanced to provide reliable, long-term suppression of chilli thrips? And how can it be also employed in other cropping systems and/or other pests of economic importance in WA?

Contact details

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Flies as efficient pollinators in horticulture

Industry/ Commodity	Avocado
Researcher(s) / lead organisation	David Cook Shoaib Tufail (DPIRD)
Partners / funders	Hort Innovations Australia
Dates of commencement and completion	October 2025 to October 2030
Project stage	Near Commercial

Problem or opportunity addressed / addressing

There is an urgent need to develop alternative managed crop pollinators for Australian horticulture to respond to challenges posed by the widespread decline of wild pollinators and ability to source managed bee hives. This project extends pioneering work from Hort Frontiers project PH16002 which identified flies with potential as managed crop pollinators. This new project will advance the four most promising candidate species (Eristalis tenax, Eristalinus punctulatus, Calliphora dubia and C. vicina) by evaluating their risks, costs and benefits and developing pathways to large scale rearing and deployment with commercial partners.

Summary of project

The new project will progress fly research and development for crops where each fly species has been proven to pollinate effectively (avocado, cherry and vegetable seed) and evaluate managed fly performance in new cropping systems including apple, pear and almond. In addition, DPIRD will assess the use of irradiated flies v fertile flies to determine a safe level of radiation that doesn't compromise fly foraging behaviour and longevity in the event it is deemed necessary to do so.

Expected or current outputs

This new 5 year Hort Innovation funded project will advance the four most promising candidate species (Eristalis tenax, Eristalinus punctulatus, Calliphora dubia and C. vicina) by evaluating their risks, costs and benefits and developing pathways to large scale rearing and deployment with commercial partners.

Industry relevance and adoption pathway

There is an urgent need to develop alternative managed crop pollinators for Australian horticulture to respond to challenges posed by the widespread decline of wild pollinators, increasing risks to honeybee health, expansion of crops and cropping systems less suited to honeybees, and forecasts that future demand for commercial pollination services will exceed honeybee supply. This project extends pioneering work from Hort Frontiers project PH16002 which identified flies

This project will make a vital contribution to future proofing horticultural crop pollination in Australia. It will provide growers with additional managed pollinators matched to specific crops and growing regions to complement existing honeybee pollination services.

Next-stage questions

Development of a slow-release lure in collaboration with the WA Chem Centre to attract and retain calliphorid flies released into an orchard environment as managed pollination insects in support of honey bees.

How well do both calliphorid flies and hover flies pollinate commercial apple varieties when tested under netting, which often affects honey bee navigation and colony health.

How well do Eristalis tenax and Calliphora dubia flies pollinate avocado trees when released into open orchards where their disperal rate will be measured.

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Intercropping as an IPM strategy for Spodoptera litura in asparagus production, Broome, Western Australia

Industry/ Commodity	Asparagus
Researcher(s) / lead organisation	DPIRD Aimee Grieves, Kiran Mahat, Carla Milazzo, Christopher Ham, Julia Grassl, Muhammad Shoaib Tufail
Partners / funders	Hort Innovations Australia
Dates of commencement and completion	June 2025 - June 2026
Project stage	Demonstration

Problem or opportunity addressed / addressing

Spodoptera litura is a major pest of asparagus production in Northern Australia, and current management practises rely heavily on broad-spectrum insecticide applications. Insecticide resistance has already been confirmed in the local S.litura population highlighting the need for integrated pest management strategies that reduce the reliance on chemical control.

Summary of project

This study evaluated the potential of three intercrop species (niger, mungbean and cowpea), grown alongside asparagus to support beneficial arthropods and reduce S.litura incidence. The objectives were to: (i) monitor S. litura population dynamics using pheromone trapping; (ii) assess the relative attractiveness of intercrop species to S. litura; (iii) quantify S. litura larval abundance and beneficial arthropod populations in monocropped and intercropped systems; and (iv) assess relationships between S. litura abundance and beneficial arthropod populations.

Expected or current outputs

Conference proceedings, internal report.

Industry relevance and adoption pathway

S.litura has emerged as a major issue for the local horticulture industry.

We have invited local farm managers to visit our trial area where we have demonstrated the ability for intercropping to be used as an IPM strategy without the need for chemical control. We will assist the farm managers in developing a plan for integration of IPM strategies into their current practises. Alternative IPM strategies are currently being investigated.

Next-stage questions

Further evaluation under commercial production conditions is required to compare intercrop systems directly with conventional asparagus monocropping to find and optimise approaches for agricultural systems in Northern Australia.

Contact details

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Effect of soil fumigation on potato disease

Industry/ Commodity	Potatoes
Researcher(s) / lead organisation	Wossen Mengesha, Julia Grassl
Partners / funders	DPIRD
Dates of commencement and completion	Pilot trial completed 2026
Project stage	Early research

Problem or opportunity addressed / addressing

Potato growers rely on soil fumigation to suppress soil-borne pathogens, but the benefits and impacts on soil microbial diversity are often uncertain. This pilot project investigated the effect of soil fumigation on potato yield and soil microbiomes to provide evidence that supports more sustainable disease management decisions.

Summary of project

An on-farm pilot trial was conducted to evaluate the effects of metham sodium soil fumigation on potato production and soil-borne diseases. Pre-plant soil inoculum levels, potato yield, and disease incidence and severity at harvest were compared between fumigated and non-fumigated plots. Diseases assessed included black dot (Colletotrichum coccodes), powdery scab (Spongospora subterranea), and common scab (Streptomyces spp.). Changes in bacterial and fungal soil microbial communities were also evaluated over a single growing season.

Expected or current outputs

1. Evidence that metham sodium fumigation did not significantly improve marketable potato yield or reduce the incidence of the assessed soil-borne diseases under the conditions of this pilot field trial.
2. Characterisation of the impact of metham sodium fumigation on bacterial and fungal soil microbial communities, including reduced microbial diversity and shifts in community composition.

Industry relevance and adoption pathway

The project provides preliminary evidence to support decision-making on the use of metham sodium fumigation in potato production.

Further validation across multiple sites and growing seasons would support broader industry adoption and inform best management practices.

Next-stage questions

Are the effects of metham sodium fumigation on potato yield, soil-borne diseases, and soil microbial communities consistent across different environments and growing seasons?

Can integrated disease management approaches reduce reliance on soil fumigation while maintaining potato productivity and soil health?

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Pathology support to cotton growers of Western Australia

Industry/ Commodity	Cotton
Researcher(s) / lead organisation	Dinesh Kalfe, Qld DPI, Sambasivam Periyannan, UniSQ, Sarah Nolan-Gorman, DPIRD
Partners / funders	CRDC
Dates of commencement and completion	01/07/2025
Project stage	Early research

Problem or opportunity addressed / addressing

Western Australia's emerging cotton industry is centred in the Ord River Irrigation Area (ORIA), a tropical production region with disease risks that differ from eastern Australia's established cotton-growing areas.

Limited knowledge of cotton diseases in WA highlights the need for surveillance, diagnostics, and baseline data to support grower decision-making and sustainable industry growth.

Summary of project

The Australian Cotton Disease Collaboration (ACDC) Project A3.1 provides cotton pathology support to WA growers through disease diagnostics and crop surveillance activities. The project delivers diagnostic services for samples submitted by growers and industry stakeholders, complemented by biannual surveys of cotton-growing regions. Information collected is used to identify diseases present in WA cotton crops, monitor disease occurrence and distribution, and improve understanding of pathogen risks within the tropical production system. The project also aims to strengthen local diagnostic capability and establish networks between growers, industry, and researchers.

Expected or current outputs

Disease diagnostic support for WA cotton growers and industry.

- Biannual disease survey datasets from cotton production areas in the ORIA
- A baseline inventory of diseases and pathogens present in WA cotton crops, with fungal coultures submitted to the Australian Cotton Disease Collaboration Pathogen Collection, and a identical dataset held in WA.
- Identification of emerging disease threats
- Improved understanding of disease risks associated with tropical cotton production
- Increased local pathology and diagnostic capacity within Western Australia.
- Extension materials and communication of findings to growers and industry stakeholders.

Industry relevance and adoption pathway

The project supports growers through disease diagnostics and region-specific disease surveillance.

Findings are shared through industry networks, field days, and grower engagement activities, enabling informed disease management and improving preparedness for emerging disease threats in WA cotton.

Next-stage questions

- Identify key diseases and pathogens affecting WA cotton
- Understand seasonal and environmental drivers of disease
- Compare WA disease risks with eastern Australian production systems
- Inform disease management and biosecurity strategies for growers?

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Development of an integrated pest containment strategy for Polyphagous Shot Hole Borer-Fusarium Dieback to facilitate eradication and control

Industry/ Commodity	Trees
Researcher(s) / lead organisation	Treena Burgess, Duccio Migliorini
Partners / funders	WAARC
Dates of commencement and completion	Nov. 2025 - Nov. 2026
Project stage	Early research

Problem or opportunity addressed / addressing

The spread of the ambrosia beetle Euwallacea fornicatus and its symbiotic Fusarium fungus in Western Australia poses a serious phytosanitary threat to tree crops across the region. The decline caused by this insect–fungus pathosystem is commonly referred to as Polyphagous Shot Hole Borer–Fusarium Dieback (PSHB-FD) and has resulted in significant economic losses in California, Israel, and South Africa.

Summary of project

The research undertaken within this project is divided into two main workstreams. The first focuses on assessing the potential susceptibility of the most widespread tree species and cultivars in Western Australia to the fungal pathogen, while also identifying attractants for the beetle. The aim is to identify the production systems at greatest risk of infestation and to generate knowledge that can support the development of effective trapping systems. The second workstream is aimed at identifying chemical treatments capable of controlling both the beetle and its fungal symbiont in trees that are already at an advanced stage of colonisation.

Expected or current outputs

Stone fruit cultivars grown in Western Australia exhibit different levels of susceptibility to the fungal pathogen, as reflected by their sapwood response. Laboratory inoculation trials showed that, three weeks after inoculation, some cultivars developed, on average, slightly larger lesions than the other stone fruit species tested. Over the coming months, these experiments will be expanded to include a wide range of additional plant species of economic, ornamental, and ecological importance across Western Australia.
Field trials evaluating chemical treatments against PSHB-FD are currently underway in native stands. The first results are expected from next spring onwards, with assessments conducted at six-month intervals over a period of several years from the start of the project.

Five artificial diets were successfully identified for establishing laboratory colonies, enabling detailed investigations of the beetle's reproductive performance. To identify potential attractants for lure development, an experimental olfactometer was used to evaluate beetle responses to different sources of volatile compounds. Several of the tested volatile sources elicited significant attraction, paving the way for their immediate evaluation as candidate lures in field trials.

Industry relevance and adoption pathway

The spread of PSHB-FD poses a major threat to Western Australia's horticultural industries, urban forests, and native ecosystems. By identifying susceptible host species, effective monitoring tools, and chemical control options, this project will provide the evidence base required for informed management decisions and improved biosecurity preparedness.

Research outcomes will be translated into practical management recommendations through close collaboration with industry partners and government agencies, including DPIRD, DBCA, local councils, arboriculture professionals, and commercial growers. Findings will be disseminated through technical guidelines, workshops, field demonstrations, scientific publications, and extension activities, facilitating the uptake of integrated management strategies for PSHB-FD.

Next-stage questions

Focusing on tree species and cultivars that are highly susceptible to PSHB-FD, the most promising chemical treatments, together with novel beetle biocontrol approaches, will be evaluated through field trials aimed at identifying effective disease management strategies that can be readily adopted by industry.

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