Spotlight
ON COTTON R&D

SUMMER 2024-25

Growing innovation in spray technology

Unravelling the role of nitrogen fertiliser

Pathologists on-farm under the ACDC

CRDC

Allan Williams

In the Spotlight

Welcome to the Summer edition of *Spotlight*.

The run down to the end of the year is here, as we also see an uptick for the cotton industry on the back of rain across many regions and healthy allocations. It's been a busy time for growers juggling harvesting one of the largest winter crops for many seasons, along with a big cotton planting.

A wet spring inevitably brings weed pressure, and with weeds comes a heightened risk of spray drift. CRDC has been involved in an innovation initiative with the Australian Government to revolutionise spray application. Through the Business Research and Innovation Initiative, two impressive inventions from SwarmFarm and the LX Group are giving spray operators the tools to avoid spray drift. You can read all about them in this edition.

We also encourage growers and spray contractors to use WAND: the GRDC, CRDC and Goanna Ag Weather and Networked Data system. This technology gives another layer of security and surety that spray operations are happening under the correct weather conditions. It's changed how some growers plan spraying operations and organise and train staff. This technology is not available to growers anywhere else in the world.

A big focus of this issue of *Spotlight* is greenhouse gas emissions (GHG) from cotton growing, and the leading cause of emissions: nitrogen (N) fertiliser. While N is often seen as the key driver of productivity, the role actually belongs to healthy soil. While we understand the reasoning behind applying N at levels beyond the needs of the plant, to mitigate the risk of under-fertilisation, this is not serving the soil, growers or the industry well in the long run.

N optimisation remains one of the key ways we can reduce our GHG emissions. With research showing around one third of applied N is lost to the atmosphere, there are many cases for creating more efficient use methods. We outline some key findings from recent and ongoing research in this edition, while including some basic explanations of emissions and how they impact our industry and planet. CRDC is developing a GHG emission reduction research strategy, pulling together all the various research efforts underway regarding soils, carbon and N. We give a brief outline in this edition, but stay tuned as our working group, including Innovation Broker Nicola Cottee and cotton's sustainability advisor Chris Cosgrove, start to talk with growers about this important strategy.

In this edition, we also bring you an update on the new Australian Cotton Disease Collaboration (ACDC) led by Innovation Broker Elsie Hudson. Growers who've battled disease will pleased to hear that through the ACDC, and in conjunction with CottonInfo, our industry pathologists will be working directly with growers on-farm to understand and provide solutions around their specific issues.

We also introduce you to our newest Innovation Broker, Nick Tomkins, who joins the CRDC team from CSIRO. We are looking forward to harnessing his skills in driving innovation and commercialisation. He will be leading CRDC's R&D in weeds, circularity and fibre quality.

On a sad note, we honour the life of Ralph Schulzé AM who was a pioneer of our industry. Ralph's contributions began in 1960, and his visionary work in running cotton's first agronomy trials laid the foundation for modern cotton farming in Australia. He was CRDC's inaugural Executive Director, serving in the role from 1990 to 2004, and he was instrumental in advancing cotton R&D. His legacy continues to inspire us, and in this edition, we honour the impact he had on our industry.

Wishing you all the best for both the festive and the cotton season ahead.

Allan Williams
Executive Director

CRDC

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

Summer 2024-25

FEATURES

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

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

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

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MELANIE JENSON

ON THE COVER:
SwarmFarm autonomous robots are opening up new possibilities for farmers.

Want to see more of Spotlight?

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

COTTON NEWS

35-plus years of research online via Inside Cotton

OVER 35 years of CRDC-supported cotton research is available online to growers, consultants and researchers at Inside Cotton.

Inside Cotton is a digital library of materials important to the Australian cotton industry. Within it you will find:

- CRDC's final research reports (1986 - present).
- CRDC Spotlight magazines (2007 - present).
- CRDC corporate publications, including Strategic RD&E Plans, Annual Operational Plans and Annual Reports.
- Historical Australian Cotton Conference papers and presentations (1984 - 2014).
- Archived materials from the Cotton CRCs, Land and Water Australia, and the National Program for Sustainable Irrigation.

CRDC General Manager of Communication and Extension, Ruth Redfern, says so much of the earlier R&D remains relevant today.

"In bringing together *Spotlight* we access a lot of previous research related to current projects. So much of today's CRDC-supported R&D builds on from previous work, standing on the shoulders of the many incredible cotton researchers that have gone before," Ruth said.

"In this edition alone, we look at the work of Dr Ian Rochester from 2013 in relation to nitrogen fertiliser management, and how the Precision to Decision Agriculture program in 2016-2018 influenced the development of today's cotton industry digital strategy.

"Growers and agronomists looking for more in-depth information about on-farm issues and the R&D we feature in *Spotlight* can find it at Inside Cotton.

"It's open to all and completely free to use, browse and download."

For more
Inside Cotton
www.insidecotton.com

Australian Food and Fibre farm manager David Kumer, with UniSC's Research Assistant Maggie Campbell-Jones and Professor Stuart Parsons at 'Redmill' Moree installing acoustic monitors.

Sensing something in the bush

THE bush now has ears thanks to acoustic recorders being deployed around the Gwydir Valley (Kamilaroi country).

Scientists from the University of the Sunshine Coast (UniSC) and Queensland University of Technology (QUT) are currently working with nine farm managers across 11 properties in the region. Led by bat biologist and ecologist Professor Stuart Parsons (UniSC), they are working to determine the diversity and activity of birds and bats that are known to play a role in natural pest management in cotton. It's part of a CRDC-supported project to quantify the importance of integrated pest management (IPM) strategies and habitat connectivity in cotton landscapes.

UniSC Research Assistant Maggie Campbell-Jones joined Stuart on the trip to Moree.

"Working with the cotton growers has been a great experience so far, all of the growers have been incredibly knowledgeable and welcoming," Maggie said.

"We have found some great spots on the farms thanks to their advice and property tours."

The team put out 19 small sensors and are already looking forward coming back to install larger and more technical sensors, developed with support from CRDC and growers, that use AI to identify bat and bird species in real time. This cutting-edge acoustic monitoring gives researchers and growers the ability to monitor birds and bats to understand how to increase their presence on farms, and so improve biodiversity and enhance natural capital.

"We have only just installed our first small sensors and are excited to get data back in the coming months," Stuart said.

"We will be collecting recordings from our smaller sensors each month and using AI to help us identify any bat or bird calls made in each location.

"We can use these recordings to identify which areas may have more beneficial insect-eating species and if there's any key factors attracting them to those sites."

For more
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Creating opportunities for increased irrigation efficiency and emission reduction

COTTON growers will be the beneficiaries of two cotton industry-related projects that have gained funding under the Australian Government's Natural Heritage Trust Climate-Smart Agriculture Program. Out of more than 100 applications, 12 projects were awarded funding, including two from CRDC.

CRDC secured funding to lead an irrigation project focused on increasing climate resilience through improved water productivity, and will also be a major supporter and collaborator in a project with the Queensland University of Technology (QUT) to predict and directly measure the impact of enhanced efficiency nitrogen fertiliser on greenhouse gas (GHG) emissions and production in cotton fields.

The project *Advancing the adoption of climate-smart, innovative irrigation control technology for the cotton and dairy industries*, will be led by CRDC in partnership with the dairy industry. It will focus on helping cotton growers and milk producers to improve water productivity and reduce emissions. This will be facilitated by the faster adoption of autonomous irrigation system VARIwise, a CRDC-supported agricultural innovation that helps farmers adopt precision irrigation practices.

VARIwise can deliver up to 10 per cent water savings and an average five per cent productivity improvement in cotton and pasture. Through this project, VARIwise will be developed into a commercial-ready package that can be adopted in any irrigation system. Regional demonstration sites in NSW and Tasmania will showcase the technology and become a training ground for its use.

The second cotton project, *Climate Smart Cotton: Reducing nitrous oxide emissions with enhanced efficiency fertilisers*, will be headed by QUT's Professor of Global Change, Peter Grace.

The work will look at enhanced efficiency fertilisers which could provide growers with an immediate option for reducing their carbon footprint, given that 67 per cent of cotton's greenhouse gas emissions are attributable to conventional nitrogen fertilisers and how they are managed on-farm.

Technology is allowing cotton growers to create efficiencies, which will be boosted through new research and extension under the Climate-Smart Agriculture Program.

Focus on nitrous oxide emissions

To account for these emissions reductions accurately, the project will create a methodology so growers can use emission factors in their carbon calculations that are more appropriate to their agroecological zone and irrigation system. This will include a predictive emissions algorithm to enhance the cotton industry's ability to forecast emissions and implement effective reduction strategies. To capture high quality emissions data, automated nitrous oxide (N_2O) emissions samplers will be built to create more robust and defensible emission factors.

These cotton industry projects are two of 12 large-scale projects announced under the Climate-Smart Agriculture Program's Partnerships and Innovation grants round aimed at delivering funding for new technology and tools for climate-smart farming.

The Climate-Smart Agriculture Program is funded by the Australian Government and will deliver $302 million over five years from 2023-24 to drive agricultural sustainability, productivity, and competitiveness.

"Our farmers have a long history of adapting to the conditions of the Australian landscape and climate, they are productive and agile when finding ways of producing our food and fibre that reduce the impact on the land," Minister for Agriculture, Fisheries and Forestry, the Hon. Julie Collins MP said.

"These grants are designed to aid farmers, creating new opportunities to move from theory to adaptable practice.

"I want to congratulate the successful applicants and I am looking forward to seeing the results of their projects."

For more

Climate-Smart Agriculture Program

www.agriculture.gov.au/climate-smart

Supporting the journey to a circular economy

WITH a keen interest in the circular economy and an ambition to support growers to create a sustainable industry, Nick Tomkins (pictured) has been appointed CRDC's newest Innovation Broker.

Based in Brisbane (Yuggera country), Nick took up the role in August and will be leading CRDC investments and innovation in the areas of circular economy, weeds and fibre quality. Nick brings a history of fostering innovation and commercialisation in agriculture to the team. He holds degrees in law and commerce and brings strong skills in research management and impact-driven science commercialisation to CRDC.

"I've come from a really different background, having done a law and commerce (finance) degree and starting my career in research and development tax consulting," Nick said.

"I've worked in both animal and human food research, most recently at CSIRO. Those roles have given me a great appreciation for the work of farmers, and how our ag sector plays such a large role in making Australia the economic powerhouse that we are.

"I was attracted to cotton because I've seen from the outside how successful the industry is, and as how hard it has worked to ensure cotton is grown sustainably and with the support of rural communities.

"The role CRDC plays in supporting the industry to invest in the future provides the inspiration to work here.

"Circularity is something I am really passionate about, having taken CSIRO through a journey to identify circular opportunities for food loss," he said.

CRDC's Executive Director Allan Williams said Nick's experience fits well with CRDC's focus on collaboration in project development, innovation and commercialisation under the 2023-23 Strategic Plan, Clever Cotton.

Nick joins fellow Innovation Brokers Susan Maas, Dr Nicola Cottee, Elsie Hudson, Stacey Vogel and Rachel Holloway and led by General Manager, Innovation, Dr Merry Conaty.

For more
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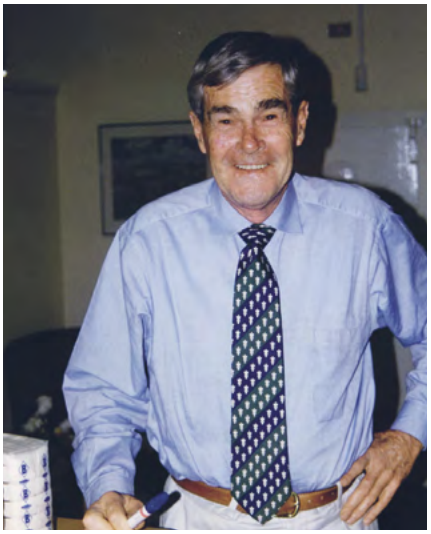
In Memoriam: Ralph Schulzé AM

IT is with deep respect and admiration that we remember Ralph Schulzé AM, considered one of the founding fathers of the Australian cotton industry after his passing in November.

Ralph's contribution to cotton began in 1960, when he undertook the first cotton agronomy trials at the Narrabri Research Station (now the Australian Cotton Research Institute, ACRI). His pioneering work helped lay the foundation for modern cotton farming in Australia.

His efforts in research, development and extension, both domestically and internationally, over the next forty years were instrumental in shaping the industry. Ralph's vision and collaboration with global experts brought valuable knowledge and expertise to Australian shores, fostering a thriving cotton community.

As the first Executive Director of the CRDC from 1990 to 2004, Ralph's leadership was pivotal in advancing research and development, ensuring the industry's growth and sustainability.



He had an unwavering commitment to progress and innovation, helping to establish or working closely with the industry bodies of the day.

He was instrumental in helping to organise the first Australian Cotton Conference, then served as a committee member for the next 22 years, chairing the Conference in 2000. He was also the instigator of the first World Cotton Research Conference, held in Australian in 1994.

In 2015, Ralph's significant service to cotton research and innovation was recognised in the Australia Day honours with a Member of the Order of Australia (AM).

Beyond his professional achievements, Ralph was a dedicated family man and community member, advocating for rural causes and supporting local organisations.

Ralph legacy will continue to inspire future generations of cotton growers and researchers.

Team of pathologists to visit growers as part of new ACDC

A team of regionally-focused pathologists are ready to meet growers and consultants on-farm to discuss and investigate disease concerns as cotton's new Australian Cotton Disease Collaboration (ACDC) gets underway.

The ACDC is a partnership between CRDC, the University of Southern Queensland (UniSQ) and the Qld Department of Primary Industries (Qld DPI, formerly Qld DAF). It is run out of a Virtual National Centre, with a focus on understanding the impact of farming system practices on disease, and enhancing pathology resources to develop innovative and effective management strategies.

UniSQ's Sam Periyannan is the Director of the Virtual National Centre, and Qld DPI pathologist Dr Linda Smith is Deputy Director.

CRDC Innovation Broker Elsie Hudson manages the ACDC and said meeting industry needs while increasing and building capacity of scientists to respond to current and emerging disease threats was a key aim of the ACDC.

"This includes fostering the development of current and new researchers, upskilling growers, consultants and extension officers, and partnering with others to develop a world-class research program," Elsie said.

Geographically, disease issues vary. As such the ACDC leadership team has been working with associate partners NSW Department of Primary Industries and Regional Development (DPIRD – formerly NSW DPI), Northern Territory Department of Agriculture and Fisheries (NT DAF), and Western Australia's DPIRD. Along with CSIRO as a collaborator, they are developing projects to understand and address disease issues at specific regional levels.

Qld DPI's Sharna Holman has been appointed as the CottonInfo Disease Technical Specialist, and further regional support is being provided through the CottonInfo network of Regional Extension Officers.

The ACDC Director Sam Periyannan and Deputy Director Linda Smith (right) travelled to Kununurra where they met with Sarah Nolan from WA DIPIRD.

Change to disease survey model

Through the ACDC, the CRDC-supported annual disease surveys that have been undertaken across NSW and Qld growing regions will be replaced with a dedicated team of pathologists who are available to address disease concerns with growers on-farm. Linda Smith says the surveys were very useful to give them an understanding of the disease issues that presented that season in each region and the trends over time, however they didn't allow for a crucial transfer of information that only face-to-face meetings can provide.

"By engaging closer with growers and consultants, we will not only learn what the disease concerns are but also what the conditions were, and what farming practices were undertaken prior to the observed issue that might have contributed to its development," she said.

"These discussions will help to understand the cause and develop potential solutions.

"Annual disease surveys took a lot of a pathologist's time and resources: we need to focus on research to deliver management strategies and believe this direct engagement with growers will greatly aid this."

Growers and consultants are encouraged to reach out to the ACDC team, where together with the region-specific pathologist, they will investigate the circumstances and potential causes of the disease, and will have the capacity to take a farming systems-based approach to minimise its impact. The ACDC will also investigate pathogen behaviour and their interaction with various host plants.

On-farm trials will run across four

states and some will have the advantage of being held on long-term established sites such as NSW DPIRD's Dr Guna Nachimuthu's rotation trials at the Australian Cotton Research Institute at Narrabri (Kamilaroi country), and the Verticillium-dedicated site at 'Getta Getta' near Goondiwindi (Bigambul country) with growers Ben and Will Coulton. Fusarium will be the focus of trials on the Darling Downs (Barunggam country) with grower Nic Clapham.

"If there are any growers who wish to be involved to conduct field trials on-farm we are keen to hear from them," Linda said.

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We want the dirt on your disease

Understanding the genetic diversity of pathogens is crucial to monitor their evolution, spread and adaptation. The ACDC and the regional pathologists team are eagerly waiting to receive disease samples from cotton farms. Even if you have had a pathogen diagnosis in the past and believe you know what is currently causing disease in your cotton, they still would like to receive a sample so that they can be sure they are capturing isolates of all pathogens and representatives of all the variants present in cotton fields.

Please contact the pathologist in your state/territory for details of how and where to send samples.

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CottonInfo Disease Technical Lead announced

QLD DPI (formerly Qld DAF) development extension officer Sharna Holman has been appointed to the CottonInfo Disease Technical Lead role, adding to her current position as the CottonInfo Biosecurity Technical Lead.

It's the perfect extension mix according to CRDC's Innovation Broker Elsie Hudson.

"There's a really important overlap with biosecurity and disease," Elsie said.

"For example, some diseases found in our cotton fields have exotic strains that are closely related, so it helps to know about these, to both prepare for and manage an incursion."

Sharna is coming to the end of her CRDC-supported PhD, conducting research in Kununurra (Miriwoong country) in WA to identify the factors influencing larval survival of cluster caterpillar (*Spodoptera litura*). The research will inform management practices for this important pest in the north. Sharna will now be permanently based in Toowoomba (Barunggam country), Qld.

"I can start taking on new challenges now," she said.

"Being based in Toowoomba means I'm closer to growers that are facing disease challenges such as Verticillium wilt and Fusarium wilt.

"From the start of my career, I've always been interested in getting research into growers' hands, and that means working with the researchers to make sure their work gets to them.

PAUL GRUNDY

While based in Toowoomba, working on her cluster caterpillar PhD project means Sharna spends part of the year away in Kununurra.

"There are a couple of reasons I've taken on this role.

"I love the work I get to do in extension – bringing research to growers – and the ACDC is creating a whole new avenue of how we do disease research.

"It's an exciting opportunity, and the work I do in biosecurity complements disease in that prevention is better than cure, but if we have disease how do we manage it?"

CottonInfo Program Lead Janelle Montgomery says Sharna has a successful history in disease extension in her previous role as Qld DPI's cotton development extension officer in Emerald (Gayiri country), Central Qld.

"This was particularly around the defoliating Verticillium wilt strains, and involved developing extension material promoting integrated disease management and practices to prevent the spread of disease which all align nicely with biosecurity," Janelle said.

"Sharna's experience and personality enable her to connect seamlessly with both researchers and growers, making her a great asset for cotton extension."

Your farm data: everyone wants it but how can it be shared securely and safely and to your benefit?

FARM data has become a commodity, it has value. In one aspect, data is much like most things farmers produce: once it leaves the farm, it's rare for a farmer to control how it is processed and ultimately what's served up to the consumer.

Most data is created through software programs that are purchased or come with products, and can include production, sensor, soil, climate, environment and data from monitors, machinery, and other tools.

Data holds value for many entities other than the farmers themselves. One farmer's data on its own holds little value for anyone else, however aggregating many farmers' data can create significant value through providing a full picture of an industry or being used to train algorithms.

Farmers see the benefits of their data being aggregated and used in ways such as forming a better understanding of the impact of their farming practices, offering solutions or 'prescriptions', helping build smarter machinery more suitable for their needs, and guiding artificial intelligence and autonomy. When data is shared with service providers, it can inform improvements to systems, resulting in better outcomes for farmers.

At the same time, terms and conditions re data sharing can be long, complex and difficult to read and farmers may not be fully aware of how and for what purpose their data is being used.

Data protection

In 2017, the CRDC-led Accelerating Precision to Decision Agriculture (P2D) project identified that trust in sharing data was a barrier to the uptake of digital technology. Just over half of farmers were found to have no trust or little trust in service/technology providers maintaining their data privacy.

As a result, the National Farmers' Federation (NFF) Farm Data Code was created. The Code aims to promote adoption of digital technology by ensuring that farmers have comfort in how their data is used, managed, and shared. It was developed by the NFF Farm Data Working Group which brought together farmers, researchers, industry experts and technology providers, and included CRDC General Manager of Innovation, Dr Meredith Conaty.

"Farm data is very valuable and it should be shared for the benefit of farmers and the industry"

CRDC was integral in the establishment of the NFF Farm Data Code, along with a cotton industry digital strategy and data platform to take advantage of what digital agriculture has to offer.

"The Farm Data Code emerged from the CRDC-led P2D program and aims to inform the data management policies of product and service providers who manage data on behalf of farmers – and provide a yardstick by which farmers can evaluate the terms and policies they encounter when it comes to data sharing," Merry said.

"Accreditation under the Code shows that they've taken the concerns of farmers seriously which creates unity in the industry."

The principles of the Code are transparency, fairness, control, portability, security and compliance. The major benefits to farmers are:

- increased awareness and understanding of the ways in which providers are collecting, using, and sharing their farm data;
- a framework to compare providers and inform negotiations about data terms and policies; and
- improvements to industry-wide data practices over time.

Code creates security

NFF Data Policy Manager Gabi Ceregra says that data should be shared for the betterment of agriculture. It helps farmers make better decisions, and in the artificial intelligence (AI) world, make decisions for them. The issue she says, is how can farmers' data be shared securely and safely so they and the broader industry can benefit from it?

"The NFF Farm Data Code is a code of conduct on how farm data should be managed to protect farmers and stay in control of it," Gabi said.

"Farmers can be sure certified providers comply with the Code, and it simplifies terms and conditions, which can be complicated and written in legalese.

"The ACCC says it would take the average user nearly 46 hours a month to read every privacy policy they encountered in full."

The Code is a voluntary code of conduct, and all product and service

providers who manage farm data on behalf of farmers, either directly or further down the supply chain, are encouraged to comply with the Code's principles.

"Farm data is very valuable and it should be shared for the benefit of farmers and the industry," she says.

"The technology you have available in the cotton industry is immense and sophisticated: predicting yield, when to irrigate using sensors and phones and so on. The data growers produce is already being collected and used.

"Agricultural industries should be sharing because you need to import data in to get useful information but it also creates aggregate data sets where other farmers can get benefit.

"In terms of AI – if you're not contributing to AI systems, you are not being represented which is not ideal for agriculture."

For more

NFF Farm Data Code

www.nff.org.au/programs/australian-farm-data-code/

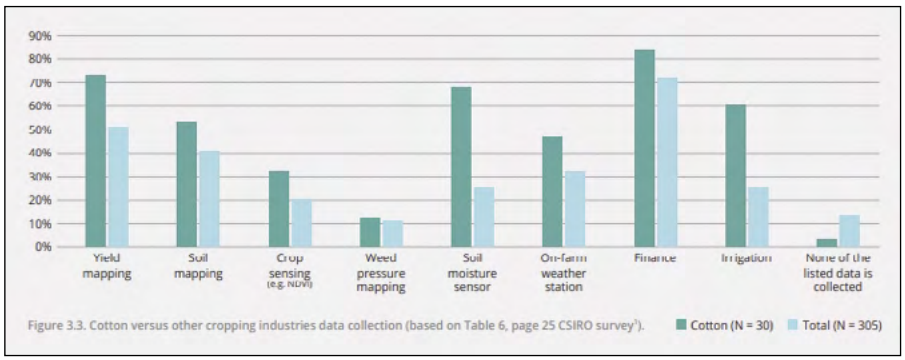


Figure 3.3. Cotton versus other cropping industries data collection (based on Table 6, page 25 CSIRO survey[1]).

Accelerating a digital future

IN 2016, CRDC led the Accelerating Precision to Decision Agriculture project (P2D). P2D brought together all 15 Research and Development Corporations (RDCs) through the Rural R&D for Profit program to evaluate the current and desired state of digital agriculture in Australia. CRDC is now implementing recommendations from P2D and the subsequent *Growing a Digital Future* project reports which provide a comprehensive and coherent framework for the digital innovation of Australian agriculture.

A key finding of P2D was that the full implementation of digital agriculture in Australia would boost the gross value of agricultural production (GVP), including forestry, fisheries and aquaculture, by 25 per cent, or $20.3 billion compared to 2014-15. The overall potential increase in national gross domestic product (GDP), including the flow-on effect to other parts of the Australian economy, was estimated to be $24.6 billion. For the cotton industry that translated to an estimated GVP increase of $394 million, and a $692 million benefit to the wider economy.

Recommendations from P2D focused on ensuring Australian primary producers are able to overcome the challenges limiting digital agriculture and profit from their data, and the need to facilitate the development of digital technology.

Other key recommendations were fostering the establishment of appropriate legal frameworks, data systems and access to critical datasets; and identifying the data communications systems required to deliver the benefits of digital agriculture to the Australia farm and agribusiness sectors.

Trust and legal barriers

P2D found that legal and regulatory frameworks around agriculture data were piecemeal and ad hoc. Fifty-six per cent of producers surveyed as part of the project had no trust or little trust in service/technology providers maintaining their data privacy. It recommended a voluntary data management code of practice and a data management certification or accreditation scheme be developed to provide quality assurance of Australian agricultural data. This has been realised through the NFF Farm Data Code and Accreditation system.

The report also recommended that each RDC develop a digital agriculture strategy, which the cotton industry has acted on. Over the past four years, a cross-sectoral group of cotton industry bodies, growers, gins, merchants, classers and researchers have been meeting to develop cotton's digital strategy. Its purpose is to prepare Australian cotton for a digital future and enable the industry to share, coordinate and use the mountains of data it creates in more meaningful ways (read the full story in *Spotlight* Spring 2024).

Data analysis and decision support

CRDC is also working on the development of an industry data platform on the back of the recommendations, which found there is a need for a platform for owners and users of agricultural data to exchange, market and value add data for a variety of end purposes. That's because fully-enabled decision agriculture require models and analytics with the ability to transform data into insights applicable to decision-making.

This includes availability of appropriate data. The P2D report says the whole agriculture value chain – irrespective of industry sector – could gain from improved access and interoperability of stored data through the sharing of datasets that are valuable across the rural sector.

The cotton industry data platform will aggregate, store, analyse and communicate data back to the industry and beyond. The development of this data platform is a key element of CRDC's Strategic RD&E Plan, Clever Cotton, and its data-driven decisions theme. We'll be bringing you more information about the data platform as it develops here in *Spotlight*.

COMMENT: WITH CROP CONSULTANTS AUSTRALIA

Are you collecting the data you really need?

The Australian cotton industry quite rightly prides itself on its availability of data – a credit to the long-term annual surveys undertaken by CRDC and CCA which capture the key data sets upon which the industry demonstrates its progress and practice change.

In the Spring 2024 edition of *Spotlight,* CCA spoke about the importance of on-farm data, and some valuable ways that in this digital age, you can make sure that the data your enterprise is accurate as possible.

In this edition, we would like to explore how important that data is, both now and going forward, to your individual business and the Australian cotton industry as a whole.

During the recent review by the Australian Pesticides and Veterinary Medicines Authority (APVMA) of paraquat and diquat, it became clear that there were some significant gaps in published and peer reviewed industry data and research that could have assisted the regulators to develop a comprehensive picture of the farming systems in which these products play a key role.

The cotton industry, in its submissions to the review by both Cotton Australia and Crop Consultants Australia, was in a much better position than other key agricultural industries to fill these gaps. The data from the CRDC surveys allowed immediate access to 30 years of product usage and crop management data. Combined with cotton's ongoing work in sustainability, a strong case has been presented to the APVMA to demonstrate responsible use and application of these important actives.

This review was extensively covered by the media and potentially has garnered more attention than any previous APVMA review. Most growers would have been aware of draft recommendations and their implications, and thanks must go to the many who made their own submissions during a very busy time in the field. Most however, would not have been aware of the enormous, concerted effort that went on in the background during the period of the review as industry bodies, researcher groups and grower bodies worked fill the gaps of missing data to assist the APVMA in their further review.

The review highlighted that in some cases, the rapid adoption of technology (including optical spot sprayer systems) had not been matched by the collection and analysis of that data by industry bodies and researchers. It has to be said that there would not be many sectors in Australia who could work as collaboratively as agriculture over the period of the review, and the additional input that was received from growers, consultants and researchers was overwhelming.

While the review is not complete and the APVMA is set to deliver its findings in early 2025, there are a number of other key reviews in both planning and progress stages which will require industry input. The APVMA updates these priorities on their website at www.apvma.gov.au/regulation/chemical-review/listing-chemical-reviews/chemicals-prioritised-reconsideration. Again, the CRDC and CCA data will provide a solid basis for industry submissions.

This review process has provided a key clear example of the application of data. It has also highlighted that it is timely that both as an industry and as individuals, we examine exactly what data we have collected, are collecting now, and possibly and probably will need in the future. While sustainability has long been a mandate for Australian cotton, the compulsory provision of greenhouse gas emissions is now clearly on the horizon, with the Commonwealth Government currently developing voluntary accounting standards for agriculture, fisheries and forestry. Are we really prepared for what may be requested of us in the not-so-distant future?

Requests for data to justify our social license to farm should not be your primary reason for working on this part of your business. Application of data to reflect on decision making, planning for the future, succession and benchmarking is critical to sound business management. Additionally, the future efficiencies that you may achieve will be well worth the effort.

Potentially many of us are not aware just how much important data we already have assembled, albeit stored in many places. This is not just that recorded through state-of-the-art telematics, but also that collected in the past - even in the farm diary of old.

In order for us to make the most of this data, the initial step is always to make sure that just like in the CRDC surveys, all data is stored securely (from both data theft and loss through fire or flood), in the one place, on the one platform. Only then can you access it quickly and easily when required and reap the maximum benefit.

As the complexity of data collection, its ownership and its interpretation becoming ever increasing, it is sometimes easy to feel that the whole concept is beyond our understanding. It is also easy to dismiss new opportunities believing that they are not within our economic reach or personal ability to interpret.

This is where your consultant can assist. They have the skills and expertise to assist you collate that data that is ready on hand, assess your gaps in data collection and collation, and integrate the application of your data into your future planning. Gone are the days when your consultant only provides agronomic advice and you may be surprised by the suggested small changes, that will make all the difference to your next crop.

Challenge accepted: innovators deliver spray application options to mitigate drift

In 2021, CRDC led a challenge to innovators across Australia to help solve one of cotton's most persisting problems by posing the question 'Is it possible to revolutionise agricultural spray application?'

The challenge was a part of the Australian Government's Business Research and Innovation Initiative (BRII), which is designed to support innovators with funding for early-stage development of solutions to real-world issues across industries including agriculture.

Initially, six applicants were chosen in response to the spray application challenge, each receiving a grant of up to $100,000 to further develop their ideas and test their feasibility. From these six, two applicants were then chosen to move to the next stage, receiving up to $1 million from the government to develop a prototype or proof of concept.

The two successful innovators were INCYT and SwarmFarm.

INCYT is part of the LX Group, which is a 'full stack' company – so called because it produces everything from electronic hardware and firmware through to the cloud back-end and software for a range of clients across many industries. The team specialise in internet of things (IoT) and electronic product development and have been designing for tech start-ups through to multi-nationals for over a decade.

SwarmFarm are no stranger to the cotton industry. Based in Gindie in Central Queensland (Gayiri country), farmers Andrew and Jocie Bates are innovators of agricultural robots for crop production. Their SwarmBots are capable of autonomously spraying and slashing, along with testing now underway for a tillage capability. Their distinct orange colour and lack of cab are now seen spraying farms unaccompanied across NSW and Queensland.

Starting from two very different places, both companies have been working on creating new specifications for their spray application technology through the BRII challenge.

Top Gun inspiration for Maverick

The INCYT innovation is the creation of a system called Maverick Spray Advisory, an advanced spray management and optimisation system that allows spray operators to plan, track and record spray jobs. Its dynamic forecast allows growers to plan their spray activity more accurately a week ahead.

Maverick products are being released commercially in stages, with the first in 2023. This first release focused on delivering the 'spray advisory' – a traffic-light-style dashboard so operators know when to start, continue or stop spraying. It involves using a base station, with software and sensors designed to be retrofitted to interface directly with existing systems in all makes and models of tractors and spray rigs.

"Maverick essentially uses a broad range of sensors putting accurate, real-time data in the operator's hands and coupling it with our decision-making software," INCYT CEO Adam Schindhelm said.

"In giving spray operators Maverick and its ability to interpret spraying conditions, we can help stop drift and actually open the spray window, not close it."

The BRII challenge enabled the INCYT engineering team to expand its focus and use its development expertise to address the complex area of spray drift.

"Through the BRII challenge we established industry connections and aligned our technology and R&D roadmaps to focus more on mitigations for drift issues," Adam said.

"CRDC helped us establish numerous industry and grower connections that not only aided with the BRII project but also accelerated adoption and refined the overall strategy for INCYT technology in the cotton industry.

"We see Maverick as a useful system on any Australian cotton farm, starting from providing information for spray planning with its dynamic forecast, to an alert system that makes sure operators are made aware of any change in conditions, to becoming an in-cab spray management system.

"While Maverick is already in use on many cotton farms in a number of regions, we aren't nearly finished with the engineering and development from our side."

Wee Waa (Kamilaroi country) cotton grower Ben Swansbra has been using the Maverick system and has seen multiple benefits.

"Just knowing the exact conditions on our farm ensures that I know when I can or can't be out there spraying, without having to make a guess based on a far-away weather station," Ben said.

"This gives me peace of mind that I'm doing the right thing and provides the historical data to show we are spraying correctly and within guidelines, should we need it for auditing, which is becoming more common with some of the spray drift issues experienced in the wider area."

Spray application specialist Craig Day of Spray Safe and Save was also one the six finalists in the BRII challenge for his water quality project. Craig has been running spray applicator training throughout cotton growing regions and uses the Maverick Spray Advisory.

"One of the reasons Maverick Spray Advisory is popular with cotton growers is because it shows them exactly what the local Delta T, temperature and wind conditions are, resulting in an easy-to-understand dashboard that gets updated as the local conditions change," Craig said.

"The alert system is also great, as it gives the user a warning when a pre-set variable such as wind speed or direction changes during the spray application, allowing the operator to immediately take this into account and act accordingly."

Future releases will involve a simple yet comprehensive framework for spray planning with dynamic risk forecasting based on the details of the spray plan, and an active monitoring component that measures the performance of the spray session from both a drift and spray efficacy perspective.

"Our goal is to develop a tool that growers can rely on with embedded up to date chemical label data, clear risk signalling and simple clear reporting, ultimately leading to better spray results," Adam said.

For more
INCYT Maverick
www.incyt.com.au

OPPOSITE PAGE:
Wee Waa cotton grower Ben Swansbra says the Maverick system has created surety around local weather conditions.

ABOVE:
Maverick is an in-cab spray management system.

Robots leading a revolution

A robot that autonomously roams paddocks spraying weeds, that starts and stops its operation depending on the weather conditions, and is able to refill itself may seem like a pipe dream, but these machines do exist and they are quietly roaming Australian paddocks, changing the face of farming as they go...

SwarmFarm have revolutionised spray application under the CRDC and Australian Government Business Research and Innovation Initiative (BRII) challenge by eliminating the possibility of off-label spray application. Their autonomous SwarmBots now stop/start or move spraying dependent on weather conditions and the proximity of sensitive areas downwind of the spray application. Low power mode software puts robots into a deep sleep to save power and reduce emissions during times when spray conditions are not favourable. In a huge leap forward for autonomy, the SwarmBots can now dock and refill without human intervention.

According to SwarmFarm founder Andrew Bates, the BRII challenge accelerated their ability to bring the new capabilities to the market.

"We have a really passionate team here at SwarmFarm, and BRII allowed them to pin their ears back and get going on development," Andrew said.

"BRII allowed us to fast track our aim to integrate weather stations' data into the robots so we could be working in 100 percent correct conditions, and we knew if we did that, then the dock and refill capabilities would be needed to take advantage of these spray windows.

"Now what Australian growers have is access to are robots that virtually eliminate human error, which is the cause of spray drift, without the need to handle pesticides.

"We know it's human nature that ultimately causes drift because the science and research has been done and if you spray in the correct weather conditions, off target drift can be prevented.

"We have the R&D and science at our disposal to avoid it – it's all on the label. We really saw this as part of our research during BRII.

HAYES SPRAYING

"The labels basically say if you spray in these conditions drift won't happen, but unfortunately to get the job done people may be tempted to work on the fringes of the safe spray conditions to get the job done.

"Our robots can get 100 percent of the available and correct spray conditions and take the human factor out of it.

"Very few people are able to achieve even 60 percent use of the available spray window due to other farm priorities and tasks that also need to be done.

"And we have a future where the application window will become smaller still, which makes the need to make the most of available spray windows even more important.

"Robots with spraying capabilities like ours overcome the human factor to avoid drift and make the most of a window as they're not compromised by staff availability, the time of day or night, or whether there is anyone around to help refill, which are all considerations with conventional sprayers.

"Our technology actually rewards farmers with a bigger spray window."

Prior to BRII, SwarmBots were already engineered with inherent drift reduction qualities, with a relatively slow top travel speed of 10km an hour and a very stable boom, which are key aspects of drift management. Because they are light (three to five tonnes depending on the configuration), they can get onto fields sooner after rain and be in the field more often.

"On the other side of it, normally people wait until there are enough weeds before they spray, but with robots that isn't a consideration," Andrew said.

"I say never let the engine go cold, run your robot like a centre pivot and keep it going all season long and never let a weed get bigger than a Coke can."

It's always been about keeping the robots small, lightweight, simple and low cost. Small commodity (spray) tanks have kept the weight factor and hence compaction down. Now dock and refill means they didn't have to compromise size or weight to tackle blanket spraying by increasing tank capacity.

Development of a dock and refill system has been a major breakthrough that has created improvements in spray application even beyond SwarmFarm's intention.

"We have taken the weight out of spot spraying technology, and with dock and refill we now have the ability to run higher water rates for blanket sprays which gives us options in terms of how we use the robots on a couple of levels," Andrew says.

"We have uncoupled machine size from productivity."

"We have uncoupled machine size from productivity..."

Autonomous dock and refill offers an advanced efficiency gain by making the most of an available spraying window and SwarmFarm's statistics show that dock and refill has also opened up use for blanket spraying for insecticides, fungicides and residuals.

"We are currently sitting at around 220,000 operation hours across all SwarmBots and I predict that figure will double by the end of the fallow up here, just before planting winter crops around April.

"Our robots have already covered over five million acres in Australia – no-one else is close to that. By enabling autonomous spot spraying we are driving down the weed seed bank and significantly reducing herbicide usage."

These figures are only set to rise with another 60 robots currently on order. Demand is being driven by giving growers new avenues to manage pests and diseases that once weren't considered practical.

"I'm using the dock and refill function to apply foliar fertiliser sprays to our chickpeas – something I would never have time to do with a conventional sprayer because it's impractical from a labour and/

or opportunity perspective," Andrew said.

"It's allowed us to do something we never considered practical.

"The CRDC BRII challenge is one of the most fantastic things we've been involved in. To be able to pitch a vision and a solution that the government and cotton industry could back, meant derisking the investment and making it possible to bring it to the market.

"It's not just about the dollars either. We were linked with experts across the cotton industry through CRDC, the APVMA, Stop off Target Spraying (SOS) spray groups and more – it's one of the best things we've ever done.

"The outcomes we've achieved are good for the industry, Australian growers, the environment and good for us.

"It still to this day blows my mind: firstly, how cool these robots are and secondly, the pride for what we've developed up here on a farm in the middle of Queensland."

CRDC Senior Innovation Broker Susan Maas says for her, being involved in the BRII challenge brought a sense of satisfaction in having delivered this world-first SwarmFarm technology to Australian growers, the cotton industry and agriculture as a whole.

"BRII was a great program. Providing the opportunity to work with a range of different companies to bring a fresh commercial lens to spray drift was a new experience," Susan said.

"With the Australian Government as the direct funding body, CRDC could focus on playing a guiding role, while still being involved in the innovation and 'start up' way of thinking.

"The experience has expanded who we work with and how we work with them.

"We were able to connect the BRII participants so they could meet and talk to people about the spray drift problem – to work out what would have the most benefit for growers and cotton.

"This in turn means we end up with better, more suited innovations for agriculture."

For more
SwarmFarm Robotics
www.swarmfarm.com

Where will the future take robots?

SwarmFarm are one of the few companies worldwide with real robots already working on farms. For the Bates's, it's really just the beginning as they continue to challenge the status quo. Their innovative vision for the future questions the entire on-farm cycle: from how cotton is bred, to how it is managed and even picked.

"SwarmFarm robots are not simply a driverless tractor that automates existing field operations: we believe that robots are the obvious progression after the tractor," Andrew said.

"Robots are giving us a new way to look at how we farm and offer opportunity for efficiency and productivity gains.

"For example, cotton is bred to be planted by current conventional planters and picked by mechanical pickers. I can't wait to get our first robotic cotton partnership under way, to pick cotton as it is ripened.

"As an industry, we currently work on picking at 80 per cent open cotton, exposing it to weather damage as bolls open and then compromising the last 20 per cent of yield.

HAYES SPRAYING

SwarmFarm's new tillage addition is changing the way people manage their staff and their farms.

"With a robot we could segregate every pick in terms of quality and get higher yield and better quality – and then imagine we could change the genetics to suit robots, not cotton pickers.

"We could unlock higher yielding or better water efficiency which may never have come about until robots.

"We grow everything in rows but we might start planting in hexagonal configurations, for example. Right now, we're still defining everything from a double disc planter perspective.

"A lot of technology needs robotics to be applied."

SwarmFarm autonomy brings many benefits

Simon Doolin has had a SwarmFarm SwarmBot on his farms at North Star (Kamilaroi country) for three years and says it has been a game changer for a number of reasons, including for compaction, labour and safe spraying.

MELANIE JENSON

Doolin Agriculture Farm Manager Henry Dight and Simon Doolin are enjoying the benefits autonomy in offering spray operations. The single SwarmBot unit is covering 7000 hectares of summer and winter crop, including under several centre pivots.

"For us, spraying can be a seven day a week job, so that meant being on standby all the time. That's where the robot comes into its own," Simon says.

"It has freed us up on-farm and we can get other jobs done, like farm maintenance and earthworks, instead of having someone either on a spray rig or on standby.

"As a result our paddocks are in better condition, and we have the peace of mind that the robot is working under correct conditions.

"From an industry or broader perspective it means sprays can be done in perfect conditions not to suit or fit in with someone's calendar or availability.

"While the robots still need to be checked and moved, they are just out there, getting the job done, day or night, so it's taken a lot of the stress out of weed management for us.

"I had originally ordered two units because I didn't think one would keep up – but I didn't need the second one as this one has us covered."

The Doolins grow a range of crops across several properties, including dryland broadacre crops (grains and legumes), and irrigate cotton and rotations crops under a centre pivot. The country varies from lighter soils to heavy clays in undulating country. They've used precision ag technology for many years, which has included tram tracks. Simon says the decision to keep the weight of the SwarmBots down was a good one.

"They've gone down the right path keeping them light and low horsepower," he says.

"It's only doing 10km an hour, but it is consistent and gets over a lot of country.

"The light weight has really good for our soil, as our wheel track issues have disappeared, and they can now read our contour banks better."

SwarmFarm platform Swarm Connect allows just about any spraying technology and software to be attached to the robot. This was an attractive option for the Doolins when they were looking at purchasing spraying machinery, and influenced their decision.

"Most farmers today have invested in some sort of spot-spraying technology," Simon said.

"It has allowed us to go with Weed IT, which we already used on farm, albeit with spraying contractors. This option has worked well for us, fitted to a Hayes 18-metre trailing boom.

"We also took into consideration the price of tractors, and the amount of hours we'd be putting on them, along with an operator, so we decided to go one step further with an autonomous robot.

"Spraying is a slow steady job, that you need good conditions for, and those conditions can change quickly.

"I know the SwarmBot will stop when conditions deteriorate and continue when suitable, which really comes into its own at night, when no-one really wants to get out of bed to get on a conventional spray rig."

Adding the dock and refill technology will be the next step, which will open up blanket spraying capabilities. Green on green technology would also add another benefit in terms of timeliness.

"Camera sprays in typical fallow don't really work for us until December or January, but if we could follow behind the headers at harvest time that would be ideal."

Not all inversions are equal: there's only one sure way to tell

The most advanced hazardous inversion sensing technology in the world was developed by Australia's cotton and grain industries.

The WAND (Weather and Networked Data) system can distinguish a hazardous surface temperature inversion from a non-hazardous one in real-time, as well as give users an accurate two or 24-hour forecast to their onset and end. It has the capability of not only helping alleviate off-target sprays but also opening up the spray window in comparison to using traditional inversion detection approaches.

WAND has been a ground-up build, both scientifically and structurally, with the aim of giving crop managers the ability to detect hazardous inversions, a leading cause of spray drift – in part because they can be difficult to detect.

From the science aspect, it has involved building prototypes, gathering data, modelling, developing and trialling software and testing its efficacy. Physically, it has involved designing and physically putting together each component in a workshop in Goondiwindi (Bigambul country) in regional Queensland, building each 10 metre tower, and travelling across the country erecting them.

Goanna Ag CEO Jay Jalota, Chief Operating Officer Tom Dowling and Chief Development Officer John Pattinson at the headquarters in Goondiwindi.

WAND is the result of blue-sky thinking and collaboration between R&D and commercial technology providers, and is only available to Australian cotton and grains farmers.

Initially developed with support from the Grains Research and Development Corporation and CRDC in collaboration with Goanna Ag, WAND is now operated by Goanna Ag, who are working to continuously build the usability of the product that the company has become known for through its other range of products.

With the WAND network now built and operational, Goanna CEO Jay Jalota says Goanna are now focused on WAND's usability and new features for people planning and carrying out spray operations.

He says the greatest outcome of WAND is the hazardous inversion alerts which have opened up additional spray window opportunities compared to traditional inversions.

"The biggest benefit of the underlying science and work of the cotton and grains industry is that is has opened up an additional four hours per day of additional safe spray time," Jay says.

"It's not just about knowing when a hazardous inversion starts – of equal value is knowing when it will stop, so there is no time wasted getting back in the field.

"The comparisons we ran on WAND versus traditional inversion monitors were an eye-opener, as there were assumptions around the type, timing and duration of inversions. Through WAND we've taken the guesswork out of that."

Since launching in December 2022, over 3800 WAND customers have gained access to 102 weather towers. Sixty per cent of cotton growers who use WAND have reported making a change to their spray application as a result.

"As growers become aware of WAND's capabilities we have seen increases in usage especially in the summer months, which has doubled from one summer to the next," Jay said.

"Not only has the number of people using it increased, so has their frequency of use."

The investment to develop, build, install and manage the WAND network was provided by GRDC and CRDC. This investment is approaching completion and Goanna Ag now need to create a sustainable business model to maintain and further develop the platform. That includes a new subscription option, which went live in November.

"Importantly, access to the key functionality of WAND remains free: the real-time weather data, the detection of the presence or absence of hazardous inversions, and the 'nowcast' prediction within the coming two hours."

Importantly, access to the key functionality of WAND remains free: the real-time weather data, the detection of the presence or absence of hazardous inversions, and the 'nowcast' prediction within the coming two hours.

Growers and spray contractors who wish to access additional features – additional WAND towers, 24-hour hazardous inversion forecasts, rain and humidity, long-term searchable history and future enhancements such as text message alerts around hazardous inversion status – can purchase an annual subscription for $249.

As a limited introductory offer, subscribers who choose the paid option will be eligible for a $500 credit against the purchase of a new Goanna Ag weather station for orders placed by January 31, 2025.

CRDC's Innovation Broker Susan Maas has welcomed the new features and the subscription service.

"This is a crucially important step forward for WAND as it transitions from being research and development supported by GRDC and CRDC, to a commercialised product delivered by Goanna Ag for the benefit of the grains and cotton industries," Susan said.

"Ensuring it is self-sustaining means vital research and development levy funds can be reinvested by GRDC and CRDC in important new projects for growers.

"WAND is world-leading technology available only to Australian farmers, which is a significant achievement for our industries and Goanna Ag."

For more

WAND

www.wand.com.au

Hazardous surface temperature inversion information

www.grdc.com.au/resources-and-publications/all-publications/factsheets/2024/05/hazardous-inversion

Steve Klowss and his team at 'Strathguyle' use WAND which they see as a key tool to ensure correct spraying operations.

Everyone on board with WAND

Farm manager Steve Klowss says all his staff have the WAND app on their phones and are well-versed in using it, along with his aerial spraying contractors in Mungindi, North West NSW (Kamilaroi country).

Steve manages 'Strathguyle' for Evolution Farming, which has a WAND tower on the property. It's used with a Goanna Ag weather station and in-built weather stations in spray rigs to mainly track wind speed and direction. The key tool is the WAND tower though, Steve says, having been hit by some serious drift events.

"We were all for putting a tower up here because in the 2022-23 season we got drifted about seven times – it was shocking, we thought we would have to plough it out," he said.

"We averaged 11.5 bales when others around us were seeing 15 to 17."

The hazardous inversion forecast has made planning spraying jobs and organising staff easier to manage.

"The boys can get on the app and check the conditions and the inversion forecast," Steve said.

"We aim to pull up an hour before a hazardous inversion is forecast to start, so even the two-hour nowcast allows us to potentially mix up half a tank and get it out in plenty of time prior to the forecasted time.

"Using the WAND forecast saves us time, and you know when you can spray for sure, we know what time we can mix up a load and spray in the right conditions."

Steve's spray rig drivers also keep a manual log of conditions taken from WAND, along with the on-board weather data.

"WAND has been really useful, especially in winter when we are spraying dryland," Steve said.

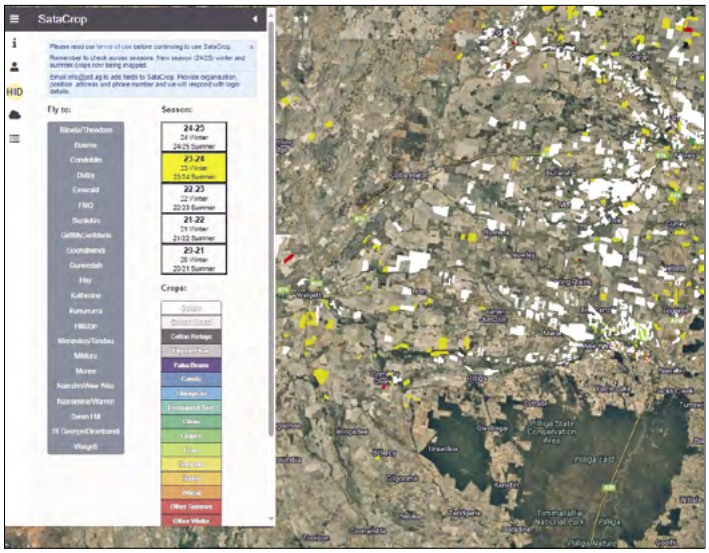
"We've been drifted badly don't want to do it to others.

"And it's not just about using it with herbicides, it has a place when using insecticides.

"Using WAND has makes us more aware. We always knew that there was a risk of inversion any time of the day, but now we have the information at hand to tell us for sure."

Put yourself on the map

Farmers from all cropping industries are encouraged to get on-line and map their fields to help prevent off-target spraying.



Growers are urged to map their fields on SataCrop. It's a simple, free and practical way for crop managers to let others know what they have in the ground at any given time.

SataCrop is an industry initiative developed by Cotton Australia and Precision Cropping Technologies (PCT) that can map all crop types in a season, farm by farm and field by field. This allows spray organisers and operators to know where sensitive crops are located in proximity to their planned spray operation.

Growers are encouraged to map all crop types with SataCrop. It's a simple, easy to use way to provide information on crops to others, and to gain a greater awareness of surrounding agriculture for yourself. The more farmers and land managers who log on and record crop locations, the better the tool works.

Coupled with vigilance around spray conditions, wind directions, and application, SataCrop helps to reduce adverse effects of spray drift.

"Stewardship of all pesticide applications to prevent off-target spray damage is a priority across all of agriculture to ensure protection of crops and the surrounding environment," Cotton Australia's Policy Officer for Research Direction and Stewardship, Doug McCollum said.

"Suffering spray drift damage is frustrating and has a detrimental financial impact on our growers.

"It's an issue affecting all of agriculture across a range of pesticides, so it's important for all that we remain vigilant to protect our farms and the ongoing access to key chemicals, by responsibly using the tools we have at our disposal."

Each season, Cotton Australia works closely with cotton growers, spray applicators, chemical registrants, resellers, regulators and other agricultural industries to develop and deliver campaigns to mitigate spray drift.

It is also critical that growers report any incident, or suspected incident to Cotton Australia as soon as it occurs.

Cotton Australia has introduced the 'Snap Send Solve' app which provides a platform for cotton growers to document and report spray drift incidents efficiently, facilitating timely responses from growers and industry stakeholders. Damage can also be reported to a Cotton Australia Regional Manager.

"It is essential that incidents are properly logged and investigated, and Cotton Australia has a straightforward process that is simple and confidential," Doug said.

"It is important that we are made aware of spray drift incidents so that we can make representations on behalf of the industry.

"While Cotton Australia cannot take legal action, provide professional advice or submit adverse experience reports to regulatory authorities, we can point growers in the right direction and tailor spray drift awareness initiatives into key areas based on feedback received by growers."

Help protect our bees using BeeConnected

Through BeeConnected, registered farmers and contractors receive notifications when a registered beekeeper places their beehives near a farm or where crop protection products may be applied.

Registered beekeepers also receive an alert when a farmer or contractor intends to use a product to protect their crop. The tool enables instant messaging between beekeepers, farmers and contractors, while maintaining privacy through the use of a restricted in-app messaging service. BeeConnected is free and available on iPhone, Android and desktop computers.

For more

BeeConnected
www.croplife.org.au/resources/programs/beeconnected/

For more

SataCrop
www.cottonaustralia.com.au/spraydrift-and-satacrop

Snap Send Solve app
www.cottonaustralia.com.au/spray-drift-app

Spray drift information
www.cottoninfo.com.au/pesticide-input-efficiency
www.grdc.com.au/resources-and-publications/resources/spray-drift

Creating a pathway for Australian cotton's carbon journey

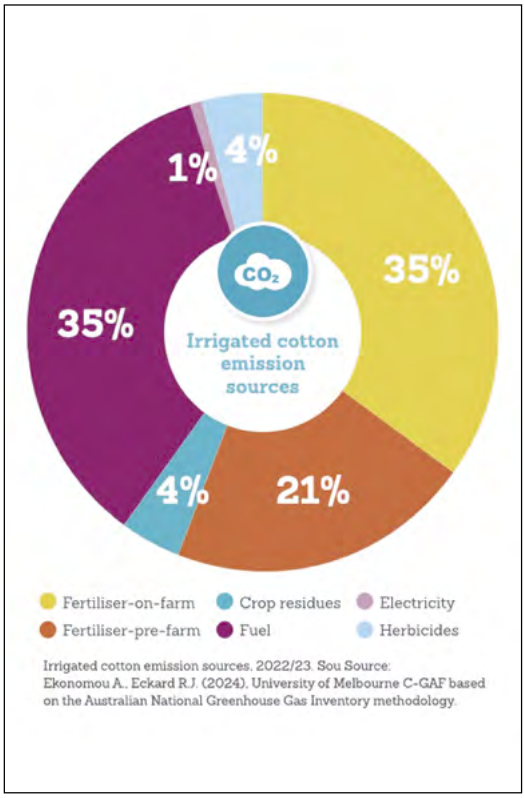
Welcome to *Spotlight's* Australian cotton emissions feature. In the following articles, we aim to explain the key points growers need to know about a topic that is confusing to many people. And we step through CRDC's approach: navigating a clear path through the complexity to manage risks and opportunities for the industry, based on the available science and grower input.

Under CRDC's current Strategic Plan, Clever Cotton, CRDC has an objective to establish a sustainable, low-carbon cotton production system. Investments under the Plan's carbon theme are designed so that by the plan's end in 2028, the cotton industry meets market, community and government expectations for carbon. This aligns with and help informs cotton's PLANET. PEOPLE. PADDOCK Sustainability Framework.

Under this theme, CRDC will:

- establish ways to reduce greenhouse gas (GHG) emissions on cotton farms
- define and describe pathways for carbon sequestration and capture on farms
- improve understanding about managing soils for organic carbon and supporting soil health
- support growers to manage carbon across their farming system, and
- give growers the tools to measure and report their emissions profile.

The carbon theme has a strong focus on improving cotton's nitrogen use efficiency by reducing fertiliser rates to match plant demand. Previous research by CSIRO, supported by CRDC, has shown that on-farm emissions from nitrogen (N) fertilisers account for about 35 per cent of



Irrigated cotton emission sources, 2022/23. Sou Source: Ekonomou A., Eckard R.J. (2024), University of Melbourne C-GAF based on the Australian National Greenhouse Gas Inventory methodology.

R&D on-hand to manage nitrogen use efficiency

Since 1984, the cotton industry has invested heavily in R&D across nitrogen (N) fertiliser use and issues, including through the recent three-year More Profit from Nitrogen program. The breadth and depth of research is extensive, with CRDC's online library, Inside Cotton, listing 225 publications on the topic. These include a range of subjects such as soil and nutrition, rotations and irrigation – all factors in improving N use efficiency.

A significant contributor to this recent knowledge is Jon Baird, who has been working on CRDC-supported irrigation and N research for the cotton industry since 2014, when he started with NSW DPI (now DPIRD). He was also the CottonInfo Nutrition Technical Lead. Much of what we know about N application timing and relationship to irrigation is thanks to Jon's work. Jon has recently left cotton for a position with CRDC's sister organisation, the Grains Research and Development Corporation (GRDC).

Spotlight **asked Jon to name the top five learnings from his research over the past 10 years, in terms of managing N in cotton cropping systems. They are:**

- **The losses of fertiliser occurring early season during the first irrigation can be significant, upwards of 50 per cent of the applied amount.**
- **The method of in-crop application is not that important: ensuring the fertiliser is incorporated into the soil profile properly has greater significance for plant recovery and efficiency.**
- **N is key for optimal yield, but don't forget other macro and micronutrients. Especially in high-stress events, such as severe waterlogging, a multi-nutrient fertiliser is more important than N alone.**
- **Enhanced fertilisers will reduce losses, especially in the early season. However, you need to align the active lifespan with crop utilisation. If this isn't aligned correctly, you will lose the benefit of the inhibitors.**
- **Irrigation management is crucial for plant health and nutrient efficiency. Timely water application and quick turnarounds on the field will improve nutrient use.**

total emissions for a bale of cotton.

Helping growers realise value

CRDC Innovation Broker Nicola Cottee leads the carbon theme.

"Australian cotton growers are seeking clarity on why they should engage in carbon conversations and how to reduce their GHG emissions so they have options to respond to a changing climate and market demands," Nicola said.

"This is really important to us, as our focus is on ensuring that the options are there for when growers want/need them and that growers have confidence in their ability to capture value from carbon opportunities.

"In some ways, we're building the system around growers to make managing carbon easier, rather than asking them to take specific actions.

"In other ways, we'll be providing growers with specific information so that they can make their own decisions about managing carbon across their farming systems."

CRDC in consultation with Cotton Australia has begun to develop an Emissions Reduction Research Strategy to provide a clear path to emissions reduction.

The strategy will describe where the industry is now, where it aims to be in the future, and the research investments needed to achieve this and support growers.

"Many of the research actions needed to manage the climate-related risks and opportunities facing the cotton industry are already underway," Nicola says.

"The strategy brings these together, helps us identify gaps that we can address ourselves or collaborate with other organisations on to avoid duplication of resources, and provide estimated timelines for delivery of research outcomes."

The most important output of this strategy will be an Australian cotton emissions reduction pathway. The industry's sustainability advisor Chris Cosgrove is working on this pathway with cotton's Sustainability Working Group. He says it will deliver a clear, credible and achievable pathway of short-term and future actions for cotton to reduce emissions.

"It will spell out what some growers may be able to do now and what they may be able to do in future," Chris said.

"It will also make clear that while some future actions and technologies shows promise, their successful development is outside the control of growers.

"For example, using green nitrogen will significantly reduce cropping system emissions, but this depends on the manufacture of nitrogen fertiliser from renewable energy sources being commercialised.

"Even without a specific focus on reducing GHG emissions, many growers are already growing low-emission cotton right now just by growing a productive crop with nitrogen matched to yield targets and other inputs, like diesel, minimised."

"The emissions reduction pathway will focus on the actions most needed to reduce the source of cotton GHG emissions and those that growers can implement today.

"Even without a specific focus on reducing GHG emissions, many growers are already growing low-emission cotton right now, just by growing a productive crop with nitrogen matched to yield targets and other inputs, like diesel, minimised.

"If you're doing that, you're already reducing the GHG emissions per kilogram of cotton you grow without waiting for new technology, because it makes good business sense."

The Emissions Reduction Research Strategy is based on science and evidence. It shows that the three main actions, identified through research, for cotton to reduce GHG emissions are:

1. Reduce reliance on fossil fuels on-farm and in manufacture of inputs like fertiliser.
2. Reduce on-farm emissions from nitrogen fertiliser.
3. Improve soil health to improve productivity, resilience, and reduce inputs.

Spelling out a future ambition and providing a clear and credible and science-based pathway to achieve it will be essential for maintaining market access and attracting continued investment to the industry.

For growers, a clear science-based and economically viable pathway supported by the customers, investors, governments and other stakeholders the industry relies on will provide the certainty needed to support long-term planning and investment.

For more
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Grower attitudes around emissions and carbon

CRDC's long-standing grower survey has found many cotton growers are finding the world of on-farm emissions and carbon footprint difficult to navigate. For those who are taking steps to reduce their carbon footprint, reducing nitrogen (N) fertiliser use is the most common method.

Around a quarter of all cotton growers answered questions about their season for the 2024 Grower Survey, which included a carbon and emissions focus.

Assessing carbon footprints

The survey shows that while growers understand that assessing their carbon footprint is important, many remain unsure or feel they don't know enough about the topic to fully understand and address emissions.

Just over half are assessing or are planning to assess their carbon footprint. A further 34 per cent have already made changes to their cotton production system in order to lower their carbon footprint.

The top three reasons growers are assessing (or planning to) are: because they feel forced to, or believe it will become mandatory in the future; to establish a baseline footprint for comparison on changes to their farming inputs; and enforcement by Government or their financial institutions.

These reasons were followed closely by: wanting to show credentials to maintain market access and to secure longer term opportunities; for future carbon credits; and to increase financial gain and reduce costs. Industry pressure and social license were also important to growers.

Most growers are using their bank, independent assessor, or a third party to undertake assessments (35 per cent). The cost involved was why a small percentage of growers had not looked into an assessment.

"Many growers remain unsure about the topic to fully understand and address emissions"

Meanwhile, 45 per cent of growers were not assessing their carbon footprint and had no plans to. They were asked the reasons why they had this stance, and the top four reasons were:

- They just don't have time and/or have other things to focus on (26 per cent).
- There's no benefit / financial incentive for them to do this (14 per cent).
- It's not necessary / required / won't do it until forced to (11 per cent)
- Just haven't got around to it / taking steps to eventually assess (10 per cent)

Lowering emissions and reducing footprints

The survey shows that a significant portion of growers are aware of what they can do right now to lower greenhouse gas emissions and reduce their carbon footprint. N fertiliser and diesel use aren't just the two largest contributors to GHG on cotton farms, they are also the factors growers can most easily address.

A third of those working to reduce their carbon footprint are reducing N inputs and inorganic fertilser use, while a further 30 per cent are investing in more lower-emission equipment (e.g. better fuel efficiency, bigger machines, less hours, quicker water running, solar power). Others are reducing emissions with minimal or zero till systems.

Adjusting the timing/application/scheduling of N fertilisers and improving water efficiency along with using more organic fertilisers such as compost were equally used at reduction methods across 21 per cent of growers. For eight per cent of growers, different inputs such as coated urea/nitrification inhibitors are being used, followed by crop rotation, increasing the efficiencies of inputs and returning stubble to the soil.

For those not working to lower their carbon footprint, the survey found that barriers include not knowing enough about it or a lack of knowledge around how to do it, the cost involved, and the lack of incentive or financial benefit. 11 per cent said they were already undertaking green initiatives, and they can't do much more.

For more
CRDC 2024 Grower Survey
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Pilot workshop in the Macquarie

To overcome challenges highlighted by growers in the survey, along with ongoing industry feedback, CRDC and CottonInfo will support a pilot workshop in the Macquarie Valley next year to discuss carbon, biodiversity and natural capital.

It will be developed and run by CottonInfo Energy and Climate Technical Specialist Jon Welsh (pictured). Jon has authored many studies into N use, carbon management and reduction methods on cotton farms.

CottonInfo Program Lead Janelle Montgomery said the workshops aim to help growers understand what they need to know and what they need to do now in terms of managing their carbon footprint.

"This pilot workshop will equip growers with the knowledge and science to make informed decisions around carbon in their farming systems," Janelle said.

"This latest grower survey is proof that there are still a lot of grey areas for cotton growers in terms of their understanding of emissions and how to go about assessing their emissions.

"Jon has the technical understanding needed to deliver these and his experience as a fellow farmer is always well received by growers.

"We will also include a segment to help growers understand the role of natural capital on their farm and the need to protect biodiversity, to create more resilient farms and protect market access.

"The first workshop will be held in the Macquarie, with the potential to be rolled out across other regions. Stay tuned to CottonInfo for more details."

This workshop follows recent initiatives from some Cotton Grower Associations (CGA) and CottonInfo who have organised regional workshops to discuss carbon and emissions. CRDC will continue to support CGAs to host a carbon and emissions conversation with members through its Grassroots Grants Program.

Plans are also underway to develop a project to walk growers through a carbon plan, provide them with a low-risk environment for testing GHG emission reduction technologies in their farming system, and help them understand how to capture value from engaging in carbon conversations.

Scoping your emissions

A carbon footprint is the total GHG emissions (Scope 1, 2 and 3) caused directly and indirectly by your farming activity.

Despite what you may have heard, calculating your emissions should not be difficult. There are some key concepts to understand. GHG emissions are counted as carbon dioxide equivalent (CO_2e). There are seven different GHGs and all have different a different 'potency' in terms of their heat trapping capability and impact on global warming. The two main GHGs the cotton industry produces are nitrous oxide (N_2O) and carbon dioxide (CO_2).

To simplify accounting and reporting, all GHG are standardised into their carbon dioxide equivalent. For example, one tonne of N_2O is equivalent to 273 tonnes of carbon dioxide (273t CO_2e).

The scope of emissions

While cotton production creates emissions, vegetation on cotton farms removes (sequesters) CO_2 from the atmosphere, and stores carbon in vegetation and surrounding soil.

Companies all around the world are increasingly being asked to measure the net emissions associated with their business activites. For apparel and textile companies, that includes measuring the emissions created in the production of cotton, and all other emissions along their value chain.

To do this in a consistent way around the world, GHG emissions are divided into three categories: Scope 1, 2 and 3.

How GHG emissions are defined for cotton growing

Scope 1:

Come from your direct actions as a cotton grower on-farm from assets you own. The number one emission is nitrous oxide from denitrification of nitrogen fertiliser. Burning diesel in pumps, machinery or in trucks you own to transport cotton is the second most impactful.

Scope 2:

Come from fossil-fuel generated electricity used in the operations you own to produce cotton (domestic electricity is not included). The leading source for cotton is pumping irrigation water.

Scope 3:

Come from the activity of all the third parties associated with growing your cotton. They can be 'upstream' or 'downstream' from you. Upstream are things like the fossil fuels used to manufacture fertiliser – by far the biggest Scope 3 source for cotton production. Downstream, it could be the energy used to gin and process your cotton.

It's different along the chain:

Remember, Scope 1 are emissions that come from assets you own when you grow cotton, and Scope 3 are emissions someone else has generated in goods or services you use to grow cotton. Whether emissions are Scope 1, 2 or 3 depends on where you sit in the value chain. The emissions released in the manufacture of fertiliser are scope 3 for cotton growers, but are Scope 1 emissions of the fertliser companies that own the manufacturing

Why do I need to store carbon in the soil?

Apart from allowing us to grow better crops, healthy soil stores more carbon.

Soils contain the largest terrestrial reservoir of carbon on the planet, holding three times the amount stored in vegetation. Plants absorb CO_2 by photosynthesis, and some of that is stored in the soil as soil organic carbon via living roots and when plants (and animals) die and decompose.

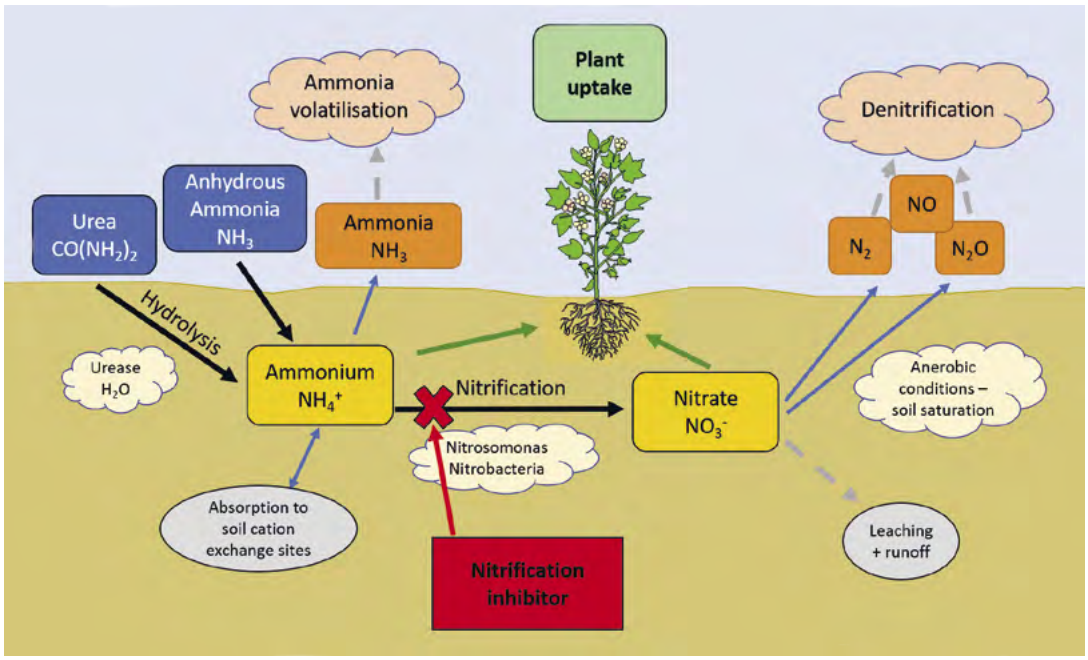
As all farmers know, increasing organic matter in soil increases soil health. So the number one reason – and often the only reason – for farmers to increase soil carbon is to increase soil health and therefore increase their productivity and resilience to climate extremes.

"While there is a lot of talk around carbon credits, the real and immediate value for most farms from improved soil health is likely to be reduced input costs, increased productivity and resilience, and increased access to premium markets," cotton's sustainability advisor Chris Cosgrove says.

"The three main ways for a cotton farm to reduce net GHG emissions are to reduce fossil fuel use, reduce nitrogen fertiliser use (and/or increase nitrogen use efficiency), and maintain or increase trees to store carbon permanently.

"When looked at in this way, you can see actions to grow cotton as efficiently as possible and reduce input costs and improve soil health will normally support improved margins – and will also deliver cotton with a low GHG intensity.

"This should be enough to more than enough for most growers to manage risks, increase productivity and maintain markets – anything on top of that like carbon credit payments should be seen as an optional extra."



JON BAIRD

facility. The emissions released from nitrogen in your soil are your Scope 1 emissions, but are Scope 3 emissions for companies that buy your cotton.

GHG emissions are estimated, not measured

Accurately measuring GHG emissions would involve putting a big tent over your farm and using sensitive equipment to precisely measure GHG emissions. This is not exactly practical.

Instead, virtually all GHG emissions around the world are estimated using calculators. These calculators are based on research that estimates the emission factors of each activity that releases emissions. All emission factors for GHG estimation in Australia are outlined in the Federal Government's *National Greenhouse Accounts Factors* publication. Here you will find the CO_2e emission factors for calculating the emissions released when a litre of diesel is burnt, when a kg of N is applied to the soil, and so on. Because they are based on research and modelling, emission factors are regularly updated.

Why do different GHG calculators give different results?

In theory they shouldn't, because they are all based on the same emission factors. If you enter your input data – diesel use, fertiliser use, yield etc – into any calculator, you should get the same result.

In practice, there are sometimes different results for two main reasons:

1. A calculator may not be using the latest emission factors. Remember, these are updated regularly as research improves, and if the organisation behind a calculator doesn't update emission factors every time they are released, you will get different numbers
2. There are different standards for accounting GHG emissions. What gets included and what gets left out varies slightly between these standards. If two calculators use different standards but exactly the same emission factors, they will produce slightly different results. This is obviously a bad outcome and a source of great confusion. Eliminating inconsistency in calculation across agriculture is a priority.

What is being done to standardise GHG calculations in cotton and agriculture?

A number of steps are being taken to eliminate inconsistency in GHG calculations:

1. Using the same calculator. If everyone uses the same calculator, they will all get the same result. The Australian cotton industry, and almost every other agriculture industry, has adopted the Greenhouse Accounting Framework (GAF) calculators developed for each commodity by the University of Melbourne.
   The GAF team is led by Professor Richard Eckard, one of Australia's leading agriculture GHG specialists and one of a small number of experts on a new technical committee responsible for monitoring and updating emission factors when needed – which should give growers confidence in the robustness of the GAF tools.
   For farms with more than one commodity, the Agricultural Innovation Australia (AIA) Environmental Accounting Platform (EAP) pulls together GAF tools for each commodity into a single platform to give farmers and their supply chains a standardised approach to carbon accounting across a wide range of commodities. The platform has recently received certification under the National Farmers' Federation Australian Farm Data Code. (See story page 9).
2. The Australian Government has convened a refererence group to advise on a common approach to GHG accounting and reporting across all sectors.

Optimising irrigation performance offers a way to improve both water management and nitrogen (N) use efficiency.

Irrigation is key to better nitrogen efficiency

Automated bankless systems give irrigators more opportunity for greater control over water flow on and off the field (than in traditional syphon systems), offering greater irrigation efficiency.

Dr Wendy Quayle of Deakin University says irrigation efficiency is strongly aligned to nitrogen (N) losses as it has important control over plant N uptake and environmental loss via periods of soil saturation, N application uniformity, root growth, run off and deep drainage.

"Water volumes and water velocity flowing through the field in bankless systems are high which may alter the availability of soil sourced N" Wendy said.

"So, although nitrogen management itself can improve nitrogen use efficiency, accurate control of irrigation is imperative for even further improvements in N management."

In the 2024-25 season, Wendy and Deakin University PhD student Gerardo Torres are working with growers in the Riverina region of NSW (Wiradjuri country) to monitor water and N balance simultaneously in their (drain back) automated bankless channel systems.

"In participation with these growers, we have been monitoring irrigation cycles which has involved using farm wi-fi systems to log field sensor data so that gate opening timing is more accurate with less need for field visitations," Wendy said.

"This sensing is being conducted in combination with manual measurement of water flow on and off the field and total dissolved N concentration within and between bays.

"The data will give more accurate estimation of the application, plant availability and use efficiency of both of these inputs which is important for growers looking to redevelop and transfer to bankless systems."

WENDY QUAYLE

The data from a project in the Riverina will give more accurate estimation of the application, plant availability and use efficiency of nitrogen and water, which is important for growers looking to redevelop and transfer to bankless systems.

Gathering new data sets

For the first time in bankless cotton, evapotranspiration is being measured directly without the need for other crop measurements. Soil moisture is continuously logged and Gerardo has automated deep drainage meters and located them at different positions in the soil profile to provide estimates of water and N movement within and below the root zone. He is also undertaking root imaging to characterise root growth in these high yielding systems according to grower water management.

Wendy found that during her experiments in the 2023-24 season, irrigation water application was lower than 0.6ML/ha/irrigation cycle in the vegetative/squaring stages due to ongoing seasonal rainfall. Nevertheless, typical water applied in full irrigation later on was favourable, being sustained at 0.7 to 0.9 ML/ha/irrigation cycle.

"This confirms previous anecdotal evidence that automated bankless systems are efficient compared with conventional syphon systems when well operated," Wendy said.

Estimates of run off for the first individual bay in a sequence of bays in the drain back systems is approximately 50 per cent. However, this reduces to around 25 to 30 per cent as the irrigation cycle progresses and growers manage drainage from upstream bays to water lower bays.

"Simultaneously, knowing the amount of N that runs off is important to ensure field N budgets are met," Wendy said.

"An in-season water run urea event with a target of 50 kg N/ha indicated that 22 to 30 per cent of the applied N left the area to which it had been applied.

"Although preliminary, there was apparently greater recovery of mineral N in the bankless channel end compared with the furrow end of the bays.

"Although plant growth and yield were not affected, further clarification may warrant growers to modify application rates to account for this variability."

For more

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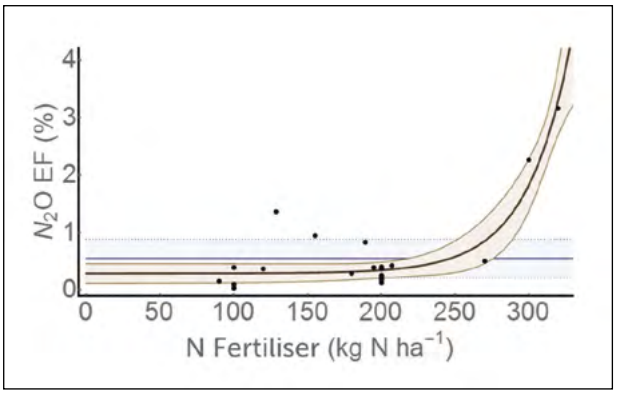
Optimisation is the name of the game

In cotton growing, greenhouse gas (GHG) emission factors from nitrogen (N) fertilisers increase exponentially above a certain application rate.

Optimising N fertiliser use and increasing efficiency is one of the most direct actions growers can take to reduce inputs, costs and GHGs). The 2024 CRDC Grower Survey shows many growers are already managing inputs and emissions this way.

Previous CRDC-supported research by AgEcon found that reducing the incidence of over-application of N to cotton crops can lead to substantial emissions abatement, reduce variable costs and result in higher profits. Adopting N best management practices has the potential to provide long-term, additional farm business value through increased productivity, reducing GHG emissions and improving the environmental condition of a farm, such as increasing stored soil organic carbon. Irrigation management and N fertiliser timing, along with rate, are key areas for improving N efficiency.



In cotton growing, emission factors from nitrogen (N) fertilisers increase exponentially above a certain application rate. Above around 250kg of N fertiliser applied per hectare, the emissions of nitrous oxide (N_2O) rise exponentially. N_2O is a potent greenhouse gas with 273 times the global warming potential of CO_2. So, reducing N_2O emissions by even a small amount can have a big impact on emissions. There are four main pathways to N loss: leaching, volatilisation, denitrification and via run off.

Queensland University of Technology's Professor of Global Change Peter Grace says in terms of reducing GHG emissions, increasing N efficiency is "the way to go as far as I'm concerned in the cotton industry".

"From an environmental perspective, nitrous oxide emissions from nitrogen fertilisers may seem low, but they have a large impact on global warming and your carbon footprint," he said.

"From a productivity perspective, when you are losing N_2O, you are using a lot more N – it's an economic loss to a grower when it goes into the atmosphere.

"By using the optimum rate, you get optimal yield and minimise N loss into the atmosphere.

"It's about the right product, right rate, right time and right placement."

Former CottonInfo Nutrition Technical Lead Jon Baird said the main goal is to apply the bulk of N fertiliser before flowering.

"Aligning N fertiliser availability with the peak fruiting period during the season is critical for high N fertiliser utilisation," he said.

"If you can achieve that, then there won't be a yield deficit.

"Cotton N requirements prior to flowering are low at less than 30 kg N/ha, but once flowering starts, plant use increases to 4kg N/ha/day."

Talking with growers about management

Optimising how growers use nitrogen (N) fertiliser presents a significant opportunity for reducing cotton's greenhouse gas emissions (GHG) and establishing a sustainable low-carbon production system.

However, the path to optimisation is not straight forward.

CSIRO's Dr Peter Thorburn says management of N fertilisers in cotton is primarily a business decision for growers, who are mitigating the risks of reduced yield and profitability. Growers often want to apply enough N to achieve a 'big crop in a good year'.

"The outcome of this strategy is over-application of N and increased GHG in all years that are not 'good', which raises the question: 'what is the best way to help cotton growers optimise N management and reduce GHG emissions?'," Peter asks.

Peter is heading a new CRDC -supported project working with CSIRO social scientists Dr Michelle Miller and Dr Zelalem Moti, to better understand grower's decision-making processes related to N fertiliser use. They've been gathering feedback from growers on strategies for optimising N use.

"Two of the themes that are emerging are farmers thinking about N management of new, higher yielding varieties and cotton-wheat rotations, but we will have a better picture when the data collection and analysis are complete," Peter said.

"From the information we gather from crop managers, we will look at the suitability and feasibility of different N fertiliser business risk mitigation products or incentives.

"In particular, we will focus on whether insurance could be a useful to manage the financial risk of low yields with nitrogen risk insurance. This has been available in the Australian sugar industry since 2022.

"Should the evidence point to insurance as a potentially effective tool, we will map the knowledge and tools required to develop N risk insurance for cotton.

"If the knowledge and tools exist, we will develop and pilot a prototype N risk insurance product and assess its commercial potential with insurance companies."

Growers or consultants wishing to be involved in Peter's research are encouraged to email him.

For more
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Enhanced efficiency fertilisers reduce emissions

The use of enhanced efficiency fertilisers (EEF) in cotton systems provides a clear benefit for reducing nitrogen (N) losses and improving efficiency.

CRDC-supported research has shown that EEF products (formulations with controlled nutrient release or altered reactions that lead to nutrient losses) allow growers to reduce application rates of N, while maintaining yields similar to what they currently achieve.

The research was undertaken across three sites by former NSW DPIRD scientist Jon Baird.

Previous research has shown the period between fertiliser application and the first two irrigations in the season results in the greatest fertiliser loss from a cotton system. A positive result for the EEFs was the higher levels of mineral N recovered early in the growing season at first flower.

Atmospheric gaseous losses are the primary pathway for fertiliser loss from the field.

EEFs contain either a physical or chemical barrier that prevents or slows the conversion of fertiliser N to the highly soluble form of nitrate-N. Nitrate-N is the dominant form of N in vertosol soils and is the preferred form of nitrogen for plant uptake, but is highly soluble. Nitrate-N is susceptible to high losses, especially when soils become waterlogged, leading to atmospheric gaseous losses or leaching into the subsoil or tail water.

Higher N at first flower

"We found the EEFs (at 30 per cent reduced application rates – see table next page) had higher N recovered at the first flower growth stage, which is an important finding for the industry, as higher retention of N fertiliser leads to higher plant use and greater growth," Jon said.

"This is an advantage compared to the optimum management tactics for untreated urea, which include splitting the application (pre-plant and in-crop) or applying all in-crop, which was designed to avoid the high losses from a cotton system at the first and second irrigation events or prior to planting."

By reducing the losses, the trials improved fertiliser utilisation, had better nitrogen use efficiency and higher levels of post-harvest residual N. The improvement in N efficiency between the EEF products and untreated urea ranged between 22 and 50 per cent across the three experimental sites. However, the improvement was not always attributed to higher yields.

Yields were similar across the sites between the EEFs and untreated urea.

"Typically, it is challenging to determine fertiliser responses in cotton systems at or near industry rates, due to the high background fertility of the native soils and historically high application rates," Jon says.

"This is a conundrum we faced with the case study sites, but the experiment results prove growers can use EEFs at a reduced N application rate, while producing yields comparable to what they currently achieve using untreated urea.

"Growers still need to be mindful of the N products they use, and management strategies still require optimum application dates to achieve the desired effect of reducing losses of N while maintaining high plant utilisation efficiency and high crop productivity."

Effect on high N use

This was shown in another one of Jon's trials looking at how well EEFs perform when N fertiliser application rates are extremely high. Jon used a novel nitrification inhibitor used in reducing the loss of fertiliser N.

"Growing high yielding cotton crops often includes high nutrition rates and intensive irrigation strategies to promote optimum plant growth, but while these systems can be high performing, the sustainability credentials can be low, mainly due to high fertiliser losses as application rates exceed plant requirements," Jon said.

Nitrification inhibitors are a type of EEF that contain compounds that reduce the activity of microbes responsible for converting ammonium-N to nitrate-N. The delay in the conversion reduces nitrate levels and thus minimises the risk of a denitrification event. Denitrification is the process that converts nitrate-N in the soil to nitrogen gas, thus removing this plant available nitrogen and returning it to the atmosphere. Inert dinitrogen gas is the ultimate end product of denitrification,

"Due to commercial field operations and/or residual levels of mineral N, we did not find evidence to warrant improvements in fertiliser use efficiency," Jon said.

Research is underway investigating the supply of plant available forms of N at critical crop stages including pre-planting.

Building on Jon's work and the More Profit from Nitrogen program, research to better understand soil nitrogen (N) availability and N sources (nitrate, ammonium, organic N) at critical stages of cotton growth is underway. This will help farm managers better manage the crop's N requirements, and set application rates to balance production, profits and environmental outcomes (namely N losses) through better accounting for N availability in soil.

CSIRO's Dr Dio Antille and Sandra Williams are investigating the supply of plant available forms of N at the critical stages of pre-plant, first flower, start of boll fill and cut-out. Two field experiments are underway, the first building on the legacy of Dr Ian Rochester in the long-term rotation field that started in 1995 at the Australian Cotton Research Institute at Narrabri; the second at a commercial cotton farm near Griffith (Wiradjuri country).

Soil samples are being tested to characterise soil microbial communities, and the nutritional and carbon status of the soil at the four key crop stages. The trials consist of three randomised treatments of a continuous-cotton, cotton/long-fallow/faba bean and cotton/long-fallow/cotton with a single application of 300 kg/ha N. A control treatment (no N applied) will be used to quantify the fertiliser use efficiency. Together, these results will link N availability, soil carbon status and the microbial drivers of this to cotton management (rotation) and crop productivity.

The research is investigating four key questions:

- What N forms are available in soil and in what quantities, and what are the controlling soil processes at the four key stages of the cotton production cycle?
- What is the relative importance of those N forms, as determined at key stages of the cycle, for cotton nutrition and fertiliser N budgeting, both pre-plant and in-crop?
- Is there an effect of soil type on the relative quantities of plant available N forms at those four key stages of the cycle, and how this can be managed?
- How can N availability (all N forms) be incorporated into existing models to predict crop N requirements throughout the season and enable growers make accurate fertiliser N decisions?

For more

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"While inhibitors have a place in reducing greenhouse gases and improving nitrogen use efficiency, this study proved other factors need to be considered, and management should take a holistic approach to enhancing N fertiliser use.

"Firstly, soil mineral N needs to be accounted for when budgeting for crop needs, and secondly, in-crop management should be aimed at crop needs, not to increase excessive levels of N, which isn't required by crops."

Effect of leaching

The study also provided an insight into the effect of leaching.

Tail water N can indicate leaching levels from the field, associated with the application of irrigation water. In Jon's trials, the tailwater ranged from 26 mg/L (untreated) to 17 mg/L (nitrification inhibitor).

The tailwater had significantly higher N levels compared to the water collected from the head ditch supply channel (<1 mg/L).

"This signifies that the N collected from the tailwater was a result of in-field leaching and not residual from the irrigation water applied to the field," Jon says.

"Due to the similar levels of N in the tailwater, there was no evidence the inhibitor reduced in-field leaching of the fertiliser N from the field."

Jon's full research papers will be published in Inside Cotton (www.insidecotton.com) and case studies via CottonInfo.

For more

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Measuring enhanced nitrogen efficiency in the paddock

CRDC Innovation Broker Dr Nicola Cottee is excited by a new project announced by the Australian Government that will put the cotton industry at the forefront of greenhouse gas (GHG) emissions measurement.

CRDC is a major investor in the National Heritage Trust Climate-Smart Agriculture project Climate Smart Cotton: Reducing nitrous oxide emissions with enhanced efficiency fertilisers, overseen by Queensland University of Technology's (QUT) Professor of Global Change, Peter Grace with researchers from QUT and NSW DPIRD (formerly NSW DPI).

It's a supply-chain collaboration, with QUT, CRDC and NSW DPIRD joined by the Department of Agriculture, Fisheries and Forestry, CottonInfo, Fertilizer Australia, Nutrien Ag Solutions and Incitec Pivot Fertiliser.

The aim of the project is to generate data to help growers report and substantially reduce GHG emissions from their cotton production systems, positioning Australia as the preferred international supplier of low-emissions fibre. It recognises that synthetic N fertiliser application is the largest source of GHG emissions from cotton farms – approximately 67 per cent of cotton's GHG emissions are attributable to N fertiliser manufacture and management.

Using state-of-the-art equipment, Peter and his colleagues will collect data to help growers using enhanced efficiency fertilisers accurately measure emission reductions.

To achieve this, the project focuses on analysing data to develop a method to predict and reduce emissions for enhanced efficiency fertilisers (EEFs). While not widely used in cotton, evidence from grains cropping indicates an 80 per cent reduction in emissions could be achieved in cotton production with the use of EEFs.

QUT will initially measure the impact of EEFs against urea at three sites across the cotton industry. The data will then be modelled so that N_2O emissions can be estimated for other sites. A separate project being designed with the Zero Net Emissions Agriculture CRC (ZNE CRC) will then allow growers to benchmark a range of EEFs and products.

This is expected to enhance cotton's ability to forecast emissions and implement effective reduction strategies. Specialised automated samplers will be constructed for in-field N_2O emissions, creating improved methodology for emissions monitoring to generate more robust and 'defensible' emission factors.

What are defensible emissions?

National Greenhouse Gas Inventory (NGGI) compatible data is a gold standard that governments and markets expect the Australian cotton industry to meet. For emission factors to be defensible, they must be published in a peer-reviewed journal and accepted by the NGGI. The fact the grant requires all research to be made available in the public domain enhances the transparency of the data and its ultimate acceptance for international recognition by the market.

Community, government, and market interest in accessing robust GHG emissions data for Australian cotton is increasing. To capture value from this interest, growers require science-based and defensible data to accurately assess their on-farm GHG emissions.

As a result, research is needed to ensure the industry has a robust framework for growers to conduct GHG accounting, particularly in securing access to finance and markets. Growers also need a way to accurately measure emissions from fields with in-field sensors, which will also be developed

What are EEFs?

Across agriculture globally, approximately half of all N applied is lost to the environment via dinitrogen, nitrous oxide (N_2O), ammonia, leaching and runoff due to over application and low utilisation efficiency.

N_2O is a long-lived soil borne greenhouse gas that accumulates in the atmosphere. Its main source is N applied as fertilisers. Over the past 150 years, the increase in atmospheric N_2O concentration has led to stratospheric ozone depletion and global warming, with the current growth rate estimated at two per cent per decade. How to reduce N_2O emissions from N fertilisers is a major global challenge that needs to be urgently addressed for sustainable environmental quality and food and fibre production.

The use of enhanced efficiency fertilisers (EEF) could potentially provide a pathway for a rapid decrease in N_2O from cotton fields, as well as providing productivity and economic benefits.

Peter is also leading research under the ZNE CRC which links to this Climate-Smart project. Titled Novel low emissions fertiliser evaluation, Peter's research is looking at novel coated EEFs and bio fertilisers that reduce N_2O emissions in cropping system and agronomic packages. In conjunction with benchmarking innovative GHG-reducing practices and products in the Climate-Smart project, the ZNE CRC work will allows growers to compare other EEFs against the benchmark.

under the project. The cost of these units is otherwise prohibitive for growers.

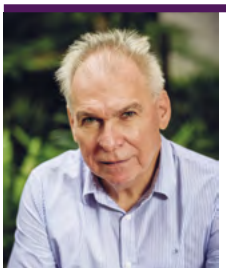
Over-application of N fertiliser still an issue

Addressing over-application of N fertiliser would reduce GHG emissions from fields, however despite many decades of industry research, a barrier exists to some growers lowering application rates to industry recommendations.

"EEFs are looking like a way to provide growers with increased productivity and an immediate option for reducing N losses and ultimately their carbon footprint," Peter said.

"They are designed to reduce N losses and make fertiliser N available over a longer period of time, ensuring that plant needs are met gradually over a single season. However, with any reduction in GHG emissions, it is crucial that the cotton industry can accurately measure any gains.

"Failure to generate cotton-specific emission factors for EEFs will mean that growers will be limited in the management options to reduce



"This improved methodology for emissions monitoring will generate more robust and defensible emission factors."

Professor Peter Grace

emissions, which will potentially overestimate their GHG emissions intensity (GHG emissions/lint yield) for their cotton production systems.

"This may limit the ability of growers, and the broader cotton industry (through the sustainability framework) to deliver against their emissions reduction ambitions."

Nicola says it's exciting to be a part of such a huge collaboration stretching right along the supply chain.

"We are working with organisations that have an interest in helping growers accurately report and reduce their carbon footprint," she said.

"The inclusion of commercial N fertiliser producers and distributors to work with industry researchers is really exciting.

"Without verifiable cotton-specific data, the cotton industry is at risk of 'greenwashing' carbon emissions data.

"Building semi-automated and automated samplers for N_2O emissions will be safer and easier to deploy and maintain in remote locations."

"These samplers can also capture higher-quality data (which is not subject to the human error associated with manual sampling) and an increased quantity of data, as they have continuous monitoring capacity."

"Introducing a modelling methodology will allow the researchers to reliably estimate emission factors for EEFs applied to a broader range of environments and cotton production systems.

"This means that growers can use emission factors in their carbon calculations that are more appropriate to their agroecological zone and irrigation system.

"Without this modelled component, growers would need to rely on emission factors generated at one of the three specific field locations measured in the project.

"This improved methodology for emissions monitoring will generate more robust and defensible emission factors."

For more

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Wiser use of water with technology uptake

The *Advancing the adoption of climate-smart, innovative irrigation control technology for the cotton and dairy industries project* will be led by CRDC in partnership with the dairy industry,

The project will enable producers to increase climate resilience through improved water productivity, while reducing emissions.

It will be undertaken under the Australian Government's Natural Heritage Trust Climate-Smart Agriculture Program.

CRDC Senior Innovation Broker Susan Maas said the focus will be on translating the innovative autonomous irrigation control system VARIwise from the research phase to a commercial-ready package that can be adopted in any irrigation system.

On-farm research has demonstrated VARIwise can deliver 10 per cent in water savings and five per cent productivity improvement in cotton and pasture, significantly increasing the climate resilience of irrigators while reducing emissions from water logging. Other benefits include reduced labour costs and lower energy costs due to reduced pumping and increasing the industry's water use efficiency.

VARIwise was developed through previous CRDC-led national projects under the Australian Government Rural R&D for Profit program supported by the cotton and dairy industries: Smarter Irrigation for Profit 1 and 2 (SIP). Two partners in SIP will join the Climate-Smart project: the University of Tasmania, and the University of Southern Queensland (UniSQ), where VARIwise was developed by Dr Alison McCarthy and Associate Professor Joseph Foley.

MELANIE JENSON

VARIwise was developed by Dr Alison McCarthy and Associate Professor Joseph Foley as part of a previous CRDC project with UniSQ.

Emissions and productivity gains

Water productivity in the cotton industry has averaged an increase of 0.3 per cent per year since 2007. Many cotton growers are approaching or are at a stage where efficiency gains are becoming harder to find.

"Step change improvements in water productivity are critical if Australian irrigation industries are to adapt to short and long-term changes in climate," Susan said.

"VARIwise represents a step change in water use efficiency gains and will assist industries to demonstrate their water sustainability credentials."

Faster uptake of VARIwise precision irrigation will enhance the economic viability and climate resilience of Australian irrigators.

"If adopted by 10 per cent of the cotton industry and five per cent of the dairy industry and at an average value of $200 per ML, the water saved is potentially worth $24 million each year," Susan said..

"If more product were grown using the saved water, an additional $21 million could be produced.

"There are so many benefits: improving soil health through reduced water logging, improving riparian and ground water quality through reduced runoff and ground water seepage, improving our understanding and optimisation of technology."

But if the technology is so powerful, why isn't everyone using it?

"Research has found barriers to adoption of precision irrigation technologies such as VARIwise, including poor interoperability and connectivity between existing irrigation sensor systems, and access to ongoing precision technology support," Susan said.

To address these barriers, irrigation technology companies and precision irrigation consultants previously involved in Smarter Irrigation for Profit research trials were invited to be partners in this new project.

"We will break down these barriers by working with commercial technology providers and consultants to develop VARIwise into a format that can easily interface with any on-farm sensor and irrigation system and non-exclusive commercial access will maximise adoption," Susan said.

The project includes on-farm demonstration activities led by irrigation technology consultants. These will be at Moree-Narrabri (Kamilaroi country) the Darling Downs (Barunggam country), and in Tasmania at Burnie-Ulverstone and the Meander Valley-West Tamar (Tommeginne country). Growers and consultants will be invited to visit the sites to learn more about VARIwise technology.

For more

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Are you a researcher or innovator with research, technology, or intellectual property (IP) in drought and climate resilient agriculture? Have you thought about commercialisation but weren't sure where to start?

CRDC partnering on drought innovation

CRDC has partnered with a specialised team of expert venture builders at Beanstalk Venture Studios to help innovators, researchers and entrepreneurs build new agtech solutions for farmers by turning their innovations in agriculture into commercial reality.

The partnership is focusing on identifying and supporting innovators to solve the biggest drought-related challenges facing farmers. With funding from the Australian Government's Future Drought Fund, Beanstalk will connect IP owners with experienced startup co-founders and entrepreneurs, a dedicated venture building team, and a flexible pathway for commercialisation that does not require them to leave their existing role.

When the rain stops: CRDC is helping growers become more resilient in drought conditions.

Calling all researchers

The program is principally aimed researchers working for a university or research institute who have developed IP relevant to drought and climate resilient agriculture; technical experts working in industry or agribusiness, with IP or a technology that has not yet been commercialised; and university students completing their Masters or PhD on IP relevant to drought and climate resilient agriculture.

The Venture Studio provides one-on-one support from expert company builders and ex-founders. The team will validate the commercial potential of a participant's IP and launch a startup, with funding available for new ventures at the earliest stage, and up to $250k available for those that progress within the program.

"One part of our role is to help innovators who may have a great idea but are not always able to find an experienced founder for commercialisation and launch," says Marcus Agnew, Head of Beanstalk's Drought Venture Studio.

"What we do is all about helping the innovator, as the Venture Studio does not take any equity in new startups, nor is there any cost to participate.

"This is about commercialising new solutions for Australian agriculture that tackle drought and improve resilience.

"In our first cohort alone, we've seen innovations with direct relevance to the cotton industry, such as: seed multilayer coating technology and drying processes; electrical treatments to increase seed germination and vigour, and a super absorbent polymer technology that has multiple applications, including as a water retention agent or seed coating.

"We put participants in touch with future customers, producers, and investors and tap into a supportive community of farmers, investors, and agrifood companies who want to see the technology commercialised.

"And by matching the innovator with an experienced founder, they receive professional support ."

Sharing cotton's perspective

CRDC Innovation Broker Susan Maas has met with the Drought Venture Studio team to discuss cotton industry drought preparedness and resilience.

"There are obviously avenues to alleviate drought such as improving water use efficiency technology and improving the resilience of dryland cotton growing, however under the banner of drought resilience there is quite broad scope for ideas. For example, community resilience, mental health and helping people cope better with drought could also be a part of what we address," Susan said.

"The partnership with the Drought Venture Studio gives us an opportunity to work closely with the Beanstalk team, so that when they are scouting for innovators and new technology, they have a good understanding of the issues, limitations and risks facing the Australian cotton industry.

"CRDC will also play a networking role, connecting relevant innovators to the broader industry, particularly growers.

"Collaboration also opens up an exciting way for us to see new ideas coming through the start-up chain and what investment in them might look like.

"It gives us the ability to work with those start up entities and look at their fit for cotton and how they could benefit us.

"We have so much amazing talent in the research and development community, it's really helpful to have a group like Beanstalk who can help them take their ideas and IP from a concept to an in-market, commercial solution."

For more

Beanstalk Drought Venture Studio

www.ventures.beanstalkagtech.com

YEAR IN REVIEW

Investment, innovation, impact

As growers know, the Australian cotton industry is highly-regarded for its innovation and its commitment to investing in RD&E. CRDC's role to turn this investment in innovation into impact, guided by our Strategic RD&E Plan for 2023-28, Clever Cotton.

The just-published CRDC Annual Report and Performance Report look back at the major developments in Australian cotton RD&E during 2023–24, our first year of investment under Clever Cotton. In this *Spotlight* feature, we highlight some of these key investments.

CRDC RD&E achievements 2023-24

Cotton's digital strategy: preparing Australian cotton for a digital future

A cotton industry cross-sectoral group led by CRDC and comprising cotton industry bodies, growers, gins, merchants, classers and researchers have been meeting to develop a digital strategy for the Australian cotton industry for the past four years. In 2023–24, the strategy was finalised. Its purpose is to prepare Australian cotton for a digital future and enable the industry to share, coordinate and utilise its data. In 2023–24, the group endorsed the NFF Farm Data Code as the basis for good data governance in the cotton industry, and developed a data governance framework, incorporating the principles of the Farm Data Code and detailing data sharing guardrails for the industry. Work is now underway on data standardisation, and developing a cotton industry data platform, as outlined in the Data-driven decisions theme of CRDC's Strategic RD&E Plan 2023–28, Clever Cotton, to aggregate, store, analyse and communicate data to the industry and beyond.

Australian Cotton Disease Collaboration: CRDC's $10 million commitment to disease RD&E

CRDC's first major initiative under Clever Cotton – the Australian Cotton Disease Collaboration – was announced early in 2023–24. Disease is a major priority issue for the cotton industry, contributing to significant yield losses and undermining long-term confidence in cotton growing. In extreme cases, some growers have opted out of cotton in response to severe and escalating disease pressure. As a result, CRDC has established ACDC as a new collaborative approach to disease research. ACDC is a comprehensive program that will deepen our understanding of the impact of disease, enhance foundational pathology resources and capability, and deliver tactical management and innovative technical solutions for cotton growers. Its goal is to reduce the economic impact of current and emerging diseases of cotton to less than five per cent of the cost of production, down from 14 per cent, through RD&E and practice change.

WAND: World-first solution to combat spray drift saves growers time, money

More than 2,400 grain and cotton growers and spray contractors across QLD and NSW have signed on to Weather and Networked Data (WAND), the world-first, Australian-developed weather data system to help minimise spray drift. WAND is the result of six years of collaborative research by CRDC and the Grains Research and Development Corporation (GRDC), with the support of commercial partner, Goanna Ag. Research conducted by CRDC in 2023–24 found that 60 per cent of cotton growers who have accessed WAND have made a change in their spray application as a result. In 2023–24, WAND completed its transition from R&D supported by CRDC and GRDC to a commercial product delivered by Goanna Ag for the benefit of the cotton and grains industries – a crucial step in the commercialisation pathway, meaning vital R&D levy funds can be reinvested in important new projects for growers.

Canopy temperature sensors: Commercialising a ground-breaking algorithm

CRDC successfully facilitated the commercialisation of ground-breaking research by the University of Southern Queensland (UniSQ) in 2023–24, helping cotton growers to optimise their irrigation scheduling from the crucial first irrigation. Through collaborative efforts between CRDC, CSIRO and UniSQ, a new algorithm has been licensed to Goanna Ag. This new algorithm leverages multiarray sensors to distinguish between canopy and bare soil temperatures, allowing for early-season canopy temperature measurements important for the first irrigation, and also eliminates the need to adjust sensor height throughout the crop's growth cycle. It builds upon previous research conducted by CSIRO in partnership with CRDC, which involved the development of stress-time thresholds for cotton irrigation timing, primarily relying on canopy temperature measurements. The original algorithm was made available through Goanna Ag in 2019, resulting in enhanced irrigation practices.

Circularity: Developing the circular economy for Australian cotton

CRDC has committed $2 million to circularity research over the next three years toward the Clever Cotton goal of developing the circular economy for Australian cotton and creating a scalable solution for textile waste. In 2023–24, research commenced across seven projects to address key circularity research gaps and questions, including: on-farm trials to develop a proof-of-concept for returning textile waste to cotton fields; an investigation into textile waste composting; consideration of the best method for delivering textile waste to farms (for example, pelletisation); an evaluation of cotton fibre waste processing and compositing alternatives, including comparisons

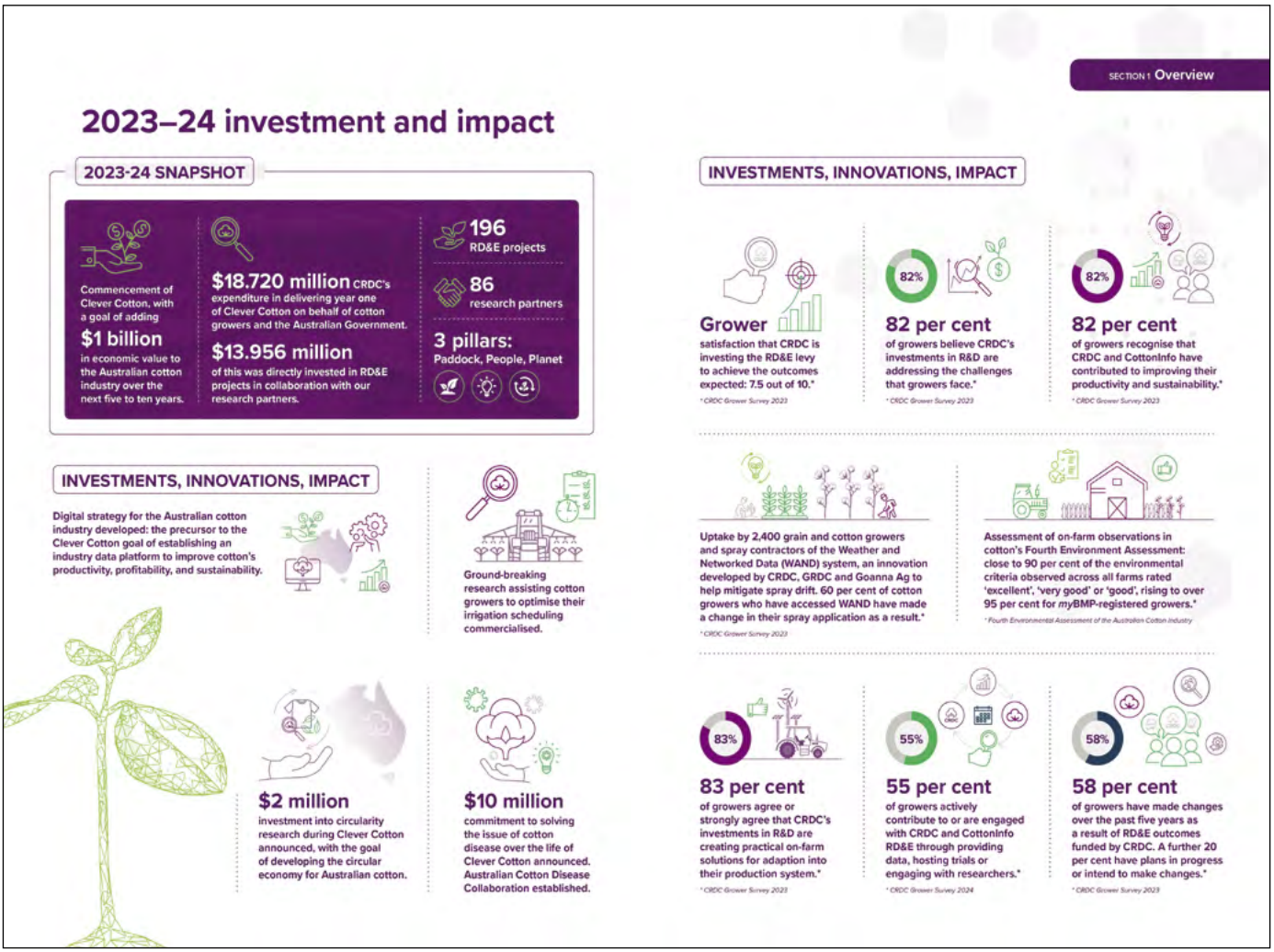
of business models, greenhouse gas emissions and commercialisation opportunities; an economic study into the benefits of composting textile waste, including identifying optimal locations; and the development of standards for textile composting and waste processing through Standards Australia.

Fourth independent environmental assessment: Continuing cotton's 30-year commitment

The results of a comprehensive independent assessment of cotton's environmental performance were released in 2023–24, revealing significant gains, plus areas for improvement. The latest assessment continues cotton's 30-year commitment to independent environmental assessments, conducted each decade. Conducted by GHD, the fourth assessment found the Australian cotton industry had delivered fully on four of the six recommendations in the third assessment from 2012, and has made significant progress on the other two. The assessment also made 16 new recommendations which will be assessed in another 10 years. GHD's on-farm observations rated close to 90 per cent of the environmental criteria observed across all farms as 'excellent', 'very good' or 'good', rising to over 95 per cent for myBMP-registered growers. GHD also observed the industry has sound processes in place to identify and respond to current and emerging environmental issues through the implementation of the PLANET. PEOPLE. PADDOCK. Sustainability Framework.

Environmental Accounting Platform: Standardised carbon accounting across commodities

Australia's first cross-sectoral carbon accounting engine, the Environmental Accounting Platform (EAP), went live in 2023–24, providing agriculture sectors with a standardised approach to carbon accounting across a wide range of commodities, including cotton. The project has been led by Agricultural Innovation Australia in partnership with CRDC and eight other Research and Development Corporations (RDCs). The EAP is a pre-competitive solution, which provides growers and supply chains with an accessible and standardised approach to carbon accounting across multiple commodities



on a national scale. It enables growers to calculate their carbon footprint at a commodity, enterprise and whole-of-business level and can also be integrated into the current service offerings of farm and business solution providers, supply chain, agribusiness, financial institutions and others.

Strategic Roadmap: Determining the path forward for Australian cotton

The development of a strategic roadmap for the Australian cotton industry continued in 2023–24 via a collaboration between Cotton Australia, CRDC and the Australian Cotton Shippers Association (ACSA). The roadmap is focused on helping Australian cotton remain competitive in changing international fashion and textile markets. Five key topic areas are being addressed: traceability; industry data; sustainably certified cotton/the myBMP program; human rights; and Australian cotton marketing. The need for the strategic roadmap emerged from changes in the global cotton and textile landscape, including new overseas legislation affecting market access, companies being required to report on social and environmental impacts, and global frameworks requiring evidence of social and environmental impact back to farm level. CRDC-supported RD&E is crucial to many of the roadmap elements.

Australian Future Cotton Leaders Program: Developing cotton's leadership capacity

A record number of applications were received for the 2024 Australian Future Cotton Leaders Program, conducted by Cotton Australia with support from CRDC. 46 cotton industry participants applied, resulting in the selection of 16 program participants from across the cotton supply chain: growers, consultants, merchants, researchers and extension officers. The program is held every two years and is designed for emerging leaders within the cotton industry. It has produced 116 graduates since commencing in 2006, with many former graduates now holding leadership positions within cotton industry organisations. CRDC has supported the program since inception. Together, CRDC and Cotton Australia provide support for a number of leadership programs, including the Australian Future Cotton Leaders Program, the Australian Rural Leadership Foundation's TRAIL and Australian Rural Leadership Program, and Nuffield Australia's Farming Scholarships.

Improving on-farm biodiversity: Three years of the Country Road, Landcare Australia and cotton industry partnership

The partnership between iconic Australian brand Country Road, environmental management organisation Landcare Australia and the Australian cotton industry to improve biodiversity on cotton farms reached its third anniversary in 2023–24. Together with Cotton Australia and CRDC, the partners are working to restore native habitats and increase biodiversity in the Namoi Valley of NSW. Under the project, six farming families in northern NSW have planted 11,800 seedlings along 11.6km of riverbank over the past three years, rehabilitating a total of 59.6 hectares of native vegetation. Country Road committed $600,000 in the first three years of the project and has since raised $790,000 through sales of its iconic Heritage Sweat and brand contributions. The work builds on CRDC-supported research to understand biodiversity priorities and conditions across cotton landscapes.

For more
2023-24 Annual Report and Performance Report
www.crdc.com.au/publications/crdc-annual-report

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

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