POTATOLINK R&D FORUM 2023

PotatoLink held a research and development forum in June 2023. Seven speakers covered a range of topics including diseases, irrigation, monitoring technology and more.

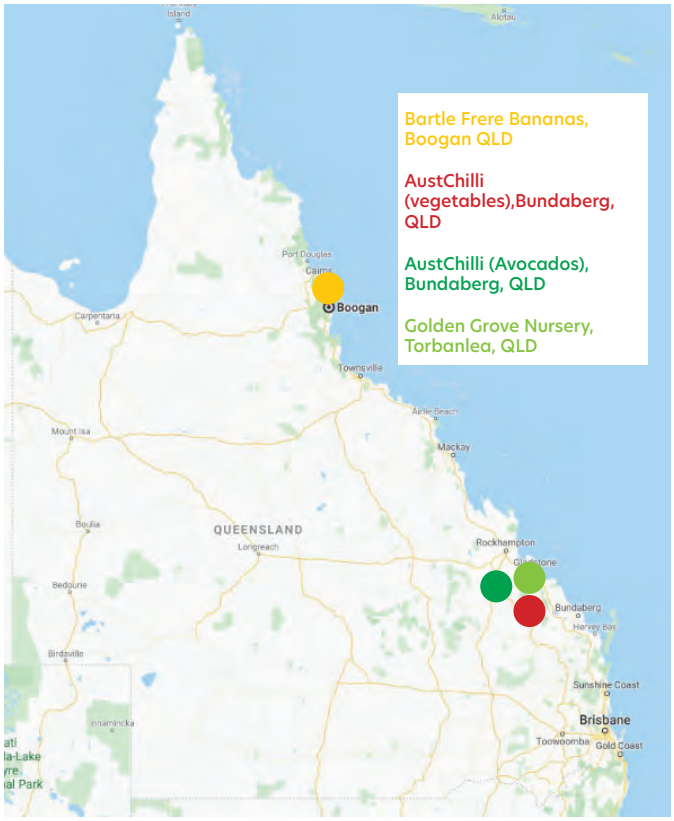
RESEARCH PROJECTS

Digital Remote Monitoring

Henry Hyde from Applied Horticultural Research (AHR) presented his work on the Smart Farming project, where he discussed soil moisture monitoring, irrigation management and automated record keeping.

Operating with unpredictable weather within sensitive environments, Australian primary industries have always been at the forefront of innovation. With a specific focus on the Great Barrier Reef's (GBR) delicate ecosystem, the Digital Remote Monitoring project aims to support horticultural operations to improve efficiency and sustainability.

To showcase the potential benefits of a purpose made Hitachi Control Tower system, four pilot smart farms have been established at the northern and southern border of the GBR, each representing a different crop.



Pilot smart farm sites

PRECISION WEATHER MONITORING

On-farm weather stations are an integral part of the Hitachi Control Tower's infrastructure, providing farmers with accurate, real-time information on crucial weather parameters. These include rainfall, temperature, humidity, and wind speed and direction. By combining this on-farm data with forecasts from the Bureau of Meteorology, farmers can make informed decisions, ensuring optimal irrigation practices and water usage. This precise weather monitoring is crucial in mitigating the high spatial variability of weather conditions in Queensland, ultimately leading to improved potato yields and resource efficiency.

OPTIMAL SOIL MOISTURE MANAGEMENT

Farming is inherently dependent on water resources, making efficient irrigation management a top priority. The implementation of soil moisture probes across all pilot smart farms allows farmers to remotely monitor soil water content accurately. Armed with this information, they manage water efficiently for maximum yield and minimum waste. Using soil moisture probes can also lead to reduced nutrient leaching. The automatic alerts generated by the Hitachi Control Tower ensure timely interventions, preserving crop health.

DATA FUSION FOR ENHANCED INSIGHTS

The true power of the Digital Remote Monitoring project lies in its ability to combine data from various sensors. By combining information from soil moisture probes and weather stations, the Hitachi Control Tower generates highly accurate forecasts of soil water content up to five days ahead. This foresight plays a critical role in reducing plant stress by allowing farmers to optimise irrigation management and anticipate water needs. The visual representation of this data on the interactive dashboard provides a clear roadmap for timely and informed decision-making.

SUSTAINABLE NUTRIENT MANAGEMENT

The Australian banana industry's experience with fertiliser regulation has inspired the adoption of a real-time nitrate photometer on the banana pilot farm. The photometer has been positioned to measure the concentration of nitrate leaving the property via subsurface leaching. This approach has been able to verify that the farm's fertiliser program is sufficient and meets best practice.

While the real-time nitrate photometer is a highly accurate sensor useful in environmentally sensitive areas, it is quite costly. A more cost-effective monitoring option is the full-stop wetting front detectors. These full-stops capture a sample from water that moves down through the profile. This sample can then be extracted and analysed immediately using a portable photometer.

The results from the full stops are also being used to validate a nutrient loss model, which will be used to provide recommendations regarding the application timings of fertiliser.

EFFICIENT HARVEST OPERATIONS

The introduction of GPS trackers on farm vehicles at the banana pilot farm is being used to locate bunches during harvest, increasing efficiency while reducing far traffic and therefore reducing fuel and erosion.

The GPS location of vehicle activity is tracked and displayed on the Hitachi Control Tower.

AUTOMATED RECORD KEEPING

The GPS activity of chemical applications is automatically saved and linked to other key certification data. These certification data include activity start and end times, weather conditions (temperature, humidity, and change in temperature) during application, operator name, chemical type, and withholding period. The system aims to further develop and facilitate more cost-effective and efficient Freshcare environmental audits.

RELEVANCE TO THE POTATO INDUSTRY

The implementation of digital remote monitoring through the Hitachi Control Tower offers numerous advantages to the potato industry. By incorporating weather and soil moisture monitoring, irrigation efficiency can be enhanced, leading to precise water application and ultimately promoting optimal potato yield. Additionally, nutrient monitoring helps minimise input usage.

Through GPS activity tracking, harvest operations become more efficient, resulting in reduced labour requirements. Automated record-keeping feature significantly cuts down on the time and cost associated with certification audits.

This project has been funded by Hort Innovation, using the Hort Innovation nursery products research and development levy and the Australian Government's National Landcare Program. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Read more https://ahr.com.au/digital-remote-monitoring

Nitrate photometer

GPS tracking for efficient harvest operations

Mechanisms and manipulation of resistance to powdery scab in potato roots

In his presentation, Professor Calum Wilson of the Tasmanian Institute of Agriculture (TIA) at the University of Tasmania discussed the major outcomes from the recently completed Hort Innovation project *Mechanisms and manipulation of resistance to powdery scab in potato roots* (PT17003). Professor Wilson highlighted a new rapid cultivar screen for disease resistance and new resistant varieties being developed as a result of the project, as well as potential new disease controls targeted towards plant roots.

Potato powdery scab can cause significant yield losses and impact quality of crops. The infection targets both the tuber and root phases, with root infection playing a crucial role in hampering nutrient uptake and water absorption.

RAPID SCREENING: A BREAKTHROUGH IN EVALUATING RESISTANCE TO ROOT INFECTION

Traditionally, evaluating a variety's resistance to powdery scab has been time-consuming and resource-intensive, involving lengthy field or glasshouse trials and focussed on tuber disease, ignoring the yield debilitation root infection phase. However, the research team has developed a new screening method for root infection that takes less than a week.

By taking a small piece of a plant's root and exposing it to the pathogen to measure how much pathogen sticks to the root hairs, the team could determine resistance within 48 hours. This innovative approach has highlighted that susceptibility to root disease is not always evident in tuber diseases. In other words, some varieties have good tuber resistance, but poor resistance to root infection, for example Nicola potatoes.

Diseased roots (right) vs non-diseased roots (left). Photo by M. Balendres

NEW RESISTANT VARIETIES

Another significant breakthrough lies in enhancing resistance of commercial cultivars through tissue culture techniques. The group has already succeeded in generating variants with enhanced disease resistance in laboratory and glasshouse testing. These new variants have displayed promising resistance to root infection, indicating a potential path towards developing highly robust resistance traits. The team aims to further test disease resistance and the agronomic potential of these variants in the field with a view to commercial exploitation.

Results from quick screening of different varieties.

Highly susceptible	Moderately susceptible	Moderately resistant	Good resistance
Nicola	Gold Rush	Russet Burbank	Russet Nugget
Liseta	Yukon Gold	Desiree	Granola
Kranz	Tasman	Dawmore	Tolaas
Shepody	Spunta	Sebago	Tolangi Delight
Shine	Pontiac	Brake light	
Red Ruby	Frontier Russet	Ruby Lou	
Patrones	Lustre	Fontenot	
Delaware	Wilwash	Purple Congo	
Nooksack	Leven	Cranberry Red	
Coliban	Bintje	Nampa	
Southern Cross	Pentland Dell	Spey	
Kennebec	Mainstay	Banana	
Diment	Cariboo	Pink Eye	
Kipfler	Atlantic	Dutch Cream	
Up-to-Date	Chiefton		
	Sequoia		
	Bismark		
	Yellow King		

UNRAVELLING THE ROLE OF ROOT EXUDATES

Root exudates, the secretions from plant roots, play a vital role in attracting pathogenic organisms like powdery scab. The research team has explored the differences in root exudate profiles between susceptible and resistant varieties and discovered that certain exudates attract the pathogen, while others repel it. Manipulating these attractants and repellents may offer a novel strategy for screening and breeding resistant varieties in the future.

LOOKING AHEAD: TARGETING THE ROOT INFECTION PROCESS

Understanding the root infection process is crucial for devising effective strategies to combat powdery scab. The research team has examined the surface proteins on the potato root, aiming to identify the receptors that the pathogen binds to. This work is still in its early stages, but the potential to develop a variety that resists the binding and infection of the pathogen, and therefore halting the disease, is a promising prospect.

The project's findings have far-reaching implications for sustainable potato farming. The rapid screening method allows farmers to rapidly assess varieties susceptibility to root infection and choose the most appropriate variety for their disease risk. Additionally, the development of resistant variants of commercial cultivars, the identification of putative pathogen binding targets on roots and the understanding of interactions of the pathogen with plant root exudates open up new possibilities for future breeding programs.

Read more about this research in previous issues of PotatoLink Magazine

https://bitly.ws/X2kX

https://bitly.ws/X2m8

Other speakers

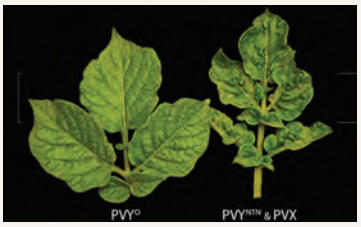
TETAAN HENNING ON MOBILE DRIP IRRIGATION

Tetaan Henning of Eco Water Management discussed the mobile drip irrigation technology Dragon Line, providing an overview of how it works and uses examples to highlight the benefits for use in Australian potato crops.

Extra resources: Mobile drip irrigation webinar https://bitly.ws/X2q7

TIM NEALE ON REMOTE SENSING AND YIELD MAPPING

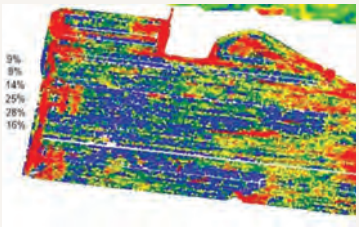
Tim Neale of Data Farming discusses remote sensing and yield mapping in potatoes. He explains high-resolution satellite imagery and talks about how it can be used in crop management and yield mapping to assess overall performance.



NIGEL CRUMP ON VIRUSES

Dr Nigel Crump from AuSPICA highlighted the impact of viruses on yield, the importance of seed certification to ensure you 'don't plant a problem', and other research and initiatives of AuSPICA.

DAVID ODDIE ON SOIL NUTRIENT VARIABILITY - MAPPING AND APPLICATION



David Oddie from Precision Agriculture discussed the use of mapping to understand soil nutrient variability. He highlighted the importance of regional and paddock-level variability in soils and compares different methods of soil testing to create nutrient maps and variable rate applications.

Re-visit the R&D forum - a selection of speaker recordings are available on the PotatoLink website. https://bitly.ws/X2qI

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

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