Spotlight
ON COTTON R&D

AUTUMN 2019

Creating disease suppressive soils through rotations

Delivering RD&E impact

Setting sustainability targets

CRDC

Ian Taylor

In the Spotlight

Sustainability is a key word for the Australian cotton industry, and CRDC is working through its RD&E projects, programs and key collaborations to improve outcomes for and beyond the industry.

CRDC's *Investment.Innovation.Impact* report outlines our investments and impact under the 2013-18 CRDC Strategic Plan. From this report we can see impressive benefit-cost ratios of research, along with the impact of the contribution from growers in research and development. Similarly, CottonInfo's five-year review shows an industry full of people willing to make change based on sound R&D and a palatable extension delivery mechanisms. The percentages of growers planning to, or who have made changes toward improved efficiency and sustainability through the uptake of current R&D, technology and advice from industry experts is very pleasing to see. These changes and attitudes are further highlighted and collated in the annual *CRDC Grower Survey, Australian Grown Cotton Sustainability Report, Cotton Industry Water Productivity* report and Crop Consultants *Australia's Cotton Market Audit* and *Cotton Consultants Survey*, all of which are featured in this edition.

CRDC is also endeavouring to continue leading new projects under the Australian Government's Rural R&D for Profit program. CRDC has made an application on behalf of collaborators for the *Australan Agriculture: Growing a Digital Future* project, following Phase 1 of this project, *Accelerating Precision to Decision Agriculture* (P2D). An application to continue the *Smarter Irrigation for Profit* (Phase 2) project has also been made on the success of Phase 1 which wound up last year. We look forward to success in our applications and moving even further forward in the efficiency and sustainability stakes.

Crop managers personally are approaching sustainability in the way they manage soil-borne diseases. Our interview with Narrabri grower Brendon Warnock shows how rotations are working to improve sustainability, improve profits and reduce disease. Research backs up Brendon's on-farm experience, as industry moves to develop disease-suppressive soils to manage, in particular Verticillium wilt in the north and black root rot in the south. To further assist crop managers, CRDC has been involved in supporting a new pathologist and cotton agronomist to be based in the south. CottonInfo has been strengthened with the creation of a Soil Health Technical Lead position and an Irrigation and Nutrition specialist, to further assist in best practice soil management throughout the industry.

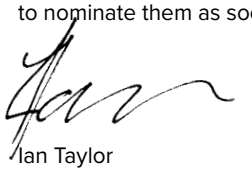
With harvest yet to start on the Darling Downs and regions further south, we're taking a look at round module plastic wrap contamination and what it means for cotton processors and the reputation of Australian cotton as a quality, contaminant-free fibre. Harvester set up is also an integral part of picking quality cotton, as research shows and included in this edition.

If there is one thing this season has brought us, it is plenty of sunshine. Our article on solar pumping is pertinent in times of low productivity and as a long term measure to decrease costs and further improve our sustainability credentials.

Two industry stalwarts were honoured in this year's Australia Day Honours, with Mike Logan receiving an AM, and Geoff Brown receiving an OAM. Congratulations to you both and thank you for your untiring work for the Australian cotton industry.

On a more sombre note, we honour the passing of industry researcher Lily Pereg, whose untimely death shocked the cotton research community and Australians in general in January. Lily was integral in our understanding of black root rot, and we can attribute much of what we know today to this tireless researcher. Vale Lily.

Lastly, we would love to see you all at the Cotton Collective and awards this year in Griffith, and if you know someone who deserves recognition for their contribution to industry, be sure to nominate them as soon as possible!



Ian Taylor
Acting CRDC Executive Director

Autumn 2019

MELANIE JENSON

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CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

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

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MELANIE JENSON

ON THE COVER:
Maules Creek farmer Brendon Warnock has successfully used rotation crops to reduce the incidence of Verticillium wilt and increase returns (for more, see page 22).

Want to see more of Spotlight?

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

COTTON NEWS

FEATURES

Hitting the mark: five years of RD&E investment

INCLUDED with this edition of *Spotlight* is your copy of CRDC's Investment.Innovation.Impact report – a summary of our investments and impact under the 2013-18 CRDC Strategic Plan.

Over the course of these five years, we invested $95.6 million of funds entrusted to us by cotton growers and the government into 862 RD&E projects in collaboration with 205 research partners across our five priority areas – farmers, industry, customers, people and performance – achieving major impacts for growers and the industry. In this report, we bring you the key highlights and impacts achieved by CRDC and our investments during the 2013-18 period.

Major highlights over the past five years include a benefit-cost ration of 17.1 : 1 in CRDC's early planting research in the QLD Central Highlands which translates to $17.10 in benefit to growers for every $1 invested by growers and the government through CRDC into this RD&E. CRDC has also invested $395,000 in 45 local projects run by Cotton Grower Associations through the Grassroots Grants program, supporting local RD&E initiatives.

Thanks for tagging us IREC!

WE love to see how CRDC's investments are helping to create initiatives where crop managers can come to see, learn and improve. CRDC has supported the development of trial and pump sites at the IREC trial site near Whitton in the Riverina, which were on display at their annual field day, with a range of speakers and CRDC-supported soil, weeds and irrigation research.

IREC chair Rob Houghton said support from CRDC to develop the irrigation system meant they can now recirculate all water and manage irrigations remotely.

"We can stop and start and manage the flow and in the event of big rain we can access the site remotely and put water off the fields into our reservoir," Rob said.

"This technology is proving itself again and again and is quite life changing in a lot of ways because it offers so much more flexibility.

"The pump set up was a major attraction at our field day and as a result we had three farmers now looking to install the same system.

"This is the big benefit of the demonstration – we can show the capability of these remote systems.

"Looking at things working is the real benefit of the field station, and we are really grateful to CRDC for the support to make it happen."

We love to see researchers, growers and partners in the cotton industry tag us on their twitter, so we can join in the conversation and share your insights, queries, achievements and work. Tag us at @CottonResearch and we can further share your work, event or research.

And, if you've got a query about research, need a solution, or have something cotton-related to share from the field, tag CottonInfo @CottonInfoAust on Twitter as well, so we can share and also direct any queries to the relevant CottonInfo REO, technical lead or research scientist.

For more:
www.twitter.com/cottonresearch
www.twitter.com/cottoninfoaust

A new look at disease

CRDC-supported Honours student Aphrika Gregson is providing a new 'picture' of Verticillium wilt.

THE new images portray Verticillium wilt as it's never been seen before in Australia.

Using a fluorescent protein that allows the pathogen to be visualised in an infected cotton plant or host (using confocal laser microscopy), Aphrika and a team from University of Queensland are working to identify and confirm *Verticillium dahliae* disease entry and infection pathways in cotton plants. They are using use the green fluorescent protein (GFP) gene inserted into different *V.dahliae* isolates to determine if a plant is a host of Verticillium, its level of infection and the spread through the plant. Similar technology was used by the Australian banana industry to fight the devastating Panama 4 disease. CRDC recognised a fit with the cotton industry's search for a deeper understanding of Verticillium wilt.

As part of CRDC's *Innovative solutions to Cotton Diseases* project, Aphrika's preliminary research has focused on adapting the technique from Panama to *V. dahliae*, before applying the transformed strains to look at infection, virulence and host colonisation by the pathogen.

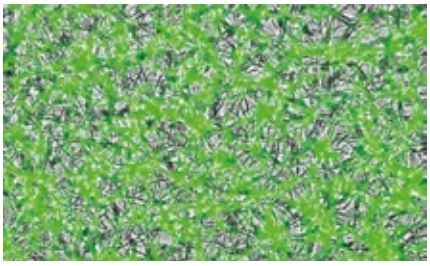
"So far, we have had promising success introducing the GFP gene into several *V. dahliae* strains," Aphrika says.

"At the moment I'm undertaking an assay of the transgenic strains on cotton.

"The GFP appears to be stable and the pathogen certainly hasn't lost any virulence; both great signs for the future work we hope to do in this project.

"The next step is to transform isolates that represent each of the strains present in Australian cotton; 1A, 2A and 4B, as well as isolates within these strains that differ in virulence.

"From here, we can begin to deepen our understanding of the pathological differences between these strains by observing the way they enter, colonise and reproduce in a cotton host, to find answers for disease management options.



Verticillium wilt as you've never seen it before. This research will help identify disease entry and infection pathways in cotton plants.

"The Panama 4 disease study using this technique determined that dying leaves of infected plants were heavily loaded with disease inoculum, and therefore management practices were implemented to remove infected leaf material, instead of assisting the disease cycle by leaving it in the fields."

For more
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Get the picture with grower survey

HOW many cotton growers use solar energy, automated irrigation, have a biosecurity plan and a positive outlook for the industry? Would you like to know what fellow growers are up to?

CRDC's latest grower survey results (season 2017-18) are out now and have the answers to these questions and more. The survey results are available on-line through an interactive digital dashboard, that allows growers to regionalise results.

The report doesn't just provide interesting comparisons for individual growers, it is an important tool for CRDC's Monitoring and Evaluation Framework. This latest survey gathered mid-term assessment of growers' views of CRDC's performance against the Strategic RD&E Plan 2018-23.

A number of focus areas were in the survey including: management of weeds and disease control; irrigation; automation; workforce and industry sentiment.

"The survey provides a snapshot to all levels of industry, from growers to administrators and government," CRDC's Acting Executive Director Ian Taylor said.

"It allows us to gauge the impact of research, development and extension, and it was really pleasing to see so many growers using CRDC and CottonInfo as conduits to research and practical knowledge.

"This year we had 246 respondents and we thank each of them for participating.

"We've seen an increase in positivity in the industry and an uptake in technology such as solar and automation, with more growers saying they were considering moving to these technologies, with 35 percent of growers currently using automation on their farm, while 40 percent are considering their options for the future.

"Of those surveyed, 17 percent generated and used solar energy on their farm in 2017-18."

Climate, weather and water are major challenges. Eighty-two percent mentioned water and weather as the primary challenges to improving or even sustaining the farm profitability.

Ian says industry still has some work to do to communicate the need for on-farm biosecurity plans.

More than half of growers reported that they had a biosecurity plan or were developing one. Yet one in three growers reported that they don't have a physical plan.

"The analysis of survey data indicates that having a biosecurity plan creates very different on-farm behaviours," Ian said. "The results indicate there are clear benefits from having a biosecurity plan in place in terms of best managing current weeds, pests and diseases, let alone being prepared for an exotic pest incursion."

The 2019 survey will open in June and details will be included in the next edition of *Spotlight*.

For more:
To download the *2018 Grower Survey*, go to www.crdc.com.au/growersurvey

ACRI badly damaged by storm

A severe storm with 150km hour winds and hail hit the Australian Cotton Research Institute (ACRI) prior to Christmas, causing an estimated damage in excess of $2 million, not including the damage to actual crops, refrigerated samples and research capabilities.

JUST after 6pm on December 20 the severe storm cell cut a swathe through the ACRI and surrounding farms which resulted in the loss of power, significant infrastructure damage and defoliation of all trials. The facility was without power for eight days, and even with backup generators supplying power to critical infrastructure, some important refrigerated material was lost. The main building was uninhabitable due to water inundation and significant damage to airconditioning systems on the roof.

CSIRO's Mike Bange works at the ACRI, seen here with the remains of trials at the site.

However the facility is assuming 'business as usual', while still trying to support researchers who have lost work and critical data, their office spaces and some amenities. CRDC worked with NSW DPI and CSIRO to assess the impact on researchers and research.

"We met at ACRI with affected researchers and discussed the implications of the damage," CRDC's Acting Executive Director Ian Taylor said.

"Every field trial at the research station was affected, as well as some in protected environments.

"The breeding program (both trait and variety) has been significantly affected with the majority of effort being set back by 12 months and other work even further."

On a positive note, Ian said CRDC was using affected trials to shed light on best managing hail damaged crops.

"We also have many off-site trials, so research efforts can be focused on maximising the outcomes of these trials and supporting our researchers," he said.

Industry mourns tragic loss of researcher

THE staff at CRDC have paid tribute to researcher and valued member of cotton research community Lily Pereg, who passed away while overseas in early January.

CRDC R&D Manager Susan Maas worked directly with Lily on several projects.

"Lily was a passionate researcher and in her 20 years in the cotton industry contributed significantly to knowledge and understanding of soil borne disease, in particularly black root rot," Susan said.

"Much of what we know about the pathogen today we can attribute to Lily.

"She was committed to her work and it was her passion, which showed in how happy she was to share everything possible with all in the research and cotton communities.

"Lily collaborated with many other CRDC-supported researchers, in particular pathologists, and her absence will be keenly felt at our future meetings, conferences and in particular FUSCOM, which she delighted in."

Cotton industry pathologist Dr Linda Smith worked with Lily through research on various cotton funded projects and said she and many others were in shock and sadness at the news of her untimely passing.

"We would see each other at cotton conferences and meetings, and she always greeted me with a beautiful smile and a big hug, keen to hear how my research was going," Linda said.

"Lily had a passion for microbiology that was infectious. That was Lily; a genuine and kind person who always had time for others.

"Lily was a very special person and will be missed by all who knew her."

Dr Oliver Knox worked at UNE where Lily was also based.

"Lily was a colleague and friend who most of us in the cotton industry will know best for the work she and her students did on black root rot.

"Lily was, however, passionate about soil microbiology and there was a lot more to Lily's research in this area.

"On the news of her passing I had conversations with several students, staff and industry representatives many of which were reflective of a person who was not afraid to share her thoughts, time and knowledge.

"I personally will miss our meetings over tea and coffee in Booloominbah, her smile and her unending patience.

"There is no doubt that Lily's presence will be sorely missed by many associated with the cotton industry."

On behalf of the entire cotton research community, Vale Lily.

RUTH REDFERN

Australian agriculture is looking to position itself to take advantage of a future driven by digital technologies and precision agriculture. Pictured here, Griffith cotton grower Roger Commins demonstrating his automated irrigation system to the CRDC Directors and team.

Australian agriculture: growing a digital future

DIGITAL transformation is a big cultural change for all sectors, businesses and people: hence a strategic guided approach is needed to manage the change.

The Australian agricultural sector has already examined the current and future state of digital agriculture in Australia via the Australian Government's Rural R&D for Profit program's *Accelerating Precision to Decision Agriculture* (P2D).

The project was led by CRDC and estimated digital agriculture could lift the GVP of agriculture by $20.3 billion, a 25 percent increase on 2014-15 levels. However, according to findings from the P2D project, Australian producers are not ready to reap these benefits.

CRDC R&D Manager Jane Trindall says the report from the project made 13 recommendations in the areas of strategy, leadership, governance, digital literacy and enablers to achieve these gains. This collaboration was the first time all 15 of Australia's RDCs joined forces on a sector-wide initiative.

To implement the recommendations from P2D, 11 RDCs have collaborated to submit a new Rural R&D for Profit application: *Australian Agriculture: Growing a Digital Future*.

"We made this application so we can lift the digital maturity of the sector from ad-hoc to competitive, lift economic growth and prepare the workforce for the future," Jane said.

"This effort could lift GVP by an additional 1.8-3.6 percent over and above the average GVP growth of the sector by 2022, adding $1.3-2.7 billion to the sector.

"We will do this through three key investment areas" says Jane.
These three areas are as follows:

Digital transformation hub

A virtual digital transformation hub will include a team of digital/data experts to initiate digital strategies and support their implementation. Supporting resources including a digital maturity framework, agricultural data governance framework and information architectures will be developed. These may be the first of their kind for agriculture.

Digital capability (digital literacy and learning pathway for data scientists)

The focus of this area will be both upskilling those within industry and making sure those coming into the industry have the required skills. This project will develop and deliver a digital capability framework and training program, establish digital farms and fisheries and deliver a digital immersion program for imagining the future.

There is a need to build the STEM capability in the agricultural workforce and research community to solve today and tomorrow's problems. This project aims to excite data scientist/analyst students to pursue a career in agriculture.

Foundational data and analytics

Interoperability has long plagued precision agriculture. This project sets out to harmonise identifiers for Australian producers, farms and fields to increase the interoperability of agricultural data. This will enable automated data exchange and/or the application of machine learning to provide producers with insights from their data.

This project is a supported by funding from CRDC, Meat and Livestock Association, Sugar Research Australia, Australian Wool Innovation, Fisheries Research and Development Corporation, AgriFutures Australia, Wine Australia, Dairy Australia, Australian Pork Limited, Australian Eggs and Horticulture Innovation Australia. The project will be delivered in collaboration with six research partners and supported by the National Farmers' Federation, the Food Agility CRC and four international digital agricultural programs.

"While the success of the application is unknown, RDCs are getting on with the job and will kickstart activities this year with the commencement of a digital transformation taskforce for the Australian agricultural sector," Jane said.

"This will include the development of the digital maturity, data governance and digital capability frameworks with project partners including CSIRO, Griffith University and the University of the Sunshine Coast for endorsement by the taskforce."

For more:
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Key metrics needed for sound reporting

The Australian Grown Cotton Sustainability Report was published in 2014 and included a commitment by the industry to five-yearly reporting, and to the setting of targets across six key areas.

Christoph Saenger, International Coffee Organization; Sandra Fong, Better Cotton Initiative; Lars Kahnert, Global Coffee Platform; Eliane Augareils, Better Cotton Initiative; Kai Hughes, International Cotton Advisory Committee and CRDC's Allan Williams meet for Project Delta in London.

AS part of developing those targets, the industry's Sustainability Working Group identified the importance of linking the targets to the broader sustainability agenda, including the UN's 17 Sustainable Development Goals (SDGs). Each of the targets references the relevant SDG that achieving the target would contribute to.

Sustainability programs such as the Better Cotton Initiative (BCI) of which Australia is a member, are also focused on identifying how the on-ground activities being supported by BCI are contributing to the SDGs.

CRDC R&D Manager Allan Williams says a challenge the industry faces globally is that one of their stakeholders is national governments, who view cotton as one of multiple agricultural activities that collectively can contribute to SDGs.

"In order to be able to report on agriculture's contribution to the SDGs, we require common and consistent metrics between different commodities that can be readily aggregated and reported," he said.

"The cotton industry has an excellent starting point for the key metrics that can be collected to measure the sustainability of cotton farming in the report *Measuring Sustainability in Cotton farming Systems: A Guidance Framework*, published by SEEP (International Cotton Advisory Committee's Expert Panel on the Social, Economic and Environmental Performance of Cotton)."

As the SEEP Chair, Allan was approached by BCI to ascertain SEEP's interest in looking at the cross-commodity relevance of the SEEP metrics as part of 'Project Delta', a three-year project BCI is leading working with the International Coffee Organisation. Project Delta aims to facilitate aligned and comparable sustainability performance measurement and reporting across different agricultural commodity sectors, help monitor progress toward SDG commitments for both business and government and trigger the development of value-adding services for farmers from their performance data.

A kick-off meeting was held in London at the International Coffee Organisation headquarters earlier this year.

"It presents an opportunity for credible sustainability standards to take a leadership role in defining how sustainable production of key global commodities is defined and measured," Allan said.

The importance of metrics

The issue of consistency of metrics is directly relevant for the Australian cotton supply chain.

Many brands and retailers are setting targets regarding the percentage of sustainable cotton that they will use in their supply chain. Cotton produced in accordance with the standards such as BCI, organic or Fairtrade is generally regarded by the retailers and brands as being more sustainable, and many brands adopt a portfolio approach to their more sustainable cotton sourcing.

"However, retailers and brands are under pressure to go beyond simply procuring cotton produced in accordance with a standard in order to demonstrate their sustainable and ethical supply chain responsibilities," Allan said.

"They are being asked to demonstrate the impact of their investment in more sustainably produced cotton and their (changed) procurement practices, which relies on access to robust data: but there is no common set of indicators that the sustainable cotton initiatives collect, meaning that it is difficult for a retailer to report holistically on their cotton portfolio.

"Further, each initiative has different traceability protocols, which adds logistical costs to a retailer's supply chain.

"A more coordinated approach by the cotton industry, including the sustainability standards, is required to ensure that retailer data expectations can be met in a way that does not unduly increase the burden of the industry in supplying that information.

"I'm working on this aspect as part of my role as the chair of SEEP, via collaboration with Cotton2040," Allan said.

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Staying committed to sustainability

The cotton industry is preparing its second Sustainability Report, with the release of the *Australian Grown Cotton Sustainability Targets* due later this year, focusing on environment, economic and social outcomes.

THROUGH CRDC and Cotton Australia, the industry produced its first *Australian Grown Cotton Sustainability Report* in 2014. This report included a commitment to ongoing sustainability reporting, engaging stakeholders and developing industry sustainability targets. The data gathered to monitor progress towards the targets will facilitate increased reporting across the supply and value chain for cotton.

Specifically, it is developing sustainability targets that:

- Boost farm productivity
- Increase water use efficiency
- Reduce the carbon footprint
- Enhance biodiversity
- Reduce work-related injuries and fatalities

"These targets have been developed around our most important priorities and take into account the industry's track-record and the improvements this dynamic industry has managed to achieve already," CRDC R&D Manager Allan Williams said.

"The Australian cotton industry has a long and positive history of working to be more sustainable, but in a competitive and changing world, achieving sustainability targets won't just happen unless there is a dedicated and coordinated effort across the industry.

"To crystallise this commitment, the Sustainability Working Group (SWG) was formed, comprising of growers, representatives from Australian Cotton Shippers Association, Cotton Australia, CottonInfo, CRDC and *my*BMP to develop the industry's sustainability targets.

"This can be achieved using the body of R&D managed by CRDC, extension through CottonInfo, Cotton Australia's policy, advocacy and communication and ACSA's supply chain engagement. The *my*BMP program is a key mechanism that will support achievement of the targets at the farm level."

The role of the SWG is to better coordinate the industry's broad body of existing sustainability work, help direct investment and effort to achieve and report against the sustainability targets and to provide a united vision for further positive change. The SWG will track and report against progress towards the sustainability targets and engage with stakeholders to help ensure that reporting is meeting their needs.

Allan said the SWG will support the industry to achieve these targets via a principles-based strategy that will engage with stakeholders, make evidence-based decisions and embed a sustainability culture across the industry by expanding on the broad body of existing sustainability work.

RUTH REDFERN

Enhancing biodiversity is a key sustainability target in the industry's coming Sustainability Report.

Queen's honour for former CRDC chair

CRDC has congratulated its former chair and cotton grower Mike Logan on being awarded a Member (AM) In The General Division Of The Order Of Australia in the Australia Day Honours.

Mike was awarded for his significant service to primary industry through rural research and sustainable development programs. As well as serving the cotton industry as CRDC chair from 2007-13, Mike was also a board member of Cotton Australia and most recently Dairy Connect CEO from 2012-16 and a member of the Dairy Research Foundation.

Mike has been growing cotton at Narrabri since 1983 and has had a particular interest in natural resource management, sitting on various local, state and national bodies. He has advised ministers on the Murray Darling Basin Water Buy Back and the Irrigation Efficiency and Infrastructure programs. He was chair of the National Program for Sustainable Irrigation and the Cooperative Research Centre for Irrigation Futures.

Starting his leadership journey in 1993 as an Inaugural Graduate of the Australian Rural Leadership Program (ARLP), Mike went on to become a director in 1993.

Cotton consultant Geoff Brown was also a recipient of an Australia Day Honour, see our story on page 35 with our regular Crop Consultants Australia column.

CottonInfo: kicking goals with growers

SINCE its inception in 2012, CottonInfo has grown to become a trusted source of information for growers and consultants.

One hundred percent of growers now source information from CottonInfo and over the past five years, CottonInfo has run nearly 1000 extension activities, with a total 14,000 participants.

The industry's extension program has recently undertaken a review, capturing key highlights/achievements of CottonInfo's first six years under the first Strategic Plan from 2012-18. CottonInfo is a collaboration between CRDC, Cotton Australia and Cotton Seed Distributors (CSD) who are responsible for providing the future leadership and resourcing of CottonInfo and its team members in conjunction with research partners.

Program Manager, Warwick Waters said the principle outcome sought is an efficient and effective pathway for the delivery of the results of industry R&D and innovation more broadly.

"It is designed to service the commercially unmet cotton R&D information needs of growers and to support industry efforts to improve practices, productivity, competitiveness and environmental performance.

"In these areas, the five-year review shows success, particularly in the realm of practice change.

"Of 126 events where intention to change was evaluated, 1600 growers indicated they would change practices as a result of increased awareness or knowledge."

In particular, regional tours with a specific focus and researchers were successful in provoking practice change, improved knowledge or greater efficiency. Nearly 100 percent of participants in the 2015 CottonInfo Irrigation Automation Tour said they would do something differently on their farm and 73 percent of attendees at the 2016 Nutrition Research Tour said they were likely to adopt new practices after attending. In all, 95 percent of consultants and 88 percent of growers think CottonInfo has assisted with practice change in key areas.

RUTH REDFERN

CottonInfo's field days and researcher tours have given crop managers a first-hand look at new technology, science and the opportunity to talk directly with researchers, leading to practice change and increased efficiency in water, nutrition and pest management.

Improving management practice is an essential component of CottonInfo's remit. 100 percent of respondees at the CottonInfo-ICAN regional weed management workshops in 2017 said the information learned would help with decisions in the field, while nearly 80 percent of people at the 2018 CottonInfo Nitrogen and Irrigation Research Tour saw an opportunity to improve their own irrigation efficiency and management practices.

The CottonInfo team has also had the capacity to respond to emerging needs of the industry. The team has run workshops around emerging pest threats or where a knowledge gap was identified as a result of feedback around management practices. Crop managers reported higher levels of confidence about growing high yielding crops using IPM after the workshop.

The team of dedicated industry professionals has used a variety of channels to connect with growers and consultants, producing a new series of fact sheets, e-news and videos to promote best practice. This capacity has also continued to evolve and expand, with new technical lead positions recently announced in areas of soil health and fibre quality.

For more

View CottonInfo's impact: 2012-18, available at www.cottoninfo.com.au

94% of consultants and 90% of growers believe CottonInfo provides **useful, credible information**

CottonInfo is considered a **trusted information source** by 89% of consultants and 94% of growers

100% of consultants and 78% of growers **source information** from CottonInfo

Water productivity on the rise

Early indications from the latest water productivity benchmark study indicate continual improvement in water use efficiency in the Australian cotton industry.

The *Cotton Industry Water Productivity* benchmarking team is finalising WaterTrack surveys covering the 2017-18 cotton season. They have so far covered more than 200 cotton fields, approximating to 13,000 ha, across 48 growers.

"Participant numbers are slightly up on previous surveys and give balanced representation across all major valleys," NSW DPI's David Perovic said.

"Early indications have identified improved water productivity compared to previous cycles. On-farm Gross Production Water Use (GPWUI) was 1.174 in 2006-07; 1.139 in 2007-08; 1.120 in 2012-13 and is tracking around 1.2 bales/ML for 2017-18.

"This trend naturally requires confirmation when all data become available and ginning data has been slower to come through from the south."

The CRDC-supported benchmarking project is a major vehicle for collecting water-use data from across the industry to track improvement and communicating water-use efficiency more broadly.

Creating a continuous data series

Using data from seven previous published studies and other ongoing experiments and surveys, the benchmarking team can interrogate patterns stretching back 27 years, to more-accurately track the progress of water productivity across the cotton industry.

MELANIE JENSON

NSW DPI/CottonInfo's David Perovic and Ben Crawley have been undertaking the latest benchmarking study.

"Water productivity appears to be slowly increasing over the past 10 years, indicating the cotton industry has achieved steady improvement in yield with less water (Figure 1), but also experiences broad seasonal variation," David said.

Meanwhile, the project has also begun supplementing survey data using other industry data sources and surveys. This allows the gaps between WaterTrack survey years to be filled to create a complete time-series for tracking the improvement in water productivity.

"These longer time-series data indicate that the industry is achieving a steady increase in yield from less water." David said.

"Analysis also reveals a high level of seasonal variation in water productivity and highlights the need to monitor water productivity at regular intervals and to look at longer-terms trends rather than comparing single points in time.

"Furthermore, these additional industry data allow us to examine the drivers of water productivity."

Additional data sources: Identifying the drivers of yield and water productivity

The benchmarking team is also value-adding to data from ongoing experiments and surveys. One of these, for example, the CRDC Grower Survey, now features questions that allow calculation of GPWUI. This means that industry-wide water productivity can be monitored and benchmarked regularly in the future. These data sources also have associated management, climate data and agronomic measurement, which allow examination of the drivers of yield and water productivity. Ongoing analysis is looking into the effects of soil type, rainfall, temperatures, evapotranspiration, irrigation systems, establishment method, fertiliser rates, crop rotations and others factors in driving water productivity.

"The benchmarking team has made a number of innovations to the way they examine water productivity in the cotton industry," NSW DPI and CottonInfo's Ben Crawley said.

"A key component of this has been data-sharing with other industry partners.

"The project now utilises a more comprehensive time series of data, spanning 27 years, and is able to cross-valid data trends with multiple sources of data to provide more robust indications of water productivity trends, and to identify the drivers of water productivity, assisting the industry to move beyond slower incremental gains."

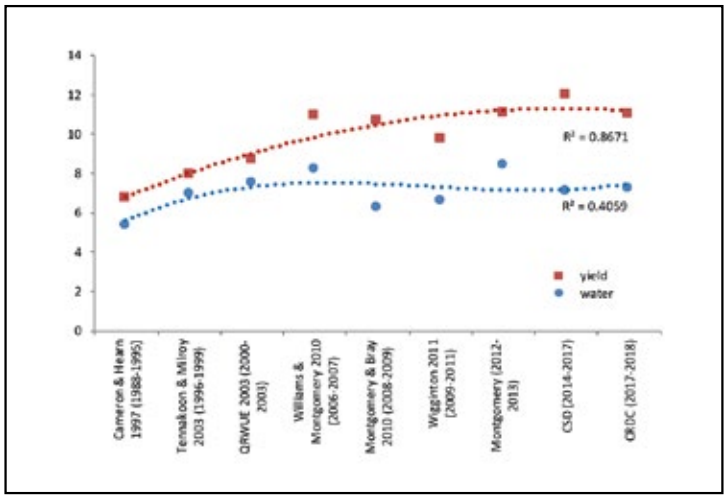

FIGURE 1. Longer-term trends in cotton yield, irrigation water applied from a continuous data set spanning 1991-2018. Dotted lines indicate trend lines (increasing for yield and decrease for irrigation).

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Industries' plan to build on efficiency gains

To maintain or increase farm profit, significant increases in water productivity are required by all agriculture sectors.

CRDC is hoping to help realise gains through technology for five industries: cotton, sugar, rice, dairy and grains through its application for funding for Phase 2 of the *Smarter Irrigation for Profit* project, through the Australian Government's Rural R&D for Profit program. The Phase 2 application sets out to realise potential gains in water productivity, energy efficiency and farm profitability across five agriculture sectors by implementing the recommendations from the Phase 1 project Smarter Irrigation for Profit, which wound up in 2018.

Phase 2 aims to increase the water productivity of over 4000 irrigated cropping and pasture agricultural enterprises by 10 to 20 percent. It will focus on advancing precise irrigated agriculture research; development and delivery of autonomous irrigation; and managing the yield gap via best practice irrigation extension. This project is supported by Dairy Australia, Sugar Research Australia, AgriFutures Australia, GRDC and CRDC with 14 research and development partners and 46 irrigation optimisation and key learning sites.

"Reduced water availability and increased climate variability is impacting on how Australian irrigators utilise and manage water," CRDC R&D Manager Jane Trindall said.

"This project will fund innovative research across the nation to increase the water productivity of irrigated agriculture."

Smarter Irrigation for Profit Phase 1, funded via Round 1 of the Rural R&D for Profit program, found participating farmers from the dairy, cotton, sugar and rice industries could achieve a 10 to 20 percent improvement in water productivity through adoption of new and existing precision irrigation technologies. The project also identified significant energy savings which also enhanced profitability.

MELANIE JENSON

Through Smarter Irrigation for Profit, leading cotton industry researchers and engineers have shared their knowledge with the dairy, rice and sugar industries, which has filled knowledge gaps,improving the operation and optimising irrigation management. Pictured are USQ's Dr Alison McCarthy, Dr Malcolm Gillies, Dr Joseph Foley and consultant Peter Smith.

"With an estimated 15 percent increase in adoption of technologies across Australia, the cotton and sugar industries alone would provide an overall benefit of between $200 million to $315 million," Jane said.

"Phase 2 will realise these potential gains in productivity and farm profitability across the five agriculture sectors by implementing recommendations from Phase 1.

"With the support of 14 research and development partners we aim to transfer the learnings of the latest R&D via 46 cotton, dairy, sugar, rice and grains and irrigation optimisation and key learning sites, which were a very successful aspect of the first program."

The main recommendations from Phase 1 were to:

- Build the understanding of farmers and service providers of the importance of monitoring (soil moisture, plant growth).
- Explore advanced technologies for monitoring and scheduling, eg remote sensing.
- Further develop scheduling tools and systems.
- Improve automation components, integrating them into practical, user-friendly systems.
- Expand the use of co-learning approaches.

Phase 2 will directly address the Phase 1 recommendations through four sub-programs of work while delivering against the Rural R&D Program objective of significant increases in farm productivity and profit.

Sub-programs will include advancing precise irrigation technologies along with development and delivery of autonomous irrigation to improve automation components.

RD&E activities will be conducted on 11 key learnings sites. A further 35 irrigation optimisation sites will be established across five irrigated agricultural crops/pasture with a focus on increasing private sector involvement and managing the yield gap via best practice irrigation extension. Irrigation water use measurement and reporting also features in Phase 2, as these factors become a market access requirement as multi-nationals seek to increase the percentage of sustainably sourced product.

For more information and outcomes of Smarter Irrigation for Profit (Phase 1) go to www.crdc.com.au/smarter-irrigation

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Working together, working smarter

MELANIE JENSON

Tasmanian dairy farmers are improving pasture production while saving water and energy through a better understanding and uptake of variable rate irrigation, supported by collaboration with cotton industry research.

Nigel Brock has been working with cotton industry researchers through the Smarter Irrigation for Profit project on his Tasmanian dairy farm to optimise his overhead pasture irrigation systems using variable rate technology.

Nigel and Rachael Brock farm at Montana in the North West of the Apple Isle and say learning more about how to set up and use variable rate irrigation (VRI) on their centre pivots has allowed them to schedule and apply water to improve water use and energy efficiency while improving pasture growth.

A main component of this has been better understanding of scheduling, soil water holding capacity and when to begin irrigating to optimise pasture growth, through being involved in the Smarter Irrigation for Profit project supported by the Australian Government's Rural R&D for Profit program. The Brock's farm was one of five dairies in Tasmania where researchers from the cotton and dairy industries worked with farmers to improve efficiencies in centre-pivot systems.

"The result of the VRI working effectively has saved water mainly because the water is used in the right place and at the right rate, not wasted on roads and drains," Nigel said.

"Using the VRI we can also differentiate between the sandy hills and the clay loam flats and

apply the correct irrigation amount to maximise pasture production in both areas.

"In the past with conventional pivots this was a real balancing act – do we irrigate the hills more and over water the flats or vice versa? Either way one area was always being watered inefficiently and this lead to a loss of pasture production.

"We think the VRI can also work very effectively at irrigation start up when the sandier soils begin to dry out much faster than the clay flats.

"With the correct mapping and planning, water can be targeted at specific zones that require more or less which is a huge benefit to pasture production going forward into summer as the RAW (readily available water) level in the soils remains adequate for both zones."

Collaboration is key

The Brock's have been involved in the Smarter Irrigation for Profit project, which saw multiple research and on-farm collaborations with farmers and researchers from the cotton, dairy, rice and sugar industries to advance water use efficiency through information and expertise sharing. The Brock's have been working with specialist cotton industry researchers from the University of Southern Queensland and the Tasmania Institute of Agriculture (TIA).

One of these people is Dr Joseph Foley of USQ, who is regarded as a leader in the field of irrigation automation in both in field and overhead irrigation systems. This is the first time he's worked with the dairy industry.

"Collaboration is always a good thing as it brings together a wide variety of ideas and perspectives and I believe the Smarter Irrigation for Profit program was a prime example of collective thinking which brought about some key findings," Nigel says.

"We believe any project that can bring about positive efficiency changes can only be beneficial to the industry.

"Being part of the project has certainly improved our knowledge of the VRI technology and its implications as we purchased the VRI technology many years ago but had failed to utilise it to its full potential due to a lack of technical know-how and support.

"Throughout the project we have become more aware of the importance of the design, measuring, mapping and energy components of irrigation.

"Knowing what you have got and how to use it can be a big advantage.

"The project team helped explain all aspects of using the technology to full advantage. We were doing an okay job of irrigating prior to the project but a much better job after. So much so that we will definitely be using VRI technology on the new pivot."

Scheduling equals savings

The Brock's maintain that the biggest savings that can be taken from the use of the technology in irrigation management is around the correct application. If the correct application is applied *when* it is required then there is a considerable saving in water and energy usage.

"With our pivot we were able to irrigate at night

MELANIE JENSON

Although the Tasmanian dairy landscape is vastly different to our cotton growing regions, the science governing irrigation optimisation can be transferred from one industry to another successfully.

"...the combined study of all these aspects through the Smarter Irrigation for Profit project has demonstrated what best practice can begin to look like."

and over the weekends to still achieve the correct application rate but using the cheaper energy tariff.

"With a comprehensive farm map entered into the VRI we were also able to make considerable savings in water losses by avoiding laneways and drains.

"This had a double saving effect in that we saw a reduction in repairs and maintenance of our laneways also, plus the saving of lost water due to runoff. I guess with an improvement in pasture production across the whole site coupled with the dollar savings in costs you could say it was a win-win situation.

"Irrigation management requires a lot of knowledge across many aspects, from pump and pivot design, soils, mapping technology and pasture requirements and we believe that the combined study of all these aspects through the Smarter Irrigation for Profit project has demonstrated what best practice can begin to look like.

"Fully autonomous irrigation systems are possibly a little way off for us, but the work of the project is certainly guiding us as farmers to improving what we already have and the benefits can be substantial."

The work on Brock's farm was part of the broader Smarter Irrigation for Profit project across five Tasmanian dairy farms which involved improving irrigation efficiency, together with soil water and pasture growth monitoring by TIA over three years, starting in 2015.

During the project researchers shared increasing amounts of information and ideas with the irrigators, being able to track improvements in irrigation and production as they increasingly optimised their irrigation. James Hills says the introduction of VRI technology has led to a reduction in water use of between 29 and 34 percent across two of the sites, compared with flat rate applications.

Production up: costs down

Rob Bradley was one of the five farms involved and has implemented VRI and improved scheduling on his farm at Cressy and says he's increased pasture production by 200 tonnes over 117 hectares under pivots. This was achieved through better irrigation scheduling to keep moisture in the root zone for optimal growth using less water. More pasture means less supplementary feed costs and better use of water and energy. The researchers calculated that payback on the VRI was reduced from nine to three years.

MELANIE JENSON

Well known cotton industry researcher Dr Joe Foley talks to dairy farmers in Tasmania about variable rate irrigation and how he has helped the Brock family improve pasture production and reduce overheads.

As Rob says, "We're putting the water where it needs to go, we're using less power to do it and we're growing more grass".

There has been a very high level of interest in the outcomes of the Tasmanian dairy project both across the dairy industry as well as from other agricultural industries that rely on irrigation.

"This has been demonstrated by the significant number of field days and workshops that have been requested throughout this project from farmer groups, agricultural consultants and other agribusiness representatives from the dairy, cotton, sheep, beef, potato and vegetable industries," James Hills says.

"A total of 45 field days, industry forums and workshops were held across five states with more than 1000 in total attending these events, indicating the size and national impact of the learnings from this project.

"The interest by consultants in improving their understanding of irrigation scheduling in particular provides a pathway for application of this knowledge."

Stimulated by Smarter Irrigation for Profit, the dairy industry is also now developing an industry-based training package, based on the cotton industry's WATERpak, including irrigation agronomy for different pastures.

For more

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Keeping an eye on module wraps

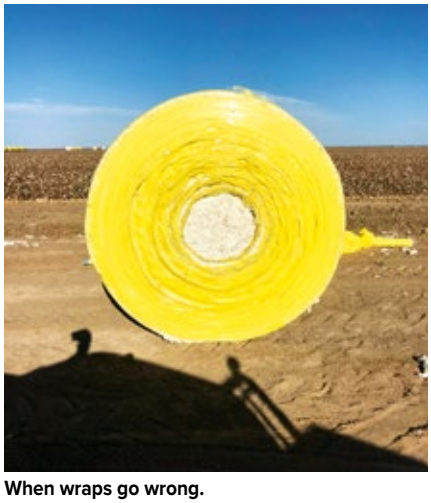
Maintaining Australia's reputation for clean cotton requires focus on how we handle new technology in round module harvesters.

The industry is known for its rapid uptake of technology and research. Paradoxically, recent technological and engineering breakthroughs have not only revolutionised the industry, they've also brought with them new considerations.

On-farm, the introduction and rapid adoption of John Deere's 7760 and the later models CP690 and CS690 round module harvesters is one such instance; changing harvesting but also raising considerations around the polyethylene wrap on the modules.

Australia outstrips the rest of the world collectively in the uptake of these machines. Released in 2008, by the 2010-2011 season there were approximately 80 JD 7760 machines in Australia that harvested approximately 44 percent of the 4.2 million bale crop. Just 12 months later, there were more than 200 machines harvesting approximately 75 percent of the (5.4 million bale) crop. Today between 90 and 95 percent of the crop is harvested with these machines. By comparison, about 50 percent of the US crop is currently harvested by John Deere round module harvesters.

The reasons, beyond Australian growers' keen uptake of technology and efficiency drive, are varied.



When wraps go wrong.

Brighann Ginning's Damian Tonkin and Ian McDonald with CRDC's Allan Williams and CSIRO's Stuart Gordon and Andrew Krajewski.

MELANIE JENSON

"It's taken a bit longer to take off in the US, this is mainly due to the size and scale of their industry, amount of existing equipment and the diverse nature of farming all of which makes it harder to change practices," CottonInfo Fibre Quality Technical Lead René van der Sluijs said.

"Also a large percentage of cotton in the US is stripped instead of picked, and the release of the CS690 stripper in 2014 certainly assisted in the increased uptake."

While improving efficiency by reducing labour and machinery requirements dramatically, new contamination scenarios due to the plastic wrap are a reality. On average, 2710 metric tons or 15 million metres of plastic is used annually wrapping Australian cotton. Each round module wrap is 21 metres and weighs about 3.8 kg.

Even if a tiny piece of that wrap makes its way into round modules then turnout bales, it can cause issues for spinners and go on to adversely affect the appearance of yarn, fabric and the final product.

"It's the number one problem for manufacturers of high-quality cotton products overseas and has serious impacts on ginners' time and productivity here in Australia," René said.

"According to the International Textile Manufacturers Federation, the degree of fibre contamination varies widely from country to country and region to region and is related to different farming, harvesting and ginning practices.

"Australian cotton has the international reputation of being among the cleanest and least contaminated, and we need to keep it that way."

The plastic wrap can find its way into the round modules via machine/wrap malfunction, operator mismanagement, poor loading and transportation. Sometimes the contamination is obvious, in other instances the 'tail' or a tear may find its way into the centre of the module.

Sharp focus on plastic wrap contamination is a must to maintain Australia's reputation for clean cotton. Vigilance while harvesting and transporting is the key to avoiding contamination.

The Australian Cotton Ginners Association (ACGA) members are the first to deal with plastic wrap contamination – at the gin. In an effort to detect contamination, gin sensors were developed with the Association and CSIRO with support from CRDC, however nothing is better than a preventative.

ACGA chair, Andrew Vanderstok, said ginners were very aware of the issue, which is a headache for them, is time-consuming and disruptive to the ginning process.

"Good on-farm practices is a key factor and also transportation prior to the ginning process," he says.

"If there is some sort of problem with the wrap mechanism and it is not detected or correctly dealt with by the operator, this puts the responsibility on the ginner to remove any contaminants prior to ginning.

"We get reports of the 'tail' of the (previous) wrap being found in the middle of a module, and tears along the edges of the modules.

In Australia 95 percent of the crop is harvested using round module machines, in the US it's around 50 percent.

"John Deere released a new guide last year, and I would encourage all machine owners to make sure drivers have read and understand it.

"Trying to iron out the issue of wrap malfunctions during the building process should be a priority.

"Making sure machine operators have inductions and are trained to be on the lookout for wrap malfunctions is essential."

Spotlight spoke to several ginners and growers who said they seen a pattern of plastic wrap contamination based on the sequence of the wraps on the roll.

Brighann Ginning's head ginner Damian Tonkin said they've seen patterns emerge during some ginning seasons.

"There are 24 wraps in a roll and there is an RFID tag for every wrap, so when we find this large piece or 'tail' as they call it in the module, we can find the RFID tag on that piece," he said.

"In one instance we found that the piece of wrap was always numbered 24 which indicates it was the last wrap on the roll on a particular machine.

"From what I have been told from the grower, the operator was doing something wrong when it comes to changing from one roll to the next roll in the magazine.

"The operator needs to be aware that this can happen and need to be properly trained to operate the machine."

Damian said the installation of gin sensors has been helpful, but not infallible.

"If we detect plastic in cotton it requires a total shutdown and trace back through the full system as it breaks up and moves quickly."

Start on farm

"Once a country has achieved a reputation for contamination, the likelihood of it achieving base world market prices is slim and growers are usually heavily discounted ranging from five to 30 percent even if the fibre quality is acceptable," René said.

"The first and most logical step to address the problem of contamination is to prevent/avoid or minimise the contamination entering the production process, particularly during growing, harvesting and ginning."

René recommends that growers:

- Store rolls of plastic wrap in their original packaging in an enclosed shed to avoid exposure to direct sunlight and moisture.
- Ensure that the harvester is set-up according to the Operators Manual and regular cleaning and servicing is conducted before, during and after harvesting has been completed. Take care that the wrap components are clean and free from debris.
- Use only trained and skilled drivers to operate harvesters.
- Tag modules and notify the ginner of any potential bale wrap encountered during harvesting.
- Stage modules on high, flat and well drained areas of bare soil and as per the method of transport and storage at the gin.
- Repair significant wrap tears in the field prior to loading on the module truck to prevent further wrap damage and ginning problems.
- Secure loose outer tails with 3M Hi-strength 90 spray adhesive or lint bale repair tape.
- Ensure that any chain beds used are fitted with rounded cleats, so that the chains will not puncture the plastic wrap.
- Ensure that modules are loaded without piercing the module wrap.
- Make all workers aware of the consequences of contamination. Provide workers with the tools to clean up and isolate rubbish. Use only white cleaning rags.

For more

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Optimising spindle harvester operation

The cost of cotton production in Australia is one of the highest in the world, at almost three times the world average, although high yields and high quality cotton fibre ensure that the industry has remained competitive.

Harvesting on average contributes about nine percent to the total cost of production, so it is hardly surprising there is a constant focus for both growers and researchers on making efficiency gains in this area. Making sure cotton pickers are working optimally is one area where gains can be made with little to no additional overheads.

The bulk of cotton in Australia is now harvested with the John Deere 7760/CP690 spindle pickers. Research has shown that harvesting efficiency is influenced by many in-field conditions, including variety, boll size, degree of boll opening, plant size and yield. What hasn't been so clear in the past is the effect on quality of row unit settings such as ground and spindle speed, compressor plate pressure, spindle tip clearance and scrapping plates in a high yielding production system such as Australia's. Although studies have been conducted to determine the effect of spindle speed on fibre quality, the effect was still unclear.

"It is generally accepted that harvesting plays an important role in determining efficiency, as well as fibre and seed quality," CottonInfo's Fibre Quality Technical Lead René van der Sluijs said.

"However we still needed to determine the effect machine setup has on harvesting efficiency and cotton quality."

How well set up are you?

As a result René began two lines of study: one study focused on ground and spindle speed, compressor plate pressure,

spindle tip clearance and scrapping plates attached to the back compressor plates, and the second study focused on drum arrangement.

René found that ground speed and scrapping plates attached to the back compressor plates did not have an effect on gin turn out, however, the compressor plate pressure setting did appear to decrease turnout as the front and back plate tension was increased, with the highest turnout achieved with the standard setting of 0.5F/2.0B. Although the mechanically-damaged seed fell within the acceptable range, the level of damage increased as the front and back compressor plate pressures were increased.

René found that ground speed and back compressor plate pressure setting had little or no effect on fibre quality. However the addition of scrapping plates resulted in improved colour grade and a statistically significant increase in fibre length, micronaire, the trash count and size, and a decrease in elongation. The interaction between the scrapping plates and the front compressor plate setting resulted in a positive increase in strength, while interaction between the scrapping plates and the back compressor plate setting was significant in terms of nep content. A decrease in compressor plate setting resulted in an increase in total and fibrous nep content.

Drum arrangement

Spindles are attached to picker bars which are arranged on rotating drums. Conventional picking units have two opposed contra-rotating drums, one on each side of the row. The in-line drum arrangement has both drums on the right side of the row, resulting in the cotton plant being picked only from one side, and was introduced by John Deere in 1989.

René's drum arrangement study showed that the harvesting efficiency of the opposed drum arrangement was substantially better than the in-line units and resulted in a 22 percent increase in yield. This increase in yield did not, however translate into higher gin turnout as the seed cotton harvested by the opposed drum arrangement contained more trash, which was removed during the ginning process.

"The addition of scrapping plates resulted in improved colour grade and a statistically significant increase in fibre length and micronaire..."

"Although there were small differences in terms of fibre colour (both Rd and +b), fibre length, length uniformity, short fibre index, strength and micronaire, after ginning they were not statistically significant," René said.

Similarly, in terms of fineness and maturity there were no significant differences between the two picker drum arrangements – trash levels, total, fibrous and seed-coat neps as well as nep and seed-coat nep size also showed no significant differences.

"These two studies have shown that harvesting machine setup and adjustment in terms of compressor plate, spindle tip clearance and addition of scrapping plates, has a substantial effect on fibre quality and turn out," René says.

"Ground speed and drum arrangement meanwhile having little or no effect on fibre quality and gin turn out.

"It is therefore important to ensure that the harvester is in good mechanical condition and initially set up according to the manufacturer's recommendations and changes to these settings are then made in accordance with field conditions, which include picking conditions, defoliation and yield."

Avoid a sticky situation

CottonInfo IPM Technical Lead Paul Grundy has put together this guide for SLW management.

Recent hot weather has seen silverleaf whitefly (SLW) numbers increase in many valleys, with a number of fields likely to or have required control action.

SLW has evolved to become one of the most complex insects to manage in our cotton system because we are essentially controlling an insect not to protect the plant from damage, but to prevent its honeydew (excrement) from contaminating open bolls. The amount of SLW honeydew secretions it takes to contaminate a crop is difficult to accurately define because factors such as the weather, crop stage and on-going SLW population dynamics all influence honeydew accumulation.

CottonInfo Integrated Pest Management (IPM) Technical Lead Paul Grundy has complied this information to help crop managers with decision making – please consider the following 10 points.

1. Honeydew contamination on cotton does happen.

While nearly all crop managers will have heard that sticky cotton can seriously impact Australian cotton's reputation and hence the price received by growers, over the last decade the incidence of stickiness has been isolated, leaving the impression that things would have to be really bad before a bale is affected.

The truth is that stickiness can be a real problem. In spinning mills visually "clean" cotton can cause problems as heat generated through friction can cause sugars to melt. These melted sugars can then result in cotton sticking to machinery, eventually necessitating reduced speed, and hence efficiency, or total shut-down for cleaning.

Naturally effective: Predators such as this tangleweb spider are the enemy of SLW, however numbers this year may require further control.

Consequently, cotton producing regions that develop a reputation for supplying honeydew contaminated lint risk losing an inherent premium on the world market. It is critical that the Australian cotton industry upholds best management of SLW to maintain its reputation for producing uncontaminated, high quality cotton.

Don't be complacent—ensure SLW are managed to prevent honeydew accumulating as the weather cannot be relied upon to fix it.

2. Use the SLW matrix threshold to guide your decision making.

The matrix (found in the Cotton Pest Management Guide) will help you identify whether or not a population of SLW is increasing at a rate that is likely to present a honeydew contamination risk when your cotton bolls begin to open.

In recent years, the matrix and associated sampling strategy has potentially underestimated SLW populations (particularly when conditions are hot and adult whitefly move deeper into the canopy), and this deficiency is currently being addressed by further research. Nonetheless, the matrix is still the industry's best guideline for if and when control action is required.

It is important to use the matrix as a guide for decision making, but to also consider the other factors covered in this list.

3. Examine the lower canopy leaves for large nymphs.

Examine the lower canopy leaves for large nymphs. If your sampling of 5th node leaves indicates that SLW adults are in the crop and increasing, sample additional main stem leaves adjacent to the bottom three-four fruiting branches.

An abundance of large nymphs on the leaf undersides indicates that the population is established and more adults will be emerging soon.

Note that honeydew is produced by both adults and nymphs.

4. Examine the lower leaves for signs of honeydew.

A very light sparkle on the leaf topside when it is rolled in sunlight is a warning that honeydew is starting to accrue within the canopy.

Over time, this sparkle will develop from pin prick spots to pencil sized dots. If this level of progression occurs within a week

you need to consider your control options for SLW (taking into account when boll opening might commence). If a low-level sheen appears on the lower leaves and you are near or have open cotton, SLW should be treated immediately with a product that is appropriate for the crop stage, population density and time to defoliation.

5. Consider resistance and your local pyriproxyfen usage window.

Low levels of resistance were detected two seasons ago to the industry's cornerstone control product – pyriproxyfen.

In response to this problem TIMS have implemented a voluntary 30-day usage window that is tailored to the needs of each valley. The window aims to limit the chances of SLW being treated more than once if populations become mobile between fields and farms. A critical factor for resistance management is to ensure that pyriproxyfen is applied only once per season as repeat applications will rapidly increase resistance levels.

6. You do not have to spray just because of the window.

One of the drawbacks of having an application window is that some people feel compelled to spray SLW before the usage window closes.

Spraying below-threshold SLW is counter-productive for resistance management.

The window is scheduled to coincide with both the time at which SLW would normally be expected to reach the pyriproxyfen threshold and allow time for effective control before bolls begin to open.

If SLW numbers are still below threshold at the end of the window and you are worried that control might still be necessary before defoliation, other products such as spirotetramat (Movento®), diafenthiruon (Pegasus®), acetamiprid/emamectin (Skope®), cyantraniliprole (Exirel®) or dinotefuran (Starkle) should provide effective control for any late season build-up depending on the situation's circumstances. Whilst not in the same category in terms of lasting efficacy when compared to pyriproxyfen, the use of these products on populations that have not built up as quickly late in the season should provide effective control given that crop maturity is not far away.

7. Consider your crop stage.

The aim for SLW IPM is to have the population at low levels by the time the first bolls open. This is why the pyriproxyfen window is centred around mid-season, to allow for the 16 to 20 day post-treatment period that will elapse before the population fully declines. During this post-treatment period SLW will continue to secrete honeydew, so avoid using pyriproxifen near the end of the window period if your crop is more advanced and likely to have open bolls within 16 to 20 days of treatment.

8. Do not mix pyriproxifen with a knockdown insecticide.

There have been isolated cases of crop managers "spiking" pyriproxyfen with a knockdown product (neonicotinoids or pyrethroids) to hasten adult knockdown. This is a dangerous practice as it destroys natural enemy populations on which the lasting efficacy of pyriproxyfen depends and also provides resistant individuals with greater opportunity to escape, passing on their genes to the next population. Pyriproxifen works best when supported by good IPM practices.

9. Look after your friends.

The management of SLW is a lot easier in a farming system that has not been disrupted by broad spectrum insecticide use for other pests such as mirids.

One of the reasons pyriproxyfen works so well is that it is highly selective and leaves the majority of SLW natural enemies in place after application. These natural enemies are very effective at "mopping up" any SLW that survive treatment (including potentially resistant individuals) and thus minimises the chance of SLW resurgence and can help delay resistance.

10. Don't drop the ball on other pests.

While SLW take their share of the limelight mid-season crop managers should be mindful that mites, mirids, aphids and stink bugs can also cause problems during flowering and boll filling.

Ensure that your crop sampling is effective for these pests and that any control decisions are consistent with recommended thresholds and good practice for minimising disruption to natural enemies.

PAUL GRUNDY

SLW have many hosts – keeping farms as weed-free as possible is another link in the control armour.

Finally, if there is a risk that your crop has honey dew contaminated open bolls what should you do?

At the end of the day we are all human and while we are doing our best to manage a dynamic biological system, things may not go to plan. If you suspect honeydew contamination might be affecting the open bolls in your crop there are steps that you can take that may help:

Rainfall and weathering can greatly assist with honeydew breakdown, so the number one thing you can do is to delay picking of suspect fields until last to increase the chances of rainfall falling on the crop. It is better to have the risk of a colour downgrade than be discounted for SLW honeydew contamination.

The other step you can take if you are concerned, is to talk to your ginner and/or marketer.

For more:
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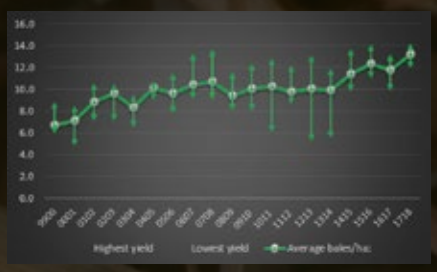
Creating disease suppressive soils

Growers are increasingly changing the way they manage disease, by creating disease-suppressive systems as opposed to looking for silver bullets. It's about prevention rather than cures.

The Australian cotton industry's most pre-eminent pathologist, the late Stephen Allen explained that disease is the soil's way of restoring natural diversity when we impose a monoculture on it. He said when we create a monoculture, the soil reacts by finding ways to take the monoculture out to return diversity to this living microcosm.

Brendon Warnock's farm in the Namoi Valley, is a living example of Stephen's words.

It's no secret that fields in the Namoi are struggling with the effects of Verticillium wilt, a soil-borne disease that has varying degrees of severity, from leaf discolouration to death. The re-emergence and severity of this disease in the past four years, it would be fair to say, has take the cotton industry by surprise and quickly taken a hold in cotton fields. However if we think back to Stephen's words, and examine Brendon's situation, it was probably inevitable.



By turning to a rotation system, Brendan has turned the tables on soil health and yield loss.

"The primary disease of concern for us is verticillium wilt," Brendon told *Spotlight*.

"We used to only grow cotton, so our soils built up a lot of Verticillium inoculum.

"Disease severity increased until poor performing fields were yielding 40 percent less than our highest, dragging our average down.

"Research indicated that one way to combat Vert was through crop rotation so we began growing corn in the summer of 2014-15.

"We now grow a cotton/wheat/corn/faba bean rotation and have seen a good improvement in yields.

"The variation between top and bottom yielding fields in the 2017-18 season was only 15 percent, so our average yield should be more consistent in the future and hopefully not too badly affected if there is a cool wet season favourable to Vert infection.

"We are happy with our progress but do see plenty more gains to be made yet."

A wide range of diseases inflict an expensive burden on the growers in our industry and Brendon reminds us that "It costs the same to grow a low yielding, disease-affected crop as it does to grow a high yielding disease-free crop".

"The difference in profit can be many thousands of dollars per hectare and a very large figure for the industry as a whole.

"Diseases are constantly evolving, with their impact spreading and becoming more severe.

"We need a focused, coordinated effort with a 'continuous improvement' mindset.

"We are able to combat disease by targeting research towards the pathogen, the host and the environment and great work has already been done with plenty of opportunity to achieve more."

Brendan says there are still pressing issues such as the spread of diseases. With support from CRDC he attended the *10th Australasian Soilborne Diseases Symposium* in Adelaide last year.

"One of the most pressing issues is to determine if Vert is being moved around the industry in planting seed as one researcher at the symposium hypothesised," he said.

"One of the other challenges is extension, as changing practices in the industry can be difficult.

"Many growers can identify the cost of disease to their business, but may be unsure what path to take to combat the issue.

"I believe the best way to encourage practice change is through hands on experimentation.

"Demonstration sites and master classes could get the ball rolling disseminating new knowledge.

"But," he says "we also need to provide growers with tools to measure and assess changes in disease burden over time as they implement change".

And so we come back to the words of Stephen.

"One of the most powerful changes my increased understanding of disease has given me is a different way of thinking about disease," Brendon said.

"I no longer think of disease as something imposed on us from outside but something we have created for our self through unsustainable practices.

"I think of disease now a message guiding us on a path towards finding ways to work with natural systems rather than against them.

"This mindset helps to make the issue less stressful and indicates that with the right approach diseases can be overcome and that the future looks bright."

Brendon said the topic of disease suppressive soils, as he is creating on his farm, was discussed at the soils symposium by a visiting US researcher who suggested that there was potential in Verticillium to recombine and form new strains – that biology will find a way around you – "which was a 'whoa' moment for many attendees".

"The symposium discussed the elements of disease suppressive soils, two major factors in this system being the use of fallow and rotation crops.

"It highlighted the importance of understanding how diseases and management interact and looking at a systems perspective not just one disease and one management style of it."

MELANIE JENSON

Taking the longer view in the south

MELANIE JENSON

Growing incidence of black root rot in Southern NSW has led to a rethink about the role of rotation crops in disease management.

The southern environment and climate can be a challenge at the start and the end of the cotton growing season. Cold starting temperatures can slow cotton seedling development and it make it difficult for seedlings to 'outrun' diseases such as black root rot.

Black root rot spores will build up over time when a hosts crops are continually grown.

"Cotton is the main host and we are now seeing patches of black root rot in Murrumbidgee fields after about five or six cotton crops — even with rotation with cereals," Kieran said.

"However, a sensible cotton–wheat–fallow rotation will delay disease build-up and help reset the compaction in the field.

"Legumes are also hosts of the black root rot fungus, so crop choice should be carefully considered when setting up rotation plans."

Hillston growers with a longer history of cotton now have problem fields with black root rot. In the warmer Hillston environment, crops may grow out of the disease, but top end yields are not reached in these patches.

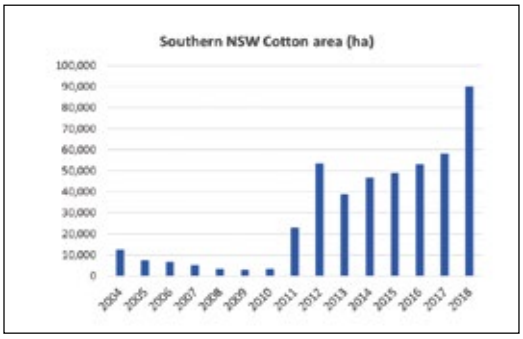


FIGURE 1. Cotton growing area in southern NSW, 2004–2018. The increase in area planted to cotton in Southern NSW and Northern Victoria has been quite incredible. The 2017–18 area planted to cotton was 90,415 ha.

"One grower estimates the difference can be six bales – 14 bales/ha in the good areas and eight bales/ha in the affected areas," Kieran said.

"A meeting with industry pathologists at Hillston last year determined that there is no one solution to the problem other than fields going out of cotton for three years.

"CSIRO's cotton breeding team are working on a genetic solution, but it is likely to still be a number of years away.

- **Think long term about protecting and improving the soil health of individual fields to capture the upside of returns from cotton.**
- **Yield decline in back to back cotton can be as high as 1.5 bales/ha year on year, caused by compaction and disease build-up.**
- **Black root rot is occurring in Murrumbidgee fields after about five or six cotton crops — even when the cotton is grown in rotation with cereals.**
- **A comparison of three cotton rotations showed back to back rotation of cotton had the highest gross income but it also had the lowest gross margin over a 10-year period, due to yield reductions, compared with cotton–fallow and cotton–wheat–fallow rotations.**

"The 2017–18 season also saw early infections of alternaria leaf spot in back to back cotton.

"This caused setbacks to some crops and maybe a more common event in our environment following a dry winter coupled with a cool start."

How long is too long?

One of the major threats to ongoing good returns for cotton is the temptation to increase the area of back to back cotton. Kieran says growers often ask, "How long can I go back to back?"

"Ideally it would be good to see no back to back cotton but in years with good water availability, the area of back to back cotton will increase," he said.

"This is a ticking time bomb in terms of disease build up.

"Prevention and good management practices are the only measures available at present to combat disease.

"Cotton growers need to have realistic expectations of yields from back to back cotton – the yield penalty can be at least 1.5 bales/ha compared with fallow.

"I have seen farms with long-term back to back where the yield decline gets to a point where losses occur.

"We have a different growing environment in the south compared with the northern cotton regions and we need to make realistic management decisions on long-term rotations.

"Turning fields around in time, over winter, for the next cotton crop is full of challenges and compromises. It can result in fields with poor seedbeds."

For More

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Compaction

A wet pick increases compaction and results in soil structure decline.

Kieran has suggested that fields where this happens should be left out of any back to back cotton program, and instead, a cereal crop grown to repair compaction at depth.

A project run by the Southern Valleys Cotton Growers Association with funding from CRDC looked at measuring soil compaction on irrigated farms that have been exposed to heavy machinery, as well as multiple cultivations, and compared the structure to that of a controlled traffic farm.

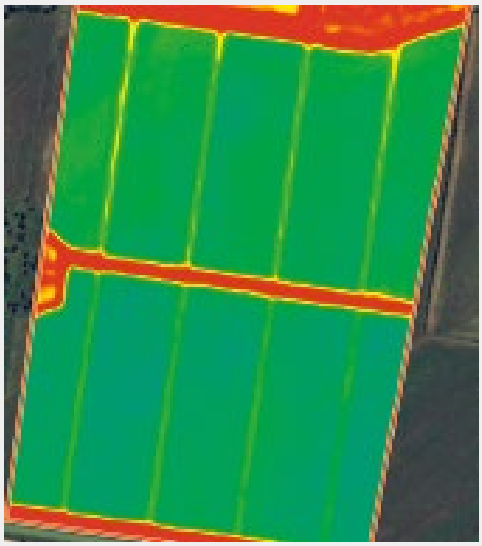
KIERAN O'KEEFFE

Compaction field day in Southern NSW, supported by CRDC.

There was also monitoring of water infiltration over a cotton season to assess if there were negative effects being seen due to compaction. Data was collected from three cotton fields, each with slightly different management histories, as well as from a dryland farm that runs a controlled traffic system

The key findings

- Under controlled traffic, compaction can be limited to the top 10–20 cm.
- Depth of compaction in irrigated soils is quite deep and difficult to fix. A dry pick would require a 40 cm deep rip, a wet pick would require a 60 cm deep rip.
- Beds suffer much worse compaction issues than hills. Furrows seem to crack more and therefore somewhat fix themselves.
- Old school thinking is that furrows are where the compaction is. The reality is that in irrigated systems the big machinery on beds causes much worse compaction then seen in furrows.
- Slightly different A-B lines each year creates more compaction across a wider area — use set A-B lines.
- Water infiltration is less in the compacted zone compared to guess rows — meaning that the "bucket" available to the plant is reduced.



This image shows cotton grown after a fallow summer yielding 1.28 bales/ha more (13.8 percent) than cotton grown after a crop (predominantly cotton) the previous summer. The results also show that hills performed better than beds under back to back crops by 7.5 percent. In fallow conditions there was no difference between hill/bed geometry. This raises the question, "Do we have a compaction issue from the previous wet winter and harvest that causes compaction on beds compared to hills in back to back rotations?"

Rotations: What do the figures say?

A study into the whole farm comparison of four cotton-based rotation treatments highlights the importance of crop selection in terms of financial performance.

Economist Janine Powell, formerly of NSW DPI, now a principal at AgEcon, and NSW DPI's Fiona Scott found that when water is not the limiting factor, in absolute financial terms, cotton-winter fallow-cotton will generate the higher total farm gross margin. Over the longer term, however, she says the research shows this higher profitability is accompanied by declining soil fertility, crop health and cotton yield per hectare.

The two-year rotation of cotton, wheat, followed by summer and winter fallows generated the highest business return.

The same rotation was most resilient to commodity price variability, 100 percent likely to return a positive farm operating surplus and 20 percent likely to return over $500,000.

A whole farm budget for a representative farm in the lower Namoi Valley in northern NSW (in 2016) was used to analyse the financial implications of four cotton-based rotations conducted in recent years at the Australian Cotton Research Institute, near Narrabri (Table 1).

Mean results indicated a positive return for all rotations within the representative farm budgets. Farm operating surplus ranged from $177,715 to $374,755 indicating that in the restricted irrigation water availability scenarios, assuming average commodity prices, each rotation would still generate a profit.

The two rotations including vetch were the least resilient to variable commodity prices. As land was allocated to use all of the irrigation water available, each treatment's return per megalitre influenced the whole farm results.

"The development of the whole-farm model has been profitability focused, however, it is important to note the other considerations for crop selection which affect the long-term sustainability of the irrigation farming business," Janine said.

"A budget snapshot does not take into account the longer-term benefits in terms of improved soil and agronomic sustainability.

"Research has proven the numerous benefits of including various crops in rotation with cotton from management of pests, weeds and disease through to improved soil nutrition and structure."

Long-term rotation trials by NSW DPI researcher Nilantha Hulugalle also found that in general, lowest average lint yields per hectare were with cotton monoculture. The cotton-wheat systems generally returned higher average gross margins/ML irrigation water than cotton monoculture and other rotation crops. This indicates that where irrigation water, rather than land, is the limiting resource, cotton-wheat systems would be more profitable.

	Summer	Winter	Summer	Winter
Treatment 1 (T1)	Cotton	Vetch	Cotton	Vetch
Treatment 2 (T2)	Cotton	Fallow	Cotton	Fallow
Treatment 3 (T3)	Cotton	Wheat	Fallow	Fallow
Treatment 4 (T4)	Cotton	Wheat	Fallow	Vetch

Table 1: Experiment treatments

Treatment	ML/ha	Ha of irrigated rotation	Ha of non-irrigated crops	Fallow
T1	6.4	200	382	200
T2	5	256	326	200
T3	3	428	154	200
T4	3.7	346	236	200

Irrigable land allocated to each treatment

Rotation	Gross income ($/ha)	Total variable costs ($/ha)	10-year Gross margin ($/ha)	Gross margin/ML
Back to back	36,180	27,767	8,413	$115
Cotton–fallow	30,000	18,625	11,375	$227
Cotton–wheat–fallow	35,870	23,375	12,495	$192

Returns of three cotton rotations

Rotations in the long term

In Southern regions where seedling diseases are leading to economic losses, CottonInfo REO Kieran O'Keeffe says he is seeing a trend where cereals are grown after cotton as a low input crop that may or may not get a spring irrigation.

"The crop is primarily grown as a repair crop," he said.

"When planning rotations, it is best to think of crop choices and the long-term implications of those choices.

"An interesting exercise is to do budgets out for 10 years and look at the

overall returns and the sustainability of consistent returns."

Using software Kieran compared three rotations:

- back to back cotton
- cotton–fallow
- cotton–wheat–fallow

The back to back rotation had the highest gross income but also the lowest gross margin over a 10-year period. Four crops were grown back to back before it had to be fallowed due to yield reductions due to disease. The back to back rotation had seven cotton crops in the 10 years. The other rotations grew five cotton crops in the 10 years.

The cotton-fallow rotation used 50 ML in the 10 years with the best gross margin/ML return of $227. The cotton-wheat-fallow rotation had the highest 10-year gross margin but used 65 ML over the 10 years so had a lower gross margin/ML.

Yield is the primary driver when considering the profitability of a cotton enterprise. A 20 percent increase in yield from 10.5 to 12.6 bales/ha, results in a 54 percent increase in gross margin per hectare. A 20 percent decrease in yield results in 55 percent decrease in gross margin per hectare.

Price received per bale of cotton is almost as critical. A 20 percent reduction in price received from $474/bale to $379/bale results in a 47 percent reduction in gross margin per hectare. A 20 percent increase in price received per bale (to $569/bale) results in a 47 percent increase in gross margin per hectare.

"There will be a range of crop options to grow as rotations evolve to suit individual enterprises and grower preferences and there is also interest in fitting cover crops and biofumigant crops into the sequence," Kieran said.

"We need to think long term about protecting and improving the soil health of individual fields and the health of crops, to capture the upside of cotton returns."

"The back to back rotation had the highest gross income but also the lowest gross margin over a 10-year period."

Maintaining soil biology for disease suppressive soils

Research has shown that biological disease suppression mediated by soil microorganisms including soil fungi can assist farmers in reducing the impact of diseases on cotton production through crop management.

A single gram of soil can contain 10 billion bacteria, five kilometres of fungal hyphae, thousands of protozoa, hundreds of nematodes and dozens of insects, such as spring tails, beetles and spiders.

Fungi are an important component of biota accounting for more than 60 percent of microbial abundance in agricultural soils in Australia, including under irrigated cotton.

Soilborne diseases such black root rot, Verticillium and Fusarium wilt have a significant impact on cotton production. Currently, the management of disease impacts is through the use of genetically resistant cultivars, chemicals or rotations with non-host crops.

Plant-associated fungal communities can function as an important line of defence against fungal pathogens and are improved through the use of rotation crops in cotton systems.

Microbial interactions play a complex role in broad-scale ecosystem functions: plant health, decomposition and nutrient cycling. Soils with species-rich communities are more resistant to pathogen invasions.

Recent research has looked to determine the fungal community composition, diversity and interactions as influenced by cropping history including fallowing and their links to disease incidence and suppression.

The *Digital technologies for more dynamic management of disease, stress and yield* project supported by CRDC and the Australian Government through the Rural R&D for Profit program integrates several researchers' field experiments, sampling and surveillance, with grower's practices and laboratory studies.

The diversity and abundance of soil fungal community varied significantly by crop management history. Soils from continuous cotton and cotton-fallow rotations showed lowest fungal abundance and diversity and microbial catabolic diversity. Fungal communities in suppressive cotton soils were characterised by higher diversity and higher connectedness.

CRDC and CottonInfo have been highlighting the need for healthy and abundant soil biology through the 'Soil Your Undies!' campaign. Pictured is MacIntyre Valley grower Andrew Newell getting into the spirit of soil health.

Results for diversity indices showed significantly greater diversity in the long-term crop rotation experiment compared to other experiments such as biofumigation. Diversity was lowest in the soils under brassica crop rotation experiment. In a long-term trial near North Star on the Queensland/NSW border, surface soils from continuous cotton and cotton-fallow rotations showed lowest abundance of fungal populations and overall catabolic diversity of soil microbial communities.

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New pathologist for the south

To address capacity needs in Southern NSW, particularly in the area of pathology, new industry roles have been created.

CRDC and NSW DPI have already welcomed a new cotton crop protection specialist, Tim Green. Tim will focus on crop protection through pathology and entomology. A technical officer role also forms part of the project, which has not yet been filled.

With the separation of the CottonInfo Disease and Biosecurity technical lead positions, Tim will become the CottonInfo Disease Technical Lead, while QDAF's Sharna Holman will remain in the biosecurity lead role.

Based at the Yanco Agricultural Institute Tim will liaise with industry pathologists to produce Southern-specific disease extension materials and conduct the southern component of the CRDC-supported national cotton disease survey.

Tim will provide a Southern link to a number of CRDC-supported projects, particularly the disease survey project and Duy Le's innovative solutions project focused on new methods to control black root rot and alternaria. He will be working with CottonInfo's Regional Extension Officer Kieran O'Keeffe, CSD, local agronomists and local researchers to address the crop protection issues of our southern cotton growers.

"I originally come from a combined Merino sheep stud and beef cattle property just outside of Nimmitabel in the Monaro region," he says.

"Despite my family giving me a good-humoured hard time for converting to another fibre, I'm truly excited to be joining such an innovative, vibrant industry.

"After just a few weeks in the job all growers and agronomists have been very keen to collaborate and share ideas.

"With the cotton industry in the south being relatively new, there is a lot of room for new practices and the evolution of current ones. I look forward to watching and helping this industry develop in the coming years."

Tim attended Charles Sturt University from 2014 to 2016, graduating with a Bachelor of Science (double major Plant Science and Microbiology). In 2017, he began work as a technical officer with the DPI at the Wagga Wagga Agricultural Institute working in cereal pathology and in 2018 completed his Honours through the Australian National University investigating novel pathogenic species related to *Zymoseptoria*

Tim Green

tritici, a common fungal wheat pathogen.

"I then transitioned into my current role of cotton pathologist at the Yanco Agricultural Institute in January this year," Tim says.

"Moving into the cotton industry I look forward to applying my laboratory and glasshouse skills, in particular genetics, and field surveying background into this new industry.

"My aim will be to replicate trials and research conducted in the Northern regions in the Southern cropping area to ensure the applicability of these results to a different growing area.

"This research will be focused not just on disease but also on pests as I my role will encompass crop protection as a whole."

Tim says on a personal note he's a keen rugby player and supporter, and strongly believes in the future of agriculture in Australia and the engagement of youth in it. As such he was named the Royal Agricultural Society of NSW's Rural Ambassador for 2018.

CRDC's Susan Maas said "This project is recognition from both NSW DPI and CRDC of the need to build cotton research capacity in Southern regions.

"This has been a challenge we have been trying to address for some time, and it is good to see an appointment in place.

"Separating the issues of disease and biosecurity in CottonInfo will also ensure these two critical industry issues are given sufficient extension support."

For more

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Hayden will be focusing on improving water infiltration by incorporating cover crops into the system as part of his industry role.

Riverina welcomes Hayden

THERE'S a new face in cotton in the Riverina, with the appointment of Hayden Petty as the new Cotton Research Agronomist based out of NSW DPI at Yanco.

The position is supported by NSW DPI and CRDC, with Hayden taking over from Steve Buster, who took on the role on its creation, to meet the needs of cotton growers in the Riverina, covering the areas of Hillston, Condobolin, Griffith, Coleambally and Berrigan.

Hayden has experience in broadacre cropping and has built research expertise over the past two years. He graduated with a Bachelor in Agricultural Science and completed 1st Class Honours with NSW DPI in grains research, focusing on the relationship between water soluble carbohydrates and freezing temperatures in wheat.

"I originally come from a livestock background on the NSW South Coast, so moving to the Riverina into this cotton role has been a massive eye opener," he said.

"The cotton industry has been very welcoming and I am keen to continue building networks in both the northern and southern cotton regions through research trials and development activities."

Hayden will continue the work started by Steve Buster in 2016 under a CRDC-supported project focusing on optimising seedling emergence.

"I will also be focusing on improving water infiltration by incorporating cover crops into the system," Hayden said.

"I've also got a keen interest in precision agriculture and hope to implement such systems in my research to improve water use efficiency and maintain high yields in the Southern NSW region."

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Dr Oliver Knox.

MELANIE JENSON

Growing CottonInfo's capacity

THE CottonInfo team continues to grow in strength, with the appointments of Dr Oliver Knox as Soil Health Technical Lead and Jon Baird as Nutrition Technical Lead.

Oliver and Jon both work as researchers and scientists in the industry. Oliver currently runs the Cotton Hub at the University of New England and has helped run CottonInfo campaigns such as 'Be a Good Mate' and 'Soil your Undies!' Jon has been integral in providing the industry with essential data and improved knowledge around nitrogen use and irrigation.

"CottonInfo is continuing to develop its core capacity of connecting growers and consultants with research," Program Manager Warwick Waters says.

RUTH REDFERN

Jon Baird.

"With the departure of John Smith last year, we needed to recruit a replacement Nutrition Technical Lead and Jon Baird comes to this role with his existing research projects focused on the relationship between nutrition and irrigation management, as well as excellent networks with nutrition researchers through the Australian Government's Rural R&D for Profit program's More Profit from Nitrogen project.

"Many growers would recognise him from our researcher tours."

A new technical lead position has been created for Soil Health as a recognition of the importance of healthy soils to the cotton production system.

"Dr Oliver Knox will bring years of experience and knowledge to the role that will focus on connecting growers with research on soil quality, biology and structure," Warwick said.

"Current projects in this space include cover cropping, use of manures in cotton systems, understanding soil constraints on root depth and the impact of compaction."

For more
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CRDC and UNE: Fulfilling industry needs

Last year's Cotton Industry Awards held at the Australian Cotton Conference have highlighted the success of the University of New England's (UNE) Cotton Production Course, supported by CRDC.

Four of the young achiever nominees were previous cotton production course students, who have been guided through their study by Brendan Griffiths, who himself was a course student, 'way back' in 1994. Brendan's name is perhaps not the only one known to many in the industry from that year, which also included well known industry identities Jim O'Connor, Chris McCormack and Annabelle Guest, among many others.

The course has had, and going on the recent cotton awards, continues to have an influence on delivering people with the skills to meet the needs of the industry. A major part of this is maintaining the remit to better prepare cotton industry personnel to make sound decisions based on well-founded information.

"This has all primarily started with the UNE co-ordinators of the units who have all had either strong links, vested interests or both with the cotton industry," says UNE Cotton Hub's Dr Oliver Knox.

"Whether you did the courses with Steve Buster, who instigated the development of the units as the only specialised university level qualification in cotton production in Australia, or Guy Roth, John Stanley, and now Brendan and myself, the impetus on learning industry relevant skills has been core to delivery of each unit.

This has always been achieved through the units continued reliance on industry support, initially under the various Cotton CRCs and now CRDC.

"This support, as well as allowing the units to remain viable, also provides enrolled students with access to the researchers, consultants, growers and support industries that all assist in delivery of the material on the cotton units," Oliver said.

This aspect of the cotton units has and remains vitally important.

Annabel Twine completed the course in 2010 when Guy Roth was co-ordinator and has now taken on a leading role in the industry as CottonInfo's Darling Downs regional extension officer. Annabel speaks highly of the experience.

"You got to speak to researchers, lecturers that you had heard about, but did not previously have access to," she said.

"It used the specific terminology that's used in the industry that you could relate to and when people talked to you, you could understand the language they used and how it related to the industry."

The ability to focus explicitly on cotton is what has attracted people to the course over the years and continues to attract them today .

"It was specific to cotton and that's what I was working on," Annabel said.

"We often come out of university having done study that was not specific to our current job or area of interest, and this cotton course was specific, which is exactly what I wanted."

Others have similar reasons. Robert Gill, a consultant with BioAg in Griffith finished last year.

"The biggest things were the practical implications of the residential schools we did during the seasons, where the material you were learning was applicable," he said.

"It really helped put the learning into a practical sense at the same time and allowed me to take it back to my southern clients and apply that information.

"It was pretty attractive to them and pretty attractive to me too."

Jess Strauch completed the units in 2017 and last year took the current cohort through the gin tours at Goondiwindi where she works for Namoi Cotton. She says what stood out for her was coming from marketing and ginning background, how she really enjoyed the agronomic and soil aspects of the courses.

"I actually really enjoyed the cotton in the environment unit," Jess said.

"It was something I had not had a great deal to do with and it was a little bit different and new to me."

The graduates also outlined a commitment from their employers.

Annabel was working as a consultant with Queensland Cotton based in St George and the company fully supported her through her study, while Jess approached her general manager at Namoi Cotton about undertaking further study in the cotton industry.

"I thought the cotton course was a fantastic fit and they came on board with that," Jess said.

She said the flexibility offered in the course to co-ordinate study around her work was also a consideration.

"At times it was a little tricky, for example during busy times like ginning, but the co-ordinators were very flexible – this was fantastic," Jess says.

MELANIE JENSON

Brendan Griffiths not only completed the UNE Cotton Course, now he teaches it. He is pictured here with students attending a field day in Northern NSW.

Robert said he was doing one unit per semester, taking two and a half years to complete, which he says was ideal as he needed to fit it around work, and to get his winter crops in.

"It was all about how much I could get through, and Brendan helped me with this," he said.

Brendan and Oliver say they are very appreciative of employers' support of students.

"Having flexibility for students is important, and we have to work with the fact that delivery is often restricted to UNE's trimesters," Brendan said.

"While this can be an issue we do try to make the units as accessible as possible.

"Completing the Graduate Certificate was also made easier for both Rob and Jess by the fact that UNE recognised their prior university study, so only had to complete the cotton units to graduate with the certificate."

The graduates agree the course has delivered meaning, offered flexibility, and given them the tools they've needed for the industry.

"Absolutely, this course has delivered," Annabel says, backed up by Rob who said "Definitely, over and above, I would recommend to other students to do what I have done, in the time frame that I did."

The course is made possible with funding through CRDC. There have been 836 students enrolled over the last 10 years, with an average of eight graduates completing all four units in every year. The course is currently delivered by Brendan as a major in the Diploma in Agriculture (for externally enrolled undergraduates) and a stream in the Graduate Certificate in Rural Science (for externally enrolled post-graduates), both offered by UNE. Completing all four units (Applied Cotton Production, Cotton Protection, Cotton and the Environment and Cotton Farming Systems) is recognised as the Cotton Production Course within the university awards.

UNE also offers the courses as part of their bespoke course catalogue, which started in 2018, and to some undergraduates and MSciAg students who take Cotton Production as an elective. In addition, they regularly welcome some students each year onto the units from other tertiary institutes under a cross institutional learning agreement.

Oliver says sticking to what works has been key.

"'If it isn't broke then don't fix it' could be one motto that has been adhered to in the life of the course," Oliver says.

"Despite the move to on-line delivery of lectures, the use of intensive schools based in cotton regions is still a big part of all the units, deliberately exposing students to the people and aspects of the industry that they need to be familiar with.

"Numbers are good and we believe the course continues to deliver people ready to meet the needs of the cotton industry."

Oliver and Brendan encourage *Spotlight* readers to take a closer look at the course.

"If you are reading this and have one of those big white folders tucked away somewhere, why not get it out and have a little reminisce and if you don't have a folder, then why not have a look at the course options and perhaps enrolling for next year.

"You never know, it might one day help you get your achievements recognised at an industry awards dinner!

"For further information on the Cotton Production Course, units or degree paths available at UNE, feel free to contact myself or Brendan."

For more

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Jon Welsh discussing pumping efficiency with Emerald grower Hamish Millar.

Pumping with solar:

Saving money and improving the environment while the sun shines

Integrating solar energy into your existing pump sites may be the best way to reduce your escalating pumping costs, according to the latest research.

Agricultural economists at AgEcon recently conducted a study on an irrigation property near Comet in Queensland where they compared the alternative energy generation potential of three different sites on the property: a river pump; a pumping station for centre pivots; and a grain drying facility.

The research, supported by CRDC, found the potential for huge energy cost savings in a number of scenarios through the integration of solar energy into existing grid-connected sites.

What to consider

AgEcon partner and CottonInfo Energy and Climate Technical Lead Jon Welsh says there are many considerations for irrigators looking into alternative energy to offset pumping costs.

"On-site co-generation for irrigators hasn't been feasible in the past, but we believe technology advances in renewable energy and in batteries will be able to offer cost savings for irrigators in the very near future," he said.

"The cost benefits are highly dependent on the rate of consumption and on government incentives, access to Feed-In-Tariffs (FITs) and network connection costs."

Through their research, AgEcon found growers were very interested in alternative energy solutions to offset their escalating pumping costs.

Emerald cotton grower Hamish Millar said he was keen to find a solution to his current scenario of paying $300-$350/ha in energy costs.

"I believe renewables do have a place in the future of agriculture. It may not be the solution for everything, but I think in combination (with other energy sources) it is something we should be pushing for," Hamish said.

Nigel Burnett, also a cotton grower at Emerald, agrees that there is a willingness among growers to look for alternative energy sources that provide both security and cost savings.

"Our biggest problems are the high cost of electricity and the reliability of the service," he said.

Nigel expressed frustration that he cannot rely on his existing grid-connected pump sites for energy security and has had to install a

diesel generator as an alternative.

"It's no surprise to me that the cotton industry is working towards solving these problems. And that will enable us as an industry to work towards a more sustainable future."

Simplifying the process

With incentives for solar energy exports varying between states and energy retailers, the connection criteria can be a difficult beast to navigate in order to determine whether solar integration is a viable solution.

Through their research into a number of different energy-use scenarios on farm, the economists have attempted to simplify the process for interested growers.

The case study at Comet in Queensland found that both the centre pivot system and the grain drying facility were viable sites for solar energy integration.

Case studies

The centre pivot site had 110kw and 132kw pump motors supplying year-round irrigation water. By installing a 225kw photo-voltaic (PV) system in combination with a diesel generator and existing grid connection at a capital cost of $380,000, payback on the investment was 6.5 years.

AgEcon's Janine Powell says this scenario represents an excellent cost saving for the grower.

"Although it is a large site which is not eligible for a FIT, the solar installation was still able to save $860,000 over a 25-year period," she said.

Analysis of the centre pivot scenario showed over 60 percent of the load being covered by solar power, reducing the average cost of electricity by 15c/kWh and abating just over 2,700t of CO_2 over the 25-year project life.

The grain drying facility site consisted of a 37kW fan and 3kW small augers. The study showed that by integrating a 38kW PV system and a 30kW inverter into the existing grid-connected system at a cost of $35,600, the investment would be paid back within five years.

There are many considerations for irrigators looking into alternative energy to offset pumping costs.

The only site which was not found to be suitable for solar integration was the river-pump site. Its seasonal use meant that the renewable energy generated would be unused for most of the year.

However, the study found that by incorporating a 400kW diesel generator into the existing grid-connected system at a cost of $122,700, payback occurred within five years and energy cost savings were considerable.

The downside is that the emissions savings in this scenario are minimal.

No time like the present

Jon believes that as the current Renewable Energy Targets winds down in the next few years, there is no time like the present to invest in cost-competitive renewable technology.

"With up-front small-scale certificates still trading near upper limits and the low capital cost of solar, there is a real opportunity for irrigators to capitalise on this very attractive investment scenario," he said.

"It's a rare intersection of good on-farm economics and environmental outcomes."

More information on the study can be found via a factsheet or short film on the CottonInfo website www.cottoninfo.com.au

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Q. What is a Microgrid?
A. Clusters of generators which operate as single contollable entities

Q. What is a Feed-In-Tariff?
A. A premium rate paid for electricity fed back into the electricity grid from a designated renewable electricity generation source.

Putting our best foot forward for our industry

Being in the agricultural game can sometimes feel like you are at the wrong end of the stick for many reasons. Be it the weather, disease or commodity prices, we could be forgiven for considering an alternative lifestyle and vocation. Recently however, it has been the reactive criticism in mainstream and social media and questioning of the cotton industry's social right to farm.

The agricultural sector was an early adopter of social media in Australia, and it continues to be a tool used by most of us daily in our businesses – for both information sharing and gathering. Sadly though, many in our industry have been on the end of social media backlashes against them through no fault of their own. Such was the case during the fish kills in Menindee in January this year.

The cotton industry has had its fair share of criticism and scrutiny over the years, much of it being well founded. Some past statistics of water and chemical usage and practices are enough to make even the more 'experienced' of those working in industry shiver.

What does not seem to be broadly appreciated are the huge leaps in water efficiency and reductions in chemical usage that have been demonstrated in the cotton industry over the past 20 years – and even over the past 10 years. Sometimes it appears that the industry just can't shake of the myths and 'sins' of its past and becomes a convenient scapegoat for ill-informed 'blame gaming'.

While it is tempting to reply to such criticism with an emotive backlash, it is important to remember that we have facts and figures at our fingertips to counter these accusations. These facts and figures speak for themselves and many have been readily quoted by Cotton Australia and other industry bodies in reply to the issue.

"The long-term data from surveys demonstrates the outcomes of a long history of innovation, research and a whole of industry commitment to triple bottom line improvement."

Since 1982, Crop Consultants Australia (CCA) has been involved in the annual survey of members which provides valuable data to the cotton industry. Now supported by the CRDC, CCA coordinates the *Cotton Market Audit* each year on behalf of the cotton industry.

The *Cotton Market Audit* is an important and reliable set of data that helps the demonstrate its practice changes and improvements to the public. It informs regulators and product reviews; provides direction to research and policy priorities, and identifies trends, emerging issues and potential threats important to growers and agronomists.

Details on obtaining data from this survey are available on the CCA website www.cropconsultants.com.au

A separate report, the *Cotton Consultants Survey* is a qualitative survey completed by CCA members each year. The survey covers a very broad range of topics; from staffing and professional development needs to every aspect of producing and managing a cotton crop (soils, pests, weeds, fertiliser, technology and water).

Also supported by CRDC, these annual reports, and historical reports are available on the www.insidecotton.com website.

The long-term data from both these surveys demonstrates the outcomes of a long history of innovation, research and a whole of industry commitment to triple bottom line improvement. CCA members, as advisors and researchers have played a key role in driving this innovation.

As a professional development organisation, CCA remains committed to providing our members with timely, informative information provision and training opportunities to ensure that they continue to deliver best practice in the field to their clients. Integral to this are our face to face seminars and workshops which feature agendas developed directly from member feedback and 2019 is no exception.

This year we head back to Narrabri on June 19 and 20 for our two-day seminar with an agenda focussing on putting our best foot forward for our industry and our businesses. Speakers will cover such topics as the latest in disease management in innovation in the paddock. This year's highlight however will be internationally-renowned motivational speaker Amanda Gore who will join us as our dinner speaker.

Following on from the success of the CCA regional workshops series in 2018, we will again be visiting the regions in 2019 at the following dates and venues.

August 15 2019 – Jondaryan Woolshed, Jondaryan, QLD
August 22 2019 – The Exies Club, Griffith, NSW.
August 29 2019 – The Town and Country Club, Moree, NSW.

COMMENT: WITH CROP CONSULTANTS AUSTRALIA

This year CCA heads back to Narrabri on June 19 and 20 for its two-day seminar with an agenda focusing on "putting our best foot forward for our industry and our businesses".

These workshops will have an agenda tailored specifically around issues in each region and provide an ideal opportunity for attendees to network and discuss local issues.

All CCA events are open to members and non-members alike. It should be remembered however that members receive significant discounts on registration, so it is worthwhile considering investing in membership as part of your registration. Registrations will open in April with early bird discounts available.

We look forward to welcoming all members of the industry to our events in 2019. As an informed and proactive group of professionals, together we can promote the success stories that are the Australian cotton industry.

For more information on the CCA survey data, membership or events, visit the CCA website at www.cropconsultants.com.au

Geoff's OAM for service to cotton

Pioneering cotton consultant Geoff Brown was honoured on January 26 with the Medal Of The Order Of Australia (OAM) In The General Division for his services to the cotton industry and the community of Wee Waa in North West NSW.

Geoff was a founding member and past president of Cotton Consultants Association (now Crop Consultants Australia). An agronomist since 1979, Geoff has mentored and trained countless young agronomists in the industry since entering it.

Geoff was mentioned by CCA in the Winter 2016 edition of *Spotlight* as one of the 'statesmen' of the profession as they celebrated 30 years of association.

"People such as Geoff Brown were instrumental in not only pioneering the industry, but recognising a need for crop consultants to work together with the research and chemical sectors to develop their profession," the CCA column said.

His services to the town of Wee Waa were long and varied, including Rotary (life member) and a chair of the Wee Waa Medical Centre.

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