PCA2025

ABSTRACT BOOK

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Protected Cropping Australia Conference

28-30 JULY 2025
ADELAIDE CONVENTION CENTRE

Growing profitably and sustainably

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The Rise of CEA: Defining Excellence in Controlled Environment Agriculture - Lessons for Australia, Global Insights That Matter

Levi Nupponen

Keynote Panel Presentations & Panel
Hall C, July 29, 2025, 09:00 - 10:30

As global momentum builds around Controlled Environment Agriculture (CEA), there's real value in reflecting on what works—and what doesn't. In Australia, the opportunity is clear: rising demand, climatic pressures, and shifting supply chains are creating the right conditions for growth. From observing both success and failure—locally and abroad—it's become clear that outcomes are shaped less by technology and more by execution. Strong teams aligned financial partners, competitive tendering, value-driven design, and integrated sustainability aren't optional—they're foundational. And no matter how promising the opportunity, it won't deliver without cashflow discipline and operational clarity. Because at the end of the day, you can't go green in the red.

How does AI work in a greenhouse?

Mr Paul Voutier[1], **Mr Leigh Oliver**
[1]*Ambit Robotics*

Ag Tech Innovation (Robotics, AI, Automation)
Hall C, July 29, 2025, 11:10 - 12:45

Most commentary on AI focuses on the technology's potential to transform everything from irrigation control to plant breeding. But how does the technology actually work?

Paul and Leigh will step the participants through the AI model development process, using the example of our yield forecasting model for greenhouse tomatoes. Avoiding technical language; we will outline how models are trained and then used to provide insights to growers.

The presentation will use examples from the development of our yield forecasting model, using images of tomatoes and demonstrate how they are processed.

The presentation will leave participants with a clear understanding of the tools that sit behind the AI hype, and what they can and can't do. We hope the presentation will help farm decision-makers navigate what is possible from this new technology.

WaterWise for the Future: Building Irrigation Capacity in Intensive Horticulture for Sustainable Growth in Coastal NSW

Dr Matt Champness[1], Ewan Leighton
[1]*Local Land Services*

Nutrition & Irrigation
Hall B, July 29, 2025, 16:15 - 17:30

Protected cropping in NSW coastal regions faces significant irrigation management challenges, particularly among culturally diverse growers operating on steep terrain with suboptimal irrigation systems. Current issues include inadequate irrigation system design, poor distribution uniformity, excessive runoff & erosion issues, and limited understanding of water quality impacts on production. The irrigation challenges are compounded by limited certified private sector irrigation expertise, lack of grower willingness to pay for professional advice, and high proportion of lesee growers. Preliminary work has revealed concerning patterns of poor irrigation distribution uniformity, particularly on steep slopes, leading to significant crop production, erosion and sedimentation issues.

The "WaterWise for the Future", to be delivered by Local Land Services will address these challenges through a comprehensive four-year capacity-building program in the Coffs Harbour and Greater Sydney regions, supported by the Australian Government through funding from the Climate-Smart Agriculture Program under the Natural Heritage Trust. The project will conduct detailed on-farm irrigation and drainage assessments to identify common issues and develop targeted solutions. Implementation includes regular field walks, hands-on training sessions, and on-farm demonstrations, focusing on irrigation fundamentals to build grower capacity from basics through to ag-tech adoption readiness. The program also addresses market gaps through train-the-trainer sessions for private sector advisors while implementing low-cost monitoring tools to demonstrate water and solute movement.
Expected outcomes include enhanced grower capability in irrigation scheduling and system management, improved private sector capacity, and increased adoption of sustainable water management practices.

A Transition to Clean Energy

Mr Sohum Gandhi[1]
[1]*Enriva Pty Ltd*\

Energy Efficiency
Hall A, July 30, 2025, 14:45 - 15:35

Enriva has recently completed an industry first energy transition project at a 10 hectare glasshouse in New Zealand. The project introduced energy efficiency measures, integrated various energy users, decommissioned 30MW of coal fossil fuel and commissioned 9MW of high efficiency waste biomass energy plant. A synopsis of the project can be found in this video. I (Sohum) would be honored to present this project for the first time to the protected cropping industry at your conference.

Video link:

https://youtu.be/XTgCIBVb_Ds?si=lnERwfcXPuap81Nx

Green and Clean: Mastering pest management and hygiene in horticulture

Mr Jasper Verhoeven[1]
[1]Royal Brinkman, [2]Brinkman Australia Pty Ltd

IPDM & Biosecurity - Session Sponsored by Syngenta
Hall C, July 29, 2025, 16:15 - 17:30

In the last few years, hygiene has become such an important topic for the most horticultural crops due to the speed of plant viruses spreading in vegetable crops and the risks of getting fungi and bacteria problems in ornamentals or soft fruit crops.
We believe that growers worldwide can achieve the highest possible return from their crops with optimal implemented hygiene. For this HortiHygienz offers a total solution for any company in the world.
New to build greenhouses take hygiene as an agenda topic, to prevent diseases now and for the future. You must consider the different ways that diseases can entering your facility.
We see hygiene as a important part of our ICM concept; the HortiHygienz concept combines different areas of hygiene. By looking for the best hygiene products for growers need, pay attention on application techniques, advice, and installation of hygiene locks.
Hygiene is more than cleaning & disinfecting the greenhouse and tools. It starts already at the entrance door which should be covered for all incoming person and goods.
Thanks to innovations, the solutions remain progressive and appropriate to the ever-changing world of requirements and wishes of entrepreneurs and their customers to deliver beautiful, produced products on a sustainable manner.
With the HortiHygienz concept we offer customers a practical solution for the challenges in the field of horticultural companies.

Smart fertigation: unlocking higher yields and sustainability in greenhouse cucumber production at different EC and K levels

Ms. Sonali[1], Dr. Zhonghua Chen[1], Dr Samsul Huda[1], Dr Vijay Jayasena[1], Dr Jing He[1], Dr Talaat Ahmed[1]
[1]*Western Sydney University*

Nutrition & Irrigation
Hall B, July 29, 2025, 16:15 - 17:30

Fertigation systems in high-tech greenhouses improve crop performance by optimising water and nutrient use, critical for sustainable food production. Electrical conductivity (EC), an indicator of diverse nutrient concentration, significantly impacts plant growth and resource efficiency. In this, context the study also investigated the availability and uptake of potassium (K) in greenhouse production, examining the impact of various EC levels. The research evaluated Lebanese and Continental cucumbers under three EC levels (1.0, 2.5, 3.5 dS/m) and potassium (K) concentrations (185, 370, 512 ppm).
Key physiological responses, such as photosynthesis and stomatal conductance, remained stable across EC levels, while electron transport rates peaked at EC 2.5, which also improved fruit shelf life at 2°C and 7°C of storage temperatures. The study also reflected significant differential expression of potassium transporter genes, correlated with yield and water use efficiency (WUE), highlighting the molecular link between nutrient management and plant responses. Likewise, in potassium fertigation Medium and high K levels boosted yield, with medium K enhancing vapor pressure deficit, electron transport rate, and transpiration rate. Nutrient analysis showed higher calcium, phosphorus, and iron at medium K, while magnesium and chlorine were more abundant at low K. Metabolomics approach reflected the role of primary metabolites (amino acids) and secondary metabolites (phenols, flavonoids, organic acids) in improving physiological parameters and fruit quality. To assess the potential application of this approach a cost-benefit analysis at three fertigation levels identified EC 2.5 as the most economical, with net present values of 31.3 USD m^{-2}·$year^{-1}$ in Australia and 13.1 USD m^{-2}·$year^{-1}$ in Qatar. These findings emphasize that optimized fertigation enhances sustainability, crop performance, and economic viability, especially in water-scarce regions.

Unlocking the key drivers of business profitability

Mr Paul Omodei[1], Mr Paul Omodei[1]**, Ms Donna Lucas[2]**
[1]Planfarm, [2]RMCG

Building Resilient Profitable Businesses
Hall C, July 29, 2025, 13:45 - 15:05

In this session, Paul Omodei and Donna Lucas will lead a comprehensive discussion on the key factors that drive profitability in the protected cropping sectors. Drawing insights from Hort Innovation funded Level Up Hort Vegetable and Onion Benchmarking Program, this presentation will explore financial benchmarks identified over two years of data collected by Planfarm and RMCG, with additional data being gathered for the next three years. A subset benchmark for Protected Copping will be made available for discussion.

This benchmarking initiative has provided valuable financial insights, gathered from businesses within the industry and across Australia, offering a deeper understanding of the variables impacting profitability. The session will feature insights from Planfarm and RMCG consultants who will discuss the hot topics uncovered through their extensive work with vegetable and onion growers across Australia. These findings reveal both the challenges and opportunities within the industry, offering actionable strategies for improving operational efficiency and financial performance in a Protected Cropping growing system.

This interactive session aims to engage the audience in an open dialogue about how benchmarking can provide significant value to businesses. Attendees will have the opportunity to explore how these learnings can be applied to their own operations, ask questions, and share experiences with industry peers. The session will provide practical knowledge on how financial benchmarking can be leveraged to drive continual business improvement within the protected cropping sector.

Join us for a collaborative discussion on the essential tools and strategies needed to thrive in today's competitive agricultural landscape.

Effective management of Tobamoviruses (Tomato brown rugose fruit virus & Cucumber green mottle mosaic virus) in greenhouse horticulture

Dr Len Tesoriero[1]
[1]*Crop Doc Consulting Pty Ltd*

IPDM & Biosecurity - Session Sponsored by Syngenta
Hall C, July 29, 2025, 16:15 - 17:30

The recent detection of Tomato brown rugose fruit virus (ToBRFV) in Australia has highlighted the need for sound farm and crop biosecurity as well as validated monitoring and effective disinfection systems. Both ToBRFV and Cucumber green mottle mosaic virus (CGMMV) are highly contagious on the respective hosts, and they persist for long periods in the greenhouse environment making them extremely difficult to eradicate. Understanding how and where these viruses persist, and how they can cause recontamination of greenhouses and plants is integral to their effective prevention and management. This presentation will review these aspects of virus epidemiology and focus upon critical control points that growers need to manage. For instance, both viruses have an aerosol mode of transmission which can negate disinfection strategies, particularly between crops. There are some research gaps that the protected cropping industry would be prudent to urgently address to validate nursery and farm quality management systems.

Food safety risk management in protected cropping systems

Dr SP Singh[1]
[1]*NSW Department of Primary Industries and Regional Development*

Food Safety
Hall A, July 29, 2025, 13:45 - 15:05

Fresh horticultural produce grown in protected cropping systems, such as greenhouses and hydroponic facilities, offers enhanced quality and yield but presents food safety challenges similar to field production systems. Microbial contamination risks arise from water sources, growing media, worker hygiene, equipment, and environmental factors. Understanding the sources and routes of microbial contamination is the key to effective risk management strategies. As part of the Safe Leafy Veg program, food safety controls and their effectiveness have been investigated in protected cropping systems across Australia. This presentation will highlight microbial food safety challenges in protected cropping systems and outline best management practices to ensure the production of safe, high-quality fresh produce. Compliance requirements for new food safety regulation for leafy vegetables, melons and berries will also be covered in the presentation.

Economic and environmental gains from sustainable eggplant fertigation

Mr Md Mazadul Islam[1], Jing He[1], Li Li[1], Mr Samsul Huda[1], Mr David Tissue[1], Mr Zhong-Hua Chen[1]
[1]*Western Sydney University*

Nutrition & Irrigation
Hall B, July 29, 2025, 16:15 - 17:30

Sustainable fertigation strategies are crucial for improving both economic viability and environmental sustainability in protected cropping systems. Potassium (K) plays a critical role in enhancing plant physiology, postharvest quality, and metabolic efficiency, yet its optimized application remains a challenge for resource-efficient greenhouse farming. This study evaluates the impact of three potassium fertigation levels on the physiological traits, postharvest quality, and metabolomic responses of eggplant cultivated in a high-tech greenhouse. Additionally, a Life Cycle Assessment (LCA) was conducted to quantify the environmental footprint of each fertigation regime, providing a holistic view of its sustainability. Physiological measurements were analyzed to determine the influence of potassium on plant growth. Postharvest quality traits such as fruit firmness, color, total soluble solids (TSS), and shelf life were assessed to evaluate consumer-related benefits. Furthermore, metabolomic profiling was performed using high-throughput analytical techniques to identify biochemical shifts associated with potassium availability. The LCA analysis considered factors such as water use efficiency, fertilizer input, carbon footprint, and overall resource consumption, comparing the environmental impact of different potassium levels. Preliminary findings indicate that higher potassium levels significantly improved physiological parameters and overall plant health, while yield remained unchanged across treatments. Higher potassium levels significantly improved postharvest traits, indicating improved marketability and storage potential. Metabolomic profiling revealed potassium-induced shifts in key metabolic pathways, influencing sugar metabolism and secondary metabolite accumulation, which contribute to fruit quality and stress resilience. The LCA results highlight the trade-offs between productivity and sustainability, showing that precision potassium management can lower fertilizer waste, minimize carbon emissions, and enhance economic returns. These insights provide a strong foundation for developing climate-smart fertigation strategies that balance high-yield production with ecological responsibility in protected cropping systems.

Banker Plants in IPM: A Useful Tool, But Not a One-Size-Fits-All

Dr Anita Marquart[1]
[1]*Biological Services*

IPDM & Biosecurity - Session Sponsored by Syngenta
Hall C, July 29, 2025, 16:15 - 17:30

Banker plants are regaining popularity as a tool for supporting beneficial insect establishment in commercial protected cropping systems. While they have been used in the past, their effectiveness varies depending on the crop, environment, and target pest. At Biological Services, we conducted trials to assess their real-world performance in commercial capsicum and tomato crops in South Australia and Victoria. In tomato crops, Verbena hybrida was tested as a banker plant to support Nesidiocoris tenuis establishment, particularly during the cooler months when its establishment is challenging. The primary results were enhanced establishment of Nesidiocoris during the winter season and extended survival within the crops. Building on this, we collaborated with RMCG to trial Alyssum banker plants in protected capsicum crops in South Australia. This study confirmed the known benefits of the Alyssum banker system, but it also highlighted a few unexpected challenges. This project highlighted the need for tailored approaches towards the implementation of banker systems.

Engineering Sunlight for the Horticulture Industry

Mr Chris Wilkins[1], Chelsea Maier, Amity Bliss
[1]LLEAF Pty Ltd

Climate, Energy & Renewables Climate control (incl. lighting) - Session Sponsored by Denso
Hall A, July 29, 2025, 11:10 - 12:45

Light is a crucial factor in greenhouse cultivation, directly influencing plant growth, health, and productivity. But how well do you understand its role in your crop's development? Are you confident your greenhouse provides uniform, optimal lighting across the entire canopy?

LLEAF offers a comprehensive overview of light's impact on horticulture, helping growers fine-tune greenhouse conditions for improved yields. This session will cover the fundamental principles of horticultural lighting and its practical applications in controlled environments. Through real-world case studies, LLEAF will demonstrate how optimising light conditions can enhance plant health, boost productivity, and improve crop quality.

Whether you're a grower, researcher, or industry professional, this session provides valuable insights into the science of greenhouse lighting and practical strategies for maximising its benefits.

Introducing horticulture's new protected cropping program: Growing horticulture through protected cropping innovation

Dr Gordon Rogers[1]
[1]*Applied Horticultural Research*

(Protected Cropping Research, Development Program) - Session Sponsored by Hort Innovation
Hall C, July 30, 2025, 11:10 - 12:10

Growing horticulture through protected cropping innovation

This program, funded through the Hort Innovation Frontiers program, will help protected cropping growers maintain profitability by delivering key aspects of the Protected Cropping Strategic Investment Plan, specifically sustainability, advanced agronomy, automation to reduce labour costs, energy and improving staff skills and management.

Over 7 years, the program will address urgent issues and opportunities that were identified during consultations with leading growers in Australia. The issues come from industry, and the solutions will come from a combined effort between researchers, growers and industry specialists working together toward common goals.

Key program outcomes include:

New technology: Innovating a two-dimensional avocado canopy for automated pruning, automated tomato pollination, crop spraying with robots, and tomato truss packing and harvesting systems to minimise labour, a supplemental LED lighting system for Australian conditions, and labour-saving automated equipment for avocado cultivation.

Attracting and retaining people: Creating a high-tech horticulture training program in South Australia, developing a software to monitor farm worker training, and enhancing skills of farm staff in avocado cultivation.

Sustainability: Developing a system for recycling perlite growing media and strategies to enhance strawberry cultivation with reduced nitrate leaching in Northern NSW.

Advanced agronomy: Establishing a cutting-edge research facility in South Australia, introducing an AI-based growing system for local growers, creating a quality management system for avocado substrate cultivation, tools to manage biennial avocado bearing, optimising light interception for better yield in containerised avocados. The research will support the design of netting, rain covers, and solar panel-protected cropping systems to consistently produce high yields of quality fruit, increase resilience to extreme climate events, and potentially generate electricity for onsite and offsite use.

Project partners include Favorite Hydroponic Tomatoes, Costa, Apex Greenhouses, PolyBee, Victorian Department of Agriculture, Hort Innovation and PCA.

Varroa: the new frontier for honeybee pollination

Mr Danny Le Feuvre[1]
[1]*Australian Honeybee Industry Council*

Agronomy & Environment + Pollination & Pest Management
Hall C, July 30, 2025, 15:55 - 17:15

Honeybees underpin much of the agricultural production in Australia and none more so than many of the high value crops produced under protected cropping systems.

Varroa destructor, a new pest that is spreading across Australia will impact all pollination dependent crops.

Overseas experience has shown that 90-95% of unmanaged feral honeybees will disappear when the mites establish impacting the 'free' pollination services that growers have been using. In this presentation we can discuss what this new pest will mean for growers and the impacts it is having on the ground for beekeepers. I will be able communicate practical tips and tricks for growers to take when securing hives on their farms.

Enhancement evaporative cooling for greenhouses

Mr Hussein Ibrahim[1]
[1]*Zebbraagriculture*

Smart Indirect Latitude air cooler

Introduction and summery

High humidity in greenhouses restricting plant to grow and causes the majority of diseases and fungal infections which warrant chemicals and the conventional cooling system providing high humidity and cooling shorts and consuming much water & Energy.

Hypotheses

Using the smart designs of Invented hybrid IDEVC & DEVC , will minimize humidity and solve the shortages in cooling , water& Energy conserve , Which reflect in good impact in protected cultivation greenhouses and poultry cages

Description

The Indirect Evaporative Cooling “Passive Cooling “ has been launched in the new design , that it mainly depends in cooling the raw air before this cold air penetrating the watered cooling pads in order to get reliable humidity that needed to offer a good indoor environment that suitable for the green plant needed to grow and develop, that high humidity resulted in the affection the plant by pathogens micro – organisms such as fungal and Bacteria, which reflect bad to the yield and cost farmers to apply fungicides and other chemicals to fight these infection and then the product will considers as Non – Organic which also affect the Consumers by cancer and other related diseases

Here in this design the Passive or Indirect cooling has been launched by dividing the cooler system into two chambers separated by Latitude Cooling Pad See the enclosed Auto –cad drawings

The Lower Chamber

The lower chamber provided with a passive cooler, a copper air paths and channels is used to cool air by get in touch with the interior barriers of cooper sheet, that this system is get cold by continues watering the outside cooper sheet by the water that falling downwards from the Latitude cooling pad an experiment done decreasing in tumpreture was 14 degree

Assessing Visual and Olfactory Cues for Enhanced Monitoring of Serpentine Leafminer in Protected Cropping Systems

Mr Lok Nath Aryal[1], Mr Md Sahadat Hossain[1], Ms Sanjana Akter[1], Dr Syed Zulfiqar Rizvi[1], Dr Soo Jean Park[1], Dr Bishwo Mainali[1]

[1]Macquarie University

Agronomy & Environment + Pollination & Pest Management, Hall C, July 30, 2025, 15:55 - 17:15

Serpentine leafminer (SLM)- Liriomyza huidobrensis Blanchard is a recently established invasive polyphagous pest in Australia. It poses a significant threat to vegetable and ornamental plants grown in protected settings. Chemical pesticides have limitations in controlling this pest due to its small size, rapid reproduction, and quick development of resistance. Early detection and mass trapping are key to the sustainable management of SLM. Sticky traps are commonly used for monitoring of SLM but the efficiency of such traps in reflecting the on-crop abundance is often debated. As part of an effort to develop an efficient trap that encompasses both visual and olfactory stimuli, we investigated SLM's response to different colours and shapes of sticky cards in field cages, as well as to essential oils in a Y-tube olfactometer. Additionally, we assessed the combined effect of essential oils with the most preferred sticky trap in protected cropping environment. Yellow colour proved to be the most effective, while geometric shapes such as rectangular, triangular, circular, or cylindrical did not significantly influence SLM attraction, leading to the design of a radially symmetrical flower model trap (FMT), which was found to be significantly more attractive to SLM compared to other shapes of sticky cards. The FMT combined with clove or basil oils, performed as good as the FMT alone, in protected cropping system, despite both clove and basil oils eliciting SLM's response in Y-tube olfactometer assay. This discrepancy suggests a need to optimize concentrations of essential oils for effective SLM trapping.

Boosting crop yield in protected cropping systems with carbon

Miss Amrutha Vijayakumar[1], Dr Suzy Rogiers[1], Dr Onoriode Coast[1]
[1]University of New England, Armidale, NSW 2351, Australia
[2]NSW-DPI, Wollongbar, NSW 2477, Australia

Climate, Energy & Renewables Climate control (incl. lighting) - Session Sponsored by Denso
Hall A, July 29, 2025, 11:10 - 12:45

High-tech glasshouses account for 20% of Australia's protected cropping area and they have the potential to contribute to growing Australian agriculture to $100 billion by 2030. Carbon dioxide (CO_2) is critical for crop growth and yield, with low CO_2 levels in high-tech climate-controlled glasshouse inhibiting critical physiological functions leading to significant yield reductions. Industry practices to avoid low CO_2 in climate-controlled glasshouses typically involve CO_2 enrichment but optimal levels to maximize crop yields are challenging to define. Production at sub- and supra-optimal CO_2 incur economic, environmental and crop yield penalties. Here we investigate the optimal CO_2 levels for tomato production in high-input controlled-environment glasshouses. Our preliminary result indicates leaf photosynthesis (and likely growth) is limited at CO_2 below 294-380 ppm and increases curvilinearly with increase in CO_2 then plateaus around 734-820 ppm (high-end range). This paper will expand on linkages between tomato photosynthesis and yield in this range of CO_2 and the role of nutrition in regulating tomato yield response to CO_2 enrichment. The results can be scaled and applied to other high-tech glasshouse systems globally, influencing industry best practices.

Assessing the Australian native bush tomato (Solanum centrale) for greenhouse production

Dr Jay Bose[1], Mr Adam Tiberi[1], Ms Isabella Sciberras[1], Mr David Randall[1], Ms Seidat Oluwadamilola Dauda[1], Dr Sunil Panchal[1], Professor Vijay Jayasena[1], Professor Zhong-Hua Chen[1], Dr Michelle Mak

[1]Western Sydney University, [2]Hawkesbury Institute for the Environment

Emerging Crops and Technologies

July 30, 2025, 11:10 - 12:10

Developing sustainable horticulture solutions involves addressing the three pillars of sustainability: people, planet and profits. In this study we looked to the Australian native bush tomato as a potential new crop under protected cropping. Solanum centrale is an endemic desert species which has sustained indigenous diets for thousands of years but despite rising interest, cannot meet the current demand from wild harvested sources. The challenges of adapting a desert plant into a protected cropping system may be numerous, however the benefits to growers in establishing new high-value income streams that provide risk mitigation avenues and are also low resource-hungry crops are worth pursuing.

Although studies have shown that crop diversity is the key to nutritional stability and building sustainable food systems, measurements over decades show increasingly homogeneous cropping systems. We believe that developing emerging crops specifically adapted to protected cropping can help change this trajectory but to succeed they must be developed to suit the grower's needs as the foundational guiding principal. We therefore investigated; solutions to low germination rates, which is necessary to provide a reliable source of nursery stock, the appropriateness of substrates including Rockwool®, native soil mix, cacti mix and a custom mix, fertigation requirements (EC, pH and irrigation shots), light supplementation, plant health via multiple measurements, integrated pest & disease management, pollination requirements and crop yield. We also offer research gaps and next steps needed for growers to implement this crop into their production systems. Although this is the first stage in developing a new crop option for growers, we believe the PCA community will find this an interesting topic to investigate. Furthermore, this research is ongoing with opportunities for collaboration with growers and allied trade.

Skilling the Way to Labour Efficiency

Mr Navtej Bal[1]
[1]*Ironwood Institute*

Business Management & Labour Efficiency
Hall A, July 29, 2025, 14:25 - 15:05

Title: Skilling the Way to Labour Efficiency: Empowering Growth in Protected Cropping
In today's rapidly evolving agricultural landscape, labour efficiency is a cornerstone of profitability and sustainability, particularly in the realm of protected cropping.

The Ironwood Institute's initiative, "Skilling the Way to Labour Efficiency," directly addresses these challenges by equipping the agricultural workforce with advanced skills and practical knowledge to optimize productivity, reduce waste, and foster sustainable growth. This submission aligns with Protected Cropping Australia's 2025 conference theme, "Growing Profitably and Sustainably," by demonstrating how targeted skill development can catalyze transformative change.
Our program integrates cutting-edge training in precision agriculture, mechanization, digital data management, and safety protocols. By partnering with industry experts, academic institutions, and technology innovators, the Institute delivers comprehensive training modules that bridge the gap between traditional farming practices and modern, technology-driven approaches. Notably, our hybrid approach strategically balances the strengths of both local and overseas workforce contributions, enhancing cultural exchange and best practice sharing. This model not only enriches the learning environment but also ensures that diverse perspectives drive innovative solutions and operational excellence.
Central to our approach is a combination tool that integrates a wide range of skill sets through vocational training and higher education, with skills development as the major focus. This tool blends theoretical foundations with practical, hands-on training, creating a continuous learning pathway that accommodates entry-level workers and seasoned professionals alike.
Participants engage in workshops, real-world demonstrations, and continuous professional development opportunities, ensuring that their learning directly translates into measurable operational improvements.
Early outcomes from our initiatives indicate significant enhancements in labour productivity, operational efficiency, and worker safety. The Ironwood Institute invites conference delegates to explore our model as a blueprint for advancing labour efficiency in the protected cropping industry.

Protected cropping trends and insurance insights from Europe

Marie Groenhof, **Miss Ilse Van De Meent**[1]
[1]*Achmea Farm Insurance*

Business Management & Labour Efficiency
Hall A, July 29, 2025, 14:25 - 15:05

As a leading provider of agricultural insurance in the Netherlands, Hagelunie is at the forefront of addressing the complexities of risks associated with protected cropping . This experience has equipped Hagelunie with a deep understanding of both emerging and existing risks in this rapidly evolving sector. A speaker can be facilitated by Hagelunie and Achmea Farm Insurance, part of international services provider Achmea Group.

Artificial Intelligence and Agricultural-Technologies in Protected Horticulture: Trends, Challenges, and Opportunities

Dr Md Shahiduzzaman[1], **Dr. Kalyan Dhanagopalan**, **DR Subas Dhakal**
[1]*University Of New England (UNE)*

Ag Tech Innovation (Robotics, AI, Automation)
Hall C, July 29, 2025, 11:10 - 12:45

This paper reviews the integration of Artificial Intelligence (AI) and Agricultural Technologies (Ag-Tech) in Protected Horticulture (PH) and identifies trends, challenges and opportunities. Based on the preferred reporting items for Systematic Reviews and Meta-Analysis (PRISMA), this study reviews 120 outputs for the period 2010-2025 found in Scopus and Web of Science databases on: “AI and Ag-Tech in PH environment”. This study has two specific objectives: (a) to identify key research trends and key research themes and (b) generate policy and practice related insights into the growth of PH sector and its contributions to food security. Using “Leading Eigenvalues” clustering algorithms and thematic mapping, this study identifies six major themes influencing the PH sub-sector. They are: Big Data and Monitoring System, AI, Greenhouse Robots and Precision Farming, Machine Learning, Automation, and the Internet of Things (IoT). Challenges and opportunities of using these technologies in small-scale greenhouse environment are discussed. While AI-powered PH systems have demonstrated potential in precision farming, crop health monitoring, and climate control, several challenges hinder widespread adoption. High initial investment costs, energy-intensive operations, the complexity of AI models, and the need for skilled personnel remain key barriers. Additionally, the "black box" nature of AI raises concerns about transparency, trust, and data privacy among stakeholders. Despite these challenges, emerging opportunities lie in the advancement of explainable AI (XAI), data security and regulatory frameworks in ensuring long-term viability. Based on the findings, this study contends that deeper and meaningful human-technology interactions is required to achieve digital maturity in PH. By addressing these challenges, AI-enabled PH has the potential to not only contribute to smart and viable horticultural ecosystem but also creating a more resilient and efficient global food system.

Evaluating stingless bees and flies as pollinators for glasshouse strawberries

Dr Claire Allison[1], Mr Michael Duncan[1], Dr Jonathon Finch[2], Dr Mark Hall[3], Dr Onyeka Nzie[4], Ms Caroline Ponsonby[1], Prof Markus Riegler[1], Assoc. Prof Robert Spooner-Hart[1], Dr Patsavee Utaipanon[1], Prof James Cook[1]

[1]Hawkesbury Institute for the Environment, Western Sydney University, [2]Tasmanian Institute of Agriculture, University of Tasmania, [3]City of Greater Bendigo, [4]Hort Innovation

Pollination

Hall A, July 29, 2025, 16:15 - 17:30

Strawberries are increasingly grown in polytunnels or glasshouses, which partly or fully exclude wild pollinators. Consequently, pollination must be actively managed to deliver high quality crops. Honeybees are a poor option in glasshouses, so we tested the performance of two native stingless bee species (Tetragonula carbonaria and T. hockingsi) and two fly species (a blow fly and a hover fly) in approximately 100 m2 research glasshouse chambers at the NVPCC in Richmond, NSW. We used controlled experiments where individual flowers received insect pollination, hand pollination, or no pollination (control). Overall, we found that all four insect species increased fruit size and quality greatly in comparison with controls. However, there were also differences in performance between the insect species, linked to their behaviour. In addition, there is a general difference in approach when using stingless bees or flies. The flies can be purchased as pupae, hatched out and applied to the crop as a one-off “treatment”, whereas hive bees are valuable livestock that also need to be managed. We discuss the pros and cons of these native alternative pollinators.

Meeting the Challenge: Navigating Increasing Sustainability Requirements in Food Safety Certification

Ms Jane Siebum
[1]*Freshcare*

Food Safety
Hall A, July 29, 2025, 13:45 - 15:05

As sustainability and compliance demands for market and consumers evolve, Freshcare remains a trusted leader in food safety assurance. Over the past 25 years Freshcare has consistently delivered practical, industry-driven solutions for growers and participants. As a standards owner, Freshcare's globally benchmarked programs provide growers with accessible, effective, and recognised food safety certification.

This presentation explores Freshcare's role in shaping industry best practices through projects and initiatives including the Regulatory Technology framework project (in partnership with Hort Innovation), gaining further regulatory and government recognition for our Food Safety and Quality program and our Standards Review. These projects are focused on reducing duplication, enhancing compliance tools, and increasing engagement to support Freshcare participants in meeting increasing demands of sustainability and food safety requirements efficiently.

Attendees will gain an understanding of how Freshcare is implementing strategies to enable regulatory collaboration, streamline compliance while additionally working to ensure our Standards remain fit for purpose, allowing participants to focus on best practice in food safety and sustainability.

Pollination in protected strawberries - pollen requirement, alternative pollinators, and CEA environments

Dr Melissa Broussard[1]
[1]*The New Zealand Institute For Plant And Food Research, Ltd*

Pollination
Hall A, July 29, 2025, 16:15 - 17:30

Protected cropping systems can pose unique challenges for both pollinators and pollination, whether traditional glasshouses or controlled environment agriculture (CEA) with LED light. To investigate pollination in these highly modified systems, we introduced seven species of insects into three growing environments - hail netting, tunnel house, and CEA systems. We examined the pollen flow from each species of insect in each environment and found several alternative pollinators that were as efficient as bumble bees – the industry standard outside of Australia. We then examined the pollination requirement of strawberry cultivar 'Monterey' as well as performance of the most promising pollinator, drone flies, in both CEA and glasshouse strawberry production systems using the same cultivar'. Trials assessing the pollination requirement of this cultivar found that substantially fewer fertilised achenes were necessary than values reported in the literature. Implications for the strawberry industry and other protected flowering crops will be discussed.

Eliminating Single-Use Plastics in Hydroponic Production: A High-Impact Shift from Plastic Pots to Ellepot Paper Pots

Mr Darran Stone[1]
[1]*Ellepot*

Sustainability & Waste Management
Hall A, July 30, 2025, 11:10 - 12:10

The transition away from single-use plastics is a growing priority for the protected cropping industry. Hydroponic growers, in particular, face challenges in balancing sustainability, efficiency, and profitability while maintaining high-quality production. This presentation explores how Oksasen Puutarha, a leading Finnish producer of hydroponic lettuce and herbs, significantly reduced plastic waste by transitioning from traditional plastic pots to Ellepot degradable paper pots. This shift resulted in an 80.7% reduction in plastic waste, improved operational efficiency, and a strong return on investment (ROI).

Key outcomes from this case study include:

Sustainability impact: A reduction of 18.4 tonnes of plastic waste per year, lowering disposal costs and aligning with environmental goals.

Operational improvements: Faster root development, increased plant uniformity, and reduced labour requirements.

Economic viability: The shift to Ellepot resulted in significant cost savings, with the investment paying for itself in under 28 months.

Scalability for protected cropping: The transition was successfully integrated into a high-volume hydroponic system, demonstrating its feasibility for commercial adoption.

This case study provides a practical roadmap for growers looking to reduce plastic waste while maintaining efficiency, profitability, and crop performance. By implementing biodegradable alternatives, protected cropping operations can future-proof their businesses against evolving regulations, consumer expectations, and environmental concerns.

With a focus on real-world data and practical outcomes, this presentation will highlight how adopting Ellepot technology can help growers reduce plastic dependency, lower costs, and improve overall production efficiency, making a strong case for sustainable yet commercially viable innovation in hydroponics.

Optimising honeybee pollination in protected apple orchards

Dr Lisa Evans[1], Mr Brian Cutting[1,2], Dr Melissa Broussard[2], Dr Mateusz Jochym[2], Dr Paul Martinsen[2]
[1]Plant & Food Research, [2]Plant & Food Research

Pollination
Hall A, July 29, 2025, 16:15 - 17:30

Protected cropping systems offer growers greater control over environmental conditions, enhancing crop resilience. However, these systems can disrupt honey bee colonies and pollination efficiency, potentially reducing crop yield and quality. We investigated honey bee colony performance and foraging behaviour in apple orchards that were fully covered with hail netting, partially covered, and open, in both NZ and Australia.

Over four years, we assessed the strength of 372 colonies across 30 orchard blocks, before and after flowering. Colony strength declined significantly in fully covered orchards, particularly when hives were positioned centrally, whereas colonies in partially covered and open orchards maintained more consistent strength. However, bee movement assessments showed that when hives were located centrally, bees travelled further into covered crops, with likely benefits for pollination compared with hives located on the edges of covered orchards. Considering the observed colony decline in fully covered orchards, these findings reveal a trade-off between pollination and colony health. Further investigation showed that creating gaps in netting above centrally-located hives mitigated colony losses and improved foraging range compared to edge-positioned hives, helping to balance this trade-off.

Forager navigation was also affected by netting type. While white netting had no significant impact in our trial, black netting altered the accuracy of foraging communication dances, potentially impairing foraging efficiency and the ability of bees to return to their colony. These findings offer practical insights for growers and beekeepers to optimise pollination strategies in protected cropping environments.

The use of solitary bees in protected cropping

Dr Katja Hogendoorn[1], **Dr Lisa Evans**[2]
[1]The University Of Adelaide, [2]Plant & Food Research Australia

Pollination & Pest Management
Hall C, July 30, 2025, 14:45 - 15:35

The risks involved in relying on a single species for crop pollination are well understood, but not always heeded. In many developed countries worldwide, plantings around pollination dependent crops aim to support and increase pollinator diversity. By comparison, resilience of pollination in protected cropping has received less attention. Worldwide, pollination in large netted areas is done nearly completely by honey bees, while the exponentially expanding greenhouse industry nearly solely uses bumblebees for pollination. As bumblebees are not present in mainland Australia, our greenhouses are in need of alternative pollinators.
In the last 70 years, a wealth of solitary bee species has been investigated for their ability to pollinate greenhouse crops, and numerous effective species have been identified, both in Australia and the rest of the world. But while the need to expand the portfolio of pollinators in protected cropping is well understood among researchers, the use of solitary bee species in industrial protected cropping remains negligible. In this contribution, we will investigate the traits that determine the suitability of solitary bees as greenhouse pollinators, review the status quo and explore the opportunities for deployment of solitary bees in protected cropping in Australia.

Development of the hoverfly (Eristalis tenax) as a complementary managed pollinator for horticultural crops.

Dr Raylea Rowbottom[1], Dr Cameron Spurr[1], Professor Romina Rader[2], Dr Abby Davis[2], Ms Amy Lucas[1], Dr Lena Schmidt[2], Dr Karen Santos[2], Ms Jelena Preradovic[2]
[1]seedPurity P/L, [2]School of Environmental and Rural Science, University of New England

Pollination & Pest Management
Hall C, July 30, 2025, 14:45 - 15:35

Many horticultural crops depend on insect pollination. Honeybees are currently the only large scale and widely available managed pollinator for Australian producers. While they are excellent pollinators of many crops, over-reliance on a single species poses significant risks and challenges for optimising and future-proofing crop pollination. Additionally, some protected cropping systems and production environments are not well suited to honeybees.

The project, "Managing flies for crop pollination" (PH16002) is a strategic partnership initiative under the Hort Frontiers Pollination Fund investigating the potential to develop flies as managed pollinators. Flies are one of the most diverse animal groups in the world present in almost all habitats and, after bees, are the second most abundant insect pollinator group. Many are obligate pollen and nectar feeders and are well suited to mass rearing.

In this presentation, we outline work to develop the hoverfly, Eristalis tenax, as a commercial managed pollinator for protected cropping and present case studies for berry, cherry and vegetable seed crops demonstrating the effectiveness of this species as a complimentary pollinator to optimise crop yield and quality. We highlight progress towards development of mass scale rearing capacity, considerations for effective deployment in protected crops and early examples of commercial crop pollination with E. tenax.

Identification of host plant volatile compounds for modifying adult pest behaviour of Liriomyza huidobrensis

Mr Md Sahadat Hossain[1], **Ms Sanjana Akter**[1], **Mr Lok Nath Aryal**[1], **Dr Bishwo Mainali**[1], **Dr Soo Jean Park**[1]

[1]*Applied Biosciences, Macquarie University*

Liriomyza leafminers pose a significant threat to horticultural crops, diminishing productivity and quality through creating mines and thereby impairing the plant's photosynthetic processes. Traditional management relies heavily on synthetic pesticides, but resistance development and negative side effects remain persistent challenges. Host plant volatiles play a key role in leafminer behaviour, presenting an opportunity for alternative management strategies. Certain essential oils (EOs) attract leafminers, while others act as repellents.. This study investigates specific compounds in host plant volatiles and their EOs to develop attractant or repellent tools for managing L. huidobrensis in protected cropping systems. Oviposition and stippling assays revealed significantly stronger preference for oviposition on lychnis, petunia and cucumber plants among the nine tested plants, with bean serving as a positive control. Similarly, L. huidobrensis significantly preferred petunia and cucumber for feeding. Conversely, salvia and Russian sages were unattractive for oviposition or feeding, suggesting potential repellent properties. Gas chromatography-mass spectrometry (GC-MS) analysis identified nonoterpenes and sesquiterpenes as dominant compounds. Gas chromatography-electroantennogram detection (GC-EAD) revealed electrophysiologically active compound(s) in Russian sage, salvia, celery, chrysanthemum and lychnis volatiles. These findings suggest bean, petunia, celery, chrysanthemum and lychnis as promising sources of attractant compounds, while salvia and Russian sages may contain repellent compounds. This knowledge contributes to the formulation of novel attractant and repellent blends for further assays, advancing sustainable L. huidobrensis management tools.

Attracting multi-generational talent in a competitive world: How can protected cropping continue to encourage capable people into the industry?

Mr Jack Kovacevic[1]
[1]*Denso*

Building Resilient Profitable Businesses, Hall C, July 29, 2025, 13:45 - 15:05
Nearly all businesses find it hard to attract quality talent to their respective industries. There are increasing offshore options for people to explore opportunities in many industries, including the technology sector. Therefore, it may become more difficult for the Australian protected cropping industry to compete for the attention of uniquely qualified, talented people with useful skills to sustain local industry growth.

This discussion will present some of the tools and methods which could be applied by the protected cropping industry to develop a long-term pipeline of opportunity for horticulture businesses and potential technical employees alike.

Technology adoption: Developing the right foundations for success.

Mr Jack Kovacevic[1]
[1]*Denso*

When considering a new technology there are often many questions and some trepidation in knowing where to start, which supplier or partner to engage, which technology is best suited, can you afford it etc. However, it is not as difficult (or scary) as you might think. It all starts with a plan.

Understanding the importance of technology adoption in a more competitive environment will be critical for growers to remain sustainable in the near and long-term future. This presentation will aim to support growers when they consider the starting point in their technology adoption journey and for existing technology adopters to consider the next steps for sustained success.

Coping with hotter and brighter climates

Mr Graeme Smith[1]
[1]*Graeme Smith Consulting*

Agronomy & Environment + Pollination & Pest Management
Hall C, July 30, 2025, 15:55 - 17:15

Australia, indeed the world, has for some decades emulated the successful Dutch in their choice of technologies and growing methodologies, however they can never give us our climate, that is in the main, warmer, and brighter than many other global locations that use greenhouse and hydroponic systems to produce a wide range of vegetables, flowers and fruits.

As a majority of Australian growers experience warm to hot, and typically dry summers, greenhouse crops can undergo significant stress over extended periods that often impact plant yield, quality and produce uniformity that ultimately influences facility viability.
And given we are experiencing annual upticks on average temperature and radiation levels, growers need to use their technologies and systems to adapt as best they can for the increasingly challenging climate periods.

This presentation will provide Australian greenhouse growers with a suite of tools to 'steer' their crops to better cope their hotter and brighter periods that will include:

- Average 24hour temperature targets
- Managing humidity targets (relative humidity, humidity deficit and vapour pressure deficit)
- Water content in the growing substrate
- EC in the Drip & Drain
- Daily irrigation start and stop times
- Plant management and cultural treatments

Rock solid developments in the Grodan research department.

Mr. Tico van Leeuwen[1], **Mr Saskia Blanch**[1]
[1]*Grodan/Irribiz*

Agronomy & Environment + Pollination & Pest Management,
Hall C, July 30, 2025, 15:55 - 17:15

Substrate and root zone management are key to achieving a productive, balanced crop—something growers across Australia have long understood using stone wool substrates for over two decades.

The last couple of years, we've been working behind closed doors, focusing on research and innovation.

Now, we're here to share fresh insights and reconnect with the industry—bringing forward new knowledge and tools for the future.

This presentation explores how the versatility of stone wool substrates is evolving to meet today's challenges—especially rising energy costs that impact the profitability of high-tech horticulture.

Through recent research on tomatoes (with applications now expanding to cucumbers and strawberries), we investigated how smart irrigation strategies and precise root zone management can reduce energy use without sacrificing crop performance.

The findings are promising: by fine-tuning irrigation based on real-time data and leveraging the unique properties of stone wool, growers can improve water use efficiency, reduce energy input, and support both profitability and sustainability.

Beyond the growing cycle, we're also working on solutions for what comes next—developing ways to repurpose used stone wool.

A second-life approach that not only reduces waste, but helps return valuable material back into broader horticultural systems, supporting a more circular, environmental future.

We're here to share practical, research-backed insights that will help you make informed choices about substrate and energy management—supporting resilient, future-ready production systems in Australia's dynamic horticultural landscape.

Genetic defence mechanism for tomato varieties Highly Resistant (HR) to ToBRFV

Mr Martijn van Stee[1], Mr Fabio Pappalardo[1], Mr Manus Thoen
[1]Enza Zaden Australia

IPDM & Biosecurity - Session Sponsored by Syngenta
Hall C, July 29, 2025, 16:15 - 17:30

Enza Zaden has developed a groundbreaking mechanism to combat the Tomato Brown Rugose Fruit Virus (ToBRFV) through the introduction of High Resistance (HR) varieties and rootstocks. This innovation is based on a hypersensitivity reaction that actively blocks the virus's spread, rather than merely delaying it. The HR rootstocks provide an additional layer of defence containing the virus to reduce overall pressure. This dual approach ensures comprehensive protection for tomato plants, significantly reducing the risk of infection and enhancing crop resilience.

The discovery of a specific gene that confers high resistance to ToBRFV marks a significant breakthrough. This gene, identified through extensive screening of wild tomato germplasm, offers a unique solution to the rapidly spreading virus. The high resistance level is critical as it prevents the virus from entering the plant, unlike intermediate resistance which only delays propagation. This innovation is poised to secure tomato production globally, benefiting both large-scale and smallholder farmers.

Enza Zaden's HR varieties and rootstocks represent a game-changing advancement in the tomato industry, providing a robust defence against ToBRFV and ensuring healthier, more productive crops. This comprehensive strategy not only protects current crops but also minimizes the risk of long-term soil infection, safeguarding future cultivation cycles. Focus of the presentation will be on how such resistance mechanism (Hypersensitivity) works and how can practically help Australian tomato growers to prevent or minimize the spreading of such vicious virus.

Managed buzz-pollination of protected crops by native, blue-banded bees

Ms Jyotsana Chauhan, Mr Rogelio Garcia, Prof James Cook, Brian Cutting, Michael Duncan, Dr Lisa Evans, Dr Flore Mas, Dr Michelle Mak, Dr Simon Tierney, Prof Robert Spooner-hart
[1]Hawkesbury Institute for the Environment Western Sydney University, [2]Plant and Food Research

Several crops grown under protected environments require cross-pollination, including berries and some solanaceous fruiting vegetables. For a number of these crop flowers, specialised pollination, known as "buzz-pollination", significantly improves crop yield. Other countries deploy bumble bees for this purpose, but bumble bees don't occur on mainland Australia. A native and alternative buzz-pollinator group is the blue-banded bees (Amegilla), which are solitary and do not form social colonies, but do nest in aggregations. Females nest naturally in soil embankments and mud walls but the adults are not present year-round. As part of a Hort-Innovation-funded project, we have successfully developed relocatable nesting substrate units to enable the management of Amegilla pollination service delivery. Bees emerging from these artificial nests exhibit normal behaviours: foraging for pollen and nectar, mating and provisioning their nests. We have also assessed blue-banded bee pollination in greenhouse chillis and their visitation to artificial flowers treated with forager-attractant plant volatiles, to investigate the potential of bee-feeding stations in commercial production houses. We report on the results of this work to date and discuss our future plans.

Leafeon: Toward Accurate Sensing of Leaf Water Content for Protected Cropping With mmWave Radar

Mr Mark Cardamis[1]
[1]*Unsw*

Plant sensing plays an important role in modern smart agriculture and the farming industry. Remote radio sensing allows for monitoring essential indicators of plant health, such as leaf water content (WC). While recent studies have shown the potential of using millimeter-wave (mmWave) radar for plant sensing, many overlook crucial factors, such as leaf structure and surface roughness, which can impact the accuracy of the measurements. In this article, we introduce Leafeon, which leverages mmWave radar to measure leaf WC noninvasively. Utilizing electronic beam steering, multiple leaf perspectives are sent to a custom deep neural network, which discerns unique reflection patterns from subtle antenna variations, ensuring accu- rate and robust leaf WC estimations. We implement a prototype of Leafeon using a Commercial Off-The-Shelf mmWave radar and evaluate its performance with a variety of different leaf types. Leafeon was trained in-lab using high-resolution destructive leaf measurements, achieving a mean absolute error (MAE) of leaf WC as low as 3.17% for the Avocado leaf, significantly outperforming the state-of-the-art approaches with an MAE reduction of up to 55.7%. Furthermore, we conducted experiments on live plants in both indoor and glasshouse experimental farm environments. Our results showed a strong correlation between predicted leaf WC levels and drought events.

Sonication unzips floral anther trichomes boosting pollination and tomato fruit size

A/Prof Christopher CAZZONELLI[1], Dr Sidra Anwar[1], Happy Singh[1], Angus Dingley[2], Dr Thailammai Vinoth[3], Weiguang Liang[1], Dr Laurel George[1], Prof. Brian Sindel[2], Prof. Chun Wang[3]

[1]Hawkesbury Institute For The Environment, Western Sydney University, [2]Department of Agronomy and Soil Science, School of Environmental and Rural Science, University of New England, [3]School of Mechanical and Manufacturing Engineering, University of New South Wales

Pollination

Hall A, July 29, 2025, 16:15 - 17:30

Artificial tomato pollination methods rely on cellular vibrations from air displacement, electric vibration wands and trellis tapping, which have potential to spread pathogens. Bioacoustic frequencies emitted from buzzing bees to ultrasonication can vibrate plant cells without physical contact. The effects of frequency-dependent sonication on the poricidal anther cone sheath, self-pollination, seed set, and fruit size remain unclear. We engineered devices to investigate the frequency-dependent power-law behaviour of floral living cells from greenhouse-grown tomato varieties - contrasting contact-induced oscillations from a vibrating wand and mechanical shaker arm with precision non-contact sonication emitted by a subwoofer speaker. The velocity and acceleration of vibrating flowers and impact on poricidal anther cone sheath cellular structures, self-pollination, and fruit development were assessed. Sonic frequencies ranging from 50 to 10,000 Hz increased pollination, fruit size, weight, and seed set in Sweetelle, Endeavour, Paulanca and Managua commercial varieties. Scanning electron microscopy revealed sonication separated the intertwined trichomes and unzipped their meshed network that locks the lobes of the anther cone sheath together thereby releasing pollen grains. Near ultra-sonic frequencies boosted fruit size, whereas seed set remained constant thereby challenging the floral cell power-law rheological characteristics under different frequency scales. Tomato flowers displayed a low power-law cell behaviour to frequency-dependent sonication enabling its effectiveness as a precision non-contact technology to boost pollination and tomato fruit size without a substrate-borne component.

Bioscout - Helping farmers see the unseen

Mr Charles Simons[1]
[1]*Bioscout Australia*

Ag Tech Innovation (Robotics, AI, Automation)
Hall C, July 29, 2025, 11:10 - 12:45

BioScout services provide much needed data and visibility to users that ultimately save them yield quality and quantity as well as minimise fungicide resistance. Unlike other traditional disease detection and management methods, which can only see and react to diseases after they have spread costing farmers billions, our airborne disease tracking platform lets farmers know when disease strikes and what they can do about it.

Growers lose at least 20% of their crop yield to plant diseases each growing season globally , which amounts to $1Trillion USD per year in losses to fungal diseases. To compenate this we have to produce chemicals and this cost yearly $20 Billion USD to manufacture and apply to global crops. This all leads to CO2 emmisions of over 75 million metric tons annually.

BioScout's technology will minimise yield losses due to plant disease infection. Our core value proposition is Real-time tracking and species identification of the pathogens in a farm field. Ultimately, BioScout offers users the ability to monitor what pathogens are present pre- and post- fungicide spraying.

What does this mean for horticulture and broadacre farmers usning our AI powered Scouting devices?
● Improved fungicide efficiency – users are able to track how well fungicides are working and are able to monitor appropriate levels to know exactly when to spray i.e. more specific or regular fungicide spraying or being able to distinguish between different plant diseases that may threaten other crops;
● Monitor increasing fungicide resistance before it becomes irreversible. Fungicides, in the past, have been lost due to unchecked mutation of diseases that become resistant to fungicides;
● By applying the correct chemistry at the right time can reduce carbon emmisions by 400kg/ha annually
● Bioscout is designed and manufactured in Sydney

Plant Empowerment: the road-map to sustainable horticulture! A Data-Driven growing philosophy to grow more sustainable and profitable

Mr Ton Habraken[1]
[1]*Plant Empowerment Foundation*

Nature itself provides the solution for sustainable cultivation and optimal results; the natural growing power and resilience of plants. The backgrounds and practical implementation are revealed in the book: Plant Empowerment, the basic principles.

Plant Empowerment is an integrated approach to sustainably growing crops in greenhouses by supporting the plant's balances. The starting point is to stimulate and support the natural growing power of the plants by creating optimal growth conditions, both above soil and in the rootzone.

Under all conditions, the plant aims to optimize its three balances to become strong and healthy. By supporting these balances, the plants make more efficient use of water, fertilizers and energy. In nature, plants are resilient against pests and diseases. Plant Empowerment uses these natural characteristics to optimize plant growth. That's why Plant Empowerment contributes to sustainable horticulture.

Continuously collecting data during the cultivation process provides insights into how the greenhouse and plant function. By applying the new insights and principles of Plant Empowerment, many growers already benefit from improved results. They observe better growth and production, fewer pests and diseases and save water and energy at the same time.

The horticultural sector needs more effective and sustainable cultivation. We believe that Plant Empowerment provides the roadmap to achieve this. But it needs further development, refinement, implementation, and adaption to local conditions. At the same time, we face a huge challenge regarding knowledge transfer and training of students, growers, consultants and researchers to speed up the learning curve.

Plant Empowerment is not only a philosophy or a theory. It is the result of a vast development process, both in research projects and practical applications. It has been conducted from 2005, first mainly in the Netherlands, and later also in different regions of the world!

Lessons from the Field: Sales Strategies for Building Profitability in Horticulture

Miss Georgia Stormont[1]
[1]*Curious Georgia Coaching*

Building Resilient Profitable Businesses, Hall C, July 29, 2025, 13:45 - 15:05
Sales is the engine that drives profitability in any agribusiness, yet the art of selling in the horticulture industry is often underestimated. Drawing from my personal journey as a sales representative in a vegetable seed company and now as a business owner coaching agricultural teams, this session explores the real-world challenges and triumphs of increasing sales and profitability.

From navigating price-sensitive markets to fostering long-term customer relationships, I will share first-hand experiences of successes and failures—what worked, what didn't, and the key lessons learned along the way. Participants will gain insights into the mindset shifts required to create demand beyond discounts and deals, practical sales techniques that build trust and repeat business, and strategies for selling value rather than just product.

Attendees will leave with actionable takeaways to improve their own sales performance and drive greater profitability in their businesses.

Smart Farm Management System: Enhancing Efficiency and Sustainability through an Online Dashboard

Mr Mark Cardamis[1]
[1]*Unsw*

Climate, Energy & Renewables Climate control (incl. lighting) - Session Sponsored by Denso
Hall A, July 29, 2025, 11:10 - 12:45

The agricultural sector faces increasing challenges, including climate change, resource efficiency, and market competitiveness. To support sustainable and profitable farming, we propose a Smart Farm Management System integrating real-time data collection, advanced analytics, and a user-friendly online dashboard. This system leverages IoT sensors and remote monitoring to optimise farm operations, including irrigation, nutrient management, and environmental control.

Our solution provides farmers with a centralised digital platform that collects and visualises key performance indicators, enabling data-driven decision-making. By integrating plant phenomics and automated sensing technologies, the system enhances crop yield prediction, disease detection, and resource efficiency. Users can access live reports, predictive insights, and automated alerts via a web-based dashboard, ensuring proactive farm management. The system's scalability and adaptability make it suitable for diverse farming operations, from smallholders to large-scale agribusinesses.

This presentation will introduce a real-world use case, demonstrating how practical grower adoption of digital technologies can lead to tangible benefits in farm productivity, sustainability, and profitability. By combining cutting-edge research with user-centric design, our Smart Farm Management System presents a cost-effective, scalable, and impactful solution for modern agriculture.

Optimizing Water, Energy, and Production for Horticultural Success

Mr John van der Wilk[1]
[1]*Irribiz*

Energy Efficiency continued & Market Chain Supply
Hall A, July 30, 2025, 15:55 - 17:15

1. Water and energy are key factors for achieving profitability in horticulture, as they directly impact production costs and efficiency.

2. Crop-specific solutions are essential for ensuring optimal growth, tailoring strategies to the unique needs of each plant type for the best results.

3. Minimizing energy costs while optimizing production is crucial for maintaining both economic efficiency and sustainability in agricultural operations.

Water and energy management are fundamental to achieving profitability and sustainability in modern horticulture. This presentation will explore strategies to minimize energy costs while optimizing crop production, with a focus on crop-specific approaches that tailor resource use to the needs of individual plant types. Practical case studies will demonstrate innovative methods for reducing water consumption without compromising yield, aligning with the conference theme of “Growing Profitably and Sustainably.” Delegates will gain insights into new technologies, operational adjustments, and proven techniques that can significantly lower production costs while enhancing environmental stewardship in greenhouse and open-field operations.

Strengthening biosecurity measures to prevent diseases

Mr Ivan Casteels[1]
[1]*Roam Technology*

Mixed Themes | Managing pests and diseases in the greenhouse
July 30, 2025, 14:45 - 15:35

I will talk about hygiene and biosecurity in general. of course also in depth a bit about ToBRFV.
Further information about hygiene protocols will follow and the importance of it.
What steps to follow in hygiene and biosecurity.
what to do when you want to implement protocols.
Recommendations and advice

-- Update

Hygiene hot topic (every moment of the day, no matter what you do or where you are).
I will talk about specific hygiene guidelines for all the methods used and activities at plant nurseries and production greenhouses
Preventing problems versus trying to cure problems is also something I will address.
Preventing infections spread through water and roots that remain in the greenhouse in the irrigation system and on surfaces such as hands, conveyor belts, gutters, wheels, floors, tables, etc.
What will be addressed as well is that a well-executed business hygiene takes time, money and attention. When talking about hygiene you have to do it all. Doing a bit in hygiene won't work.
Anyone who is present has to do with the company hygiene. That will be addressed as well.
Plenty of examples will be given what to think of, what to do etc.....
I am not going to talk about specific products (as it is not a promotional talk about products)
This presentation is purely to make people aware about how important is hygiene and biosecurity but on top of that also that most companies don't take it serious enough and don't do enough to be in control.

Benefits of nanobubble technology for protected cropping

Mr Leon Power[1]
[1]*Nanobubble AgriTech*

Nutrition & Irrigation
Hall B, July 29, 2025, 16:15 - 17:30

Nanobubbles are a novel irrigation technology being increasingly adopted by growers in Europe and Northern America. The technology has several benefits, primarily that it is a chemical free tool to:
- increase crop yield and growth rates
- increase root size and root health
- mitigate several root and soil borne pathogens, in particular, Pythium, Phytophthora, Fusarium
- improve water quality
- provide a quick ROI for growers, improving business profitability and crop reliability

Although there are several nanobubble technology providers, Nanobubble Agritech specialise in larger sized irrigation applications, and being based locally, can provide local ANZ support and servicing, as well as low cost trial systems to de-risk any investment decision for growers.

Life History traits of Liriomyza huidobrensis and its parasitoid (Neochrysocharis formosa) on different temperature

Mrs Sanjana Akter[1], **Mr Md. Sahadat Hossain**[1], **Mr Lok Nath Ayral**[1], **Dr Syed Zulfiqar Rizvi**[1], **Dr Soo Jean Park**[1], **Dr Bishwo Mainali**[1]

[1]*Macquarie University*

The serpentine leafminer, Liriomyza huidobrensis, is a highly polyphagous pest recently established in Australia, posing a significant threat to the horticulture industry. Neochrysocharis formosa (Westwood) is one of the most common larval endoparasitoids of L. huidobrensis. Understanding the basic biological characteristics of L. huidobrensis and its parasitoid under different temperatures is crucial for developing sustainable control strategies. Temperature is a critical abiotic factor that significantly influences the efficacy of biocontrol approaches in host-parasitoid systems. In this study, L. huidobrensis and N. formosa were reared on kidney bean (Phaseolus vulgaris L.) plants at constant temperatures of 17, 23, 25, and 35°C to assess the developmental rate and survival of L. huidobrensis, alongside the efficacy of N. formosa as a biocontrol agent. The influence of temperature on the development and survival of L. huidobrensis, as well as on the life-history traits and efficacy of N. formosa adults (lifespan, parasitism rate, and non-reproductive host-killing events), is discussed. These findings contribute to a better understanding of temperature-dependent development and survival of both the host and the parasitoid, as well as the biocontrol efficiency of N. formosa against L. huidobrensis under different temperatures.

Multi-Action 3-in-1 Insecticide, Miticide, and Fungicide: An Ideal Solution for Integrated Pest and Disease Management

Mr Eugene Chau
[1]Muirs, [2]Rovensa Next

Mixed Themes | Managing pests and diseases in the greenhouse
July 30, 2025, 14:45 - 15:35

Pest and disease resistance is a significant challenge for growers, making Integrated Pest Management (IPM) essential. PREV-AM, a versatile 3-in1 insecticide, miticide, and fungicide using cold-pressed orange oil as its active ingredient, is a valuable addition to IPM programs. It controls pests like whiteflies, two-spotted mites, and powdery mildew while supporting environmentally friendly practices and preserving beneficial organisms. PREV-AM acts quickly and physically on pests and diseases. Its low surface tension allows it to penetrate insect spiracles, suffocating them. It breaks down the waxy exoskeletons of soft-bodied insects, exposing them to predators and environment. For flying insects, it disrupts their waxy wing coatings, immobilizing them upon contact. As a fungicide, it penetrates fungal mycelia and spores, destroying the living cells beneath.
PREV-AM's rapid knockdown and non-residual properties make it excellent for IPM programs. Strategies include targeting pest at economic threshold, using lower rates to make pests more susceptible to beneficials, targeting hotspots, nocturnal sprays, and releasing beneficials after application. PREV-AM's unique physical mode of action makes resistance unlikely. When used with other crop protection products, it often improves pest control efficacy. PREV-AM integrates well with various nutritional and crop protection products, reducing the need for multiple chemical treatments. It can be applied at any stage of crop growth and integrates seamlessly into existing spray programs. PREV-AM's high volatility ensures it breaks down quickly, leaving minimal residues. There is no withholding period, allowing use up to harvest, beneficial for continuously harvested crops.
Incorporating PREV-AM into pest and disease management strategies helps reduce reliance on chemical pesticides, aligning with sustainable farming goals.

Eating with your eyes

Mr Terry Parsons[1]
[1]*Envirotec Horticultural Structures*

Building Resilient Profitable Businesses
Hall C, July 29, 2025, 13:45 - 15:05

In an era of rising costs, unpredictable weather, and increasing pressure for sustainability, Australian growers must find ways to remain both profitable and environmentally responsible.

Greenhouses and Shadehouses create a controlled environment that allows growers to optimise conditions, leading to increased productivity and higher-quality produce. This consistency translates directly into better market opportunities and improved financial returns. At the same time, protected cropping significantly reduces the need for pesticides and fertilisers, cutting expenses while supporting sustainability initiatives.

Beyond profitability, risk mitigation is a key advantage. With extreme weather events becoming more frequent and pests posing an ongoing threat, protected cropping shields crops from these challenges, offering growers greater security and peace of mind. However, not all structures are created equal. Investing in high-quality, durable solutions—paired with expert installation—ensures long-term performance and maximises return on investment.

This presentation will explore the tangible benefits of protected cropping, showcasing real-world examples of how Australian growers are leveraging greenhouses and shadehouses to thrive in an increasingly challenging industry. By embracing innovation, they are not only safeguarding their future but also contributing to a more sustainable and resilient food production system.

Growing Profitably and Sustainably Using Vento Tunnel Films, Increased Yields While Reducing Energy and Labour Costs with Self-Ventilating Greenhouse Films

Mr Robert Trenchard[1]
[1]*Terrashield Pty Ltd T/a Shield Plastics*

Agronomy & Environment + Pollination & Pest Management
Hall C, July 30, 2025, 15:55 - 17:15

Introduction to Vento Tunnel Films

Vento Tunnel is an advanced greenhouse film with ventilation holes. The ventilation holes are covered by a reflective film used to reduce mid-day heat and keeps rainwater from entering the structure.

The ventilation holes allow the hot and humid air trapped along the ridge to easily escape, replacing it with cooler air through natural displacement. The optional" addition of side-vento films on the side of a structure further enables this replacement of cooler air.

Vento tunnel films lower the temperature and humidity during the day, while maintaining the temperature at night.

Daios Plastics, who manufactures Vento Tunnel films. now has over 53 international patents and co-operates closely with customers around the world to introduce truly revolutionary products.

Currently available in widths of up to 9.2m.

Results of Trials

Results of a study conducted by UC Davis in Mexican strawberry and blackberry production greenhouses will be presented.

These trials showed temperatures maintained at 3-5 degrees Celsius lower than peak daytime summer temperatures. This reduction in temperature occurred without any reduction of light or energy to plants and resulted in greater vegetative development, more vigorous plants and greater flowering.

The trials resulted in yield increases of 15 to 25% in high quality fruit production when compared to both conventional and novel IR blocking films.

Comparisons will be made between crops and climatic conditions of the study region and regions of tunnel/greenhouse growing areas within Australia.

Indicative Cost Benefit Analyses will be provided to show applicability to the Australian marketplace.

Horticulture Goes Urban delivering knowledge to enable close to consumption production of perennial crops

Dr Samantha Baldwin[1], Jenny Green, Nick Gould, Kimberley Snowden, Helen Boldingh, Falk Kalamorz, Jia-Long Yao, Denise Conroy, Christina Roigard, Rangi Mātāmua
[1]The New Zealand Institute for Plant and Food Research Limited, [2]Massey University

Energy Efficiency continued & Market Chain Supply
Hall A, July 30, 2025, 15:55 - 17:15

Horticulture Goes Urban is a multi-year research mission started in 2019 to design perennial plant packages for protected cropping growing systems to meet the needs of a growing urban population. The aim of this research is to ultimately deliver fresh fruit products, grown close to consumption. Protected cropping systems aim to provide year-round food security, with more climate resilient growing systems mitigating the risks from future climate change and reduced productive land availability. The research to date has been developing a deep understanding of both the genetic adaptations and the environmental optimisation required to deliver knowledge and plant variety packages for future protected cropping industries for woody perennials. This has included identifying the genetic control of key flowering, pollination, fruiting and plant architecture traits across a range of species. Additional work has focused on understanding how to manipulate plant responses, how to modify the growing environment and generation of new plant propagules for indoor production. In parallel, international consumer insight research is identifying future consumer needs including the appetite for future high-technology growing systems across different cultures. Importantly delivering with Māori through Māori-led research understanding the cultural connections between food (kai), and growing methods that are closely connected to the natural environment, like lunar-stellar markers, with how future food production systems such as protected cropping systems can interlink. This research investment has included connections with industry through NZ indoor growing summits to ensure knowledge sharing and relationship building across grower and technology sectors.
This combination of developing horticultural knowledge and purpose bred plant varieties, along with understanding the goals of growers and consumers, will help build a viable pathway to future proof our perennial crops for production in challenging circumstances.

Resource Use Efficiency and Sustainability Assessment of Australian Greenhouse Capsicum Production

Dr Jing He[1], Prof Meng Xu[1,2], Prof Graciela Metternicht[1], Prof Yi-Chen Lan[3], Prof David Tissue[3,4,5], Prof Zhong-Hua Chen[1,4,5]

[1]Western Sydney University, [2]Zhejiang University of Finance and Economics, [3]Fu Jen Catholic University, [4]Hawkesbury Institute for the Environment, [5]National Vegetable Protected Cropping Centre, [6]Global Centre for Land Based Innovation

Energy Efficiency continued & Market Chain Supply

Hall A, July 30, 2025, 15:55 - 17:15

High-tech protected cropping systems in Australia, particularly in greenhouse environments, play a critical role in enhancing food security and sustainability. This study evaluates resource use efficiency and sustainability in high-technology greenhouses in Australian for capsicum production. Two greenhouse cooling systems — pad-fan system and fan-coil system — were compared regarding the energy-water-food nexus, environmental impacts, and economic potentials. The two greenhouse systems, both equipped with advanced environment and utility sensors, are managed by a Priva© greenhouse control system through Internet of Things (IoT) to optimise the growth environment. By integrating quantitative analysis with life cycle assessment, we assessed the impacts of two greenhouse environmental control systems on cooling energy consumption, water use, crop yield, environmental footprint, and economic feasibility. The trials were conducted in the high-technology glasshouse at the National Vegetable Protected Cropping Centre, Richmond, NSW, Australia. Results show that both environmental control systems can achieve constant and high yield, reaching higher than 30 kg m-2·year-1. Albeit higher water demand, the pad-fan system consumes significantly less cooling energy comparing to the fan-coil system. Economic modellings were conducted on the two greenhouse capsicum production systems under industry settings. The results revealed that a high-technology greenhouse equipped with pad-fan cooling system can be broke even in 5 years, comparing to more than 10 years in a greenhouse controlled by a fan-coil system for cooling. These findings underscore the importance of optimising greenhouse design and management strategies to balance resource use efficiency with crop productivity and profitability. This research provides crucial insights for developing more sustainable and resilient greenhouse cropping systems.

The Food Frontier: Could The Asia-Pacific Feed The World?

Mr Alastair McLean[1]
[1]*Powerplants,* [2]*Protected Cropping Australia*

Energy Efficiency continued & Market Chain Supply
Hall A, July 30, 2025, 15:55 - 17:15

The rapid population expansion in nations such as China and India is widely recognized, yet the combined populations of countries nearer to Australia's borders—Indonesia, the Philippines, Vietnam, and Japan position them as an emerging global population powerhouse.

Asia leads the world in food production, yet it remains a net food importer. This raises the question: can innovations in technology and agricultural methods match the pace of this population surge? Furthermore, what possibilities does this create for Australia within the Asia-Pacific region?

Optimizing Hydroponic Mini Cucumber Cultivation: Enhancing Nutrient Management, Labour Efficiency, and Space Exploration

Mr Anshul Phaugat[1]
[1]*ARC Centre Of Excellence - Plants For Space, La Trobe University*

Mini cucumbers (Cucumis sativus L. cv. Mini Munch) have emerged as a promising candidate for space crop cultivation due to their rapid fruiting, high water content, and nutritional benefits. This study investigates the influence of varied nitrogen concentrations on the growth, development, and labour efficiency of mini cucumbers cultivated hydroponically. Three nutrient treatments are compared: a control based on standard Hort Innovation formulations, a low-nitrogen treatment (T2) reflecting the minimal optimal range for cucumbers, and a further reduced nitrogen treatment (T3) with concentrations decreased by 50% relative to T2. Key growth parameters including plant height, leaf number, chlorophyll content, and photosynthetic performance are systematically monitored to assess developmental responses and yield quality. The integration of automated fertigation and precision drip irrigation systems ensures consistent nutrient delivery and minimizes issues such as salt accumulation. By optimizing nutrient formulations and light conditions, this research aims to streamline harvesting processes, thereby reducing the labour intensity typically associated with the high vigour of mini cucumbers. The findings will contribute to the development of efficient crop management strategies and precision agriculture protocols, ultimately supporting sustainable food production in extreme environments, including space-based agricultural systems.

The underestimated importance of controlled air movement through the canopy for more active, more healthy and more sustainable crops

Mr Ton Habraken[1]
[1]*Ludvig Svensson BV*

Climate, Energy & Renewables Climate control (incl. lighting) - Session Sponsored by Denso
Hall A, July 29, 2025, 11:10 - 12:45

Growers face significant challenges while trying to create the perfect climate throughout their greenhouse. Reaching an even temperature and the ideal humidity levels is a complex task.

Subjects to be handled during the presentation:
- Creating a homogeneous greenhouse climate
- Preventing fungal diseases.
- Creation of an active greenhouse climate without having to use the "minimum pipe" temperature - Saving energy
- Stimulating the diffusion process of water vapor out of the micro climate around the crop.
- Stimulating evaporation by convection - positive effect on the energy balance of the plant.
- Promoting photosynthesis bringing CO2 closer to the stomata.
- Positive stimulation of the pollination process.

One of the most underestimated benefits of controlled airflow is its impact on secondary metabolite synthesis, particularly in **aromatic herbs** such as basil, thyme, and rosemary.
- The optimal airflow in a greenhouse depends on crop type, growth stage, and environmental conditions. For example, gentle airflow strengthens stems. For herbs in the vegetative growth stage, $\mathbf{0{,}3\text{-}0{,}5\ m/s}$ is recommended.
- Moderate airflow enhances mechanical stress responses, promoting stronger stems and shorter internodes. For mature aromatic herbs, $\mathbf{0{,}5\text{-}0{,}8\ m/s}$ is optimal.
-Stronger airflow ($\mathbf{0{,}8\ m/s}$) increases essential oil production and plant resilience. Additionally, it improves gas exchange, CO_2 uptake, and photosynthesis while reducing humidity-related diseases.
- $\mathbf{1{,}2\ m/s}$ is more suitable for fruiting plants and crops requiring higher transpiration rates, as well as herbs with robust stems.

Strategic airflow management in greenhouses is not merely a climate control tool. It is an active factor in strengthening plant structure, enhancing flavor and aroma, and reducing disease pressure. By harnessing turbulence, growers can cultivate more resilient and aromatic herbs, directly increasing their appeal to consumers.

- How to measure airflow in greenhouses - Tips & Tricks

Polyhouse in the Lockyer shows potential for sub-tropical summer

Ms Heidi Wiggenhauser[1], Mr Gaurav Bhuju[1], Mr Col Douglas[1], Dr Elio Jovicich[1]
[1]Department of Primary Industries

Emerging Crops and Technologies
July 30, 2025, 11:10 - 12:10

Low-tech polytunnels with soil-grown vegetables cover over 50 ha in the Lockyer Valley, QLD, producing cucumbers and eggplants during mild winters. Production is limited in hot, humid summers due to poor ventilation. An improved polyhouse design featuring roof vents and soilless systems was tested for crops planted in mid-October 2024, including cucumber, eggplant, beans, zucchini, capsicum, and melons. Monthly maximum and minimum air temperatures recorded inside the polyhouse ranged from 36.1°C and 18.1°C in October to 34.7°C and 20.7°C in February. Rainfall during the period totalled 460 mm. High-wire trellised cucumbers produced marketable yields of 22 kg/m^2 over a 64-day harvest period. Galia-type melons achieved Total Soluble Solids of up to 15.5 °Brix after 84 days. High-wire trellised beans yielded 8 kg/m^2 over 48 days. Small-fruited eggplants (390 g/fruit), pruned to two stems and leaned to 45°, produced 11 kg/m^2 by mid-March. Capsicum cultivars yielded 6–7 kg/m^2 until late February. Vertically trellised parthenocarpic zucchini averaged 200 g/fruit across 28 cuts per plant over a 64-day period. Overall, production quality was noteworthy despite challenging environmental conditions. The low-cost polyhouse demonstrated its potential to extend the growing season during summer and encouraged year-round evaluations at the Gatton Smart Farm.

Strengthening Northern Australia's horticulture through protected cropping pathways to adoption

Dr Elio Jovicich[1], Ms Heidi Wiggenhauser[1]
[1]Department of Primary Industries

Emerging Crops and Technologies
July 30, 2025, 11:10 - 12:10

Horticulture in Northern Australia, predominantly conducted outdoors near the Tropic of Capricorn, faces significant challenges due to variable and extreme climatic conditions. By 2023, protective structures—such as poly-tunnels, screens, and shade houses—covered 689 hectares, accounting for 4.9% of Australia's protected cropping area. Through a CRC for Development Northern Australia project, we explored how protected cropping technologies mitigate climate risks and improve market access. Collaborations with industry stakeholders and Research Development and Extension (RD&E) organisations across Northern Queensland, the Northern Territory, and Western Australia identified key investment opportunities to scale protected cropping systems. Research demonstrated the ability of these systems to manage extreme weather, pest pressures, and yield inconsistencies for high-value crops, though barriers such as high capital and operational costs and intensive management persist. Proof-of-concept production systems and capacity-building initiatives are pivotal for de-risking adoption and ensuring continuity. Industry-focused evaluations at demonstration sites in Ayr, Queensland, and Carnarvon, Western Australia, featuring retractable roof structures and on-farm trials, highlighted year-round production capabilities and notable yields: capsicums (15 kg/m^2), eggplants (18 kg/m^2), cucumbers (20 kg/m^2), zucchini (15 kg/m^2), beans (6 kg/m^2), and specialty melons (3 $fruits/m^2$ at 16 °Brix). Additional opportunities were identified for crops such as ginger, turmeric, and dragon fruit, as well as advancements in structural resilience to strong winds. Outputs such as grower case studies, crop trials, and a video on melon production for export are aiding investment planning. Stakeholder engagement has been a cornerstone of the project, extending to industry events, education initiatives, and contributions to the Australian Protected Cropping Strategy 2021–2030. Continued efforts in capacity building, demonstration sites, and networking are essential for advancing protected cropping systems and strengthening agriculture in Northern Australia.

Understanding nutrient use in Cannabis sativa L. to optimise cultivation in protected cropping environments

Dr Ricarda Jost[1,2,3,4]

[1]La Trobe University, [2]La Trobe Institute of Sustainable Agriculture and Food, [3]Australian Plant Phenomics Network - LTU node, [4]ARC Research Hub for Protected Cropping (PC Hub)

Hemp- and drug-type (aka medicinal) cannabis (Cannabis sativa L.) varieties are used for diverse industrial and pharmaceutical applications with expanding markets worldwide. Hemp cultivars are largely characterized by efficient nutrient use – which enables cultivation on marginal lands - and high vegetative biomass for bast fibre and hurd production. Drug-types are more compact, with high flower harvest index and low nutrient efficiency. The latter is indicating a lack of selection pressure due to 'spoiling' of this high value crop with ample fertiliser during its long domestication history. While drug-type cannabis with high levels of delta-9-tetrahydrocannabinol (THC) has been cultivated by humans over centuries, high cannabidiol (CBD) producing cultivars for medical products had to be generated by introgression into drug-type cannabis. These new cultivars were selected based on the CBD content of flowers, often neglecting other agronomically important traits. Here, I assess the performance of hemp- and drug-type cannabis with particular emphasis on how protected cropping environments affect nutrient use, growth characteristics and yield. Cross-comparison to cultivation of dwarf tomato will help to highlight some key differences to more conventional crops - and how these genetic differences affect crop management in protected cropping environments – particularly with respect to fertigation and light intensity / quality. I will then give some examples of how different cultivation strategies impact plant health and product quality.

Climate screens: an indispensable tool for greenhouse growers to achieve more resilient, sustainable and profitable cultivation

Mr Ton Habraken[1]
[1]*Ludvig Svensson Bv*

Energy Efficiency
Hall A, July 30, 2025, 14:45 - 15:35

Climate screens are an indispensable tool in any greenhouse.
Besides shading and energy saving there are several other ways how climate screens can improve the growth of your crop and can make your greenhouse operation more sustainable and profitable.

During this presentation all the aspect that "you never thought you wanted to know" about climate screens will be handled.

A light diffusion radiative cooling film for high-yield protected cropping.

Mrs Maduni Wijethilake[1], Dr Jihong Han[2], Mrs Mayumi Silva[3], A/Prof Han Lin[1], Prof Baohua Jia[1]

[1]School of Science, RMIT University, [2]Hawkesbury Institute for the Environment, Western Sydney University,, [3]Bioscience and Food Technology discipline in the School of Science, RMIT University

This study assesses the effectiveness of Light Diffusion Radiative Cooling (LDRC) film in energy-efficient protected cropping systems, addressing critical challenges in sustainable agriculture and food security. As climate change intensifies, the energy consumption associated with controlled-environment agriculture necessitates innovative solutions. We explored LDRC films as adaptive technologies that optimise light transmission and thermal regulation within greenhouse environments, specifically evaluating their impact on radish cultivation compared to conventional greenhouse covering films. LDRC films utilise advanced radiative cooling mechanisms with diffuse light rays, potentially enhancing growth conditions and improving the nutritional properties of crops. Our methodology involved uncontrolled, tiny greenhouse experiments measuring key climatic parameters—temperature, humidity, soil moisture, and light intensity—as well as crop productivity metrics and nutritional profiles under both film types. Results demonstrate that LDRC films significantly outperform conventional options regarding microclimate regulation, exhibiting reduced temperature fluctuations and improved humidity control. Assessments of soil moisture revealed benefits in water conservation and enhanced plant water availability. Nutritional analyses indicated notable variations in nutrient content, correlating with improved radish growth parameters. This research provides valuable insights into deploying LDRC film technologies in protected cropping systems, offering a sustainable and efficient alternative to traditional polyethylene films, with far-reaching implications for crop management and environmental sustainability.

Unpacking two multi-party trials on streamlining cross border inspection process and digital labelling for traceability, marketing and compliance.

Greg Calvert[1]
[1]*FreshChain Systems*

Ag Tech Innovation (Robotics, AI, Automation)
Hall C, July 29, 2025, 11:10 - 12:45

Two trials to modernize the horticultural industry.
The first trial investigated streamlining and digitizing the cross-border inspection process to reduce rejections and create a potential “green pass” whilst ensuring no compromise to critical biosecurity and phytosanitary protocols. The fundamental
objective was to thoroughly evaluate the advantages of introducing a more streamlined, digitally driven approach to cross-border inspections for all participants within the supply chain.
This involved a detailed assessment of the specific digital tools required to realize these benefits, determining how best to utilize them, and pinpointing the optimal points within the shipment process for deployment.
Furthermore, the trial analyzed whether legislative or operational changes would be necessary to achieve improvements in both preventing and remediating issues. Key findings emphasized the necessity of establishing robust data sharing agreements among supply chain partners, integrating pre-emptive tools within
packhouse ordering systems, and utilizing smart packaging and remedial tools to aid inspectors in addressing problems. The importance of smart devices for efficient data processing and transmission, credentialed data access based on relevance,
streamlined state inspection processes (potentially requiring legislative changes), and the adoption of global data standards to facilitate real-time data exchange between systems was also highlighted. The second trial concentrated on punnet-level traceability for enhanced food safety, marketing outcomes and compliance. The challenges addressed enabling instant traceability of punnets back to their origin, gaining a deeper understanding of consumer sentiment, acquiring punnet-level distribution and quality metrics, improving the understanding and rectification of factors affecting quality, ensuring compliance with current and future regulatory demands. Digital labeling transforms horticulture by enhancing food safety and regulatory compliance through traceability. Smart labels strengthen consumer relationships, while data-driven insights optimize operations and marketing. Furthermore, they improve efficiency, sustainability, brand value, and security. New revenue streams are unlocked through data monetization, and enhanced biosecurity tools boost consumer confidence.

Rainbow Bee Eater: An update on the ECHO2 renewable energy systems at Holla-Fresh and Katunga Fresh.

Peter Burgess

Climate, Energy & Renewables Climate control (incl. lighting) - Session Sponsored by Denso

Hall A, July 29, 2025, 11:10 - 12:45

Rainbow Bee Eater: An update on the ECHO2 renewable energy systems at Holla-Fresh and Katunga Fresh.

Rainbow Bee Eater's Australian designed and manufactured ECHO2 renewable energy systems are now installed at Holla-Fresh and Katunga Fresh to deliver significantly lower energy costs and significantly lower carbon emissions.

ECHO2 converts renewable local biomass residues such as wheat straw and wood into energy, biochar and carbon removal certificates.

ECHO2 clean syngas energy is suitable for generating heat, electricity, hydrogen and liquid fuels. ECHO2 Biochar locks up atmospheric carbon dioxide for thousands of years and has many large scale applications in agriculture, horticulture and industry.

Vibratory mating disruption as a potential tool for managing serpentine leafminer (Liriomyza huidobrensis) in protected cropping systems

Dr Anu Jayaweera[1], Dr Christopher Pastras[1], Dr Bishwo Mainali[1]
[1]Macquarie University, Sydney

Exotic leafminers, including serpentine leafminer (SLM) (Liriomyza huidobrensis) cause significant damage to protected crop industries in Australia. Even though integrated pest management strategies such as effective monitoring, biological control and use of specific systematic insecticides are recommended for their management, insecticides act as the main method of control. The use of insecticides could create additional issues due to the development of insecticide resistance and negative impacts on the biological control agents, consequently resulting in pest outbreaks prompting development of alternative environment-friendly control strategies. Vibrational mating disruption (VMD) exploits the substrate-borne vibrational communications of insects to disrupt their mating, thereby offering a novel potential for pest management. The method has been proved effective in controlling the vineyard pest leafhoppers (Scaphoideus titanus and Hebata vitis.) in vineries in Italy. This study investigated the substrate-borne vibratory mating communication of SLMs on bean plants and the potential of exploiting it as VMD method to enhance their control. We used single-point Laser Doppler Vibrometry to describe the vibratory mating communications of SLM and investigated the impact of playback signals on their mating behaviours. Males initiate mating calls by quick body movements, and our study characterises this unique vibratory signalling. Our laboratory playback trials showed that playback vibratory signals greatly reduce the male copulatory behaviours: in the presence of the playback, males did not display any calling behaviour, had minimum activity level, and had no interest on the female compared to the control group. These results suggest that playback vibratory signals adversely impact on male copulatory behaviours highlighting the potential of deploying it as a mating disruption strategy against SLMs. To our knowledge, this represents the first attempt to test VMD against an insect pest in Australia.

Keywords: Protected crops, Behavioural pest management; substrate-borne signals, mating communication; playback signals

How can automated insect monitoring technology enable site-specific (berry) pollination management?

Alan Dorin

Berries Forum
Hall A, July 30, 2025, 13:45 - 14:45

In this presentation, I will explain new technologies my team is developing that assist to improve insect pollination of covered crops, especially but not exclusively, berries. Insect pollination under cover is understood to be difficult. The reasons for this are many and varied, and often related to insects' preferences to remain under open sky, within a temperature and humidity range that may not be realised within a covered crop, and among vegetation and landscapes with clear navigable landmarks. The systems I will explore in this talk allow accurate, automated bee counts to be made across large areas of poly-tunnel. They count individual bees, trace their movements, and document individual flower visits. The outcome is a detailed map of pollen flow, pollination hotspots and bee deficits. This data can then be used to support individual site-specific decision-making about hive numbers, locations and efficiencies. The data also supports infrastructure-specific decision making to assist growers to create spaces well suited to insect pollination of their specific crops. The ultimate goal is an understanding of a site's requirements for effective insect pollination, and a boost in pollination-dependent crop yield.

Enza Zaden Hypersensitivity reaction as defence mechanism to ToBRFV on Tomato

Mr Manus Thoen
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Enza Zaden has developed a groundbreaking mechanism to combat the Tomato Brown Rugose Fruit Virus (ToBRFV) through the introduction of High Resistance (HR) varieties and rootstocks. This innovation is based on a hypersensitivity reaction that actively blocks the virus's spread, rather than merely delaying it. The HR rootstocks provide an additional layer of defence containing the virus to reduce overall pressure. This dual approach ensures comprehensive protection for tomato plants, significantly reducing the risk of infection and enhancing crop resilience.

The discovery of a specific gene that confers high resistance to ToBRFV marks a significant breakthrough. This gene, identified through extensive screening of wild tomato germplasm, offers a unique solution to the rapidly spreading virus. The high resistance level is critical as it prevents the virus from entering the plant, unlike intermediate resistance which only delays propagation. This innovation is poised to secure tomato production globally, benefiting both large-scale and smallholder farmers.

Enza Zaden's HR varieties and rootstocks represent a game-changing advancement in the tomato industry, providing a robust defence against ToBRFV and ensuring healthier, more productive crops. This comprehensive strategy not only protects current crops but also minimizes the risk of long-term soil infection, safeguarding future cultivation cycles. Focus of the presentation will be on how such resistance mechanism (Hypersensitivity) works and how can practically help Australian tomato growers to prevent or minimize the spreading of such vicious virus.

Agricultural plastics – what is the future?

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Sustainability & Waste Management
Hall A, July 30, 2025, 11:10 - 12:10

Australia's target to achieve 80% resource recovery from all waste streams by 2030 and goals for a circular economy is driving significant changes in how plastic waste is managed across sectors, including agriculture. Extensive research and engagement into a national stewardship scheme for agricultural plastics was completed in 2023 describing the scale of agricultural plastics generated and template for implementation.

Challenges persist in on-farm retrieval, contamination with soil and organics, and the lack of suitable collection infrastructure. In many regions, these materials still end up being stockpiled, buried, or burned.

Despite these difficulties, there is continued focus on specific waste streams including drumMUSTER and Big Bag Recovery and initiatives undertaken by irrigation manufacturers such as Netafim and Rivulis.

Regional initiatives are starting to gain traction with local governments (e.g. Southern Downs and Bundaberg Regional Councils in Queensland, Swan Hill Regional Council in Victoria) working with growers to support plastic recycling on the ground. An initiative supported by NSW Government is also working with the cut flower industry to reduce plastics entering waterways and increase recycling rates.

We continue to work with growers to assist them in "Moving up the waste hierarchy" including consideration of alternatives to plastics, regional logistics and recycling infrastructure and assisting growers in preparing plastics for collection.

The recently established Solving Plastic Waste CRC aims to further understand the impact of plastics used in agriculture and provide increased opportunities for recycling, This will be achieved through extensive collaboration with Partners and other stakeholders, progressing the following long-term goals:

- Upgrade the properties of high-volume plastic waste streams
- Increase mechanical recycling of end-of-life plastics
- Enable a circular economy for plastics
- Reduce the transmission of microplastics to soils.

Understanding “e-weights” (AQS) and how it instantly (and legally!) reduces giveaway

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Berries Forum
Hall A, July 30, 2025, 13:45 - 14:45

Full Details can be found here:
www.andinspection.com.au/resources/aqs-average-quality-system-and-e-weights/

The Average Quantity System (AQS) is a system in Australia that regulates the amount of product in pre-packaged goods. It’s designed to be fair for both consumers and manufacturers.

Here’s a quick break down of how it works:

Manufacturers can fill packages with an average amount, rather than having to ensure every single package meets a minimum weight (like under the minimum weight system).
This reduces waste for manufacturers.

There are still measurement rules to make sure consumers get what they pay for:
The average amount in a batch of packages must be equal to or greater than the amount stated on the label (this is defined as ‘nominal quantity’).
A small number of packages can have slightly less than the labelled amount, but not more than a certain limit (defined as ‘tolerable deficiency’)
No package can have less than the labelled amount (twice the prescribed tolerable deficiency).

By implementing AQS, manufacturers can instantly minimise waste, improve efficiency, and stay compliant with Australian legal standards, benefiting both the business and the customer.

Bioreactors: A Sustainable Solution to Nutrient Pollution

Mrs Melinda Simpson

Berries Forum
Hall A, July 30, 2025, 13:45 - 14:45

The berry industry in Australia is under increasing pressure to demonstrate environmentally sustainable practices while maintaining productivity. To support this, we explored the use of the Hort360 Best Management Practice (BMP) platform as a tool to collect on-farm data, identify areas for improvement, and implement targeted changes across berry production systems. This presentation will highlight how Hort360 was used in collaboration with berry growers to assess current management practices. By working directly with growers to complete the relevant Hort360 modules, we were able to build tailored action plans aimed at improving both environmental and production outcomes.

As part of this project, we trialled the use of woodchip bioreactors as an innovative strategy to reduce nutrient pollution from substrate-based berry systems. The drainage water often high in nitrates, was collected and directed through bioreactors to remove excess nutrients before re-entering the environment. Early results show promising reductions in nitrate concentrations, highlighting bioreactors as a practical solution for managing drainage in intensive berry production.

We also trialled direct seed drilling of pollination mixes along headlands and in between blueberry rows to increase floral resources for native pollinators and improve biodiversity.

By integrating the insights gained through Hort360 with on-ground actions like bioreactor installation and increasing floral resources, we demonstrated a pathway for growers to improve sustainability

This presentation will share key findings, grower feedback, and recommendations for broader adoption of Hort360 in the berry sector, with a focus on nutrient management and water quality improvements.

Sustainability in protected cropping

John Baker

Sustainability & Waste Management
Hall A, July 30, 2025, 11:10 - 12:10

Perfection Fresh is proud to be leading the way in sustainable protected cropping, transforming challenges into opportunities through innovation, technology, and a commitment to environmental stewardship. In the face of growing climate pressure, consumer expectations, and biosecurity threats like the tomato brown rugose fruit virus, we have doubled down on practices that not only reduce our environmental footprint but also drive commercial resilience.

Across our glasshouse and high-tech farming operations, including our flagship sites like Two Wells and Bundaberg, we've implemented smart irrigation systems, real-time crop monitoring, and data-led pest management to reduce inputs while increasing yield and quality. In Bundaberg, for instance, Priva sensors and Bitwise Agronomy tools have helped us fine-tune water and nutrient delivery, resulting in more sustainable and profitable berry production.

Our protected cropping sites are also playing a central role in the trial of the Leading Harvest Sustainability Standard, a globally recognised certification that benchmarks agricultural sustainability across biodiversity, water, soil health, and worker welfare.

These initiatives are backed by strong ESG governance, with 100% of our labour hire providers independently audited, a Climate Transition Plan in motion, and transparent targets to reach net zero by 2050.

This presentation will explore how protected cropping is not just enabling year-round production, it's becoming a proving ground for the future of sustainable horticulture.