Spotlight
ON COTTON R&D

WINTER 2023

Setting native veg targets: what do growers think?

Calculating cotton GHG emissions a reality

Water use efficiency doubles

CRDC

Dr Ian Taylor

In the Spotlight

Welcome to the winter edition of *Spotlight* and the start of a new era for CRDC as we get ready to launch our new Strategic RD&E Plan for 2023-28, Clever Cotton.

The plan will shortly be signed off and will come into effect on July 1, so in this edition, we bring you an update on what Clever Cotton means for cotton RD&E, and the list of our 2023-24 investments. I'd like to thank all of the growers, consultants, researchers and others who have offered input, outlined issues and taken the time to respond to calls for feedback. We look forward to working closely with you as we deliver Clever Cotton over the next five years.

Feedback has also been an essential component of the work our Innovation Broker Stacey Vogel and the Sustainability Working Group have been undertaking of late: talking to landholders about their thoughts on native vegetation and setting targets for the industry. These issues are complex – like others that fall within the PLANET. PEOPLE. PADDOCK Sustainability Framework – and so we are working with growers to ensure we, as an industry, get them right.

We are also seeking feedback on a new tool to calculate greenhouse gas emissions on cotton farms. Until now, there has been no method to collect this information. Importantly, this tool is based on those developed for other primary industries, like grains, sheep and beef, to ensure consistency across different commodities – and it will help underpin a whole-of-farm tool being built now with CRDC's support. We invite growers to try out the new tool and provide feedback.

Finally, it's that time of year again, where cotton growers are invited to provide feedback to CRDC on a number of issues and aspects of cotton growing via the annual *CRDC Grower Survey.*

The experiences and opinions of growers are integral to how we prioritise our RD&E investment. To make it quicker and easier for growers to participate, the survey is short, conducted via phone by an expert research team, and includes core annual questions plus focus areas to investigate specific aspects of the farming system. Your responses are anonymously compiled to create the survey results, which are then made available back to you via a downloadable report and our online interactive digital dashboard. You can also go back in time to look at previous results, as previous survey reports are housed online at Inside Cotton, our electronic library.

All cotton growers who have a number on file with us will be contacted from June 1 and we strongly encourage you to have your say. Importantly, your views help inform our future research and help us document changes in practices over the 20 years we've been conducting this survey. It also gives you the opportunity to learn what other growers are doing – consider it a virtual look over your neighbour's fence.

Dr Ian Taylor
CRDC Executive Director

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.

Winter 2023

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

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:
Cotton grower Blake Phillips with his boys Ace and Amarni are in their element on the Gwydir River – see story page 24.

Want to see more of Spotlight?

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

COTTON NEWS

FEATURES

ON THE COVER

NEW PRODUCTION MANUAL OUT NOW

Whether it's your first rodeo or you're an old hand at cotton growing, the Australian Cotton Production Manual is your one-stop book of knowledge. *Spotlight* subscribers receive their copy with this Winter edition, and it's also available for download via the CRDC and CottonInfo websites.
www.cottoninfo.com.au/publications/australian-cotton-production-manual

Collective and trade show set for August

THE 2023 Australian Cotton Trade Show will be held in conjunction with Cotton Australia's Cotton Collective and Industry Awards in Toowoomba (Barunggam country) on August 2 and 3.

Drawing on the successful biennial Australian Cotton Conference model, a 'mini' conference went on the road to Griffith (Wiradjuri country) in 2017 and 2019. The Cotton Collective research and policy forums and cotton trade display saw more than 60 exhibitors and 450 growers, consultants, researchers, processors and service providers attending.

"The 'mini' conference in the south proved to be very successful – so it will be repeated at the Toowoomba Showgrounds this year," Trade Show organiser Brian O'Connell said.

The Cotton Australia Industry Awards will be held Wednesday evening. It marks the first year of CRDC directly supporting an award: the Chris Lehmann Young Cotton Achiever of the Year Award.

"This award recognises and celebrates our rising stars – those aged 35 and under making a positive contribution to Australia's cotton industry," said CRDC's Executive Manager, Communications, Ruth Redfern, who represents CRDC on the Award's selection panel.

"Recent winners of this award are a diverse and high achieving group, including Jess Strauch (2022), Emma Ayliffe (2021), Murray Connor (2019) and Bill Back (2018).

"CRDC is delighted to be supporting the awards directly, after many years of representing the industry on various selection panels. We obviously have a strong interest in the CSD Researcher of the Year category as well, with so many CRDC-supported researchers having achieved this honour over the 30 years of the awards," Ruth said.

Tickets for the Cotton Collective and Cotton Industry Awards dinner will go on sale soon via Cotton Australia.

MELANIE JENSON

GRDC Chairman John Woods, Goanna Ag CEO Alicia Garden and CRDC Executive Director Dr Ian Taylor at one of the first WAND towers erected east of Goondiwindi (Bigambul country).

WAND up for award

THE WAND spray hazard warning system has been nominated for a national award just months after the system has gone live.

WAND is a finalist in the 2022-23 IoT Awards, the official awards program of IoT Alliance Australia, Australia's peak industry body for the Internet of Things (IoT).

WAND (Weather and Networked Data) is the result of six years of collaborative research by the Grains Research and Development Corporation (GRDC) and CRDC into meteorological conditions and the spray application of crop protection products. Goanna Ag, based in Goondiwindi (Bigambul country) is the commercial partner in the system, supplying software, hardware and deployment expertise.

WAND is a spray drift hazardous weather warning system that provides real-time weather data for growers and spray operators about the presence or absence of hazardous temperature inversions. It consists of a world-first network of 100 Profiling Automatic Weather Stations (PAWS) across the grain and cotton regions of NSW and Queensland. The PAWS have remote sensing capability and new proprietary software to provide growers and spray contractors with a two-hour forecast of real-time weather data that is updated every 10 minutes.

Within days of coming on line in December 2022, hundreds of farmers and spray contractors had accessed WAND. User numbers have now grown into the thousands and the technology is being linked to other ground-breaking advancements in spray drift management such as the CRDC-supported Business Research and Innovation Initiative (BRII) challenge recipients LX and SwarmFarm. Both companies will use the system to enable their novel spray technology systems.

For more
WAND
www.goannaag.com.au/wand-app

Working together for greater benefit

AS most – if not all – cotton growers are also grain or pulse growers (among other crops and often livestock), CRDC isn't the only research and development corporation (RDC) cotton growers interact with. Mixed-farm operations have the benefit of two RDCs, the Grains Research and Development Corporation (GRDC) and CRDC to deliver impactful R&D into the field.

While the crops each require specific agronomic management, there are some on-farm issues that are common across farming systems, like weed control and resistance, spray management and biosecurity. In acknowledgement of this, earlier this year CRDC's directors and senior managers met with their GRDC counterparts for a joint board meeting.

On the agenda was collaboration, the major research priorities across cotton and grains, shared current and potential innovation investments, and sustainability.

"This is the first board meeting of its kind, presenting an invaluable opportunity to strengthen the CRDC-GRDC partnership, for the benefit of our cotton and grain growers," CRDC Executive Director Dr Ian Taylor said.

"Both organisations are focused on delivering impactful R&D, and working together we can deliver even greater benefits.

"One of the major items for discussion at the meeting was WAND: the cotton and grain spray drift prevention program with Goanna Ag: the single largest investment in CRDC's 30-year history. WAND is an excellent example of cross-sectorial collaboration helping to deliver real, tangible impact on the ground.

RUTH REDFERN

CRDC Executive Director Dr Ian Taylor, GRDC Deputy Chair Roseanne Healy, GRDC Chair John Woods, CRDC Deputy Chair Rosemary Richards, CRDC Chair Richard Haire, and GRDC Managing Director Nigel Hart.

"While WAND is certainly the largest of our cross-sectoral investments, we work closely with GRDC on a host of other R&D projects: from area wide management and novel control methods for weeds, to on-farm safety and training."

Collaboration is also extending into regions where cotton is still a relatively new crop from a commercial standpoint, such as the Northern Territory and Western Australia.

"Our CRDC Innovation Broker Susan Maas has been working closely with the Northern Australia Cooperative Research Centre (CRCNA) and GRDC as a part of CRCNA's Cotton, Grains and Cattle RD&E initiative (see story next page)," Ian said.

"We are continually looking for ways to leverage the impact of our R&D, and collaboration delivers the best outcomes for our levy payers."

Cotton growers invited to apply for CRDC board

Cotton growers are strongly encouraged to apply to join the CRDC board as part-time non-executive directors.

Applications for the CRDC board positions are currently open, with up to seven directors set to join CRDC Chair Richard Haire and Executive Director Dr Ian Taylor to oversee CRDC's investments in research, development and extension.

Applications will be assessed by a selection committee, headed up by former CRDC Chair and cottongrower Mike Logan AM. The selection committee will make nominations to the Minister for Agriculture, Fisheries and Forestry who will appoint the successful directors. Each director will be appointed for a term of up to three years, starting October 2023.

Nominations will be based upon board experience, diversity, and the skills and experience of the applicants in fields such as: cotton production or processing, data governance and application, digital literacy, science and technology transfer, social science and change management, innovation and commercialisation, environmental stewardship, economics or finance, public administration and corporate governance, and international marketing and trade.

Applications close Wednesday 7 June.

For more
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CRDC partners on Northern Australia RD&E

AGRICULTURAL production in Northern Australia will be bolstered with research beginning on the collaborative Cotton Grain Cattle (CGC) program.

This four-year, $8 million project is a collaboration between CRDC, the Grains Research & Development Corporation (GRDC) and the Cooperative Research Centre for Developing Northern Australia (CRCNA) who will oversee the program. It involves around 30 partners including universities, state/territory governments and industry stakeholders to enhance the productivity and sustainability of the northern regions of Western Australia (WA), the Northern Territory (NT), and Queensland.

Comprising six interlinked projects, the program is designed to address pressing research gaps in the emerging broadacre regions of Northern Australia, while also boosting the value delivered to the cattle industry. The program is based on an analysis undertaken by the CRCNA which highlighted the importance of integrated agricultural systems in the north. It revealed that the greatest RD&E investment value is achieved when cropping is coordinated with other activities, such as beef production. By focusing on these key areas, the CGC is set to elevate the agricultural profile of Northern Australia, creating a robust and sustainable sector that will benefit the local economy.

The six projects of CGC are:

- Crops for cattle to increase the efficiency of Northern Australian cattle production systems using local crops to improve dry season weight gain (NT)
- Fundamentals of cropping-systems that deliver sustainable growth of the agricultural sector (NT)
- Cropping-enabled cattle production enabled by feed products from irrigated cropping (WA)
- Ord River Irrigation Area (ORIA) sustainable systems for diversification of ORIA cropping (WA)
- Extension capacity of cropping systems, enhancing to sustain growth (NQ)
- Cotton, Grains, Cattle farming systems (NQ)

CRDC Innovation Broker Susan Maas took a secondment from CRDC to assist CRCNA develop the CGC program. She says the project aims to unlock the potential of the north's agricultural capabilities while ensuring responsible resource management and environmental stewardship. It also recognises the increasing importance of local cotton and grain production to optimise the northern cattle industry.

RUTH REDFERN

Comprising six projects, the $8 million Cotton Grain Cattle program is designed to address pressing research gaps in emerging broadacre regions of Northern Australia, while also boosting value to the cattle industry.

Susan was involved in creating the six linked projects that will be based across tropical North Qld, Douglas Daly in the NT and the Ord in WA.

"This initiative represents a major step forward in building on past crop-specific northern research to support the establishment of a robust and sustainable farming system," Susan said.

"The project engages with local stakeholders and has ongoing local oversight: both essential components in ensuring the project delivers on the needs of northern growers and producers, and contributes to the long-term growth and prosperity of the northern agricultural sector.

"There's a huge interest in northern cropping, and increasing demand for cotton seed and grains within the cattle industry.

"The program focuses on collaboration and regional impact, and ensures we're moving away from isolated research efforts to a cohesive farming system that benefits the entire region.

"CRDC's committed to the sustainable development of cotton in the north, underpinned by RD&E, the adoption of best practice and the meeting of community expectations: so we're thrilled to be part of the CGC program," Susan said.

GRDC and CRDC are investing approximately $1 million each into CGC, demonstrating their commitment to northern broadacre production.

Dr Joe Eyre of the Queensland Alliance for Agriculture and Food Innovation (QAAFI) at the University of Queensland is leading the Cotton, Grains, Cattle farming systems (NQ) sub-project.

He says that the program will aim to answer questions relevant to cotton-grains-cattle farming systems in North Qld and provide stakeholders with the information they need to make informed decisions.

"Our research will identify best practices for pest and disease management, canopy management, and soil water capture and conservation in the north," Joe said.

"We will also explore opportunities for increasing the value and resilience of cropping systems, and the potential for on-farm produced feed sources for cattle."

For more:
CRCNA
www.crcna.com.au

CRDC Executive Director Dr Ian Taylor commending CSIRO on its extensive upgrades and operational capacity.

ALI SMITH

R&D capability strengthened at new look ACRI

COTTON research has a secure future with the opening of CSIRO's state-of-the-art facilities at the Australian Cotton Research Institute (ACRI).

An official opening in March marked the finalisation of three years of staged renovations and new building works, via a $25 million investment from the Australian Government. The upgrades include the newly-built Cotton Management Research Laboratory, where insect resistance monitoring and crop nutrition get a boost, as well as new cotton breeding areas, and increased storage and processing areas. Previous stages have included construction of a machinery shed and workshop, utilities upgrades and a new state-of-the-art insectary.

ACRI is a unique research facility, located between Narrabri and Wee Waa (Kamilaroi country) in the cradle of the Australian cotton industry and shared by researchers from CSIRO and NSW DPI. It has housed some of the industry's most pre-eminent researchers from NSW DPI (who manage the facility) since the late 1950s and CSIRO since the early 1970s. It's been the site of cotton breeding and entomological studies by researchers who have shaped and will continue to shape the industry. It has also been a major employer in the region, with scientists, technical staff, administrators, farm staff, mechanics, gardeners and others who keep the facility running.

CRDC Executive Director Dr Ian Taylor was a guest at the opening and spoke to the crowd assembled to celebrate this milestone.

"ACRI is an asset to the local community and more broadly the Australian cotton industry," he said.

"The R&D undertaken here has had an enormous impact on the local and global cotton industry, particularly germplasm, integrated pest management, and resistance monitoring techniques.

"CRDC supported the early plant breeding and entomological work at ACRI which set the Australian industry on a successful path to where it is today, with world-leading varieties, and integrated pest, insecticide and resistance management strategies.

"CSIRO is a world-class research organisation and now their ACRI facilities have received a much-needed upgrade to suit. Our Australian cotton researchers are the envy of the world."

All about the cotton science at AACS conference

AUSTRALIA'S cotton research community will gather in Toowoomba (Barunggam country) in September for the Association of Australian Cotton Scientists (AACS) conference.

The fifth biennial conference will be held from September 5 to 7 at the Empire Theatre's Armitage Centre in Toowoomba's CBD.

The research conference is an important platform for cotton researchers to present and discuss concepts, key issues and the latest findings in research relevant to the Australian cotton industry. The event gives scientists the opportunity to hear about research across other specialisations and institutions. Research in the Australian cotton industry involves many entities including CRDC and CSD, who return as major co-sponsors of the event, along with fellow sponsors Bayer, CSIRO and the University of Southern Queensland.

"The industry's researchers are spread across the country and the conference provides a valuable opportunity to come together, network, collaborate and celebrate our work in the industry," AACS chair Dr Paul Grundy said.

"We will also welcome a number of delegates from the United States.

"Feedback and registration numbers have been positive; everyone is keen to catch up and meet new researchers to the industry we haven't had the opportunity to connect in person due to COVID-19."

Researchers can submit abstracts and register via the AACS website.

"We welcome submissions in all areas of cotton research and extension, and presentation of the papers will be scheduled into the program," Paul said.

"More information will be available on the website closer to the date.

"We've been able to keep the registration cost down this year due to support from our sponsors, including CRDC and CSD, so are expecting another successful event."

For more

Association of Australian Cotton Scientists
www.australiancottonscientists.org

Water benchmarking shows near 100% improvement

Between 1997 and 2021, Australian cotton growers have shown a nearly 100 per cent improvement in water productivity.

In 1997, the average Gross Production Water Use Index (GPWUI) was 0.62 bales/ML. In 2021, it was 1.22 bales/ML. This means growers are producing twice the amount of cotton lint than they did in 1997, with the same amount of water.

The cotton industry has been tracking its water productivity since the 1990s. This research is currently led by NSW DPI's Water Productivity research team with support from CRDC. The most recent figures were released in December 2022 and included results from the 2021 harvest.

The research team collected farm and water records from key cotton growing regions. For the 2021 harvest, 31 growers took part in the survey, representing 5.5 per cent of irrigated cotton bales produced in Australia for the year. The most recent figures show that growers used 52 per cent less water in 2021 to produce every kilogram of cotton lint than they did in 1997.

These gains have been driven by a combination of factors: the genetic improvements in cotton itself, the grower's commitment to improved water management, and CRDC's significant investment in effective RD&E.

The continued tracking has also shown that the improvement is not reflected in year-on-year GPWUI increases. NSW DPI researcher Dr Malem McLeod says that water productivity improvement has been tapering off since 2007. GPWUI was 1.13 bales/ML in 2007; 1.14 in 2008; 1.120 in 2013; 1.19 for 20118 and 1.22 in 2021.

"Although the long-term trend of cotton water productivity is increasing, there is annual fluctuation – negatively affected by low rainfall years, and bouncing back in wetter years.

"The average GPWUI dropped from 1.19 bales/ML in 2018 to 0.94 bales/ML in the drought-affected 2019, when in-crop rainfall was the lowest it has been since 1993.

"To counter the effect of drought and heat stress on the crop, growers increased the frequency of irrigation – from an average of eight to 10.4 applications. This resulted in a 1.5 ML increase in average total water input per hectare – from 10.62 ML/ha in the 2018 season to 12.07 ML/ha in 2019."

At the same time, average yield dropped from 12.35 bales/ha in 2018 to around 11.19 bales/ha in 2019. The 9.7 per cent drop in lint yield and 13.7 per cent increase in average total water use led to a 21.7 per cent drop in GPWUI from 2018 to 2019.

In the more favourable rainfall season of 2020-2021, yield climbed back to an average of 11.87 bales/ha, while the average total water input in 2021 decreased by 2.2 ML/ha – equating to an increase of 29 per cent in water productivity.

"This indicates the resilience of the industry as it bounced back during the favourable 2021 season which produced around 5.5 million bales, while also highlighting the vulnerability of the cotton industry to climate change," Malem said.

"We are looking forward to analysing the 2022 data to assess how the extensive flooding across cotton growing regions in late 2022 affected GPWUI."

The benchmarking project has highlighted that there is scope for improved efficiency in limited water situations. A new project co-funded by CRDC and NSW DPI focusing on limited water decision support for growers is led by NSW DPI water productivity R&D officer, Sarah Dadd.

"How growers apply water when it is in limited supply is complex," Sarah said.

"Some growers plant on known limited water situations, while others manage unpredicted water demands during the season.

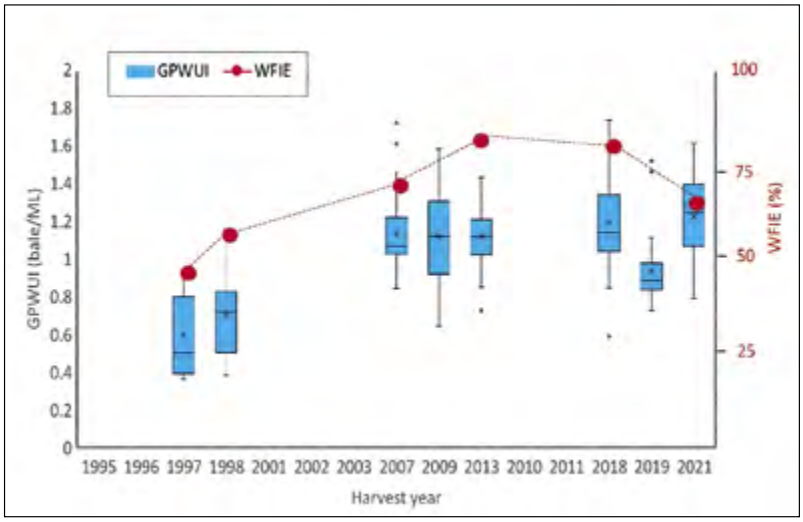

Figure 1. GPWUI and WFIE (1997 to 2021 cotton seasons): The blue boxes represent the distribution of GPWUI values in the harvest year the benchmarking occurred. The x in the centre of each blue box is the average GPWUI, the top of the blue box represents the water productivity obtained by the top 25% of growers. The red circles represent WFIE. Data prior to 2019 are redrawn from previous benchmarking from 2003 to 2014.

ALI KUCHEL

NSW DPI's Dr Malem McLeod says water use efficiency is improving, while the rate of improvement varies.

"When irrigation water is limited, it is crucial to make the most of the available water and apply water strategically and avoid yield penalties.

"It's not just getting timing and application of irrigations right – there are a lot of other farming influences, like farm layout, labour availability, crop health and soil compaction, that affect water productivity."

The limited water decision support project is collating previous R&D about water productivity in limited water scenarios, understanding where the R&D has been used, and identifying research gaps.

"We are working to develop a matrix to map water management activities to help demonstrate the interrelationship of actions and decisions on water productivity and profitability," Sarah said.

Sarah is currently interviewing cotton growers in limited water irrigation systems, to capture their experience and understand how they make decisions to optimise yield with limited water.

For more

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Key Points

NSW DPI released its latest Gross Productivity Water Use Index (GPWUI) results in December 2022 which found:

- Water productivity of the cotton farms surveyed has doubled over 24 years from 1997 to 2021.
- In 2021, half as much water was used to grow a bale of cotton compared to 1997.
- Water productivity improvement has been tapering off since 2007 compared to the period between 1997 and 2007.
- The long-term trend of cotton water productivity is improving but the annual value is influenced by seasonal climatic conditions.
- Australian growers are edging closer to CRDC's goal (outlined in the CRDC Strategic RD&E Plan 2018-2023) of increasing water productivity to 1.32 bales/ML in irrigated systems by 2023.

MELANIE JENSON

What do growers think of setting native vegetation targets?

Cotton growers are taking the opportunity to have input into a new model for managing and measuring native vegetation on farms.

The work is being undertaken by the industry's Sustainability Working Group with support from CRDC Innovation Broker Stacey Vogel. Stacey, Jenny Brown from Cotton Australia, and cotton industry sustainability adviser Chris Cosgrove have been working for more than two years to create a model that makes sense for Australian conditions and also meets the increasing expectations of customers around the world. This model has been developed in collaboration with natural resource management groups, and grower consultation is a crucial aspect of refining it and setting targets for the Australian industry's Sustainability Framework, PLANET. PEOPLE. PADDOCK.

The Working Group is now meeting with growers to explain the proposed native vegetation model in detail and seek feedback. The model will be refined based on this grower feedback.

"An industry-scale model for native vegetation on cotton farms has to make sense for Australian farms and still meet customer expectations," Jenny says.

"While cotton picking has limited growers' availability for our meetings, feedback so far shows growers are aware of the need for proactive action and are cautiously supportive of the approach we are suggesting."

There are three components to the proposed approach: regionally appropriate native vegetation targets; consistent native vegetation indicators and definitions; and regional hubs to bring all the support tools and information together for growers in one place.

Stacey said there has been broad grower support for regional native vegetation targets that align with the priorities of localised natural resource management (NRM) organisations such as Local Land Services in NSW or the Fitzroy Basin Association in Queensland.

"This alignment would make it very clear what practical and voluntary actions – if any – can be taken on a cotton farm to contribute to regional priorities," Stacey said.

"Growers' main concerns here are that industry-scale mapping is accurate and that there is a genuine effort by all growers to support the native vegetation targets.

"Getting accurate but low-cost mapping that can be consistently applied across all states and territories has been a priority for us, and we are working with researchers and governments to do that."

Growers also support the approach to create native vegetation indicators and definitions that are consistent and relevant.

"Our native vegetation indicators need to be aligned with customer sustainability frameworks to measure industry-scale progress, at no cost to growers, to show we're getting it right as an industry," Chris says.

"We are working towards consistent definitions across different state and territory legislation and with other industry sustainability frameworks like beef and grains.

"The aim is for different governments and agriculture sectors to be working together to have consistent native vegetation definitions and metrics, to coordinate work and avoid duplication, and to give clarity and coordination to all farmers.

"To this end, the Australian cotton industry is working on a separate but related project to bring cohesion and consistency for growers and industry when defining, measuring and reporting on sustainability indicators." (See story next page).

To meet a need requested by growers, regional support hubs are being proposed to provide support and coordinated action on biodiversity and native vegetation management and enhancement.

"We are continually hearing that a one stop shop is needed, due to the disparity of information and resources along with the rapidly evolving and complex nature of native vegetation and biodiversity measuring and monitoring," Jenny says.

"It's no surprise there has been strong support from growers for a hub to house information especially for trusted advice on what to do, financial support, and coordinated action with others in the area especially for pest/weed control.

"Bringing this information into one place will make it much easier for growers to take action that is specific to their region and their operation if they want to."

Consultation will continue until all growers have had a chance to review the proposed native vegetation model and targets.

Why do we need to take native vegetation on farms seriously?

Many of the people all farmers around the world rely on – customers, banks and governments – are starting to treat on-farm native vegetation impacts as seriously as they do on-farm greenhouse gas impacts. So, just as customers expect us to report cotton production greenhouse gas emissions, very soon customers will expect us to report native vegetation on cotton farms.

We don't want to wait to be told what to do by customers and governments. Instead, we see this as an opportunity to create a voluntary, industry-scale approach that makes sense for Australian cotton farms and still meets customer expectations.

All farmers, all around the world, are in the same position. But cotton industry researchers have been working for more than two years on this opportunity. This work puts the Australian cotton industry in a great position to respond proactively and take advantage of emerging market opportunities. It also makes it easier for more growers to gain value from having native vegetation on farms.

We can't tell growers what to do with their land. We do, however, want to clearly show the risks and opportunities growers and the industry face, so they can make an informed decision to support a model designed to fit in with Australian farming systems. This will in turn, maintain access to premium cotton markets, and build trust in the Australian cotton industry.

"We will not publish our proposed targets for broader feedback until we have had a chance to present them directly to cotton growers, either via farm visits or planned cotton industry meetings," Stacey said.

"We are urging growers to look out for these consultation opportunities in future, as grower feedback will be used to refine our approach."

For more

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ALI KUCHEL

Sustainability data and reporting: we're making it better for industry and growers

Work has started on an ambitious 18-month project to enhance the collection and reporting of sustainability data in the cotton industry, under the guidance of the industry's Sustainability Working Group. It is being led by sustainability advisor Chris Cosgrove, who shared with *Spotlight* why the work is happening and how it will benefit the industry and cotton growers.

Measuring and reporting sustainability at a farm or industry scale can look incredibly confusing.

This is because of difficulties encountered when attempting to measure aspects of sustainability across farms: how do we measure changes in native vegetation, soil health or human rights on one farm, let alone across an entire industry?

It's also confusing because there are so many really complicated sustainability standards and guidelines that food and fibre customers around the world use. These standards are all kind of similar, but also subtly different which is why we often see different metrics used to measure the same thing: we want to avoid this inconsistency at all costs.

The Australian cotton industry's PLANET. PEOPLE. PADDOCK. Sustainability Framework already reports industry-scale progress every year. This new project will improve and enhance sustainability data collection and reporting.

Better data = better decisions

This data will not just help the Australian cotton industry keep and maintain markets. Better data helps everyone associated with the industry make better decisions.

Better data helps industry see more clearly what is happening, and to allocate resources where they are most needed to achieve the sustainability outcomes we all want to see.

Better data gives growers evidence they need to decide if changes are needed on their farms. And better data helps everyone outside the industry make better informed decisions – to work for the industry, to partner with us, to advocate for us, to buy Australian cotton, and so on.

The cotton industry is using existing sustainability frameworks to develop its own reporting matrix.

The roadmap to better data

1. Define indicators

We've developed a reporting matrix based on the major existing and emerging global sustainability frameworks that our customers use. Some of the most important are shown here.

We're populating that matrix with indicators from those global sustainability frameworks. Where there is inconsistency between frameworks, we choose the indicators we think our customers are most likely to choose.

2. Source data

We already have industry data for many of these indicators in the matrix. Where there are data gaps we are collaborating with government and research institutions to find low-cost ways of finding credible industry-scale data. There will be no added time or cost to growers for this industry-scale data collection, beyond the industry surveys already in place like the CRDC Grower Survey (with the 2023 survey now open!).

3. Measure and value change

We will aim to use the enhanced data we collect to do the following:

- Show annual and long-term trends.
- Value natural and social capital at an industry scale. For example, instead of saying soil health increased or decreased, what was the value of that change? Or what did that change cost the industry and its growers, or how much did it save them?
- Investigate if we can set science-based targets for the industry to aim for. Science Based Targets define what level of impact we need to avoid to prevent irreversible change to ecosystems, and will increasingly be used by food and fibre customers to manage impact in their supply chain. They are defensible, clear, and don't ask for 'continual improvement'.

If all goes to plan, we hope to bring all this together for our next major five-year sustainability report, which will be completed in 2024.

4. Make it available at farm level

We hope individual farmers who want to measure their own farm sustainability will use exactly the same indicators we use at industry level, because it's so important we're consistent. The difference is farmers may choose different data sources to measure these indicators for their farm.

PLANET. PEOPLE. PADDOCK. data is at industry scale. We average data across the entire industry to show customers, government and others how the industry is performing. Because we look for data that is as low-cost as possible, it will be reliable enough to show broad industry trends but may not detailed enough to show what is happening on every farm.

Farmers wanting to measure their own farm sustainability could choose the free or low-cost data sources we use at industry level. Alternatively, they may want more detailed (and expensive) data.

The quality and cost of sustainability data will vary depending on what a farmer needs to use it for.

For example, participating in environmental markets, providing evidence to support premiums, or making large investment decisions about land use and management practices will need to be much more accurate than broad industry trend data: there may be a cost to collecting this quality of data, but that cost should be offset by the additional money to be made from premiums, ecosystem service payments, or increased productivity.

The indicators, data sources and methodologies we use will all be made available to farmers as they are finalised during this project.

For more

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Cotton carbon calculator now ready for use by growers

The ability to calculate cotton-growing greenhouse gas emissions (GHG) has become a reality with the development of a new calculator specifically for cotton.

Importantly, this tool provides a consistent accounting method for growers across mixed commodity enterprises.

Experts from the University of Melbourne's Primary Industries Climate Challenges Centre (PICCC) have developed this calculator, which gives cotton growers the tools to estimate their GHG emissions annually. The information can be used to identify how to reduce on-farm emissions, while also providing a baseline to inform growers whether participating in carbon markets is a worthwhile proposition for their enterprise.

CRDC General Manager, Innovation, Allan Williams said PICCC had developed calculators for most primary industries, including grains, sheep and beef. He has encouraged cotton growers to use the tool and provide feedback to CRDC.

"This calculator is consistent with the calculators our fellow research and development corporations (RDCs) are promoting for their commodities," he said.

"Cotton growers who also have livestock, for example, will use a very similar PICCC tool to calculate livestock emissions, using the tool promoted by Meat and Livestock Australia.

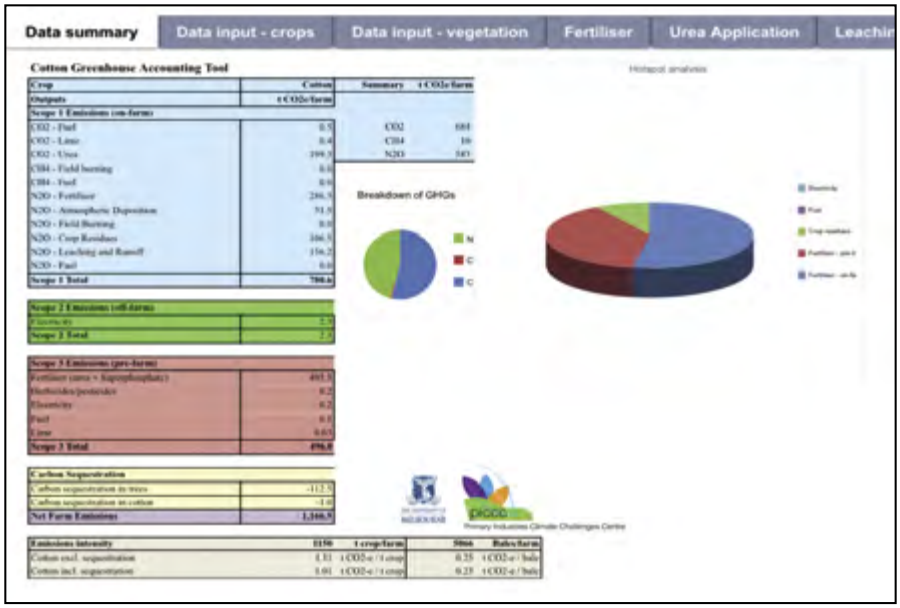
"Feedback from all producers will be passed on to Professor Richard Eckard and his team at PICCC to make the tool even easier and more accurate."

Currently the tool's main purpose is to calculate emissions. It can account for sequestration in managed forests or plantations on a farm, and in future this feature may be extended to accounting for sequestration by native vegetation on cotton farms.

"PICCC is a team of independent experts, and the calculator is aligned with the Australian government's National Greenhouse Gas Inventory method, which in turn has been approved by the Intergovernmental Panel on Climate Change (IPCC)," Allan said.

This comprehensive tool calculates Scope 1 emissions: 'direct emissions' within the farm's control such as nitrous oxide from fertiliser; Scope2 emissions: 'indirect emissions' from purchased energy – electricity and diesel; and Scope 3 'pre-farm emissions: all other indirect emissions outside the farm's direct control such as from urea manufacture.

The specific commodity calculators are also forming the basis of a collective cross-sector project, led by Agricultural Innovation Australia and supported by CRDC, to develop a whole-of-agriculture carbon footprint solution (see story next page). The *Know and Show your Carbon Footprint* initiative will see the development of a cross-commodity platform to help growers baseline carbon emissions and understand their residual footprint.



Is the calculator easy to use?

Yes! All you need to do is:

- Go to https://piccc.org.au/resources/Tools.html
- Click to download 'Cotton GHG Accounting Framework'
- Enter data asked for in the DATA INPUT – CROPS tab. It will calculate total cotton growing emissions and emissions per bale in the DATA SUMMARY tab.

We'd love to hear from you:

- Is it clear how to use the calculator? If not, what would improve its ease of use?
- Any technical questions or suggestions.
- Any feedback that will help this calculator become part of your toolbox.

Provide feedback to Allan Williams by July 30.

For more

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Mixed farming operators who have been searching for a way to understand their whole-of-farm carbon emissions will be supported through a new *Know & Show Your Carbon Footprint* initiative, supported by CRDC.

Developing standardised carbon accounting across commodities

The cross-sectoral initiative is underway to develop a solution that enables Australian farmers, fishers and foresters to understand their enterprise's carbon footprint and make better informed decisions to reduce emissions and capture new opportunities.

It is being led by Agricultural Innovation Australia (AIA), of which CRDC is a member.

AIA is a not-for-profit public company established by Australia's rural research and development corporations (RDCs) to facilitate joint investment and collaboration in cross-sectoral agricultural issues of national importance.

While there has been much work at a scientific and academic level to understand the carbon footprint of agricultural commodities, tools have not been readily accessible to growers, prompting the RDCs, through AIA, to focus on a whole-of-agriculture solution.

"Access to this information can support growers with market access, carbon market opportunities as well as increased confidence when dealing with stakeholders, including financial institutions, around natural capital and asset management," AIA CEO Sam Brown said.

AIA starts all initiatives with an in-depth discovery phase to ensure they fully understand the problem to be solved. Twelve RDCs are participating in this phase to give AIA a deeper understanding of current gaps, pain points and specific needs of the growers, commercial players and solution providers across the different commodities.

"What we are already hearing is that many growers are operating mixed enterprises or are keeping that option open to manage risk into the future," Sam said.

"This is why it was important for us to focus on a common and standardised carbon accounting framework.

"Growers are also concerned about potential future market access issues and being able to identify ways to reduce the carbon footprint of their entire enterprise."

This move aligns with CRDC and the Australian cotton industry's cross-sectoral approach to setting biodiversity and native vegetation targets that are based on a standardised definitions and calculations (see story page 12).

MELANIE JENSON

Growers are concerned about potential future market access issues and being able to identify ways to reduce the carbon footprint of their entire enterprise, according to AIA CEO Sam Brown.

Carbon accounting is an important aspect of natural capital along with biodiversity and native vegetation. The AIA strategy is consistent with feedback from recent grower forums held by CRDC to develop an industry biodiversity strategy.

The design of the *Know & Show Your Carbon Footprint* solution is being informed by agricultural carbon accounting situations in other countries. AIA analysis has shown that Australian agriculture is in a prime position to move early and together create a common, consistent platform, and to avoid the fragmentation, duplication and inconsistences other markets are now faced with.

The initiative has already garnered interest from the private sector, including supply chain organisations and commercial providers.

"We've held discussions with potential private sector investors and partners," Sam said.

"They see clear efficiencies in bringing the RDCs' commodity-specific carbon research and knowledge together and want to be able to include this type of carbon footprint solution in their own client service offerings."

For more

Agricultural Innovation Australia

www.aginnovationaustralia.com.au

Looking for new alternatives

Boomi (Kamilaroi country) dryland farmer and grazier Tim Houston hasn't officially started his Nuffield global focus program studies, yet he's already champing at the bit to get going.

Tim has recently returned from New Zealand's south island, where, as the 2023 CRDC and Cotton Australia-supported Nuffield Australia scholarship awardee, he joined around 200 alumni at the Nuffield International Triennial Conference. With the 2023 theme 'Beyond', the conference provided an opportunity to learn, experience, share and debate during a nine-day trip from Christchurch to Queenstown across some of NZ's most scenic routes. The conference attracts key decision makers, investors and ag influencers from around the world, and offers the Nuffield alumni the chance to continue to learn, innovate and build international networks and business connections.

It wasn't just the incredibly scenic landscape and diverse farms in the south island that blew Tim away.

"The New Zealand trip was above and beyond my expectations," Tim said.

"Farmers over there wake up to million-dollar views every morning, and we saw really diverse businesses which are great at value-adding to their products with on-farm processing and marketing.

"But I was really blown away by the intelligence, knowledge and insights of the Nuffield alumni on the tour – what an amazing group of people.

"I met people from all countries of all ages, some in their eighties, which is testament to the saying that 'Nuffield Scholars are scholars for life'.

"The conversations I had and the breadth of their experience and knowledge was amazing.

"Nuffield says their scholars are innovative, free-thinking people and I found this out this in NZ."

Tim says there is common thread that ties such a diverse demographic together: a passion for agriculture and a thirst for knowledge.

MELANIE JENSON

Tim Houston has returned from his first Nuffield experience which has made him even more eager to start his study which will explore how to sustainably intensify broadacre farming.

"Everyone I met was passionate and interested in agriculture, what others are doing around the world and how to do things better," he said.

For Tim, this ethos is part of farming.

"Here at home, we are always looking over the fence to see what others are doing," Tim said.

"I believe there's always a way to do things better, so we look outward to bring relevant info back to our own operations.

"After the tour in NZ I am really keen to now go on my global focus program and to see these other countries and meet people."

Tim's Nuffield global focus program will take him to Argentina, Ireland, France and Poland to explore his topic of how farmers in other parts of the world are navigating the challenges of 'sustainable intensification', or doing more with existing land, without creating negative impacts on the business, the environment or communities.

"I want to know how landholders are managing this concept in a way that actually provides positive social, economic and environmental outcomes – a triple bottom line," he said.

"I'll be keen to share new knowledge and my experience with others in the industry through my final report when I'm finished, along with taking up other opportunities for learning that Nuffield offers which I really experienced in NZ."

As part of Tim's studies, he will be meeting with CRDC Innovation Broker and CottonInfo NRM Technical Lead Stacey Vogel to discuss cotton's proposed native vegetation model (see story page 10).

Keen to be a scholar for life?

If you're interested in being a part of an exciting program with access to a global network of passionate people in agriculture, the CRDC and Cotton Australia-supported Nuffield Scholarship is for you. Applications for the 2024 intake close on June 9, with applications encouraged from those keen to research both drought resilience and sustainability. Applications are open to those involved in food and fibre production typically aged between 28 and 45. Each cotton scholar receives a bursary valued at $35,000, enabling them to travel overseas both individually and in small groups, studying a topic of importance to the scholar and the cotton industry, and reporting back on their findings.

For more

Nuffield Farming Scholarships

www.nuffield.com.au

Reduce nitrogen inputs to improve carbon storage

Reducing the incidence of over-application of nitrogen (N) to cotton crops can lead to substantial emissions abatement, a reduction in variable costs and higher profits.

Avoided N:	Avoided N2O	Average size farm	Enterprise gross revenue
70kg/ha	5.75 kg/ha	495ha	$6240/ha

The outcomes for the industry of adopting an N BMP certification over a 25-year period.

Industry research has shown that emissions factors increase exponentially above a certain N application rate. Adopting nitrogen best management practices (N BMP) has the potential to provide long-term additional value through reducing greenhouse gas emissions and improving the environmental condition of a farm, such as increasing stored soil carbon.

Economic benefits can be achieved through input savings from sample baseline scenarios, as well as improved productivity and market premiums for sustainable products, emissions and pollution reduction, and carbon sequestration.

"This is an area of economic consideration that current private sector and government activity suggests will drive markets and influence the value of credits schemes (current and planned) and premiums paid for more sustainable products," says AgEcon's Jon Welsh.

AgEcon were commissioned by CRDC to study the outcomes of implementing N BMP (as identified in the More Profit from Nitrogen (MPfN) program) and applied to the Australian cotton industry over 25 years.

Farm-level benefits

The economists reviewed and assessed the theoretical environmental and economic benefits, as well as associated additional costs, of implementing N BMPs on-farm under a farming enterprise audit certification that pays a one per cent product premium.

This study builds on the MPfN Program recommendations of researchers led by Dr Dio Antille of CSIRO who examined a methodology for determining the Most Economic Rate of Nitrogen (MERN) and its subsequent influence on improved adoption of N BMP.

An investment analysis was used to evaluate the longer-term economic benefit, as well as associated costs, of on-farm N BMP adoption in the context of participating in a certification scheme.

The emissions calculation is based on the non-linear equation with the difference between 300 kg N/ha and 230 kg N/ha (MERN) applied. The outcomes for the industry of adopting an N BMP certification over a 25-year period are shown in Table 1. N rates (kg N/ha) were adapted to reduced levels recommended for specific research sites, or where stipulated, region or industry, from research findings of the MPfN program.

For a high-value crop such as cotton, achieving a one per cent premium for cotton lint easily outweighed BMP certification costs. The same was true in cherries, dairy and sugar. Under the assumptions used, adoption among the industries showed an immediate payback with significant internal rate of return.

The analysis found carbon abatement results well above the average price of $16/t CO2e offered in the Australian Governments' Emissions Reduction Fund (ERF) reverse auction. The public benefit applies the ERF average price to emissions abatement calculations to examine per hectare public benefits.

"The decision on whether a farming enterprise should consider investing in N BMP recommendations can be informed by applying performance metrics that compare new or updated N BMPs with business-as-usual scenarios," Jon said.

"With marginal returns increasing at the optimal N rate, this effectively changes the shape of the nitrogen response curve – instead of a rising response curve rising and flattening out and maximum yield in a traditional scenario – a spike now exists where there is a premium available for abatement and sustainable practice."

Trade in global goods is becoming increasingly aware of environmentally responsible farm production as evidenced by the rise in certification schemes.

Markets and consumers demand more action from industries in addressing emissions, and N fertiliser use is a significant contributor to the carbon footprint of cotton production.

"This study introduced a new paradigm for profitable N BMP adoption in the cotton, sugarcane, dairy and horticulture industries of the MPfN Program," Jon said.

"On an average-sized farm, adopting a theoretical N BMP certification showed significant economic returns and immediate payback, particularly in high-value (per ha) crops such as cotton and cherries.

When N use was more than the framework NUE, as proposed by MPfN researchers, it was economic and public benefits that remained the highest."

For more
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RUTH REDFERN

Clever Cotton: CRDC's new bold plan for RD&E

CRDC's new Strategic Research, Development and Extension (RD&E) Plan for 2023-2028 will shortly be signed off by Cotton Australia and the Minister for Agriculture, Fisheries and Forestry, before coming into effect on July 1.

The plan, Clever Cotton, sets out a vision for a sophisticated, prosperous and sustainable Australian cotton industry that is strongly connected to its value chain. It commits CRDC to invest in RD&E to address and capitalise on challenges and opportunities for the benefit of levy payers, the cotton industry and the wider community.

The plan defines what CRDC aims to achieve over the next five years and what it will do to get there, recognising that the industry operates in uncertain times and needs 21st-century approaches to overcome 21st-century challenges. As CRDC Executive Director Dr Ian Taylor says, the greatest challenges offer the greatest opportunities for change, innovation, and decisive leadership: three traits synonymous with the Australian cotton industry.

"Clever Cotton provides a pathway for the cotton industry to address complex systems issues. Our vision for the future is to create a sophisticated and prosperous cotton industry: one that seizes opportunities through advances in science and technology, harnesses the creativity of people, and reimagines our farming practices to deliver more sustainable cotton," Ian said.

New plan, new approach

Built on the foundations of Paddock, People and Planet (which you may recognise from the Australian cotton industry's PLANET. PEOPLE.

PADDOCK. Sustainability Framework), CRDC's new strategic plan has a significantly different look and feel to previous plans as CRDC moves from a project-centric approach to one based around larger programs of work.

Ian explains that this shift helps CRDC remain focused on delivering solutions to big challenges.

"One of the main benefits of shifting to a program approach is that we'll be investing in bigger, collaborative programs of work, where we bring together all the relevant researchers and interested growers around a specific area – be it disease, or water use efficiency, or carbon," he said.

"In the past we've invested in specific, individual research projects; now we're going to be investing in whole programs of work that aim to really shift the dial on impact for growers in these critical areas.

"Our new approach also brings new partners into the mix – new industry and commercial partners to help us address the complex problems facing cotton and agriculture, like climate change, sustainability, digital disruption and biosecurity.

"Together with our core cotton research community, these new partners will help us deliver better solutions more rapidly for our cotton growers."

CRDC Chair Richard Haire said the new approach, and the wider strategic plan, is about ensuring the sustainability of our cotton system, while also stretching the limits of its performance.

"The plan ensures that our wonderful industry, built on a relentless pursuit of continuous improvement, remains nimble and agile in the face of a dynamic external environment," Richard said.

"It also ensures that CRDC as an organisation remains focused on maximising our impact by optimising the output of the resources we intend to invest across the life of this plan."

Importantly, Richard says, while the plan may look different in many ways to its predecessors, it retains elements that have proven so successful in delivering sustained industry excellence over CRDC's 30-plus years.

"The attributes of authentic collaboration driven by curiosity, a deep-seated respect for disciplined adoption, and a generous willingness to share our learnings have created an ecosystem of excellence that is admired both here and abroad, and these elements remain vital to the delivery of the ambitious goals in this new strategic plan."

New pillars, new look team

Clever Cotton is built on three pillars of investment: Paddock, People and Planet. Each pillar contains three themes, creating nine key investment areas.

This has required changes among the CRDC R&D team's areas of responsibility, along with a title change to 'Innovation Brokers' to reflect and align with the new plan's focus on the brokering of innovation.

"Our familiar faces from the last plan are still with us, but have new titles," said Ian.

"We have Allan Williams as our General Manager of Innovation, leading a team of Innovation Brokers: Susan Maas, Elsie Hudson, Merry Conaty, Stacey Vogel and Rachel Holloway, plus Innovation Process Developer Warwick Waters.

"We are also delighted to welcome Nicola Cottee to the team.

"This is an exceptional group of Innovation Brokers, with a wealth of knowledge, expertise and contacts across their respective areas, and they are approaching this new era with enthusiasm and energy for the innovations ahead."

For more
CRDC Strategic RD&E Plan
www.crdc.com.au/strategicplan

Former CRDC-supported scientist joins team

Former cotton scientist Dr Nicola Cottee has returned to her research roots, joining the CRDC Innovation Broker team.

Nicola has a long-standing association with CRDC, the industry and cotton research. She completed her CRDC and CSIRO-supported PhD into the heat tolerance of cotton at ACRI in 2009.

Since then, she has worked as a postdoctoral fellow with CSIRO, as a research direction & stewardship policy officer with Cotton Australia, and most recently, as a senior technical advisor with the NSW Environment Protection Authority.

Nicola is based in Sydney, and has joined the CRDC team part time as an Innovation Broker.

CRDC Executive Director Dr Ian Taylor said Nicola brings extensive cotton experience to CRDC.

"We are delighted to welcome Nicola to the CRDC team as we prepare to start investing under our new Strategic RD&E Plan 2023-28. One of the core pillars of our new plan is People, and our goal under this pillar is to continue to develop our world-class researchers.

"Nicola is a perfect example of this: a former CRDC-supported PhD scholar, who went on to work as a researcher, policy officer and technical advisor, bringing her experience and skills back to CRDC to lead a portfolio of investments.

"Nicola's strong network and experience will be of great benefit to CRDC and the cotton industry."

From field to field: circularity project fires up after floods

The next stage in identifying a scalable, long-term solution to the issue of textile waste in landfill is now underway with cotton farmers harvesting phase two trials on farms in Queensland and now NSW.

Goondiwindi (Bigambul country) grower Sam Coulton, inspired by the environmental benefits of diverting hundreds of thousands of tonnes of textile from landfill each year, hosted the phase one trial during the 2021-22 season. Gunnedah's (Kamilaroi country) Scott Morgan, a leading cotton farmer in sustainability, has this season become part of the project. Scott said his decision to take part in the trial was easy, as he has been an early adopter of a large-scale solar generation and numerous water conservation projects on his farm.

"I'm excited about returning 100 per cent cotton back to farms because I think helping close the circularity gap is the right thing to do for the environment," Scott said.

"My strong hope is that the cotton waste can also improve soil health and organisms – thereby improving crop yields."

Flooding last year delayed spreading, however in late December, Scott was able to distribute around 2.4 tonnes of the shredded material onto an already planted cotton field. The material was then watered into the soil using overhead irrigation. Scott said the healthy crop was harvested in late May.

Meanwhile at Goondiwindi, poor weather, heavy flooding and logistics issues also impacted Sam Coulton's trials, with 600 kilograms of cotton waste added to a trial plot. This was less than hoped for but significant in his second year of the trials. The material has now broken down and is far less visible in the soil.

"The first phase was positive, but with COVID and poor weather we were limited in what we could achieve," Sam said.

"I am hopeful this phase will lead to a major transformation in cotton circularity."

In terms of soil health, the test results from phase one were very encouraging. Soil scientist Dr Oliver Knox, head of the University of New England's Cotton Hub and CottonInfo's Soil Health Technical Lead, is overseeing the research component of the trials.

"Firstly, this work is very important in helping to resolve the issues caused by Australians throwing away 23 kilos of textile waste per person each year," he said.

"Importantly, we found that in the first year, cotton textile waste had no adverse impact on soil health or yield.

"The lack of effect on the crops last season was exciting, because it provided evidence that we can divert this material from landfill, where it has the potential to generate methane, and instead apply it to a productive system where it has the potential to feed the soil without a detrimental effect on a valuable crop.

"Another exciting observation was where we applied the shredded cotton and compost at 50 tonnes/ha to an area of stock route.

"In these soils we saw an increase in soil organic carbon and also sulphur.

"The organic carbon in the top 10cm of soil increased from 0.77 per cent to 1.08 per cent, which is a significant jump. Sulphur has also increased from 4.5mg to 7.4mg per kilogram – an indication of improved soil fertility and health.

"The potential to improve these soils, which are still relied on for cattle movement and feeding in times of drought, suggests further opportunities as well as insight into what we might achieve over time under the cropping areas of the farm."

Phase two program partners Cotton Australia, Goondiwindi Cotton, CRDC and Sheridan have been joined by Thread Together, a charity that adopts an ethical response to the issue of fashion excess. CEO Anthony Chesler said the company's focus was recycling excess stock as opposed to textile waste.

"Thread Together never declines a donation of excess clothing and sometimes this creates more supply than demand," Anthony said.

"As part of this new challenge, we were pleased to work with the Worn Up company to ensure 100 per cent cotton garments were shredded and dispatched to Gunnedah."

Tanya Deans, President Hanes Australasia, said after the success of the Goondiwindi trial, Sheridan was delighted to be involved in phase two.

"Progress towards circularity is an important part of our sustainability journey and Sheridan, together with the wider Hanes business, is committed to supporting this effort in the provision of cotton waste offcuts," Tanya said.

"I'd also like to thank CRDC and Thread

ALI KUCHEL

Goondiwindi cotton grower Sam Coulton with Dr Oliver Knox at Sam's farm after the cotton waste material was applied to the field last year.

Together for supporting this mission with their generous contribution as well. This is just the beginning of innovative solutions on our shores and we are proud to be a part of it."

As well as providing funding for Oliver's leading research and development in this area, CRDC has committed almost $2 million over the next three years to a new suite of projects to complement this initial work.

CRDC Innovation Broker Dr Merry Conaty oversees this investment for CRDC and said it is aimed at increasing the industry's understanding of the science of textile waste breakdown and its effects on soil health, as well as the logistics and business challenges of processing and transporting textile waste back to cotton farms.

"This program of work could be a game-changer for the Australian cotton industry in achieving circularity. Ensuring scientific rigour is essential: we need to fully appreciate the soil science and the long-term impact of returning cotton textiles to the farm.

"At a farm level, we need to quantify the effect on such aspects as our carbon footprint, soil health and soil water holding capacity, our environment including waterways, while also assessing the impact on brands, customers and other stakeholders.

"One of the new CRDC-supported projects underway is a three-year investment with the University of Newcastle to continue investigating the effects of dyes and finishes from textile waste material on soil health, especially on the diversity, growth and functioning of soil microbes which are critical for the health and resilience of soils across the landscape.

"This project will also look at ways to pelletise cotton textiles through biological breakdown of the waste material to enable spreading on fields using existing farm machinery."

Leading the Goondiwindi and Gunnedah circularity project is Cotton Australia's Brooke Summers, who works closely with brands and their consumers through the Cotton to Market program.

"The results from phase one show it's possible to find a scalable solution to cotton textile waste right here in Australia," Brooke said.

"Our farmers want it and they are passionate about returning cotton waste to their farms to become part of the next crop, closing the loop on circularity.

"Cotton consumers want it too and they are demanding environmental solutions as part of their purchasing decisions.

"Phase two should bring us a step closer, but we need the committed involvement of governments, industry groups, brands and potential investors.

"All the results are being scientifically assessed before a full report is produced to guide future circularity developments."

For more
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Feeding the soil and not the plant: ‘organic diet’ returns greater soil nutrient availability

MATT CHAMPNESS

Taking the approach of feeding the soil rather than the plant using chicken litter improves nutrient availability and uptake of nitrogen (N) in cotton crops.

Poultry litter preserves the soil N pool, supports soil microbial growth and supplies other key nutrients to the soil. The litter also releases phosphorus (P) slowly throughout the growing season and could replace the need for mineral P application. While not impacting urea uptake, litter supports greater total N uptake by the plant.

These are the findings of a long-term study in NSW’s Riverina (Wiradjuri country) where litter is a widely available by-product of the poultry industry. It’s used by growers in the Murrumbidgee Irrigation Area (MIA) for restoring cut areas in laser levelled fields, ad hoc soil health benefits and sometimes P nutrition. Dr Jackie Webb and Dr Wendy Quayle of Deakin University have quantified the impact alternative amendments such as poultry litter have on cotton crops, soil health and urea fertiliser efficacy. Understanding N, P and potassium (K) nutrient release and the plant and soil responses, provides further understanding of the litters’ ability to perform in crop nutrient budgets.

The research was undertaken with support from CRDC and the National Landcare Smart Farming Partnerships Program at De Bortoli’s farm near Griffith.

Industry research consistently shows urea-N fertiliser uptake by plants is low, at around 17 to 32 per cent. Determining how poultry litter affects fertiliser N cycling and soil nutrient supply over the growing season under real-world field conditions could help improve these figures.

“We tested urea applications of zero, 50, 150, and 300 kg/ha with or without poultry litter (equivalent to 15 tonnes),” Jackie says.

“Our key findings are that while poultry litter has limited impact on increasing urea uptake, it offers other benefits for soil and plant N cycling.

“This research highlights the need to manage the soil N pool as the main source of N to the crop, involving integration of manure amendments and reduced rates of urea fertiliser to feed the soil N pool.”

Urea uptake

The trials showed that on average, the crop sourced most of its N from existing soil reserves (62 per cent), with 20 per cent from urea and an estimated 18 per cent from poultry litter. This explains the lack of yield response in the study, which is often observed in other field trials.

“Most of the urea that we tracked through 15N isotope enrichment ended up being retained in the soil,” Jackie says.

“The greatest losses to the environment, of up to 39 per cent, were in the highest treatments of 300kg N/ha and although poultry litter did not impact plant urea uptake, it did consistently support greater total plant N uptake.”

Poultry litter supported higher microbial biomass throughout the season and boosted and retained total soil nitrogen in the form of organic N. By harvest, soil total N levels in the litter amended treatments remained on par with measurements taken prior to urea application, while a significant decline was seen in non-amended treatments even when high urea rates were applied.

ABOVE: **Aerial view of the hand-picked microplots at harvest where 15N-labelled urea was applied for the poultry litter study.**

With such high total N levels in the top soil at the end of the season (0.13 versus 0.09 per cent) these benefits could flow on to subsequent crops.

Sustained release of soil nutrients

Poultry litter was found to be a key player in P and K supply, while the rate of N supply varied depending on which form it was in, whether nitrate or ammonium (NO3 and NH4).

The researchers tracked the soil nutrient release trends throughout the growing season, after litter application, to determine how the timing of soil nutrient release matched the plant's needs. They found the crop was getting all N requirements regardless of urea application rate or litter amendment during the key uptake phase.

"These in-field measurements of soil N supply are proof that soil mineralisation is an important source of N to the cotton crop," Wendy said.

"P in the form of phosphate from the litter continued to be released over the growing season, which is promising for avoiding P losses from the soil, however litter treatments were only meeting 11 per cent of the crop's P needs during peak demand.

"If the crop's peak demand for P occurred more than a month later (when the highest soil P availability was observed), then poultry litter could have met up 41 per cent of the plant's P needs, so perhaps the litter application could be managed to synchronise with crop P demand."

All in all, poultry litter is shaping up as an available, viable alternative for cotton growers in the Riverina.

"While the variable physical and moisture content characteristics of poultry litter can make it difficult to prescribe application rates and timing for plant nutrient management, using it to feed the soil, from where plants directly source most of their nutrients from, improves mineralisation and overall nutrient uptake and therefore offsets more expensive mineral fertiliser and less sustainable inputs," Wendy said.

The research has added to knowledge around managing nutrition and soil health in the variable red/brown soils found in the region. CRDC has supported various soil health projects focused on southern growing regions, most recently through a Grassroots Grant project in the region to better understand highly variable soils.

WENDY QUAYLE

Plant Root Simulator probes (PRS® probes) were deployed across all stages of the growing season to measure soil N, P, and K release rates.

For more

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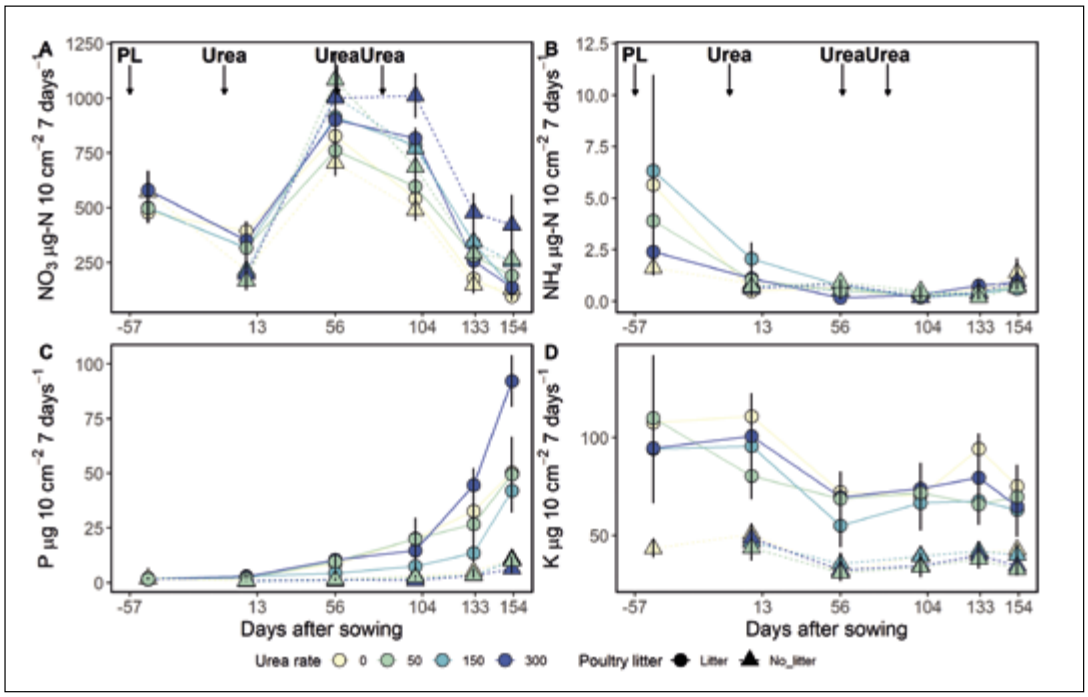
www.doi.org/10.1007/s10705-022-10251-z



Time series of nutrient supply rates in the surface soil over the 2020-2021 season.

MELANIE JENSON

Up the creek… with a paddle, nature and science

There's no better way to appreciate a river than with a kayaking adventure, especially when kids and cotton growers are involved!

A group of around 50 growers, interested locals, scientists and staff from local natural resource management (NRM) groups and children gathered on the banks of the Gwydir River east of Moree (Kamilaroi country) in March ready to take to the water.

It was an opportunity to share CRDC-supported research into biodiversity and ecosystems services through talks from aquatic experts, entomologists and ecologists about what animals contribute to natural pest control in the region and how to manage their habitats. They were joined by Moree-based indigenous educator Kerry Saunders of Yinarr-ma who shared her cultural heritage and local bush tucker knowledge.

Out in the kayaks, David Preston from the Department of Industry and Environment led the paddling and shared his knowledge of environmental flows and riverine health. He was joined by Jay Barnett from OzFish Unlimited and NSW DPI's Rodney Price, who leads the fish-friendly water extraction program to install fish screens in northern NSW.

Staying dry on land, cotton industry scientist Simone Heimoana of CSIRO was on hand to talk about pest suppressive landscapes: those landscapes that have the right mix of habitats to support beneficial insects, bats and birds, while discouraging the build-up of insect pests. Simone spoke about how healthy remnant native vegetation with few weeds and an intact understory is the greatest contributor to building such a landscape and the fact that native vegetation is also linked to better soil retention and carbon sequestration.

She explained that CRDC-supported research from the University of New England has found that bats contribute ecosystem services in the form of pest management, to the value of $99-$126/ha in dryland and $286-$361/ha in irrigated cotton. The presence of bats and birds on cotton farms has also been found to be an indicator of the health of the farm ecosystem.

Simone explained that insect pests are more commonly found on exotic weeds than on native plants, for example, box thorns commonly harbour green vegetable bugs. Research has showed that weeds in general harbour pests, whereas native vegetation supports beneficials when crops are fallow.

ABOVE: Kerry Saunders' (left) presentation on the nutritional benefits of native grains and local cultural information was popular with adults and children alike.

Queensland University of Technology (QUT) ecologist Dr Susan Fuller was also at the event, talking about acoustic monitoring technology for bats and birds. With the Australian Government National Landcare program's Smart Farming Partnership Initiative, CRDC has supported a project to develop this technology, offering growers and the industry a clear idea of what lives in and relies on vegetation on cotton farms, allowing their contribution to IPM and other ecosystem services to be calculated.

Birds and bats are notoriously hard to survey, particularly if they are nocturnal and small – as is the case with microbats which are important and valuable predators of insects. Susan said using the technology, QUT researchers had found 10 bat and seven bird species that use or are dependent on remnant or restored vegetation on cotton farms.

Making the trip from Armidale (Nganyaywana country), UNE's Dr Rhiannon Smith shared the latest from her ongoing CRDC-supported research into revegetation techniques and the co-benefits of native vegetation. This information has been distilled into the new publication *Native Revegetation Guide for Australian Cotton Growers,* available via the CottonInfo website.

Creating the guide required collating measurements and undertaking trials across NSW to provide the first research-based publication of its kind specifically for cotton-growing environments in Australia. This created a lot of interest among participants from both inside and outside the cotton industry, who were keen to know more about the suitability of certain trees and plants to the area and tips for successfully growing them.

Blake Phillips manages farms west of Moree for Unibale and described the day as "brilliant". He and his nature-loving kids had been looking forward to the trip after it had been postponed several times due to wet weather.

"It was brilliant, my kids and I spend a lot of time in the bush chasing bugs and insects, we love being outdoors in nature," he said.

"The day was really informative; we learned a lot of different things – for instance I didn't know that some of the bats and birds can eat their bodyweight in insects in one night!

"I am a farmer but also an environmentalist for the bush: it's where we like to spend our time and look after it.

"The bush is so alive at the moment, the wildflowers and the bugs, and we've found native bees out here lately. I've read up on them and there are over 500 types of native bees: we look for them wherever we go.

"On farm, we are also always on Satacrop and Bee Aware, looking at where the hives are. We manage by the book and look after our refuges and have native corridors with healthy riparian zones along the river.

"We've also returned a portion of the farm near the river to bush as it was better suited to that."

Kerry Saunders' presentation was a winner with all, and Blake plans to book in for a full tour with her in Moree soon.

"The kids are as keen as mustard to get involved in that, they loved it," he said.

"It was such a good day and a great mix of stuff – it's a shame it wasn't for two days so we could go further up the river!"

The event was organised and hosted by CRDC Innovation Broker and CottonInfo NRM Technical Lead Stacey Vogel and CottonInfo Gwydir Regional Extension Officer, Janelle Montgomery. The family-friendly event was supported by CRDC, CottonInfo, the Biodiversity Conservation Trust, Landcare NSW, the Murray Darling Basin Authority and the Australian Government. Stacey is planning on hosting similar trips in other cotton-growing valleys.

In the meantime, for growers wanting a closer look at their region's on-farm biodiversity, the *Managing biodiversity on cotton landscapes* tool identifies the biodiversity, threatened and iconic species, priority areas and management actions for each cotton-growing region's Local Government Area. It's available on the CottonInfo website.

MELANIE JENSON

Kayakers make their way upstream on the Gwydir River, enjoying a guided tour and commentary on biodiversity and river health.

For more

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www.cottoninfo.com.au/managing-biodiversity-cotton-landscapes

www.cottoninfo.com.au/publications/native-revegetation-guide

How medicine met ag in an innovator's mind

Nanoparticles that were originally created to treat cancer in humans are being further developed to protect cotton crops from drought, and to deliver agrochemicals and fertilisers directly into plants, avoiding environmental exposure.

This innovative approach is the brainchild of this year's CRDC-supported ABARES Science and Innovation award winner, Dr Cong Vu, who is applying his expertise in biomedical science to the cotton industry.

"We are able to use nanoparticles to deliver various types of agrochemicals, pesticides and fertilisers into a precise location in a cotton plant, which minimises residues in the environment," Cong said.

"The agrochemicals are loaded inside nanoparticles, to guard against pesticide loss or degradation in the environment.

"This will enhance efficiency of these products over an extended duration and protect crops for longer."

Cong completed his PhD in nano-medicine at the University of NSW (UNSW), as part of a world-leading group using nanotechnology to deliver anti-cancer drugs to cancerous cells while leaving healthy cells alone. One afternoon in the lab, while researching the history of cancer drugs, Cong came to realise that anticancer drugs and pesticides share many characteristics, such as poor water solubility and off-target toxicity.

"It got me thinking, if I can develop nanoparticles to promote drugs to targeted cancer cells in the human body, why can't I do the same for agrochemicals in plants, while reducing the effects of pesticides on the environment?" he said.

"We can control the morphology (structure) of the nanoparticle, and by doing that we can control where the nanoparticle can get inside the plant."

"If I can develop nanoparticles to promote drugs to targeted cancer cells in humans, why can't I do the same for agrochemicals in plants?"

STEVE KEOUGH

Federal Minister for Agriculture, Fisheries and Forestry, the Hon. Senator Murray Watt with Dr Cong Vu at the awards announcement.

In the true spirit of modern innovation, in 2021 Cong founded the start-up Nanosoils Bio to develop these agro nanoparticles, with the support of Professor Justin Gooding. Nanosoils was incubated by NSW DPI, the GATE program and accelerated by Sparklabs Cultiv8. Professor Brajesh Singh from Western Sydney University has also lent his support to the trials.

"I realised we can expand and translate our technology from medicine to agriculture by developing nano-agrochemicals and now we are also looking at the drought-resilience aspect using silica nanoparticle technology," Cong said.

"The nanoparticle helps the plant tolerate drought stress and can also be a nutrient for the plant.

"My aim is to maximise the uptake of silica nanoparticles in cotton to help the plants deal with drought stress, which accounts for 67 per cent of yield loss, according to industry studies."

Cong says the technology could be used as a seed coating, replacing traditional methods and nanoparticles could also be added to fertiliser. While still at the early testing stage, results are promising and Cong is enjoying working in agriculture for the first time as a part of a start-up.

"I find it is very interesting, and surprising, as I didn't think I'd be working with the cotton industry here," he says.

"I came to Australia from Vietnam to study nano-medicine and expected to be a medical researcher at a university somewhere. But this discovery happened and I'm now looking forward to applying my research for the cotton industry."

Cong says a similarity in medical and agricultural research is making innovations for the benefit of the end users.

"Instead of being a medical researcher providing technology to doctors and surgeons to treat patients, I'm providing agricultural research to farmers to treat their plants," he said.

While cotton is his first priority, Cong hopes to one day expand the technology to food crops including barley, wheat and rice.

For more
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Special early careers day at this year's CCA seminar

Registrations are now open for the Crop Consultants Australia (CCA) flagship event in July.

The CCA Cropping Solutions Seminar, aptly themed *Growing Connections*, will span over three days from July 25 to 27 at the Crossing Theatre in Narrabri (Kamilaroi country).

The program is unique in that the agenda of CCA's seminars and workshops are set by the membership. It is a process that CCA has implemented since the inception of its events more than 30 years ago, and it continues to differentiate the learning experience of those who attend.

Topics of priority this year include integrated pest management updates, managing for spray drift events, ongoing professional development opportunities and employment updates for consultants.

As well as incorporating the usual features of CCA AGM, the CCA networking dinner on July 26 and networking breakfast on the morning of July 27, this year's event will feature a special 'lead-in' workshop for lesser experienced ag professionals.

The early careers day will give those in the newest cohort of industry professionals the opportunity to network, learn and develop new skills. Focusing on HR issues, time management and soft skill development, this workshop is the culmination of several years of planning by the CCA board. Attendees are able to register for this session alone, or stay on for one or two more days of professional development.

While CCA events are targeted at their membership, they are open to all with an interest in agronomy consulting and research.

For more

Crop Consultants Australia

https://cropconsultants.com.au/event/cca-cropping-solutions-seminar-2023/

Overcoming adversity and looking to lead

Cotton grower and ginner Henry Lavender is about to embark on a journey that has been described by past participants as the 'experience of a lifetime'.

Henry has been accepted into course 30 of the Australian Rural Leadership Program (ARLP) with support from CRDC, Cotton Australia and Australian Food and Fibre (AFF).

Twenty-five year-old Henry is definitely not short on enthusiasm. He says overcoming a serious back injury sustained in 2019 took a lot of mental strength and physical work which contributed to the "highly driven personality I have now".

Henry grew up on a cropping and cattle farm south of Gunnedah in the Upper Namoi (Kamilaroi country). He's a firm believer in giving back to a community and says it is leaders like his current boss, Scott Davies of Carroll Cotton, that he looks up to. It was Scott who suggested Henry apply for ARLP. Henry is currently completing a Bachelor of Agriculture/ Bachelor of Business while working as operations manager at Carroll Cotton. He says his serious injury changed his perspective on life, made him more driven, and led to his decision to apply for ARLP.

"I'm born and bred in the community out here which has a lot of great people – and I'm keen to give back," Henry said.

"I've heard a lot about the course and spoken to people who have done it and rave about it. I'm really looking forward to learning from leaders in cotton and outside of cotton. This program will give me the skills to contribute to leadership roles in the cotton industry.

"It's going to be a huge learning curve no doubt, and I want to use the skills I learn to grow and help others.

"While I've recovered from my injury, I still suffer a lot of nerve pain, so I've looked deeply into the human mind and body to find ways to overcome it, and it's made me realise there is so much to learn about how we think and behave.

"I'm ready for a new challenge and the ARLP is just what I'm looking for."

Henry will begin his ARLP journey in June. The ARLP is a 15 month program, with sessions in Australia and overseas. Selection for the program is competitive, with 30-35 participants selected each year. The cotton industry has been supporting ARLP since its inception in 1993, with Henry bringing cotton's total participants to 46 over this 30 year period.

Henry is the operations manager at Carroll Cotton for Scott Davies, who he says has inspired him to become an effective leader.

Applications for the next intake of ARLP (course 31) are open and close on July 2, 2023. Cotton growers and others in Australian cotton are strongly encouraged to apply, with up to two scholarships available through support from CRDC, Cotton Australia and AFF.

For more

Australian Rural Leadership Foundation

https://rural-leaders.org.au/australian-rural-leadership-program/

Do ag careers have a perception problem?

Finding suitable staff can be a constant battle on farms, let alone during a national labour shortage, which is why CRDC's fellow research and development corporation (RDC) AgriFutures Australia commissioned a national research project to better understand the issue.

The nationwide study was funded to better understand and respond to community perceptions and worker experiences in agriculture. The key outcomes show that rural industries need to focus on workforce attraction and retention in the following areas: good working conditions and work culture, access to career information and trust in how rural industries perform.

The study into workforce attraction and retention in rural industries has found that the perceptions of agriculture as a potential career choice vary widely from the experiences of those working in it. The results shows the importance of closing the gap between the perceptions of community members and the reality of agricultural workers in order to attract staff.

"The results show that 41 per cent of community members think farm workers are not treated well in Australia, yet 70 per cent of rural industry workers are extremely likely or very likely to remain in the sector," said Dr Kieren Moffat from Voconiq, who led the study.

"The data from our study suggests this perception gap can be closed if community members can learn more about the actual experiences of rural industry workers to develop a more realistic understanding of what a role in one of these industries can look like."

More than 5000 people completed the *Community Perceptions and Worker Experiences* survey, which was conducted in 2022. Of those surveyed, 34 per cent were current or past workers from across Australian rural industries, while 66 per cent were community members.

The study showed that members of the general population, and prospective agricultural workers, lack knowledge about the nature of rural work. They consider rural industries to only offer low paid, physically demanding and short-term work.

An industry's impact on the environment and its sustainability performance also factor into how it's perceived and whether people will consider joining it. The recommendation from the project is to make the general population aware of how an industry is adapting to climate change and implementing more sustainable practices.

"This is an area Cotton Australia are leading and CRDC are supporting with key workforce research projects," said General Manager of Innovation, Allan Williams.

"Our PLANET. PEOPLE. PADDOCK. Sustainability Framework has set ambitious targets across all areas of cotton farming, including workplace and working conditions.

"The cotton industry is working collaboratively with other rural industries to develop targets for work, health and safety, fair pay, working conditions – diversity, training and the need to protect workers' rights through the cotton value chain.

"This national study supports the investments Cotton Australia and CRDC have made into attraction and retention initiatives for the cotton industry to be a positive 'employer of choice' both on-farm and in other sectors of the industry and agriculture."

For more

Community Perceptions and Worker Experiences

www.agrifutures.com.au/community-perceptions-and-worker-experiences/

Scholarships for students choosing a future in cotton

CRDC recently announced support for two Horizon scholars, an initiative run by AgriFutures Australia with support from seven RDCs and private enterprise.

Georgie Oldham of Sydney (Eora country) and Niamh Mason of the Riverina (Wiradjuri country) will each participate in the program through support from CRDC.

The Horizon Scholarship provides eligible university students with a $10,000 bursary over two years, plus opportunities to develop their leadership skills and expand their networks. As part of the program, students also attend an annual four-day professional development workshop and complete two weeks of industry work placements per year. The Horizon program is open to students studying agriculture-related or STEM (science, technology, engineering and maths) degrees with major studies and/or subject selections that align to agriculture.

After completing her HSC, Sydney-based Georgie moved to Armidale (Nganyaywana country) to attend the University of New England and study a Bachelor of Rural Science.

"I am passionate about plant breeding and genetics, specifically the use of biotechnology within agriculture to achieve more sustainable and profitable production systems," Georgie said.

"Next year, I'm hoping to complete my honours project on cotton and am looking forward to working with CRDC on innovative research. I would like to have a career in research, specifically cotton breeding."

Georgie says receiving the scholarship has granted her the opportunity to be involved with and work in the cotton industry – something she never envisioned to be possible given her "non-traditional agricultural upbringing".

"It is an honour to be able to set an example for people from non-traditional farming backgrounds," she said.

Niamh, meanwhile, grew up on a mixed-farming enterprise between Finley and Jerilderie growing rice, wheat and livestock.

"I completed school in Finley, followed by a gap year working at Rice Research Australia. I moved to Gatton (Barunggam country) in 2022 to begin studying agricultural science with a major in agronomy at the University of Queensland.

Newly named Horizon Scholars Niamh Mason (top) and Georgie Oldham.

"I am passionate about food and fibre sustainability and security and am interested in getting into research after my degree, in a field such as research agronomy, plant breeding or crop pest control.

"I also really enjoy working with farmers and would love to have a position in the future that could help connect farmers to research.

"I am most excited to make connections with people who are as passionate about Australian agriculture as I am."

For more
Horizon Scholarships
www.agrifutures.com.au/horizon

Harry Paine has decided a research career is now for him, after spending time at ACRI as a CSIRO and CRDC-supported vacation scholar.

Finding solutions one summer at a time

In just one holiday, university student Harry Paine has discovered a new use in cotton for a novel mulch product. He's also been inspired to change tack from a future career as an agronomist or consultant into agricultural research, now he's hooked on solving key issues facing Australian agriculture.

Harry's opportunity to enter the cotton science realm came through the CSIRO Agriculture and Food's vacation scholarship program, supported by CRDC.

He was teamed up with CSIRO's Sandra Williams based at the Australian Cotton Research Institute (ACRI) near Narrabri (Kamilaroi country) and CSIRO's Dr Stuart Gordon based at Werribee (Woiworung country). Stuart's current research project is testing whether a sprayable biodegradable mulch, originally developed for horticulture and forestry, can be used in cotton to inhibit moisture loss, weed establishment and soil temperature variation.

Harry worked in the lab and field at ACRI to undertake an aspect of research over 10 weeks in the summer holidays. He is one of four students CRDC and CSD supported across CSIRO cotton-related projects.

Harry is a fourth-year honours student studying Bachelor of Science and Advanced Studies (Agriculture) at the University of Sydney, majoring in plant production and soil science and hydrology.

His vacation scholarship led to an impressive discovery, some unforgettable experiences and a career rethink.

Through his research, Harry found that the mulch has the potential to increase soil temperature. This could have application particularly in cooler climates, by allowing earlier planting and lengthening the crop season. This is thanks to the black pigment in the mulch which absorbs nearly all the sunlight it captures.

Harry says the CSIRO scholarship program was an extremely rewarding and exciting experience in being able to work alongside some of Australia's leading researchers in agriculture. So much so it's altered his career path.

"Not only was it an exciting opportunity to gain experience in the field of agronomic research, but the enjoyment of working in the field was incredible," he said.

"Being able to learn new things every day I worked at the ACRI was nothing short of amazing and knowing that the work I was doing had a real-world impact was exciting and deeply rewarding.

"The most I've gained from the program is the invaluable experience from not only working in cotton, but also the field of research in general along with the important networks I've now developed with the talented researchers at ACRI."

The program has been successful in creating awareness of cotton research and the opportunities it contains.

"The program itself is a really important stepping stone for helping someone to choose what career in agriculture they'd like to pursue.

"For me, it's definitely got me hooked on wanting a career into the field of agronomic research where I can have a real-world impact given the changing nature of our global environment both geopolitically and environmentally.

"Before this experience I was more geared towards being an agronomist or consultant.

"I'm just about to start my honours project which will be looking at creating easy-to-use digital soil maps, using both physically sampled and proximally-sensed data.

"The scholarship has galvanized my desire to pursue a career in agricultural research where I can really look into how we can solve key issues within Australian agriculture as well as issues affecting global production systems.

"As for the biodegradable mulch, it's certainly an interesting product!"

CSIRO's scholarship program addresses difficulties in finding and hiring quality Australian graduates who are ready to begin their careers in science and innovation in the cotton industry. By exposing talented undergraduate students to the excitement of scientific research it is hoped the students will follow careers in biological and agricultural sciences while contributing to cotton industry research led by CSIRO.

In all there were 19 students in the 2023 program, who visited CRDC, cotton farms and ACRI at Narrabri.

For more

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Cotton and grains explore agricultural traineeship model

CRDC and the Grains Research and Development Corporation (GRDC) have taken the lead in exploring strategies to increase on-farm workforce capacity to help address shortages of skilled workers on farms.

The *Exploring a cotton and grains agricultural apprenticeship/traineeships model* project is investigating how Vocational Educational Training (VET) and formal apprenticeships and traineeships can support pathways for young people in the cotton and grains industry and opportunities for a traineeship model for on-farm staff.

The CRDC/GRDC project is identifying the skills required through corroboration with farmers, current apprentices or trainees and Registered Training Organisations. This will enable the Central Queensland University (CQU) research team to investigate the complex issues that exist for multiple stakeholders and which, up till now, have prevented the establishment of an agricultural apprenticeship that is fit-for-purpose for the cotton and grains industries.

"It is well known that there is a significant workforce shortage across the Australian agricultural industry," says Associate Professor Amy Cosby at CQU, who is leading the project.

"While enrolments in agricultural university degrees have increased recently, this trend has not occurred in VET. And yet accredited education and training through VET and higher education are deemed critical to upskilling the next generation agricultural workforce.

"We are examining how agricultural apprenticeships/traineeships operate in Australia and abroad and in other competing industries, such as mining and construction.

"We are speaking with key stakeholders in cotton, grains and broader agricultural industry about what they perceive to be the ideal model for an on-farm apprenticeship/traineeship that meets the needs of both farmers and young people entering the industry."

MELANIE JENSON

It's a move supported by Andrew Watson at Boggabri who grows both cotton and grain. He's concerned about where their on-farm workforce is going to come from amid competition from other sectors, particularly mining, for both staff and housing. These are issues common across primary industries, as outlined in the community perceptions research project (see story page 28).

"We set ourselves up as a place people want to work, but it's getting harder to get people out here," Andrew said.

"Young people are being taken up by mining jobs – particularly dump truck driving – and housing is a major issue for prospective staff of all ages.

"To have a pathway for upskilling staff in both cotton and grain production while on the job would be something I would support," he said.

"Young people, especially those who've been out of school for a couple of years, need to be earning money to survive, possibly supporting families, so it can't just be an educational model.

"I see value in making training vocational with some formal training to support it. It makes sense to have training across the cropping systems, as we don't have one without the other: they are intertwined.

"The basics are the same: we plant the seed, nurture the seed, protect the crop and then harvest it. Broadly speaking, I don't see a real difference in many aspects – cotton is a crop like the six to eight other crops we grow here."

Andrew says sustaining his workforce is a priority but remains a challenge. He says vocational training would work for young people who are already working and don't want to go into full time study, but are looking for a change or to upskill. When *Spotlight* contacted Andrew in mid-May to talk about workforce, he had received two enquiries in three days from young people in just that situation. One of them is looking to study too.

"I've had phone calls about work from two people in their twenties with skills and qualifications from other industries, but no experience in cotton or grain," Andrew said.

"Even without that experience, they are already in the workforce, understand agriculture and are potentially keen to work and live in the area.

"This is the exact scenario where a VET program would be really helpful – it would give us some backup in upskilling new staff, while acknowledging their skills development with a qualification."

For more

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CRDC Investments 2023-24

2023-24 marks the first year under CRDC's new Strategic RD&E Plan: Clever Cotton. During this year, CRDC will invest $20.98 million into RD&E projects across the Plan's three pillars (Paddock, People, Planet) and nine themes, in collaboration with around 100 research partners, and on behalf of Australia's cotton growers and the Australian Government. This table outlines the confirmed projects that CRDC will invest in during this year, along with the lead researcher, their research organisation, and the commencement and completion dates for the projects. As this is the first year of investment under a new Strategic Plan, additional projects are currently in development. For further information about Clever Cotton, the Plan's pillars and themes, or any of the projects listed, please visit the CRDC website.

Theme	Sub-theme	Project title	Project code	Researcher	Organisation	Commenced in:	To be completed in:
Pillar 1: Paddock							
1.1 Data-driven decisions	**1.1.1 Data-driven decisions**	Annual consultant qualitative and quantitative surveys 2022-24	CCA2202	Doug McCollum	CCA	Apr-22	Mar-25
		CRDC Cotton Grower Survey 2023-25	INTS10342	Michael Sparks	Intuitive Solutions	Jan-23	Nov-25
		PhD: Assessing yield and fibre quality variability in cotton systems through data science for improved management	US2104	Mikaela Tilse	USYD	Mar-21	Feb-24
		Rural Safety and Health Alliance collaboration 2021-24	RIRDC2201	Georgina Toose	AgriFutures	Jul-21	Jun-24
1.2 Adaptive systems	**1.2.1 Solving farming systems contraints**	Advanced field sensing for improved cotton management	USQ2303	Alison McCarthy	USQ	Jul-22	Jun-25
		Agricultural Innovation Australia - Agri-climate outlooks	AIA2301	Annabelle Van Klaveren	AIA	Jul-22	Dec-26
		Collaborative weeds research	GRDC		GRDC	Jul-22	Dec-25
		Economic assessment of Australian cotton systems: key drivers of profitability?	CSD10438	Michael Bange	CSD	Mar-23	Dec-23
		Limited water decision support	DAN2203	Sarah Dadd	NSW DPI	Jul-21	Jun-24
		Modern systems agronomy for resilient cotton production	CSP2001	Katie Broughton	CSIRO	Jan-20	Sep-23
		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-25
		PhD: Classifying the suitability of Murrumbidgee Valley soils for cotton production	US2002	Jonathon Moore	USYD	Mar-20	Sep-23

Please note that this table is current as of 28 April 2023, and may be subject to change.

		Post doctorate: Climate proofing Australia's cotton industry through improving crop water use and photosynthetic carbon assimilation (climate proof cotton)	UWS2201	Demi Sargent	WSU	Jul-21	Jun-24
		Post doctorate: Measuring evapotranspiration from canopy temperature	USQ2302	Simon Kelderman	USQ	Jul-22	Jun-25
		Seeking regionally specific guidelines for cover crops through 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
	1.2.2 Disease	Characterisation and management of Alternaria leaf spot and black root rot pathogens of cotton in NSW	DAN2307	Duy Le	QLD DAF	Jul-22	Jun-24
		Disease management in cotton farming systems - a participatory action research approach to deliver solutions	CSD2303	Michael Bange	CSD	Oct-22	Sep-26
		Tactical management and surveillance of Verticillium, Fusarium and reoccurring wilts	DAQ2302	Linda Smith	QLD DAF	Jul-22	Jun-24
	1.2.3 Biosecurity	Australian Research Council (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 to support sustainable insect management	DAQ2301	Jamie Hopkinson	QLD DAF	Jul-22	Jun-25
		Regional demonstration of integrated weed tactics across farming systems	DAN2304	Eric Koetz	NSW DPI	Jul-22	Dec-24
		Review of the Biosecurity Plan for the cotton industry	PHA2201	Stuart Kearns	PHA	Jul-21	Jun-24
		SOS Group communication support - Spray drift and Weather and Networked Data (WAND)	IREC 10488	Iva Quarisa	IREC	Mar-23	Dec-23
		Spray drift hazard alert and warning systems - Weather and Networked Data (WAND)	DISA2201	Alicia Garden	Discovery Ag	Jan-22	Jun-28
		Validation and implementation of new molecular tools for Bt resistance monitoring	CSP2204	Sharon Downes	CSIRO	Sep-21	Aug-24
		What is the best fit for electric weed control in Australia?	DAWA10493	Catherine Borger	WAAA	Jul-22	Jun-24
	1.2.4 Northern Australia	Supporting a sustainable northern Australia cotton, grain & cattle system	CRCNA2301	Carla Keith	CRCNA	Jul-22	Oct-26
1.3 Connected market intelligence	**1.3.1 Connected market intelligence**	Australian Cotton Industry Strategic Roadmap	CA2301	Brooke Summers	CA	Jul-22	Sep-23
		Better Cotton Initiative membership 2022-23	CRDC2309	Vinay Kumar	BCI	Sep-22	Sep-23
		Community Trust in Cotton	REFL10444	Kieren Moffatt	Voconiq	Mar-23	Mar-24
		Community Trust in Rural Industries Phase 2	RIRDC10461	Georgina Toose	AgriFutures	Jul-22	Jun-25
		Membership of the Sustainable Agriculture Initiative (SAI) - Australian chapter 2022-24	CRDC2303	Selwyn Heilbron	SAI	Jul-22	Jun-24
		Support for the Sustainability Working Group, industry sustainability reporting and integration of research into myBMP	CRDC2113	Chris Cosgrove	Sustenance Asia	Apr-21	Jun-24
		Sustainable Apparel Coalition membership 2021-24	CRDC2205	Glenn Robinson	SAC	Jul-21	Jun-24

Theme	Sub-theme	Project title	Project code	Researcher	Organisation	Commenced in:	To be completed in:
Pillar 2: People							
2.1 Design and innovation	**2.1.1 Design and innovation**	Agriculture Innovation Australia membership	AIA2101	Sam Brown	AIA	Jul-20	Jun-24
2.2 Leadership and capacity	**2.2.1 Leadership**	Australian Future Cotton Leaders Program 2022 and 2024	CA2201	Paul Sloman	CA	Oct-21	Oct-24
		Delivering best practice to manage future workforce skills	CQU2201	Nicole McDonald	CQU	Oct-21	Sep-24
		Exploring a cotton and grains agricultural traineeship model	CQU2303	Amy Cosby	CQU	Jul-22	Sep-23
		How to attract and retain young people on cotton farms	CQU2301	Amy Cosby	CQU	Oct-22	Sep-24
		Nuffield Australia Farming Scholarship 2023 - Tim Houston	CRDC2301	Jodie Redcliffe	Nuffield Australia	Oct-22	Oct-24
		Nuffield Australia Farming Scholarships 2024	NUFA10483	Jodie Redcliffe	Nuffield Australia	Oct-23	Jan-25
	2.2.2 Capacity	2023 Australian Cotton Industry Awards Sponsorship: CRDC Chris Lehmann Young Cotton Achiever of the Year award	CA10491	Adam Kay	CA	Mar-23	Dec-23
		AACS 2023 Australian Cotton Research Conference sponsorshop	AACS10490	Paul Grundy	AACS	May-23	Oct-23
		Australian Rural Leadership Program (ARLP) Course 29, 30 & 31 and TRAIL 2022, 2023 & 2024	RIR2201	Tristan Richmond	ARLF	Jul-21	Dec-25
		Horizon Scholarship 2022: Ayla Christophers	RIRDC2203	Abbey O'Callaghan	AgriFutures	Apr-22	Jan-24
		Horizon scholarship 2023: Georgie Oldham	RIRDC10499	Abbey O'Callaghan	AgriFutures	Mar-23	Jan-24
		Horizon scholarship 2023: Niamh Mason	RIRDC10500	Abbey O'Callaghan	AgriFutures	Mar-23	Jan-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: Integrating deep learning AI software with hardware for next generation acoustic biodiversity monitoring	QUT2301		QUT	Jul-22	Nov-25
		Science and innovation awards for young people in Agriculture, Fisheries and Forestry: 2023 TBA & 2024 TBA	ABA2301	Maree Finnegan	ABARES	Jul-22	Jun-24
2.3 Adoption and impact	**2.3.1 Adoption**	Climate and energy for future cotton farming businesses (CottonInfo Climate and Energy Technical Lead and myBMP module lead)	AE10070	Jon Welsh	AgEcon	Jul-23	Jun-26
		CottonInfo Fibre Quality Technical Lead (including myBMP module lead)	VANM10023	Rene van der Sluijs	TTS	Jul-23	Jun-26
		CottonInfo field demonstration trial: Optimisation of application in tailwater backup system	CSD10485	Andrew McKay	CSD	Oct-22	Jul-23
		CottonInfo Irrigation Technical Lead (including myBMP module lead)	GVIA2301	Lou Gall	GVIA	Jul-22	Jun-25
		CottonInfo multimedia content development	DAQ2202	Tonia Grundy	QLD DAF	Jul-21	Jun-24
		CottonInfo Natural Resource Management (NRM) Technical Lead (including myBMP module lead)	CRDC10071	Stacey Vogel	Stacey Vogel Consulting	Jul-23	Jun-26
		CottonInfo Nutrition Technical Lead (including myBMP module lead)	DAN2202	Jon Baird	NSW DPI	Jul-21	Jun-24
		Professor of Soil Biology (CottonInfo Soil Health Technical Lead and myBMP module lead)	UNE2001	Oliver Knox	UNE	Jul-19	Jun-24
		Scientific and CottonInfo Weed Technical Lead (including myBMP module lead)	DAN2302	Graham Charles & Eric Koetz	NSW DPI	Jul-22	Jun-25
		Supporting farming system adaptation to climate and biological threats (including CottonInfo Technical Leads and myBMP module leads Paul Grundy and Sharna Holman)	DAQ2201	Paul Grundy	QLD DAF	Jul-21	Jun-24
	2.3.2 Impact	Commercialisation management	CRDC2203	Jarrod Ward	Ahurei Pty Ltd	Jul-21	Jun-24
		Farm performance – rate of return data for cotton sustainability reporting	CRDC2208	Simon Fritsch	Agripath	Nov-21	Mar-24
		Regional Australia Institute (RAI) assessment of CRDC RD&E investment on the socio-economic resilience of rural and regional communities	RAI10501	Katherine Bassett	RAI & GRDC	Apr-23	Jun-24

Theme	Sub-theme	Project title	Project code	Researcher	Organisation	Commenced in:	To be completed in:
Pillar 3: Planet							
3.1 Natural capital	**3.1.1 Biodiversity and soils**	Cotton Landcare Tech Innovations: Contract with Landcare Australia to replant 6.5ha of trial site	NLP2301	Rob Porter	Landcare Aust	Oct-22	Jun-24
		Impacts and solutions: scoping study on the relative impacts of irrigation infrastructure on fish	DAQ10015	Michael Hutchison	QLD DAF	Aug-23	Jun-24
		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
	3.1.2 Water	Evaluating the economic and environmental return on investment of modern fish screens	DAN2308	Craig Boys	NSW DPI	Jul-22	Jun-25
		Understanding the environmental co-benefits of irrigation water in the northern Murray-Darling Basin	GU2201	Rebekah Grieger	GU	Jul-21	Jun-24
3.2 Carbon	**3.2.1 Carbon**	Assessing the critical nitrogen (N) and phosphorus (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
		Carbon and biodiversity benchmarking in native vegetation on cotton farms	UNE2301	Rhiannon Smith	UNE	Jan-23	Dec-25
		Greenhouse gas baseline and mitigation for cotton	CSP2102	Hizbullah Jamali	CSIRO	May-21	Jun-25
		PhD: Quantifying the temporary climate mitigation impacts of biogenic carbon	NCSU2301	Steven Pires	NCSU	Aug-22	Aug-24
		Timing of nitrogen (N) availability and forms of N supply to cotton from arbuscular mycorrhiza fungi	UNE10082	Getnet Dino Adem	UNE	Jul-23	Jun-26
		Understanding nitrogen (N) cycling in cotton soils, and the timing of N availability to plant roots	CSIRO10081	Timothy Weaver	CSIRO	Oct-23	Sep-26
3.3 Circular economy	**3.3.1 Circular economy**	An evaluation of cotton fibre waste processing and composting alternatives: Comparison of business models, greenhouse gas emissions and commercialisation opportunities	UTS10080	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
		Developing a pathway for the composting and agricultural use of pure cotton textile waste	2223FRP037	Johannes Biala	UQ	Jul-23	Jun-26
		The economic benefits of composting textile waste: process mapping and optimal location	RMIT10072	Rajkishore Nayak	RMIT	Apr-23	Sep-23

Key

AACS	Association of Australian Cotton Scientists
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
AgriFutures	AgriFutures Australia
AIA	Agriculture Innovation Australia Ltd
ARLF	Australian Rural Leadership Foundation
BCI	Better Cotton Initiative
CA	Cotton Australia
CCA	Crop Consultants Australia
CQU	Central Queensland University
CRCNA	Cooperative Research Centre for Developing Northern Australia
CSD	Cotton Seed Distributors
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DU	Deakin University
GRDC	Grains Research and Development Corporation
GU	Griffith University
GVIA	Gwydir Valley Irrigators Association
HIA	Hort Innovation
IREC	Irrigation Research and Extension Committee
NCSU	North Carolina State University
NSW DPI	NSW Department of Primary Industries
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
SAI	Sustainable Agriculture Initiative
TTS	Textile Technical Services
UC	University of Canberra
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
WAAA	Western Australia Agriculture Authority
WSU	Western Sydney University

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