Spotlight
ON COTTON R&D

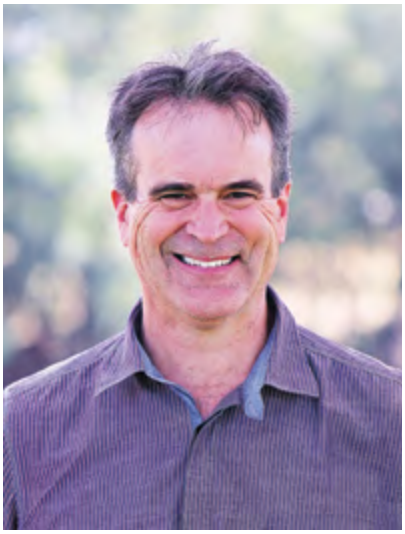
WINTER 2024

Transparent and independent: 30 years of environmental assessments

Familiar faces for key CRDC roles

Dryland cotton takes centre stage

CRDC



Allan Williams

In the Spotlight

Welcome to the Winter edition of *Spotlight*.

In this edition, we discuss the just-released Fourth Environmental Assessment, commissioned by CRDC and Cotton Australia as part of our industry's PLANET. PEOPLE. PADDOCK. Sustainability Framework, and some of its recommendations.

As we all know, the Australian cotton industry is no stranger to scrutiny from outsiders. But with 30 years of independent and publicly available environmental assessments and reporting, arguably the greatest scrutiny comes from within our industry itself. There is no other agricultural industry in Australia with such a long history of examining its own progress in such an independent, transparent way.

After three decades, and with such strategies in place as the framework, 10-year assessments, five-yearly reports and annual updates, our industry is well ahead of the curve when it comes to commitment and credentials. But, as ever, there is still work to do.

At CRDC, one of our key goals is helping growers prepare for a world of increased scrutiny and ensuring we as an industry can meet ever-changing global requirements to maintain market access.

One area we're currently focusing our research, development and extension (RD&E) effort on is emissions – helping to provide a standardised approach for growers to emissions calculations, and providing knowledge and tools to reduce emissions.

With our fellow research and development corporations, we've invested in the development of a standardised emissions calculator with Agricultural Innovation Australia. The Environmental Accounting Platform (EAP) allows growers to calculate their carbon footprint at a commodity, enterprise, and whole of business level. We're also supporting the new CRC for Zero Net Emissions from Agriculture (ZNE-AgCRC) to develop technologies and solutions to reduce emissions from Australian agriculture. We'll be working closely as a partner in this venture to ensure the outcomes are meaningful for cotton.

Another area we're continuing to focus RD&E effort is water use efficiency (WUE). In this edition we talk to Macquarie grower Sinclair Steele and CottonInfo Regional Extension Officer Amanda Thomas about how changing an irrigation system has had wider system benefits: including to on-farm health and safety. I'd also like to take this opportunity to thank Amanda for her significant contribution to the industry, as she leaves CottonInfo in August to concentrate on the family's farming enterprise. As a cotton grower and one of the original CottonInfo team members, Amanda has been a stalwart and an enormous asset to the growers in the region and beyond.

Finally, in this edition we've included information on how growers can be involved in setting research priorities: from speaking directly to our team of experienced Innovation Brokers, led by our new General Manager, Innovation, Dr Merry Conaty, through to representing your local growers and CGA at the twice yearly priority setting forums. A great opportunity will be at the Australian Cotton Conference in August. As Foundation Sponsors, our CRDC team will be at the Conference, and look forward to talking to you about your research needs.

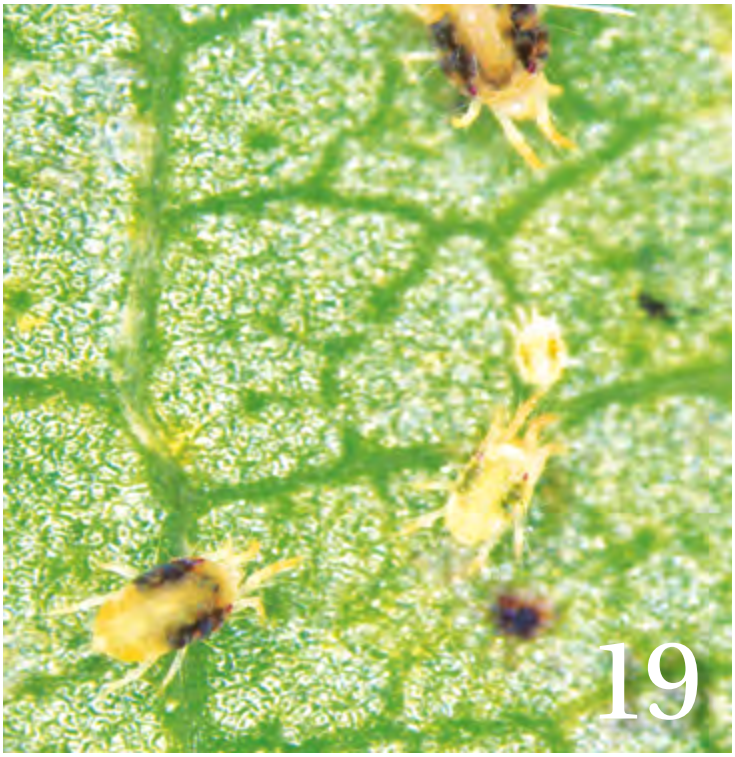
Allan Williams
Executive Director

CRDC

CRDC acknowledges Australia's Indigenous people as the traditional custodians of our country, and recognises their continuing connection to lands, waters and culture. We pay our respect to Elders past, present and emerging, and extend that respect to all Indigenous people.

MELANIE JENSON

Winter 2024



Spotlight is brought to you by Australia's cotton growers and the Australian Government through the publisher Cotton Research & Development Corporation (CRDC). CRDC is a research and development partnership between the Australian cotton industry and the Australian Government.

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

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Our vision: A globally competitive and responsible cotton industry.
Our mission: To invest in RD&E for the world-leading Australian cotton industry.

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MELANIE JENSON

ON THE COVER:
The Australian cotton industry has welcomed its Fourth Environmental Assessment.

Want to see more of Spotlight?

This edition can be viewed online at: www.crdc.com.au

COTTON NEWS

4 Opening up the cotton industry
4 What's it like to work on-farm?
7 Who sets cotton's research priorities?

FEATURES

ON THE COVER
Familiar faces in new CRDC leadership **5**
30 years of voluntary environmental assessments pay off **9**
Dryland growers keen to get the good oil **26**

Make an impact through the grower survey **8**
Helping growers lower emissions **10**
Giving growers tools to measure biodiversity and natural capital **11**
Excellence is the name of the game for the 2024 Conference **13**
Celebrate industry stars at the Awards night **14**
Creating a shift for workforce success **16**
Resistance highlights flow-on effects of spray decisions **17**
Creating confidence when the pressure is on **19**
Innovator tackles drought resilience at evokeAG **20**
Hot weather and a hot topic in the Macquarie **21**
Focus on siphonless irrigation at Irricom **23**
Know before you go... **24**
Tackling on-farm emissions calculation **29**
Delaying development and maturity at Terry Hie Hie **30**
CRDC 2024-25 Projects List **31**

Horizon Scholar Julian Craven.

Opening up the cotton industry

JULIAN Craven is the 2024-26 CRDC-supported AgriFutures Horizon Scholarship awardee.

Julian is studying for a Bachelor of Science (Agriculture Innovation and Water Science and Policy) degree at Australian National University in Canberra (Ngunawal country). CRDC Innovation Broker Rachel Holloway will oversee Julian's two-year scholarship and organise placements and opportunities within the industry.

"This is a great honour and I look forward to working with my sponsor CRDC, the work experience and mentorships," Julian says.

"I hope to really utilise my industry connections in gaining a further understanding in the science, RD&E, and leadership aspects of agriculture."

Agriculture has always been a big part of Julian's life, growing up in rural Victoria and with parents closely linked to the industry.

"I am passionate about sustainable agriculture, particularly water science. I also have a keen interest in international and domestic engagements between industries and markets in an increasingly globalised world.

"I can only anticipate how beneficial this scholarship will be in progressing my professional development in the industry as well as discovering more about who I aspire to be in the workforce following my tertiary studies.

"I look forward to what the future brings!"

For more

www.agrifutures.com.au/opportunities/horizon-scholarship/

Workforce has been identified as a priority area by cotton growers. CRDC is supporting PhD candidate, psychologist and cotton grower Chantal Corish address workforce issues for growers.

What's it like to work on-farm?

ALL cotton farm staff are encouraged to take part in a survey from cotton grower and psychologist Chantal Corish, designed to address on-farm attraction, retention and capacity.

The survey is part of Chantal's CRDC-supported PhD research project with Central Queensland University. She is exploring the effect psychological safety has on team learning, performance and wellbeing among cotton farming employees, as a step towards achieving a positive workforce culture. The findings will form an integral part of the larger CRDC project SHIFT: Delivering Best Practice to Manage Future Workforce Skills (see story page 18), including a psychosocial wellbeing vehicle being developed to assist growers manage their workforce.

"My research seeks to better understand the factors that lead to a psychologically safe workplace, and how these can be utilised within cotton farm work environments to enhance the employment experience for cotton farm employees," Chantal says.

"Learning more about the factors that lead to a psychologically safe work environment and understanding ways to improve this could illuminate what may be a lynch pin to achieving a more socially sustainable work environment in terms of learning and wellbeing.

"I'm aiming to generate new knowledge that would place the industry at the cutting edge of positive workplace culture and sustainability, and this survey is an important aspect of the research."

Chantal said her research so far has shown that the opposite of a psychologically safe workplace is one where most interactions are based on fear.

"A fear-based work culture leads to less initiative, less enthusiasm, less problem solving, less innovation and learning, and robotic compliance," she says.

"Naturally these are not qualities cotton farmers would value in their staff, so I'm looking at the role psychological safety plays in avoiding these traits.

"It's a competitive employment landscape out there, so through my research and the SHIFT project, we aim to give cotton growers the tools to create workplaces of choice for prospective and current employees.

"This survey forms an integral part of this work, so I'd really appreciate all farm staff completing this survey, and growers encouraging their staff to do so."

Tell us what you think

The survey only takes 15 minutes to complete online and the data is completely anonymous and confidential. Follow the link or QR code to the survey page, which gives more information on how the responses are managed.
bit.ly/CottonTeamSurvey

For more

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Familiar faces in new CRDC leadership

MELANIE JENSON

The CRDC Board travelled to Moree for its meeting in April and while there took the time to visit local farms and growers, including the Gwydir River on Hugh and Sarah Ball's 'Norwood'. Pictured are CRDC General Manager Communications and Extension Ruth Redfern, CottonInfo Program Lead Janelle Montgomery, Director Ross Burnett, Moree grower and host Mick Humphries, CRDC Chair Richard Haire, Director the Hon. Niall Blair, CRDC General Manager Business and Finance Graeme Tolson, CRDC General Manager Innovation Dr Merry Conaty, Director Michelle Tierney, Director Sally Ceeney, CRDC Innovation Broker Elsie Hudson, CRDC Executive Director Allan Williams, Deputy Chair Bernie George and Director Julie Bird.

LONG-STANDING cotton industry leaders Allan Williams and Bernie George have been appointed to key positions within CRDC, with Allan appointed as CRDC's new Executive Director and Bernie selected as CRDC's new Deputy Chair.

The announcements were made by CRDC Chair Richard Haire – himself a long-standing cotton industry leader – following CRDC's board meeting in Emerald (Gayiri country) in March. Dr Meredith (Merry) Conaty was also announced as CRDC's General Manager, Innovation, taking over the role previously held by Allan.

"On behalf of the CRDC board, I am delighted to announce these appointments and welcome Allan, Bernie and Merry into these roles," Richard said.

"Bernie is no stranger to those in the industry, having lived and worked in cotton farming in the Namoi Valley for the past 30 years. He was acknowledged for his contribution with the Service to Industry Award at the Australian Cotton Conference in 2022 and is still actively involved in cotton as the Water Services and Compliance Manager at Australian Food & Fibre.

"His familiarity with the cotton industry, and his extensive board experience – including as a former Chairman of Cotton Australia – makes him the ideal Deputy Chair for CRDC."

Meanwhile, Allan has been acting in the role of Executive Director since late August 2023, and Richard said the Board was very pleased that he decided to apply for the role.

"Allan brings a lifetime of experience across cotton research and development, policy and international representation of the industry to this role," Richard said.

"He's been an integral member of the CRDC team for 12 years – firstly as an R&D Manager, then General Manager, Innovation, and most recently, Acting Executive Director.

"The depth and breadth of his knowledge of cotton is well known among his peers, and we've received a lot of positive feedback on his appointment from across the industry.

"His experience, combined with strong leadership, established relationships and sound guidance mean he is the ideal person to lead the CRDC team to deliver the 2023-2028 Clever Cotton Strategic Plan."

Allan's history with cotton is a long one. He grew up on a cotton farm near Wee Waa (Kamilaroi country) after his father Richard moved from the United States in the early 1960s to try his luck at this new crop in a new country. This put Richard among the first wave of Americans to kick start the industry here and Allan into an environment of farming innovation from early childhood.

RUTH REDFERN

CRDC's new Executive Director Allan Williams.

Allan shares his father's qualities as a great supporter and promoter of research and development, understanding the value and importance of it for a successful cotton industry in Australia.

"Dad's lifelong passion was cotton and science, which led him to be a part of the group who formed the Australian Cotton Growers Research Association (ACGRA), which he chaired for many years. He was also the Chair of CSD for 21 years and his legacy at CSD continues with the Richard Williams Research Initiative," he said.

"During these years he believed in collaboration, vision, support and direct grower involvement in setting research priorities, which I believe are as important today as they were in 1960s and at the heart of what we do at CRDC today."

Prior to joining CRDC, Allan worked across several key industry organisations, including the Better Cotton Initiative, ACGRA and Cotton Consultants Australia (now Crop Consultants Australia). While with ACGRA, Allan developed the industry's Best Management Practice Program, which has evolved into myBMP.

Today, he is co-Chair of the cotton industry's Sustainability Working Group, which leads the Australian industry's PLANET. PEOPLE. PADDOCK. Sustainability Framework. He also holds the position of Chair of the International Cotton Advisory Committee's (ICAC's) Expert Panel on the Social, Economic and Environmental Performance of Cotton since 2006. He is held in high esteem by the international cotton community, invited to be a keynote speaker at the most recent ICAC plenary meeting in Mumbai.

When it comes to the Executive Director role, Allan says helping growers prepare for the future in two key areas is a major aim.

"The challenge we have and what I will be very focused on at CRDC is preparing growers for a different future that includes greater climatic variability and extremes, and the impact of that on the crop, and on how the crop is managed, from pests to irrigation to harvest," he said.

"From a global perspective, increased pressure and regulation from the major markets for Australian cotton is a reality."

"Water will increasingly be an issue and we need to identify every incremental gain we can make in terms of water use efficiency.

"So, we need to continue to invest in R&D that supports this. Improving our resource efficiency is a win/win – it helps growers maintain profitability, and it helps enhances our environmental and sustainability credentials."

From a global perspective, increased pressure and regulation from the major markets for Australian cotton is a reality.

"As a fibre-producing industry we are a part of the fashion supply chain, which is coming under increasing scrutiny for not just what happens in cotton production here, but where our fibre ends up in the value chain and the conditions of people working in it," Allan said.

"Labour conditions, while not an issue domestically, can be an issue globally at various points between the farm and the consumer. As part of the fashion supply chain, it is important from a market access and a human rights perspective that our cotton is not processed under poor conditions.

"There are many changes ahead for the cotton industry: our role is to support our growers by giving them the tools and the knowhow to be as prepared as possible to deflect negative changes and to harness the opportunities that change can also bring.

"This will be made possible by our team of Innovation Brokers, led by Merry as our new General Manager, Innovation."

Merry has been acting in this role since August, while also managing her two groundbreaking projects: the development of an Australian cotton industry data platform, and circularity research that could revolutionise the industry's sustainability credentials.

Merry has lived and studied in Narrabri since she was a PhD student studying cotton nutrition and physiology at the Australian Cotton Research Institute. She now holds both a Bachelor of Science in Agriculture and a Doctor of Philosophy from the University of Sydney. Post her PhD, Merry worked for Bayer Crop Science in research, product development, extension activities, commercial evaluations and registration of agronomic traits and chemicals at its Narrabri research facility. She joined the CRDC team in 2019, bringing her background in cotton science to innovation brokering. Merry is based in Narrabri with husband, fellow cotton industry scientist Dr Warren Conaty.

"I'm excited about CRDC's Strategic RD&E Plan, its direction and the ambitious targets we have set ourselves," Merry said.

"In the next five years, we'll be delivering impact in brand new areas of research and development for the cotton industry. It's a new era for cotton research, and a new era for CRDC."

CRDC is currently seeking a new Innovation Broker to fill Merry's former role.

For more

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MELANIE JENSON

CRDC is encouraging growers to get involved in setting research priorities.

Who sets cotton's research priorities?

Are you a grower and wondered who decides the industry's research, development and extension (RD&E) priorities? The good news is, it's you! But how, you ask?

CRDC Executive Director Allan Williams says it's important that growers know their voices can be heard, and that he and the Innovation team at CRDC are listening.

"We really want growers to know that our team is always accessible and we want to hear their issues, wins and emerging scenarios," Allan said.

"Our team of Innovation Brokers are all specialists in cotton RD&E, with impressive experience at many levels of the industry, including in the field.

"They bring with them a deep understanding of cotton growing in Australia, yet do rely on growers to keep them informed about what's happening at the coal face."

There are five ways for growers to contribute to setting research priorities:

- Join your local Cotton Grower Association and become the nominee to attend the twice yearly Cotton Australia/CRDC research priority forums (generally held May/June and November in Sydney or Brisbane)
- Talk directly to a CRDC Innovation Broker
- Send thoughts/comments/suggestions to www.crdc.com.au/growers/feedback-rde-priorities
- Talk to a CottonInfo Regional Extension Officer (REO) or Cotton Australia Regional Manager
- Take part in CRDC's annual Grower Survey, the results of which help inform RD&E priority setting.

The investment process

The process of deciding where to invest CRDC's annual RD&E funding is a collaborative one.

CRDC works closely with the industry's peak representative body, Cotton Australia, and the Australian Government on an annual basis to identify and evaluate cotton's requirements for RD&E. Cotton Australia and theme-level advisory committees provide advice to CRDC on

research projects and where research dollars should be invested, guided by the priorities established in the 2023–28 Strategic RD&E Plan, Clever Cotton.

CRDC and Cotton Australia hold two annual research priority forums, bringing together growers from across all cotton growing valleys to identify the gaps in the existing research portfolio and opportunities for new research. These Cotton Australia/CRDC forums are supported by various grower advisory committees on specific areas of research plus forums with research partners to identify emerging research issues and blue sky ideas.

After consulting with growers, researchers, Cotton Australia and the government, CRDC then determines investment priorities through the development of Investment Plans and Theme Plans, which are signed off by the CRDC Board. CRDC then calls for interested researchers to submit applications, and the proposals are assessed.

As part of determining which proposals are successful, CRDC again undertakes a process of consultation with growers. The final investment decision-making authority rests with the CRDC Board. Once approved by the Board, successful proposals become contracted projects with CRDC.

"Importantly, every piece of research that CRDC invests in is done so in partnership with growers, the Government and our research partners," said Merry Conaty, CRDC's General Manager, Innovation.

"Under Clever Cotton, we're focusing on delivering large-scale investments, providing better solutions for complex problems, and having a greater impact for the industry."

2024–25 R&D priorities

The 2024–25 priorities forum, held in June 2023, identified a range of broad areas of focus for future RD&E investment, including:

- The management of disease and the impact of disease on productivity and profitability (in particular Verticillium wilt, Fusarium wilt and black root rot).
- Constraints to production from soil condition, especially soil compaction and declining soil health.
- The better use and integration of data collected on farm to support decision making and on farm management.
- The management of pests (especially silverleaf whitefly, mirids and mealy bugs), integrated pest management, and understanding of how to minimise insect pest damage to yield and fibre quality.
- The management of water, including automation, optimisation, improved scheduling technology, and strategies to reduce evaporation from storages.
- The management of input costs, especially fertilisers (with a focus on how to increase the effectiveness of applied nutrients through better decision making).
- The calculation of carbon emissions from cotton production, especially greenhouse gas emissions driven by on-farm management, and how to transition to a low carbon farming system.
- The measurement and management of biodiversity, including habitat provision in riparian areas and weed management in remnant vegetation.
- Capacity both on farm and off, and the difficulty in attracting and retaining staff.

During 2024-25, CRDC will be investing in projects to address these key needs. In this edition of *Spotlight* we outline several of the investments already underway, including Irricom for water use efficiency knowledge, new cutting edge biodiversity monitoring for growers, and industry programs for staff attraction and retention.

To see the full list of current and planned 2024-25 investments, we have included our annual roundup in this edition of *Spotlight* on pages 31 to 35.

For more

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Make an impact through the grower survey

CRDC's annual Cotton Grower Survey is now open, with all growers and farm managers invited to participate via telephone. For 20 minutes of your time, it's the opportunity to provide valuable information to CRDC about the industry, on-farm practices and to direct priority areas for future research.

The 2024 results will be available to all growers later in the year via a report and an interactive dashboard enabling growers to explore the data in more depth. Growers can compare their practices and results to others in their region and beyond, offering a greater insight into how other growers manage their farms and the opportunity to benchmark.

The survey is conducted by independent researcher, Intuitive Solutions, who ensure the information growers provide in the survey remains confidential, and only aggregated, anonymous information is passed on to CRDC.

To make it quicker and easier for growers, it's done via telephone. All cotton growers who have a number on file with CRDC will be contacted from June 1 and are encouraged to have their say. The questions consist of core annual questions and various focus areas to investigate specific aspects of the farming system.

With more than two decades of survey data, the reports document changes in industry practices over time. All previous survey reports are housed online at Inside Cotton, CRDC's electronic library.

For more

CRDC Grower Survey
www.crdc.com.au/growersurvey

MELANIE JENSON

30 years of voluntary environmental assessments pay off

The latest independent assessment of the environmental performance of Australia's cotton industry has identified significant gains and areas for improvement.

The Fourth Independent Environmental Assessment was undertaken by sustainability-focused global professional services company GHD at the request of Cotton Australia, CRDC and cotton's Sustainability Working Group.

CRDC Executive Director Allan Williams says the assessment continues a long-standing commitment by the cotton industry to seek an external, independent perspective on performance.

"The cotton industry was the first agricultural industry to commission independent environmental assessments and that has continued every 10 years since 1991," Allan said.

"Between assessments we also undertake a full five-year sustainability report, plus annual sustainability updates, to track and share progress towards our targets and identify where we need to improve.

"Now with a 30-year history of attention to our environment and how we manage our effect on it, it shows that the term sustainability is not new to us, and that we are prepared to be inward-looking as an industry while also looking outward.

"The independent assessment is an endorsement of the industry's mechanisms for identifying and managing risks.

"It found that our industry has sound processes in place to identify and respond to current and emerging environmental issues, through the implementation of cotton's industry-wide sustainability framework PLANET. PEOPLE. PADDOCK.

"There are no surprises for us in the assessment – all of the new recommendations are already being actioned or are included in current industry plans.

"It doesn't mean we can rest on our laurels, but it shows that the industry has transparent, robust systems in place."

The assessment included a combination of interviews with industry stakeholders, visits to farms of all sizes and desktop research. It also looked at industry's response to the six recommendations from the previous (2012) assessment, showing the industry has delivered on four and made significant progress on the other two.

The latest assessment has 16 recommendations which the industry has accepted.

"Pleasingly, all these recommendations are either currently being actioned or strategic planning is underway to decide the next steps," Allan said.

"More than half of these recommendations are to continue work we've already got underway and others are initiatives put forward by the cotton industry (during the 18-month assessment timeline) to GHD as actions that are planned."

Cotton Australia CEO Adam Kay said the assessment is another indication of the commitment

The latest assessment has made 16 recommendations, which in a credit to the industry, are already either currently being actioned or strategic planning is underway.

of the cotton industry to continually improve its environmental and sustainability outcomes.

"The assessment's on-farm observations rated close to 90 per cent of the environmental criteria observed across all farms as 'excellent', 'very good' or 'good', rising to over 95 per cent for myBMP-registered growers," Adam said.

"We are committed to doing everything we can to safeguard our environment and to continually improve as an industry using science-based criteria in an open and transparent way."

Carbon emissions on growers' radars

The report noted that water use and management has been an area of considerable industry RD&E investment which has resulted in demonstrable on-farm improvement over many years. On the issue of natural resource management, GHD recommended the industry continues cross-sector work to establish indicators and targets for biodiversity and soil, including continuing industry specific investigations on nitrogen use and links to emissions, while increasing extension efforts to assist grower understanding and awareness of how they can increase their natural capital on farm.

It also found the industry had made continual progress in pest management with pesticide use significantly reduced and while herbicide use has increased, overall Environmental Toxic Load has 'reduced dramatically' – a result of the industry's significant investments in a multi-pronged approach to reduce pesticide use and resistance.

Among the recommendations is to increase transparency and consistency of reporting of the number of growers registered and certified with myBMP, along with more details about growers, volume and total area of myBMP cotton, in a way that maintains grower confidentiality.

Updating the online myBMP platform is being planned.

"Cotton Australia is planning to work with stakeholders to review and update the myBMP website, its content and functionality," Adam said.

"It will greatly improve the visibility of the program and assist growers to understand the full benefits of certification while enabling a streamlined process for signing on and completing the required units of competence."

For more

www.crdc.com.au/publications/australian-cotton-industry-fourth-environmental-assessment-2024

Helping growers lower emissions

The *Fourth Environmental Assessment of the Australian Cotton Industry* report found that growers are showing an increasing focus on carbon and emissions, and the report urged a continuation of cross-sector work to establish indicators and targets for greenhouse gas (GHG) emissions and carbon storage.

It also identified the need for more information for growers on energy, emissions and climate change. How to transition to a low carbon farming system was also a priority outlined by cotton growers and backed by industry in the CRDC/Cotton Australia 2024–25 priorities forum, held in June 2023, which identified focus areas for future RD&E investment.

CRDC is supporting ongoing and new initiatives to provide growers with the knowledge and tools to monitor and manage soil carbon and GHG emissions.

A new initiative and broader commitment by CRDC to helping growers transition to a lower emissions future is underway with the first meeting of the largest Co-operative Research Centre (CRC) in Australian history. CRDC has supported the new CRC for Zero Net Emissions from Agriculture (ZNE-Ag CRC), a multi-stakeholder approach to transitioning Australian agriculture to net-zero, healthy, resilient, and profitable farming systems by 2040.

The CRC will develop technologies and solutions to reduce emissions from Australian agriculture, mitigating risks to future investment and trade and securing its economic future.

Agriculture directly contributes to 14 per cent of Australia's national emissions and reducing them is often seen as a cost burden that is a trade-off with economic drivers of productivity, profitability and growth. The ZNE-Ag CRC will create rapid research, development and adoption of science and technology-led solutions.

This national collaboration has $300 million in funding over 10 years, including $87 million from the Australian Government. CRDC is a Tier 2 partner, represented by CRDC Innovation Broker Dr Nicola Cottee, who attended the first meeting.

"There was a huge turn out and everyone is keen to get stuck into it," Nicola said.

"CRDC, along with fellow research and development corporations Meat and Livestock Australia and Hort Innovation Australia, can play an important role in ensuring that CRC investments align with industry priorities.

"There seems to be some good opportunities for the cotton industry, particularly around lowering emissions from nitrogen fertiliser application, which currently accounts for around 30 per cent of total cotton emissions.

"There's interest in on-farm demonstrations sites for stacked emissions technologies to show what a low carbon farm looks like when it has cotton and beef as part of the business.

"What I am looking forward to is a coordinated approach to designing low-carbon farming systems that make sense economically."

For more

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ZNE-Ag CRC

www.zneagcrc.com.au

Giving growers tools to measure biodiversity and natural capital

Increasing extension efforts to assist grower understanding and awareness of how they can increase natural capital on-farm is a recommendation of the *Fourth Environmental Assessment of the Australian Cotton Industry*.

Furthermore, in the CRDC/Cotton Australia research priorities forum, held in June 2023, the measurement and management of biodiversity, including habitat provision in riparian areas was identified as a priority area for RD&E investment by cotton growers. This will be partly addressed through a new CRDC scoping study which will identify and review existing and emerging on-farm biodiversity monitoring tools and technology. It's also the focus of a project underway that will test the value proposition of novel acoustic monitoring technology.

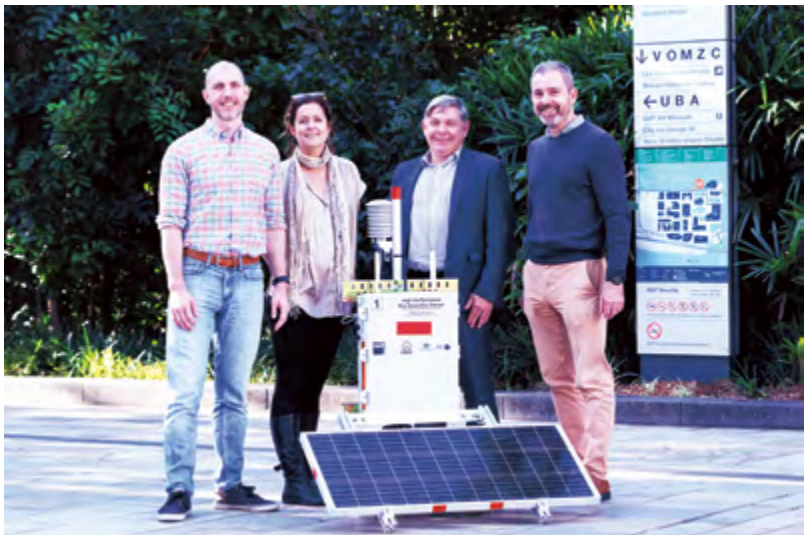
According to a KPMG study on natural capital and biodiversity, nature's contribution to the global economy is estimated to be USD$125 trillion per year, while over 50 per cent of the world's GDP (USD$44 trillion) is moderately or highly dependent on nature and its services. The Word Economic Forum's 2021 Global Risks Report ranks biodiversity loss as the fourth top risk by impact, following infectious diseases, climate action failure and weapons of mass destruction.

The term biodiversity encompasses the variety of life on earth, including animals, plants and other living organisms and ecosystems in which they live. Natural capital is the stock of the earth's renewable and non-renewable resources, including trees, soils, air, water, and all living things. It is from these natural assets that a wide range of benefits (often called ecosystem services) are produced.

The role of birds and bats

Birds and bats are known to play a role in natural pest management in cotton landscapes.

In Australia, the pest suppression benefits of bats to the cotton industry have been estimated at between $99 and $126/ha in dryland Bollgard cotton and $286 to $361/ha in irrigated. A study in the US estimated that Mexican free-tailed bats provided cotton growers there with an avoided cost (due to reduced use of pesticides) of on average USD$74/acre of crop land.



Ground-breaking acoustic monitoring technology developed under a previous CRDC project will be used in a new initiative to bring the technology to growers. Pictured are the developers Philip Eichinski, Professor Susan Fuller, Professor Stuart Parsons and Professor Paul Roe.

Similarly, insectivorous birds feed on insect pests in many crops including cotton. Understanding where, when and why birds and bats live where they do is needed so this biodiversity can be protected and even improved and natural pest control harnessed by growers.

In the new CRDC-supported project, scientists from the University of the Sunshine Coast (UniSC) and Queensland University of Technology (QUT) aim to quantify the importance of integrated pest management (IPM) strategies and habitat connectivity in determining the diversity and activity of birds and bats that are known to play a role in natural pest management in cotton landscapes.

Autonomous monitoring for growers

Led by bat biologist and ecologist Professor Stuart Parsons (UniSC), the project will use novel automated acoustic monitoring devices with artificial intelligence-based software, developed under a previous CRDC-supported project by Stuart and his team of bird biologist and ecologist Professor Susan Fuller (QUT) and computer scientist Professor Paul Roe (QUT).

The monitoring system was developed in a previous project under the National Landcare Program in collaboration with CRDC and will undergo further field testing as part of this new project. Their innovation means monitoring birds and bats can be undertaken autonomously over large areas for a long time at relatively low costs.

"We will combine new information with spatial data previously collected through the CRDC Natural Capital Assessment project to quantify the effects

of landscape structure and remnant vegetation intactness on the presence of beneficial bats and birds," Stuart said.

"Through this research we want to empower growers to actively manage natural areas to increase ecosystem services provided through natural insect pest suppression.

"We will demonstrate how growers can make use of these innovative technologies for data collection, so that monitoring of beneficial biodiversity becomes standard practice in the future as part of farm business.

"The cotton industry will also potentially gain a biodiversity monitoring tool for sustainability reporting and international recognition for delivering positive biodiversity outcomes."

Understanding value

More broadly, the Australian cotton industry is seeking to better understand vegetation on cotton farms and the broader landscape, including ecosystem services such as natural pest control and biodiversity value.

"Bats and birds provide IPM to the cotton industry," Stuart says.

"However, to provide IPM services, bats and birds that are known to consume pest insects must be present.

"Key elements influencing the presence of bats and birds is connectivity of the surrounding landscape and the safeguarding of remnant and restored native vegetation on farms, as habitat fragmentation can have a negative impact on biodiversity."

Bat species richness is higher in well-connected landscapes. Habitat conservation and restoration, in combination with connectivity of landscape structures has been shown to be important for bird conservation. Even woody vegetation along field edges can provide avian biodiversity benefits and pest control services.

Microbats are an important predator of pest insects helping achieve integrated pest management. New technology will allow growers to remotely monitor these elusive animals and other biodiversity on their farms.

Mapping cotton farm biodiversity

Work carried out previously for CRDC has mapped key biodiversity data across cotton properties as well as the broader cotton landscape.

"Importantly, this work mapped remnant vegetation and identified corridors that help native species move. It also identified priority areas that should be targeted for revegetation.," Stuart said.

"When combined with bat and biodiversity indicators, this data will provide important insights into how landscape connectivity influences natural pest control services."

Australian cotton growers have a strong connection to their land and embrace emerging technology.

"In our previous project, interviews with growers revealed that they are quick to trial and adopt new biodiversity monitoring technology on their properties," Stuart said.

"Two key motivations were identified; they have a strong desire to be a good steward of the environment for future generations; and they recognise the benefits of increasing biodiversity from a business perspective.

"Our acoustic system for automated monitoring of target species of birds and bats will now be scaled up and deployed across farms."

CRDC Innovation Broker and CottonInfo Technical Lead for Natural Resources Stacey Vogel oversees the project and said the field work will be based in the Gwydir Valley (Kamilaroi country). Researchers will work with CottonInfo's Program Lead Janelle Montgomery, who is based at Moree, to identify growers interested in participating in the project.

"Growers' successful IPM strategies and on-farm management of remnant vegetation will be central to the field work and research visits," Stacey said.

"This project will test the value proposition of the monitoring technology and the findings will be regularly shared with growers to empower them to make decisions about on-farm management of their biodiversity and native vegetation.

"We want to answer the important question of whether retention of remnant vegetation and corridors enhance beneficial bird and bat activity and pest suppression on-farm."

For more

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Excellence is the name of the game for the 2024 Conference

Artificial intelligence, carbon and sustainability, emerging diseases and the global markets are just some of the topics set to be covered by the 2024 Australian Cotton Conference 'Cultivating Excellence' program.

The event will feature the trademark mix of speakers: growers, consultants, scientists and experts from the textile, marketing and shipping sectors. More than 100 exhibitors will fill the trade hall along with the 2000 attendees expected to attend the Conference over three days.

The Conference will open with a fast-paced session with fighter pilot Daniel Walker who is a part of the Afterburner team of fighter pilots and military aviators. Delegates will get an insight into one of the most elite organisations in the world and learn how to thrive and adapt to complex and rapidly changing environments.

The always entertaining mathematical whiz and well-known media personality Adam Spencer will also be part of the first session, talking about how digital transformation will change work and business forever. The closing speakers are also always eagerly anticipated, and this year Australian cricketing legend Steve Waugh will take to the stage, along with wellbeing expert Rob Edwards.

MELANIE JENSON

CRDC-supported researcher and Professor of Climate Change Peter Grace presenting at Cotton Conference 2022.

The remaining sessions will be bursting with the latest RD&E from CRDC-supported researchers and Innovation Brokers. General Manager, Innovation Dr Merry Conaty will be talking about the value of data and CRDC's plans to create an industry digital strategy and data platform.

"CRDC have led an initiative for three years to create a digital strategy for the Australian cotton industry," Merry said.

"Along with representatives from across the cotton supply chain we are developing cohesive industry positions on data sharing, data privacy and management, as well as building a world first data platform to facilitate the connecting of data through the industry.

"We believe this will deliver value back to growers and industry and futureproof our markets.

"We're looking forward to sharing with everyone where this is up to and how they can be involved."

CRDC Innovation Broker Elsie Hudson will discuss the new Australian Cotton Disease Collaboration, and CottonInfo Program Lead Janelle Montgomery will co-chair a session on irrigation.

"Water management is always high on the agenda for growers, which was evident at last Conference as the room was overflowing for the irrigation session," Janelle said.

"Based on the fact 65 people turned up a recent field day at Warren in the Macquarie Valley to look at Sinclair Steele's siphonless system, we anticipate a lot of interest in this session from right across the industry and will have growers on board to share their experiences."

The program is being continually updated, with the latest information on the Conference website. CRDC Innovation Broker Dr Nicola Cottee is helping pull together an exciting panel of speakers on carbon and on-farm emissions.

"This is such a rapidly evolving area, and there is a lot of questionable information out there: we will break down the science around emissions, carbon cycling and sequestration," Nicola said.

The Conference runs from August 6 to 8 at the Gold Coast Convention Centre, with the Australian Cotton Industry Awards Dinner to be held on the final evening.

Registrations are now open.

For more
www.australiancottonconference.com.au

Support to attend Conference available

CRDC's support as a Foundation Sponsor for Conference supports a reduced cost for growers' tickets. CRDC is also offering travel scholarships for researchers to attend. Researchers interested in applying for a CRDC travel bursary should complete a Travel, Conference and Scientific Exchange application, available at www.crdc.com.au/researchers/expressions-interest.

Celebrate industry stars at the Awards night

It's the industry's night to celebrate its people when around 1000 Conference-goers come together for the Australian Cotton Industry Awards Dinner, held on the final evening of conference: Thursday, August 8.

Awards will be presented for the Incitec Pivot Fertilisers (IPF) Service to Industry, Cotton Seed Distributors (CSD) Researcher of the Year, CRDC Chris Lehmann Young Cotton Achiever, AgriRisk High Achiever and Bayer Cotton Grower of the Year. Finalists were announced in late May and early June.

Rising stars

For the second year, CRDC is supporting the Chris Lehmann Young Achiever of the Year Award, and the finalists are CRDC Innovation Broker Elsie Hudson, Qld DAF development and extension officer Sharna Holman, and HMAg agronomist Alexandra (Alex) Trinder.

Elsie began her career bug checking during holidays from the University of Queensland and advanced to agronomist in Narrabri (Kamilaroi country). During the 2018 drought, she joined CottonInfo as a Regional Extension Officer, later becoming a Research and Development Manager, now Innovation Broker, at CRDC. In her role, she manages key research portfolios to deliver outcomes for growers and leads major disease research through the Australian Cotton Disease Collaboration (ACDC). Elsie is based in Goondiwindi (Bigambul country) where she's a member of the Macintyre Valley Field Day committee.

As well as being a development and extension officer with Qld DAF, Sharna Holman is the industry's biosecurity technical lead with CottonInfo, and a PhD student supported by CRDC. Sharna splits her time between Toowoomba Qld (Barunggam country) and Kununurra WA (Miriwoong country), where she is conducting her PhD research into a damaging pest for northern cotton, the cluster caterpillar, which will inform industry pest management practices. In her CottonInfo role, Sharna has driven awareness of the importance of biosecurity, and through her effort, more than half of Australian cotton farms are now equipped with a biosecurity plan. Sharna is a passionate advocate for young people in agriculture.

Cotton consultant Alex is a Director at HMAg in Moree (Kamilaroi country) where she manages large areas of irrigated and dryland cotton, growing impressive yields. She is actively involved in the Moree Young Aggies group, facilitating community fundraising and scholarships, and contributes to the Gwydir Cotton Growers Association as Treasurer. Alex founded the Gwydir Valley Young Consultants' Group to mentor younger agronomists and serves on the board of Crop Consultants Australia, focusing on professional development and agronomic research projects.

Young Achiever finalist Elsie Hudson.

"With the number of outstanding young people making a contribution to the cotton industry, you can only imagine how difficult it is to select just three finalists," CRDC General Manager Communications and Extension Ruth Redfern said.

"Our congratulations to each nominee in the Young Achiever category on the contributions they are already making to cotton."

Leading research

In the CSD Researcher of the Year category, the three finalists are all CRDC-supported researchers: Dr Alice Payne, RMIT, Dr Nicole McDonald, CQU, and Dr Lisa Bird, NSW DPI.

Alice is a Professor and Dean of the School of Fashion and Textiles at RMIT. Her research focuses on environmental and social sustainability issues throughout the life cycle of clothing. Her recent work, supported by the cotton industry through CRDC, has examined labour issues in

LEFT:
Sharna Holman of Qld DAF is a Young Achiever finalist, along with agronomist Alex Trinder (right) of HMAg.

the cotton value chain, as well as technologies to address the problem of textile waste. Alice is part of the Australian Fashion Council-led consortium designing the National Clothing Product Stewardship Scheme.

Nicole has been a researcher within the Australian cotton industry since beginning a CRDC-supported PhD project investigating cotton farm workers' experiences of job satisfaction in 2014. Over the past 10 years, she has pioneered cotton social science projects studying work engagement, diversity and inclusion, and the future of work culminating in an action research project through CQU, supported by CRDC, called SHIFT: Delivering Best Practice for Management of Future Workforce Skills (read more about this on page 18).

Lisa Bird of Tamworth (Kamilaroi country) and her NSW DPI team based at the Australian Cotton Research Institute (ACRI), Narrabri, have a critical role in the Australian cotton industry. Lisa and the team run the industry's insecticide resistance program, supported by CRDC, which conducts surveillance and research across five of the six major insect pests of cotton (Helicoverpa, mirids, thrips, mites and aphids).

Outstanding in their field

Six finalists were named for the Bayer Grower of the Year and AgriRisk High Achiever awards, from Dalby (Barunggam country) on Queensland's Darling Downs to Coleambally in the NSW Riverina (Wiradjuri country).

Finalists in the Grower of the Year category are Kurt, Luke and Ross Von Pein from Pallathorpe Enterprises, Macalister Qld (Barunggam country country), Scott Balsillie of Eastern Australia Agriculture at Dirranbandi Qld (Kooma country), and Lindsay George of Lawson Grains, Moree NSW.

In the AgriRisk High Achiever field are Steve and Bridget McVeigh of 'Loch Eaton' at Dalby Qld, David and Julie Bellato of Greenline Framing at Coleambally NSW, and Scott, Jo & George McCalman of 'Kuranda' at Gunnedah (Kamilaroi country) NSW.

Cotton Australia's CEO Adam Kay said the high calibre of nominees in the grower categories made the judging process extremely difficult, with all growers showing knowledge and skills that can transfer so that other growers can benefit.

Cotton Australia and last year's Bayer Grower of the Year Johannes Roellgen and AgriRisk High Achiever Dan Skerman were joined by sponsor judges from Bayer and AgriRisk in interviewing all nominees before deciding on the final six. The judges then visited each finalist on their farms to witness first-hand their innovative and forward-thinking farming practices.

"Each of the finalists have displayed a commitment to growing cotton and a readiness to trial new farming methods and adopt technology to continue to improve their crops and yields while focusing on soil health and other environmental outcomes," Adam said.

Celebrating our industry

"The gala awards evening perfectly bookends the Conference by celebrating what makes the industry so successful – it's people," CRDC Executive Director Allan Williams said.

"We applaud all the award nominees and finalists for their contributions and commitment."

The Awards dinner always sells out and this year the MC is Australian comedian Peter Helliar.

Make sure to book your Australian Cotton Industry Awards Dinner tickets when you register for Conference.

For more
www.australiancottonconference.com.au

Creating a shift for workforce success

Helping growers attract and develop their on-farm workforce requires a new way of thinking. This is embodied in the SHIFT initiative.

SHIFT has been developed by Dr Nicole McDonald in conjunction with cotton growers under the CRDC-supported project *Delivering best practice to manage future workforce skills*. It is helping growers create a workplace culture that attracts people to their business.

A deep understanding of the challenges growers face is needed to create workable solutions. Over the past 18 months, Nicole has been co-designing solutions by working with cotton growers and their teams. Four main themes have come through:

- Recruitment is harder than it has ever been.
- New team members are 'greener' than they have ever been.
- Technical and non-technical skills need development.
- Psychosocial wellbeing is a challenge.

"A common theme we've heard from growers is young people are coming to the farm with limited skills in managing themselves, or knowing how to show up in a workplace," Nicole says.

"It places additional burden on growers who are juggling multiple demands and need people to be willing and able to work effectively.

"We've identified skills these young people need to develop quickly to thrive at work, they include self-organisation, how to seek and receive feedback, and strategies to be resilient if it becomes challenging, or they make mistakes."

The SHIFT team has developed a series of 17 guides to support the development of non-technical skills, centred around leadership, new entrants, communication, and team effectiveness.

"We wanted to create resources growers can hand to their employees, so they are taking some responsibility for their upskilling," Nicole said.

"We will release these guides soon on our new SHIFT facebook page, and we're running virtual farm catchups with growers and their teams discussing skills and strategies associated with our topic areas.

"There is a wealth of knowledge in this industry and people have developed their non-technical skills through their many different experiences.

"We can better unlock development of these skills if successful practices and strategies are shared between growers so we are normalising these conversations, as everyone is developing skills in this area.

"It's a 'progress over perfection' mindset needed to work on the people aspect of effective farming."

Nicole said other growers enjoy hearing examples of success on the virtual farm catchups.

Panelists Sam Heagney, Farm Manager at South Bunarba Agriculture near Mungindi, north-west NSW (Kamilaroi country) and the irrigation management team's Josh Lewellyn spoke on the topic of leadership behind the farm gate.

"Making a start and doing something is better than a perfect nothing when it comes to putting into practice ways to support your team," Sam said.

Josh says for him, this means making it clear to employees that he's accessible on the phone.

"I do this consistently – there is an immediate time cost when I'm juggling what I have to get done in a day, but the benefit is people do speak up and that saves us time in the long run and makes us more productive," he said.

Growers say there have been so many great examples of important communication and leadership and they could relate to the vulnerability aspect, where tough conversations are easier when we understand everyone makes mistakes and/or have tough days – and empathy is the key.

"This feedback is integral to how we shape these programs and the grower-to-grower interactions are proving very helpful to them," Nicole says.

"These sessions run for an hour around lunch time so people can jump in if taking a break. We want these sessions to be accessible and as convenient as possible so cotton growers to take time for their personal development and to check in with their peers from different valleys on workforce challenges and solutions."

Catch up on events and resources

Three 'virtual farm catchups' have seen more than 60 growers and team members jump on-line for these lunchtime sessions to listen, chat and reflect on their workforce development in a way that's grounded in the reality of day-to day activities. Even more growers have received the SHIFT workforce resources, specifically designed for cotton growers.
To keep up with virtual catch ups and SHIFT resources, follow on facebook, follow the link below or scan the QR code.
https://bit.ly/SHIFTUpdates

For more
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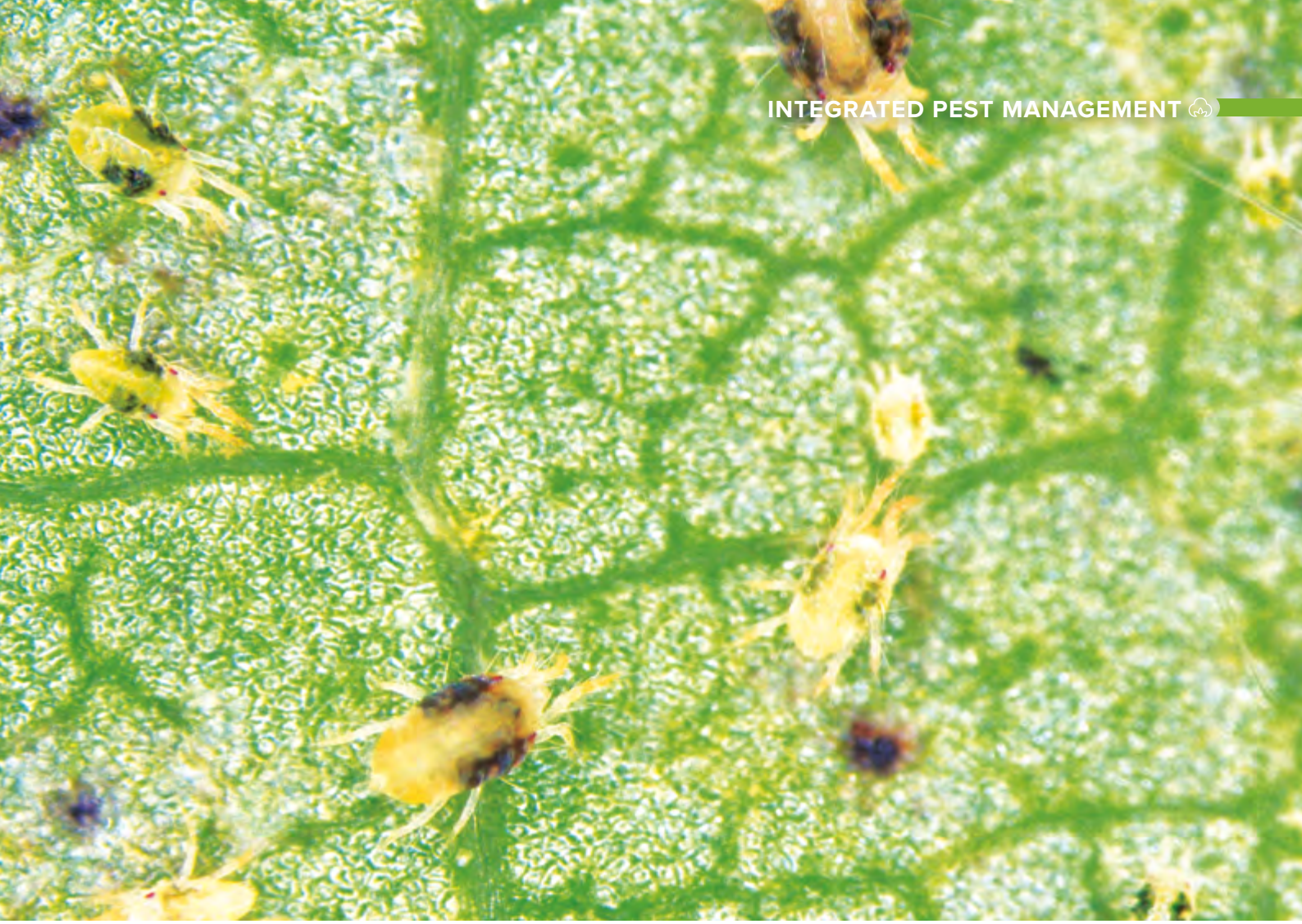


NSW DPI

Resistance highlights flow-on effects of spray decisions

Insecticide resistance in two-spotted mites this season is a reminder that in integrated pest management (IPM), everything is interrelated, every action has a reaction and decisions can have implications across multiple seasons and multiple pests.

Unprecedented levels of resistance to diafenthiuron (Pegasus, Receptor) in several two-spotted mite populations in the Gwydir and Lower Namoi (Kamilaroi country) saw CottonInfo meetings held in Moree and Narrabri with growers and consultants to hear about their experiences and share recent resistance data.

CottonInfo IPM Technical Lead Dr Paul Grundy facilitated the meetings which included NSW DPI's Dr Lisa Bird and CSIRO's Dr Simone Heimoana. Lisa manages CRDC-supported insecticide resistance surveillance programs and provided results from two-spotted mite resistance testing, explaining how multiple applications of the same mode of action drives resistance.

"We had noticed small changes in two-spotted mite susceptibility to diafenthiuron in growing regions of northern NSW over the last few years, but this season we saw resistance increase considerably in these regions – to 24 per cent compared to three per cent last year and one per cent in 2021-22," Lisa said.

"Based on our preliminary research on these resistant two-spotted mite populations we have found that resistance is due to a major genetic mechanism which increases in frequency when selection pressure is applied.

"In other words, resistance is likely to increase and become more widespread without careful management".

Multi-insecticide resistance likely

This comes on top of moderate to high abamectin resistance in two-spotted mite which has been an issue in cotton for several years.

Two spotted mite has developed rapid resistance to key products which has put the industry on alert and reinforced the need to adhere to the IRMS, follow label requirements and understand damage thresholds for all insect pests. Early control has a great impact on populations of pests and beneficials later in the season.

"There is no evidence of cross resistance between diafenthiuron and abamectin, but there is likely to be multi-resistance in two-spotted mite.

"This means if you have a mite with the gene for diafenthiuron resistance, it may also carry a second independent gene for abamectin resistance and this may reduce the effectiveness of both products in the same mite population.

"But the good news is that we have found no cross-resistance between diafenthiuron and other miticides like etoxazole or propargite so these two products should continue to be effective rotational options for two-spotted mite management in cotton.

"Coming into next season it will be very important to be mindful that diafenthiuron resistance risk in two-spotted mite is at the highest levels seen in cotton and there is a likelihood of field failures of this product in some areas.

"Crop managers are urged to follow the Insecticide Resistance Management Strategy (IRMS) and not to place unnecessary selection pressure on diafenthiuron: this means only spraying on threshold and avoiding consecutive applications of this product."

Diafenthiuron is a very useful insecticide for control of multiple pests particularly later in the season. But if there are other pests such as whitefly or aphids at above threshold levels in the crop, Lisa recommends using alternative insecticides to control them.

"The resistance surveillance program is here to help you understand the resistance risk in your area and we urge people to get in touch with NSW DPI or your local CottonInfo Regional Extension Officer (REO) if you suspect resistance and would like your mites tested," Lisa said.

Based on the discussions at the meetings, Paul says the takeaways reinforce that when managing pest A we need to be mindful of how it might affect pest B or C at some point in the future. Based on discussions, pest management tactics last season were drivers for what was seen this season, illustrating the longer-term effects of IPM decisions.

"During 2022-23 aphids were highly abundant late season and were often controlled with diafenthiuron," Paul said.

"An abundance of two-spotted mite this season saw diafenthiuron used again and it would seem that the higher usage across two seasons, albeit for different pests, has contributed to the spike in resistance levels.

"This shows how the management of pest complexes can interact over and across seasons.

"Just because aphids or whitefly are being targeted doesn't mean you won't have an effect on mite resistance."

While resistance to any insecticide is a failure, the loss of diafenthiuron to control mites is particularly worrisome as there are very few effective alternatives.

Follow the guidelines

Moree based agronomist Ben Dawson said the detection of resistance is a warning to industry as diafenthiuron is an important product that we cannot afford to lose, and that label requirements and insecticide resistance guidelines are there for a reason.

"It's such an important tool for us late season if we need it: there's no other product that manages those three key pests in one pass," Ben said.

"We need to make sure we take into account the crop's ability to compensate before deciding to spray mirids and thrips early in the season, because if you do an early spray you'll often need to use a product like diafenthiuron later.

"As Lisa said, there are alternatives such as propargite and etoxazole which have different modes of action that we can take advantage of."

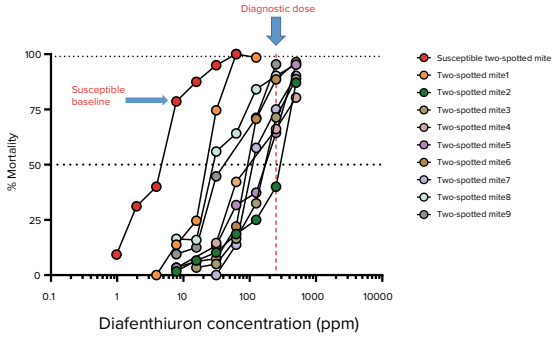
The feedback from the meetings will be relayed to the Transgenic and Insecticide Management Strategy (TIMS) panel.

"The discussions had at this meeting will help to map out a suitable response to prevent resistance from getting worse and hopefully recover the function of that product," Paul says.

"The growers and consultants in attendance

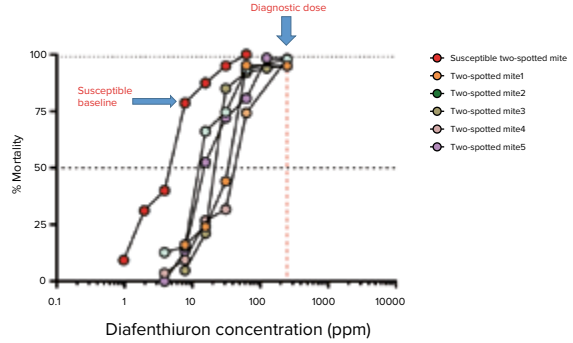
Full dose-response testing in two-spotted mite 2021-22

- High level of susceptibility in field populations confirmed by dose response largely to the left of the diagnostic dose



Full dose-response testing in two-spotted mite 2023-24

- Major shift away from susceptibility in field populations confirmed by dose response crossing over the diagnostic dose



said it was great to be able to discuss face-to-face with the entomologists to get a greater understanding on how we could manage mites better in the future.

"Other feedback was that the best part was everyone talking about their own strategies on how to reduce the resistance.

"We heard that a significant challenge was the movement of large numbers of mites out of sorghum crops at harvest into the neighbouring cotton fields.

"Some farms just don't seem to ever get mites, whereas others do and they tend to be found more commonly in fields close to native vegetation of riparian zones."

Forty percent of attendees said they would do something differently after being at the meeting, including reducing diafenthiuron usage next season, not growing alternate hosts for mites near cotton (especially in known mite areas), avoiding products that have been shown to have resistance issues, and trying to avoid products for other pests that can lead to mite flare ups.

Consultants are encouraged to collect mites for resistance testing from a range of fields (both sprayed and unsprayed) throughout the season to better understand the extent of the problem. For information on where to send, contact your local CottonInfo REO, Paul or Lisa.

For more
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Dr Lisa Bird
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Creating confidence when the pressure is on

A working knowledge of entomology gives consultants an insight into the science of managing insect pests in cropping systems. It's the key to implementing successful integrated pest management (IPM).

A new, three-part entomology course has been designed and delivered to early-career professionals through the Early Career Agriculturalist project, supported by GRDC and CRDC and delivered by Crop Consultants Australia (CCA).

CCA offered the tailor-made, online short course with IPM Technologies to consultants and other industry professionals across cotton, grains and broadacre agriculture. Over three sessions, participants were taken through the basics of taxonomy, biological control and IPM practices.

"Entomology is a foundation of all that we do in broadacre agriculture," CCA's Leisl Coggan said.

"We aimed the workshop at consultants, researchers and broader industry members just starting out.

"The course has been really popular and feedback very encouraging, participants felt they gained a lot from it.

"Given the popularity, CCA is exploring opportunities to deliver another similar short course in the future to industry members of all levels of experience."

Sarah Ziebarth from B&W Rural in Mungindi (Kamilaroi country) in north west NSW has spent four summers looking after cotton and other crops around the border town on the Barwon River.

She signed up for the course to gain an even deeper understanding of familiar and new insect pests and to improve identification skills, particularly for emerging pests.

"As we all know, some pests are very similar looking and it's difficult telling the difference with complete certainty sometimes, so I want to improve my identification skills," Sarah said.

"This is particularly the case for new exotic pests such as fall armyworm, which at a glance could resemble many other pests at certain stages in the life cycle.

"Then there are common pests that have moved into our region such as mealybugs.

"I'm hoping the course gives me in-depth information on the entomology to give us a better understanding of how to manage it.

"There is plenty of literature on mealybugs – and that the cheaper more broad-spectrum options tend to flare other pests – so I want to know as much as possible about them so we can choose our pesticides and time our applications as best we can.

"I'm also looking to understand more about common pests so we can manage them well in high pressure years.

"Some pests we see every year in varying numbers, while others seem show up out of the blue. The high numbers of cotton aphid last year was a good example.

"The more we know about the pests we are dealing with or may have in the future and the methods of control, including biological control, puts us in a better position to manage them well under IPM guidelines, particularly in those high-pressure years."

For more
Leisl Coggan
events@cropconsultants.com.au

Feedback from an IPM and entomology short course has been so supportive, CCA is considering running more of them. One of the reasons consultant Sarah Ziebarth joined in was to improve confidence in identifying similar looking and emerging pests.

Innovator tackles drought resilience at evokeAG

Biofuels, artificial intelligence, carbon farming and the cutting edge of agtech innovation were on the agenda at evokeAG's 2024 event in Perth (Wajuk country) in late February, however it was novel technology to help drought proof cotton that was turning heads.

evokeAG is a venture of CRDC's fellow research and development corporation AgriFutures Australia, aimed at creating one meeting place to see what is happening across agrifood tech in Australia and the world. It attracts farmers, innovators, accelerators, researchers, universities, corporates, government and investors to one location for collaboration.

CRDC Innovation Brokers Susan Maas and Nicola Cottee attended the event, along with General Manager Communications and Extension Ruth Redfern.

"It lives up to its name as the event to share ideas and build connections in pursuit of a more resilient, sustainable, and profitable agrifood sector and value chain," Ruth said.

"Our CRDC-supported ABARES Science and Innovation Award winner for 2023, Dr Cong Vu, was part of the evokeAG startup and scaleup sessions with his company NanoSoils Bio, which could be a game changer for cotton growers by reducing the impact of dry years and drought.

"He really benefited from being at evokeAG and we are pleased to be supporting him in his research journey via a further travel scholarship to travel to the US."

Innovator Cong Vu has been supported by CRDC in his nanoparticle research to create more resilient cotton plants.

Cong showcased his nanoparticle technology, which can be used to deliver pesticide and fertiliser to a plant via seed coating, to help reduce pesticide use and spray drift. Cong aims to further maximise the uptake of these silica nanoparticles in cotton to help the plants deal with drought stress, an issue that is responsible for 67 per cent of yield loss.

The opportunity to showcase his research in evokeAG's Startup Alley has opened doors and possibilities, which brings innovations closer to the field.

"As a result, I have been invited to speak overseas and have seen growing interest in my technology from other countries," Cong said.

"Working with CRDC and cotton in Australia to establish NanoSoils has had geographical advantages because the industry is globally so well regarded.

"The Australian industry, backed by CRDC R&D, has built a very high reputation, and because I am applying nanotechnology here, it will really assist me in applying the technology overseas.

"This experience has helped me think more deeply about NanoSoils' market and I am targeting the US now."

After the showcase, Cong was invited to attend one of the biggest conferences related to nanotechnology for agriculture in the world. CRDC is supporting his attendance to the 2024 Nanoscale Science and Engineering for Agriculture and Food Systems Conference in the US with a travel bursary, where he will present a poster *Application of nanotechnology for Australian cotton.*

"I have also been selected as one of 30 global Sustainability Stars by the American Chemical Society," he said.

"It's an amazing honour for me as only 30 people are selected across the globe and most of them are associate professors or senior managers of big companies such as Unilever.

"I'll travel to the US soon to attend the conference and build the connection with the US market and investors. I'll be working on raising capital for NanoSoils, as we are targeting $1.5 million in a seed round starting from July this year."

For more
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Sinclair Steele is making a move to siphonless irrigation across his farm and says the only one disappointed in the new system is his chiropractor.

ELKA DEVNEY

Hot weather and a hot topic in the Macquarie

A stinking hot summer's day and not a breath of wind at Marthaguy near Warren (Wiradjuri country) didn't deter 65 growers from braving 40-plus degrees to look at a new irrigation system back in February.

Grower Sinclair Steele at 'Kainga', Warren, had recently developed two new cotton fields and put in a bankless system using the siphonless 'pontoon' design.

Sinclair's system created so much interest among fellow growers in the valley he approached local CottonInfo Regional Extension Officer (REO) Amanda Thomas, suggesting they run a field day.

"As the word got around the valley of his development pre-season, he had lots of growers asking to come and have look when the irrigation was in full swing," Amanda said.

"Of course, he obliged but after a couple of tours he thought it was going to be long summer if he didn't come up with a plan B to handle the interest, so he suggested a field day.

"Normally when it comes to holding field days this process goes the other way and it's the industry asking the growers to be a field day host.

"It's one of the most unusual requests I've had since becoming an REO, so my curiosity was piqued. We got organised and picked the hottest day we could to hold the event, which turned out to be one of the most well-attended field days I've seen."

Over the past six years, Sinclair has set up his irrigation cropping business with a strong lean towards efficiency and automation. He worked closely with designer Bernie Martin of Tahlee Consulting Services in Gunnedah to come up with a design that best suited the 270 hectare greenfield

development he had planned with the siphonless pontoon layout. Sinclair plans to automate the system over winter and aims to convert his full 680 hectares of irrigation over to automated siphonless. He had investigated several options in the lead up to installing the pontoon system, including looking at overhead and large pipes through the bank. Deciding on and designing the pontoon system was a process he worked through with his consultants to make sure it was the best fit possible for his farm.

"We didn't like the original 'pontoon' design so we worked on that and the design evolved to suit our particular situation and needs," Sinclair said.

At the field day Sinclair spoke about the efficiencies of the design and how one person now waters 220 hectares of cotton as opposed to the usual two or three people (himself and two team members) to water the traditional siphon fields. He's seen a 20 per cent increase in machinery efficiency as no head ditches means machines are going forward and not wasting time reversing on the head ditch end.

"It was amazing how many hectares in a 12-hour shift were getting across without a tractor hitting reverse. It's just like a tail drain on both ends," he said.

"The channel height sensors we've installed (for remote sensing when we go autonomous) are cutting down the channel chasing significantly, which lessens wear and tear on vehicles and people."

Sinclair spoke candidly about how he values his team – Paul Robertson and Liam Hutchinson – noting they are key to the success of his farming enterprise.

"I would rather put capital into improving and automating the irrigation layouts to make life easier for my team who are highly skilled, rather than sourcing ongoing casual labour and unskilled workers," Sinclair said.

"I want all three of us to have a good work-life balance, yet siphon irrigating doesn't really lend itself to that.

"Irrigating with siphons, as we all know, is a labour-intensive exercise that for the most part doesn't require any skills other than starting and stopping a siphon and handling a shovel, yet it's still expensive.

"I'm trying to avoid operations here that are hard on humans and gear, and because we aren't throwing siphons and digging rotabucks, we can be doing other jobs or spending time doing things we enjoy with family and friends.

"I think the chiropractor in Dubbo is the only one disappointed we are going siphonless at this stage!

"In terms of health, farm safety is improved due to less manual labour and driving around channels at all hours which will be even better when we automate our system.

"We are also improving the machinery repair and maintenance bill by removing the low skilled seasonal labour."

There have also been unexpected benefits. It was a big year for trash on Sinclair's farm, and he said the new system handled it very well, including blow away grass that had been stopping pipes in the siphon fields.

"I didn't expect the gains in machinery efficiency we saw either," Sinclair said.

"In terms of efficiency, meter measurements found the new system has used very similar water use to a siphon field of approximately seven to eight megalitres per hectare, which included two megs to water up following very dry winter.

"The season has gone very well considering the short turn around, and how dry it was when we were pulling up rows and getting ready to plant.

"The system possibly runs more tailwater than a head and tail drain scenario, and if heavy rain occurs following an irrigation pump, capacity is critical and something I factored into this design."

Amanda says the field day offered growers a lot of food for thought.

"The field day proved very popular – I think it was because growers were able to see the pontoon in action and hear first-hand from the grower," she said.

"They got to have a 'warts and all' look and the system and an insight into Sinclair's journey and the outcomes now the system is in place.

"I would like to thank Sinclair, Paul and Liam for hosting the day and sharing the journey they have started, that will hopefully allow them to reduce their golf handicaps and spend time with their families in the summer."

CottonInfo Irrigation Technical Lead Lou Gall, CottonInfo Regional Extension Officer Amanda Thomas, field day host Sinclair Steele and CottonInfo Program Lead Janelle Montgomery.

Focus on siphonless irrigation at Irricom

MELANIE JENSON

Bankless/siphonless irrigation systems are becoming increasingly popular to reduce the staff burden and time taken to prepare fields for irrigation using traditional siphons. These systems also lend themselves to full automation, creating further labour and time efficiencies.

Deciding to change or upgrade an irrigation system involves many considerations, with growers looking for methods to improve water use efficiency (WUE), save labour and energy costs, and free up their time to concentrate on other aspects of the farm.

Siphonless systems are becoming more popular as growers look to cut labour costs and reduce the amount of time spent preparing for and physically irrigating crops. These systems also lend themselves to automation and remote-control, either at installation or down the track. For some, that's the reason for installing a siphonless system in the first place. Remote control can further improve water use efficiency of these systems, as they ensure irrigations are started and stopped when the irrigator wants them to be.

At this year's Irricom event held in Narrabri (Kamilaroi country) in late February, the focus was on types of siphonless systems and how they are being designed, developed and optimised by growers across the industry. It was a must-attend event for anyone looking to move away from rotor bucks and throwing manual siphons.

Supported by CottonInfo and CRDC, Irricom brought together researchers, growers, irrigation systems designers and commercial providers. Panel sessions were held to discuss different systems. Design considerations were discussed with professionals and service providers.

CottonInfo Program Lead Janelle Montgomery says while growers with siphonless systems attest to the savings they were aiming for, the industry hasn't been able to accurately measure the performance of these systems, in terms of application efficiency and distribution uniformity.

Over recent seasons, CottonInfo's Andrew McKay, consultant Glenn Lyons and cotton grower Craig Saunders at St George in collaboration with Dr Malcolm Gillies and Dr Joseph Foley at the University of Southern Queensland (UniSQ) have attempted to evaluate the irrigation performance of a siphonless system.

Malcolm says the difficulty in modelling bankless is that water is often entering from both ends of the field.

"Also the flow into individual furrows across a bay is unpredictable and almost impossible to measure," he said.

"At Saunder's property we were able to apply our measurement and SISCO modelling approaches to the top part of the field without properly accommodating the water backing at the tail end.

"From a scientific point of view we are still lacking good data across a range of fields on the performance of these systems and a clear way to measure them.

"The work at the St George trial was probably the best attempt to date at trying to evaluate northern bankless systems and we do have some

good data at this site across whole seasons."

Janelle reiterated that it's important to know the performance of a system before it is changed, so any gains can be quantified.

"At the moment, most information around yield and efficiency is anecdotal, based on grower experiences. While these experiences are invaluable to growers considering changing their system, hard data is also important, and includes WUE benchmarking from a grower to industry level.

"The subject of the value of data was raised during the event, with agreement the information is invaluable for irrigation managers.

"It's not just about WUE benchmarking but how scheduling and management decisions impact irrigation performance.

"The progression to automation will enhance your ability to capture useable and reliable water data."

CottonInfo's Irrigation Technical Lead Lou Gall is focused on helping growers understanding the WUE of new irrigation designs and ensuring they are selecting the right designs for each field, farm and farming system.

"It's worth taking the time to see what systems other growers are implementing, to understand any pros and cons, and to design the system that works for you," Lou said.

"Forming a working relationship with a consultant who understands the constraints of your fields such as soil variability or slope, along with your irrigation delivery system, is a vital component.

"If considering automation, connectivity is a big issue for some regions, so most designs use LoRaWAN or wireless connections, while low orbital satellites are becoming a practical option.

"Of course, you don't necessarily need a whole new system to improve your irrigation, as redevelopment and infrastructure costs are significant. There may be improvements you can make within your current system – a good understanding of your current WUE will help identify if there's opportunity to optimise.

"Siphonless irrigation will not be right for everyone – there is still a place for siphons, overhead and drip systems depending on different farm and system requirements.

"If you're considering adopting a siphonless/bankless system, the CottonInfo website and the Australian Cotton Production Manual are great resources to get started."

CottonInfo is also developing further case studies to help growers understand the value of these systems, and their fit for different areas. They will be available on the CottonInfo website.

For more
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Growers Sinclair Steele, Craig Saunders and Darren Eather with CottonInfo Border Rivers/St George/Dirrandbandi REO Andrew McKay discuss siphonless irrigation systems at Irricom.

Know before you go...

Sometimes it's more economical to improve the system you've got before looking at a new one.

Under the CRDC-led Smarter Irrigation for Profit Program, economists from AgEcon undertook a study to calculate the economics of measuring and improving water use efficiency (WUE), finding the benefits are numerous.

AgEcon calculated that for a northern NSW or southern Queensland furrow irrigation system, an improvement from the average irrigation efficiency to the top 25 per cent could lead to a 16 per cent reduction in water use per hectare, allowing for 19 per cent more cotton to be grown with the same amount of water.

When the cumulative benefits of moving from the average irrigation efficiency band to top 25 per cent are captured over a 10-year period with a five per cent discount rate, the total farm benefits are equal to $574,000. This value provides a comparison figure for the cost of WUE improvements such as storage evaporation mitigation solutions, system redesign or new irrigation technologies.

Farm WUE can be affected by a range of factors including soil types, climate, irrigation system design, and irrigation practices. Therefore, when considering investment in WUE improvements, growers should undertake individual farm analysis and consider specific production system and market dynamics.

Water productivity is closely related to irrigation system efficiency metrics, which compare water inputs to water outputs at different points in an irrigation system by accounting for water losses along the way.

Getting irrigation system efficiencies wrong can lead to an over or under-estimation of water requirements, in turn risking wasted farm resources, or risking being short of water, losing crop yield or purchasing expensive water on a spot market.

At the same time, knowing your system efficiencies in detail helps to target WUE

Farm water **storage losses** averaged 25%, ranging from 17% to 38%.

Channel losses averaged 3%, ranging from 1% to 8%.

Field **deep drainage** losses averaged 13%, ranging from 2% to 43%.

Field runoff* averaged 20%, with optimised runoff 16%. Runoff is recycled, but this incurs additional system losses and pumping costs.

Improved irrigation efficiency means getting water to the plant with reduced losses along the way, so you can **grow more crop area with the same water**.

Improved irrigation efficiency has a small benefit to gross margin per hectare through **reduced pumping costs**.

The improvement in irrigation efficiency means **increased farm productivity** (GM per ML) of +21%, supporting **improved farm profit**.

Farm cotton water budget	Average WUE	Improved WUE
Farm irrigation water supply (ML)	**1,000**	**1,000**
Storage losses (% of farm water supply)	25%	20%
Channel losses (% of farm water supply)	3%	1%
Conduit efficiency (E_b) (farm supplied water delivered to the field)	**72%**	**79%**
Deep drainage (% of farm water supply)	13%	9%
Field runoff (recycled) (% of farm water supply)	20%	16%
Application efficiency (E_a) (field supplied water available to the plant)	**82%**	**89%**
Farm efficiency (E_f) (=E_b x E_a) (farm supplied water available to the plant)	**59%**	**70%**
Plant evapotranspiration (ET) requirement (ML)	7.7	7.7
Effective rainfall (ML/ha)	1.6	1.6
Used soil moisture (ML/ha)	0.6	0.6
Plant irrigation water requirement (ML/ha)	5.4	5.4
Field irrigation water requirement (ML/ha)	6.6	6.1
Farm irrigation water requirement (ML/ha)	9.2	7.8
Planted area (ha)	**108**	**129**
Yield (b/ha)	11.6	11.6
IWUI (farm) (bales/farm irrigation ML)	1.26	1.49
WFIE (plant available water/farm used water)	0.59	0.70
GPWUI (farm) (bales/total farm ML)	1.01	1.16
Gross margin ($/ha)*	$ 3241	$ 3302
Gross margin ($/ML farm irrigation water)	**$ 351**	**$ 425**

* Water budget based on NSW DPI data for 2017-18, WATERpak (field runoff data), and CottonInfo Gross Margins 2021-22

A cotton water budget for two scenarios based on results under the CRDC and NSW DPI co-funded project, Trend & Drivers of Water Productivity in Australian Cotton for furrow irrigation in northern NSW and southern QLD. The two scenarios have the same farm irrigation water supply, but scenario 1 has average WUE (average irrigation system efficiencies generating average water productivity), while scenario 2 has improved WUE to the top 25 per cent (irrigation system efficiencies generating improved water productivity).

improvements, allowing greater production and profit from limited water resources. Growers have the opportunity to have their WUE calculated free by industry experts under a CRDC project.

NSW DPI Agricultural Water Scientists led by Dr Malem McCloud and including Dr Jasim Uddin and Research and Development Officer Sarah Dadd, are undertaking the CRDC-supported Water Productivity Benchmarking Project. The team has been visiting farms, working with growers and are happy to step them through the water benchmarking process to determine gross production water use index (GPWUI).

Sarah has been working in the Gwydir Valley recently and says most growers are quite surprised how easy it is to complete.

"I find that once a grower gets their head around it, it only takes about one hour to collect last year's data," she said.

"Quite often we make a good start on the current season – which then only requires a follow up call at the end of the season.

"Once the data is collected the benchmarking team calculate the farm WUE indicators."

The Australian irrigated cotton industry has found it has doubled its average GPWUI from 0.62 bales/ML in 1997 to 1.22 bales/ML in 2021. Determining this improvement is only possible due to the generous contributions of time and data by cotton growers.

To have your WUE benchmarked, contact any of the NSW DPI team, scan the QR code, or access and complete the form online via the link below.

For more

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To fill in the survey form:
https://form.jotform.com/230107748653861

Smarter Irrigation for Profit
www.smarterirrigation.com.au

AgEcon
www.agecon.com.au

Dryland growers keen to get the good oil

A huge interest in dryland cotton research was evident at a field day near Moree in April, with 85 people turning up.

IMAGE: MELANIE JENSON

Held at Ian Bailey and family's 'Bundy Station' near Terry Hie Hie (Kamilaroi country) the area is home to significant dryland production in the right seasons.

The event was held next to B&W Rural's trial blocks of XtendFlex cotton varieties which provided the backdrop for an update from CSIRO plant breeders Dr Warren Conaty, Dr Warwick Stiller and CSD's Stuart McFayden on variety performance and what's in the breeding pipeline.

Held by the Dryland Cotton Research Association (DCRA) in association with CottonInfo, fellow cotton scientists Blake Palmer of NSW DPI, CSIRO's Sandra Williams, and Sydney University's Tom O'Donoghue shared their research. Cotton grower and DCRA Chair Ian Gourlay discussed carbon accounting, emissions and customer expectations in the future. Cotton Australia Regional Manager Alec Macintosh gave a run-down on the advantages of myBMP and how to get started.

"It was another example of great local collaboration of industry, government and corporate players in the promotion of rainfed cotton systems," DCRA research co-ordinator Annette McCaffery said.

"Many of our corporate and grower members were involved in delivering the day, presenting on emerging topics and participating in the panel discussions, which was so valuable since farmers like to learn from their peers.

"We think the day's been a great success, and the feedback was really positive.

"It was no surprise that there is interest in what we covered which was using growth hormones along with micronutrients in rainfed cotton systems, and a lot of interest in understanding more about soil carbon and the myBMP program.

"DCRA will look at developing a program to provide our members and the wider industry with further information on these topics."

Three CRDC-supported projects were topics of the day.

NSW DPI's Blake Palmer presented his work on micronutrients in minimum-till (conservation-tillage)

Interest in cotton growing is alive and well based on the turnout at a field day in the north-west slopes and plains at the Bailey family's 'Bundy Station'.

MELANIE JENSON

CSIRO's Sandra Williams, grower Ed Tomlinson and consultant Chris Maunder ran through the positive outcomes of applying hormones to allow growers to manipulate flowering.

dryland systems in north-west vertisols, which created a lot of food for thought about micronutrient availability including iron, manganese, zinc and copper.

A significant constraint of conservation tillage is it leads to nutrient stratification with higher concentrations occurring in the surface zones, often above the root zone. A key determinant to maximise yield is the optimum distribution and availability of nutrients throughout the soil, so roots can access essential nutrients and water reserves at depth, when they are needed.

"We found that these north-west vertisols have a good level of micronutrients, even after 22 years of intensive crop production we didn't see any decline in total micronutrients," he said.

"However, we did see fluctuations in the plant-available portion of the micronutrients over time and also saw stratification, but nothing changed in the total pool.

"Stratification was found to be a big factor, putting nutrients beyond where a plant can access them at the right growth stage, which is also critical."

"This suggests we have these big micronutrient banks in our vertisols, but it's the plant availability that is fluctuating and changing and might have impacts on us.

"Stratification was found to be a big factor, putting nutrients beyond where a plant can access them at the right growth stage, which is also critical.

"To minimise these issues under no-till cropping systems, strategic tillage could offer a potential solution to distribute the stratified nutrients across the planting zones and minimise the risk of stratification."

CRDC-supported post-doctoral research fellow Tom O'Donoghue spoke about the value of cover crops and the work he's doing to get trials underway across all growing regions to create a cover crop guide that is regionally specific. He canvassed the crowd to determine why they grow cover crops. The top reasons were erosion and weed control, as an opportunity crop and disease management.

"Tom has the tools to measure the impacts of cover cropping on soil properties," said CottonInfo Program Lead Janelle Montgomery, who helped organise the day.

"If you are cover cropping, Tom would love a chat, he may be able to overlay some measures to see if you are realising what you set out to achieve."

CSIRO's Sandra Williams presented the findings of another CRDC-supported project looking at

growth hormones to delay crop maturity, which was highlighted as a topic of interest by those in attendance, as it goes to the heart of establishment, the greatest ongoing challenge for dryland growers. Sandra works with Dr Katie Broughton, who leads the research (see next article).

With trials at the nearby farm of Ed Tomlinson at Terry Hie Hie, they looked at trinexapac-ethyl (TEP), which is used in cereal crops to prevent lodging, which Sandra says was a success.

"The treatment was successful in this scenario where a crop was planted earlier to use available moisture and then flowering delayed to get through the hot January period," Sandra said.

"The biggest issue in growing dryland cotton is establishing the crop.

"This research considers the idea of sowing at the first opportunity when the moisture is right (end of September/October), getting the crop well established, and then using growth regulators to delay flowering and peak flower and boll filling (late February/March moving into the cooler months of the year).

"There were significant differences for days after planting to cut out of around a week and up to 240 bolls per metre in the treated cotton."

The day finished up with Warren, who is rethinking the way they breed for dryland cotton varieties. Warren and the plant breeding team at CSIRO are working to develop varieties with superior performance under dryland production systems – a productive plant that is efficient in the way it uses water and nutrients, despite hot, dry conditions.

"The rise of cost-effective genomic sequencing, sensor technology and machine learning approaches enable us to rethink the entire breeding process to enable more consistent increase of genetic gain for dryland environments," Warren said.

"This program will enable the fast tracking of the development of new varieties better able to cope and adapt to the challenging environmental conditions faced by future partially irrigated or rainfed cotton production in Australia.

"We hope to produce elite lines for Australian dryland conditions, at a faster rate of genetic gain."

For more

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Tackling on-farm emissions calculation

Carbon and emissions were hot topics at the dryland cotton field day, reflecting the attitude of cotton growers across the industry who identified the need for standardised calculation of carbon emissions from cotton production as a priority investment area at the 2023 CRDC/Cotton Australia research priority forum.

The good news is that Australia's first cross-sectoral carbon accounting engine is now live, giving agriculture a standardised approach to carbon accounting across a wide range of commodities.

Discussion at the field day showed that access to markets and finance was on growers' minds, along with a lack of surety around calculating and managing their greenhouse gas (GHG) emissions. DCRA Chair Ian Gourlay spoke about a survey from GrainGrowers of on-farm carbon calculators (for grain growers), which showed disparity in results, leading to confusion among producers. This highlighted the need for a standardised, independent, cross-commodity, whole farm emissions calculator, which is now available in the Agricultural Innovation Australia (AIA) Environmental Accounting Platform (EAP).

Launched in late May for cotton, beef, sheep, goats, feedlots, pork, grain, sugar and poultry, growers can now calculate their carbon footprint at a commodity, enterprise, and whole of business level. It provides growers and their supply chains with an accessible and standardised approach to carbon accounting across multiple commodities on a national scale. The platform can be integrated into the current service offerings of farm and business solution providers, supply chain, agribusiness, financial institutions and others, giving their customers seamless access to the most up-to-date and consistent carbon calculations.

CRDC was one of the supporters of the development of the EAP, along with AIA and eight of CRDC's fellow research and development corporations. CRDC is investing in new initiatives like development of the EAP to provide growers with the knowledge and tools to monitor and manage GHG emissions.

Growers can access the platform via the link below.

For more

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Delaying development and maturity at Terry Hie Hie

Imagine being able to change the way dryland cotton grows to help it get through a hot, dry period or manipulate the timing of maturity so you can sow on early rain.

Australian cotton is now grown in diverse climatic and soil conditions, with dryland production accounting for up to almost a quarter of the total planted cotton area. Dryland cotton presents an attractive option for broadacre growers, but these opportunities are predominately driven by water availability, particularly at planting time.

To overcome these challenges, researchers under a CRDC-supported project have focused on exploring how novel plant growth regulators (PGRs) could be used to improve the resilience of dryland cotton crops. Encouragingly, they've found that fruit development can be delayed using early applications of a novel PGR and when used in early-sown dryland crops this can help to match the timing of peak flowering to more favourable conditions.

"Abiotic stressors, such as water, air temperatures and soil constraints, are major limiting factors to both lint yield and quality, with the effects of these factors exacerbated in dryland cotton systems," says CSIRO's Dr Katie Broughton.

"Sometimes rain and/or optimal soil-water levels come at a less than ideal sowing time, so growers are looking for an alternative where they can plant into moisture and then 'hold the crop up' and delay fruit development.

"Novel PGRs may have a role in increasing crop efficiencies and yield outcomes, primarily by boosting the resilience of crops to climatic stress.

"These motivations resulted in a large screening project that was initiated several years ago by former CSIRO researchers Dr Claire Welsh and Dr Michael Bange, supported by CRDC."

Building on this work, Katie along with fellow CSIRO researchers Sandra Willliams and Jane Caton have focused their attention on Trinexapac-ethyl (TEP) under a subsequent CRDC-supported project.

Dr Katie Broughton conducting weekly growth and development measurements at 'Myall Plain' Terry Hie Hie earlier this year.

Katie said TEP is a PGR that inhibits the late stages of gibberellic acid biosynthesis. Gibberellic acid's function in a plant is to stimulate cell elongation and cell division. TEP interferes with these processes causing reductions in cell division and elongation, leading to potentially shorter and delayed plants.

"TEP is used in cereal crops such as wheat, barley and oats to reduce lodging and enhance yield, but recent studies have shown potential for delaying fruit development of cotton," Katie said.

"We've worked grower Ed Tomlinson at Terry Hie Hie (Kamilaroi country) this cotton season to explore how different rates of TEP applied at various timings would affect growth and maturity of (double-skip) dryland cotton.

"We kept in mind the practical consideration for growers to manage balancing the appropriate rates and frequencies of application."

Ed planted 748B3F on two dates in November and December 2023. TEP was used to delay fruit development in the November planting with the aim of eliminating any maturity differences between the two planting dates by the end of the season.

Various rates of TEP were applied at the six-leaf stage to a small area within the November-sown cotton but the control treatment did not receive any TEP. Height, node, fruit development and boll counts were monitored weekly to capture any delays in development and maturity between the treatments.

"Our preliminary results indicated that within the November planting, there was an approximate one-week delay in time to first flower for cotton treated with TEP compared to the untreated control," Katie said.

"Similarly, time to cut-out (four nodes above white flower (NAWF)) and the opening of bolls were also delayed by the TEP treatments.

"As we have yet to complete our final picks, we have not been able to compare the November planting TEP treatments to the untreated December planting, however, we have seen some exciting results where a timed application of a novel PGR can delay flowering, fruit development and maturity of cotton.

"With further research to understand the rates, timing, and mechanisms of these effects better, TEPs may enable growers to better manage their crop development and timing once seedlings are out of the ground and established."

The researchers have also been working with growers and consultants on a project supported by CRDC, CSD and CSIRO to to better understand the use of early season applications of Pix (mepiquat chloride) in trials across multiple cotton regions including Griffith (Wiradjuri country) and the Darling Downs (Barunggam country),

The research was explored in a panel session at the Crop Consultants Australia meetings in Tamworth (Kamilaroi country) in June, on the back of interest from growers and consultants. The Spring edition of *Spotlight* will include an update on the research and the panel's discussions.

CRDC 2024-25 Projects List

2024-25 marks the second year under CRDC's new Strategic RD&E Plan: Clever Cotton. During this year, CRDC will invest $32.13 million into RD&E projects across the Plan's three pillars (Paddock, People, Planet) and nine themes, in collaboration with research partners and on behalf of Australia's cotton growers and the Australian Government. This table outlines the confirmed and planned projects that CRDC will invest in during this year. For further information about Clever Cotton or any of the projects listed, please visit the CRDC website: www.crdc.com.au/research-development.

Theme	Sub-theme	Project title	Project code	Researcher	Organisation	Commenced in:	To be completed in:
Pillar 1: Paddock							
1.1 Data-driven decisions	**Data-driven decisions**	***Confirmed projects:***					
		Annual consultant qualitative and quantitative surveys 2022-24	CCA2202	Doug McCollum	CCA	Apr-22	Mar-25
		Cotton industry database management	ARML10554	Lee Armson	Lee Armson	Jul-23	Jun-26
		Cotton WHS sustainability data 2019-2023	US10905	Tony Lower	USYD	Jan-24	Feb-24
		CRDC cotton grower survey 2023-25	INTS10342	Michael Sparks	Intuitive Solutions	Jan-23	Nov-25
		Project Management Committee meetings and activities: Data-driven decisions	CRDC10670	Meredith Conaty	CRDC	Jul-23	Jun-28
		Rural Safety & Health Alliance (RSHA) + Ag Safety Data Net	RIRDC11098	Georgina Toose	AgriFutures	Jun-24	Jun-28
		Plus planned investments in:					
		Data Governance and Management Group Support					
		Data platform phase 2 (build)					
1.2 Adaptive systems	**Solving farming systems contraints**	***Confirmed projects:***					
		2023-24 dryland cotton research – L'lara	US11084	Stephen Cattle	USYD	Oct-23	Jun-24
		Agricultural Innovation Australia: Agri-climate outlooks	AIA2301	Annabelle Van Klaveren	AIA	Jul-22	Dec-26
		Climate proof cotton: Phase 2	WSU11009	Demi Sargent	WSU	Jul-24	Jun-27
		Developing canopy temperature sensors with new multipixel technology	USQ2304	Alison McCarthy	USQ	Sep-22	Dec-24
		Modern systems agronomy for resilient cotton production	CSP2001	Katie Broughton	CSIRO	Jan-20	Sep-24
		On-farm demonstrating and integrating irrigation technology for cotton	USQ2301	Joseph Foley	USQ	Jul-22	Jun-25
		Optimising irrigation performance in bankless channel cotton layouts to improve water management and nitrogen use efficiency	DU2301	Wendy Quayle	DU	Jul-22	Jun-26
		PostDoc: Measuring evapotranspiration from canopy temperature (CTET)	USQ2302	Simon Kelderman	USQ	Jul-22	Jun-25
		Seeking regionally specific guidelines for cover crops through cotton-farmer-led best-practice and soil security	US2301	Alex McBratney	USYD	Feb-23	Jan-26
		Supporting southern cotton production systems: Southern cotton agronomy and fibre quality	DAN2306	Beth Shakeshaft	NSW DPI	Jul-22	Jun-25
		Water productivity benchmarking in the Australian cotton Industry	DAN2303	Malem McLeod	NSW DPI	Jul-22	Jun-25
		Whole of farm management digital dashboard	CSD2302	Michael Bange/ John Pattison	CSD/ DiscoveryAg	Oct-22	Jun-25

Note: CRDC's list of projects is current as of 18 May 2024 and may be subject to change.

Theme	Sub-theme	Project title	Project code	Researcher	Organisation	Commenced in:	To be completed in:
		Plus planned investments in:					
		Economic assessments to inform and support adaptive farming system themes					
		Farming constraints innovation development					
		Innovation for limited water and dryland systems					
		On-Farm water investment concepts					
	Disease	***Confirmed projects:***					
		Disease management in cotton farming systems – a participatory action research approach to deliver solutions	CSD2303	Michael Bange	CSD	Oct-22	Sep-26
		Project Management Committee meetings and activities: Adaptive systems	CRDC10671	Nicola Cottee	CRDC	Jul-23	Jun-28
		The Australian Cotton Disease Collaboration (ACDC)	USQ11135	Sambasivam Periyannan	USQ	May-24	Jun-28
	Biosecurity	***Confirmed projects:***					
		Advanced field sensing for improved cotton management	USQ2303	Alison McCarthy	USQ	Jul-22	Jun-25
		ARC Research Hub for Sustainable Crop Protection	UQ2001	Neena Mitter	HIA/UQ	Jul-19	Aug-25
		Developing proactive approaches to Integrated Pest Management (IPM) in cotton production systems	CSP2203	Simone Heimoana	CSIRO	Sep-21	Aug-24
		Improved insecticide resistance monitoring for key pests to support sustainable insect management.	DAN2301	Lisa Bird	NSW DPI	Jul-22	Jun-25
		Improved insecticide resistance monitoring for silverleaf whitefly (SLW) to support sustainable insect management	DAQ2301	Jamie Hopkinson	QLD DAF	Jul-22	Jun-25
		Plant Biosecurity Research Initiative (PBRI) Phase 3	HIA10549	Jo Luck	HIA	Jul-23	Jun-28
		Production of material for biopesticide commercialisation activities	WSU10312	Rober Spooner-Hart	WSU	Sep-22	Jun-24
		Quantifying the economic impact of weeds on the Australian grain and cotton cropping systems investment	GRDC10612	Emma Colson	GRDC	Jul-23	Jun-25
		Regional demonstration of integrated weed tactics across farming systems	DAN2304	Eric Koetz	NSW DPI	Jul-22	Dec-24
		Spray drift hazard alert and warning systems	DISA2201	Alicia Garden	Discovery Ag	Jan-22	Jun-28
		Supporting farming system adaptation to climate and biological threats (including CottonInfo technical leads Paul Grundy and Sharna Holman)	DAQ2201	Paul Grundy	QLD DAF	Jul-21	Jun-25
		Validation and implementation of new molecular tools for Bt resistance monitoring	CSP2204	Sharon Downes	CSIRO	Sep-21	Aug-24
		WeedSmart Phase 6	UWA10548	Jessica Strauss	UWA	Jul-23	Jun-26
		What is the best fit for electric weed control in Australia?	WAAA10493	Catherine Borger	WAAA	Jul-22	Aug-24
		Plus planned investments in:					
		Assessing the impact of pesticides on beneficials					
		Biosecurity capacity building: Biosecurity gaps					
		Biosecurity capacity building: Science exchange/travel					
		Biosecurity Tracka					
		Cross industry surveillance partnership					
		GRDC weeds collaboration					
		Innovation process for biosecure solutions					
		Strategic partnerships/grants to support pesticide sustainability targets and stewardship					
	Northern Australia	***Confirmed projects:***					
		Extension and adoption of drought resilient tropical farming systems through best management practice (BMP)	NTF10747	Hannah Leu	NTF	Jul-23	Sep-25
		NT Research Station cotton partnership	DANT10811	Michelle Uniacke	NT DITT	Sep-23	Oct-26
		Supporting a sustainable northern Australia cotton, grain & cattle system (northern program)	CRCNA2301	Carla Keith	CRCNA	Jul-22	Oct-26
		Plus planned investments in:					
		Assessing residue risks associated with standing stubble					
		Improving surveillance and understanding for endemic and exotic northern disease threats					
		Strategic northern partnerships – sustainability, indigenous engagement, capacity building					
		Sustainable pest management in northern systems					
1.3 Connected market intelligence	**Connected market intelligence**	***Confirmed projects:***					
		A review of Regen Ag standards: Risks and rewards	HAKK11099	Kater Hake	Kater Hake	Apr-24	Aug-24
		BCI Membership 2023-24	BCI10724	Vinay Kumar	BCI	Sep-23	Sep-24

		Better sustainability reporting: Better information and better decisions. A proof of concept for Australian agriculture	SUSA10782	Chris Cosgrove	Sustenance Asia	Jul-23	Jul-25
		Membership Sustainable Apparel Coalition Policy Hub	SUAC10902	Mackenzie Roach	SAC	Jan-24	Dec-24
		Membership Textile Exchange 2024-27	CASC11134	Beatrice Levy	Cascale Inc	Jul-24	Jun-25
		Project Management Committee meetings and activities: Connected Market Intelligence	CRDC10672	Meredith Conaty	CRDC	Jul-23	Jun-28
		Plus planned investments in:					
		Calculating the value of producing more sustainable cotton					
		CRDC membership of and participation in sustainability initiatives					
		Defining identifying and calculating the number of bales produced as 'more sustainable'					
		Defining market expectations: identification of key metrics					
		Improving the performance of product environmental footprint under Australian conditions					
		Incentivising participation: Business models to better reward sustainable production					
		myBMP review					
		Support for the Sustainability Working Group and industry sustainability reporting					

Pillar 2: People							
2.1 Design and innovation	**Design and innovation**	**Confirmed projects:**					
		Project Management Committee meetings and activities: Design and Innovation	CRDC10673	Meredith Conaty	CRDC	Jul-23	Jun-28
		Plus planned investments in:					
		Support for innovation brokers to develop and implement innovation and design processes					
2.2 Leadership and capacity	**Leadership**	***Confirmed projects:***					
		Australian Future Cotton Leaders program 2022 and 2024	CA2201	Paul Sloman	CA	Oct-21	Oct-24
		Australian Rural Leadership Program: Course 29, 30 & 31 and TRAIL 2022, 2023 & 2024	RIR2201	Tristan Richmond	ARLF	Jul-21	Dec-25
		Exploring smart farming technologies: impact on youth perspectives towards the agri-food sector	UM10799	Yuchen Miao	UM	Oct-23	Oct-26
		Honours: Assessment of multi-molecular films in evaporation suppression under varied climatic conditions	USQ10829	Sarah Seton	USQ	Nov-23	Nov-24
		Honours: Enhancing aerial application efficiency: Multiphase CFD optimization for cotton canopy penetration	MONU11069	Andre Briffa	Monash Uni	Mar-24	Nov-24
		How to face the agricultural labor challenges: Applying the concept of job quality to the agricultural industry	UM10810	Xinyue Tang	UM	Oct-23	Oct-26
		Joint Research and Development Corporation: Community Trust Program Phase 2	RIRDC10461	Jennifer Medway	AgriFutures	Jun-23	Dec-25
		Nuffield Australia farming scholarship: Tim Houston	CRDC2301	Tim Houston	Nuffield	Oct-22	Oct-24
		Travel scholarship: AI in entomology	USQ10691	Derek Long	USQ	Jun-24	Jul-24
		Upskilling early career agriculturists	GRDC10696	Bob Ford	GRDC	Jul-23	Jun-26
	Capacity	***Confirmed projects:***					
		AgriFutures Rural Women's Award Gala – Dinner 2023	RIRDC10692	Abbey O'Callaghan	AgriFutures	Jul-23	Jun-26
		AgriFutures Rural Women's Award Gala – Travel Scholarships 2023	CRDC10693	Ruth Redfern	CRDC	Jul-23	Jun-26
		Australian Cotton Industry Awards Sponsorship: CRDC Chris Lehmann Young Cotton Achiever of the Year Award 2024 and 2025	CA10951	Paul Sloman	CA	Oct-23	Sep-25
		Delivering best practice to manage future workforce skills	CQU2201	Nicole McDonald	CQU	Oct-21	Sep-24
		Foundation Sponsorship: 21st Australian Cotton Conference	CA10945	Tracey Byrne-Morrison	CA	Feb-24	Sep-24
		Horizon Scholarship 2023: Georgie Oldham	RIRDC10499	Georgie Oldham	AgriFutures	Mar-23	Dec-24
		Horizon Scholarship 2023: Niamh Mason	RIRDC10500	Niamh Mason	AgriFutures	Mar-23	Dec-24
		Horizon Scholarship 2024-25: Julian Graven	RIRDC11114	Annabelle Day	AgriFutures	Apr-24	Dec-25
		How to attract and retain young people on cotton farms	CQU2301	Amy Cosby	CQU	Oct-22	Sep-24
		PhD: Drought resilient cotton: Combining synthetic biology solutions to improve cotton productivity under future water limited and heatwave conditions	UWS2202	Garima Dubey	WSU	Mar-22	Mar-25
		PhD: Employing specific peptides and receptors to improve nitrogen uptake and its utilisation to enhance cotton yield	WSU10579	Bhagya Samarasinghe	WSU	Jan-24	Jan-27
		PhD: Micronutrient requirements of modern cotton cultivars. Crop rotation as a tool to ameliorate soil compaction in modern cotton farming systems.	DAN10920	Blake Palmer	NSW DPI	Jul-23	Jun-27

Theme	Sub-theme	Project title	Project code	Researcher	Organisation	Commenced in:	To be completed in:
		PhD: Quantifying the temporary climate mitigation impacts of biogenic carbon	NCSU2301	Steven Pires	NCSU	Aug-22	Aug-24
		Project Management Committee meetings and activities: Leadership and capacity	CRDC10674	Rachel Holloway	CRDC	Jul-23	Jun-28
		Summer Scholarship: Low-cost satellite technologies that remove need for cellular or radio coverage in smart broadacre irrigation	USQ10154	Simon Kelderman	USQ	Dec-22	Nov-24
		Plus planned investments in:					
		Cotton Production Course					
		Research capacity building: Awards, scholarships, sponsorships					
		Research capacity building: Support for PhD students					
		Research capacity building: Travel scholarships and international exchanges					
2.3 Adoption and impact	**Adoption**	***Confirmed projects:***					
		Assessment of the socio-economic resilience of rural and regional communities	RAI 10501	Katherine Bassett	RAI, GRDC	Apr-23	Sep-25
		Cotton industry media montoring 2023-24	CA10718	Darrin Davies	CA	Jul-23	Jul-24
		CottonInfo Climate and Carbon Technical Lead	AE10070	Jon Welsh	AgEcon	Jul-23	Jun-26
		CottonInfo Disease Technical Lead	CSD10630	Peter White	CSD	Jul-23	Jun-26
		CottonInfo Fibre Quality Technical Lead	VANM10023	Rene van der Sluijs	TTS	Jul-23	Jun-26
		CottonInfo Irrigation Technical Lead	GVIA2301	Lou Gall	GVIA	Jul-22	Jun-25
		CottonInfo Natural Resources and Landscapes Technical Lead	VOGS10071	Stacey Vogel	Stacey Vogel Consulting	Jul-23	Jun-26
		CottonInfo Weed Technical Lead	DAN2302	G Charles E Koetz	NSW DPI	Jul-22	Jun-25
		Research for Impact	HIA10594	Jane Wightman	HIA/UQ	Jun-23	Jun-26
		Plus planned investments in:					
		CottonInfo technical leads for soil health and nutrition					
		CottonInfo multimedia project					
	Impact	***Confirmed projects:***					
		CRDC Grassroots Grant: Central Highlands Weather Network	CHCGIA 11070	Alexandria Galea	CHCGIA	May-24	Nov-24
		CRDC Grassroots Grant: Darling Downs Weather Station Upgrade	DDCGI11031	Daniel Skerman	DDCGI	Jun-24	Jun-24
		Project Management Committee meetings and activities: Adoption and Impact	CRDC10676	Warwick Waters	CRDC	Jul-23	Jun-28
		Plus planned investments in:					
		Ten year impact assessment of RD&E investment					

Pillar 3: Planet							
3.1 Natural capital	**Biodiversity and soils**	***Confirmed projects:***					
		Carbon and biodiversity benchmarking in native vegetation on cotton farms	UNE2301	Rhiannon Smith	UNE	Jan-23	Dec-25
		Evaluating the economic and environmental return on investment of modern fish screens	DAN2308	Craig Boys	NSW DPI	Jul-22	Jun-25
		Impacts of landscape connectivity on bat and bird activity in cotton and value of acoustic monitoring technology: benefits for natural pest suppression.	USC10494	Stuart Parsons	USC	Jul-23	Jun-26
		Project Management Committee meetings and activities: Natural Capital	CRDC10677	Stacey Vogel	CRDC	Jul-23	Jun-28
		Plus planned investments in:					
		Demonstrating impact of land practice change					
		Improving regional information and support					
		National sustainability metrics and datasets for native vegetation (Stage 1 & Stage 2)					
		On-farm biodiversity monitoring tools scoping study					
		Riparian exotic weed management prioritisation framework					
		Updating CottonInfo biodiversity management tool – Northern Australia pilot					
	Pesticides and nitrogen	***Confirmed projects:***					
		SataCrop maintenance and hosting	CA10895	Doug McCollum	CA	Dec-23	Jun-25
		Landuse risks for pesticides and nitrogen movement in cotton catchments	SCU11080	Mick Rose	SCU	May-24	May-25

		Plus planned investments in:					
		On-farm mitigations for pesticides and nitrogen movement					
		Sensing spray drift					
		Strategic partnerships for pesticides & nitrogen movement					
	Water	***Confirmed projects:***					
		Smart system for evaporation polymer deployment	USQ10698	Michael Scobie	USQ	Sep-23	Aug-27
		Water R&D support	PHEC10735	Cathy Phelps	C&J Phelps Consulting	Sep-23	Sep-24
3.2 Carbon	**Carbon**	***Confirmed projects:***					
		Assessing the critical N and P values of cotton cultivars for improved yield and fertiliser efficiency	UQ2301	Tim McLaren	UQ	Jul-22	Jun-25
		Benchmarking soil carbon, soil properties and management between long term experimental sites and on-farm cotton industry sites	DAN2305	Guna Nachimuthu	NSW DPI	Jul-22	Jun-25
		Building profitable farming systems for the future through increasing soil organic carbon and optimising water use efficiency in a changing climate	CRDC2202	Annette McCaffery	DCRA	Jul-21	Sep-24
		De-risking nitrogen (N) decision making: Insuring against yield loss through N fertiliser reduction	CSIRO10999	Peter Thorburn	CSIRO	Apr-24	Feb-27
		Environmental Accounting Platform – Build	AIA10739	Sam Brown	AIA	Sep-23	Sep-24
		Greenhouse gas baseline and mitigation for cotton	CSP2102	Hizbullah Jamali	CSIRO	May-21	Jun-25
		Project Management Committee meetings and activities: Carbon	CRDC10678	Meredith Conaty	CRDC	Jul-23	Jun-28
		Understanding nitrogen (N) cycling in cotton soils, and the timing of N availability to plant roots	CSIRO10081	Timothy Weaver	CSIRO	Oct-23	Sep-26
		Plus planned investments in:					
		Enhanced efficiency fertilisers for establishing low-carbon cotton farming systems					
		Low-carbon cotton farming systems: case studies and field trials					
		Robust methodologies for demonstrating greenhouse gas emissions reductions for the cotton sector					
		Strategic partnerships and innovations for low-carbon cotton farming systems					
3.3 Circular economy	**Circular economy**	***Confirmed projects:***					
		An evaluation of cotton fibre waste processing and composting alternatives: Comparison of business models, greenhouse gas emissions and commercialisation opportunities	UTS 10080	Christopher Bajada	UTS	Jul-23	Jun-26
		Closing the loop: Textile waste composting for improved carbon footprint and sustainability	UON2301	Thava Palanisami	UON	Jul-22	Jun-25
		Project Management Committee meetings and activities: Circular economy	CRDC 10679	Meredith Conaty	CRDC	Jul-23	Jun-28
		Plus planned investments in:					
		Value adding to textile waste through circular economy: Pilot programs					

Key

AgriFutures	AgriFutures Australia
AIA	Agriculture Innovation Australia Ltd
ARLF	Australian Rural Leadership Foundation
BCI	Better Cotton Initiative
CA	Cotton Australia
CCA	Crop Consultants Australia
CHCGIA	Central Highlands Growers and Irrigators Association
CQU	Central Queensland University
CRCNA	Cooperative Research Centre for Developing Northern Australia
CSD	Cotton Seed Distributors
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCRA	Dryland Cotton Research Association
DDCGI	Darling Downs Cotton Growers Inc
DU	Deakin University
GRDC	Grains Research and Development Corporation
GU	Griffith University
GVIA	Gwydir Valley Irrigators Association
HIA	Hort Innovation
NCSU	North Carolina State University
NSW DPI	NSW Department of Primary Industries
NT DITT	Northern Territory Department of Industry, Tourism and Trade
NTF	Northern Territory Farmers Association
PHA	Plant Health Australia
QLD DAF	Queensland Department of Agriculture and Fisheries
QUT	Queensland University of Technology
RAI	Regional Australia Institute
SAC	Sustainable Apparel Coalition
SCU	Southern Cross University
TTS	Textile Technical Services
UM	University of Melbourne
UNE	University of New England
UON	University of Newcastle
UQ	University of Queensland
USC	University of the Sunshine Coast
USQ	University of Southern Queensland
USYD	University of Sydney
UTS	University of Technology Sydney
UWA	University of Western Australia
WAAA	Western Australia Agriculture Authority
WSU	Western Sydney University

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