CRDC ANNUAL REPORT 2015–2016

Investing in RD&E for the world-leading Australian cotton industry

Australian Government

Cotton Research and Development Corporation

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If you are interested in learning more about CRDC and its investments, visit the CRDC website www.crdc.com.au or subscribe to our quarterly magazine, *Spotlight*.

All photos and images in this report were sourced principally from CRDC, project researchers or research institutions.

Front cover photo: Emerald cotton consultant Jamie Iker is one of two cotton industry leaders who took part in the Australian Rural Leadership Program in 2015–16. He and fellow participant Sean Boland of Moree received support from CRDC, Cotton Australia and Auscott Ltd. Jamie is also part of the CRDC-supported *Strengthening the Central Highlands Cotton Production System* project, led by QDAF's Paul Grundy. Under this project, researchers have been trialling growing cotton under biodegradable plastic film to take better advantage of the region's climate. Jamie is pictured here at the trial site at 'Orana' Emerald, owned by Cowal Agricultural Operations. Photo courtesy researcher, Paul Grundy.

Published: December 2016

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Australian Government
Cotton Research and Development Corporation

Introduction
ABOUT CRDC

The Cotton Research and Development Corporation (CRDC) has been delivering outcomes in cotton research, development and extension (RD&E) on behalf of Australia's cotton growers and the Australian Government for 25 years.

Established in October 1990 and operating under the *Primary Industries Research and Development Act 1989* (PIRD Act), CRDC exists to enhance the performance of the Australian cotton industry through investment in, and delivery of, cotton RD&E. CRDC is based in Narrabri, NSW: the heart of one of Australia's major cotton-growing regions and home to the Australian Cotton Research Institute.

Cotton is a major contributor to the economy, environment and social fabric of rural Australia. Grown in New South Wales, Queensland, and recently expanding into northern Victoria, cotton is a major employer and contributor to the local, state and national economy. Over the past five years, the industry has generated an average of $1.9 billion in export revenue per annum.

CRDC's role is to invest in RD&E on behalf of cotton growers and the government, with the outcomes boosting the productivity and profitability of our industry. RD&E, and its resulting innovations, are a key driving force behind the cotton industry's continued success.

In 2015–16, CRDC invested $21 million into 290 RD&E projects in collaboration with 92 research partners and growers who conducted on-farm trials, across five key program areas: farmers, industry, customers, people and performance.

The findings from these research projects continue to be extended through a range of methods, including the industry's joint extension program CottonInfo. The adoption of best management practices is also encouraged via the industry program *my*BMP. CRDC is a founding partner of both programs.

This report outlines CRDC's investments and impact across these five program areas during 2015–16.

Vision: **A globally competitive and responsible cotton industry.**

Mission: **To invest in RD&E for the world-leading Australian cotton industry.**

Purpose: **Enhancing the performance of the Australian cotton industry and community through investing in research and development, and its application.**

ABOUT THE AUSTRALIAN COTTON INDUSTRY

The Australian cotton industry is one of the success stories of Australian agriculture. A culture of innovation within the industry, supported by and embracing a well-organised RD&E framework, has been a major contributor to this success.

From small beginnings in the 1970s, Australia's cotton industry is now a valuable agricultural export commodity. Cotton is currently the major agricultural crop grown in many rural and remote regions of Queensland (QLD) and New South Wales (NSW).

Australian cotton is the highest yielding, finest, cleanest and greenest cotton in the world. On a global scale, Australia is not a large cotton producer—only around three per cent of the global crop is grown within Australia, by some 900 cotton growers on 1250 farms in QLD and NSW, with commercial trials in Victoria (VIC).

However, Australia is one of the largest exporters of cotton, with nearly 100 per cent of the national crop exported, generating an average of $1.9 billion in export revenue annually. The industry generates significant wealth and provides an economic foundation to many regional and remote rural economies, employing up to 10,000 people.

Improved practices driven by RD&E over the past 15 years have reduced insecticide use by 92 per cent and improved water-use efficiency by 40 per cent, while improvements in fertiliser and energy use are driving an ongoing reduction in nitrous oxide emissions.

The best cotton producers now achieve more than two bales of cotton per megalitre (ML) of water—almost double the industry average of just a decade ago. The industry is at the forefront of environmental management systems, and climate variability mitigation and adaptation.

Importantly, cotton is an industry taking responsibility for itself by changing practices to meet societal expectations. The introduction of the industry's best management practice program *my*BMP, the uptake of biotechnology to help reduce pesticide use, and the implementation of the industry's environmental assessment and resulting actions, are all examples of the cotton industry recognising the need for change, and working with the RD&E system to enact it.

In recent years, new cotton varieties, new farming technologies, and favourable weather and market conditions have facilitated an expansion in southern NSW cotton-growing regions, reaching as far south as the Victorian border. The industry has also historically invested in developing cotton production practices for northern Australia, in preparation for any future commercial developments.

LETTER OF TRANSMITTAL

Australian Government
Cotton Research and Development Corporation

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14 October 2016

The Hon. Barnaby Joyce MP
Deputy Prime Minister
Minister for Agriculture and Water Resources
Parliament House
Canberra ACT 2601

Dear Minister

It is with great pleasure that I submit the Corporation's Annual Report for 2015–16, prepared in accordance with the provisions of section 28 of the *Primary Industries Research and Development Act 1989*, section 46 of the *Public Governance, Performance and Accountability* (PGPA) *Act 2013*, and the Funding Agreement 2015–2019.

The activities of the Corporation are reported against the objectives, strategies, outputs and outcomes of the CRDC Strategic Research and Development Plan 2013–18, and are consistent with CRDC's 2015–16 Annual Operational Plan and Portfolio Budget Statement.

Under section 46 of the PGPA Act, CRDC Directors are responsible for the preparation and content of the Annual Report being made in accordance with the Public Governance, Performance and Accountability Rule 2014. The report of operations was approved by a resolution of the Directors in October 2016.

Yours sincerely

Richard Haire
Chair
Cotton Research and Development Corporation

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Section 1
Executive Summary

Report from the Chair and Executive Director

Progress against CRDC Strategic R&D Plan 2013–18

Year in Review: RD&E Achievements

Organisational Highlights

2015–16 Investment and Impact

MELANIE JENSON

Executive Summary
REPORT FROM THE CHAIR AND EXECUTIVE DIRECTOR

The Australian cotton industry is one of the success stories of Australian agriculture. Australian cotton is the highest yielding, finest, cleanest and greenest cotton in the world.

We're an industry taking responsibility for ourselves by changing our practices to meet our own expectations and those of contemporary society. Australia's best cotton producers now achieve more than two bales of cotton per megalitre of water—almost double the industry average of just a decade ago. Our industry is at the forefront of environmental management systems, climate change preparedness and climate change adaptation.

It's an extraordinary story of achievement, thanks primarily to the continued support of the industry and the Australian Government for RD&E over the past 25 years.

CRDC's strategic leadership and collaboration in RD&E investment has been—and continues to be—a driving force behind the industry's continuous improvement and transformation.

From 1990 to 2015, CRDC invested more than $280 million into RD&E on behalf of the industry, delivering billions of dollars in benefit back to Australian cotton growers on their farms. One project alone—CRDC's investment in plant breeding—is estimated to have contributed $5 billion to the industry and the Australian agricultural economy.

In terms of the impact of R&D, our world-leading cotton yields and quality are easy to see and quantify. Efficiency gains in water use and reductions in pesticide use are also evident.

But arguably, cotton production would not have been possible for the last 20 years—during which time growers have collectively contributed to producing more than $27 billion in exports—if it wasn't for R&D and the industry's commitment to improving its practices for controlling insects and managing diseases such as Fusarium.

CRDC invested in some 2100 projects over these 25 years—moving from a response-oriented approach of specifically addressing the industry issues of the 1990s to a more proactive approach of collaboratively identifying potential future threats and opportunities, and strategically investing in them to ensure the industry's continued success.

As 2015 marked 25 years of CRDC-led cotton RD&E, in 2015–16, we took time to look back on these 25 years, to acknowledge the major RD&E achievements and the individuals and organisations who contributed to this success.

The foundations of the early Australian cotton industry—of forward-looking leadership, tenacity, RD&E and its resulting innovation—continue to be fundamental to the industry today. And, as it was back then, success requires a combined and collaborative effort.

The three cornerstones of CRDC have always been investment, innovation and impact. Our role is to invest in targeted and strategic research that delivers real benefits to Australian cotton growers and the wider industry, and that underpins a strong, profitable, sustainable and competitive future for cotton.

That is why, in 2015–16, CRDC invested $21 million into 290 RD&E projects in collaboration with 92 research partners and growers who conducted on-farm trials, across five key program areas: farmers, industry, customers, people and performance.

In this report, we outline the investment we have made in these projects on behalf of growers and the government, along with the resulting innovations and impacts.

Take these, for example: the world's first facility into cotton climate change research, which will help cotton growers prepare for future climate variability; the industry's first resilience assessment, which will help the industry adapt to change; and the industry's first workforce development strategy, which will help growers attract, retain and develop their staff—but three of CRDC's investments in 2015–16.

On behalf of our fellow Directors, we invite you to read the CRDC Annual Report for 2015–16.

Dr Mary Corbett
CRDC Chair

Bruce Finney
CRDC Executive Director

Dr MARY CORBETT finished her tenure as CRDC's Chair on 12 August 2016. Mary served as a Director of CRDC from 2008, and as Chair from 2013.

On behalf of the CRDC Board, we thank Dr Corbett for her contribution to CRDC during this period. CRDC Director and Deputy Chair Cleave Rogan served in the role of Acting Chair until the appointment of the incoming CRDC Chair Richard Haire on 29 August 2016 by the Minister for Agriculture and Water Resources.

As Dr Corbett was the Chair during the 2015–16 year, she remains as a signatory to this Annual Report.

PROGRESS AGAINST CRDC STRATEGIC R&D PLAN 2013–18

CRDC's RD&E investments are governed by the Strategic R&D Plan 2013–18, which outlines five key investment programs—farmers, industry, customers, people and performance. Each year CRDC completes an analysis of performance against the Strategic Plan measures.

2015–16 marked CRDC's third year of operation under the Strategic Plan. The following table shows CRDC achievements and progress against the Strategic Plan programs as of 30 June 2016.

Progress is measured through the CRDC monitoring and evaluation framework. Each of the measures of success outlined in the Strategic Plan have corresponding metrics, against which performance is measured through annual quantitative and qualitative surveys.

The red, amber and green traffic light system is used in CRDC's monitoring and evaluation to track overall performance against the CRDC Strategic Plan.

Key:
- The specific measure has been achieved.
- On target to deliver against the measure.
- Not on target to deliver against the measure.

Strategic Plan Measures	Result	Comments
Farmers: Cotton is profitable and consistently farmers' crop of choice		
Farmers increase productivity by 3 per cent per hectare per year	●	Estimated achievement of 3.1 per cent average growth in yield per hectare per annum since 2013. According to CSIRO, these yield increases can be attributed to management and the interaction of management and genetics (52 per cent); and genetic improvements (48 per cent). CRDC invests predominately in the areas of management and the interaction of management and genetics, and data from our monitoring and evaluation program has demonstrated a resulting increase in crop yield, resource-use efficiencies, and profitability.
Industry: The Australian cotton industry is the global leader in sustainable agriculture		
Industry can report against recognised sustainability indicators	●	The Australian cotton industry was the first agricultural industry in Australia to develop and document its performance against specific environmental, economic and social sustainability indicators. Developed in response to the industry's Third Environmental Assessment, the 2014 Australian Grown Cotton Sustainability Report developed and benchmarked 45 key sustainability indicators for the Australian cotton industry. Since undertaking this effort, the Australian Dairy Industry Council has also reported on its industry's sustainability (with eight target areas and 50 indicators), indicating a strong alignment between cotton and other agricultural industries.
Customers: The Australian cotton industry captures the full value of its products		
Double the premium for Australian cotton	●	While the industry receives a premium for its product (at times double the premium paid for cotton from other countries) this is not a consistent trend. Competition with man-made fibres will continue to exert downward pressure on the value of cotton. As such, CRDC's RD&E focus is on new uses for cotton and disrupting the supply chain to make cotton more competitive with man-made fibres.
People: Capable and connected people driving the cotton industry		
A skilled, educated and progressive workforce	●	CRDC continues to fund 10 leadership and development programs, run two scholarship programs for emerging researchers, and run the Grassroots Grants program to encourage local innovation. CRDC is the foundation sponsor for both the Australian Cotton Conference and the Association of Australian Cotton Scientists research conference. In 2015–16, CRDC and Cotton Australia developed the industry's first Workforce Development Strategy. Educational attainment in cotton is commensurate with regional Australia, with 28 per cent of the population possessing post-school qualifications, up from 24 per cent in 2006.
Performance: Measured performance of the Australian cotton industry and its RD&E drives continuous improvement		
Measured performance of the Australian cotton industry and its RD&E drives continuous improvement	●	A monitoring and evaluation framework has been developed for CRDC's investments, enabling performance reporting. CRDC's RD&E underpins the industry's best management practices program, *my*BMP, with industry participation in the program now at 70 per cent.

YEAR IN REVIEW: CRDC RD&E ACHIEVEMENTS

The future of cotton irrigation—irrigation automation

The CRDC-led *Smarter Irrigation for Profit* project is a large-scale, ambitious project designed to achieve a 10–20 per cent improvement in water productivity, efficiency and farmer profitability across the cotton, dairy, rice and sugar industries. Within cotton, one of the major focuses is irrigation automation, and in 2015–16, CRDC supported the CottonInfo *Irrigation Automation Tour*, which took 40 cotton growers to the southern irrigation industry to see surface irrigation automation technologies in action. Participants of the tour were impressed with the technology; 95 per cent said they would do something differently on-farm as a result of what they had learnt on the tour.

Taking research to the field: nutrition researchers tour

The CRDC-supported *CottonInfo nutrition tour* delivered a series of five nutrition field days to growers across five cotton-growing valleys in February 2016, taking the latest developments in nutrition research to 360 cotton growers and consultants. The tour involved 10 leading CRDC-supported industry researchers who presented on and discussed a range of important cotton nutrition topics, helping growers realise optimal yields and fibre quality, reduce costs and emissions, and increase margins. The tour resulted in a 35 per cent increase in understanding of soil health and nitrogen-use efficiency among attendees, and a 52 per cent increase in understanding of loss pathways and greenhouse gas emissions.

World's first facility into cotton climate change research

In a first for the cotton industry globally, a national facility for cotton climate change research has been co-established by CRDC and CSIRO at the Australian Cotton Research Institute (ACRI) at Narrabri to investigate the impacts of climate change on cotton production, and to evaluate the likely effectiveness of adaptation strategies. Over three cotton-growing seasons, CSIRO will be measuring cotton growth, production and resource-use efficiency in detail, with new in-field poly-tunnels established at ACRI maintaining elevated CO_2, temperature and variable soil water availability.

Best practice for managing cotton's riparian vegetation

A CRDC-supported project to identify the critical thresholds for riparian vegetation, run by Griffith University, has found that managing riparian lands under best practice makes an important contribution to the conservation of natural assets. The project found that canopy cover and litter loads are particularly significant drivers of riparian vegetation, and as a result, any land management activities that impact these, such as clearing and grazing, have the potential to adversely affect vegetation regeneration. The findings are important as they may inform future cotton industry's natural resource management positions.

Cotton RiverCare Champion demonstrates river stewardship

To demonstrate the best practice management of rivers and riparian areas, CRDC has appointed a cotton grower, Mark Palfreyman, as the Cotton RiverCare Champion under the *National Cotton RiverCare Champion* project. The champion will demonstrate to cotton growers and the general public how best management practice leads to good condition riparian areas. Under the program, long-term monitoring sites will be established on the Palfreyman family farm to look at water quality, the condition of native vegetation and the diversity of local fauna, with results shared in real time via social media.

CRDC commissions first-ever resilience assessment

CRDC commissioned the Australian cotton industry's first resilience assessment to better understand how to help the industry best adapt to change and to identify critical threats and opportunities for future investment. The assessment looked at three levels of cotton production: the farm, the region and the whole

of industry. It found that there are key drivers and shocks acting across the industry, and that industry leaders and growers need to be aware of the impact of those drivers, and of the changing nature, frequency or severity of shocks to better prepare and respond to them.

Do round modules have a shelf life?

A CRDC-supported project with CSIRO, *Determining the shelf life of round modules and impact on cotton quality*, aims to address fibre-quality issues in round modules that could be caused by the storage duration and conditions prior to ginning. There is a concern that the plastic wrap on round modules can create favourable conditions for microbial degradation of the cotton, which can weaken the fibre and cause quality deterioration, resulting in price discounts and yield loss for growers. Findings to date indicate that the orientation of the module during storage can influence its temperature and moisture levels, and that covering modules with a tarp can significantly reduce temperature and relative humidity fluctuations.

Measuring cotton's greenhouse gas emissions

A CRDC-supported project led by NSW DPI to review the emission methodologies of cotton has used a life-cycle assessment to produce a clear picture of the greenhouse gas (GHG) emissions profile for a representative cotton production system in North West NSW. The project found that 1 tonne of cotton lint at port had a carbon dioxide equivalent (CO_2e) of 1601 kg. The impact of the pre-farm, on-farm and post-farm stages were 407kg CO_2e; 775 CO_2e; and 419 CO_2e respectively. Six emission reduction options were developed by the researchers—optimum nitrogen (N) application rate, controlled-release N fertilisers, solar-powered irrigation pumps, biofuel-powered machinery, legume crops, and fertigation—for consideration by industry.

Can cotton be used for 3D printing?

The CRDC-supported *Cotton rapid customisation feasibility study* project, conducted by QUT, aimed to assess the feasibility of using cotton as a feedstock in rapid customisation processes, such as 3D printing. The project identified areas within the broad range of rapid customisations where cotton has a clear advantage due to its inherent material qualities. The project found five areas for future research and investigation: on-site fabrication of cotton-based filtration products; on-demand manufacture of bespoke furniture; next-generation lifestyle garments and accessories; 3D printing of children's toys; and patient-specific smart wound dressings using cotton-derived cellulose and rapid customisation.

CRDC supports new cotton innovation: an ever-dry self-cooling fabric

The CRDC-supported, Deakin University-led *Ever-dry self-cooling cotton fabrics* project has successfully developed a new coating technique that gives cotton fabrics added functionality: the ability to regulate moisture, breathability and surface temperature. This important innovation has the potential to considerably increase the use of cotton in clothing ranges, including sportswear, summer clothing and defence force uniforms. Work is now underway on the development of a commercialisation plan.

Cotton's first Workforce Development Strategy

CRDC and Cotton Australia collaborated to deliver the industry's first *Workforce Development Strategy*. The strategy is focused on delivering workforce outcomes for growers on-farm, and ultimately will ensure that the cotton industry is able to attract, retain and develop people who will drive industry competitiveness. The strategy provides a shared and focused plan to ensure the cotton industry's organisations' investments in workforce strategies target key priorities, are well coordinated and deliver maximum outcomes.

Developing skills through education

CRDC supported or led eight educational initiatives during the year to help increase the skills and knowledge of current and future cotton workforces. Over 1000 students participated in the *Cotton industry young professionals* project over the course of the program; 76 students enrolled in the UNE Cotton Production Course in this year; and CRDC supported 46 undergraduate and postgraduate students through the CRDC summer, honours and PhD and RIRDC Horizon scholarships. In addition, this year marked 12 years of investment by CRDC in the Aboriginal Employment Strategy, and supported two Indigenous students under this program.

Encouraging future leaders

CRDC invested in four leadership programs during 2015–16, designed to build a network of informed and experienced leaders. Two emerging industry leaders, Jamie Iker and Sean Boland, participated in the Australian Rural Leadership Program during 2015–16; two cotton growers, Matthew McVeigh and Tom Quigley, continued their Nuffield Scholarships; an irrigator, Adam Harris, participated in the Peter Cullen Trust program; and CSIRO research assistant, Yvonne Chang, was awarded the Science and Innovation Award for Young People in Agriculture.

Investing in grower-led grassroots research

CRDC's Grassroots Grants program encourages Cotton Grower Associations to apply for funding to support capacity-building projects in their region. Up to $10,000 in funding is available for CGAs to help fund a project aimed at increasing the engagement of growers in the industry, solving specific regional issues and improving their skills, knowledge base and networks. Since the Grassroots Grants program commenced in 2011, it has supported 44 projects across the cotton-growing valleys, including 11 projects in 2015–16.

Demonstrating best practice in cotton production

The CRDC-supported *Australian cotton production and best practice documentaries* project, delivered by QDAF, aims to communicate scientifically based crop production, protection and best practice principles to a diverse audience through a series of short, easily accessible videos. To date, 85 short videos have been produced, ranging from pre-season planter maintenance and planting tips through to overcoming challenges for new growers in the southern districts. The videos, which are published on the CottonInfo YouTube channel, have collectively received 15,000 views.

Executive Summary
YEAR IN REVIEW: ORGANISATIONAL HIGHLIGHTS

25 years of cotton RD&E, led by CRDC

October 2015 marked 25 years of *CRDC: 25 years of cotton RD&E*, invested in by cotton growers and the Australian Government and led by CRDC. The milestone was marked through the release of a special edition of the CRDC *Spotlight* magazine, and a subsequent publication *CRDC: 25 years of RD&E*, which outlined the 25 key RD&E achievements in the cotton industry over 25 years.

20 years of GM cotton: CRDC R&D underpins stewardship

2016 marked 20 years of GM cotton in Australia, with the introduction of the industry's first Bt cotton, Ingard, in 1996. CRDC has played an instrumental role in ensuring the enduring efficiency of GM cotton through stewardship. Australia is now recognised as having the most pre-emptive, rigorous and successful resistance management system for transgenic cotton in the world.

Strong support for CRDC investments among growers

For the first time in 2015–16, the Grower Practices Survey sought feedback from growers about their perceptions of CRDC and support for our RD&E investments. The survey found that 99.6 per cent of growers are aware of CRDC, 88 per cent of growers are supportive of CRDC's research and investments, and 74 per cent of growers have input into CRDC about research.

Final RD&E reports now online

Over 1100 final reports of RD&E projects invested in by CRDC are now available via the CRDC online digital library, Inside Cotton. The reports range from 1986 to 2015, including those invested in by CRDC's predecessor, the Cotton Research Council. The reports join a host of other important cotton industry materials on Inside Cotton, including previous editions of the CRDC *Spotlight* magazine, CRDC corporate publications, papers and presentations from the Australian Cotton Conferences and archived materials from the former cotton CRCs.

Second annual Strategy Forum identifies cotton RD&E priorities

CRDC hosted its second annual Strategy Forum in Brisbane in May 2016, bringing together cotton growers on Cotton Australia's grower advisory panels to help determine the industry's future research priorities. The Forum is part of CRDC's procurement process, which was revised in 2015–16 to improve efficiency, streamline the RD&E investment process and provide greater clarity to researchers.

$11.3 million for Rural R&D for Profit: CRDC leading three collaborative projects

The CRDC-led collaborative Smarter Irrigation for Profit project commenced in 2015–16 under round one of the Australian Government's Rural R&D for Profit programme. The Minister for Agriculture and Water Resources announced another two CRDC-led collaborative projects in 2016 under round two: *More Profit from Nitrogen* and *Accelerating precision agriculture to decision agriculture*, commencing in 2016–17. Collectively, these projects will contribute up to a combined $11.3 million into RD&E funding across their respective terms.

Collaboration: a key to cotton RD&E

CRDC works in partnership with other industry bodies and other rural research and development corporations (RDCs) to achieve strategic outcomes for the industry, and to leverage higher returns for our investments. This underpins our investment strategy, with CRDC partnering in over 80 per cent of RD&E projects conducted in the cotton sector. Almost 25 per cent of CRDC investments are in cross-sectoral RD&E. The collaboration extends from national to cotton industry-specific and local initiatives—from national cross-sectorial partnerships on water and soils; to the industry-specific extension joint venture, CottonInfo; and at the local level, partnerships with Cotton Grower Associations on CRDC Grassroots Grants.

International research collaboration

Australia is well recognised as a global leader in cotton RD&E and, in addition to building strong partnerships and collaborations with Australian research partners, CRDC also builds mutually beneficial relationships abroad. In 2015–16, CRDC representatives visited Cotton Incorporated, the US cotton research, development and marketing organisation, to discuss areas for RD&E collaboration. CRDC and the Association of Australian Cotton Scientists also jointly supported 14 Australian cotton researchers to attend the World Cotton Conference in Brazil in May 2016.

CRDC RD&E showcased at industry events

CRDC-supported RD&E projects have been showcased at a number of events during 2015–16, including the grower-focused Cotton Collective, held in Narrabri in August 2015 with 250 growers in attendance; and the researcher-focused Association of Australian Cotton Scientists' Australian Cotton Research Conference, held in Toowoomba in September 2015 with 200 researchers in attendance. CRDC also supported the 18th Australian Cotton Conference, at the Gold Coast in August 2016. Of the 150 speakers on the Cotton Conference agenda, 75 per cent of presentations about research were supported by CRDC.

MARY O'BRIEN

Cotton Australia Director Bob Dall'Alba, CRDC Chair Dr Mary Corbett, Deputy Prime Minister Barnaby Joyce, Cotton Australia Director Stuart Armitage, and CRDC Executive Director Bruce Finney at the announcement of the Rural R&D for Profit programme project, *More profit from nitrogen*, at Dalby in May 2016.

Commitment to sustainability: response to the Third Environmental Assessment

The Australian cotton industry has a 24-year history of independent environmental assessments, demonstrating our commitment to monitoring and improving our environmental performance. In 2012, the Third Environmental Assessment was conducted and in February 2016, CRDC and Cotton Australia officially responded, outlining the high-level outcomes that have been delivered on behalf of the industry. These outcomes include the *Australian Grown Cotton Sustainability Report* and the establishment of 45 key sustainability indicators.

Cotton Futures: investing in blue-sky, transformational cotton RD&E

Cotton Futures provide a clear framework for CRDC to invest in long-term, transformational innovations to ensure the industry remains profitable, sustainable and competitive in the future. In 2015–16, CRDC invested in 11 innovative blue-sky projects under the three Cotton Futures themes.

CottonInfo: three years of connecting growers with CRDC-led R&D

2015–16 marked three years of the industry's joint extension program, CottonInfo, supported by CRDC, Cotton Australia and CSD Ltd. Studies conducted in 2014–15 have shown that 82 per cent of growers and 90 per cent of consultants are aware of CottonInfo; 78 per cent of growers and 90 per cent of consultants source information from CottonInfo; and 89 per cent of growers and 90 per cent of consultants believe CottonInfo has helped improve practices.

CRDC Deputy Chair awarded major industry award

CRDC Deputy Chair and St George cotton grower Cleave Rogan was awarded the prestigious 2015 Incitec Pivot Fertilisers Service to Industry Award at the Cotton Industry Awards presentation in August 2015.

Cleave has grown cotton for more than 30 years, and is passionate about RD&E, having served as a Director on the CRDC Board since 2011.

First year of funding agreement partnership

2015–16 was the first year of operation under the CRDC and Commonwealth Government Funding Agreement. This agreement recognises the importance of the partnership between growers and the government as co-investors in RD&E through CRDC. The agreement sets out expectations about CRDC's performance, transparency and accountability, and runs until 2018–19.

Cotton and the agricultural innovation inquiry

In 2015–16, the House of Representatives Standing Committee on Agriculture and Industry conducted an Inquiry into Agricultural Innovation, investigating the role of technology in increasing agricultural productivity in Australia. CRDC and other industry partners made submissions and presented to the Inquiry's hearings, focusing on the industry's innovation, adaptiveness and support for technology. Submissions to the committee highlighted the Australian cotton industry's international recognition as innovative and dynamic, largely due to industry investment in RD&E.

CRDC research published in leading journals

CRDC-supported research is achieving worldwide recognition with publication in high-impact international journals. The CRDC-supported project to evaluate the extent of hydraulic connectivity between the Condamine Alluvium, the Great Artesian Basin and the Walloon Coal Measures, led by UNSW researcher Dr Bryce Kelly, was published in *Nature Scientific Reports* and has ranked in the top three per cent of research articles published worldwide. Additionally, CSIRO's Dr Nancy Shellhorn and Dr Vesna Gagic's paper on ecosystem services was published in *Trends in Ecology and Evolution*, the international ecology journal.

THE AUSTRALIAN COTTON INDUSTRY IN 2015-16:

2.5 million bales
produced by the Australian cotton industry

Increase of $1200 per hectare profit:
the increase achieved by **the top 20 per cent** of growers against the five-year average
(source: Australian Cotton Comparative Analysis 2015)

CRDC'S INVESTMENT IN 2015-16:

$21 million: CRDC's investment in cotton RD&E on behalf of cotton growers and the Government

290 RD&E projects

92 research partners

5 key program areas

farmers, industry, customers, people and performance

CRDC'S IMPACT IN 2015-16:

3.1% average growth in yield per hectare: the estimated **increase** in productivity each year since 2013. CRDC's goal is 3 per cent per hectare per annum.

95% of participants in the 2015 *Irrigation Automation Tour* said they would do something **differently** on their farm as a result of the tour.

73% of attendees at the 2016 Nutrition Researchers Tour said they were likely to **adopt new practices** around irrigation deficits and nitrogen rates to improve crop gross margins as a result of the tour.

World-leading research

Cotton climate change facility is the first for the cotton industry globally.

First-ever resilience assessment

outlines the cotton industry's resilience and preparedness.

Cotton in 3D printing

feasibility study outlines five areas for further investigation.

New coating technique developed

NEW

to give cotton fabrics added functionality – the **ability to regulate** moisture, breathability and surface temperature.

The industry's first Workforce Development Strategy

developed by CRDC and Cotton Australia.

200 Researchers

attended the **Association of Australian Cotton Scientists Conference** in September 2015, with CRDC as a foundation sponsor.

1st Cotton RiverCare Champion:

appointed to demonstrate best practice management of riparian areas.

12 years of investment

BY CRDC IN THE ABORIGINAL EMPLOYMENT STRATEGY.

14 Researchers

attended the **World Cotton Research Conference** in Brazil, co-supported by CRDC and the Association of Australian Cotton Scientists.

15,000 YouTube views:

achieved by CottonInfo's 78 CottonInfo best practice videos.

11 grassroots grants: supported this year, taking the total number since the program commenced in 2011 to 44.

89% of growers and **90%** of consultants **believe CottonInfo has helped to improve practices**

Over 1000 high school and undergraduate students: participated in the cotton industry young professionals program over the course of the program.

70% of growers: estimated to now be participating in *my*BMP.

Section 2
CRDC BUSINESS

CRDC Role

CRDC Operations

Setting the Research Priorities

Cooperation and Collaboration

JOHNELLE ROGAN

CRDC ROLE

CRDC's role is to invest in and manage a portfolio of RD&E projects on behalf of cotton growers and the Australian Government. These investments are designed to enhance the environmental, social and economic contribution of cotton, for the benefit of cotton growers, the wider cotton industry, regional communities and the Australian public.

CRDC is co-funded through an industry levy and matching Commonwealth contributions. In 2015–16, CRDC invested $21 million in RD&E into 290 projects on behalf of Australia's cotton growers and the government.

CRDC's corporate outcome is: the adoption of innovation that leads to increased productivity, competitiveness and environmental sustainability through investment in research and development that benefits the Australian cotton industry and the wider community.

CRDC has four key stakeholders: the Australian Government, through the Minister for Agriculture and Water Resources; the Department of Agriculture and Water Resources; the cotton industry's representative organisation, Cotton Australia; and cotton growers, including Cotton Grower Associations.

CRDC recognises that collaboration is essential to the delivery of RD&E outcomes. As such, CRDC partners with researchers, research organisations and growers to deliver RD&E projects, and most importantly, outcomes.

In 2015–16, CRDC partnered with 92 individual research partners, including the following:

- Department of Agriculture and Water Resources
- Department of Agriculture and Fisheries (QLD)
- Department of Primary Industries (NSW)
- Other state government departments
- CSIRO
- Cooperative Research Centres (CRCs)
- Cotton Grower Associations
- Cotton Innovation Network
- Cotton Seed Distributors Ltd
- Crop Consultants Australia
- Australian Association of Cotton Scientists
- Australian Farm Institute
- Australian Rural Leadership Foundation
- Other Rural Research and Development Corporations
- Universities
- Agribusinesses
- Supply chain and trade partners
- Specialised consultants.

Cotton growers across all valleys directly contribute to RD&E through conducting on-farm trials: a critical component of the RD&E process. In addition to their financial contribution through direct on-farm costs and opportunity costs, growers also provide their time, knowledge and expertise to research trials.

Investing in cotton RD&E

CRDC's investment in cotton RD&E is guided by a five-year Strategic Plan: the CRDC Strategic R&D Plan 2013–2018. This plan is designed to help the industry achieve its long-term vision, and to meet the industry and Government's rural research and development (R&D) priorities.

The plan has a strong focus on improving the industry's profitability, sustainability and competitiveness. It recognises the critical importance of knowledge sharing and strong relationships between cotton growers, the wider industry and its customers.

Core programs

CRDC has established five strategic outcomes to be achieved under the 2013–18 Strategic R&D Plan that informed the key focus areas for R&D investment in 2015–16:

- Farmers: Cotton is profitable and consistently farmers' crop of choice.
- Industry: The Australian cotton industry is the global leader in sustainable agriculture.
- Customers: The Australian cotton industry captures the full value of its products.
- People: Capable and connected people driving the cotton industry.
- Performance: Measured performance of the Australian cotton industry and its RD&E drives continuous improvement.

The Strategic Plan investment priorities

VISION: *A globally competitive and responsible cotton industry*				
MISSION: *To invest in RD&E for the world-leading Australian cotton industry*				
OUTCOMES:				
Farmers Cotton is profitable and consistently farmers' crop of choice	**Industry** The Australian cotton industry is the global leader in sustainable agriculture	**Customers** The Australian cotton industry captures the full values of its products	**People** Capable and connected people driving the cotton industry	**Performance** Measured performance of the Australian cotton industry and its RD&E drives continuous improvement
STRATEGIES:				
Successful Crop Protection Cotton crops protected from pest, weed and disease threats	**Respected Stewardship** Industry protects its production technologies and its biosecurity	**Assured Cotton** The integrity and qualities of Australian cotton set global benchmarks for customers	**Workforce Capacity** A skilled, educated and progressive industry workforce	**Best Practice** World's best practice underpins the performance of the cotton industry
Productive Resource Efficiencies Inputs for cotton production are optimised	**Responsible Landscape Management** Industry leads in managing natural assets	**Differentiated Products** Customers recognise the differentiated value of Australian cotton products	**Networks** An industry connected by dynamic networks	**Monitoring and Evaluation** Industry and RD&E performance is captured
Profitable Futures Innovation in cotton production	**Sustainable Futures** An industry achieving its vision	**Competitive Futures** The demand for Australian cotton product is positively transformed	**Communication** Stakeholder information needs are met	**Reviews** Continuous improvement in industry and RD&E performance

Through focusing on these five strategic priorities, CRDC will achieve its outcome of *adoption of innovation that leads to increased productivity, competitiveness and environmental sustainability through investment in research and development that benefits the Australian cotton industry and the wider community.*

Cotton Futures

The plan includes three futures themes: Profitable Futures (farmers program), Sustainable Futures (industry program) and Competitive Futures (customers program). These themes provide a clear framework through which CRDC can invest in long-term innovations to address the industry's goal to remain profitable, sustainable and competitive in 20 years' time and beyond.

The futures themes ambitiously seek to transform the industry through blue-sky research. Following extensive engagement with the cotton industry, the wider supply chain and the industry's customers to identify priority areas for blue-sky R&D investment, CRDC published the *Designing a Future for Australian Cotton* report in late 2014.

This report prioritised the top 18 transformational research concepts, five of which were then further explored through feasibility studies within the Competitive futures program area: investigating supply chain optimisation, dissolving cotton, utilising cotton as a substrate for carbon fibre, using cotton for 3D printing, and developing renewable chemicals from cotton biomass.

Additional cotton futures projects commenced in July 2015 under the Profitable Futures area, focusing on such innovations as real-time automated precision in irrigation and nutrition, and big data in agriculture. Two of these projects are delivered in collaboration with other Rural R&D Corporations (RDCs) as part of the Australian Government's Rural R&D for Profit programme and GRDC's Future Farm project.

One project is also being delivered in the Sustainable Futures area, focusing on the resilience of the Australian cotton industry.

Overall, CRDC has budgeted to invest $8.5 million in Cotton Futures research projects in 2013–18 across the three program areas. For more on the Cotton Futures investments, see Section 4: RD&E Portfolio.

Our investment process

The process of deciding where to invest CRDC's annual RD&E funding is a collaborative one, involving all major stakeholders. CRDC works closely with Cotton Australia and the Australian Government on an annual basis to identify and evaluate the cotton industry's requirements for RD&E. Cotton Australia provides ongoing advice to the CRDC on research projects and where research dollars should be invested, guided by the priorities established in the 2013–18 Strategic Plan.

In line with this plan, CRDC holds an annual strategy forum, bringing together the Cotton Australia grower advisory panels to identify the gaps in the existing research portfolio and opportunities for new research. CRDC also holds a series of discipline forums with research partners, to identify any emerging research priorities.

From here, CRDC issues a targeted annual call for research proposals against these identified priorities. In determining which proposals are successful, CRDC again undertakes a process of consultation with growers, via the Cotton Australia panels. The final decision-making authority lies with the CRDC Board.

Successful proposals become contracted projects with CRDC, and are delivered by our research partners. Critically, CRDC's success in delivering RD&E outcomes to growers and the industry is contingent upon strong relationships with our research partners, who deliver projects on our behalf.

Communicating research outcomes and achieving practice change

CRDC is actively involved in the dissemination of R&D results, working through a range of mechanisms to promote research outcomes—principally supported by the industry's joint extension program, CottonInfo.

CottonInfo aims to ensure the effective communication of, and support for, the adoption of research results through engagement and collaboration. CRDC established the CottonInfo joint venture with partners Cotton Australia and Cotton Seed Distributors (CSD) Ltd in 2012.

The CottonInfo team aims to improve industry practice, improve R&D communication, and improve industry responsiveness. The team consists of regional extension officers (on-ground support, based in the cotton-growing valleys), technical specialists (specialists in specific research areas who provide a conduit to the wider cotton research community) and experts in the industry's best management practice program, *my*BMP (who can assist growers to sign up for, and participate in, *my*BMP, providing a critical link between research extension and best practice).

Within this venture, CRDC is responsible for resourcing program management, communication and technical specialists, whose role is to translate research findings and outcomes into best practice for industry uptake.

During 2015–16, CottonInfo hosted or helped to organise 196 activities, with 3627 cotton industry personnel in attendance. To date, CRDC-supported studies have found that 82 per cent of growers and 90 per cent of consultants are aware of CottonInfo; and that 89 per cent of growers and 90 per cent of consultants believe CottonInfo has helped to improve practices.

Measuring performance and ensuring efficiency

One of CRDC's formal principles of operation is to strive to maximise the return on investment for all industry and public funds invested through CRDC into RD&E.

A variety of monitoring and evaluation projects are funded under CRDC's performance program, designed to ensure the impact of investment in RD&E can be captured and demonstrated.

One such evaluation—a CRDC analysis of a study by the Cotton Innovation Network—showed the CRDC accounted for 32 per cent of total cotton RD&E investments in Australia and was involved in over 80 per cent of all cotton RD&E. Overall, public and private RD&E investment in the cotton sector is in the order of $60 million annually—supporting an industry that generates an average of $1.9 billion per annum in export revenue and contributes to broader economic, environmental and social benefits.

As this evaluation shows, in order to achieve industry efficiency, CRDC works in collaboration with other cotton industry bodies and other rural research and development corporations (RDCs) to achieve strategic outcomes for the industry and to leverage higher returns for our investments. For more, see the Cooperation and Collaboration section of this report.

CRDC is also committed to continuous improvement in the efficiency of its operations. CRDC has invested in improved systems and infrastructure to ensure improvement in the organisation's productivity.

One such example is CRDC's annual procurement process, which was streamlined in 2015–16 to improve engagement with industry stakeholders on R&D needs and priorities, to better focus and communicate the scope of interest to research partners, and to improve the productivity of CRDC staff in brokering and administering RD&E investment.

Performance against Strategic Plan goals

Strategic Plan goals	Performance criteria	2015–16
Farmers: cotton is profitable and consistently farmers' crop of choice.	Industry productivity growth per hectare per annum.	Three per cent per hectare per annum. Estimated achievement of 3.1 per cent average growth in yield per hectare per annum since 2013.
Industry: the Australian cotton industry is the global leader in sustainable agriculture.	Industry reports to customer needs for sustainability indicators.	Achieved through responses to the 2014 Australian Grown Cotton Sustainability Report and Third Environmental Assessment.
People: capable and connected people driving the cotton industry.	National Primary Industries RD&E Framework, cotton, and cross-sectoral RD&E strategies supported.	Achieved through implementation of the cotton RD&E strategy and increasing collaborative co-investment in cross-sectoral RD&E.
Performance: measured performance of the Australian cotton industry and its RD&E drives continuous improvement.	Coverage of Best Management Practice systems across the Australian cotton industry.	Goal of 75 per cent of cotton farms participating. Estimated achievement as at 2015–16 of 70 per cent participation.

Note: CRDC did not set performance criteria for the Customers program area during 2015–16. Performance criteria have been set for 2016–17 (as outlined in CRDC's Budget Statement and 2016–17 Annual Operational Plan) and will be reported against by CRDC in the 2016–17 Annual Report. For more, see Appendix 1: Annual Performance Statement.

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CRDC Business
SETTING THE RESEARCH PRIORITIES

CRDC works with the Australian cotton industry to determine the sector's key RD&E priorities; with Government to determine its overarching agricultural RD&E priorities; and with both the industry and Government to determine the Cotton Sector RD&E Strategy.

In turn, these priorities help to shape CRDC's strategic RD&E priorities, which are formalised under the 2013-18 Strategic R&D Plan.

Industry accountability

CRDC is accountable to the cotton industry through its representative organisation, Cotton Australia. As the industry peak body, Cotton Australia is responsible for providing advice on industry research priorities.

CRDC engages with Cotton Australia in a formal process of consultation in the development and implementation of the Strategic R&D Plan, including R&D investments. This engagement ensures industry research priorities are regularly reviewed; emerging issues are actively considered; and facilitates the uptake of research in the form of best practices and the overall performance of the Australian industry.

Overarching cotton industry priorities for R&D:

- Invest in the skills, strengths and occupational health and safety of the human resources in the cotton industry and its communities.
- Improve the sustainability of the cotton industry and its catchments.
- Improve the profitability of the cotton industry.
- Create and support a strong, focused and committed research program.

In addition, at CRDC's May 2016 strategy forum, the Cotton Australia grower advisory panels identified key areas of focus for future RD&E investment, including:

- Improving the management of cotton diseases.
- Optimising seedling emergence.
- Improving phosphorous management in cotton.
- New materials and options for reducing water losses from evaporation.
- Optimising nitrogen/water interactions for best practice production.
- Mitigating and managing soil compaction for improved production.
- Improving the ability of the industry to report its sustainability performance.
- Managing natural landscapes to increase the provision of ecosystem services.
- Monitoring silverleaf whitefly insecticide resistance.
- Quantifying the value of ecosystem services.
- Resistance research and monitoring to enhance stewardship of Bt cotton and management of *Helicoverpa* spp.
- Documenting the production of best practice Australian cotton.
- Measuring and reporting the value of capacity building on farms and in research to improve workforce capability.

Government accountability

CRDC is accountable to the Australian Government through the Minister for Agriculture and Water Resources. Government communicates its expectations of CRDC through Ministerial direction, enunciation of policy, administration of the PIRD Act, and priorities (Science and Research Priorities and Rural RD&E Priorities). CRDC responds to government expectations through regular communication; compliance with the Funding Agreement, policy and legislated requirements; and the development of Strategic R&D Plans, Annual Operational Plans and Annual Reports.

The Minister wrote to Rural R&D Corporations (RDCs) on 28 January 2016 regarding the Australian Government's recently announced Science and Research Priorities and to advise of the new Rural RD&E Priorities. CRDC has reported against these new priorities in the 2015–16 Annual Report.

Government research priorities

The PIRD Act makes provision for funding and administration of primary industry research and development with a view to:

- increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries;
- achieving the sustainable use and sustainable management of natural resources;
- supporting the development of scientific and technical capacity;
- developing the adoptive capacity of primary producers; and
- improving accountability for expenditure upon research and development activities in relation to primary industries.

The Australian Government Science and Research Priorities and Rural RD&E Priorities are:

Science and Research Priorities	Rural RD&E Priorities
Food	Advanced technology
Soil and water	Biosecurity
Transport	Soil, water and managing natural resources
Cybersecurity	Adoption of R&D
Energy	
Resources	
Advanced manufacturing	
Environmental change	
Health	

National Primary Industries RD&E Framework and the Cotton Sector RD&E Strategy

The Australian, state and territory governments, rural R&D corporations, CSIRO, and universities have jointly developed the National Primary Industries Research, Development and Extension Framework to encourage greater collaboration and promote continuous improvement in the investment of RD&E resources nationally.

National research, development and extension strategies have been or are being developed for the following primary industry and cross-industry sectors:

- cotton, beef, dairy, fisheries and aquaculture, forests, grains, horticulture, pork, poultry, sheep meat, sugar, wine, wool, and new and emerging industries;
- animal biosecurity, animal welfare, biofuels and bioenergy, climate change and variability, food and nutrition, soils, plant biosecurity, and water use in agriculture.

CRDC, research organisations, industry and government are committed to the implementation of the Cotton Sector RD&E Strategy and its five research priorities:

- Better plant varieties.
- Improved farming systems.
- People, business and community.
- Product and market development.
- Development and delivery.

CRDC provides the secretariat for the Cotton Innovation Network which is responsible for implementing the Cotton Sector RD&E Strategy. CRDC is also committed to supporting the implementation of the cross-sectoral strategies, including climate change, soils, plant biosecurity, and water use.

Vision 2029: the industry's vision for a sustainable future

In addition to the above, the industry has also developed its own 20-year vision for the future that encompasses industry priorities around improved industry performance, collaboration and capacity. Developed in 2009, this Vision uses a 20-year timeframe to ensure a long-term focus.

Vision 2029: Australian cotton, carefully grown, naturally world's best

By 2029, the Australian cotton industry will be:

- **Differentiated**—world-leading supplier of an elite-quality cotton that is highly sought in premium market segments.
- **Responsible**—producer and supplier of the most environmentally and socially responsible cotton on the globe.
- **Tough**—resilient and equipped for future challenges.
- **Successful**—exciting new levels of performance that transform productivity and profitability of every sector of the industry.
- **Respected**—an industry recognised and valued by the wider community for its contribution to fibre and food needs of the world.
- **Capable**—an industry that retains, attracts and develops highly capable people.

The Vision 2029 elements were central to the development of the CRDC Strategic R&D Plan 2013–18, and continue to play a key role in guiding CRDC's investments each year, to ensure CRDC is contributing to their achievement.

Cooperation and collaboration are fundamental to CRDC's operations. CRDC works in partnership with other industry bodies and other rural research and development corporations (RDCs) to achieve strategic outcomes for the industry, and to leverage higher returns for our investments.

This collaborative approach underpins CRDC's investment strategy. CRDC partners in over 80 per cent of RD&E projects conducted in the cotton sector, and almost 25 per cent of CRDC investments are in cross-sectoral RD&E.

CRDC's cooperation extends from national to cotton industry-specific and local initiatives—from participating in national cross-sectorial collaborations on water and soils; to the industry-specific extension joint venture, CottonInfo; and at the local level, partnerships with Cotton Grower Associations on CRDC Grassroots Grants.

Cotton Australia

Cotton Australia and its members provide advice to CRDC on research strategy and investments from the perspective of cotton growers. This is achieved through grower advisory panels aligned with CRDC's programs.

Research partners

All CRDC projects are delivered in partnership with key research partners. In 2015–16, CRDC partnered with 92 research partners to deliver RD&E projects and outcomes to cotton growers and the wider industry. The full list of partners can be found in Appendix 4 of this report: the RD&E portfolio.

Growers

In addition to the Cotton Australia grower advisory panels, cotton growers also contribute to RD&E through participation in other industry committees, such as the Cotton Australia TIMS Committee and Technical Panels.

It is estimated that the grower members of TIMS collectively contribute approximately $32,600 in time to this committee.

Growers are also actively involved in RD&E through conducting on-farm trials: a critical component of the RD&E process. This involves a financial contribution through direct on-farm trial costs and opportunity costs, and the provision of growers' time, knowledge and expertise.

Cotton industry programs

CottonInfo, the cotton industry's joint extension program, is a collaboration between joint venture partners CRDC, Cotton Australia and CSD Ltd. CottonInfo is the conduit between researchers and growers, communicating research results and encouraging their adoption.

Similarly, *my*BMP, the industry's best management practices program, is a collaboration between CRDC and Cotton Australia. This program links RD&E outcomes to best management practice, and provides self-assessment mechanisms, practical tools and resources to help growers grow cotton using best practice. It is an integral part of the CottonInfo program.

Rural Research and Development Corporations

CRDC is one of 15 rural RDCs that come together under the banner of the Council of Rural RDCs (CRRDC) to coordinate efforts, collaborate and co-invest in projects and achieve consistency in communication. The focus is on improving efficiencies, maximising the impact of research outcomes and avoiding duplication in research.

The scale of this collaboration extends from large national research programs to small local projects and administration, to bring a national focus in dealing with climate variability, soil health, irrigation, crop protection, farm safety and human capacity. CRDC continues to work with the CRRDC to investigate administrative efficiency gains within the RDCs and the rural R&D system as a whole. CRDC also partners with fellow RDCs on grants under the Australian Government's Rural R&D for Profit programme.

MELANIE JENSON

Australian Government grants

CRDC works in partnership with the Australian Government and fellow RDCs on a number of grants projects.

Ongoing projects during 2015–16

During 2015–16, CRDC managed four ongoing projects under the Government's grant programs, contributing a combined $6.8 million into RD&E funding across the life of the projects, for the benefit of the Australian cotton industry, the community and other industries.

These grants, all administered by the Department of Agriculture and Water Resources, are as follows:

- **Carbon farming in the Australian cotton industry** (funded 2013–17, with $1.4 million from the *Carbon Farming Futures Extension and Outreach program*).
- **Indirect emissions of nitrous oxide from broadacre irrigated agriculture** *(funded 2013–16, with $678,000 from the Carbon Farming Futures: Filling the Research Gap program).*
- **Determining optimum nitrogen strategies for abatement of emissions for different irrigated cotton systems** *(funded 2013–17, with $770,000 from the Carbon Farming Futures Action on the Ground program).*
- **Smarter irrigation for profit** *(funded 2015–18, with up to $4 million from the Rural R&D for Profit programme—round one). Involves fellow RDCs Dairy Australia, RIRDC and Sugar Research Australia (SRA), and other research partners.*

CRDC is also involved in four other projects under round one of the Rural R&D for Profit programme, led by other RDCs and administered by the department:

- **Stimulating private sector extension in Australian agriculture to increase returns from R&D** *(led by Dairy Australia; $1.6 million from the Rural R&D for Profit programme).*
- **Improved use of seasonal forecasting to increase farmer profitability** *(led by RIRDC; $1.8 million from the Rural R&D for Profit programme).*
- **A profitable future for Australian agriculture: Biorefineries for higher value animal feeds, chemicals, and fuels** *(led by SRA; $3 million from the Rural R&D for Profit programme).*
- **Consolidating targeted and practical extension services for Australian farmers and fishers** *(led by RIRDC; $815,000 from the Rural R&D for Profit programme).*

New projects commencing 2016–17

In 2015–16, the Minister for Agriculture and Water Resources announced the new projects commencing under round two of the Rural R&D for Profit programme. These include two projects being led by CRDC, and administered by the Department, commencing 1 July 2016. These two projects will contribute a combined $7.3 million into RD&E funding across the life of the projects.

The projects are:

- **More profit from nitrogen: enhancing the nutrient-use efficiency of intensive cropping and pasture systems** *(funded 2016–20, with $5.9 million from the Rural R&D for Profit programme —round two). Involves fellow RDCs Dairy Australia, SRA, and Horticulture Innovation Australia (HIA) and other research partners.*
- **Accelerating precision agriculture to decision agriculture** *(funded 2016–18, with $1.4 million from the Rural R&D for Profit programme—round two). Involves fellow RDCs MLA, Dairy Australia, GRDC, Sugar Research Australia, RIRDC, HIA, APL, AGWA, FWPA, FRDC and AMPC, and other research partners.*

CRDC is also involved in one other project under round two of the Rural R&D for Profit programme, led by a fellow RDC and administered by the Department:

- **Digital technologies for more dynamic management of disease, stress and yield** *(led by AGWA, funded 2016–20, with $3 million from the Rural R&D for Profit programme—round two).*

Section 3
Corporate Operations

Business Financials

Our Investments in RD&E

Investments against Government Priorities

MELANIE JENSON

CRDC's investment in RD&E is funded through an industry levy and matching Commonwealth contributions. In 2015–16, CRDC invested $21 million in cotton RD&E throughout the industry supply chain. In 2016–17, CRDC estimates cotton RD&E expenditure will be $20 million.

Cotton production for the 2015–16 year is estimated to be 567,500 tonnes or 2.5 million bales of ginned cotton, which is below the previous five-year average of 4.0 million bales. Forward estimates by industry and ABARES are for continued below-average cotton production.

The lower levels of cotton production over the past two seasons has resulted in a decline in revenues. To sustain the current level of RD&E expenditure, CRDC has budgeted to draw on financial reserves. To achieve the strategic priorities of the 2013–18 R&D Plan, the CRDC is budgeting for $100 million of expenditure during the five-year Strategic Plan.

Revenue

Cotton farmers pay a levy of $2.25 for each 227 kilogram bale of cotton. Cotton levy revenue is collected at the point of ginning, that is, when cotton has been picked and delivered to cotton gins. This occurs from March to September of each calendar year, therefore cotton levy revenue in any financial year is drawn from two consecutive cotton crops.

The Australian Government provides a contribution that matches levy revenue. The maximum contribution is generally capped at 0.5 per cent of a three-year rolling average of gross value of production. Within this cap, the government reimburses up to 50 per cent of the cumulative total eligible expenditure on RD&E.

The setting and collection of the industry levy is enabled by the *Primary Industries (Excise) Levies Act 1999* and the *Primary Industries Levies and Charges Collection Act 1991* respectively. The Australian Government matching contributions in 2015–16 were capped at the value of levies collected, as it was lower than the 0.5 per cent of the three-year average gross value of production.

Revenue (actuals)	2015–16 ($m)
Industry levies	6.054
Australian Government	6.053
Royalties	0.745
Interest	1.282
Research grants	4.127
Other	0.674
TOTAL	**18.935**

Total revenue for 2015–16 of $18.935 million was $8.079 million (74.4 per cent) above budget of $10.856 million. Total 2015–16 revenue is comprised:

- Industry levy revenue of $6.054 million, which includes $3.176 million (62 per cent) from the 2014–15 crop and $2.878 million (51 per cent) from the 2015–16 estimated crop.
- Australian Government matching contribution of $6.053 million was capped at the value of levies collected.
- $0.745 million in royalties from the sale of CRDC-funded CSIRO seed varieties.
- Interest revenue of $1.282 million was 55.4 per cent above budget, due to the higher level of cash reserves under CRDC management generated by above-budget revenues in the current and prior years.
- External grants of $4.127 million included unbudgeted Rural R&D for Profit $3.522 million, Carbon Farming Initiative $0.300 million, Action on the Ground $0.170 million, Filling the Research Gap $0.050 million, third party project contributions of $0.085 million.
- Other revenue of $0.674 million, which includes project refunds.

Expenditure and investment

Actual expenditure for 2015–16 was $20.555 million, a decrease of $0.024 million over the budgeted expenditure of $20.579 million.

Actual ($m)	2011– 12	2012–13	2013–14	2014–15	2015–16
Cotton crop size (millions of bales)	5.28	4.49	3.90	2.31	2.50*
Total Revenue	25.353	30.915	27.479	20.073	18.935
Industry levies	9.532	11.801	10.997	7.298	6.054
Australian Government	9.529	11.523	11.239	7.295	6.053
Royalties	3.145	3.971	1.830	1.707	0.745
Interest	1.401	1.726	1.779	1.596	1.282
National Program for Sustainable Irrigation**	1.293	—	—	—	—
Research grants	0.426	1.356	1.243	0.925	4.127
Other***	0.027	0.538	0.411	1.252	0.674
Expenditure total	13.717	19.301	21.293	22.826	20.555
Cotton RD&E activities	10.682	15.632	18.203	19.244	17.052
Total equity position	**27.317**	**38.931**	**44.488**	**41.645**	**40.025**

* *ABARES estimate*, Agricultural Commodities March 2016.
** *The National Program for Sustainable Irrigation* (NPSI) concluded 30 June 2012.
*** Includes project refunds.

Cost Allocation Policy

CRDC has a Cost Allocation Policy for allocating direct and indirect costs to activities across its program. Expenditure in 2015–16 was allocated to the following activities:

Cost allocation activity	2015–16
Direct R&D expenditure (project costs)	$15,829,535
Indirect R&D expenditure (administration costs)	$3,503,525
Grant-funded expenditure (R&D not eligible for Commonwealth Matching)	$1,222,075
Total expenditure	**$20,555,135**

Portfolio Budget Statement

The CRDC Portfolio Budget Statement released in May 2016 provided an estimate of CRDC's outcomes, outputs, performance and financial position for 2016–17 to 2019–20. The statement was consistent with the CRDC Strategic R&D Plan 2013–18 and the Annual Operational Plan 2016–17.

Outcomes and outputs 2015–16

CRDC has one government outcome: *Adoption of innovation that leads to increased productivity, competitiveness and environmental sustainability through investment in research and development that benefits the Australian cotton industry and the wider community.*

Outcome	2015–16
TOTAL budgeted revenue	$10,856,000
TOTAL actual revenue	$18,935,202
TOTAL budgeted cost of outputs	$20,579,000
TOTAL actual cost of outputs*	$20,555,135

* Total cost is shown rather than total price because CRDC is primarily funded through industry levies rather than on the basis of the price of its outputs. Each research project and its funding contributes to the outcome. Total research expenditure for the outcome is calculated, with the remaining expenditure attributed to the outcome on a pro rata basis.

The variation between the budgeted and the actual revenue of $8.079 million is a result of the 2015–16 crop being 0.5 million bales above budgeted crop of 2.0 million bales. The larger crop has provided additional levies, Commonwealth contributions and royalties of $3.745 million. In addition, CRDC had an increase in research grants of $3.554 million, interest revenue, project refunds, and other income of $0.780 million.

Forecast revenue

Future revenue from levies, Commonwealth-matching contributions and royalties are directly impacted by cotton production. Water availability and commodity prices are significant factors in forthcoming cropping decisions. ABARES June 2016 Agricultural Commodities report estimated the average storage level of public irrigation dams serving the Australian cotton growing region was 31 per cent of capacity in June 2016, down from 35 per cent at the same time in 2015 but still above the 10-year average of 28 per cent.

Seasonal inflows into the main cotton irrigation dams can be expected before November 2016. Similarly, soil moisture profiles have improved, which may increase the planting of rain-grown cotton.

CRDC has budgeted for a $7.228 million operating deficit for 2016–17. This reflects revenue of $13.173 million and expenditure of $20.401 million. Industry levy revenue and Commonwealth contributions will continue to be drawn from two crop seasons, 2015–16 and 2016–17.

The size of industry levies and Commonwealth contributions is heavily reliant upon crop production, which is budgeted to be 2.5 million bales for 2016–17. CRDC expects that the Australian Government matching contributions will be based on matching industry levy revenue in 2016–17.

Forecast expenditure

Budgeted expenditure for 2016–17 is $20.401 million, a decrease of $0.154 million below the 2015–16 actual expenditure. The forecast expenditure for the next two years for RD&E is budgeted at $17.916 million in 2017–18 and $14.974 million in 2018–19.

Forecast deficits

CRDC is a statutory body enabled by the PIRD Act with the rights of a body corporate and has the right to retain surplus funds. However, as a corporate Commonwealth entity, CRDC must seek approval from the Minister of Finance for a deficit in any year. CRDC has sought and received approval for deficits of $7.228 million in 2016–17 and $4.118 million in 2017–18.

Corporate Operations
OUR INVESTMENTS IN RD&E

CRDC used the Strategic R&D Plan 2013–18 to guide its program investments in 2015–16. The plan was developed with extensive industry, government and stakeholder consultation and was evaluated in the preparation of the Annual Operational Plan 2015–16.

CRDC's investments addressed the Australian Government priorities (the Science and Research Priorities and the Rural RD&E Priorities), the cotton industry priorities and the collective Cotton Sector RD&E Strategy.

As established in the Strategic R&D Plan, the CRDC actively seeks to achieve a balanced RD&E portfolio that considers the distribution of investment across:

- The RD&E strategies.
- The type of research, including basic, applied, blue-sky, development and delivery.
- In-project risks.
- Researcher experience and capacity.
- Research providers.
- Timeframe to outcomes.
- The likely return on investment for projects and programs.
- R&D management.

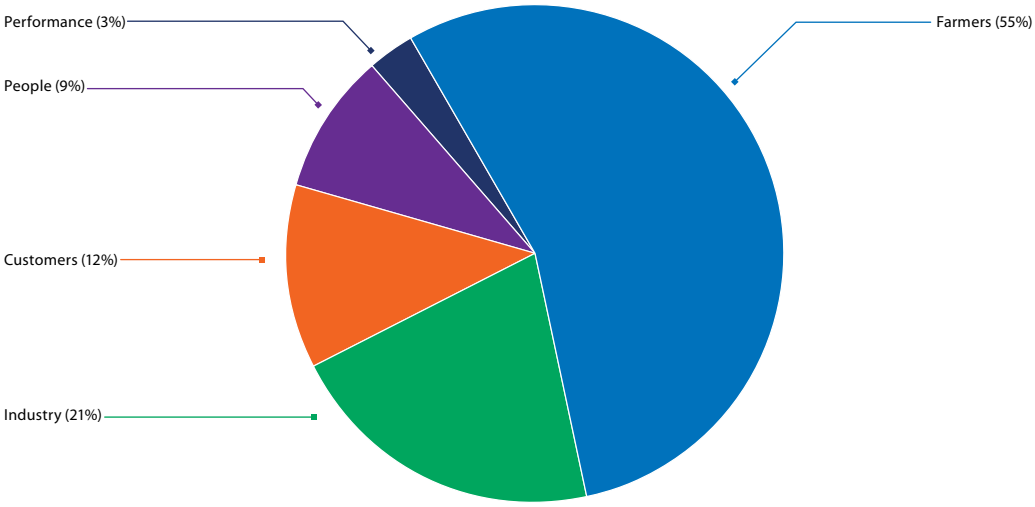
The portfolio includes RD&E that seeks to 'protect and defend' the production base from pest threats; increase productivity while ensuring resource-use efficiency; enhance product value through the supply chain; build a capable industry; and create an element of research discovery.

CRDC invests in applied RD&E that improves productivity, biosecurity, and natural resource management, and manages climate variability concurrently given the interrelationships between the issues.

Projects by CRDC program area:

CRDC program	Farmers	Industry	Customers	People	Performance	TOTAL
Number of projects	98	42	25	111	14	**290**
Program expenditure ($m)*	9.4	3.6	2.0	1.5	0.5	**17**
Program percentage (of expenditure)	55%	21%	12%	9%	3%	**100%**

* Excludes budgeted employee and supplier expenditure, contingency provisions for research and corporate research activities that support R&D planning and adoption. Some percentages have been rounded up or down.



Further detail on CRDC's projects can be found in Section 4: RD&E portfolio, and in Appendix 4: RD&E portfolio.

Total number of CRDC projects:

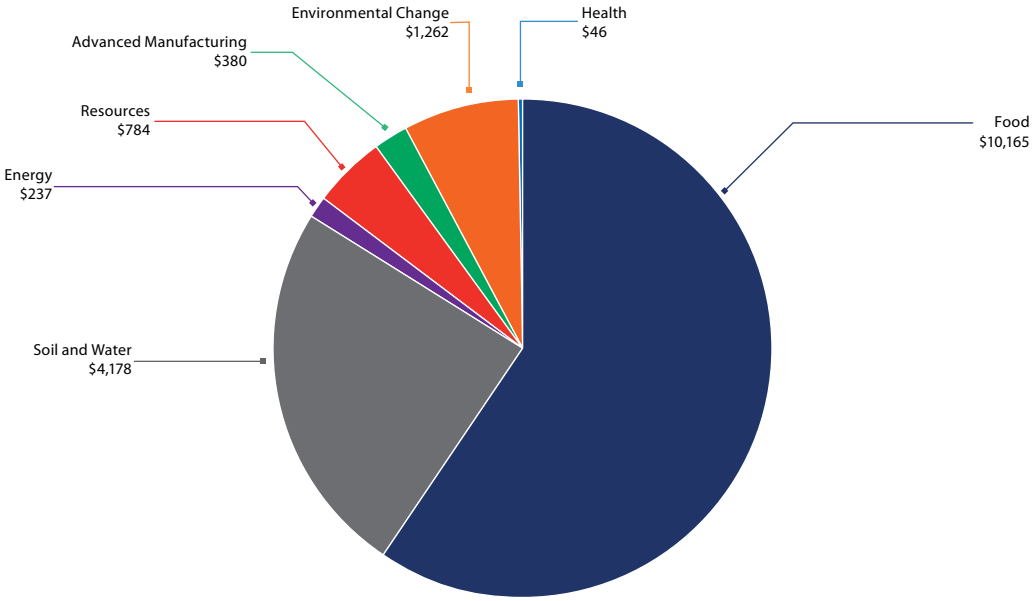
CRDC projects	2011–12	2012–13	2013–14	2014–15	2015–16
Active projects	42	50	61	118	**150**
New projects funded	125	153	142	162	**141**
Projects completed	117	142	85	130	**136**
Continuing projects	50	61	118	150	**155**

Corporate Operations
INVESTMENTS AGAINST GOVERNMENT PRIORITIES

CRDC's investments in RD&E support the achievement of the Australian Government's Science and Research Priorities and Rural RD&E Priorities.

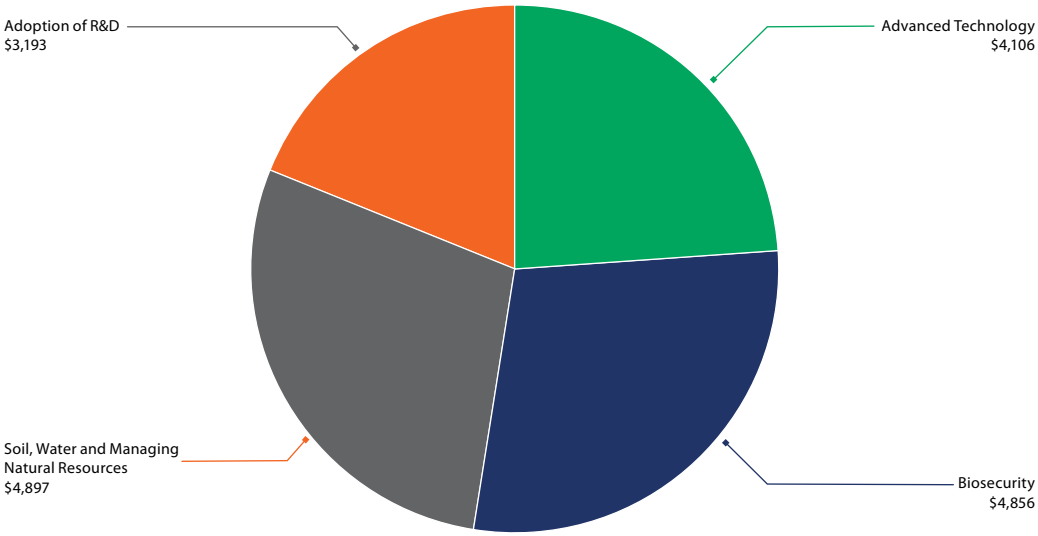
CRDC investment by Science and Research Priorities:

Science and Research Priorities (SRP)	CRDC investment ($'000)
Food	$10,165
Soil and Water	$4,178
Transport	—
Cybersecurity	—
Energy	$237
Resources	$784
Advanced Manufacturing	$380
Environmental Change	$1,262
Health	$46
TOTAL	**$17,052**



CRDC investment by Rural RD&E Priorities:

Rural RD&E Priorities	CRDC investment ($'000)
Advanced Technology	$4,106
Biosecurity	$4,856
Soil, Water and Managing Natural Resources	$4,897
Adoption of RD&E	$3,193
TOTAL	$17,052



Further detail on CRDC's projects can be found in Appendix 2: Australian Government Priorities.

Section 4
RD&E Portfolio

Program 1: Farmers

Program 2: Industry

Program 3: Customers

Program 4: People

Program 5: Performance

RUTH REDFERN

Program 1: Farmers			
Program	**Farmers**		
Outcome	Cotton is profitable and consistently farmers' crop of choice.		
Measure	Farmers increase productivity by three per cent per hectare per year.		
Theme	**1.1 Successful Crop Protection**	**1.2 Productive Resource Efficiencies**	**1.3 Profitable Futures**
Strategy Outcomes	Cotton crops protected from pest, weed and disease threats.	Inputs for cotton production are optimised.	Innovations in cotton production.
Will be achieved by	1.1.1 Monitoring and investigating the ecological behaviours and responses of cotton pest, weeds and diseases. 1.1.2 Testing practices that deliver improved management of insect pests, weeds and diseases. 1.1.3 Improving capacity, knowledge and adoption of techniques to successfully protect the cotton crop.	1.2.1 Delivering benchmarks of on-farm resource-use efficiencies. 1.2.2 Developing and proving decision systems and practices that deliver optimal resource efficiencies on cotton farms. 1.2.3 Developing new systems and tools to support farm decision-making processes. 1.2.4 Improving capacity, knowledge and adoption of techniques to optimise resource uses.	1.3.1 Investigating the application of new technologies and different scientific approaches which have the potential to deliver significant improvements and economic returns to the cotton farming system.
Measure of success	Farmers are able to improve their crop management practices based on sound science: ▪ 85 per cent of farmers adopting improved practices that reduce the reliance on pesticide inputs. ▪ 50 per cent of farmers adopting improved practices that reduce the incidence of insect pests, weeds and diseases affecting cotton on their farm. ▪ World-class science foundations for managing ecological adaptations in cotton insect pests, weeds and diseases.	Farmers are able to increase their productivity: ▪ per hectare of land. ▪ per unit of nitrogen fertiliser. ▪ per ML water. ▪ per unit of CO_2 equivalent emitted.	Farmers are profitable: ▪ Improving gross margins for Australian cotton production systems. ▪ On-farm innovations and partnerships established to drive profitability.

Case study: Growers and researchers working together to tackle disease

A collaborative project involving researchers, extension officers and cotton growers is helping to identify and tackle disease in northern NSW through on-farm trials.

The CRDC-supported trials, which are being conducted by QDAF Senior Plant Pathologist Dr Linda Smith and CottonInfo's Regional Extension Officer for the Namoi Geoff Hunter, build on the disease surveys conducted through the *Diseases of Cotton XI* and the *Fusarium wilt management in cotton* projects.

The surveys have identified Verticillium wilt as a major issue in the Upper and Lower Namoi and Gwydir Valleys, and the trials aim to help researchers and growers better understand, diagnose and manage the disease.

Six growers who have been heavily affected by Verticillium are actively involved in the trials, across six sites at Wee Waa, Narrabri, Boggabri and Moree.

The three-year trials involve different rotation crops for cotton, to field test the understanding of the Verticillium pathogens, their inoculation levels and hosts, and the impact of nutrition and soil on the disease.

'Verticillium is costing us in terms of both yield and dollars,' says Boggabri cotton grower Andrew Watson—one of the six growers participating in the trials.

'These trials will provide critical information to me, the researchers and importantly, other growers, about how to best manage vert. Being involved in a trial is significant in terms of both time and money. I have estimated that my direct costs and my opportunity costs, in terms of a crop I could have grown on the 18 hectares I have dedicated to this trial, equal around $11,000 per annum.

'But these costs are far outweighed by the knowledge I will gain from these trials—the knowledge is far more valuable to me,' Andrew said.

Key program investments

This section provides a snapshot of some of CRDC's investments during 2015–16 in this program area. The full list of CRDC's investments for this period can be found at Appendix 4: the RD&E portfolio.

Successful Crop Protection:
Monitoring and investigating the ecological behaviours and responses of cotton pest, weeds and diseases;
Testing practices that deliver improved management of insect pests, weeds and diseases;
Improving capacity, knowledge and adoption of techniques to successfully protect the cotton crop.

Significant advancements have been made in protecting cotton from insect pests, weeds and diseases, but new threats and challenges continue to emerge. The RD&E focus is on developing strategies and practices that support farmers in addressing these challenges.

CRDC's 2015–16 investment in this area included the following projects:

- *Identification of beneficials attacking silverleaf whitefly and green vegetable bug*, with CSIRO;
- *Diseases of Cotton XI*, with NSW DPI;
- *Fusarium wilt management in cotton*, with QDAF;
- *Multiple host use and gene-flow in green vegetable bug relative to cotton crop* (PhD project), with UQ;
- *Quantifying and mapping the impacts of herbicide drift on cotton (non-target crop)* (PhD project), with USQ; and
- *Regional weed management workshops for growers and advisors*, with ICAN.

The *Identification of beneficials attacking silverleaf whitefly and green vegetable bug* project aims to identify the key predators of silverleaf whitefly and green vegetable bug in cotton systems. This information will allow more-targeted sampling for these species and the development of guidelines for their conservation within the crop. Further, it provides the basis from which to develop further studies of beneficials focusing on species that are likely to have greatest impact.

The project has developed and used molecular techniques to identify predators, enabling the regular sampling of a range of predatory species through the season, quantifying the abundance of the prey and predators, and conducting analysis of the collected predators to determine if they contain DNA from either silverleaf whitefly or green vegetable bug. Testing of potential predator species is underway with several thousand samples processed. The results to date highlight the importance of early season predators for suppression of silverleaf whitefly populations. The project is due for completion in 2016–17.

The *Diseases of Cotton XI* project and the *Fusarium wilt management in cotton* project provided pathology diagnostic services, biosecurity preparedness and surveillance capacity for the cotton industry. These projects collaborated to conduct annual disease surveillance on commercial cotton farms, recording the presence or absence of exotic cotton diseases, as well as recording the incidence and severity of endemic disease and other pathology-related issues. While both of these projects concluded in 2015–16, CRDC will continue to invest in this important area of research from 2016–17.

The *Multiple host use and gene-flow in green vegetable bug relative to cotton crop* PhD project focuses on green vegetable bug (*Nezara viridula*), which has re-emerged as a cotton pest with the adoption of Bt cotton varieties. This project aims to investigate the genetic origin of *N. viridula,* in order to understand the movement of the bug from different hosts across and between cotton-growing regions. This will allow growers to prioritise weed control before a growing season, and help manage and prepare for outbreaks of green vegetable bug.

Regional variation in the bug may signify the presence of different host-related species (eg. on cotton, variegated thistle). If species limits do exist and are found within green vegetable bug, understanding their differential host use and

potential to interbreed is critical to understanding which crops they will affect, which weeds they are likely to persist on between seasons, which control methods are suitable for them, and how resistance genes spread between populations.

Sampling of *N. viridula* has confirmed that Australian populations originated from two locations, Asia and Europe, with extensive gene-flow between these two lineages of *N. viridula* along the east coast of Australia. However, there are still two genetically distinct populations of *N. viridula* in Australia: one along the east coast and one in the Northern Territory and north-eastern Western Australia. Their current independent geographical distributions keep them genetically distinct. The project is due for completion in 2016–17.

The *Quantifying and mapping the impacts of herbicide drift on cotton (non-target crop)* PhD project recognises that quantifying and mapping the impacts of herbicide drift on cotton is important for a number of reasons: cotton crop management, scientific understanding, documenting the damage for loss compensation, and improving environmental management.

As such, this project seeks to understand the responses of cotton plants that are affected by herbicides, and to assess the accuracy of remotely sensed imagery to detect and map herbicide drift damage to cotton crops. The project will develop a framework and a set of procedures or protocols that will optimise the use of sensing technology to assess and monitor herbicide drift damage. The project is due for completion in 2016–17.

The *Regional weed management workshops for growers and advisors* project, which commenced in 2015–16, aims to increase the industry's capacity to manage weeds in the cotton system, particularly with increasing herbicide resistance and species shift. The project will deliver 21 regionally adapted training workshops for growers and their advisors to address weed-management issues specific to the cotton industry. The workshops will assist participants to identify the risk to the industry and their business from herbicide resistance and/or species shift. The impact that increasing levels of weed resistance to glyphosate have on cotton farming systems will be a focal issue, with time devoted to the identification and use of strategies to delay or manage the onset of resistance.

The project will also build consultant capacity through three cotton agronomy weed management masterclasses. The project is due for completion in 2016–17.

Productive Resource Efficiencies: Developing and proving decision systems and practices that deliver optimal resource efficiencies on cotton farms; Developing new systems and tools to support farm decision-making processes.

Ensuring growers can achieve optimal resource efficiencies of key input resources is a key focus for the cotton industry's R&D. CRDC's investment focuses on developing, identifying and testing decision systems and practices to help growers improve their efficiencies.

CRDC's 2015–16 investment in this area included the following key projects:

- *Optimising management of manure in southern NSW cotton production,* with CSIRO; and
- *Smarter Irrigation for Profit*, with various research partners, including: National Centre for Engineering in Agriculture (NCEA), Sugar Research Australia (SRA), Gwydir Valley Irrigators Association (GVIA), University of Tasmania (UTAS), CSIRO, NSW DPI, Dairy Australia, Roth Rural and Regional, and the Victorian Department of Economic Development, Jobs, Transport and Resources (DEDJTR).

The *Optimising management of manure in southern NSW cotton production* project, which commenced in 2015–16, recognises that manure from local beef and poultry producers in the southern region of NSW is becoming an economical soil amendment and nutrient source option for new cotton producers in the area, and is showing benefits for soil fertility.

Given that the region is still relatively new to cotton production, there is limited research available on

regionally specific nutrient response for less-fertile southern soil types. As such, this project involves three-year replicated cotton field trials on two soil types (vertosol, chromosol) with a range of manure and cotton-trash compost amendment rates, which will be used to evaluate nitrogen balance and nitrogen-use efficiency.

An important outcome from the trials will be the evaluation of manure application as a more rapid method of improving soil fertility. The datasets will provide regionally specific information that can be used to refine existing general manure management guidelines developed for broadacre cereals, which may assist cotton growers to better estimate how manure may be applied to reduce synthetic fertiliser inputs without compromising yield and quality outcomes. The project is due for completion in 2017–18.

The *Smarter Irrigation for Profit* project, which commenced in 2015–16, is a cross-sectoral project under the Australian Government's Rural R&D for Profit programme (round one), administered by the Department of Agriculture and Water Resources. It is led by CRDC in conjunction with fellow RDCs, Dairy Australia, RIRDC, Sugar Research Australia and other research partners.

The project is a large-scale, ambitious project designed to achieve a 10–20 per cent improvement in water productivity, efficiency and farmer profitability across the cotton, dairy, rice and sugar industries, while also improving cross-sector industry research collaborations. It is designed to increase on-farm profitability by integrating new irrigation scheduling and delivery technologies into good irrigation practice.

The project comprises a series of 11 sub-projects, including cotton-specific projects around irrigation automation, grower-led irrigation systems comparisons, and maximising on-farm irrigation profitability.

One such sub-project, the *Irrigation Automation Tour* short project, ran during November and December 2015. The tour, hosted by CottonInfo with support from CRDC, took a group of 40 cotton growers, irrigators and consultants from the northern cotton-growing valleys to visit the southern irrigation industry to see surface irrigation automation technologies in action.

The four-day tour covered working irrigation systems across the Goulburn-Murray, Coleambally and Murrumbidgee irrigation areas, including pasture, maize, silage and cotton production systems. The group visited six farms, including cotton, dairy, cropping and sheep; the IREC field station and regional trial site; and irrigation automation retailers Rubicon and Padman Stops, to gain an understanding of alternative irrigation designs and the potential for automation. Feedback from the tour found that 95 per cent of participants would do something differently on-farm as a result of what they had learnt on the tour.

Strong demand for further irrigation automation information resulted in two related events: a field walk at Wee Waa to showcase irrigation automation in use on a cotton farm; and a replica of the Irrigation Tour hosted by IREC for southern irrigators who couldn't attend the original event.

For more, see The future of irrigation: automation technology case study.

Productive Resource Efficiencies: Improving capacity, knowledge and adoption of techniques to optimise resource uses.

Ensuring that information on improved resource efficiency is extended to growers is a key focus for the industry's RD&E effort.

CRDC's 2015–16 investment in this area included the following key projects:

- *Carbon farming in the Australian cotton industry*, with Jon Welsh; and
- *CottonInfo nutrition tour,* with Jon Welsh.

The *Carbon farming in the Australian cotton industry* project, due for completion in 2016–17, is funded under the Australian Government's Carbon Farming Futures Extension and Outreach program, and administered by the Department of Agriculture and Water Resources.

Case study: The future of irrigation: automation technology

It takes just one person and a mobile phone to fully irrigate a 100-hectare cotton field set up with automated irrigation at Steve Carolan's property 'Waverley' near Wee Waa, North West NSW.

Steve has 2478 hectares of irrigation at 'Waverley' with both river and bore allocations.

Last year Steve and farm manager Andrew Greste (pictured) converted 100 hectares from traditional siphons to a fully automated system, consisting of pipes through the bank and a series of gates in the channel-delivery system that can be remotely opened and closed—by mobile phone. Steve says the advantages are labour savings, improved uniformity, and water-use efficiency.

Steve and Andrew first saw the automated configuration at the CRDC-supported CottonInfo 2015 Irrigation Technology Tour at Australian Food and Fibre's 'Redmill' Moree, where CRDC and the National Centre for Engineering in Agriculture were conducting automation trials.

Steve and Andrew were so impressed with the idea of automation that they went home and began to work on converting some of their own fields. They, in turn, hosted a field day with CottonInfo, CRDC and NCEA at 'Waverley' in March 2016 to showcase their system.

Steve says ideally he would like to expand the automation system across the whole farm, and while cost is a limiting factor, with the help of the NSW DPI's Sustaining the Basin Irrigated Farm Modernisation program, further expansion of the system has begun.

CRDC-supported CottonInfo Technical Specialist Janelle Montgomery was the key organiser of the Irrigation Technology Tour, and the specific automated irrigation events at Moree and in Southern NSW that followed, including the 2016 *Irrigation Automation Tour.*

Janelle says the field days and tours have directly resulted in a number of growers investigating irrigation automation and conducting feasibility trials on their own farms.

For more on the Carolan trial and automation irrigation, see the Winter 2016 edition of CRDC's Spotlight magazine: www.crdc.com.au/publications/spotlight-magazine.

MELANIE JENSON

The project integrates the latest information on carbon, climate variability and emissions management into the cotton industry's extension efforts, with the aim of improving resource-use efficiency and reducing land-sector emissions in the cotton industry.

Through the appointment of a carbon technical specialist, Jon Welsh, within the cotton industry's extension team CottonInfo, the project focuses on:

- increasing the cotton industry's understanding of emissions reduction possibilities and sequestration; the opportunities, benefits and trade-offs under the Emissions Reduction Fund;
- upskilling cotton and grain industry advisors, extension networks and key influences; and
- consolidating current, cross-sectoral science and providing a clear direction for future research.

Of late, the project has delivered the *CottonInfo nutrition tour*, Emissions Reduction Fund webinars, energy efficiency workshops, revisions to the *my*BMP modules for natural assets and energy and input efficiency (underpinned by CRDC-supported research) and extension of these modules to growers, and presentations regarding cotton climate risk management.

Under this project, the CottonInfo technical specialist is also working with an industry economist to conduct economic costings and carbon emissions profiling with growers. For more, see The economic and environmental rewards of solar pumping case study.

The *CottonInfo nutrition tour* short project, which ran during February 2016, delivered a series of five nutrition field days to growers across five cotton-growing valleys, taking the latest developments in nutrition research to cotton growers and consultants. The tour was designed to help growers make economically beneficial and sustainable decisions for their farms.

The tour took ten leading CRDC-supported industry researchers to growers to present and discuss a range of important cotton nutrition topics, including:

- nutrient budgeting;
- improving nitrogen-use efficiency;
- mineralised nitrogen in-crop;
- nitrogen losses from irrigated cotton;
- phosphorus considerations in irrigated and raingrown cotton;
- soil health and crop rotations; and
- optimising nitrogen and irrigation application and nitrous oxide emissions.

The tour also hosted cotton grower and CRDC-supported Nuffield scholar Nigel Corish, who spoke about putting industry research along with his own into practice on his farm at Goondiwindi.

Some 360 cotton growers and consultants attended the field days, representing approximately 140,000 hectares of irrigation land, providing valuable feedback on nutrition research. The post-event surveys indicated that there was a 35 per cent increase in understanding of soil health and nitrogen-use efficiency, and a 52 per cent increase in understanding of loss pathways and greenhouse gas emissions, among attendees as a result of the field days. In addition, 76 per cent of attendees said that they would consider mineralised nitrogen calculations in more detail when developing their nutrient budgets as a result of the event.

Case study: The economic and environmental rewards of solar pumping

Energy is one of the fastest growing on-farm costs. The CRDC-funded *Improving energy efficiency on irrigated cotton farms* project, which concluded in 2015, found that the average direct energy cost was $298 per hectare, with diesel counting for at least 85 per cent.

But not for cotton grower Andrew Gill of Narromine.

The installation of a solar-diesel hybrid irrigation bore pump on his Central West NSW farm has led to substantial cuts in fuel costs, greater irrigation efficiencies and a massive reduction in greenhouse gas emissions.

Attracted by the drop in the price of solar panels in recent years and the prospect of the system paying for itself in less than four years, Andrew decided to install a solar-diesel hybrid system at one of the pump sites on his Narromine farm at the end of last year. Andrew said while the environmental achievements were important, the deciding factor was the economic viability of the project that promised a quick return on investment.

The move has cut pumping costs from $76/ML to $41/ML, and slashed diesel use by between 45,000 and 55,000 litres a year. Over 25 years, that equates to a saving of more than 1 million litres of fuel and a reduction of over 3000 tonnes in carbon emissions.

CottonInfo Technical Specialist Jon Welsh and research economist Janine Powell worked through project economics costings and carbon emissions profiling with the Gill family during feasibility as part of the CRDC and Australian Government *Carbon farming in the Australian cotton industry* project.

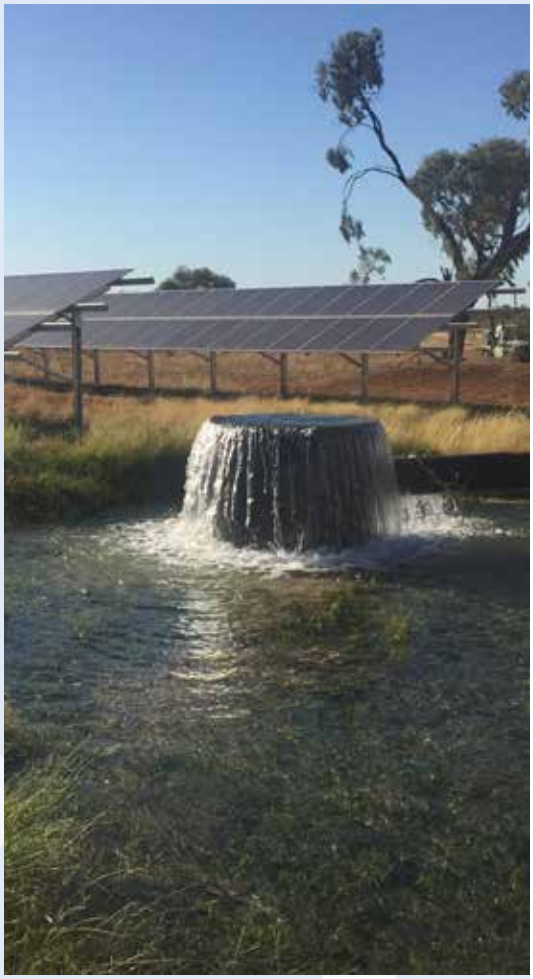
The Gills run sheep and cattle, and grow summer and winter dryland and irrigation crops, including 300 hectares of cotton each year. They have no access to river water, only bore water. Their irrigation pumping system has traditionally been run exclusively by diesel pumps.

For the past few years, they have been trying to improve the fuel efficiency of these pumps.

However, with their turbines already operating at peak efficiency, they decided to install the solar-diesel hybrid system at one of their bore sites that provides year-round pumping into a large irrigation reservoir.

Mr Gill's focus now is on fine-tuning the system and improving its efficiency. He plans to introduce more solar pump stations throughout the farm.

For Andrew's full case study, please visit: www.cottoninfo.com.au/publication-type/case-studies.



Case study: Taking cotton nutrition to the field

Cotton nutrition remains an important topic for growers and consultants as they strive to realise optimal yields and fibre quality, reduce costs and increase margins.

Too little nutrition will reduce cotton's yield potential, while too much fertiliser can reduce profitability through increased costs, contamination of groundwater, excessive vegetative growth in the crop, and related insect, disease and harvest problems.

Too much fertiliser—particularly nitrogen (N)—can be lost to the environment in certain climatic conditions. Carefully monitoring soil N stocks is critical for informing fertiliser management decisions to increase yield and reduce the carbon footprint of the fibre.

To share the latest research, CRDC supported the 2016 *Cotton Nutrition Tour*, hosted by CottonInfo. The tour took 10 CRDC-funded researchers to farms in the Upper Namoi, Macquarie, Southern NSW, Central QLD and Gwydir valleys in February 2016. About 360 growers and consultants attended the event over the five days.

The tour focused on a range of topics, from reducing inputs and improving nitrogen-use efficiency to the role of irrigation, soil health, phosphorus and crop rotations.

Researchers included Dr Oliver Knox and Dr Brendan Griffiths (UNE), Dr Ben MacDonald and Dr Gupta Vadakattu (CSIRO), Dr Graeme Schwenke and Jon Baird (NSW DPI), Dr Chris Dowling (Back Paddock), Dr Dio Antille (USQ) and Dr Francois Visser (UQ).

CRDC and Cotton Australia-supported Nuffield scholar and cotton grower Nigel Corish also joined the tour to share his learnings from Nuffield and how he has put nutrition research to the test on his Goondiwindi farm.

The tour was run with support from UNE, USQ, UQ, CSIRO, NSW DPI, and sponsors Yara, Fertilizer Australia, Koch Fertilizer, SST Software and Incitec Pivot. The Moree event was held in conjunction with the Gwydir Valley Irrigators Association. The tour was also supported by funding from the Australian Government.

For more on the tour, see the Autumn 2016 edition of CRDC's Spotlight magazine: www.crdc.com.au/publications/spotlight-magazine.

RUTH REDFERN

Profitable Futures:
Investigating the application of new technologies and different scientific approaches which have the potential to deliver significant improvements and economic returns to the cotton farming system.

Cotton growing will continue to evolve. Whether change is driven by productivity constraints, environmental, economic or regulatory factors, the long-term profitability of farmers relies on finding innovation and strategies that allow the cotton farming system to adapt. This theme looks to initiate RD&E efforts to deliver these innovations and build the longer-term profitability of cotton production.

In 2015–16, CRDC's support for this important research area included the following key projects:

- *Future Farm: Intelligent decisions—improving farmer confidence in targeted N management through automated decisions,* with GRDC;
- *Integrated program to deliver automated, adaptive, precision irrigation system,* with USQ;
- *National regulatory framework governing big data in primary production* (PhD project), with UNE.

The *Future Farm: Intelligent decisions—improving farmer confidence in targeted N management through automated decisions* project, which commenced in 2015–16, is a joint collaboration between GRDC and CRDC. Collectively, the organisations have been focusing on the challenges of increasing cotton and grain profitability and by optimising the use of inputs, enabling new farming practices and the automation of routine decision and implementation processes.

As part of the analysis, both industries have identified that further improvement in the nitrogen (N) application process is required to better manage the crop canopy at the within-field scale to optimise the use of available soil water, increase N-use efficiency, and maximise product yield and quality.

The project recognises that one effective way of optimising N use is to use the tools of precision agriculture to deliver on the 4 Rs—putting the right amount of the right product in the right place at the right time. However, such strategies can require a substantial investment in time spent processing and analysing data, and may require several steps that are not necessarily well integrated, while farmer confidence in these tools as decision aids is low given some of the assumptions that underpin them. This project will therefore re-examine and improve the way in which soil and crop sensors are used to inform decisions about N management, and to provide a way of automating the process from data acquisition, through analysis, to the formulation and implementation of decision options. This project is due for completion in 2017–18.

The *Integrated program to deliver automated, adaptive, precision irrigation system* project, which commenced in 2015–16, fits within the wider *Smarter Irrigation for Profit* project, outlined above. The aim of this sub-project is the delivery of a smart, automated precision irrigation management system, tested and validated at the field scale, and demonstrated to growers and potential commercial providers to encourage future industry adoption.

This project will deliver, demonstrate and evaluate smart automated, precision irrigation systems for the cotton (pivot and furrow), dairy (centre pivot) and sugar (furrow) industries. The prototype surface and overhead systems will be developed in close consultation with irrigators, technology suppliers and commercial suppliers, providing opportunities to develop a pathway for future commercialisation.

This project goes beyond the singular development of a novel technology, experimental trials of a particular crop trait, or simple collation of information from different monitoring technologies. Instead, the work focuses on the integration of a wide range of new and proven individual technologies that can monitor and interpret crop production response to irrigation, and manage all aspects of the irrigation

system—hence its fit within the Cotton Futures' Profitable futures theme. This project is due for completion in 2019–20.

The *National regulatory framework governing big data in primary production* project, which commenced in 2015–16, recognises that primary industry production now requires a significant increase in the use of data, but that little governance exists concerning how such data is generated, gathered, managed, analysed, accessed, and distributed. The lack of a national framework or code of practice concerning data used in primary production, combined with the economic benefit accruing to entities involved in the value chain, implies a gap in the precision agriculture infrastructure being developed to enhance farm-level decision making.

As such, this project intends to develop a model identifying systems of governance, and advance an approach for better management of primary production data. This PhD project aims to investigate these questions: How might an integrated model consisting of the production value chains described by data inputs for primary industries describe a national regulatory framework for big data?; How might the regulatory framework be constructed and implemented in Australia?; and How would this ensure productivity gains and reduction in production costs for food and income security? The project is due for completion in 2019–20.

Program 2: Industry			
Program	**Industry**		
Outcome	The Australian cotton industry is the global leader in sustainable agriculture.		
Measure	Industry can report against recognised sustainability indicators.		
Theme	**2.1 Respected Stewardship**	**2.2 Responsible Landscape Management**	**2.3 Sustainable Futures**
Strategy Outcomes	Industry protects its production technologies and its biosecurity.	Industry leads in managing natural assets.	An industry achieving its vision.
Will be achieved by	2.1.1 Monitoring for and investigating changes in pest and weed susceptibility to biotechnologies and crop-protection products used by the cotton industry. 2.1.2 Exploring tactics and strategies that lower the risks of pesticides to the environment and resistance evolution in populations of key insect pests and weeds. 2.1.3 Developing and supporting the industry's capacity to effectively steward key technologies and products. 2.1.4 Supporting the industry's preparedness and ability to deal with biosecurity threats.	2.2.1 Defining the values and drivers relating to the management of natural landscapes and systems in cotton-growing regions. 2.2.2 Recording and demonstrating improved environmental performance of the cotton industry. 2.2.3 Identifying and proving integrated management strategies which deliver environmental and productivity gains. 2.2.4 Researching the connectivity between cotton farms and natural systems in the landscape. 2.2.5 Supporting initiatives and partnerships to improve the knowledge and capacity to manage natural landscapes and systems in cotton regions.	2.3.1 Scoping and investigating critical threats and opportunities which may influence the long-term sustainability of the Australian cotton industry. 2.3.2 Supporting innovative approaches to solve traditional industry issues and drive future sustainability.

Program 2: Industry			
Measure of success	Industry is able to maintain its access to, and the effectiveness of, biotechnologies and crop protection products. ▪ 100 per cent of cotton farmers are aware of the underlying risks of trait and agricultural chemical resistance. ▪ 100 per cent of insecticide use decisions are consistent with the Insecticide Resistance Management Strategy (IRMS). ▪ The cotton industry has the necessary science to provide informed input into the development of resistance management plans for biotech traits. ▪ The cotton industry demonstrates pesticide management practices that lower the risks posed to the environment and the evolution of resistance in target insect pest and weed populations. Industry is capable of managing its biosecurity responsibilities. ▪ The cotton industry is able to meets its biosecurity obligations. ▪ The cotton industry is prepared to effectively respond to biosecurity incursions.	Industry participation in the collective management of natural landscapes. ▪ Regional delivery partnerships for every major cotton-growing region. Industry recognised for its leadership in environmental performance. ▪ Recognition by national and global initiatives for biodiversity management. ▪ 1000 km of riparian lands managed under best practice. ▪ One million hectares of floodplain vegetation managed under best practice. Industry contributes to the improvement of landscape systems knowledge and science. ▪ A comprehensive database documenting the extent and condition of the natural assets the industry utilises and manages. ▪ Two national science-based collaborations for the industry to inform surface and groundwater management.	Industry is capable of leading and adapting to change. ▪ Innovations and partnerships established to drive cotton industry sustainability.

Key program investments

This section provides a snapshot of some of CRDC's investments during 2015–16 in this program area. The full list of CRDC's investments for this period can be found at Appendix 4: the RD&E portfolio.

Respected Stewardship:
Monitoring for and investigating changes in pest and weed susceptibility to biotechnologies and crop-protection products used by the cotton industry;
Exploring tactics and strategies that lower the risks of pesticides to the environment and resistance evolution in populations of key insect pests and weeds.

Stewardship refers to protecting the long-term effectiveness of the chemicals and technology used to control pests and weeds in the Australian cotton industry. Resistance is an outcome of exposing pest or weed populations to a strong selection pressure, such as an insecticide or herbicide. Genes for resistance naturally occur at low frequencies in most populations.

Once a selection pressure is applied, such as an insecticide or from a biotechnology trait, resistance genes can increase in frequency because resistant individuals are more likely to survive and produce offspring. If selection continues, the proportion of resistant individuals may increase in the population until reduced effectiveness of the toxin is observed in the field.

Ensuring that key insect pests and weeds do not become resistant to biotechnology or crop-protection products is of critical importance to the industry.

In 2015–16, CRDC continued its support of this important research area through key projects, including:

- *Can genetic diversity predict the potential for emergent glyphosate resistance?* with the University of QLD;
- *Economic risk assessment of resistance management strategies for Bt cotton,* with CSIRO;
- *Managing Bt resistance and induced tolerance in Bollgard 3® using refuge crops,* with CSIRO; and
- *Silverleaf whitefly resistance monitoring 2013-16,* with QDAF.

The *Can genetic diversity predict the potential for emergent glyphosate resistance?* project, which concluded in 2015–16, aimed to increase genetic understanding of targeted weed species, particularly the potential risk of cross-resistance.

Resistance to herbicides can happen by changes to the target gene (target site resistance) or other genetic changes (non-target site resistance, or NTSR). NTSR is particularly difficult to decipher as it is usually polygenic and can be constitutive, stress-induced, or possibly both. Cross-resistance between different herbicide groups is not possible with target site resistance; however, since NTSR is the result of both regulatory processes (signal production, reception, and response) and protective processes of several kinds, they have the potential to interact together and accumulate, and possibly provide resistance across herbicide groups.

This project examined four weed species from cotton-growing regions: Feathertop Rhodes grass, fleabane, barnyard grass and windmill grass. The project found that the only species (of those investigated) that had a fixed target site mutation was Feathertop Rhodes grass. Fleabane, barnyard grass and windmill grass all have glyphosate resistance by NTSR mechanisms.

The genomic data generated during this project is now being used in the *Staying ahead of weed evolution in changing cotton systems* project (under the Farmers program area) to help address the issue of glyphosate resistance. For more on this project, download the full final report from CRDC's online library of final reports at Inside Cotton: www.insidecotton.com.

The *Economic risk assessment of resistance management strategies for Bt cotton* project, which concluded in 2015–16, aimed to inform the cotton industry about the economic benefits of developing resistance management plans (RMPs), and to improve the capacity of the cotton industry to base resistance management strategies/plans on

rigorous analysis of the relative effectiveness, costs, and economic risks of the options available.

Evaluating an RMP for Bt cotton involves comparing the costs to landholders today (eg. from refuge crops, planting windows, pupae busting) with uncertain future benefits from delayed resistance (eg. reduced cost of spraying, loss of yield, health and wellbeing benefits to farmers and communities). The project developed a model that provides a basis for detailed analysis and effective communication of the value of the RMP.

The *Managing Bt resistance and induced tolerance in Bollgard 3® using refuge crops* project, which commenced in 2015–16, aims to improve the ability of refuges to counter the threat of resistance. This project builds on previous CRDC-supported research, which found unexpectedly high numbers of Helicoverpa moths emerging from Bt cotton fields, suggesting that about half the moths emerging from the cotton/refuge system could be originating from Bt cotton.

Comparing the number of moths emerging from Bt cotton to those emerging from structured and unstructured refuges (unstructured refuges are non-mandatory refuges, including natural systems and other crops), will improve the estimates of the proportion of Helicoverpa in cotton ecosystems exposed to Bt toxins. This will provide the industry with an understanding as to how well refuges, both mandatory and unstructured, are working in practice to dilute any resistant individuals that may emerge from Bt crops. The project is due for completion in 2017–18.

The *Silverleaf whitefly resistance monitoring 2013–16* project aimed to provide early and rapid detection of resistance in silverleaf whitefly from Australian cotton fields while still at low frequencies. This would allow the industry to take corrective management actions before levels become problematic for control, and help maintain the industry's reputation as a producer of high-quality fibre. This project has identified early indications of resistance to one of the cornerstone silverleaf whitefly products, Pyriproxyfen, and provided recommendations to industry for the 2016–17 Insecticide Resistance Management Strategy (IRMS).

This project concluded in 2015–16, however another project, *Monitoring silverleaf whitefly insecticide resistance*, commences in 2016–17 with the same aim and lead researcher.

Respected Stewardship: Supporting the industry's preparedness and ability to deal with biosecurity threats.

Biosecurity plays a critically important role in ensuring the sustainability of the Australian cotton industry—managing the risk of pests and diseases entering, emerging, establishing or spreading to avoid production losses, management and eradication costs, and potentially the loss of important overseas markets.

CRDC's 2015–16 investment in the area of biosecurity included these key projects:

- *Plant Biosecurity RD&E Strategy*, with Plant Health Australia; and
- *Surveillance and studies for endemic and exotic virus diseases of cotton,* with QDAF.

The *Plant Biosecurity RD&E Strategy* is a component of the National Primary Industries RD&E Framework, an initiative of the Standing Committee on Primary Industries (SCoPI). The Strategy is a cross-sectoral strategy that establishes the future direction for improving biosecurity RD&E for Australia's plant industries. CRDC and the other RDCs help to co-fund the strategy, as an important collaborative effort to ensure Australia has world-leading science-based systems and capability for safeguarding our plant sector, including cotton, from biosecurity threats.

The *Surveillance and studies for endemic and exotic virus diseases of cotton* project, which commenced in 2015–16, focuses on viral diseases that are serious biosecurity and economic threats to Australian cotton, including cotton leaf curl disease, cotton leaf roll dwarf virus (causing cotton blue disease) and cotton leaf crumple virus.

The project aims to enhance and support the sustainability of the Australian cotton industry by providing continued capacity in plant virology expertise and diagnostics, building industry awareness of viral disease threats, and developing preparedness for viral diseases that pose serious biosecurity threats to the Australian cotton industry.

Under the project, researchers conduct surveillance and provide diagnostic support as required for endemic and exotic viral diseases of cotton in order to help protect and support a sustainable Australian cotton industry. This project collaborates closely with the Northern Australian Quarantine Strategy, participating in surveillance and monitoring activities in neighbouring countries for early signs of targeted viruses. Regular surveillance provides valuable information on the seasonal distribution and damage caused by the endemic cotton bunchy top disease and tobacco streak virus.

Responsible Landscape Management: Defining the values and drivers relating to the management of natural landscapes and systems in cotton-growing regions.

The Australian cotton industry recognises the need for sustainable and responsible landscape management, and over the past decade has made significant gains in improving its environmental management. Industry research has shown the mutual benefits that can be gained from managing natural assets for both production and environmental outcomes.

CRDC's 2015–16 investment in this area includes the following key project:

- *Critical thresholds for riparian vegetation regeneration in the northern Murray-Darling Basin*, with Griffith University.

This project, which concluded in 2015–16, aimed to address major knowledge gaps concerning the dynamics and resilience of riparian vegetation in cotton-growing catchments of the northern Murray-Darling Basin. The project sought to predict the outcome on riparian vegetation in this region of various land and water management and climate scenarios, and to identify robust management interventions for maintaining biodiversity and key ecosystem functions and services.

The project has found that canopy cover and litter loads are particularly significant drivers of riparian vegetation dynamics at local scales, and that consequently, any land management activities that affect these, including clearing and grazing, have the potential to impair vegetation regeneration.

Conversely, these findings demonstrate that managing riparian lands under best practice makes an important contribution to the conservation of natural assets on cotton farms. The findings are important because they may inform future natural resource management positions.

For more information on the project, see the Revealing riparian value case study.

Case study: Revealing riparian value

Australia's inland riverine and floodplain environments are among the most variable, unpredictable and dynamic ecosystems on the planet, says cotton industry researcher Dr Sam Capon.

'There are areas of amazing natural vegetation on cotton farms, especially in their riparian zones. We found more than 200 plant species in studies in the central and northern regions of the Murray–Darling Basin. This incredible biodiversity makes riparian zones the most important part of these landscapes,' said Sam.

As a Research Fellow at Griffith University's Australian Rivers Institute, Sam undertook a riparian regeneration research project with support from CRDC. The research sought to inform best practice for managing riparian lands on farms in the northern Murray–Darling Basin's cotton-growing regions, and she says each region has specific characteristics and needs.

She believes good management of riparian lands has important benefits for the health of vegetation (particularly tall eucalypt species like the river red gums, along the river banks on cotton farms in the northern Murray–Darling Basin), and that riparian vegetation also plays a really important role in terms of its ecological function in providing habitat for animals, its effect on nutrient cycling and water filtration.

Sam's parents were teachers, and most of her earlier life was spent on Queensland's eastern seaboard, which could be considered one of the most desirable places in the country. However, these days Sam has found what she describes as the most amazing ecosystems in these riparian zones and floodplains of arid and semi-arid Australia. Her admiration for these systems began in earnest while she worked along one of the most famous rivers in Australia, Coopers Creek—infamous as the site of the death of the explorers Burke and Wills in 1861.

At 1300 kilometres, the Cooper is the second longest inland river system in Australia after the Murray–Darling system.

RUTH REDFERN

While studying for her Honours degree, Sam took her first trip west to Coopers Creek, and was surprised by how stunningly beautiful and welcoming the landscape was. She continues to be fascinated by the resilience of the floodplain landscapes and their ecology, particularly how they can cope with long periods of drought then severe flooding, and their ability to survive and regenerate.

The resilience and toughness of floodplains and their riparian zones—identifying the vulnerable elements in these systems and how best to maintain them—formed the basis of Sam's PhD study. Having been involved in community engagement, Sam had found landholders to be very aware of their environments. With this in mind and to harness this knowledge, Sam's project has documented local knowledge of riparian, floodplain and wetland vegetation change, and the major factors driving this change, among farmers of the northern Murray–Darling Basin.

As part of the project, Sam has compiled an oral history of vegetation dynamics and change across the northern Basin by recording stories of local land managers. The information will be used to prepare an oral history document for use in local communities and to inform management agencies with an interest in the region.

For more on this project, see the CottonInfo focus on NRM research fact sheet 'Riparian vegetation and land management' at www.cottoninfo.com.au/publications.

Responsible Landscape Management: Researching the connectivity between cotton farms and natural systems in the landscape.

The connectivity between cotton farms and the natural landscapes within which they operate is an area that CRDC invests in to help improve the available knowledge and science.

In 2015–16, CRDC's investment in this area included the following key projects:

- *Quantifying the uncertainty associated with predicting coal seam gas (CSG) production impacts*, with UNSW;
- *Baselining lower Namoi groundwater and evaluating Pilliga coal seam gas developments*, with UNSW; and
- *National facility for cotton climate change research,* with CSIRO.

The *Quantifying the uncertainty associated with predicting coal seam gas (CSG) production impacts* project, which concluded in 2015–16, examined the impact of CSG production in the Surat Basin on groundwater levels in the upper Condamine Alluvium and the eastern portion of the Great Artesian Basin. The research aimed to highlight any potential concerns that would impinge upon the future availability of groundwater to the irrigation sector, and benchmark the groundwater quality, major ion chemistry, and groundwater and air methane concentrations in priority areas in the Condamine Alluvium.

A combination of groundwater and degassing air samples (methane (CH4) concentration and isotopic composition, dissolved organic carbon (DOC) isotopes and tritium (3H) were collected from irrigation bores and government groundwater monitoring boreholes, while a mobile methane survey took continuous air samples in and around areas of agricultural and unconventional gas production.

The study has found that the chemistry of groundwater from irrigation bores throughout the Condamine catchment indicates that recharge to aquifer depths from which groundwater is pumped occurs only following rainfall of at least 400 millimetres per month—yet this occurs on average once every four years. Such rainfall is usually associated with extra-tropical lows in spring and autumn, and the remnants of tropical cyclones in summer. Floodwater is the primary, and in some places only, source of groundwater recharge.

For more on this project, see the CottonInfo focus on NRM research fact sheet 'Evaluating the extent of hydraulic connectivity' at www.cottoninfo.com.au/publications.

The *Baselining lower Namoi groundwater and evaluating Pilliga coal seam gas developments* project, which commenced in 2015–16, follows on from the above project.

Under the project, the research team will conduct an extensive study of groundwater conditions throughout the lower Namoi. This project aims to assess the impact of the groundwater sharing plans, provide insights into groundwater recharge pathways and the age of the groundwater being used by irrigators, map connectivity between the Great Artesian Basin and lower Namoi Alluvium, and highlight any risks associated with the expansion of the coal seam gas projects in the Pilliga region. The project is due for completion in 2017–18.

The *National facility for cotton climate change research* project recognises that the increased focus on climate change by government and media has meant that balanced research on the potential impacts of climate change on cotton production in Australia is essential. This project seeks to develop a credible capacity within the industry to investigate the impacts of climate change on cotton production, and therefore evaluate the likely effectiveness of adaptation strategies, such as varietal selection, sowing date, nutritional management, irrigation strategy, and industry expansion.

Under this project, a national facility for cotton climate change research has been co-established by CRDC and CSIRO at the Australian Cotton Research Institute at Narrabri to create new knowledge about the interactive effects of projected climate change.

Over three cotton-growing seasons, researchers are imposing fully irrigated and water-stressed treatments in both high CO_2 and temperature environments similar to those conducted in the glasshouse on individual plants in recent thesis experiments by a CRDC PhD student. Cotton growth, production (yield and quality), and resource-use efficiency (eg. water and nutrition) are being measured in detail with new in-field poly-tunnels established at ACRI maintaining elevated CO_2, temperature, and variable soil-water availability for research purposes.

For more, see the Leading the world in cotton's future climate studies case study.

Responsible Landscape Management: Supporting initiatives and partnerships to improve the knowledge and capacity to manage natural landscapes and systems in cotton regions.

CRDC also invests in initiatives and partnerships to improve the knowledge and build the capacity of growers and the wider industry in managing natural resources.

Natural resource management (NRM) extension can be challenging: although cotton growers are by their very nature stewards of the land, encouraging interest in NRM can be difficult as it does not have a direct production or profitability correlation. The impact of NRM, of ecosystem services, is not measured in terms of bales per hectare or dollars per megalitre, but rather a holistic improvement in the farm's natural environment, in carbon sequestration, in green gas emissions, and in natural pest suppression—among other benefits.

As a result, extending this critical topic area to growers, their families and the wider community remains a key priority. CRDC's investment in this area for 2015–16 included the following key projects:

- *National Cotton NRM Technical Specialist*, with Stacey Vogel Consulting; and
- *National Cotton RiverCare Champion,* with Capricorn North Pty Ltd.

The *National Cotton NRM Technical Specialist* sits with the industry's extension team, CottonInfo, and provides the technical NRM skills and knowledge required to assist industry to meet CRDC's NRM goals.

The specialist's role under this project includes supporting and demonstrating the cotton industry's best practice management of riparian lands and floodplain vegetation; implementing an innovative approach using social networks to increase the engagement of cotton growers in NRM; and leading the continuous improvement of the industry's best practice recommendations for NRM. The technical specialist is using innovative and diverse methods to reach the target audience, including the development of an app about birds on cotton farms as a form of pest control.

The *National Cotton RiverCare Champion* project, which commenced in 2015–16, is managed by the NRM technical specialist and aims to support the responsible management of riverine areas within Australia's cotton-growing regions. The project recognises that in an increasing environmentally conscious global community, the industry needs to demonstrate its good stewardship of rivers and riparian areas. As such, a cotton grower has been appointed as the Cotton RiverCare Champion to establish a long-term riparian condition-monitoring site on his cotton farm, and demonstrate to cotton growers and the general public how best management practice leads to good condition riparian areas.

For more information on the project and the RiverCare Champion, see the Zoologist-turned-cotton grower case study.

Case study: Leading the world in cotton's future climate studies

CRDC and CSIRO have jointly invested in a new climate change facility at the Australian Cotton Research Institute.

The climate change facility, established under the CRDC-funded project *National facility for cotton climate change research*, consists of dedicated in-crop chambers that modify atmospheric carbon dioxide concentration CO_2 and higher temperatures on cotton grown in the field.

A major part of this investment is supporting Katie Broughton (pictured), a postdoctoral fellow in crop physiology to undertake these experiments, a first for the cotton industry globally.

The research continues on from Katie's PhD studies, also supported by CRDC, to study the physiology and growth of cotton in elevated CO_2 and temperature scenarios.

Now in its second year, the climate change facility project has involved the construction of four chambers that control temperature and CO_2 in a field at ACRI, to replicate potential future scenarios of different CO_2 and temperature levels.

With current CO_2 air levels at around 400 parts per million (ppm), the treatment with the most 'extreme' levels is injecting 550 ppm CO_2 into the chamber, and temperature is set to between two and four degrees higher than the ambient temperature compared with the conditions in the control plots outside the chambers. With current rates of CO_2 and warming increases, it is expected that the levels replicated in the trial will be realised in around 30 to 50 years. The effects on the plants are immediately visible, due to their increased growth.

Under the project, Katie is attempting to take the experiment through to yield to ascertain whether the increased growth is translated into higher yields and to quantify the effect on fibre quality.

Previous studies have shown positive effects on yield, but Katie is particularly interested in crop water use. She believes that the larger plants could use more water early in the season, leaving less water for fruit growth: a concern if water is limited.

As a result, once the effects are determined, the researchers will look at management strategies such as irrigation and growth management in next season's trials, so as to provide key information on how to manage crops in a changing climate.

For more, see the Autumn 2016 edition of CRDC's Spotlight magazine: www.crdc.com.au/publications/spotlight-magazine.

MELANIE JENSON

Case study: Zoologist-turned-cotton grower tracks river health

A zoology degree is not a traditional qualification for a cotton grower, but for Southern QLD grower Mark Palfreyman it provides an ideal grounding for his new role as national Cotton RiverCare Champion.

The CRDC-led Cotton RiverCare Champion project aims to support the responsible management of riverine areas within Australia's cotton-growing regions.

Under the project, cotton growers and the wider cotton community can follow the progress of Mark and his family as they care for their farm and its natural environment. Mark, his wife Anne and their four children Edward, Finn, Wilson and Elsie (pictured) will be discovering what biodiversity lives on their farm, how their management decisions impact on the condition of their riverine areas, and the benefits healthy riverine areas can provide to their farming business.

Mark's passion for maintaining healthy ecosystems on his farm and keen interest in native fauna make him the ideal Cotton RiverCare Champion.

Under the program, long-term monitoring sites will be established on the Palfreyman family farm to look at water quality, the condition of native vegetation and the diversity of local fauna.

Water monitoring assessments will be conducted, and photo points established to accurately capture snapshots of riparian conditions over time. Visual and technological assessments of fauna will take place through such methods as sightings, scats, tracks, camera surveillance and burrow monitoring, and an ecologist will perform a microbat and fauna survey.

CRDC-supported CottonInfo Technical Specialist Stacey Vogel says the program provides a unique way for the cotton industry to see first-hand how on-farm best management practice leads to healthy riparian areas.

Results of the project will be shared in real time via social media, including Facebook, Twitter and YouTube.

For more information, and to access the Cotton RiverCare social media accounts, visit www.cottoninfo.com.au/cotton-rivercare.

Sustainable Futures:
Scoping and investigating critical threats and opportunities that may influence the long-term sustainability of the Australian cotton industry; Supporting innovative approaches to solve traditional industry issues and drive future sustainability.

Agricultural production, including cotton production, is becoming an increasingly complex business. Major uncertainties about global economics and international markets, shifting national policies and social values, demographic changes, competition for key resources, rapid technological change and the impact of an increasingly variable climate dominated by extreme events mean agricultural industries must continually adapt to changing circumstances.

In 2015–16, CRDC invested in the following key project to help scope and investigate critical threats and opportunities:

- *Resilience assessment of the Australian cotton industry at multiple scales,* with Bel Tempo.

CRDC commissioned the resilience assessment to better understand how to help the cotton industry best adapt to change and to identify critical threats and opportunities in order to strategically target investment and resources. The assessment is structured around three scales of cotton production: the farm, the region, and the whole of industry.

The assessment found that there are five key drivers of change acting across the Australian cotton industry: demand, policy, climate change, climate variability, and cotton price. Potential shocks, which are a sudden spike in one of these drivers, relate to climate change and variability, biosecurity, policy, price and social licence. The report identifies that industry leaders and growers need to be aware of the impact of those drivers, and of the changing nature, frequency or severity of shocks to better prepare and respond to them.

The researchers believe that these drivers and shocks have the potential to push the Australian cotton industry towards identified tipping points, or critical thresholds, which, if crossed, lead to significant changes in system dynamics.

At the farm scale, the critical thresholds identified are water quality and quantity, soil health, farm profitability, and habitat proximity. Network connectivity and function, infrastructure investment, native vegetation cover, water quantity, and land availability are critical thresholds at the regional scale. At the whole-of-industry scale, the critical thresholds are social licence, network connectivity and function, and research and development investment.

The report recommends that national R&D, regional water availability and infrastructure, farm profitability, and farm-water availability thresholds should be the highest priority for interventions from a specified resilience perspective.

The full resilience assessment is available to download from the CRDC website: www.crdc.com.au/publications.

Program 3: Customers			
Program	**Customers**		
Outcome	The Australian cotton industry captures the full value of its products.		
Measure	Double the premium for Australian cotton.		
Theme	**3.1 Assured Cotton**	**3.2 Differential Products**	**3.3 Competitive Futures**
Strategy Outcomes	The integrity and qualities of Australian cotton set global benchmarks for customers.	Customers recognise the differentiated value of Australian cotton products.	The demand for Australian cotton products is positively transformed.
Will be achieved by	3.1.1 Improving Australian fibre quality testing standards and procedures and the capacity to measure and manage contamination. 3.1.2 Supporting the development and implementation of post-farmgate BMPs. 3.1.3 Developing and implementing a standardised reporting system for Australian cotton product quality and traceability. 3.1.4 Benchmarking Australian cotton against key international programs for product stewardship and sustainability.	3.2.1 Identifying opportunities for improvements in fibre quality and cotton products. 3.2.2 Demonstrating the value of different fibre classes and defining fibre quality parameters that secure a premium market. 3.2.3 Developing customer-based partnerships for the development of higher value and novel products, which differentiate Australian cotton.	3.3.1 Investigating existing and future markets for Australian cotton and communicating these findings to the Australian cotton industry. 3.3.2 Facilitating the development of new technologies and systems to improve the competitiveness of Australian cotton.
Measure of success	Customers have confidence in the integrity of Australian cotton: ▪ Australia has the best ranking for non-contamination in the International Textile Manufacturers Federation (ITMF) survey. ▪ Customers recognise and use Australia's BMP standards as their guarantee of quality assurance. ▪ Australia uses standardised reporting systems for product quality and traceability for farmers, industry and customers. ▪ Australia can respond to customer needs for reporting sustainability indicators.	Customers value the qualities of Australian cotton: ▪ New fibre classification systems established. ▪ Partnerships established to demonstrate the potential for differentiating Australian cotton.	Customers continue to demand Australian cotton products: ▪ Provide the Australian cotton industry with knowledge of fabric innovations and future market opportunities. ▪ Develop alternative and high-value cotton products.

Key program investments

This section provides a snapshot of some of CRDC's investments during 2015–16 in this program area. The full list of CRDC's investments for this period can be found at Appendix 4: the RD&E portfolio.

Assured Cotton:
Improving Australian fibre quality testing standards and procedures and the capacity to measure and manage contamination;
Benchmarking Australian cotton against key international programs for product stewardship and sustainability.

CRDC's investment in this area aims to ensure that Australia maintains its global reputation for high-quality cotton, so as to help the industry capture the full value of its products. Programs that help to maintain and improve Australian cotton's fibre quality, and demonstrate the sustainability, transparency and traceability of the Australian cotton industry, are part of this investment program.

In 2015–16, CRDC continued its support of assured cotton through key projects, including:

- *Determining the shelf life of round modules and impact on cotton quality*, with CSIRO; and
- *A review of emission methodologies for the Australian cotton industry and development of a detailed study for north west NSW,* with NSW DPI.

The *Determining the shelf life of round modules and impact on cotton quality* project aims to address fibre quality issues in round modules that could be caused by the storage duration and conditions prior to ginning. There is a concern that the plastic wrap on round modules can create favourable conditions for microbial degradation of the cotton (as a result of solar radiation, the impermeable wrapper, and when the moisture content of the cotton is too high), which can weaken the fibre and cause fibre quality deterioration, resulting in price discounts and yield loss for growers.

As a result, this project aims to establish the threshold of conditions that can cause damage, and propose potential solutions and risk-management guidelines for eliminating and reducing fibre damage during round module storage. Findings of the project to date indicate that the orientation of the module during storage can influence its temperature and moisture levels, and that covering modules with a tarpaulin can significantly reduce temperature and relative humidity fluctuations. The project is due for completion in 2016–17.

The *Review of emission methodologies for the Australian cotton industry and development of a detailed study for north west NSW* project, which concluded in 2015–16, aimed to use a life-cycle assessment to produce a clear picture of the greenhouse gas (GHG) emissions profile for a representative cotton production system in North West NSW.

The project also aimed to identify the most plausible set of emission-reduction opportunities; create a platform to routinely test emission mitigation options or the consequences of new productivity-based technologies; and undertake a sensitivity analysis to check whether the case study region was representative of other regions.

The project found that 1 tonne of cotton lint at port had a carbon dioxide equivalent (CO_2e) of 1601 kg. The impact of the pre-farm, on-farm and post-farm stages were 407kg CO_2e; 775 CO_2e; and 419 CO_2e respectively. The GHG emission profile of the representative cotton production system indicated that approximately 45 per cent of the total GHG emission was related to the production of nitrogen (N) fertiliser (17 per cent), and the use of fertiliser (28 per cent). The processes of drying seed cotton at the gin, and the ginning process itself, contributed 12 per cent and 9 per cent respectively. Among farming practices, diesel used in farm machinery, and electricity and diesel used in irrigation pumps contributed 8 per cent and 7 per cent of the total GHG emissions.

Six emission-reduction options were developed by the researchers: optimum N application rate; controlled-release and stabilised N fertilisers; solar-powered irrigation pumps; biofuel-powered machinery; legume crops; and fertigation. Once released, the final report will be available from CRDC's online library at Inside Cotton: www.insidecotton.com.

Differentiated Products:
Identifying opportunities for improvements in fibre quality and cotton products;
Demonstrating the value of different fibre classes and defining fibre quality parameters that secure a premium market;
Developing customer-based partnerships for the development of higher value and novel products, which differentiate Australian cotton.

Australian cotton growers are competing in a complex global market, with challenges coming from both within the global cotton industry (with Australian growers competing against subsidised overseas growers) and the wider global textile industry (where cotton's market share is diminishing against the ever-growing man-made fibre industry).

As a result, investments in this area look to fully exploit current advantages of Australian cotton, while also opening up other opportunities for Australian cotton to be differentiated on the world market.

In 2015–16, CRDC continued its support of the differentiated products theme through key projects, including:

- *Ever-dry self-cooling cotton fabrics*, with Deakin University;
- *Novel spinning technologies for fine and high-quality Australian cotton yarns,* with Deakin University; and
- *Smart cotton/cotton fabrics for electromagnetic interference shielding,* with Deakin University.

The *Ever-dry self-cooling cotton fabrics* project, which concluded in December 2015, successfully developed a new coating technique that gives cotton fabrics added functionality: the ability to regulate moisture, breathability and surface temperature.

Under the project, the research team developed a technique to give single-layer cotton fabrics 'ever-dry' and 'self-cooling' properties, which eliminate the wet and clinging feeling of cotton on the skin and ensure that the fabrics maintain their permeability, even at an over-saturated state. This technique has the potential to considerably increase the use of cotton in the next generation of sportswear, summer clothing, defence force uniforms, work wear and functional fabric products for healthcare.

With the project now complete, CRDC is working with the research team on the development of a commercialisation plan for the technology.

The *Novel spinning technologies for fine and high-quality Australian cotton yarns* project is exploring novel spinning technologies to improve the overall quality of yarn made from long-staple Australian cotton. It focuses on ways of making cotton yarns less hairy and more abrasion resistant, to reduce the cost of yarn sizing and improve weaving efficiency. The project aims to increase the demand for Australian cotton and the subsequent premiums offered to growers.

The research undertaken to date has had promising results, with further testing of techniques underway. The project is due for completion in 2016–17.

The *Smart cotton/carbon fabrics for electromagnetic interference shielding* project aims to create a novel type of electromagnetic interference (EMI) shielding cotton fabric that provides protection against electromagnetic radiation, with the additional value of enhanced comfort.

EMI is the name given to unwanted radiated signals that cause unacceptable degradation of systems and equipment and that can impact on human health. Exposure to electromagnetic waves is believed to have effects on immune function and neurological behaviour. As such, researchers and industrial companies have a keen interest in providing solutions to overcome the EMI problem by using advanced textile technology.

The project will use a wrap-spun yarn technique to create new cotton EMI shielding fabrics with carbon fibres as the conductive filament. The lightweight, flexible cotton/carbon technical textiles created with high EMI shielding effectiveness will be ideal for human protection and comfort. Such textiles will have the feel of normal cotton textiles, with the added advantage of providing effective EMI shielding. The project is due for completion in 2017–18. For more on this project, see the Cottoning on to smart fabrics case study.

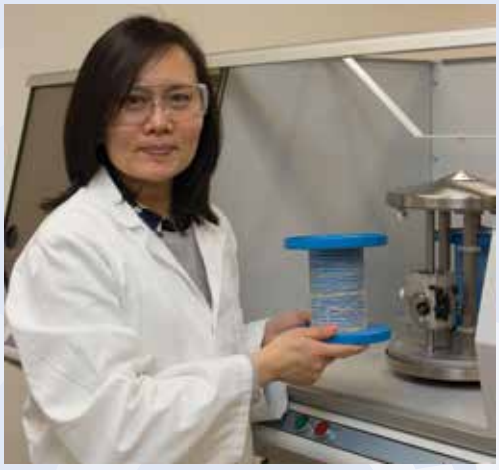
Case study: Cottoning on to smart fabrics

With developments in computer technology and interactive devices advancing at a breathtaking pace, CRDC is working to position cotton at the forefront of 'smart fabric' innovation.

Interactive electronic functionality is set to invade every aspect of our lives, including our wardrobe. Indeed, international research is already underway into shirt pockets that can charge your phone, and the integration of touch screen-style controls in denim jeans.

Unfortunately, the unwanted electromagnetic interference (EMI) emitted from electronic and digital devices, and from cables carrying high-volume electric currents, is an ever-increasing hazard of modern life. Headaches, anxiety, and compromised immune function have all been reported as symptoms associated with the constant bombardment of the human body from electromagnetic signals.

There is now a growing market for 'functional' textiles and clothing capable of shielding against harmful electromagnetic radiation. Tapping into this demand, CRDC has launched the Smart cotton/carbon fabrics for electromagnetic interference shielding project to develop a cloth, incorporating cotton fibres, that can protect the wearer against electromagnetic emissions, while also being light weight and comfortable.



Leading the Smart Cotton project is Dr Jin Zhang (pictured), a researcher at Deakin University in Geelong, Victoria, with extensive experience in working with composites and natural fibres for use in automotive and aerospace industries. According to Jin, some manufacturers are already making composite cloths with electromagnetic shielding properties, but they've tended to use heavy-metal fibres. She is working on a fabric that combines lightweight carbon fibres with high-quality, long-staple Australian cotton to create a far higher level of comfort for the wearer.

The electrostatic discharge, electromagnetic protection and radio frequency interference protection qualities of carbon fibre, combined with the hypoallergenic, excellent moisture control and comfort characteristics of Australian cotton, will give rise to a new type of shielding fabric.

The Smart Cotton project is targeting the development of a range of 'electronically functional' products, such as internal pocket liners designed to protect the wearer against mobile phone radiation. They're also researching 'next to skin' clothing for the maternity market, such as an apron expectant mothers could wear under their clothing to shield their unborn child from the radiation emitted by electronic devices.

Lightweight composite cotton-shielding fabrics could be used in everything from anti-radiation pyjamas and bedding, to curtains, ground sheets and tents.

According to CRDC R&D Manager, Allan Williams, this research project will undoubtedly add value to Australian cotton, given the scope for innovation in the rapidly evolving 'smart fabric' field. A report by the Global Industry Analysts (GIA) forecasts the global market for EMI shielding materials and technologies will reach US$7.9 billion by 2020 in a booming worldwide electronics industry.

For more, see the Spring 2015 edition of CRDC's Spotlight magazine: www.crdc.com.au/publications/spotlight-magazine.

Competitive Futures:
Investigating existing and future markets for Australian cotton and communicating these findings to the Australian cotton industry; Facilitating the development of new technologies and systems to improve the competitiveness of Australian cotton.

Continued innovation is necessary to maintain the competitiveness of Australian cotton in traditional markets, and to open up new market opportunities. Investments in this area, under the CRDC Cotton Futures banner, are designed to transform the way in which consumers demand Australian cotton products, in order to continue to ensure cotton's competitiveness.

In 2015–16, CRDC's support for the Competitive futures theme took place through key projects, including:

- *Cotton rapid customisation feasibility study,* with QUT; and
- *Regenerated cotton to carbon fibre*, with CSIRO.

The *Cotton rapid customisation feasibility study* project, which concluded in March 2016, aimed to assess the technical and economic feasibility of using cotton-derived materials as a feedstock in rapid customisation processes. Rapid customisation is a way of creating physical products directly from digital design files through computer-controlled manufacturing, the best known of which is 3D printing. It is likely to allow new forms of manufacturing, including novel combinations of materials, which have not been possible or economically feasible to achieve previously.

A particular focus of this project was to identify application areas within the broad range of rapid customisations where cotton has a clear advantage due to its inherent material qualities. Rapid customisation encompasses many different possible approaches, techniques and technologies. There are many possible ways to process cotton as a feedstock and there are diverse possibilities for end-user applications.

The emphasis of the project was on mapping out the potential approaches and assessing their feasibility with the goal to identify the most promising areas for further targeted research. The project found five areas for future research:

- on-site fabrication of cotton-based filtration products;
- on-demand manufacture of bespoke furniture using cotton-derived feedstocks and rapid customisation;
- next-generation lifestyle garments and accessories that used cotton-derived material, smart sensing material and rapid customisation;
- 3D printing of children's toys using cotton-derived feedstocks; and
- patient-specific smart wound dressings using cotton-derived cellulose and rapid customisation.

The *Regenerated cotton to carbon fibre* project, which concluded in June 2016, was a feasibility study focusing on the potential for virgin cotton (eg. cotton slivers) and/or regenerated cotton fibre to be used as an alternate feedstock in carbon fibre production. Carbon fibres are becoming essential in the fabrication of composites, and they find many uses in the creation of advanced lightweight high-strength structures for defence, aerospace, automotive and sports industries.

One of the major issues in carbon fibre fabrication is that the precursor materials such as polyacrylonitrile (PAN) are expensive. While cotton's relative purity makes it easier to work with as a potential carbon fibre feedstock, a limitation on its use as a precursor material is that the theoretical carbon yield is in the mid 40 per cent by weight range, compared to over 50 per cent for PAN. CSIRO is therefore investigating whether the use of novel ionic liquids to dissolve cotton cellulose can increase the carbon percentage for use as a carbon fibre precursor.

Program 4: People			
Program	**People**		
Outcome	Capable and connected people driving the cotton industry.		
Theme	**4.1 Workforce Capacity**	**4.2 Networks**	**4.3 Communications**
Strategy Outcomes	A skilled, educated and progressive industry workforce.	An industry connected by dynamic networks.	Stakeholder information needs are met.
Will be achieved by	4.1.1 Investigating effective strategies for attracting, developing and retaining people in the cotton industry. 4.1.2 Supporting initiatives which lead to the continuous improvement of human resource management, including on-farm Workplace Health and Safety. 4.1.3 Understanding opportunities for greater Aboriginal participation in cotton and partnering with organisations to support the development of a culturally aware cotton workforce. 4.1.4 Supporting educational opportunities which increase the skills and knowledge of current workforces and will meet the needs of future workforces. 4.1.5 Creating opportunities for, and supporting the development of, leadership skills.	4.2.1 Establishing and empowering creative forums and initiatives which build relationships. 4.2.2 Supporting and participating in collaborative cross-sectoral RD&E initiatives. 4.2.3 Creating and facilitating opportunities for national and international RD&E exchange. 4.2.4 Facilitating engagement with stakeholders for prioritising and capturing advice on RD&E issues. 4.2.5 Honing research expertise and the application of science from core research disciplines.	4.3.1 Providing information for demand-driven communication strategies and performance reporting. 4.3.2 Applying innovative communication methods.

Program 4: People			
Measure of success	Opportunities for learning are demanded by industry: ▪ A 10-fold increase in school visits to promote careers in cotton by 2018. ▪ A student gap year internship program. ▪ 50 Horizon students by 2018. ▪ 30 completed summer scholarships by 2018. ▪ 300 students having completed the UNE Cotton Course by 2018. Opportunities for workforce development are demanded by industry. ▪ 60 ginners trained. ▪ 25 industry representatives having completed the Field to Fabric Course. ▪ 50 cotton farmers awarded a new Diploma in Human Resources by 2018. ▪ A 10 per cent reduction in cotton farm-related injuries by 2018. ▪ On-farm skill development. ▪ Participation in leadership programs.	People and industry are connected through effective networks: ▪ 10 conferences and forums are coordinated which promote industry, cross-sectoral and community knowledge sharing. ▪ CRDC is an active member of key industry and government initiatives. ▪ Primary Industry Standing Committee (PISC) cotton and cross-sectoral RD&E strategies. ▪ 50 travel scholarships are supported. ▪ The cotton industry has effective collaborative structures for prioritising RD&E.	People have ready access to industry information: ▪ Communication systems for all CRDC stakeholders are meeting their communication needs. ▪ The information and services derived from CRDC investments are in demand and the technologies are adopted.

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Key program investments

This section provides a snapshot of some of CRDC's investments during 2015–16 in this program area. The full list of CRDC's investments for this period can be found at Appendix 4: the RD&E portfolio.

Workforce Capacity: Investigating effective strategies for attracting, developing and retaining people in the cotton Industry.

People are the cotton industry's most important resource, and ensuring the industry continues to have a network of capable and connected people is a key priority. CRDC's investments in this area aim to provide critical supporting information for the industry, helping to inform the industry's wider workforce development strategy.

In 2015–16, CRDC continued its investment into workforce development through a number of key projects:

- *PhD: Career motivational factors of cotton growers (attraction and retention)*, with USQ;
- *PhD: Investigating cotton farm workers' experiences of job satisfaction using social cognitive career theory,* with USQ;
- *PhD: Skills profile and labour supply structure on cotton farms*, with UNE;
- *The impact of farm workforce turnover in the cotton sector*, with the University of Melbourne; and
- *Workforce Development Strategy,* with Cotton Australia and Agrifood Skills Solutions.

The *Career motivational factors of cotton growers (attraction and retention)* PhD project looks at the psychological drivers and characteristics that impact on cotton grower motivation and work/life satisfaction. Previous research into the psychology of farming was conducted in the 1970s, but despite the cotton-growing profession changing markedly over the past four decades with the advancement of technology, there have been no major advances in this research. This research project aims to fill this gap, and will look at such factors as risk tolerance, optimism and entrepreneurship in cotton growers, and how the motivations of growers impacts on their attraction and retention strategies. The project is due for completion in 2016–17.

The *Investigating cotton farm workers' experiences of job satisfaction using social cognitive career theory* PhD project aims to identify the key personal motivational factors that attract and retain farm employees of the cotton industry. The knowledge generated from this research project may be used to guide future cotton policy, inform employers' decision making, and underpin the production of educational resources for attracting new employees into the cotton industry. The project will conclude in 2016–17.

The *Skills profile and labour supply structure on cotton farms* project is investigating the workforce needs of cotton farms and comparing them with supply sources and structures to assess the effectiveness of employee-retention practices. The project is developing an inventory of current and future labour needs, to identify the gaps and to outline the strategies to address these needs for the industry. The project is due for completion in 2017–18.

The impact of farm workforce turnover in the cotton sector project, which concluded in 2015–16, aimed to establish meaningful measures of turnover that could be used to assess changes in human resource management performance, and track progress over time; examine the real costs and impacts of staff turnover on a sample of cotton farms; identify the practices most strongly linked to low turnover; and explore the relationship between turnover performance and farm profit.

The project found that while workforce turnover was likely to increase costs and reduce profit, it was difficult to identify the impact on whole farm profitability. Workforce strategies deployed were linked to the remoteness and isolation of farms, the location of farms, and the farms' water security, which included the influence of climate and weather. Three different workforce structures were found: core contract; core casuals (skilled) and core casuals (inexperienced). Growers' 'worldviews' around people management fell into three categories: a focus on efficiency; a focus on looking

after people; and a focus on getting the best people, which resulted in differing management practices relating to turnover.

This project provided valuable information on the impact of farm turnover and best management practices for human resource management, and fed into the development of the Workforce Development Strategy.

The *Workforce Development Strategy* project, which concluded in 2015–16, was a collaboration between CRDC and Cotton Australia, with the assistance of Agrifood Skills Solutions (AFSS)—part of Agrifood Skills Australia, the key body on skills and workforce development for the Australian agrifood industry and regional Australia. The cotton industry workforce development strategy is focused on delivering workforce outcomes for growers on-farm, and ultimately, will ensure that the cotton industry is able to attract, retain and develop people who will drive industry competitiveness. The strategy provides a shared and focused plan to ensure the cotton industry's organisations investments in workforce target key priorities are well coordinated and deliver maximum outcomes. The strategy is available to download from the CRDC website: www.crdc.com.au/publications.

Workforce Capacity:
Supporting initiatives which lead to the continuous improvement of human resource management, including on-farm Workplace Health and Safety.

Health and safety continues to be a major concern for cotton growers and cotton industry employers. The goal for the industry is to reduce cotton farm-related injuries by 10 per cent by 2018. CRDC contributes to the achievement of this industry goal by investing in on-farm safety, and monitoring and evaluation projects.

In 2015–16, CRDC continued its investment into workplace health and safety through two key projects:

- *Primary Industries Health and Safety*, a joint partnership with RIRDC; and
- *Smart technology for best practice work health and safety by cotton growers*, with the University of Sydney.

The ongoing *Primary Industries Health and Safety* project aims to improve the health and safety of farm workers and their families. A jointly funded project involving six of the Rural Research and Development Corporations (RDCs), it undertakes RD&E activities to improve the physical and mental health of farmers and the safety of the farm work environment.

The project targets its health and safety information at business owners, managers and employees involved with farming, including cotton growers, as well as health professionals and researchers in the field of rural health and safety.

The *Smart technology for best practice work health and safety by cotton growers* project, which concluded in 2015–16, supported the development of two sets of communications materials specifically for cotton industry Work Health and Safety (WHS)—YouTube videos to provide best practice hazard control for the common scenarios and risks that are known on cotton farms; and a mobile website and app for cotton-specific worker induction. The induction platform allows growers to induct any number of workers simultaneously, simplifying the induction and resulting record-keeping process.

Workforce Capacity:
Supporting educational opportunities which increase the skills and knowledge of current workforces and will meet the needs of future workforces.

The cotton industry recognises the need for passionate, skilled and innovative people to shape its future in a rapidly changing and growing world. To ensure the industry is able to attract talented young people, CRDC continues to invest in a number of initiatives focused on developing students at the school, undergraduate and postgraduate levels.

In 2015–16, CRDC continued its investment into educational opportunities for current and future workforces through a number of key projects:

- *Aboriginal Employment Strategy student scholarships*, with the Aboriginal Employment Strategy;
- *Cotton industry young professionals* program, with USQ;
- *Cotton Production Course*, with UNE;
- *CRDC Summer and Honours Scholarships* program, funded by CRDC;
- *CRDC PhD Scholarship* program, funded by CRDC;
- *Developing education capacity in the Australian cotton industry* project (CottonInfo technical specialist), with CSIRO;
- *Horizon Scholarship* program, with RIRDC; and
- *Primary Industries Education Foundation*, co-funded with Cotton Australia.

The ongoing *Aboriginal Employment Strategy* program, supported by CRDC and the Aboriginal Employment Strategy, is a school-based traineeship for Indigenous students. Running for 12 years, the program provides an opportunity for local Indigenous students enrolled in Years 11 and 12 at Wee Waa and Narrabri High Schools to gain paid work experience, a nationally recognised qualification, credit towards their Higher School Certificate and exposure to the different career opportunities available in the cotton industry. The program increases the skills, experience and capacity of the young Indigenous students; exposes them to range of vocations available through the cotton industry; presents a possible source of future employment; and breaks down the barriers between non-Indigenous employees and Indigenous students. In 2015–16, CRDC supported two students through this program.

The *Cotton industry young professionals* project, which concluded in 2015–16, included CRDC support for the work of the Primary Industry Centre for Science Education (PICSE) in engaging students in science and agriculture, and the young professionals program, which placed university students into internships within the agribusiness sector of the cotton industry.

The initiatives aimed to help build awareness of the career opportunities available for young professionals in science, agriculture and cotton; to develop the on-the-job skills of university students prior to the completion of their degrees; and to establish relationships between cotton industry employers and potential future employees. The project achieved strong interaction with high school and undergraduate students, with over 1000 students participating in the science and engineering investigation awards, and testimonials from university students providing evidence of a renewed engagement with agriculture.

The ongoing *Cotton Production Course* provides a tertiary-level course on cotton production for those interested in, and working in, cotton. It also provides the wider benefit of mentoring prospective industry researchers and conducting applied systems research. The number of students participating in the course continues to increase, with 76 students enrolled in 2015–16.

The *CRDC Summer and Honours Scholarships* are available to university students completing the senior years of an undergraduate degree or enrolled in an honours program. The scholarships provide them with the opportunity to work on real research, extension or industry projects in a working environment as part of their professional development. In 2015–16, CRDC supported 13 summer/honours scholarships for students to work with existing researchers or research organisations.

The *CRDC PhD Scholarship* program funds researchers undertaking their PhDs. In 2015–16, CRDC helped fund 18 new or ongoing PhD scholars across all five of the CRDC's program areas.

The ongoing *Developing education capacity in the Australian cotton industry* project provides a full-time education officer, who implements a range of activities and programs in schools to boost knowledge of the industry and its varied career options. The office is based at the Australian Cotton Research Institute and forms part of the industry's extension program, CottonInfo.

The ongoing *Horizon Scholarship* program is an initiative of RIRDC that, in partnership with other RDCs and industry sponsors, supports undergraduates studying agriculture at university by providing a bursary, professional development workshop and work experience. In 2015–16, CRDC supported three new Horizon Scholarships for undergraduate students: Scott Nevison and Camilla a'Beckett (2015) and Sam Knight (2016). Overall, CRDC has supported 15 Horizon scholars throughout the 2015–16 year.

The *Primary Industries Education Foundation* is focused on encouraging primary industries education in schools, through providing national leadership and coordination of activities; resources for students and teachers; and encouraging interest in primary industry careers. CRDC and Cotton Australia jointly contribute to the Foundation on behalf of the cotton industry.

Workforce Capacity: Creating opportunities for, and supporting the development of, leadership skills

The cotton industry, like many other industries, is facing a period of change and uncertainty. Faced with variability in climate, competition for skilled labour, changes in land use and access to water, the industry requires a network of informed and experienced leaders that can work together to develop resilient and sustainable farming systems and communities.

In 2015–16, CRDC continued its investment into leadership through a number of key projects:

- *Cotton industry leadership development strategy*, with the Australian Rural Leadership Foundation;
- *Nuffield Farming Scholarships program*, with Nuffield Australia;
- *Peter Cullen Trust: Science to Policy Leadership Program*, with the Peter Cullen Trust; and
- *Science and Innovation Award for Young People in Agriculture*, with ABARES and the Department of Agriculture and Water Resources.

The *Cotton industry leadership development strategy* includes funding of the Australian Rural Leadership Program, which is focused on producing a network of informed, capable and ethical leaders who can work collaboratively to advance the interests of their industries, communities and rural Australia. In 2015–16, CRDC co-sponsored two participants with Auscott and Cotton Australia: cotton consultant Jamie Iker and farm manager Sean Boland.

The *Nuffield Farming Scholarships program* is the leading agricultural study program for primary producers in Australia. It provides farmers with the opportunity to pursue an area of agricultural-related study overseas, to the benefit of both the individual grower and their wider industry. In 2015–16, CRDC continued its support for two cotton growers undertaking the Nuffield Scholarship program: Matthew McVeigh and Thomas Quigley.

The *Peter Cullen Trust: Science to Policy Leadership Program* aims to enhance the role of science in policy development and bring about positive change in water and catchment management in Australia. It is intended to build the leadership and communication skills of people actively involved in water systems management—be it river or catchment, rural water or environmental science or policy. In 2015–16, CRDC supported one participant in the program: irrigator Adam Harris.

The *Science and Innovation Award for Young People in Agriculture* program recognises big ideas from young rural innovators who contribute to the success of Australia's agricultural industries. For CRDC, the awards provide an opportunity to help develop the technical and leadership skills of young cotton researchers, and reward them for their commitment to innovation. The 2016 recipient of the CRDC-supported cotton Science and Innovation Award is Yvonne Chang.

Case study: Top of the cotton crop—new CRDC-supported Horizon scholar

Ten young Australians with a love of agriculture and the capacity to be future leaders have each been awarded the RIRDC Horizon Scholarship for 2016, including one CRDC-funded scholar, Sam Knight.

The Horizon Scholarship program was developed to help address the shortage of trained professionals entering primary industries and to promote the diverse career pathways that agriculture offers.

Horizon Scholarships are open to students entering their first year of university and studying a degree related to agriculture, such as agricultural science or agribusiness.

Sam Knight (pictured) is from a family cotton farm at Wee Waa, and is studying a Bachelor of Agriculture and Business at UNE. After getting more involved on the farm during high school, he discovered a passion for cotton, which has set his career path. Sam aims to not just make an impact on his own farm, but more broadly on the industry.

He particularly wants to get involved with research and development and trials. Sam believes that through research, cotton growers can continue to increase yield and profit while reducing costs and not degrading the land.

The Horizon Scholarship provides $5000 per year for the duration of the scholar's university degree. It also offers students annual industry work placements that give them first-hand exposure to agriculture, access to industry leaders, professional development workshops and opportunities to network and gain knowledge at a range of industry events.

Scholarship recipients are selected on the basis of their commitment to a career in agriculture, as well as their leadership potential and high school academic record.

CRDC remains a strong supporter of the Horizon program, recognising that people are cotton's most valuable resource. In the 2015–16 year, CRDC supported a total of 15 Horizon scholars under RIRDC Horizon Scholarship projects.

For more on the RIRDC Horizon Scholarship, visit: www.rirdc.gov.au/research-programs/rural-people-issues/horizon-scholarship.

Case study: Award for cotton's young science innovator

Yvonne Chang, a cotton research assistant with CSIRO in Narrabri, was awarded an ABARES Science and Innovation Award by the Minister for Agriculture and Water Resources in Canberra in March 2016.

Yvonne (pictured) was selected as the recipient of the award, which is proudly supported by CRDC under the 2016 ABARES *Science and Innovation Awards for Young People* project, for her novel approach to the issue of soil organic carbon. Yvonne's project will look at the use of melanised root-associated fungi to increase long-lived soil organic carbon.

As part of the Award, Yvonne will receive a grant of $22,000 to undertake this research project, which looks at three things: improving the soil; increasing cotton yields; and reducing the impact of greenhouse gases.

Yvonne will use the grant to undertake a glasshouse or field project to examine the effect of the fungi on soil organic carbon under irrigated cotton. If the result is a significant increase in soil organic carbon, then this could help to address the long-standing issue of declining carbon in soil, and as a result, enable increased production and sustainability for cotton growers.

Yvonne, who grew up in Sydney and studied science at the University of Sydney, says her career in the fields of plant ecology and plant-soil microbe interactions was driven by an interest in understanding how living systems function.

CRDC Executive Director Bruce Finney believes Yvonne's research project has the potential to make a real, tangible contribution to the field of cotton research, and help growers improve their productivity and sustainability.

CRDC continues to be a strong supporter of the ABARES Science and Innovation Awards as a pathway to developing future research leaders, such as Yvonne.

For more on the ABARES Science and Innovation Awards, visit: www.agriculture.gov.au/abares/conferences-events/scienceawards.

MELANIE JENSON

Networks:
Establishing and empowering creative forums and initiatives which build relationships;
Creating and facilitating opportunities for national and international RD&E exchange.

The cotton industry is well known for its collaborative and inclusive nature, and CRDC's investment in this area is designed to ensure the industry continues to stay connected via dynamic networks.

In 2015–16, CRDC continued its investment into networks through a number of key projects:

- *CRDC Grassroots Grants* program, funded by CRDC;
- *Sponsorship of the Association of Australian Cotton Scientists 2015 Conference;*
- *Sponsorship of the 17th and 18th Australian Cotton Conferences*, with Cotton Australia; and
- *Travel and scientific exchange: World Cotton Research Conference, Brazil,* co-funded by CRDC and the Association of Australian Cotton Scientists.

CRDC's *Grassroots Grants* program encourages Cotton Grower Associations to apply for funding to support capacity-building projects in their region. Up to $10,000 in funding is available for CGAs to help fund a project aimed at increasing the engagement of growers in the industry, solving specific regional issues and improving their skills, knowledge base and networks. Since the Grassroots Grants program commenced in 2011, it has supported 44 projects across the cotton-growing valleys, including 11 projects in 2015–16.

CRDC's *Sponsorship of the Association of Australian Cotton Scientists 2015 Conference* provided an opportunity to showcase CRDC's investments in RD&E to the research community, and to assist the community to further develop their relationships. 200 cotton researchers and scientists attended the Conference in September 2015, with over 130 research presentations on the agenda, covering the research fields of plants, soils and systems, cotton breeding, weeds, entomology, energy, carbon and climate, nutrition, NRM, pathology, irrigation, fibre and processing, and social science.

CRDC's *Sponsorship of the 17th and 18th Australian Cotton Conferences* provide a platform to showcase the Australian cotton industry and enhance the outputs of CRDC-funded R&D and extension activities to the industry at large. The August 2014 conference saw the largest gathering of industry participants since the event commenced, with some 1800 registered attendees, including 600 cotton growers representing every cotton-growing region. The 2016 conference is expected to attract 1600 attendees, with the agenda featuring CRDC-supported research projects.

The *Travel and scientific exchange: World Cotton Research Conference, Brazil* project involved CRDC and the Association of Australian Cotton Scientists partnering to ensure Australian cotton research was well represented at the conference. Together, the two organisations supported 14 Australian cotton researchers to attend the conference, encouraging international research collaboration and showcasing Australian cotton research on the world stage. CRDC representatives were among the Australian delegation, with CRDC director and grower Cleave Rogan, General Manager of R&D Dr Ian Taylor and R&D Manager Susan Maas also attending.

Communication:
Providing information for demand-driven communication strategies and performance reporting;
Applying innovative communication methods.

CRDC's investment in the area of communication aims to ensure that stakeholders' information needs are met. In 2015–16, CRDC continued its investment into communication through two key projects:

- *Australian cotton production and best practice documentaries,* with QDAF; and
- *Stimulating private-sector extension in Australian agriculture to increase returns from R&D,* with Dairy Australia.

Case study: Industry support creates careers

Dr Sharna Holman recently began work as the CRDC-supported CottonInfo Technical Specialist for diseases, volunteers and ratoons and QDAF Development Extension Officer, based in Emerald.

The University of Sydney Honours graduate says it was exposure to the cotton industry while studying that attracted her to a world she'd barely heard of.

Recently completing a Bachelor of Science in Agriculture, Sharna says she was fortunate to receive a scholarship to attend the Australian Cotton Conference in 2014, which sparked her love of the industry.

The same year through a CRDC Summer Scholarship, Sharna (pictured) furthered her involvement with the industry by researching her honours project on Bt tolerance in Helicoverpa with Dr Mary Whitehouse and Dr Sharon Downes at the Australian Cotton Research Institute near Narrabri.

A PICSE cotton internship from CRDC followed, giving Sharna the chance to complete work placements with different researchers and commercial cotton industry organisations. She says that without these opportunities, she may never have thought of the cotton industry as a career.

For now, Sharna's role is communicating research to growers, but there are plans for further study, with a PhD in either agronomy or entomology. She would like her PhD to be research that growers can put straight into action on their farms, and believes her current role gives her a good grounding for that.

Sharna believes some of the most important challenges faced in the future are related to agriculture, such as improving and finding new ways to feed and clothe a growing population with limited resources.

She says she is continuously amazed by the innovative and inclusive nature of the Australian cotton industry, where all parts of the industry work together to improve practices to become more efficient and profitable.

For more information on CRDC's scholarships, including Summer and Honours Scholarships, visit: www.crdc.com.au.

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The ongoing *Australian cotton production and best practice documentaries* project aims to communicate scientifically based crop production, protection and best practice principles to a diverse audience through a series of short, easily accessible videos. To date, 85 short videos have been produced, ranging from pre-season planter maintenance and planting tips through to overcoming challenges for new growers in the southern districts. The videos have collectively received 15,000 views. They are accessible via the CottonInfo YouTube channel: www.youtube.com/CottonInfoAust.

The *Stimulating private-sector extension in Australian agriculture to increase returns from R&D* project recognises the opportunity for the private sector to play a greater role in extending existing and future research outcomes to growers. As such, it aims to increase the capacity of commercial and private-sector extension services in delivering R&D outputs on-farm. The project is due for completion in 2017–18.

Program 5: Performance			
Program	**Performance**		
Outcome	Measured performance of the Australian cotton industry and its RD&E drives continuous improvement.		
Theme	**5.1 Best Practice**	**5.2 Monitoring and Evaluation**	**5.3 Reviews**
Strategy Outcomes	World's best practice underpins the performance of the cotton industry.	Industry and RD&E performance is captured.	Continuous improvement in industry and RD&E performance.
Will be achieved by	5.1.1 Supporting a best practice framework as the primary integrated planning, risk management, benchmarking, knowledge development and delivery system. 5.1.2 Promoting best practices through the development and delivery Joint Venture.	5.2.1 Developing and implementing an internal M&E framework for evaluating CRDC's investment portfolio balance and its RD&E performance. 5.2.2 Conducting annual industry surveys to capture practice change. 5.2.3 Establishing a framework through which industry performance can be nationally and internationally reported.	5.3.1 Undertaking scientific discipline reviews of the industry's RD&E. 5.3.2 Commissioning and participating in independent reviews of CRDC's RD&E and organisational performance. 5.3.3 Commissioning independent reviews of the social, environmental and economic performance of the industry. 5.3.4 Participating in cross-sectoral RD&E impact evaluations and reviews.
Measure of success	Industry is able to demonstrate best practice: ▪ The cotton industry's *my*BMP program is the primary resource for farmers accessing best practice knowledge and tools. ▪ The cotton industry's *my*BMP program is nationally recognised and integrated with other agricultural sector best management practice programs. ▪ An 80 per cent coverage of Best Management Practice systems across the Australian cotton industry.	Industry and CRDC are able to capture and demonstrate performance: ▪ A rigorous monitoring and evaluation platform which measures and reports on the performance of CRDC's research and development investments. ▪ An industry performance monitoring and evaluation framework that is consistent with national and international standards. ▪ Providing the industry with cotton sustainability indicators and supporting its capacity to report against these indicators.	Industry and CRDC are able to continually review and improve performance: ▪ Independent reviews of the social, environmental and economic performance of the industry's performance. ▪ Independent reviews.

Key program investments

This section provides a snapshot of some of CRDC's investments during 2015–16 in this program area. The full list of CRDC's investments for this period can be found at Appendix 4: the RD&E portfolio.

Best Practice:
Promoting best practices through the development and delivery Joint Venture.

CRDC's support for the industry's joint venture extension program, CottonInfo, includes investment in key CottonInfo personnel (including the CottonInfo program manager and communications manager); support for the *my*BMP program; and investment in the CottonInfo technical specialists via research projects under their specific topic areas.

In 2015–16, this investment from CRDC includes a technical specialist that fits within the Performance category, under the project:

- *Science into best practice*, linking research with CottonInfo, with CSIRO.

The role of the CottonInfo technical specialist includes: developing new information and strategies to help the industry respond to current issues and pre-empt future issues; ensuring *my*BMP is linked to and updated with the latest best practice messages from research results; validating best practice guidelines using field experiments; supporting the development of key industry publications; and exploring opportunities for the development of new decision-making tools to support the uptake of research outcomes and best practices.

Monitoring and Evaluation:
Conducting annual industry surveys to capture practice change;
Establishing a framework through which industry performance can be nationally and internationally reported.

Measuring the performance of the Australian cotton industry over time is critically important: in helping the industry to continuously improve; in helping to tell the story of the industry to customers; and in helping to secure overseas markets through the demonstration of the industry's social, economic and environmental sustainability.

In 2015–16, CRDC continued its commitment to industry monitoring and evaluation through three key projects:

- *Annual Cotton Grower Practices Survey*, with Roth Rural and Regional;
- *Annual qualitative and quantitative surveys for the Australian cotton industry*, with Crop Consultants Australia; and
- *Australian Cotton Comparative Analysis*, with Boyce Chartered Accountants.

The *Annual Cotton Grower Practices Survey* gathers valuable information about cotton farming practices to give a greater understanding of the industry's performance. Each year, data is collected on the industry's yields, fibre quality and grower perspectives on RD&E. In addition, the survey monitors practices and performance over specific topic areas, including nutrition, soils, biotechnology stewardship, weed management, irrigation, energy, workforce, harvesting and riparian areas.

Case study: Converting science into best practice via CottonInfo

Sandra Williams is a highly dedicated experimental scientist with CSIRO. She is also a member of the industry's extension program, CottonInfo, a joint venture supported by CRDC, Cotton Australia and CSD.

Within CSIRO, Sandra's primary focus is on developing and delivering research to improve cotton crop decisions for sustainable cotton production. Within CottonInfo, under the CRDC-led *Science into best practice*, linking research with CottonInfo project, Sandra (pictured) takes this research and development focus one step further into extension.

Her role, like that of the other CottonInfo Technical Specialists, is to be the conduit of information from cotton researchers to the industry, ensuring that growers and consultants know of the latest research outcomes and best practice.

Sandra's focus throughout her 20-year career in cotton RD&E has been integrated pest management (IPM), which forms her speciality within CottonInfo. Her role is to provide IPM expertise into CottonInfo extension campaigns, and to play a linking role with the industry's best management practices program, *my*BMP.

Sandra believes that at the heart of IPM is the conservation of natural enemies. Her message to the industry regarding IPM is that beneficial species such as predatory insects, spiders, bats and birds can help control pests and reduce the reliance on insecticides for their management. Cotton growers who use IPM have shown that with optimal crop growth, a healthy population of beneficials and a plant-monitoring approach, it's possible to grow a Bollgard II® crop without (or with significantly reduced reliance on) insecticides.

She believes IPM is a win-win for both your crop and your bottom line.

For more information on IPM, visit: www.cottoninfo.com.au/insect-and-mite-management.

CSIRO

The 2014 grower survey, published in November 2015, focused on weeds, irrigation, weather and climate, riparian management and CottonInfo, with 38 per cent of cotton farms participating. The report is available at the CRDC website: www.crdc.com.au/publications.

The *Annual qualitative and quantitative surveys for the Australian cotton industry* project consists of two separate data sets/reports. The qualitative report is a survey of cotton consultants, which provides information on the practices and attitudes of consultants and their cotton grower clients. The quantitative data provides hard data as to practices on-farm, such as chemical use, and tracks how this has improved over time. The information provided by both surveys forms a critical data set for benchmarking, trending and research purposes. In 2015–16, two surveys were released: the 2013–14 and 2014–15 editions, with 92 consultants participating across the two surveys, representing a collective 890 growers. The reports are available at the CRDC website: www.crdc.com.au/publications.

The *Australian Cotton Comparative Analysis* report provides the industry benchmark for the economics of cotton growing in Australia. The 2015 crop report, published in March 2016, focuses on the economics of the 2015 crop from growers across the different cotton-growing valleys. It also presents trends that have been measured against more than 10 years of data. For more on the report and its key findings, read the case study titled Latest analysis reveals stellar season.

Reviews:
Commissioning and participating in independent reviews of CRDC's RD&E and organisational performance.

Ensuring continuous improvement is a key goal of the organisation, and as such, CRDC commissions independent reviews of RD&E investments and organisational performance as required.

In 2015–16, CRDC continued its investment into reviews through a number of key projects:

- *CRDC leadership program review*, with Inner Compass Pty Ltd; and
- *Impact assessment of selected clusters of projects*, with Agtrans Research and Consulting.

The *CRDC leadership program review* project, which concluded on 30 June 2016, involved a strategic review of all CRDC's investments into leadership development, to identify gaps, determine whether the current investments are resulting in strong leadership capacity, and to ascertain how to maximise leadership development potential. The review recommended the implementation of key performance metrics for each investment in order to better measure program impacts.

The *Impact assessment of selected clusters of projects* review, which commenced in May 2016, will undertake qualitative and quantitative impact assessments of CRDC investments into nutrition and water-use efficiency projects. The purpose of the evaluation is to determine the success of CRDC's investments against the stated Strategic Plan goals, and to inform future investments. The project will report in 2016–17.

Case study: Latest analysis reveals stellar season

In 2015, the top 20 per cent of cotton growers in the industry's major benchmarking study showed an increase of $1200 per hectare profit against the five-year average.

The 2015 *Australian Cotton Comparative Analysis*, produced by Boyce Chartered Accountants and CRDC, shows that although 2015 was a relatively small season in terms of hectares grown, it was a stellar season for yield and price.

The analysis, conducted annually by Boyce under a CRDC-supported project, provides a benchmark for the economics of growing cotton in Australia. The 2015 report is based on figures from growers who produced 340,000 bales, or 15 per cent of total cotton production.

The study found that 2015 was generally an ideal irrigated cotton season in terms of weather, with enough heat, rainfall at ideal times, and low levels of prolonged cloud and cold shock days all contributing to a good season for growers.

And, as a result, the report reveals that the average group of cotton growers achieved a profit per hectare of $1899—greater than both the 2014 result of $711, and the five-year average.

The top 20 per cent of growers had an outstanding season, with a profit of $3388 per hectare, against the five-year average of $2190.

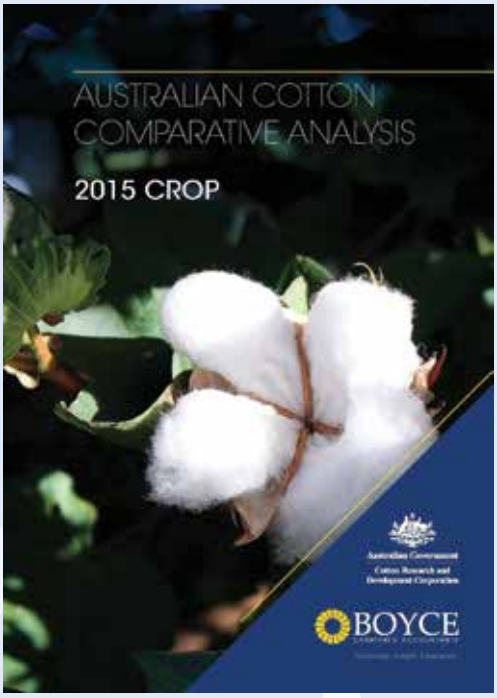
Report co-author Paul Fisher of Boyce Moree noted that yield was the distinguishing factor between the two groups. He says increased yield has two impacts: increased income and reduced cost per bale. As a result, he believes the focus for growers wishing to increase their profitability should be on increasing yield as cheaply as possible.

According to Paul, the long-term average figures for the top producers prove that it is possible to achieve a benchmark cost of production in the range of $281 to $326 per bale in a 'normal' year.

The *Australian Cotton Comparative Analysis* has been compiled independently by Boyce Chartered Accountants since 1984. CRDC began investing in the report in 2005 to promote the collation and value of benchmarking information for improving the economics of cotton production to the entire industry. The primary purpose of the report is to benchmark, on a per hectare basis, the income and expenses associated with growing fully irrigated cotton.

The reliable independent figures in the analysis provide the starting point for growers to compare, question, understand and drive improvements in the financial performance of their own cotton production.

For more on the Australian Cotton Comparative Analysis, visit: www.crdc.com.au/publications/australian-cotton-comparative-analysis-2015.



MELANIE JENSON

Section 5
CRDC People and Governance

CRDC Board

CRDC Employees

Governance and Accountability

RUTH REDFERN

Dr Mary Corbett BSc PhD (FAICD, AFAIM)
Chair

CRDC Chair, Dr Mary Corbett, has more than 20 years' experience as a Company Director in the scientific research and development area, and in education and training. Dr Corbett has significant board and corporate governance experience gained across a range of organisations. She is currently Chair of the West Moreton Hospital and Health Service, and Adjunct Professor with the University of QLD, Faculties of Health and Behavioural Sciences and Medicine and Biomedical Sciences. Previously, Dr Corbett was a board member on the Wound Management Innovation CRC, Deputy Chair of the Southbank Institute of Technology, Deputy Chair of the Australian Agriculture College Corporation, and a board director of the Sugar Research and Development Corporation, and Food Science Australia.

Dr Corbett has extensive experience as Chair and member of a number of board committees. She is Managing Director of Australian Business Class, an organisation specialising in executive leadership development.

Appointed: 01/10/2008 until 30/09/2011.
Reappointed: 01/10/2011 until 30/09/2014 (term ended 12/08/2013 upon Chair appointment).
Appointed Deputy Chair: 15/12/2011.
Appointed Chair: 13/08/2013 until 12/08/2016.
Appointed Chair of the Remuneration Committee.

Mr Cleave Rogan (MAICD)
Deputy Chair

Mr Rogan has been farming and marketing cotton and grains for 30 years. He is currently the Chair of the Cotton Innovation Network. Previously, Mr Rogan had acted in an advisory role to CRDC, working on research projects related to biosecurity, insects, weeds, diseases, cotton fibre processing and quality enhancement. Mr Rogan was a director of Cotton Australia and has been an industry representative on various other cotton industry associations and research advisory committees.

Appointed: 01/10/2011 until 30/09/2014.
Reappointed: 20/10/2014 until 30/09/2017
Appointed Deputy Chair: 27/01/2015.

Mr Bruce Finney BScAg (MAICD)

Executive Director

Mr Finney has extensive experience in the agricultural sector. Prior to his appointment to CRDC in 2004, he worked in corporate agriculture in various corporate, management and agronomy roles in Australia and in an advisory role in Argentina. He is a member of the Cotton Innovation Network, the Advisory Board QDAF programme on Agricultural Robotics at QUT and the Agriculture Senior Officials Research and Innovation Committee.

Mr Finney is a past chair of the Australian Cotton Growers Research Association and a past director of the Cotton Catchment Communities CRC and the Irrigation Association of Australia. Mr Finney is a graduate of the Australian Rural Leadership Program and of the Company Directors Course of the Australian Institute of Company Directors.

Appointed: 01/08/2004 by virtue of his appointment as Executive Director of CRDC. He attends the Audit, Intellectual Property and Remuneration Committees as an observer.

Dr Michael Robinson BSc (Hons), PhD (FAIMS, GAICD)

Non-executive Director

Dr Robinson is the CEO of Plant Biosecurity Cooperative Research Centre. Previously he was the CEO of FrOG Tech Pty Ltd, a private research company specialising in geological reconstructions and interpretations across a range of sectors, including oil and groundwater, and CEO of GeoSphere Ltd, a specialist geological consulting firm in New Zealand.

Dr Robinson has extensive experience in primary industries and natural resources research, development and extension. He was the Executive Director of Land and Water Australia, Centre Director of the Primary Industries Climate Challenges Centre (a joint venture between Department of Economic Development, Jobs, Transport and Resources (Victoria) and University of Melbourne), Chair of the National Climate Change Research Strategy for Primary Industries, CEO of the CRC for Greenhouse Accounting, and a member of the National Primary Industries Standing Committee RD&E Extension Subcommittee.

Appointed 01/10/2011 until 30/09/2014.
Reappointed: 20/10/2014 until 30/09/2017
Appointed Chair of the Audit Committee.

Ms Kathryn Adams BScAgr (Hons), LLM, MBus, MEnvStud, Grad Dip Leg Pract, Prof Cert Arbitration, Practitioners Cert Mediation & Conciliation, FAICD

Non-executive Director

Ms Adams, a microbiologist and lawyer, specialises in intellectual property management, commercial/industry application of R&D and corporate governance. She has had extensive experience in R&D investment from the perspective of a researcher, director of a research institute, and an investor. She has been a practising lawyer and was also the first Registrar of Plant Breeder's Rights in Australia.

Ms Adams was on the Board of the Cotton CRC and is currently on the Boards of a number of CRCs as well as Agriculture Victoria Services Pty Ltd, and PBIP Ltd. She is a member of the R&D Tax Incentives Committee of AusIndustry, an adjunct Senior Research Fellow with the Australian Centre for Intellectual Property in Agriculture (ACIPA, Griffith Law School), and is a Fellow of the Australian Institute of Company Directors.

Appointed: 20/10/2014 until 30/09/2017.
Appointed Chair of the Intellectual Property Committee.

Mrs Elizabeth (Liz) Alexander BA, MRurSysMgt, GAICD

Non-executive Director

As principal consultant for Blue Dog Agribusiness, Mrs Alexander undertakes community-based planning, research, project management, communication, and extension services for raingrown and irrigated cropping industries, natural resource management groups, and local government across eastern Australia. She has provided extension services, supporting Central Queensland cotton growers to undertake on-ground activities that improve water quality flowing to the Great Barrier Reef, conserve and protect biodiversity, improve production, and participate in the cotton industry's Best Management Practices program for more than 15 years.

Mrs Alexander is currently a Director of Plant Health Australia, Chair of the Theodore Irrigation Local Management Arrangements (LMA) Transition Board (Stage 3), Independent Chair of the Glencore Clermont Open Cut Groundwater and Environmental Reference Group, and was previously a director of Cotton Australia.

Appointed: 20/10/2014 until 30/09/2017.

Mr Greg Kauter BAgEc, GradCertRuSc, GAICD

Non-executive Director

Mr Kauter is an agricultural consultant with more than 30 years of cotton industry experience. He has had extensive experience in cotton research administration and industry stewardship through roles in crop protection, farming systems, plant variety and biotechnology research programs. He has also planned and developed extension strategies to facilitate the adoption of new technology and knowledge. He has experience with industry representative bodies in developing strategic priorities with cotton growers and industry stakeholders, identifying emerging issues and developing evidence-based policy responses based on sound research and information.

Mr Kauter currently consults on cotton farm management and Best Management Practice implementation. He has been the industry representative for biosecurity through Plant Health Australia Ltd and Chair of the Cotton Industry Biosecurity Group. He is a former President of the Cotton Consultants Association Inc.

Appointed: 20/10/2014 until 30/09/2017.

CRDC Board (left to right): Greg Kauter, Elizabeth Alexander, Bruce Finney (Executive Director), Mary Corbett (Chair), Kathryn Adams, Cleave Rogan (Deputy Chair) and Michael Robinson.

Composition

CRDC has a seven-member Board, consisting of a Chair (appointed by the Minister for Agriculture and Water Resources), the Executive Director (selected by the Board) and five non-executive Directors nominated by an independent Selection Committee. Appointment of non-executive Directors is subject to Ministerial approval, and Directors (other than the Executive Director) are appointed for three-year terms.

Board

CRDC Board at 30 June 2016:

1. Dr Mary Corbett, Chair
2. Mr Cleave Rogan, Deputy Chair
3. Dr Michael Robinson, Non-executive Director
4. Ms Kathryn Adams, Non-executive Director
5. Mrs Elizabeth Alexander, Non-executive Director
6. Mr Greg Kauter, Non-executive Director
7. Mr Bruce Finney, Executive Director

Responsibilities of Executive Director

The Executive Director is responsible for day-to day management of the CRDC, implementation of CRDC's plans and liaison between the Board and management. The Executive Director is also a member of the Board with the responsibilities of a director.

Responsibilities of Non-executive Directors

The roles and responsibilities of Directors are set out in the Board Charter, which includes a governance statement, conduct and ethical standards provisions. Internal reviews of Board performance are conducted annually. The Board also obtains an external review of its performance periodically.

Expertise

The CRDC Board is a skilled-based board, with Directors collectively bringing expertise in cotton production, processing and marketing, conservation/management of natural resources, science and technology and technology transfer, environmental and ecological matters, economics, finance and business management, administration of research and development, sociology and public administration.

The PIRD Act requires the CRDC Selection Committee to specify how its Board nominations will ensure that CRDC collectively possesses experience in board affairs, adding to the existing requirement for an appropriate balance of expertise.

Directors may obtain independent legal and professional advice at CRDC's expense to enable them to discharge their duties effectively, subject to prior approval from the Chair, in consultation with the Board and Executive Director. This advice may relate to legislative and other obligations, technical research matters and general skill development to ensure there is a sufficient mix of financial, operational and compliance skills amongst Board members.

Induction

Following appointment to the Board, each Director is provided with an appropriate level of information about CRDC, its history and operations, and the rights, responsibilities and obligations of Directors. This information includes the Board Charter, Strategic R&D Plan and relevant legislation.

The induction process is tailored to the needs of new Directors and may include an initial visit to CRDC office in Narrabri to meet with the Chair and staff for a comprehensive overview of corporate activities and practices and a tour of key industry research facilities.

Training

Where necessary and appropriate, CRDC sources training for Directors, either individually or as a group. The Board generally establishes the need for such training during the first meeting of Directors.

Functions

- Establishing strategic directions and targets.
- Monitoring and evaluating the research and development needs of the industry and ensuring CRDC's research program is effective in meeting those needs.
- Approving policies, plans, performance information and budgets.
- Monitoring policies, procedures and internal controls to manage business and financial risk.
- Ensuring compliance with statutory and legal obligations and corporate governance standards.

Conflicts of interest

In accordance with section 131 of the PIRD Act, Directors are appointed based on their expertise and do not represent any particular organisation or interest group.

The Board follows section 29 of the PGPA Act regarding Directors' disclosures of interests. A Director who considers that he or she may have a direct or indirect pecuniary or non-pecuniary interest in a matter to be discussed by the Board must disclose the existence and nature of the interest before the discussion.

All disclosures are recorded in the minutes of the meeting and, depending on the nature and significance of the interest, Directors may be required to absent themselves from the Board's deliberations.

The Board is very aware of its responsibilities regarding conflict of interest and duty of care, and has adopted a very cautious approach. A Board Charter clearly outlines the roles and responsibilities of Directors in terms of potential conflicts of interest. Further, the Board has a standing notice of Directors' interests that is tabled and reviewed at each meeting.

Board Charter

The CRDC Board Charter assists Directors in carrying out their duties and setting out roles and responsibilities of Directors and staff.

Indemnities and insurance premiums for Directors and officers

The Board has taken the necessary steps to ensure professional indemnity cover is in place for present and past officers of CRDC, including Directors of the CRDC, consistent with provisions of the PGPA Act. CRDC's insurance cover is provided through Comcover; however, the insurance contract prohibits CRDC from disclosing the nature or limit of liabilities covered. In 2015–16, Directors' and officers' liability insurance premiums were paid and no indemnity-related claims were made.

Board Committees

The Board operated the Audit, Intellectual Property and Remuneration Committees in 2015–16. In addition to face-to-face meetings, the Board and its committees conduct much of their work via email and telephone, supported by a secure online information portal. CRDC finds this arrangement to be effective, productive and cost effective.

Board meeting	Dates	Location
Meeting 5 – 2015	20 August 2015	Queensland University of Technology, Brisbane QLD
Meeting 6 – 2015	29 September 2015	Teleconference
Meeting 7 – 2015	10 November 2015	University of Southern Queensland, Toowoomba QLD
Meeting 1 – 2016	21 January 2016	Teleconference
Meeting 2 – 2016	23 February 2016	Yanco Agricultural Institute, Yanco NSW
Meeting 3 – 2016	21 April 2016	CSIRO Black Mountain, Canberra ACT
Meeting 4 – 2016	23 June 2016	Park Royal, Melbourne Airport VIC

Attendances at Board meetings

Director	Board meeting attendance							
	Meeting 5 2015	Meeting 6 2015	Meeting 7 2015	Meeting 1 2016	Meeting 2 2016	Meeting 3 2016	Meeting 4 2016	TOTAL
Mary Corbett	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7 of 7
Bruce Finney	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7 of 7
Cleave Rogan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7 of 7
Michael Robinson	Yes	No	Yes	No	Yes	Yes	No	4 of 7
Elizabeth Alexander	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7 of 7
Kathryn Adams	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7 of 7
Greg Kauter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7 of 7

Audit Committee

Established under section 89 of the PIRD Act and section 45 of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act), the Audit Committee's primary role is to ensure CRDC's financial reporting is a true and fair reflection of its financial transactions.

The Committee also provides a forum for communication between the Directors, the senior managers of CRDC and the internal and external auditors. It carries responsibility for identifying areas of significant business risk and stipulating the means of managing any such risk.

Michael Robinson is Chair of the Audit Committee supported by members Greg Kauter, Kathryn Adams and Alex Keatinge, an additional skills-based appointee. CRDC Executive Director Bruce Finney attended meetings as an observer. The Audit Committee met five times during 2015–16, four of which were by teleconference.

Intellectual Property Committee

The role of the Intellectual Property (IP) Committee is to assist CRDC's Board in fulfilling its responsibilities and to monitor the adequacy and effectiveness of CRDC's policies and procedures relating to the management of IP.

The Committee's specific responsibilities are to review the operation of CRDC's IP policy and IP operating principles and to consider IP matters directed to it by the Board for consideration.

Kathryn Adams is Chair of the IP Committee supported by members Greg Kauter and Elizabeth Alexander. CRDC Executive Director Bruce Finney attended meetings as an observer. The IP Committee met three times during 2015–16.

Attendances at Audit Committee meetings

Member	Date of Audit Committee meeting					
	10 Aug 2015	20 Oct 2015	1 Feb 2016	31 Mar 2016	26 May 2016	TOTAL
Michael Robinson (Chair)	Yes	Yes	Yes	Yes	Yes	5 of 5
Greg Kauter	Yes	Yes	Yes	Yes	Yes	5 of 5
Kathryn Adams	Yes	Yes	Yes	Yes	Yes	5 of 5
Alex Keatinge	Yes	Yes	Yes	Yes	Yes	5 of 5

Attendances at Intellectual Property Committee meetings

Member	Date of Intellectual Property Committee meeting			
	2 Oct 2015	28 Jan 2016	3 May 2016	TOTAL
Kathryn Adams (Chair)	Yes	Yes	Yes	3 of 3
Greg Kauter	Yes	Yes	Yes	3 of 3
Elizabeth Alexander	Yes	Yes	Yes	3 of 3

Remuneration Committee

The Remuneration Committee advises the Board on the Executive Director's remuneration and senior staff remuneration adjustments. The Chair of the Remuneration Committee was Mary Corbett, supported by members Cleave Rogan and Elizabeth Alexander. CRDC Executive Director Bruce Finney attended meetings as an observer. The Remuneration Committee met three times during 2015–16.

Attendances at Remuneration Committee meetings

Member	Date of Remuneration Committee meeting			
	28 Jul 2015	16 Mar 2016	11 May 2016	TOTAL
Mary Corbett (Chair)	Yes	Yes	Yes	3 of 3
Cleave Rogan	Yes	Yes	No	2 of 3
Elizabeth Alexander	Yes	Yes	Yes	3 of 3

Statement of principles

CRDC Directors and staff members are required to:

- Commit to excellence and productivity.
- Be accountable to stakeholders.
- Act legally, ethically, professionally and responsibly in the performance of duties.
- Strive to maximise return on investment of industry and public funds invested through CRDC.
- Strive to make a difference in improving the knowledge base for sustainable cotton production in Australia.
- Value strategic, collaborative partnerships with research providers, other research and development bodies, industry organisations, stakeholders and clients, for mutual industry and public benefits, including cooperation with kindred organisations to address matters of national priority.
- Value the contribution, knowledge and expertise of the people within our organisation and that of our contracted consultants, external program coordinators and research providers.
- Promote active, honest and effective communication.
- Commit to the future of rural and regional Australia.
- Comply with and promote best practice in corporate governance.
- Commit to meeting all statutory obligations and accountability requirements in a comprehensive and timely manner.

CRDC's small but dedicated team of skilled and experienced staff actively manage RD&E investment portfolios to achieve the cotton industry's strategic goals. Our internal capacity is an important element of the overall effectiveness of RD&E investment for the cotton industry.

CRDC Organisational Structure
As at 30 June 2016

CRDC Board of Directors

CRDC Chair Dr Mary Corbett

CRDC Executive Director Mr Bruce Finney

R&D Investment	Business and Finance	CottonInfo and Communications
General Manager R&D Investment Dr Ian Taylor **R&D Managers:** Allan Williams Jane Trindall Susan Maas	**General Manager Business and Finance** Graeme Tolson **Accountant** Emily Luff **Executive Assistant** Dianne Purcell **Project Administration Assistants** Megan Baker Amy Withington **Accounts Officer** Melanie Moloney	**CottonInfo Program Manager** Warwick Waters **Communication Manager** Ruth Redfern

Employment

Staff members are employed under Section 87 of the PIRD Act, which provides that the terms and conditions of employment are to be determined by the Corporation. CRDC complies with the Australian Government Bargaining Framework when exercising its power to engage employees in relation to sections 12 and 87 of the PIRD Act.

Including the Executive Director, there were 11 full-time employees, one part-time employee and one casual employee on 30 June 2016.

CRDC employees

Employee type	2011–12	2012–13	2013–14	2014–15	2015–16
Full-time employees	7	12	10	11	11
Part-time employees	1	2	4	1	1
Parental leave	0	1	2	2	0
Casual	0	0	0	0	1
TOTAL CRDC staff	8	15	16	14	13*

** The number of CRDC staff employed by CRDC on 30 June 2016.*

Staff training and development

In 2015–16, CRDC spent $92,490 on training and $1550 on recruitment. Areas of direct training activities were director finance and risk training, WHS training, CPA training, fraud control, ICT, strategic planning training, and support for an employee undertaking academic studies in sustainable value chains.

Throughout the year, Directors and staff participated in a wide range of CRDC-related activities involving other organisations, providing valuable experience, as well as skills and knowledge upgrades for the personnel involved.

Equal employment opportunity

CRDC is committed to a merit-based, non-discriminatory recruitment and promotion policy, and staff members are chosen strictly according to their qualifications for the job. Scientists undertaking CRDC-funded research are of diverse backgrounds and cultures.

CRDC's Equal Employment Opportunity, Discrimination and Harassment Policy defines prohibited discrimination and harassment and sets out a complaints procedure to be followed if there is a breach of this policy, including details of what action can be taken once the complaint has been made. The policy applies to all employees, whether full-time, part-time, casual or temporary, to Directors and to contractors and customers (clients).

MELANIE JENSON

The CRDC team as at October 2015; marking 25 years of delivering cotton RD&E on behalf of cotton growers and the Australian Government.

CRDC was established in 1990 as a partnership between the Australian people (through the Australian Government) and the Australian cotton industry (through Cotton Australia, its legislated representative industry body).

Location

CRDC is based in one of Australia's major cotton-growing areas, Narrabri, in North West NSW. Being centrally located within the Australian cotton industry, CRDC benefits from developing and maintaining important relationships with cotton growers, researchers, processors, and members of regional cotton communities.

PIRD Act legislation

CRDC began operations in 1990 under the PIRD Act.

Charter

CRDC's charter under the PIRD Act is to invest in and manage a portfolio of research, development and extension projects and programs in order to secure economic, environmental and social benefits for the Australian cotton industry and the community. This is to be conducted in a framework of improved accountability for research and development spending in relation to the cotton industry.

PIRD objects

The objects of this PIRD Act are to:

(a) make provision for the funding and administration of research and development relating to primary industries with a view to:

(i) increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries; and

(ii) achieving the sustainable use and sustainable management of natural resources; and

(iii) making more effective use of the resources and skills of the community in general and the scientific community in particular; and

(iv) supporting the development of scientific and technical capacity; and

(v) developing the adoptive capacity of primary producers; and

(vi) improving accountability for expenditure on research and development activities in relation to primary industries; and

(b) make provision for the funding and administration of marketing relating to products of primary industries.

Powers

Under section 12 of the PIRD Act, CRDC has the power to do all things necessary to carry out its functions, including but not restricted to:

- Entering into agreements for the carrying out of R&D or marketing activities;
- Applying for patents, either solely or jointly;
- Charging for work done, services rendered, and goods and information supplied;
- Acquiring, holding and disposing of real and personal property; and
- Anything incidental to any of its powers.

Functions

Function	Application
Investigating and evaluating the cotton industry's requirements for research and development, and the preparation, review and revision of an RD&E plan on that basis	This is achieved by continuing interaction with CRDC's legislated industry body, Cotton Australia, as well as the Australian cotton industry's wider peak body, the Australian Cotton Industry Council (ACIC). Cotton Australia undertakes a range of functions relating to CRDC, including an annual review to ensure the CRDC Strategic Plan remains current and relevant. The cotton industry and cotton researchers were closely involved in development of the CRDC 2013–18 Strategic R&D Plan, which incorporated Australian Government and cotton industry RD&E priorities, as well as advice from the Minister and the Department of Agriculture and Water Resources.
Preparing an Annual Operational Plan for each financial year	An Annual Operational Plan is submitted to the Australian Government and Cotton Australia prior to the commencement of each financial year.
Coordinating and funding RD&E activities consistent with current planning documents	RD&E projects are approved or commissioned in line with the Annual Operational Plan each year. The Annual Operational Plan is devised to address the objectives and strategies outlined in the current Strategic RD&E Plan.
Monitoring, evaluating and reporting to Parliament, the Minister for Agriculture and Water Resources, and to industry on RD&E activities coordinated or funded by the Corporation	The Corporation reports formally to the Australian Parliament through its Annual Report. In addition, CRDC informs the Minister for Agriculture and Water Resources of any matters of interest or concern in the current operating environment. This occurs in written and, where possible, face-to-face communication. CRDC is also in communication with the Department of Agriculture and Water Resources on a range of issues. Communication with the industry and Cotton Australia occurs continually on both a formal and informal basis, as outlined above. Communication with the broader community is a key focus of CRDC's communication activities. In order to ensure stringent evaluation of its RD&E activities, CRDC is committed to the ongoing Council of Rural Research and Development Corporation's Impact Evaluation process.
Facilitating the dissemination, adoption and commercialisation of research and development results in relation to the cotton industry	CRDC plays a pivotal role in facilitating fast and effective dissemination of cotton R&D outcomes. CRDC undertakes detailed analysis and planning for determining the most appropriate adoption pathway for the results of research projects. While the majority of research results are extended as information, the CRDC actively works with its research partners to develop commercial adoption pathways where that is preferred. CRDC is a founding partner in the industry's joint extension program, CottonInfo, along with co-partners Cotton Australia and CSD Ltd. Formed in 2012, the CottonInfo team works to improve responsiveness to grower needs through improved communication and regional representation, focusing on delivering research directly to growers and consultants. The model recognises the importance of supporting adoption of RD&E through multiple delivery pathways and is underpinned by the industry's best management practices program, *my*BMP. In addition, CRDC hosts forums and on-farm events, participates in roadshows and the cotton trade show, produces publications, sponsors the biennial Australian Cotton Conference and Australian Cotton Research Conference, and has a communication strategy to extend and enhance the adoption of RD&E. CRDC also collaborates in the successful commercialisation of RD&E where possible.

The PGPA Act

CRDC has been subject to the *Public Governance, Performance and Accountability Act 2013* since 1 July 2013, which provides enhanced levels of accountability as well as a planning and reporting framework.

Other legislation

The setting and collection of levies on the cotton industry is enabled by the *Primary Industries (Excise) Levies Act 1999* and the *Primary Industries Levies and Charges Collection Act 1991*.

Cotton R&D levy

The Australian Government introduced an R&D levy at the request of industry. The cotton levy funds CRDC research and development programs and the subscription for industry membership of Plant Health Australia. The levy is payable on cotton produced in Australia and the producer (the person who owns the cotton immediately after harvest) is liable to pay the levy.

The levy rate for cotton is $2.25 per 227-kilogram bale of cotton. The Australian Government contributes matching funds up to set limits.

Minister

During 2015–16, CRDC was accountable to the Australian Parliament through the Minister for Agriculture and Water Resources, the Hon. Barnaby Joyce MP.

Minister's responsibilities

The Minister's powers and responsibilities, as outlined under various sections of the PIRD Act, include appointing CRDC's Chair and Directors and, under certain conditions, terminating these appointments; approving CRDC's Strategic R&D Plan and any variations to it; appointing a person as Presiding Member of CRDC's Selection Committee, as well as other members of that Committee; and transferring to CRDC any assets held by the Commonwealth that the Minister considers appropriate and which would assist its performance and function.

Ministerial directions

CRDC complies with all Ministerial directions, legislative and policy requirements of the Australian Government that it has been able to ascertain.

CRDC received no Ministerial directions during 2015–16.

CRDC role, responsibilities and accountabilities

- CRDC is formally accountable to the Australian people through the Australian Parliament and to the cotton industry through its industry representative body, Cotton Australia.
- CRDC's stakeholders set broad objectives, which the Corporation addresses through its Strategic R&D Plan and Annual Operational Plan.
- CRDC has used these objectives as a basis for the development of its planned outcomes and the identification of key outputs.
- CRDC's reporting processes include the presentation of a formal report to its industry stakeholder. Part of this presentation includes an opportunity for questioning and debating Board decisions.
- CRDC annually reports on investments, project outcomes, operation activities and financial statements every year via its Annual Report.
- CRDC publishes an Annual Operational Plan, Strategic R&D Plan for 2013–18 and Annual Report on the outcomes of investments, projects, operations and financials.

Policies, procedures and charters

CRDC has 38 existing policies, procedures and charters to assist with the effective governance of the organisation. These documents are available from CRDC's internal shared folders and are made available to all Directors and new staff during induction training. In addition, staff receive policy training on an annual rolling basis at monthly staff meetings.

During 2015–16, CRDC adopted a cost allocation policy, a banking policy, an IP management plan and a wellbeing policy. Directors and management conducted, commissioned or enacted nine reviews during 2015–16 listed in the table below.

In addition, CRDC commissioned an external review of its policy framework for compliance with legislated requirements and consistency with best practice. The review conducted by PwC found no compliance matter or inconsistencies but recommended options for improvements to the structure of the policy framework to support efficient and effective governance.

Corporate reporting

In accordance with the PIRD Act and the PGPA Act, CRDC prepares a five-year Strategic R&D Plan, as well as an Annual Operational Plan for each financial year.

CRDC submitted its Annual Operational Plan for 2016–17 to the Minister for Agriculture and Water Resources, the Hon. Barnaby Joyce MP, on 30 June 2016 with the plan commencing from 1 July 2016. The Annual Report 2014–15 was submitted to the Minister on 9 October 2015 and the Minister tabled the report in Parliament on 3 December 2015.

Fraud control

Active fraud control is a major responsibility of all staff, and clear standards and procedures have been established. All personnel engaged in the prevention, detection and investigation of fraud receive appropriate fraud control training, consistent with the Australian Government's Fraud Control Guidelines.

Reviews 2015–16

Description	Board, committee and management	Last review
Board	Board, IP committee, Remuneration committee and Audit committee	
IP Committee Charter		Feb 2016
Remuneration Committee Charter		Apr 2016
Finance and Administration	Board, Audit committee and management	
Risk Register and Management Plan		Nov 2015
Reserves Policy		Feb 2016
Fraud Control Policy		Feb 2016
Fraud Risk Register and Management Plan		Feb 2016
Business Continuity Policy		Feb 2016
Human Resources	Board, Audit committee, Remuneration committee and management	
Wellbeing Policy		May 2016
WH&S	Board, Audit committee and management	
WH&S Management Arrangements		May 2016

The Audit Committee endorse, monitor and review the fraud control plan, which is read in conjunction with the Risk Management Plan and the Board Charter for Directors and Statement of Principles for staff.

CRDC's Audit Committee, Executive Director, and General Manager Business and Finance (the nominated fraud control officer) carry out the functions of a fraud investigation unit collectively, as described in the Commonwealth Fraud Investigation Model. The support of the Australian Federal Police would be sought if CRDC felt there was a prima facie case of fraud and further investigation was required. No such action was necessary in 2015–16.

Service charter

CRDC does not provide services directly to the public and thus does not have a service charter; however, CRDC has a Board Charter that includes a Governance Statement and a Statement of Principles that embody the set of values underlying our decisions, actions and relationships.

National Disability Strategy

CRDC working conditions and procedures for employees and stakeholders align with the *Commonwealth Disability Discrimination Act 1992* in the broader context of the National Disability Strategy 2010–20. CRDC has ensured that any person with a disability could be properly accommodated and carry out all functions, as either a staff member or a visitor. Should a future staff member or visitor need more-specialised disability assistance, CRDC will assess and meet these needs.

Equal Employment Opportunity, Discrimination and Harassment Policy

CRDC's Equal Employment Opportunity, Discrimination and Harassment Policy defines prohibited discrimination and harassment and sets out a complaints procedure.

Significant events

CRDC had no significant events in 2015–16.

Significant changes in the state of affairs

CRDC had no significant changes in its state of affairs in 2015–16.

Judicial decisions and reviews by outside bodies

CRDC had no judicial decisions or reviews by outside bodies in 2015–16.

Commercialisation

CRDC has detailed guidelines for determining its involvement in the commercialisation of the results of R&D projects where that is the preferred adoption pathway.

During 2015–16, CRDC worked with NSW DPI and BASF to develop a commercialisation plan for a biological pesticide. CRDC also worked with CSIRO on the development of commercialisation plans for gin seed fingers, Cottonspec and gin contamination sensors. In 2015–16, CRDC worked with NSW DPI, BASF and Deakin University to apply for provisional patents for inventions.

Work Health and Safety

CRDC has a strong culture of achieving best practice and continuous improvement in Work Health and Safety (WHS), as required by the *Work Health and Safety Act 2011*. This is achieved by providing the necessary resources (both human and financial) to ensure that WHS functions effectively.

In accordance with Schedule 2 Part 4 of the WHS Act, CRDC details notifiable incidents reported each year. In view of its WHS record, CRDC remains vigilant in maintaining its safety performance by conducting audits and reviews of policies and procedures.

CRDC Work Health and Safety summary

Legislative reporting requirements Schedule 2 Part 4 of the *Work Health and Safety Act 2011*	Action undertaken 2015–16
Initiatives during 2015–16 and outcomes	■ An internal WHS audit of first aid kits, training register, fire extinguishers, smoke detectors and incident reporting records was completed in May. No substantive matters were identified. ■ Fire warden, evacuation, fire extinguisher, ergonomics training. ■ Safety issues discussed formally at workplace meetings, workplace inspections held (including vehicles) and staff consulted in resolving safety issues and physical conditions of the workplace. ■ A flu vaccination program for all CRDC staff was offered. ■ WHS inductions for new staff, directors and contractors.
Statistics of any notifiable incidents as defined by s.38 of the WHS Act	■ CRDC had no notifiable incidents in 2015–16.
Details of any investigations conducted during the year, including details of all notices under Part 10 of the WHS Act	■ CRDC conducted no investigations and no notices were received from, or given to, an employee.

Freedom of information

General enquiries regarding access to documents or other matters relating to freedom of information should be made in the first instance to the Executive Director.

Funding information on individual projects funded by CRDC is available on request, unless that information has been classified as commercial-in-confidence. Information about CRDC projects is also available at the CRDC website www.crdc.com.au.

During 2015–16, CRDC had no freedom of information requests. However, in the event a request was raised the CRDC would manage the request in accordance with the provisions of its freedom of information plan, which complied with subsection 8(1) of the *Freedom of Information Act 1982*.

Categories of documents held

Category	Nature	Access
Administration	Files	D
Annual Operational Plan	Files, Publications	C
Annual Reports	Files, Publications	C
Applications, Guidelines and Contracts	Files, Publications	C, D
Assets Register	Files	D
Financial Management	Files	D
Five-Year Plans	Files, Publications	C
Project Lists	Files, Publications	C, D
Research Reports	Files, Publications	C, D
Workshop Reports	Files, Publications	C, D

C: Documents customarily made available

D: Documents not customarily made available for reasons of privacy or commercial-in confidence.

Contractors and consultants

CRDC employs consultants and contractors on a needs basis and after background checks to ensure proposed appointees have the necessary skills and experience. During 2015–16 CRDC spent $709,337, exclusive of GST, to remunerate consultants and contractors.

Privacy and confidentiality arrangements require that CRDC policy is not to disclose amounts paid to individual consultants. A list of contractors and consultants with remuneration of $10,000 or more, exclusive of GST, can be found in the following table.

Contractor	Service provided
Aboriginal Employment Strategy Ltd	HSC student traineeships
ACIL Allen Consulting	Strategic advice
Australian Institute of Company Directors	Board of management training
CA (Pacific) Pty Ltd	Software consultants
Clayton UTZ	Legal advice
Infinity Outsourcing Group	ICT consultant
Juanita Hamparsum	Committee management
Keo Design	Web consultant
Carolyn Martin	Publication content
Melanie Jenson	Publication content
Neil Deacon Design	Publication design
Nexia Court & Co	Internal audit services
Revolution IT	Software consultant
TechMAC Pty Ltd	Program management
Weemalah WriteAbility	Publication content

Payments to advertising agencies

CRDC did not engage the services of any advertising agency, market research organisation, polling organisation, direct mail organisation or media promotion organisation during the reporting year.

Payment to representative body

CRDC's industry representative body is Cotton Australia. In 2015–16, CRDC contributed $86,496 to Cotton Australia for industry consultation, capacity building of advisory panel members and RD&E projects.

These funds included $18,996 for their industry consultation role, including several specific activities:

- Industry consultation for reviewing the CRDC Strategic R&D Plan. This ensures CRDC's strategic planning continues to address evolving industry RD&E needs.
- Industry consultation and participation in CRDC forums to review RD&E funding applications and scoping of future directions in research.
- A meeting to receive and discuss the CRDC Annual Report for the preceding year. This enables the industry representative body to ensure CRDC's activities for that year have met its strategic objectives and to question senior staff on any matters of interest or concern.

While CRDC does not pay a fee for service to the industry representative body for these activities, it contributes to the expenses they incur in carrying them out, as authorised by section 15 of the PIRD Act, which relates to consultation with the industry stakeholder.

In 2015–16, CRDC contributed a total of $67,500 to Cotton Australia for the following co-funded project activities:

- $25,000 co-funding support for the Primary Industries Education Foundation to support the cotton industry's participation in cross-sectoral education initiatives.
- $30,000 support for the 2016 Australian Cotton Conference to increase awareness in the Australian cotton industry of research outcomes. This is a joint extension exercise in line with the Australian Government's prioritisation of extension and adoption in the Agricultural Competitiveness White Paper.
- $2500 co-funding support for the cross-sector CottonMap project lead by Cotton Australia and supported by CRDC, GRDC and commercial organisations. The online mapping tool is used by cotton growers, grain growers and graziers to help prevent spray-drift damage to cotton crops.
- $10,000 co-funding support for biosecurity training for cotton growers and agronomists.

Section 6
Financials

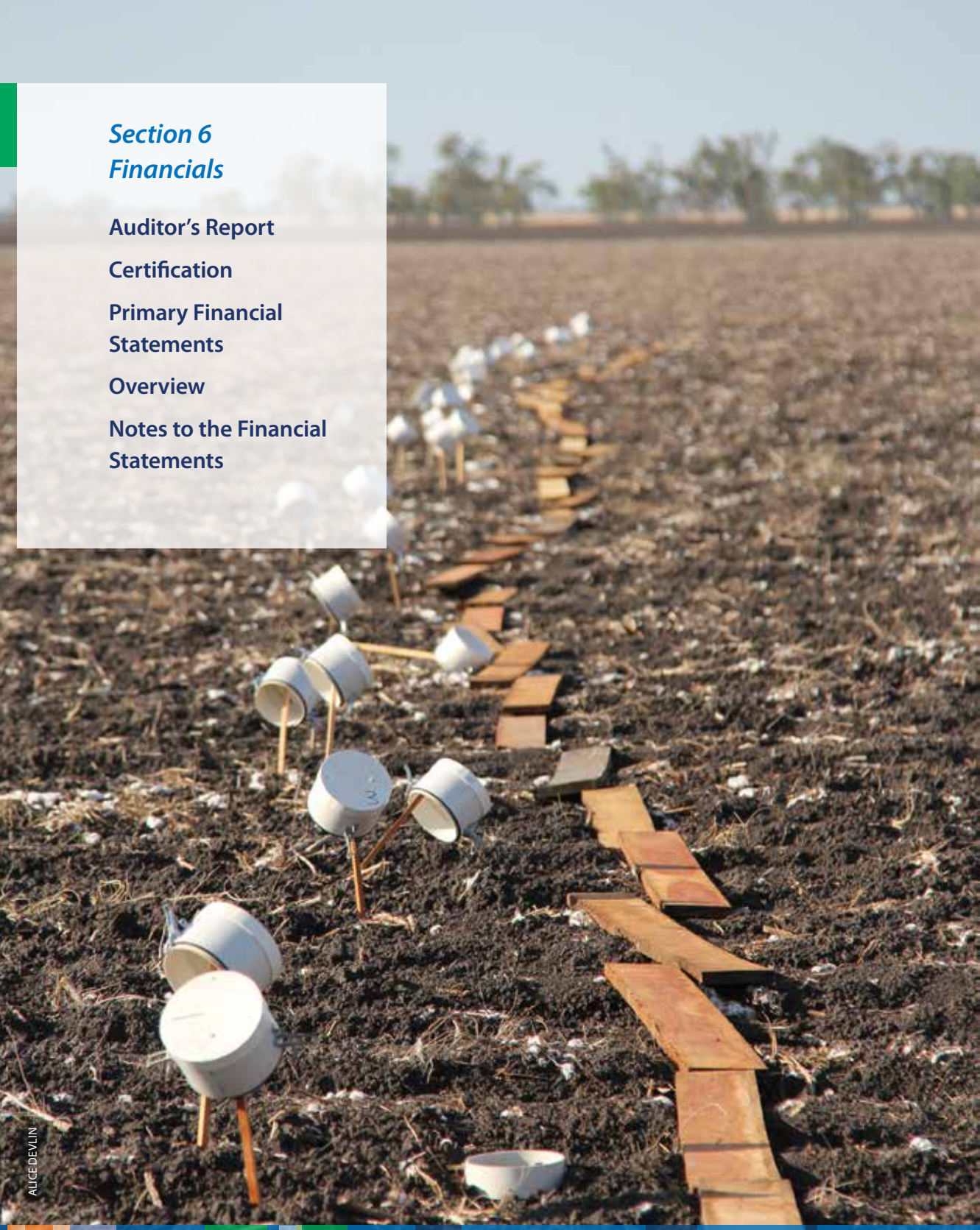
Auditor's Report

Certification

Primary Financial Statements

Overview

Notes to the Financial Statements



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Australian National Audit Office

INDEPENDENT AUDITOR'S REPORT

To the Minister for Agriculture and Water Resources

I have audited the accompanying annual financial statements of the Cotton Research and Development Corporation for the year ended 30 June 2016, which comprise:

- Statement by the Accountable Authority, Executive Director and Chief Financial Officer;
- Statement of Comprehensive Income;
- Statement of Financial Position;
- Statement of Changes in Equity;
- Cash Flow Statement; and
- Notes to the Financial Statements.

Opinion

In my opinion, the financial statements of the Cotton Research and Development Corporation:

(a) comply with Australian Accounting Standards and the *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015*; and

(b) present fairly the financial position of the Cotton Research and Development Corporation as at 30 June 2016 and its financial performance and cash flows for the year then ended.

Accountable Authority's Responsibility for the Financial Statements

The directors of the Cotton Research and Development Corporation are responsible under the *Public Governance, Performance and Accountability Act 2013* for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards and the rules made under that Act and are also responsible for such internal control as the directors determine is necessary to enable the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

My responsibility is to express an opinion on the financial statements based on my audit. I have conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. These auditing standards require that I comply with relevant ethical requirements relating to audit engagements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not

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for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of accounting estimates made by the Accountable Authority of the entity, as well as evaluating the overall presentation of the financial statements.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my audit opinion.

Independence

In conducting my audit, I have followed the independence requirements of the Australian National Audit Office, which incorporate the requirements of the Australian accounting profession.

Australian National Audit Office

Peter Kerr

Executive Director

Delegate of the Auditor-General

Canberra

17 August 2016

Cotton Research and Development Corporation

STATEMENT BY THE ACCOUNTABLE AUTHORITY, EXECUTIVE DIRECTOR AND CHIEF FINANCIAL OFFICER

In our opinion, the attached financial statements for the year ended 30 June 2016 comply with subsection 42(2) of the *Public Governance, Performance and Accountability Act 2013* (PGPA Act), and are based on properly maintained financial records as per subsection 41(2) of the PGPA Act.

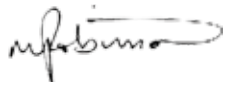
In our opinion, at the date of this statement, there are reasonable grounds to believe that the Cotton Research and Development Corporation will be able to pay its debts as and when they fall due.

This statement is made in accordance with a resolution of the Directors.

Signed

Cleave Rogan
Acting Chair
17 August 2016

Signed



Dr Michael Robinson
Director
17 August 2016

Signed

Bruce Finney
Executive Director
17 August 2016

Signed

Graeme Tolson
Chief Financial Officer
17 August 2016

STATEMENT OF COMPREHENSIVE INCOME
for the period ended 30 June 2016

	Notes	2016 $	2015 $	Original Budget $
NET COST OF SERVICES				
Expenses				
Employee Benefits	1.1A	**1,881,576**	1,878,617	2,053,000
Suppliers	1.1B	**963,528**	1,025,812	1,398,000
Grants	1.1C	**17,505,758**	19,829,203	16,988,000
Depreciation and amortisation	2.2A	**131,990**	91,989	140,000
Write-Down and Impairment of Assets	1.1D	**68,544**	—	—
Losses from asset sales		**3,739**	—	—
Total expenses		**20,555,135**	22,825,621	20,579,000
OWN-SOURCE INCOME				
Own-source revenue				
Interest	1.2A	**1,281,822**	1,596,545	825,000
Royalties	1.2B	**745,107**	1,706,735	303,000
Research grants	1.2C	**4,127,088**	925,213	573,000
Other revenue	1.2D	**672,280**	1,251,145	351,000
Total own-source revenue		**6,826,297**	5,479,638	2,052,000
GAINS				
Gains from sale of assets	1.2E	**1,491**	36	—
Total gains		**1,491**	36	—
Total own-source income		**6,827,788**	5,479,674	2,052,000
Net cost of services		**13,727,347**	17,345,947	18,527,000
Revenue from Government				
PIRD Act 1989 Contribution	1.2F	**6,053,299**	7,295,409	4,349,000
Levies and penalties	1.2G	**6,054,115**	7,298,282	4,455,000
Total revenue from Government		**12,107,414**	14,593,691	8,804,000
Surplus/(Deficit) attributable to the Australian Government		**(1,619,933)**	(2,752,256)	(9,723,000)
OTHER COMPREHENSIVE INCOME				
Changes in asset revaluation surplus	2.2A	**—**	(90,534)	—
Total other comprehensive income/(loss)		**—**	(90,534)	—
Total comprehensive income/(loss) attributable to the Australian Government		**(1,619,933)**	(2,842,790)	(9,723,000)

The above statement should be read in conjunction with the accompanying notes.

STATEMENT OF COMPREHENSIVE INCOME (CONTINUED)
for the period ended 30 June 2016

Budget Variances Commentary

Statement of Comprehensive Income for not-for-profit Reporting Entities The original budget is the Corporation's 2015–16 Portfolio Budget Statements (PBS).

Suppliers expense decreased by $0.434 million. New consulting services required for compliance with the PIRD Act 1989 Funding Agreement were not required during 2015–16. In addition, the Corporation decreased expenditure in information and communication technology and property services.

Grants expense increased by $0.518 million. RD&E project expenditure increased as a result of the unbudgeted Rural R&D for Profit grant received.

Write-down and Impairment of assets expense is represented by the write-down of an obsolete version of 'Clarity PPM' software that was replaced during 2015–16.

Interest income increased by $0.457 million as a result of holding term deposits for longer terms at interest rates above average market rate for short term deposits.

Royalties revenue increased by $0.442 million as a result of a higher proportion of 2014–15 cotton seed royalties received in 2015–16 than was estimated to be received in the PBS.

Research Grant revenue increased by $3.554 million as a result of receiving a new grant from the Rural R&D for Profit programme from the Department of Agriculture and Water Resources.

Other revenue increased by $0.321 million as a result of an increase in surplus project funds returned by research organisations.

Commonwealth Contributions; and Industry Contributions, comprising of levies and penalties, increased by $3.303 million as a result of an increase in cotton production from which levies are collected and Commonwealth contributions determined in accordance with the PIRD Act 1989.

STATEMENT OF FINANCIAL POSITION
as at 30 June 2016

	Notes	2016 $	2015 $	Original Budget $
ASSETS				
Financial assets				
Cash and cash equivalents	2.1A	**9,212,257**	6,257,640	912,000
Investments held to maturity	2.1B	**31,000,000**	35,022,609	31,000,000
Trade and other receivables	2.1C	**3,837,710**	3,747,877	2,000,000
Total financial assets		**44,049,967**	45,028,126	33,912,000
Non-financial assets				
Land and buildings	2.2A	**697,966**	710,000	870,000
Property, plant and equipment	2.2A	**79,903**	20,516	165,000
Intangibles	2.2A	**264,072**	319,848	276,000
Prepayments		**5,487**	5,487	10,000
Total non-financial assets		**1,047,428**	1,055,851	1,321,000
Total assets		**45,097,395**	46,083,977	35,233,000
LIABILITIES				
Payables				
Suppliers	2.3A	**57,995**	200,677	30,000
Grants	2.3B	**4,620,209**	3,785,284	4,000,000
Other payables	2.3C	**77,173**	109,342	30,000
Total payables		**4,755,377**	4,095,303	4,060,000
Provisions				
Employee provisions	4.1A	**316,840**	343,563	350,000
Total provisions		**316,840**	343,563	350,000
Total liabilities		**5,072,217**	4,438,866	4,410,000
Net assets		**40,025,178**	41,645,111	30,823,000
EQUITY				
Reserves		**255,403**	255,403	346,000
Retained surplus		**39,769,775**	41,389,708	30,477,000
Total equity		**40,025,178**	41,645,111	30,823,000

The above statement should be read in conjunction with the accompanying notes.

STATEMENT OF FINANCIAL POSITION (CONTINUED)
as at 30 June 2016

Budget Variances Commentary

Statement of Financial Position for not-for-profit Reporting Entities The original budget is the Corporation's 2015–16 Portfolio Budget Statements (PBS).

Cash and cash equivalents above PBS by $8.300 million. The Corporation holds deposits in interest-bearing short-term accounts with financial institutions when the funds will be required within three months and the interest rates are comparable with short-term deposits. Research grant income is held in interest-bearing short-term accounts with financial institutions awaiting completion of project milestones prior to payment to research organisations.

Trade and other receivables above PBS by $1.838 million is represented by increases in Commonwealth contributions and industry levies and interest receivables as a result of increased cotton production.

Land and buildings below PBS by $0.172 million as a result of a revaluation decrement impacting the opening balance of the building as at 1 July 2015.

Grants payable above PBS by $0.620 million is represented by an increase in accrued completed project milestones which have not been invoiced by research organisations.

STATEMENT OF CHANGES IN EQUITY
for the period ended 30 June 2016

	2016 $	2015 $	Original Budget $
RETAINED EARNINGS			
Opening balance			
Balance carried forward from previous period	**41,389,708**	44,141,964	40,200,000
Adjusted opening balance	**41,389,708**	44,141,964	40,200,000
Comprehensive income			
Surplus/(Deficit) for the period	**(1,619,933)**	(2,752,256)	(9,723,000)
Total comprehensive income	**(1,619,933)**	(2,752,256)	(9,723,000)
Closing balance as at 30 June	**39,769,775**	41,389,708	30,477,000
ASSET REVALUATION RESERVE			
Opening balance			
Balance carried forward from previous period	**255,403**	345,937	346,000
Adjusted opening balance	**255,403**	345,937	346,000
Comprehensive income			
Surplus/(Deficit) for the period			
Other comprehensive income	—	(90,534)	—
Total comprehensive income	—	(90,534)	—
Closing balance as at 30 June	**255,403**	255,403	346,000
TOTAL EQUITY			
Opening balance			
Balance carried forward from previous period	**41,645,111**	44,487,901	40,546,000
Adjusted opening balance	**41,645,111**	44,487,901	40,546,000
Comprehensive income			
Surplus/(Deficit) for the period	**(1,619,933)**	(2,752,256)	(9,723,000)
Other comprehensive income	—	(90,534)	—
Total comprehensive income	**(1,619,933)**	(2,842,790)	(9,723,000)
Closing balance as at 30 June	**40,025,178**	41,645,111	30,823,000

The above statement should be read in conjunction with the accompanying notes.

Budget Variances Commentary

Statement of Changes in Equity for not-for-profit Reporting Entities The original budget is the Corporation's 2015–16 Portfolio Budget Statements (PBS).

Deficit for the period below PBS by $8.103 million is a result of the increased revenues from industry levies, Commonwealth contributions and research grants as noted in the budget variance commentary on the Comprehensive Income Statement.

CASH FLOW STATEMENT
for the period ended 30 June 2016

	Notes	2016 $	2015 $	Original Budget $
OPERATING ACTIVITIES				
Cash received				
Industry levies and penalties		**5,917,862**	7,762,401	4,349,000
Commonwealth contributions		**5,480,679**	9,424,529	4,455,000
Royalties		**798,742**	1,855,043	333,000
Grants		**4,487,801**	931,895	630,000
Interest		**1,511,617**	1,657,528	825,000
Net GST received		**1,396,772**	1,924,442	1,737,000
Other		**997,805**	1,148,445	387,000
Total cash received		**20,591,278**	24,704,283	12,716,000
Cash used				
Employees		**1,960,750**	1,861,139	2,052,000
Grants		**18,282,139**	22,322,839	18,687,000
Suppliers		**1,222,021**	1,030,827	1,560,000
Total cash used		**21,464,910**	25,214,805	22,299,000
Net cash from/(used by) operating activities	3.1	**(873,632)**	(510,522)	(9,583,000)
INVESTING ACTIVITIES				
Cash received				
Proceeds from sales of property, plant and equipment		**2,036**	100	—
Investments		**54,922,609**	42,000,000	4,000,000
Total cash received		**54,924,645**	42,000,100	4,000,000
Cash used				
Purchase of property, plant and equipment		**196,396**	307,394	215,000
Investments		**50,900,000**	46,022,609	—
Total cash used		**51,096,396**	46,330,003	215,000
Net cash from/(used by) investing activities		**3,828,249**	(4,329,903)	3,785,000
Net increase/(decrease) in cash held		**2,954,617**	(4,840,425)	(5,798,000)
Cash and cash equivalents at the beginning of the reporting period		**6,257,640**	11,098,065	6,710,000
Cash and cash equivalents at the end of the reporting period	2.1A	**9,212,257**	6,257,640	912,000

The above statement should be read in conjunction with the accompanying notes.

CASH FLOW STATEMENT
for the period ended 30 June 2016

Budget Variances Commentary

Statement of Changes in Equity for not-for-profit Reporting Entities The original budget is the Corporation's 2015–16 Portfolio Budget Statements (PBS).

Industry levies and Commonwealth contributions increased by $2.595 million as a result of an increase in cotton production from which levies are collected and Commonwealth contributions determined in accordance with the PIRD Act 1989.

Royalty receipts increased by $0.466 million as a result of an increase in the proportion of 2014–15 royalties received in the 2015–16.

Grant receipts increased by $3.858 million as a result of new research grants being contracted.

Interest receipts increased by $0.687 million as a result of increased financial reserves being invested at above budgeted interest rates.

Other receipts increased by $0.611 million as a result of an increase in surplus project funds returned by research organisations.

Investments cash received and cash used increased above PBS as a result of an increase in the number of term deposits completed and reinvested during the year. The highest term deposit interest rates available during the year was for three to seven months.

Objective of Cotton Research and Development Corporation

Cotton Research and Development Corporation is a corporate Commonwealth entity. The Corporation is an Australian Government controlled not-for-profit entity. The objective of the Corporation is to bring industry and researchers together to establish research and development strategic directions and to invest in projects that provide the cotton industry with the innovation and productivity tools to compete in global markets.

The Corporation is structured to meet one outcome:

> 'Adoption of innovation that leads to increased productivity, competitiveness and environmental sustainability through investment in research and development that benefits the Australian cotton industry and the wider community.'

The continued existence of the Corporation in its present form and with its present programmes is dependent on Government policy and on continuing funding by Parliament for the Corporation's administration and programmes.

The Basis of Preparation

The financial statements are general purpose financial statements and are required by section 42 of the *Public Governance, Performance and Accountability Act 2013*.

The financial statements have been prepared in accordance with:

a) *Public Governance, Performance and Accountability (Financial Reporting) Rule 2015* (FRR) for reporting periods ending on or after 1 July 2015; and

b) Australian Accounting Standards and Interpretations issued by the Australian Accounting Standards Board (AASB) that apply for the reporting period.

The financial statements have been prepared on an accrual basis and in accordance with the historical cost convention, except for certain assets and liabilities at fair value. Except where stated, no allowance is made for the effect of changing prices on the results or the financial position.

The financial statements are presented in Australian dollars and values are rounded to the nearest dollar unless otherwise specified.

Taxation

The Corporation is exempt from all forms of taxation except Fringe Benefits Tax (FBT), State payroll taxes and the Goods and Services Tax (GST).

Revenues, expenses and assets are recognised net of GST except:

a) where the amount of GST incurred is not recoverable from the Australian Taxation Office; and

b) for receivables and payables.

Events after the Reporting Period

There was no subsequent event that had the potential to significantly affect the ongoing structure and financial activities of the Corporation.

Accounting Judgements and Estimates

No accounting assumptions or estimates have been identified that have a significant risk of causing a material adjustment to carrying amounts of assets and liabilities within the next accounting period.

New Australian Accounting Standards

Adoption of New Australian Accounting Standard Requirements

No accounting standard has been adopted earlier than the application date as stated in the standard.

All new standards, amendments to standards or interpretations that were issued prior to the sign-off date and are applicable to the current reporting period did not have a material effect, and are not expected to have a future material effect, on the Corporation's financial statements.

Future Australian Accounting Standard Requirements

The following new standards, amendments to standards or interpretations were issued by the Australian Accounting Standards Board prior to the signing of the statement by the accountable authority and chief financial officer, which are expected to have a material impact on the Corporation's financial statements for future reporting periods.

Standard/interpretation	Application date for the Corporation[1]	Nature of impending change/s in accounting policy and likely impact on initial application
AASB 9 *Financial Instruments*	1-07-2018	Will impact the classification of financial assets.
AASB 15 *Revenue from Contracts with Customers*	1-07-2018	Will impact the recognition, measurement, presentation and disclosure of royalties.
AASB 16 *Leases*	1-07-2019	Will impact the recognition, measurement, presentation and disclosure of motor vehicle operating leases.
AASB 124 *Related Party Disclosures*	1-07-2016	Will have no impact on disclosures as it is a requirement of the *PGPA (Financial Reporting) Rule 2015 (FRR)* to disclose related party transactions.

1. The Corporation's expected initial application date is when the accounting standard becomes operative at the beginning of the Corporation's reporting period.

All other new standards, amendments to standards or interpretations that were issued prior to the sign-off date and are applicable to future reporting periods are not expected to have a future material impact on the Corporation's Financial Statements.

1. Financial Performance

This section analyses the financial performance of the Corporation for the year ended 2016.

1.1 Expenses

	2016 $	2015 $
1.1A: EMPLOYEE BENEFITS		
Wages and salaries	**1,646,198**	1,585,128
Superannuation:		
Defined contribution plans	**157,520**	154,895
Defined benefit plans	**12,327**	10,862
Leave and other entitlements	**65,531**	127,732
Total employee benefits	**1,881,576**	1,878,617

Accounting Policy
Accounting policies for employee related expenses are contained in the People and Relationships section.

1.1B: SUPPLIERS		
Goods and services supplied and rendered		
Corporate governance	**195,486**	189,850
Consultants	**123,812**	225,028
Corporate services	**15,265**	25,693
Information technology	**218,263**	232,057
Legal services	**64,372**	4,116
Levy management	**13,251**	19,738
Personnel services	**80,756**	46,306
Property services	**63,794**	87,031
General administration	**47,825**	62,089
Total goods and services supplied or rendered	**822,824**	891,908
Goods and services are made up of:		
Goods supplied	**74,464**	293,139
Services rendered	**748,360**	598,769
Total goods and services supplied or rendered	**822,824**	891,908
Other supplier expenses		
Operating lease rentals:		
Minimum lease payments	**116,702**	113,369
Remuneration of auditors	**21,000**	17,000
Workers compensation expenses	**3,002**	3,535
Total other supplier expenses	**140,704**	133,904
Total supplier expenses	**963,528**	1,025,812

1.1 Expenses

	2016 $	2015 $

Leasing Commitments

The Corporation in its capacity as lessee does not have any significant leasing arrangements. Operating leases consist of motor vehicle leases that do not include renewal or purchase options.

Commitments for minimum lease payments in relation to non-cancellable operating leases are payable as follows:

Within 1 year	**117,225**	76,592
Between 1 to 5 years	**95,719**	46,559
Total operating lease commitments[1]	**212,944**	123,151

1 Commitments are GST exclusive

Accounting Policy

The Corporation did not hold any finance leases in 2016 (2015: nil).

Operating lease payments are expensed on a straight-line basis which is representative of the pattern of benefits derived from the leased assets.

1.1C: GRANTS

Public sector:		
Australian Government entities	**4,524,528**	5,907,416
State and Territory Governments	**4,824,839**	4,990,375
Universities and Colleges	**5,020,362**	5,801,747
Corporate extension activities	**454,148**	585,363
Private sector:		
Commercial entities	**2,681,881**	2,544,302
Total grants	**17,505,758**	19,829,203

Grant Commitments

The Corporation in its capacity as grantor has agreements for research grants payable that are commitments tied to the future performance of research, development and extension activities. Research grant commitments are Agreements Equally Proportionately Unperformed.

Commitments for research grants payable are as follows:

Within 1 year	**11,166,459**	12,269,859
Between 1 to 5 years	**8,693,550**	11,473,546
Total research grants payable commitments[1]	**19,860,009**	23,743,405

1 Commitments are GST exclusive

1.1D: WRITE-DOWN AND IMPAIRMENT OF ASSETS

Impairment of intangible assets	**68,544**	—
Total write-down and impairment of assets	**68,544**	—

1.2 Own-Source Revenue and Gains

	2016 $	2015 $
OWN-SOURCE REVENUE		
1.2A: INTEREST		
Deposits	**1,281,822**	1,596,545
Total interest	**1,281,822**	1,596,545

Accounting Policy
Interest revenue is recognised by allocating the interest income over the relevant period using the effective interest method.

1.2B: ROYALTIES		
Royalties	**745,107**	1,706,735
Total royalties	**745,107**	1,706,735

Accounting Policy
Revenue from royalties is recognised on an accruals basis in accordance with the substance of the relevant agreements except when the royalty cannot be measured with sufficient reliability. In the latter case, royalty revenue is recognised based on cash received.

1.2C: RESEARCH GRANTS		
Research grants	**4,127,088**	925,213
Total research grants	**4,127,088**	925,213

Research Grant Commitments
The Corporation in its capacity as grantee has agreements for research grants receivable that are commitments tied to the future performance of research, development and extension activities. Research grant commitments are Agreements Equally Proportionately Unperformed.

Rural R&D for Profit—Smarter irrigation for profit	**477,852**	4,000,000
Rural R&D for Profit—Accelerating precision agriculture to decision agriculture	**1,397,561**	—
Rural R&D for Profit—More profit from nitrogen: enhancing the nutrient use efficiency of intensive cropping and pasture systems	**5,889,286**	—
Carbon Farming Futures Extension and Outreach Program	**461,320**	726,620
Action on the Ground—Determining optimum nitrogen strategies for abatement of emissions for different irrigated cotton systems	**135,000**	305,000
Filling the Research Gap—Indirect emissions of nitrous oxide from broad-acre irrigated agriculture	**49,664**	99,327
Other research grant commitments	**222,150**	—
Total research grant commitments receivable[1]	**8,632,833**	5,130,947
Commitments for research grant receivables are as follows:		
Within 1 year	**4,541,298**	4,213,495
Between 1 to 5 years	**4,091,535**	917,452
Total research grant commitments receivable[1]	**8,632,833**	5,130,947

1 Commitments are GST exclusive

1.2C: RESEARCH GRANTS continued

Accounting Policy
Research Grants: Grant funding received from industry, State or Commonwealth agencies is recognised when the funds are received from the grantor.

1.2 Own-Source Revenue and Gains

	2016 $	2015 $
1.2D: OTHER REVENUE		
Project refunds	**646,481**	1,237,017
Rental income	**5,000**	5,000
Other revenue	**20,799**	9,128
Total other revenue	**672,280**	1,251,145
GAINS		
1.2E: GAINS FROM SALE OF ASSETS		
Property, plant and equipment		
Proceeds from sale	**1,491**	91
Carrying value of asset sold	**-**	(55)
Total gains from sale of assets	**1,491**	36

Accounting Policy
Sale of Assets: Gains from disposal of assets are recognised when control of the asset has passed to the buyer.

REVENUE FROM GOVERNMENT		
1.2F: REVENUE FROM GOVERNMENT		
Department of Agriculture and Water Resources:		
PIRD Act 1989 Contribution	**6,053,299**	7,295,409
Total revenue from Government	**6,053,299**	7,295,409
1.2G: LEVIES AND PENALTIES		
Industry Levies	**6,053,299**	7,295,409
Penalties	**816**	2,873
Total levies and penalties	**6,054,115**	7,298,282

Accounting Policy
Revenue from government: Funding received or receivable from non-corporate Commonwealth entities (appropriated to the Department of Agriculture and Water Resources as a corporate Commonwealth entity payment item for payment to this Corporation) is recognised as Revenue from Government unless the funding is in the nature of an equity injection or a loan. Revenue from the Department of Agriculture and Water Resources is recognised on an accrual basis from the date that the Department of Agriculture and Water Resources notifies the Corporation of the amount receivable. Revenue from Government includes:

a) Industry Levies: Under section 30(1)(a) of the *Primary Industries Research and Development Act 1989* (PIRD Act), CRDC received cotton industry levies. This contribution to the Corporation is collected and distributed by the Australian Government under the *Primary Industries (Excise) Levies 1999 Act*.

b) PIRD Act 1989 Contributions: Under section 30(1)(b) of the PIRD Act, the Australian Government provides matching payments, within certain parameters, equal to one half of the amount expended by the Corporation. Matching payments are recognised as Revenue from Government when the necessary expenditure is recognised.

2. Financial Position

This section analyses the Corporation's assets used to conduct its operations and the operating liabilities incurred as a result.

Employee-related information is disclosed in the People and Relationships section.

2.1 Financial Assets

	2016 $	2015 $
2.1A: CASH AND CASH EQUIVALENTS		
Cash on hand or on deposit	**9,212,257**	6,257,640
Total cash and cash equivalents	**9,212,257**	6,257,640

Accounting Policy

Cash is recognised at its nominal amount. Cash and cash equivalents includes:

a) cash on hand; and

b demand deposits in bank accounts with an original maturity of 3 months or less that are readily convertible to known amounts of cash and subject to insignificant risk of changes in value.

2.1B: INVESTMENTS HELD TO MATURITY		
Investments held to maturity	**31,000,000**	35,022,609
Total investments held to maturity	**31,000,000**	35,022,609
Investments held to maturity expected to be recovered		
No more than 12 months	**31,000,000**	31,022,609
More than 12 months	**—**	4,000,000
Total investments held to maturity	**31,000,000**	35,022,609

Accounting Policy

Non-derivative financial assets with fixed or determinable payments and fixed maturity dates that the Corporation has the positive intent and ability to hold to maturity are classified as held-to-maturity investments. Held-to-maturity investments are recorded at amortised cost using the effective interest method less impairment, with revenue recognised on an effective yield basis.

2.1C: TRADE AND OTHER RECEIVABLES		
Goods and services receivables:		
Goods and services	**25,789**	289,338
Total goods and services receivables	**25,789**	289,338
Government receivables		
Department of Agriculture and Water Resources		
— PIRD Act 1989 Contributions receivable	**1,946,365**	1,373,745
— Industry levies receivable	**1,312,007**	1,175,754
Total government receivables	**3,258,372**	2,549,499

2.1 Financial Assets

	2016 $	2015 $
Other receivables:		
GST receivable from the Australian Taxation Office	**221,530**	347,226
Interest	**332,019**	561,814
Total other receivables	**553,549**	909,040
Total trade and other receivables	**3,837,710**	3,747,877
Trade and other receivables are expected to be recovered in:		
No more than 12 months	**3,837,710**	3,747,877
Total trade and other receivables	**3,837,710**	3,747,877
Trade and other receivables are aged as follows:		
Not overdue	**3,837,710**	3,678,412
Overdue by: 0 to 30 days	—	69,465
Total trade and other receivables (gross)	**3,837,710**	3,747,877

No indicators of impairment were found for trade and other receivables.

Accounting Policy
Receivables: Trade receivables and other receivables that have fixed or determinable payments and that are not quoted in an active market are classified as 'receivables'. Receivables are measured at amortised cost using the effective interest method less impairment.

2.2 Non-Financial Assets

2.2A: RECONCILIATION OF THE OPENING AND CLOSING BALANCES OF PROPERTY, PLANT, EQUIPMENT AND INTANGIBLES (2015-16)

	Land $	Buildings $	Office equipment $	Computer equipment $	Fittings & furniture $	Computer Software[1] $	Total $
As at 1 July 2015							
Gross book value	190,000	520,000	60,052	87,876	13,046	513,056	1,384,030
Accumulated depreciation, amortisation and impairment		—	(50,644)	(79,572)	(10,242)	(193,208)	(333,666)
Net book value 1 July 2015	190,000	520,000	9,408	8,304	2,804	319,848	1,050,364
Additions—Purchases	—	5,336	—	78,370	2,147	110,542	196,395
Impairments recognised in net cost of services						(68,544)	(68,544)
Depreciation and amortisation		(13,086)	(7,578)	(12,193)	(1,359)	(97,774)	(131,990)
Disposals:							
Gross book value	—	(4,394)	—	(50,830)	—	—	(55,224)
Accumulated depreciation and impairment	—	110	—	50,830	—	—	50,940
Net book value 30 June 2016	190,000	507,966	1,830	74,481	3,592	264,072	1,041,941
Net book value as of 30 June 2016 represented by:							
Gross book value	190,000	520,942	60,052	115,417	15,193	436,518	1,338,122
Accumulated depreciation, amortisation and impairment		(12,976)	(58,222)	(40,936)	(11,601)	(172,446)	(296,181)
Total net book value	190,000	507,966	1,830	74,481	3,592	264,072	1,041,941

1. The carrying amount of computer software included $10,590 purchased software and $253,482 internally generated software.

No indicators of impairment were found for property, plant and equipment.

Internally generated software was determined to be obsolete and an impairment recognised of $68,544 (2015 $nil).

No property, plant or equipment is expected to be sold or disposed of within the next 12 months.

Revaluations of non-financial assets

All revaluations were conducted in accordance with the revaluation policy stated below. On 30th June 2015, an independent valuer conducted the revaluation.

A revaluation increment of $nil for land (2015: $10,000) was credited to the asset revaluation surplus by asset class and included in the equity section of the Statement of Financial Position.

A revaluation decrement of $nil for buildings on freehold land (2015: $100,534) was debited to the asset revaluation surplus by asset class and included in the equity section of the Statement of Financial Position.

No increments or decrements were expensed (2015: $nil).

2.2A (CONT'D): RECONCILIATION OF THE OPENING AND CLOSING BALANCES OF PROPERTY, PLANT, EQUIPMENT AND INTANGIBLES (2014-15)

	Land $	Buildings $	Office equipment $	Computer equipment $	Fittings & furniture $	Computer Software $	Total $
As at 1 July 2014							
Gross book value	180,000	639,887	60,052	82,158	13,596	237,901	1,213,594
Accumulated depreciation, amortisation and impairment		(29,444)	(39,907)	(63,651)	(9,377)	(145,619)	(287,998)
Net book value 1 July 2014	180,000	610,443	20,145	18,507	4,219	92,282	925,596
Additions	—	26,473	—	5,718	—	275,155	307,346
Revaluations recognised in other comprehensive income	10,000	(100,534)				—	(90,534)
Depreciation and amortisation		(16,382)	(10,737)	(15,921)	(1,360)	(47,589)	(91,989)
Disposals:							
Gross book value	—	—	—	—	(550)	—	(550)
Accumulated depreciation and impairment	—	—	—	—	495	—	495
Net book value 30 June 2015	190,000	520,000	9,408	8,304	2,804	319,848	1,050,364
Net book value as of 30 June 2015 represented by:							
Gross book value	190,000	520,000	60,052	87,876	13,046	513,056	1,384,030
Accumulated depreciation, amortisation and impairment		-	(50,644)	(79,572)	(10,242)	(193,208)	(333,666)
Total net book value	190,000	520,000	9,408	8,304	2,804	319,848	1,050,364

Accounting Policy

Acquisition of assets: Assets are recorded at cost on acquisition except as stated below. The cost of acquisition includes the fair value of assets transferred in exchange and liabilities undertaken. Financial assets are initially measured at their fair value plus transaction costs where appropriate.

Assets acquired at no cost, or for nominal consideration, are initially recognised as assets and income at their fair value at the date of acquisition, unless acquired as a consequence of restructuring of administrative arrangements. In the latter case, assets are initially recognised as contributions by owners at the amounts at which they were recognised in the transferor's accounts immediately prior to the restructuring.

Asset Recognition Threshold: Purchases of property, plant and equipment are recognised initially at cost in the statement of financial position, except for purchases costing less than $1,000, which are expensed in the year of acquisition (other than where they form part of a group of similar items which are significant in total).

The initial cost of an asset includes an estimate of the cost of dismantling and removing the item and restoring the site on which it is located.

Revaluations: Following initial recognition at cost, property, plant and equipment are carried at fair value. Valuations are conducted with sufficient frequency to ensure that the carrying amounts of assets did not differ materially from the assets' fair values as at the reporting date. The regularity of independent valuations depended upon the volatility of movements in market values for the relevant assets.

Revaluation adjustments are made on a class basis. Any revaluation increment is credited to equity under the heading of asset revaluation reserve except to the extent that it reversed a previous revaluation decrement of the same asset class that was previously recognised in the surplus/deficit. Revaluation decrements for a class of assets are recognised directly in the surplus/deficit except to the extent that they reversed a previous revaluation increment for that class.

Any accumulated depreciation as at the revaluation date is eliminated against the gross carrying amount of the asset and the asset was restated to the revalued amount.

Depreciation: Depreciable property, plant and equipment assets are written-off to their estimated residual values over their estimated useful lives to the Corporation using, in all cases, the straight-line method of depreciation.

Depreciation rates (useful lives), residual values and methods are reviewed at each reporting date and necessary adjustments are recognised in the current, or current and future reporting periods, as appropriate.

Depreciation rates applying to each class of depreciable asset are based on the following useful lives:

	2016	2015
Buildings on freehold land	40 years	40 years
Office equipment	5 to 10 years	5 to 10 years
Computer equipment	3 years	3 years
Fittings and furniture	10 years	10 years

Impairment: All assets were assessed for impairment at 30 June 2016. Where indications of impairment exist, the asset's recoverable amount is estimated and an impairment adjustment made if the asset's recoverable amount is less than its carrying amount.

The recoverable amount of an asset is the higher of its fair value less costs of disposal and its value in use. Value in use is the present value of the future cash flows expected to be derived from the asset. Where the future economic benefit of an asset is not primarily dependent on the asset's ability to generate future cash flows, and the asset would be replaced if the Corporation were deprived of the asset, its value in use is taken to be its depreciated replacement cost.

No indicators of impairment were found for assets at fair value.

Derecognition: An item of property, plant and equipment is derecognised upon disposal or when no further future economic benefits are expected from its use or disposal.

Intangibles: The Corporation's intangibles comprise of purchased and internally developed software for internal use. These assets are carried at cost less accumulated amortisation and accumulated impairment losses.

Software is amortised on a straight-line basis over its anticipated useful life. The useful lives of the Corporation's software are 3 to 5 years (2014–15: 3 to 5 years).

All software assets were assessed for indications of impairment as at 30 June 2016.

2.3 Payables

	2016 $	2015 $
2.3A: SUPPLIERS		
Trade creditors and accruals	**57,995**	200,677
Total suppliers	**57,995**	200,677
Supplier expected to be settled within 12 months:		
No more than 12 months	**57,995**	200,677
Total suppliers	**57,995**	200,677

Settlement is usually made within 30 days.

2.3B: GRANTS		
Grants:		
Public sector:		
Australian Government entities	**900,199**	759,430
State and Territory Governments	**1,079,813**	501,004
Universities and Colleges	**1,652,169**	1,563,803
Other research organisations	**182,426**	218,060
Private sector:		
Other	**805,602**	742,987
Total grants	**4,620,209**	3,785,284
Total grants are expected to be settled in:		
No more than 12 months	**4,620,209**	3,785,284
More than 12 months	**-**	-
Total grants	**4,620,209**	3,785,284

All grants payable are expected to be settled within 12 months.
Settlement is usually within 30 days of completion of milestones and receipt of a tax invoice.

2.3C: OTHER PAYABLES		
Salaries and wages	**—**	48,057
Superannuation	**589**	4,942
Statutory payable	**65,444**	49,184
State payroll tax	**11,140**	6,854
Other	**—**	305
Total other payables	**77,173**	109,342
Total other payables are expected to be settled in:		
No more than 12 months	**77,173**	109,342
More than 12 months	**—**	—
Total other payables	**77,173**	109,342

3. Funding

This section identifies the Corporation's funding structure.

3.1 Cash Flow Reconciliation

	2016 $	2015 $
Reconciliation of cash and cash equivalents as per Statement of Financial Position to Cash Flow Statement		
Cash and cash equivalents as per:		
Cash flow statement	**9,212,257**	6,257,640
Statement of financial position	**9,212,257**	6,257,640
Discrepancy	**—**	—
Reconciliation of net cost of services to net cash used by operating activities:		
Net cost of services	**(13,727,347)**	(17,345,947)
Add revenue from Government	**12,107,414**	14,593,691
Adjustments for non-cash items:		
Depreciation/amortisation	**131,990**	91,989
Net write down of non-financial assets	**68,544**	—
Net write down from sale of assets at a loss	**2,248**	—
Movements in assets/liabilities		
Assets:		
(Increase)/decrease in net receivables	**(89,832)**	2,504,773
(Increase)/decrease in prepayments	**—**	(1,282)
Liabilities:		
Increase/(decrease) in employee provisions	**(26,723)**	28,329
Increase/(decrease) in supplier payables	**(142,682)**	104,540
Increase/(decrease) in other payable	**(32,168)**	14,833
Increase/(decrease) in grants payable	**834,924**	(501,448)
Net cash used by operating activities	**(873,632)**	(510,522)

4. People and Relationships

This section describes a range of employment and post employment benefits provided to our people and our relationships with other key people.

4.1 Employee Provisions

	2016 $	2015 $
4.1A: EMPLOYEE PROVISIONS		
Leave	**316,840**	343,563
Total employee provisions	**316,840**	343,563
Employee provisions are expected to be settled within:		
No more than 12 months	**236,231**	282,988
More than 12 months	**80,609**	60,575
Total employee provisions	**316,840**	343,563

Accounting Policy

Liabilities for short-term employee benefits and termination benefits expected within twelve months of the end of the reporting period are measured at their nominal amounts.

Leave

The liability for employee benefits includes provision for annual leave and long service leave. No provision has been made for sick leave as all sick leave is non-vesting and the average sick leave taken in future years by employees of the Corporation is estimated to be less than the annual entitlement for sick leave.

The leave liabilities are calculated on the basis of employees' remuneration at the estimated salary rates that will be applied at the time the leave is taken, including the Corporation's employer superannuation contribution rates to the extent that the leave is likely to be taken during service rather than paid out on termination.

The liability for long service leave has been determined by reference to the Department of Finance standard parameters for the Long Service Leave Shorthand Method set out in the Financial Reporting Rule. The estimate of the present value of the liability takes into account attrition rates and pay increases through promotion and inflation.

Separation and Redundancy

Provision is made for separation and redundancy benefit payments. The Corporation recognises a provision for termination when it has developed a detailed formal plan for the terminations and has informed those employees affected that it will carry out the terminations.

Superannuation

Staff of the Corporation are members of Public Superannuation Funds, Self Managed Superannuation Funds, the Public Sector Superannuation Scheme (PSS) or the PSS accumulation plan (PSSap).

The PSS is a defined benefit scheme for the Australian Government. The PSSap is a defined contribution scheme.

The liability for defined benefits is recognised in the financial statements of the Australian Government and is settled by the Australian Government in due course. This liability is reported in the Department of Finance's administered schedules and notes.

The Corporation makes employer contributions to the employees' superannuation scheme at rates determined by an actuary, or by statute, sufficient to meet the current cost to the Government. The Corporation accounts for the contributions as if they were contributions to defined contribution plans.

The liability for superannuation recognised as at 30 June represents outstanding contributions for the final fortnight of the year.

4.2 Senior Management Personnel Remuneration

	2016 $	2015 $
Short-term employee benefits		
Salary	**671,424**	658,253
Other[1]	**39,904**	41,374
Total short-term employee benefits	**711,328**	699,627
Post-employment benefits		
Superannuation	**67,510**	65,597
Total post-employment benefits	**67,510**	65,597
Other long-term employee benefits		
Annual leave	**45,574**	44,525
Long-service leave	**16,817**	18,014
Total other long-term employee benefits	**62,391**	62,539
Total senior executive remuneration expenses	**841,229**	827,763

Notes:

1. Other includes motor vehicle benefits, other benefits and fringe benefit tax on those benefits.

The total number of senior management personnel that are included in the above table are 3 (2015: 3).
The total number of non-executive directors that are included in the above table are 6 (2015: 9).

4.3 Related Party Disclosures

Certain director-related entities have transactions with the Corporation that occur within normal customer or supplier relationships on terms and conditions no more favourable than those which it is reasonable to expect the Corporation would have adopted if dealing with the director-related entity at arm's length in similar circumstances. Section 15 of the PGPA Rule 2014 is applied by the Board when a Director gives notice of a material personal interest in a matter. These transactions include the following entities and have been described below where the transactions are considered likely to be of interest to users of these financial statements:

	2016 **$**	2015 $
Transactions with Director-Related Entities		
Michael Robinson is the Chief Executive Officer of Plant Biosecurity CRC which received funding from CRDC for projects:		
PBCRC1501 'Networking remote diagnostics for the Australian cotton industry' for the project term of 1/7/2014 to 30/6/2015.	—	32,345
Elizabeth Alexander is a non-executive director of Plant Health Australia which received funding from CRDC for projects:		
PHA1501 'Review of the Industry Biosecurity Plan for the cotton industry' for the project term of 7/7/2014 to 30/6/2015.	—	16,000
PHA1502 'Provision of the independent technical, secretarial and operational services to the NWPPA 2014–15' for the project term of 7/7/2014 to 30/6/2017.	**10,000**	18,000
PHA1601 'Plant Health Australia Membership Subscription 2015–16' for the project term of 1/7/2015 to 30/6/2016.	**2,000**	—
PHA1602 'Plant Biosecurity RD&E Strategy 2015–16' for the project term of 1/7/2015 to 30/6/2016.	**9,090**	—
Total transactions with director-related entities	**21,090**	66,345

5. Managing Uncertainties

This section analyses how the Corporation manages financial risks within its operating environment.

5.1 Contingent Assets and Liabilities

The Corporation had no contingent assets and liabilities in the current or prior period.

Significant Remote Contingencies

Commonwealth Contributions

The Cotton Research and Development Corporation was established under the *Primary Industries Research and Development Act 1989*. This Act states that the Commonwealth government will make payments to the Corporation equal to one half of the Corporation's annual expenditure. However, government matching payments must not exceed industry levy receipts nor exceed 0.5% of the amount that the Minister determines to be the gross value of production (GVP) for that financial year. In 2015–16 Commonwealth contributions were capped to levy receipts of $6,053,299, leaving a remote contingent receivable of $11.352 million for unmatched R&D expenditure.

5.2 Financial Instruments

	2016 $	2015 $
5.2A: CATEGORIES OF FINANCIAL INSTRUMENTS		
Financial Assets		
Held-to-maturity investments		
Term deposits	**31,000,000**	35,022,609
Total held-to-maturity investments	**31,000,000**	35,022,609
Loans and receivables		
Cash and cash equivalents	**9,212,257**	6,257,640
Trade and other receivables	**357,808**	851,152
Total loans and receivables	**9,570,065**	7,108,792
Total Financial Assets	**40,570,065**	42,131,401
Financial Liabilities		
Financial liabilities measured at amortised cost		
Grants payable	**4,620,209**	3,785,284
Suppliers payable	**57,995**	200,677
Total financial liabilities measured at amortised cost	**4,678,204**	3,985,961

Accounting Policy

Financial assets

The entity classifies its financial assets in the following categories:

a) held-to-maturity investments; and

b) loans and receivables.

The classification depends on the nature and purpose of the financial assets and is determined at the time of initial recognition. Financial assets are recognised and derecognised upon trade date.

Effective Interest Method

Income is recognised on an effective interest rate basis except for financial assets that are recognised at fair value through profit or loss.

Impairment of Financial Assets

Financial assets are assessed for impairment at the end of each reporting period.

Financial assets held at amortised cost—if there is objective evidence that an impairment loss has been incurred for loans and receivables or held to maturity investments held at amortised cost, the amount of the loss is measured as the difference between the asset's carrying amount and the present value of estimated future cash flows discounted at the asset's original effective interest rate. The carrying amount is reduced by way of an allowance account. The loss is recognised in the Statement of Comprehensive Income.

Financial assets held at cost—if there is objective evidence that an impairment loss has been incurred, the amount of the impairment loss is the difference between the carrying amount of the asset and the present value of the estimated future cash flows discounted at the current market rate for similar assets.

Financial liabilities
Grants and Suppliers payable are recognised at amortised cost. Liabilities are recognised to the extent that the goods or services have been received (and irrespective of having been invoiced).

	2016 $	2015 $
5.2B: NET GAINS OR LOSSES ON FINANCIAL ASSETS		
Held-to-maturity investments		
Interest revenue	**1,096,764**	1,341,394
Net gain on held-to-maturity investments	**1,096,764**	1,341,394
Loans and receivables		
Interest revenue	**185,058**	255,151
Net gain from loans and receivables	**185,058**	255,151
Net gain from financial assets	**1,281,822**	1,596,545

5.2C: FAIR VALUE OF FINANCIAL INSTRUMENTS

	Carrying amount 2016 $	**Fair value 2016 $**	Carrying amount 2015 $	Fair value 2015 $
Financial Assets				
Held-to-maturity investments	**31,000,000**	**31,000,000**	35,022,609	35,022,609
Cash and cash equivalents	**9,212,257**	**9,212,257**	6,257,640	6,257,640
Trade and other receivables	**357,808**	**357,808**	851,152	851,152
Total Financial Assets	**40,570,065**	**40,570,065**	42,131,401	42,131,401
Financial Liabilities				
Grants payable	**4,620,209**	**4,620,209**	3,785,284	3,785,284
Suppliers payable	**57,995**	**57,995**	200,677	200,677
Total Financial Liabilities	**4,678,204**	**4,678,204**	3,985,961	3,985,961

The Corporation's financial assets and financial liabilities comprise of term deposits held at banks, cash and deposits held at banks, current receivables and current liabilities. It is held that their carrying amount and fair value are the same.

5.2D: CREDIT RISK

The Corporation's maximum exposure to credit risk is the risk that arises from the potential default of a debtor. This amount is equal to the total amount of trade receivables (2016: $25,789 and 2015: $289,338). The Corporation has assessed that there is no risk of default and has not recognised an impairment allowance account.

The Corporation manages its credit risk through monthly reviews by management of the Corporation's debtors and the use of policies and procedures that guide employees in managing debtors.

The Corporation holds no collateral to mitigate against credit risk.

Credit quality of financial instruments not past due or individually determined as impaired

	Not past due nor impaired 2016 $	Not past due nor impaired 2015 $	**Past due or impaired 2016 $**	Past due or impaired 2015 $
Held-to-maturity	**31,000,000**	35,022,609	—	—
Cash and cash equivalents	**9,212,257**	6,257,640	—	—
Trade and other receivables	**357,808**	781,687	—	69,465
Total	**40,570,065**	42,061,936	—	69,465

Ageing of financial assets that were past due but not impaired for 2016

	0 to 30 days $	**31 to 60 days $**	**61 to 90 days $**	**90+ days $**	**Total $**
Trade and other receivables	—	—	—	—	—
Total	—	—	—	—	—

Ageing of financial assets that were past due but not impaired for 2015

	0 to 30 days $	31 to 60 days $	61 to 90 days $	90+ days $	Total $
Trade and other receivables	69,465	—	—	—	69,465
Total	69,465	—	—	—	69,465

5.2E: LIQUIDITY RISK

The Corporation's financial liabilities are payables. The exposure to liquidity risk is based on the notion that the Corporation will encounter difficulty in meeting its obligations associated with financial liabilities. The Corporation has minimal exposure to liquidity risk. The Corporation receives funding from industry through levies and contributions from the Australian Government. In addition, the Corporation has controls in place to ensure that it has adequate resources to meet its financial obligations and has no past experience of default.

Maturities for non-derivative financial liabilities 2016

	On demand $	Within 1 year $	1 to 5 years $	> 5 years $	Total $
Grants payable	—	**4,620,209**	—	—	**4,620,209**
Suppliers payable	—	**57,995**	—	—	**57,995**
Total	—	**4,678,204**	—	—	**4,678,204**

Maturities for non-derivative financial liabilities 2015

	On demand $	Within 1 year $	1 to 5 years $	> 5 years $	Total $
Grants payable	—	3,785,284	—	—	3,785,284
Suppliers payable	—	200,677	—	—	200,677
Total	—	3,985,961	—	—	3,985,961

The Corporation manages its finances to ensure it has adequate funds to meet payments as they fall due. In addition, the Corporation has policies in place to ensure timely payments are made when due and has no past experience of default.

The Corporation has no derivative financial liabilities in both the current and prior year.

5.2F: MARKET RISK

The Corporation holds basic financial instruments that do not expose it to certain market risks. The Corporation is not exposed to 'currency risk' or 'other price risk'.

Interest Rate Risk

Interest rate risk refers to the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market interest rates. The Corporation is exposed to interest rate risk primarily from 'Cash and cash equivalents' and 'Investments held to maturity'.

A 30 basis point (2015: 40 basis points) change is deemed to be reasonably possible and is used when reporting interest rate risk.

The method used to arrive at the possible risk of 30 basis points was based on both statistical and non-statistical analysis. The statistical analysis has been based on the cash rate for the past five years issued by the Reserve Bank of Australia (RBA) as the underlying dataset. This information is then revised and adjusted for reasonableness under the current economic circumstances.

Interest rates for cash held at banks in operating accounts and at call accounts ranged from 0% to 2.05% as at 30 June 2016. Term deposit fixed interest rates during the year increased from 2.84% to 3.30% for new term deposits. Interest rates on term deposits held at the end of the year range from 2.95% to 3.30%. Although Australian interest rates are at record lows it is expected there will continue to be downward pressure on interest rates due to volatility in the world economy continuing to effect the Australian economy. The sensitivity analysis has used 30 basis points as a reasonable representation of the continued volatility in the economy.

Sensitivity analysis of the risk that the entity is exposed to for 2016

	Risk variable	**Change in risk variable %**	**Effect on: Profit and loss $**	**Effect on: Equity $**
Interest rate risk	**Interest**	**+0.30%**	**137,646**	**137,646**
Interest rate risk	**Interest**	**-0.30%**	**(137,646)**	**(137,646)**

Sensitivity analysis of the risk that the entity is exposed to for 2015

	Risk variable	Change in risk variable %	Effect on: Profit and loss $	Effect on: Equity $
Interest rate risk	Interest	+0.40%	192,668	192,668
Interest rate risk	Interest	-0.40%	(192,668)	(192,668)

5.3 Fair Value Measurement

The following tables provide an analysis of assets and liabilities that are measured at fair value.

The remaining assets and liabilities disclosed in the statement of financial position do not apply the fair value hierarchy.

The different levels of the fair value hierarchy are defined below.

Level 1: Quoted prices (unadjusted) in active markets for identical assets or liabilities that the entity can access at measurement date.

Level 2: Inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly.

Level 3: Unobservable inputs for the asset or liability.

5.3A: FAIR VALUE MEASUREMENT

	Fair value measurements at the end of the reporting period			For Levels 2 and 3 fair value measurements		
	2016 $	2015 $	**Category (Level 1, 2 or 3)**	**Valuation technique(s)**	**Inputs used**	**Range (weighted average)**
Non-financial assets						
Land	**190,000**	190,000	Level 2	Market comparables	Sale prices of comparable land Land size Long-term land appreciation rate	N/A
Buildings on freehold land	**507,966**	520,000	Level 2	Discounted cash flow	Price per square metre Market rate of interest	N/A
Other property, plant and equipment	**79,903**	20,516	Level 2	Depreciated replacement cost	Market prices of similar assets less depreciation	N/A
Total non-financial assets	**777,869**	730,516				
Total fair value measurements of assets in the statement of financial position	**777,869**	730,516				

Fair value measurements

The highest and best use of all non-financial assets are the same as their current use.
There were no transfers of recurring fair value measurements between level 1 and level 2 in the current or prior year.

6. Other Information

6.1 Reporting of Outcomes

The Corporation is structured to meet one outcome:

'Adoption of innovation that leads to increased productivity, competitiveness and environmental sustainability through investment in research and development that benefits the Australian cotton industry and the wider community.'

6.1A: NET COST OF OUTCOME DELIVERY

	Outcome 1	
	2016 $	2015 $
Expenses	**20,555,135**	22,825,621
Income from non-government sector		
Industry Contributions	**6,054,115**	7,298,282
Royalties	**745,107**	1,706,735
Interest	**1,281,822**	1,596,545
Other	**4,799,368**	2,176,358
Total	**12,880,412**	12,777,920
Other own-source income	**1,491**	36
Net cost/(contribution) of outcome delivery	**7,673,232**	10,047,665

Section 7

Appendices

Appendix 1: Annual Performance Statement

Appendix 2: Australian Government Priorities

Appendix 3: Environmental Performance

Appendix 4: RD&E Portfolio

Appendix 5: Glossary and Acronyms

Appendix 6: Annual Reporting Requirements

Appendix 7: Index

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APPENDIX 1: Annual Performance Statement

Each year CRDC evaluates and reports on performance criteria outlined in the CRDC Budget Statement, and goals outlined in the CRDC Strategic R&D Plan 2013–18.

As an entity established under the PIRD Act, CRDC does not produce a Corporate Plan under the PGPA Act 2013 and is therefore exempt from the requirement to map purposes to outcomes. However, CRDC's Annual Performance Statement is in accordance with s39(1)(b) of the PGPA Act for the 2015–16 financial year and accurately presents CRDC's performance in accordance with section 16F of the PGPA Rule.

CRDC completes an annual analysis of performance in the CRDC Portfolio Budget Statement. The 2015–16 performance measures were outlined in the 2015–16 CRDC Portfolio Budget Statement, Section 2: Outcomes and planned performance, pages 105–17, and reported against in the 2016–17 CRDC Portfolio Budget Statement, Section 2: Outcomes and planned performance, pages 110–113.

The following table reports on CRDC outcomes against the 2015–16 performance criteria.

Cotton Research and Development Corporation—Performance criteria	
Outcome 1	Adoption of innovation that leads to increased productivity, competitiveness and environmental sustainability through investment in research and development that benefits the Australian cotton industry and the wider community.
Objectives	**Farmers—cotton is profitable and consistently farmers' crop of choice.** Deliver RD&E for cotton producers to increase productivity, successfully protect crops from threats, optimise resource efficiencies and innovate for improved profitability.
	Industry—the Australian cotton industry is the global leader in sustainable agriculture. Deliver RD&E for the cotton industry for stewardship of its production technologies and its biosecurity, to lead in responsible landscape management and achieve its vision for a sustainable future.
	Customers—the Australian cotton industry captures the full value of its products. Deliver RD&E for the cotton industry to set global benchmarks for cotton qualities and quality assurance, differentiate the value of Australian cotton products to customers and transform the competitive future for the Australian cotton industry.
	People—capable and connected people driving the cotton industry. Deliver RD&E for the cotton industry to ensure workforce capacity, effective networks and communication.
	Performance—measured performance of the Australian cotton industry and its RD&E drives continuous improvement. Deliver RD&E which supports a best practice framework for the cotton industry, captures and demonstrates performance and conduct reviews which enable continuous improvement by CRDC and the industry.

Cotton Research and Development Corporation—Performance criteria	
Delivery	**Farmers—cotton is profitable and consistently farmers' crop of choice.** Strategically prioritise investment in basic, applied and blue-sky research collaboratively with research and cross-sectoral partners to develop new knowledge, practices and technologies for on-farm application by cotton farmers.
	Industry—the Australian cotton industry is the global leader in sustainable agriculture. Strategically prioritise investment in basic, applied and blue-sky research collaboratively with research and cross-sectoral partners to develop new knowledge, practices and innovative approaches to solve industry issues.
	Customers—the Australian cotton industry captures the full value of its products. Strategically prioritise investment in basic, applied and blue-sky research collaboratively with research partners to develop new knowledge, practices, processes, higher value and novel products for the Australian cotton industry and its customers.
	People—capable and connected people driving the cotton industry. Strategically prioritise investment in research, development and extension collaboratively with research, industry and cross-sectoral partners to develop new knowledge, human capacity, support communication and adoption of R&D results.
	Performance—measured performance of the Australian cotton industry and its RD&E drives continuous improvement. Strategically prioritise investment in research, development, data capture and analysis, reviews and extension with research, industry and cross-sectoral partners to drive performance outcomes.

Performance information 2015–16		
Year	Performance criteria	Targets
2015–16	**Farmers—cotton is profitable and consistently farmers' crop of choice.** Industry productivity growth per hectare per annum.	Three per cent per hectare per annum. Estimated achievement of 3.1 per cent average growth in yield per hectare per annum since 2013.
	Industry—the Australian cotton industry is the global leader in sustainable agriculture. Industry reports to customer needs for sustainability indicators.	Achieved through responses to the 2014 Australian Grown Cotton Sustainability Report and Third Environmental Assessment.
	Customers—the Australian cotton industry captures the full value of its products. Customers continue to demand Australian cotton products.	*
	People—capable and connected people driving the cotton industry. National Primary Industries RD&E Framework cotton and cross-sectoral RD&E strategies supported.	Achieved through implementation of the cotton RD&E strategy and increasing collaborative co-investment in cross-sectoral RD&E.
	Performance—measured performance of the Australian cotton industry and its RD&E drives continuous improvement. Coverage of Best Management Practice systems across Australian cotton industry.	Goal of 75 per cent of cotton farms participating. Estimated achievement as at 2015–16 of 70 per cent participation.

* Note: CRDC did not set performance criteria for the customers' program area during 2015–16. Performance criteria have been set for 2016–17 (as outlined in CRDC's Budget Statement and 2016–17 Annual Operational Plan) and will be reported against by CRDC in the 2016–17 Annual Report.

Analysis of Performance

CRDC's RD&E investments are governed by the Strategic R&D Plan 2013–18, which outlines five key investment programs—farmers, industry, customers, people and performance. Each year CRDC completes an analysis of performance against the Strategic Plan measures.

2015–16 marked CRDC's third year of operation under the Strategic Plan. The tables below show CRDC's achievements and progress against the Strategic Plan programs as of 30 June 2016. Progress is measured through the CRDC monitoring and evaluation framework. Each of the measures of success outlined in the Strategic Plan have corresponding metrics, against which performance is measured through annual quantitative and qualitative surveys.

The red, amber and green traffic light system is used in CRDC's monitoring and evaluation to track overall performance against the CRDC Strategic Plan.

Key:
- ● The specific measure has been achieved.
- ● On target to deliver against the measure.
- ● Not on target to deliver against the measure.

Strategic Plan Measures	Result	Comments
Farmers: Cotton is profitable and consistently farmers' crop of choice		
Farmers increase productivity by 3 per cent per hectare per year	●	Estimated achievement of 3.1 per cent average growth in yield per hectare per annum since 2013. According to CSIRO, these yield increases can be attributed to management and the interaction of management and genetics (52 per cent); and genetic improvements (48 per cent). CRDC invests predominately in the areas of management and the interaction of management and genetics, and data from our monitoring and evaluation program has demonstrated a resulting increase in crop yield, resource-use efficiencies, and profitability.
Industry: The Australian cotton industry is the global leader in sustainable agriculture		
Industry can report against recognised sustainability indicators	●	The Australian cotton industry was the first agricultural industry in Australia to develop and document its performance against specific environmental, economic and social sustainability indicators. Developed in response to the industry's Third Environmental Assessment, the 2014 Australian Grown Cotton Sustainability Report developed and benchmarked 45 key sustainability indicators for the Australian cotton industry. Since undertaking this effort, the Australian Dairy Industry Council has also reported on its industry's sustainability (with eight target areas and 50 indicators), indicating a strong alignment between cotton and other agricultural industries.
Customers: The Australian cotton industry captures the full value of its products		
Double the premium for Australian cotton	●	While the industry receives a premium for its product (at times double the premium paid for cotton from other countries) this is not a consistent trend. Competition with man-made fibres will continue to exert downward pressure on the value of cotton. As such, CRDC's RD&E focus is on new uses for cotton and disrupting the supply chain to make cotton more competitive with man-made fibres.

People: Capable and connected people driving the cotton industry		
A skilled, educated and progressive workforce	●	CRDC continues to fund 10 leadership and development programs, run two scholarship programs for emerging researchers, and run the Grassroots Grants program to encourage local innovation. CRDC is the foundation sponsor for both the Australian Cotton Conference and the Association of Australian Cotton Scientists research conference. In 2015-16, CRDC and Cotton Australia developed the industry's first Workforce Development Strategy. Educational attainment in cotton is commensurate with regional Australia, with 28 per cent of the population possessing post-school qualifications, up from 24 per cent in 2006.
Performance: Measured performance of the Australian cotton industry and its RD&E drives continuous improvement		
Measured performance of the Australian cotton industry and its RD&E drives continuous improvement	●	A monitoring and evaluation framework has been developed for CRDC's investments, enabling performance reporting. CRDC's RD&E underpins the industry's best management practices program, *my*BMP, with industry participation in the program now at 70 per cent.

Individual program performance under the CRDC Strategic Plan

Program 1: Farmers		
Theme: Successful Crop Protection		
Outcome: Cotton crops protected from pest, weed and disease threats		
Will be achieved by:	**Measure of success**	**Progress**
Monitoring and investigating the ecological behaviours and responses of cotton pests, weeds and diseases.	World-class science foundations for managing ecological adaptations in cotton insect pests, weeds and diseases.	***In progress.*** Understanding the ecology of cotton pests (insect, weed and pathogens) is the focus of 13 projects, including five PhDs and three post-doctoral positions. This information ensures a strong scientific basis for development of best practice and is the foundation for implementation of integrated pest, weed and disease management strategies.

Program 1: Farmers		
Will be achieved by:	**Measure of success**	**Progress**
Testing practices that deliver improved management of insect pests, weeds and diseases.	85 per cent of farmers adopting improved practices that reduce the reliance on pesticide inputs.	***In progress.*** Current investments have resulted in the successful development of the Resistance Management Plan (RMP) for the next-generation Bt cotton. The plan approved by APVMA enables Bollgard 3® cotton to be commercially grown by Australian cotton growers. Bollgard 3® cotton contains an additional insecticidal protein to effectively control *Helicoverpa* spp., a key pest of cotton. It may further alleviate the need for additional sprays. Testing new and novel products and practices to improve insect pest, weed and disease management continues. New thresholds and tactics have been developed for a number of emerging insect pests, weeds and diseases. A number of innovative crop-monitoring technologies and bio-pesticides are under development and are likely to significantly change the reliance on pesticide inputs. CRDC, NSW DPI and commercial partner BASF are currently commercialising a new bio-pesticide formulation for the control of sucking pests in cotton. High adoption of best practice integrated pest management (IPM) has seen total insecticide active applied (g/ha) continue to decrease, with a 90 per cent reduction over the last decade.
Improving capacity, knowledge and adoption of techniques to successfully protect the cotton crop.	50 per cent of farmers adopting improved practices that reduce the incidence of insect pests, weeds and diseases affecting cotton on their farm.	***In progress.*** The ecology and best practice recommendations developed by research are packaged and communicated to industry through investment in CottonInfo. The CRDC and CottonInfo *Cotton Pest Management Guide* and *Australian Cotton Production Manual* are sought-after publications with annual subscriptions of 3000 and 2800 respectively. They consistently rank as the most preferred method of receiving R&D information among consultants.

Program 1: Farmers		
Theme: Productive Resource Efficiencies		
Outcome: Inputs for cotton production are optimised		
Will be achieved by:	**Measure of success**	**Progress**
Delivering benchmarks of on-farm resource-use efficiencies.	Farmers are able to increase their productivity: ▪ per hectare of land. ▪ per unit of nitrogen fertiliser. ▪ per ML of water. ▪ per unit of CO_2 emitted.	***In progress.*** Two projects are specifically providing benchmarks of on-farm resource-use efficiencies regarding water and energy use. The Australian cotton industry has used values of Gross Production Water Use Index (GPWUI farm) to benchmark water-use efficiency since 1988–89 and in the 2014–15 season, the GPWUI farm was 1.14 bales/ML. Commonwealth grants are being utilised to benchmark energy efficiency and greenhouse gas emissions on farms. Currently, 1.92 kg of cotton lint is produced for each unit of CO_2e, and 23.6 kg of nitrogen (N) is used to produce one 227-kg bale of cotton.
Developing and proving decision systems and practices that deliver optimal resource efficiencies on cotton farms.	Farmers are able to increase their productivity: ▪ per hectare of land. ▪ per unit of nitrogen fertiliser. ▪ per ML of water. ▪ per unit of CO_2 emitted.	***In progress.*** A number of projects continue to investigate nitrogen (N), in particular looking at developing a comprehensive understanding of the N requirements of high-yielding cotton crops; and the N loss pathways associated with each stage of the cotton farming system. Research is also ongoing into phosphorous and potassium nutrition, and managing carbon in the cotton farming system. The latter research has demonstrated the potential for a range of benefits by incorporating a corn rotation, including the increased yield of cotton in the crop following corn; higher levels of soil carbon (especially at depth, i.e. 60–120 cm); increased cotton root densities and rooting depth; and a decrease in black root rot infestation.

Program 1: Farmers		
Will be achieved by:	**Measure of success**	**Progress**
Developing new systems and tools to support farm decision-making processes.	Farmers are able to increase their productivity: ▪ per hectare of land. ▪ per unit of nitrogen fertiliser. ▪ per ML of water. ▪ per unit of CO_2 emitted.	***In progress.*** Current irrigation projects have led to advances in the optimisation and automation of irrigation applications. Remote sensing and satellite imagery can now be used as indicators of crop stress and spatial variability, and the industry is close to fully understanding how weather forecasts and canopy temperature sensors can be used to refine scheduling decisions. The development of a control system for variable rate irrigation application, and software that sequences irrigations and controls the communications between the system components, brings the industry close to smart automated furrow irrigation.
Improving capacity, knowledge and adoption of techniques to optimise resource uses.	Farmers are able to increase their productivity: ▪ per hectare of land. ▪ per unit of nitrogen fertiliser. ▪ per ML of water. ▪ per unit of CO_2 emitted.	***In progress.*** CRDC is supporting the enhancement of a crop carbon management tool. The tool allows farmers to better understand the source and extent of nitrous oxide emissions from their cotton farm, and how to reduce them by improving their farming efficiency.
Theme: Possible Futures		
Outcome: Innovations in cotton production		
Will be achieved by:	**Measure of success**	**Progress**
Investigating the application of new technologies and different scientific approaches which have the potential to deliver significant improvements and economic returns to the cotton farming system.	Farmers are profitable: ▪ On-farm innovations and partnerships established to drive profitability. ▪ Improving gross margins for Australian cotton systems.	***In progress.*** The objective of the Cotton Futures profitable futures theme is to increase cotton producer profitability through improved productivity and certainty of production. Feasibility studies for some projects identified in the futures program have begun while other advanced projects have been incorporated as part of the Australian Government's Rural R&D for Profit programme. The targets for the profitable futures theme are: ▪ Doubling input efficiency by 2029. ▪ Reducing per hectare volatility of yield by half by 2029. ▪ Reducing per bale volatility of quality grade by half by 2029.

Program 2: Industry		
Theme: Respected Stewardship		
Outcome: Industry protects its production technologies and its biosecurity		
Will be achieved by:	**Measure of success**	**Progress**
Monitoring for and investigating changes in pest and weed susceptibility to biotechnologies and crop protection products used by the cotton industry.	Industry is able to maintain access to, and the effectiveness of, biotechnologies and crop protection products.	***In progress.*** CRDC supports significant monitoring programs for conventional cotton and the Bt proteins Cry1Ac, Cry2Ab and VIP. These monitoring programs continue to support the robust RMP for Bt cotton as well as the Insecticide Resistance Management Strategy (IRMS) for conventional insecticides. These programs are pre-emptive and enable industry to respond effectively and early should a change in the resistance frequency of pest population be detected. The Australian cotton industry was identified as the leading industry worldwide in its approach to Bt stewardship.
Exploring tactics and strategies that lower the risks of pesticides to the environment and resistance evolution in populations of key insect pests and weeds.	100 per cent of farmers are aware of the underlying risks of trait and agricultural chemical resistance. 100 per cent of insecticide-use decisions are consistent with the Insecticide Resistance Management Strategy (IRMS). The cotton industry demonstrates pesticide management practices that lower the risks posed to the environment and the evolution of resistance in target insect pest and weed populations.	***In progress.*** There is a high level of awareness of the risks of trait and agricultural chemical resistance. The 2013 Grower Practices Survey found 83 per cent of growers agreed that all their insecticide-use decisions were consistent with the IRMS. Herbicide resistance has been identified as a significant emerging issue. Investments have been made in identifying practices to reduce the risk of herbicide resistance, including development of a herbicide resistance management strategy.
Developing and supporting the industry's capacity to effectively steward key technologies and products.	The cotton industry has the necessary science to provide informed input into the development of resistance management plans for biotech traits.	***In progress.*** The range of research investment into determining an effective RMP for third-generation transgenic cotton includes: ▪ Efficacy and expression characteristics of the toxins contained in Bollgard 3®. ▪ Reviewing the effectiveness of key tactics in the current RMP, *Helicoverpa* spp. ecology. ▪ Examining resistance levels and characteristics. Investments are also supporting investigations into the efficacy and expression characteristics of an alternative Bt cotton product TwinLink Plus® containing the Cry1Ab gene, Cry2Ae gene and Vip3Aa19 gene. This science has been used by the TIMS Bt Technical Panel to provide advice to industry on the development of the RMP for the third-generation Bt technology.

Program 2: Industry		
Will be achieved by:	**Measure of success**	**Progress**
Supporting the industry's preparedness and ability to deal with biosecurity threats.	Industry is capable of managing its biosecurity responsibilities: ▪ The cotton industry is able to meet its biosecurity obligations. ▪ The cotton industry is prepared to effectively respond to biosecurity incursions.	***In progress.*** Investment in biosecurity research has resulted in additional surveillance and diagnostic capacity within existing CRDC-funded disease projects for each of the six priority disease threats. Additionally, investments further support surveillance in Australia's near neighbours to identify the existence of pest and disease threats that might affect the Australian industry. Biosecurity awareness is promoted through industry publications and CottonInfo. The CottonInfo team have undertaken specialist biosecurity training and are an important resource should an incursion be detected.
Theme: Responsible Landscape Management		
Outcome: Industry leads in managing natural assets		
Will be achieved by:	**Measure of success**	**Progress**
Defining the values and drivers relating to the management of natural landscapes and systems in cotton-growing regions.	Industry participation in the collective management of natural landscapes: ▪ Regional delivery partnership for every major cotton-growing region.	***In progress.*** The resilience assessment of the Australian cotton industry project is assisting the cotton industry to develop a whole-of-system perspective that incorporates the economic, social and ecological dimensions of the industry, and how these interact with, influence each other and change over time. Of particular importance is how the industry copes in the face of major expected and unexpected future changes and events (or shocks) such as droughts or market fluctuations.
Recording and demonstrating improved environmental performance of the cotton industry.	Industry contributes to the improvement of landscape systems knowledge and science: ▪ A comprehensive database documenting the extent and condition of the natural assets the industry utilises and manages.	***In progress.*** The first Australian Grown Cotton Sustainability Report has documented the progress and status of the industry against 45 environmental indicators. The report, launched in 2014, is a significant step for the cotton industry to more proactively manage its environmental credentials, and has identified additional opportunities for the industry to further enhance its standing as a world leader in sustainability.
Identifying and proving integrated management strategies which deliver environmental and productivity gains.	Recognition by national and global initiatives for biodiversity management.	***In progress.*** Current investments underway will provide knowledge to use trees to arrest lateral saline water movement, boost the carbon footprint of cotton farms, and keep pest thresholds lower for longer. The NRM technical specialist will deliver these innovative management strategies through *my*BMP and the CottonInfo platforms.

Program 2: Industry		
Will be achieved by:	**Measure of success**	**Progress**
Researching the connectivity between cotton farms and natural systems in the landscape.	One million hectares of floodplain vegetation managed under best practice.	***In progress.*** The current investments provide knowledge for key environmental assets in cotton landscapes—riparian vegetation, deep drainage, groundwater and ecosystem services. CRDC has supported the appointment of a RiverCare Champion to demonstrate and extend knowledge of riparian management to other cotton growers in the industry. The Champion is a cotton grower who is also passionate about riparian zones and the importance of carefully managing these ecologically sensitive areas. He is using his farm as a model farm to demonstrate how cotton farms and riparian management can be better integrated.
Supporting initiatives and partnerships to improve the knowledge and capacity to manage natural landscapes and systems in cotton regions.	Two national science-based collaborations for the industry to inform surface and groundwater management.	***In progress.*** Science partnerships remain a work in progress as research and NRM funding programs are uncertain at a state and national level.
Theme: Sustainable Futures		
Outcome: An industry achieving its vision		
Will be achieved by:	**Measure of success**	**Progress**
Scoping and investigating critical threats and opportunities which may influence the long-term sustainability of the Australian cotton industry.	Industry is capable of leading and adapting to change.	***In progress.*** The objective of the Cotton Futures sustainable futures theme is to achieve an increasingly resilient and responsible cotton industry. The targets for the sustainable theme program are: ▪ The cotton industry is an innovative, low-impact irrigator by 2029. ▪ The Australian cotton industry is carbon neutral by 2029. ▪ The Australian cotton industry is recognised as the leader in sustainable agriculture by 2029.
Supporting innovative approaches to solve traditional industry issues and drive future sustainability.	Innovations and partnerships established to drive cotton industry sustainability.	***In progress.*** The objective of the Cotton Futures sustainable futures theme is to achieve an increasingly resilient and responsible cotton industry. The targets for the sustainable theme program are: ▪ The cotton industry is an innovative, low-impact irrigator by 2029. ▪ The Australian cotton industry is carbon neutral by 2029. ▪ The Australian cotton industry is recognised as the leader in sustainable agriculture by 2029.

Program 3: Customers		
Theme: Assured Cotton		
Outcome: The integrity and qualities of Australian cotton set global benchmarks for customers		
Will be achieved by:	**Measure of success**	**Progress**
Improving Australian fibre quality testing standards and procedures and the capacity to measure and manage contamination.	Australia has the best ranking for non-contamination in the International Textile Manufacturers Federation (TMF) survey.	***In progress.*** Two projects have been initiated to further improve the non-contamination and quality status of Australian cotton, looking at minimising plastic contamination and improving moisture management in the round-module harvester system. CRDC and research partner CSIRO are currently developing commercialisation plans for instruments developed to measure fibre specifications that better enable spinning mills to match fibre quality to yarn specifications.
Supporting the development and implementation of post-farmgate BMPs.	Customers recognise and use Australia's BMP standards as their guarantee of quality assurance.	***In progress.*** CRDC continues to support the training of cotton ginners and the investigation of how farm management and ginning practices influence fibre quality. The *my*BMP program has been recognised by the Better Cotton Initiative, enabling certified *my*BMP cotton to be sold as Better Cotton.
Developing and implementing a standardised reporting system for Australian cotton product quality and traceability.	Australia uses standardised reporting systems for product quality and traceability for farmers, industry and customers.	***In progress.*** A project has been initiated to determine whether the geographic origin of cotton lint can be objectively identified. Terms of reference to investigate options for enhancing the retrospective traceability of cotton have been developed.
Benchmarking Australian cotton against key international programs for product stewardship and sustainability.	Australia can respond to customer needs for reporting against sustainability indicators.	***In progress.*** Sustainability indicators for Australian cotton farming have been developed, informed by international initiatives, including the Better Cotton Initiative and the International Cotton Advisory Committee's Expert Panel on the Social, Economic and Environmental Impact of Cotton. Accreditation of growers through the industry's *my*BMP program now enables Australian growers to be accredited under the Better Cotton Initiative program, returning a premium to growers for the supply of *my*BMP-accredited cotton lint.

Program 3: Customers		
Theme: Differentiated Products		
Outcome: Customers recognise the differentiated value of Australian cotton products		
Will be achieved by:	**Measure of success**	**Progress**
Identifying opportunities for improvements in fibre quality and cotton products.	Customers value the qualities of Australian cotton.	***In progress.*** Collaborations have been established with six spinning mills to test Cottonspec, and with eight mills under the Premium Cotton Initiative to produce high-quality yarns and fabrics from Australian cotton.
Demonstrating the value of different fibre classes and defining fibre quality parameters that secure a premium market.	New fibre classification systems established.	***In progress.*** A project investigating novel spinning technologies to produce fine and high-quality yarns from Australian cotton has been initiated. Research has demonstrated that Australian long-staple cotton is a viable replacement for a proportion of extra-long staple yarn in high-quality fabrics.
Developing customer-based partnerships for the development of high value and novel products, which differentiate Australian cotton.	Partnerships established to demonstrate the potential for differentiating Australian cotton.	***In progress.*** A collaborative project with the integrated spinning mill Esquel Limited is developing novel cotton/wool fabrics.
Theme: Competitive Futures		
Outcome: The demand for Australian cotton products is positively transformed		
Will be achieved by:	**Measure of success**	**Progress**
Investigating existing and future markets for Australian cotton and communicating these findings to the Australian cotton industry.	Customers continue to demand Australian cotton products: ▪ Provide the Australian cotton industry with knowledge of fabric innovations and future market opportunities.	***In progress.*** The objective of the Cotton Futures competitive futures theme is to capture increased value through supply chain transformation and development of new products and markets. The targets for the competitive futures theme are to: ▪ Reduce the length and complexity of the supply chain to add $1 billion of value to the Australian cotton industry by 2029. ▪ Explore, identify and realise new end uses of cotton to add $2 billion of value to the Australian cotton industry by 2029.
Facilitating the development of new technologies and systems to improve the competitiveness of Australian cotton.	Development of alternative and high-value cotton products.	***In progress.*** A number of projects have been initiated that are aiming to develop new technologies to add value to cotton products, including new finishes for anti-wetting, self-sterilising cotton fabrics, and ever-dry self-cooling cotton fabrics.

Program 4: People		
Theme: Workforce Capacity		
Outcome: A skilled educated and progressive industry workforce		
Will be achieved by:	**Measure of success**	**Progress**
Investigating effective strategies for attracting, developing and retaining people in cotton.	Opportunities for workforce development are demanded by industry.	***In progress.*** CRDC and Cotton Australia have developed the first on-farm Workforce Strategy. The strategy outlines key initiatives for attraction, retention and development of on-farm labour and, with additional investment into the People in Agriculture program, will provide key resources for growers and employees. CRDC also has three investment projects further supporting this objective.
Supporting initiatives which lead to the continuous improvement of human resource management including on-farm Workplace Health and Safety.	A 10 per cent reduction in cotton farm-related injuries by 2018.	***In progress.*** CRDC currently has two investment projects aimed at addressing on-farm health and safety. These projects have delivered a profile of incidents occurring on cotton farms and are developing campaigns to increase awareness and tactics to address specific incidents (such as rollover protection for quad bikes). CRDC has also co-invested with other RDCs in the People in Agriculture, and Primary Industries Health and Safety Partnership program, as well as in the *my*BMP human resource management (HRM) module update, to ensure that growers are able to access best practice information.
Understanding opportunities for greater Aboriginal participation in cotton and partnering with organisations to support the development of a culturally aware cotton workforce.	Opportunities for learning are demanded by industry.	***In progress.*** CRDC supports student workplace scholarships through the Aboriginal Employment Strategy and is currently supporting the placement of two Indigenous students in the cotton industry.
Supporting educational opportunities which increase the skills and knowledge of current workforces and will meet the needs of future workforces.	▪ 50 Horizon scholars by 2018. ▪ 30 completed Summer Scholarships by 2018. ▪ 300 students having completed the UNE Cotton Course by 2018. ▪ On-farm skill development. ▪ 50 cotton farmers awarded a new Diploma in Human Resources by 2018.	***In progress.*** In 2015–16, CRDC supported 13 CRDC Summer and Honours Scholarships, and 15 RIRDC Horizon Scholarships supporting the development of undergraduate agricultural students. CRDC also invested in three new PhD Scholarships during the 2015–16 year, taking the total number of PhD scholars supported by CRDC to 18. An additional 76 students enrolled in the UNE Cotton Production course supported by CRDC in 2015-16, while initiatives to support on-farm skill development and a new Human Resource Management Diploma continue to be developed.
Creating opportunities for, and supporting the development of leadership skills.	Participation in leadership programs.	***In progress.*** CRDC supported two Nuffield scholars, two participants in the Australian Rural Leadership Program, and one participant in the Peter Cullen Trust program.

Program 4: People		
Theme: Networks		
Outcome: An industry connected by dynamic networks		
Will be achieved by:	**Measure of success**	**Progress**
Establishing and empowering creative forums and initiatives which build relationships.	▪ 10 conferences and forums are coordinated which promote industry, cross-sectoral and community knowledge sharing.	***In progress.*** CRDC provided support for the 18th Australian Cotton Conference and provided 14 travel scholarships for industry researchers to attend the World Cotton Conference in Brazil. As an active participant in cross-RDC collaborative forums, CRDC is developing collaborative and co-investment initiatives with fellow RDCs to ensure stakeholder needs are met. Additionally, CRDC supported numerous industry and technical forums throughout 2015–16.
Supporting and participating in collaborative cross-sectoral RD&E initiatives.	▪ CRDC is an active member of key industry and government initiatives. ▪ Agriculture Senior Officials Committee (AgSOC) cotton and cross-sectoral strategies supported.	***In progress.*** CRDC participated in activities that include joint national strategic R&D planning with AgSOC, particularly in relation to climate change, soils and water, human capacity, communication and impact evaluation. CRDC is a participant in the soils cross-sectoral strategy with the Department of Agriculture and Water Resources and other RDCs.
Creating and facilitating opportunities for national and international RD&E exchange.	▪ 50 travel scholarships are supported by 2018.	***In progress.*** CRDC supported 21 travel scholarships and scientific exchanges during 2015–16 to enable growers, advisors and researchers to participate in key industry, national and international forums. Additionally, CRDC has established relations with its US counterpart (CottonInc) and the first scientific exchange under this program commenced in June 2016.
Facilitating engagement with stakeholders for prioritising and capturing advice on RD&E issues. Honing research expertise and the application of science from core research disciplines.	The cotton industry has effective collaborative structures for prioritising RD&E.	***In progress.*** CRDC supported the activities of the Cotton Australia grower advisory panels, which provide advice on RD&E. Additionally, CRDC supported the activities of the Cotton Innovation Network, which is part of the AgSOC RD&E framework and was formed to help the cotton industry form RD&E strategy. The main purpose of the Cotton Innovation Network is to ensure the industry gets best value for its investment in research to achieve key outcomes.

Program 4: People		
Theme: Communication		
Outcome: Stakeholder needs are met		
Will be achieved by:	**Measure of success**	**Progress**
Providing information for demand-driven communication strategies and performance reporting.	Communications systems for all CRDC stakeholders are meeting their communication needs.	***In progress.*** CRDC invested $1.5 million in the CottonInfo joint venture during 2015–16 to assist in the development and extension of research outcomes. Research has found that 78 per cent of growers and 90 per cent of advisors source information for their business from CottonInfo; and 89 per cent of growers and 90 per cent of advisors believe CottonInfo helped them improve on-farm practices.
Applying innovative communication methods.	The information and services derived from CRDC investments are in demand and the technologies adopted.	***In progress.*** CRDC is continuously applying innovative communication methods to communicate the outcomes of investments to the core stakeholders and target audiences. This has included an overhaul of all CRDC and CottonInfo communications.

Program 5: Performance		
Theme: Best Practice		
Outcome: World's best practice underpins the performance of the cotton industry		
Will be achieved by:	**Measure of success**	**Progress**
Supporting a best practice framework as the primary integrated planning, risk management, benchmarking, knowledge development and delivery system.	The cotton industry's *my*BMP program is the primary resource for farmers accessing best practice knowledge and tools.	***In progress.*** CRDC invests in two projects to support the achievement of this objective. Firstly, the development of a centralised information repository for the storage of all extension materials and CRDC reports, Inside Cotton. Secondly, CRDC has invested in the review of all of the *my*BMP modules to ensure consistency within and between modules and their applicability for implementation on-farm. This has resulted in greater alignment with on-farm needs.
Promoting best practices through the development and delivery Joint Venture.	▪ An 80 per cent coverage of best management practice systems across the Australian cotton industry. ▪ The cotton industry's *my*BMP program is nationally recognised and integrated with other agricultural sector best management practice programs.	***In progress.*** CRDC invests in a number of Technical Specialists within CottonInfo, who are charged with extending information to growers and updating *my*BMP modules, to ensure they reflect the latest in research findings and outcomes. CRDC commissioned a review of *my*BMP and a number of key recommendations have been developed to ensure that *my*BMP continues to meet industry needs. Coverage of *my*BMP is increasing, with 70 per cent of cotton farms now participating.

Program 5: Performance		
Theme: Monitoring and Evaluation		
Outcome: Industry and RD&E performance is captured		
Will be achieved by:	**Measure of success**	**Progress**
Developing and implementing an internal M&E framework for evaluating CRDC's investment portfolio balance and its RD&E performance.	A rigorous monitoring and evaluation platform which measures and reports on the performance of CRDC's research and development investments.	***In progress.*** CRDC invested in the development of a Monitoring and Evaluation framework. This framework was completed during 2015–16 and reviewed externally to ensure it is robust and logical. The framework is being implemented to ensure compliance with the PGPA Act.
Conducting annual surveys to capture practice change.	An industry performance monitoring and evaluation framework that is consistent with national and international standards.	***In progress.*** CRDC invests in two projects to assess industry performance: an annual Grower Practices Survey and a survey conducted by Crop Consultants Australia. These two surveys provide details of current industry practice from a grower and a consultant perspective.
Establishing a framework through which industry performance can be nationally and internationally reported.	Providing the industry with cotton sustainability indicators and supporting its capacity to report against these indicators.	***In progress.*** As a result of the Third Environmental Assessment, CRDC invested in a project to develop sustainability indicators, enabling the industry to report its performance at a national and international level. The resulting sustainability report was launched in 2014. CRDC and Cotton Australia officially responded to the Third Environmental Assessment in 2016.

Program 5: Performance		
Theme: Reviews		
Outcome: Continuous improvement in industry and RD&E performance		
Will be achieved by:	**Measure of success**	**Progress**
Undertaking scientific discipline reviews of the industry's RD&E.	Independent reviews of the CRDC's research and development performance.	***Achieved.*** CRDC has undertaken a review of soil science in cotton. CRDC has completed a review of its leadership and capacity-building investments and currently has impact analysis underway for its nutrition and water investments.
Commissioning and participating in independent reviews of CRDC's RD&E and organisational performance.	Independent reviews of the CRDC's research and development performance.	***In progress.*** CRDC's M&E framework enables performance monitoring of the R&D portfolio. CRDC conducted an internal review of its organisational performance in 2015–16, prior to an external review of organisational performance being conducted in the 2016–17 year. The review has identified opportunities for improvement in CRDC's processes.
Commissioning independent reviews of the social, environmental and economic performance of the industry.	Independent reviews of the social, environmental and economic performance of the industry's performance.	***In progress.*** CRDC and Cotton Australia have developed 45 sustainability indicators to enable the industry to benchmark and monitor its performance against these indicators.
Participating in cross-sectoral RD&E impact evaluations and reviews.	Independent reviews of the social, environmental and economic performance of the industry's performance.	***In progress.*** CRDC is working with CRRDC to develop the process and methodology for cross-sectoral RD&E impact evaluation and review.

Appendix 2: Australian Government Priorities

CRDC is accountable to the Australian Government through the Minister for Agriculture and Water Resources and the Australian cotton industry. CRDC operates under two key pieces of legislation: the *Primary Industries Research and Development Act 1989* (PIRD Act), and the *Public Governance, Performance and Accountability Act 2013* (PGPA Act).

The PIRD Act makes provision for funding and administration of primary industry research and development with a view to:

- Increasing the economic, environmental and social benefits to members of primary industries and to the community in general by improving the production, processing, storage, transport or marketing of the products of primary industries.
- Achieving the sustainable use and sustainable management of natural resources.
- Making more-effective use of the resources and skills of the community in general and the scientific community in particular.
- Supporting the development of scientific and technical capacity.
- Developing the adoptive capacity of primary producers.
- Improving accountability for expenditure on research and development activities in relation to primary industries.

The Minister wrote to Rural RDCs on 28 January 2016 regarding the Australian Government's recently announced Science and Research Priorities and to advise of the new Rural RD&E Priorities. CRDC has reported against these new priorities in the 2015–16 Annual Report.

A description of the Australian Government's Science and Research Priorities and Rural RD&E Priorities are outlined below.

Science and Research Priorities

1: Food

1.1 Knowledge of global and domestic demand, supply chains and the identification of country-specific preferences for food (and fibre).

1.2 Knowledge of the social, economic and other barriers to achieving access to healthy Australian food (and fibre).

1.3 Enhanced food production through:

1.3.1 novel technologies, such as sensors, robotics, real-time data systems and traceability, all integrated into the production chain.

1.3.2 enhanced food production through better management and use of waste and water; increased food (and fibre) quality, safety, stability and shelf life.

1.3.3 enhanced food production through protection of food (and fibre) sources through enhanced biosecurity.

1.3.4 enhanced food production through genetic composition of food (and fibre) sources appropriate for present and emerging Australian conditions.

2: Soil and Water

2.1 New and integrated national observing systems, technologies and modelling frameworks across the soil-atmosphere-water-marine systems.

2.2 Better understanding of sustainable limits for productive use of soil, freshwater, river flows and water rights, terrestrial and marine ecosystems.

2.3 Minimising damage to, and developing solutions for restoration and remediation of, soil, fresh and potable water, urban catchments and marine systems.

3: Transport

3.1 Low-emission fuels and technologies for domestic and global markets.

3.2 Improved logistics, modelling and regulation: urban design, autonomous vehicles, electrified transport, sensor technologies, real-time data and spatial analysis.

3.3 Effective pricing, operation, and resource allocation.

4: Cybersecurity

4.1 Highly secure and resilient communications and data acquisition, storage, retention and analysis for government, defence, business, transport systems, emergency and health services.

4.2 Secure, trustworthy and fault-tolerant technologies for software applications, mobile devices, cloud computing and critical infrastructure.

4.3 New technologies and approaches to support the nation's cybersecurity: discovery and understanding of vulnerabilities, threats and their impacts, enabling improved risk-based decision making, resilience and effective responses to cyber intrusions and attacks.

4.4 Understanding the scale of the cybersecurity challenge for Australia, including the social factors informing individual, organisational, and national attitudes towards cybersecurity.

5: Energy

5.1 Low-emission energy production from fossil fuels and other sources.

5.2 New clean energy sources and storage technologies that are efficient, cost effective and reliable.

5.3 Australian electricity grids that can readily integrate and more efficiently transmit energy from all sources, including low- and zero-carbon sources.

6: Resources

6.1 A fundamental understanding of the physical state of the Australian crust, its resource endowment and recovery.

6.2 Knowledge of environmental issues associated with resource extraction.

6.3 Lowering the risk to sedimentary basins and marine environments due to resource extraction.

6.4 Technologies to optimise yield through effective and efficient resource extraction, processing and waste management.

7: Advanced Manufacturing

7.1 Knowledge of Australia's comparative advantages, constraints and capacity to meet current and emerging global and domestic demand.

7.2 Cross-cutting technologies that will de-risk, scale up, and add value to Australian manufactured products.

7.3 Specialised, high value-add areas such as high-performance materials, composites, alloys and polymers.

8: Environmental Change

8.1 Improved accuracy and precision in predicting and measuring the impact of environmental changes caused by climate and local factors.

8.2 Resilient urban, rural and regional infrastructure.

8.3 Options for responding and adapting to the impacts of environmental change on biological systems, urban and rural communities and industry.

9: Health

9.1 Better models of health care and services that improve outcomes, reduce disparities for disadvantaged and vulnerable groups, increase efficiency and provide greater value for a given expenditure.

9.2 Improved prediction, identification, tracking, prevention and management of emerging local and regional health threats.

9.3 Better health outcomes for Indigenous people, with strategies for both urban and regional communities.

9.4 Effective technologies for individuals to manage their own health care, for example, using mobile apps, remote monitoring and online access to therapies.

In July 2015, the Australian Government developed clear, farmer-oriented priorities to target rural research, development and extension (RD&E) funding. New Rural Research and Development Priorities were published in the *2015 Agricultural Competitiveness White Paper.*

Rural RD&E Priorities

Advanced Technology. To enhance innovation of products, processes and practices across the food and fibre supply chains through technologies such as robotics, digitisation, big data, genetics and precision agriculture.

Biosecurity. To improve understanding and evidence of pest and disease pathways to help direct biosecurity resources to their best uses, minimising biosecurity threats and improving market access for primary producers.

Soil, Water and Managing Natural Resources. To manage soil health, improve water-use efficiency and certainty of supply, sustainably develop new production areas and improve resilience to climate events and impacts.

Adoption of R&D. Focusing on flexible delivery of extension services that meet primary producers' needs and recognising the growing role of private service delivery.

As part of CRDC's Annual Performance Statements the following outputs and outcomes were delivered during 2015–16 to address the Science and Research Priorities and Rural RD&E Priorities.

Rural RD&E Priorities	Science and Research Priorities	CRDC RD&E outputs and outcomes 2015–16
Advanced technology To enhance innovation of products, processes and practices across the food and fibre supply chains through technologies such as robotics, digitisation, big data, genetics and precision agriculture.	▪ Food ▪ Soil and Water ▪ Advanced Manufacturing	Three specific focus areas were identified in Cotton Futures workshops to increase productivity and certainty of production: autonomous farming, agri-intelligence systems, and future cotton farms. To date, CRDC through discrete investments and through the Rural R&D for Profit programme has invested in six projects to address these outcomes, including: ▪ Irrigation scheduling using canopy temperature sensing. ▪ Smart autonomous irrigation. ▪ Irrigation systems comparison. ▪ Future farm. ▪ Machine vision spot sprayer. ▪ Robotics to improve weed control.
Biosecurity To improve understanding and evidence of pest and disease pathways to help direct biosecurity resources to their best uses, minimising biosecurity threats and improving market access for primary producers.	▪ Food	▪ The industry has a biosecurity plan that has been tested through the identification of the defoliating strain of verticillium wilt. ▪ The TIMS Technical Panel functions effectively to inform Resistance Management Plans for Bollgard 3® and for next-generation herbicide tolerant traits that are finalised/underway. ▪ The industry has achieved an 89 per cent decline in ai/ha insecticide use. ▪ The latest CRDC-supported CCA survey has found that: — 94 per cent of farm advisors follow the IRMS when making spray decisions. — 93 per cent of farm advisors aim to conserve beneficial insects wherever possible. — 79 per cent of farm advisors use double-knock strategies for managing glyphosate resistance. — 58 per cent of growers use residual herbicides. — 99 per cent of farm advisors follow industry's recommended sampling strategy for abundance. — 80 per cent of farm advisors report that black root rot is less or similar prevalence. — 30 per cent of farm advisors report verticillium wilt is more prevalent while 70 per cent report similar or less prevalence. — 55 per cent of farm advisors report that Helicoverpa is more prevalent, while 95 per cent report that aphids are less prevalent.

Rural RD&E Priorities	Science and Research Priorities	CRDC RD&E outputs and outcomes 2015–16
Soil, water and managing natural resources To manage soil health, improve water-use efficiency and certainty of supply, sustainably develop new production areas and improve resilience to climate events and impacts.	▪ Food ▪ Soil and Water ▪ Environmental Change ▪ Health	▪ We are measuring and know our footprint: — Yields increased by 2.5 per cent per annum between 1990 and 2015. In 2013–2015, this is estimated to be an increase of 3.1 per cent. — Nitrogen Fertiliser Use Efficiency (NFUE) is 23.6 kgN/bale. — Gross production water-use efficiency (GPWUI) is 1.14 bales/ML. — 1.92 kg cotton lint is produced per unit of CO_2e. ▪ The CRDC-supported UNSW research team (led by Bryce Kelly) have had their Condamine connectivity study published in *Nature Journal*. The paper 'Assessing Connectivity Between an Overlying Aquifer and a Coal Seam Gas Resource Using Methane Isotopes, Dissolved Organic Carbon and Tritium' has been published as open source and is free to download.
Adoption of R&D Focusing on flexible delivery of extension services that meet primary producers' needs and recognising the growing role of private service delivery.	▪ Food ▪ Soil and Water ▪ Energy ▪ Resources ▪ Advanced Manufacturing ▪ Environmental Change ▪ Health	▪ The CottonInfo joint venture is delivering extension to growers and industry, resulting in adoption and practice change. In 2015–16, CottonInfo hosted or helped to organise 196 events with 3627 attendees. The team also presented to another 1573 people in other activities, such as conferences, forums and workshops. ▪ *my*BMP is now recognised as meeting the requirements of the Better Cotton Initiative. Post-farm gate BMPs (classing and ginning) continue to be supported by their respective industry sectors. ▪ 360 growers, advisors and researchers attended the Nutrition Researchers Tour. 73 per cent of attendees said they were likely to adopt new practices around irrigation deficits and nitrogen rates as a result of the tour. ▪ 100 growers, advisors and researchers participated in irrigation automation events and workshops. 95 per cent of participants in the 2015 *Irrigation Automation Tour* said they would do something differently on their farm as a result of the tour. ▪ 14 workshops on managing glyphosate and herbicide resistance were held across the cotton industry. ▪ Support for ongoing R&D cross-sector partnerships addressing climate change, natural resource management, irrigation and biodiversity, and encouraging the development of new scientists in these areas.

Science and Research Priorities per CRDC RD&E program 2015–16 ($'000)

Science and Research Priorities	Food	Soil and Water	Transport	Cybersecurity	Energy	Resources	Advanced Manufacturing	Environmental Change	Health	TOTAL
Expenditure	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	$'000	($'000)
Program 1: Farmers	4,703	3,317	—	—	237	499	—	643	21	**9,420**
Program 2: Industry	2,329	345	—	—	—	285	—	619	—	**3,578**
Program 3: Customers	1,519	77	—	—	—	—	380	—	—	**1,976**
Program 4: People	1,326	151	—	—	—	—	—	—	25	**1,502**
Program 5: Performance	288	288	—	—	—	—	—	—	—	**576**
TOTAL*	**10,165**	**4,178**	—	—	**237**	**784**	**380**	**1,262**	**46**	**17,052**

* Excludes budgeted employee and supplier expenditure, contingency provisions for research and corporate research activities that support R&D planning and adoption. Some funding totals have been rounded up or down to the closest whole number.

Rural RD&E Priorities per CRDC RD&E Program 2015–16 ($'000)

Rural RD&E Priorities	Advanced Technology	Biosecurity	Soil, Water and Managing Natural Resources	Adoption of R&D	TOTAL
Expenditure	$'000	$'000	$'000	$'000	**$'000**
Program 1: Farmers	2,309	2,423	3,628	1,059	**9,419**
Program 2: Industry	185	2,418	875	100	**3,578**
Program 3: Customers	1,572	0	222	182	**1,976**
Program 4: People	40	15	28	1,420	**1,503**
Program 5: Performance	0	0	144	432	**576**
TOTAL*	**4,106**	**4,856**	**4,897**	**3,193**	**17,052**

* Excludes budgeted employee and supplier expenditure, contingency provisions for research and corporate research activities that support R&D planning and adoption. Some funding totals have been rounded up or down to the closest whole number.

Appendix 3: Environmental Performance

CRDC has integrated the principles of ecologically sustainable development under section 516A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) into its planning framework. As such, each of the measures of success within the CRDC program areas (outlined in the Strategic Plan) consider triple bottom line outputs.

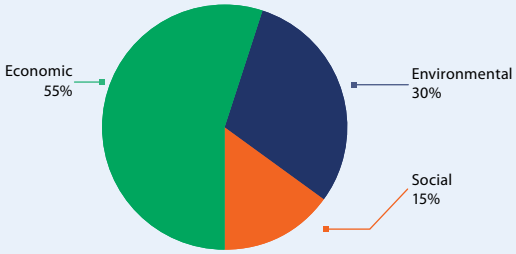
In line with this, the Annual Operational Plan 2015–16 was designed to ensure RD&E investments provide measurable environmental, economic and social benefits to the cotton industry and the wider community.

Environmental and social objectives underpin the economic viability of the industry. Improvements in the efficient use of resources (water, energy, nutrition and chemicals), crop yields per hectare, and efficient farming methods aid the economic performance of cotton growers.

A contracted project with Crop Consultants Australia gathers information about on-farm practices and attitudes across the industry. This information is analysed by CRDC and provides valuable guidance for researchers for future RD&E directions.

CRDC RD&E investments across economic, environmental and social performance outcomes 2015–16

Performance outcomes	CRDC investment (%)
Economic	55%
Environmental	30%
Social	15%
Total	100%



CRDC program contribution to economic, environmental and social outcomes 2015–16

	Economic		Environmental		Social		Total	
CRDC programs	Investment total	No. of projects	Investment total	No. of projects	Investment total	No. of projects	Investment total	No. of projects
Program 1: Farmers	$5,753,596	53	$3,247,761	36	$417,885	9	$9,419,242	**98**
Program 2: Industry	$1,807,260	16	$1,449,386	19	$321,299	7	$3,577,945	**42**
Program 3: Customers	$1,721,372	19	$216,286	4	$38,004	2	$1,975,662	**25**
Program 4: People	$0	0	$0	0	$1,502,631	111	$1,502,631	**111**
Program 5: Performance	$95,741	4	$247,735	4	$232,654	6	$576,130	**14**
Total	**$9,377,969**	**92**	**$5,161,168**	**63**	**$2,512,473**	**135**	**$17,051,610**	**290**
Percentage	**55%**	**32%**	**30%**	**22%**	**15%**	**46%**	**100%**	**100%**

Appendix 4: RD&E Portfolio

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
PROGRAM 1: FARMERS Successful Crop Protection					
2016 FUSCOM meeting	CRDA1604	CRDC	Susan Maas	12/04/16	12/04/16
A predictive diagnostic test for black root rot in cotton soils	CRDC1624	Microbiology Laboratories Australia	Maria Manjarrez	30/04/16	31/10/16
Beatsheets for IPM workshops	CRDC1618	CottonInfo	Warwick Waters	1/12/15	31/12/15
Biogene feasibility study	UWS1602	UWS	Robert Spooner-Hart	1/12/15	30/06/16
Centre for Biopesticides and Semiochemicals: Development of new tools and strategies for IPM	DAN1404	NSW DPI	Robert Mensah	1/07/13	30/06/18
Centre for Biopesticides and Semiochemicals: Novel insecticides and synergists from endemic and exotic flora	UWS1401	UWS	Robert Spooner-Hart	1/10/13	30/06/18
Centre for Biopesticides & Semiochemicals: Semiochemical management for occasional pests of cotton and grains	UNE1404	UNE	Peter Gregg	1/10/13	30/06/18
Commercial development and evaluation of a machine vision-based weed spot sprayer	NEC1402	NCEA	Steven Rees	1/07/13	30/03/18
Crop protection development specialist (CottonInfo technical specialist and *my*BMP module lead)	DAQ1502	QDAF	Sharna Holman	1/07/14	30/06/17
Diseases of Cotton XI	DAN1403	NSW DPI	Karen Kirkby	1/07/13	30/06/16
Enhancing IPM in cotton systems	CSP1401	CSIRO	Lewis Wilson	1/07/13	30/06/18
Establishing southern cotton IPM	DAN1501	NSW DPI	Sandra McDougall	1/07/14	30/06/17
Fusarium wilt management in cotton	DAQ1402	QDAF	Linda Smith	1/07/13	30/06/16
Identification of beneficials attacking silverleaf whitefly and green vegetable bug	CSP1303	CSIRO	Lewis Wilson	1/07/13	31/07/16
Management of Solenopsis mealybug, mirids and apple dimpling bug in Bollgard® cotton	DAQ1501	QDAF	Richard Sequeira	1/07/14	30/06/17
Management options enhancing beneficial microbial functions in cotton soils	CSE1401	CSIRO	Gupta Vadakattu	1/07/13	30/08/16
Microbial solutions for sustainable cotton and soil health management	UNE1303	UNE	Lily Pereg	1/07/12	31/10/15
Northern Australia cotton development and coordination leader	CSP1602	CSIRO	Stephen Yeates	1/10/15	30/06/18
PhD study: Developing the weed control threshold	DAN1601	NSW DPI	Graham Charles	1/11/15	30/06/17
PhD: Centre for Biopesticides and Semiochemicals: Novel insecticides and synergists from endemic and exotic flora	UWS1601	UWS	Michelle Mak	1/07/15	30/06/18
PhD: Host plant relationships of green mirids—is alternative control possible?	UQ1402	UQ	Justin Cappadonna	18/11/13	17/11/16

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
PhD: Microbial tools for advancing the management of soil and seedling health in cotton production systems	UNE1305	UNE	Sarah Cooper	1/02/13	1/02/16
PhD: Multiple host use and gene-flow in green vegetable bug relative to cotton crop	UQ1403	UQ	Dean Brookes	1/03/13	1/10/16
PhD: Quantifying and mapping the impacts of herbicide drift on cotton (non-target crop)	USQ1404	USQ	Luz Angelica Suarez Cadavid	25/11/13	30/06/17
Postdoc: Hard-to-control weeds in northern farming systems—understanding key processes to improve control methods	DAN1402	NSW DPI	Sudheesh Manalil Velayudhan	1/07/13	30/06/17
Regional weed management workshops for growers and advisors	CRDC1621	ICAN	John Cameron	1/03/16	30/06/17
Review of technologies that can be enabled by robotics to improve weed control in Australian cotton farming systems	CRDC1615	SwarmFarm Robotics	Andrew Bate	26/10/15	30/07/16
Staying ahead of weed evolution in changing cotton systems	UQ1501	QAAFI	Jeff Werth/ Bhagirath Chauhan	1/07/14	30/06/19
Travel and scientific exchange: Attending the 49th Annual Society for Invertebrate Pathology Conference	QUT1604	QUT	Christopher Noune	1/05/16	31/07/16
Updating and expanding WEEDpak in support of the cotton industry and *my*BMP	DAN1305	NSW DPI	Graham Charles	1/07/12	31/07/15
Viruses, vectors and endosymbionts: Exploring interactions for control	UQ1305	UQ	Sharon van Brunschot	1/04/13	31/01/17
PROGRAM 1: FARMERS Productive Resource Efficiences					
18th Australian Cotton Conference, 2016—Climate Risk Management Presentation: Dr Walter Baethgen	CRDC1629	CottonInfo	Jon Welsh	6/06/16	8/08/16
Advancing VARIwise with autonomous irrigation and a grower's guide	NEC1401	NCEA	Alison McCarthy	1/07/13	30/06/16
Agronomic management for better fibre and textile quality	CSP1308	CSIRO	Michael Bange	1/07/12	30/06/16
Agronomy for resilient future cotton systems	CSP1601	CSIRO	Michael Bange	1/07/15	30/06/18
Applying plant-based measurements for irrigation in water-limited environments.	CSP1104	CSIRO	Onoriode Coast	1/07/12	30/06/16
Assessing the impacts of new harvesting technologies on cotton	NEC1301	NCEA	John Bennett	1/07/12	31/12/15
Assisting cotton industry diversification in coastal North Queensland & tropical Australia	CSP1302	CSIRO	Stephen Yeates	1/07/12	30/09/15
Benchmarking water-use efficiency and crop productivity in the Australian cotton industry	DAN1505	NSW DPI	Janelle Montgomery	1/07/14	30/06/19
Capital item: Drive on load cells	DAQ1604	QDAF	Paul Grundy	1/06/16	31/08/16
Capital item: Soil moisture monitoring equipment	UQ1404	UQ	John Smith	1/04/14	31/03/15

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
Capital item: Southern connected systems—trial picker	DAN1603	NSW DPI	John Smith	8/04/16	30/06/17
Carbon farming in the Australian cotton industry (CottonInfo technical specialist and *my*BMP module lead)	CFEO1401	CSD	Jon Welsh	1/07/13	30/06/17
Carbon farming in the Australian cotton industry—Grant communications support	CFEO1501	Seed Media Pty Ltd	Rachel Bowman	28/10/14	10/01/17
Carbon farming in the Australian cotton industry—Economic and risk analysis	CFEO1502	NSW DPI	Janine Powell	1/07/14	1/05/17
Carbon farming in the Australian cotton industry—Additional grant support	—	—	—	1/07/13	30/06/17
Consolidating targeted and practical extension services for Australian farmers and fishers	RIRDC1604	RIRDC	Vicki Woodburn	1/07/15	30/06/18
Cotton nutrition webinar series and NUTRIpak review	CFEO1604	Back Paddock Pty Ltd	Chris Dowling	1/05/16	30/06/16
CottonInfo nitrogen trials	CRDC1611	CRDC	Warwick Waters	1/08/15	30/06/16
CottonInfo nutrition tour	CFEO1602	CottonInfo	Jon Welsh	8/02/16	12/02/16
Determining optimum nitrogen strategies for abatement of emissions for different irrigated cotton systems	AOTG1401	NSW DPI	Graeme Schwenke	1/07/13	30/06/17
Development of a pump efficiency monitor for use in the Australian cotton industry	NEC1501	NCEA	Gary Sandell	1/07/14	30/06/16
Development of revolutionary 'float actuated, fully automatic, flow regulating valves'	CRDC1514	Cocky Valves	Peter Cocciardi	1/07/14	30/06/16
Economic assessment of implementing potential mitigation/sequestration options in cotton	CFEO1603	Janine Powell	Janine Powell	1/05/16	30/06/17
EM38 soil water workshop	CRDC1607	DNRM	Jenny Foley	20/07/15	21/07/15
Emissions Reduction Fund—extension and outreach project placement	CFEO1601	CSIRO	Trudy Staines	11/12/15	3/02/16
Identifying practical solutions to optimise nitrogen and water-use efficiency in cotton production	FTRG1601	NSW DPI	Jonathan Baird	1/09/15	30/06/16
Improved use of seasonal forecasting to increase farmer profitability	RIRDC1603	RIRDC	Vicki Woodburn	1/07/15	30/06/18
Improving cotton productivity with crop nutrition	CSP1403	CSIRO	Ian Rochester/ Michael Bange	1/07/13	30/09/16
Increasing profitability through improved nitrogen-use efficiency and reducing losses of nitrogen	AOTG1601	QUT	Peter Grace	1/07/15	30/06/18
Indirect emissions of nitrous oxide from broadacre irrigated agriculture	FTRG1401	CSIRO	Ben Macdonald	1/07/13	30/06/16
International student exchange: Texas A&M Bt susceptibility influenced by diet	CLW1602	CSIRO	Ashley Tessnow	10/06/16	31/08/16

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
Irrigation benchmarking of lateral move and centre pivot systems in the Queensland Murray–Darling Basin	DAQ1503	QDAF	Rosie Hannah	1/07/14	30/09/15
Monitoring greenhouse gas emissions from irrigated cropping systems	CLW1401	CSIRO	Ben Macdonald	1/07/13	30/06/17
Network Development Officer—Upper Namoi Valley	CRDC1405	UNCGA AgVance	Katie Slade	1/07/13	30/06/16
Optimising management of manure in southern NSW cotton production	DU1603	CSIRO	Wendy Quayle	1/07/15	30/06/18
Optimising water and energy use in the Central Queensland irrigation sector	DAQ1404	QDAF	Lance Pendergast	1/07/13	31/03/16
PhD: Improving precision agriculture and environmental performance for the Australian cotton industry through fertiliser optimisation	ANU1602	ANU	James Latimer	1/02/16	30/06/19
PhD: Self-guided drones for tracking irrigation in a cotton field	USQ1402	USQ	Derek Long	1/03/14	1/03/17
PhD: Soil-specific strategic irrigation: identifying saline-sodic water as a resource	NEC1403	NCEA	Aaditi Dang	3/03/14	5/01/17
PhD: The impact of irrigation methods and management strategies on nitrogen fertiliser recovery in cotton	UQ1502	UQ	John Smith	1/07/14	31/12/18
PhD: The physiology of cotton crop nutrition, shade & waterlogging	US1301	USYD	Najeeb Ullah	31/03/12	30/09/15
PhD: Utilising novel plant growth regulators to develop resilient future cotton systems	CSP1604	CSIRO	Claire Welsh	1/01/16	31/12/18
Phosphorus availability in raingrown cotton	UNE1501	UNE	Brendan Griffiths	1/07/14	28/02/16
Postdoc: Closing the soil carbon balance in cotton-farming systems	DAN1401	NSW DPI	Guna Nachimuthu	1/07/13	30/06/16
Postdoc: Cotton production in a future climate	CSP1501	CSIRO	Katie Broughton	1/07/14	31/01/18
Postdoc: Professor of soil biology	UNE1403	UNE	Oliver Knox	1/01/14	31/12/18
Resilient cotton-farming systems in irrigated vertosols: soil quality, carbon and nutrient losses, cotton growth and yield in long-term studies	DAN1503	NSW DPI	Guna Nachimuthu	1/07/14	30/06/17
Review of SOILpak and NUTRIpak	CRDC1628	Soil Management Designs	David McKenzie	1/06/16	31/07/16
Smarter Irrigation for Profit: Develop precise and automated control systems for a range of irrigation systems	RRDP1603	NCEA	Joseph Foley	1/07/15	30/04/18
Smarter Irrigation for Profit: Evaluation of scheduling tools for the sugar industry	RRDP1609	SRA	Peter Samson	31/05/16	30/04/18

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
Smarter Irrigation for Profit: Grower-led irrigation system comparison in the Gwydir Valley	RRDP1606	GVIA	Louise Gall	1/07/15	30/04/18
Smarter Irrigation for Profit: Increasing farm profit through efficient use of irrigation for dairy farms	RRDP1604	UTAS	James Hills	1/07/15	30/04/18
Smarter Irrigation for Profit: Irrigation agronomy for tailored and responsive management with limited water	RRDP1602	CSIRO	Hizbullah Jamali	1/07/15	30/04/18
Smarter Irrigation for Profit: Irrigation Automation Tour	RRDP1608	NSW DPI	Janelle Montgomery	30/11/15	3/12/15
Smarter Irrigation for Profit: Maximising on-farm irrigation profitability—southern connected systems	RRDP1605	NSW DPI	Peter Regan	1/07/15	30/04/18
Smarter Irrigation for Profit: Optimised dairy irrigation farms	RRDP1607	DA	Monique White	1/07/15	30/04/18
Smarter Irrigation for Profit: Project leadership and coordination	RRDP1501	RRR	Guy Roth	1/07/15	30/05/18
Smarter Irrigation for Profit: When and how much	RRDP1601	DEDJTR	Mike Morris	1/07/15	30/04/18
Soil system research—physical, chemical and biological processes for plant growth and nutrient cycling down the whole soil profile	UNE1601	UNE	Oliver Knox	1/07/15	30/06/18
Spatio-temporal visualisation of irrigated cotton root development in Eastern Australia	UNE1603	UNE	Brendan Griffiths	1/10/15	30/06/16
Strengthening the Central Highlands Cotton Production System	DAQ1401	QDAF	Paul Grundy	1/07/13	30/06/17
The implications of 'big data' for Australian agriculture	CRDC1529	AFI	Mick Keogh	1/04/15	30/11/15
Workshop on soil constraints	CRDA1607	CottonInfo	Alice Devlin	1/06/16	31/07/16
PROGRAM 1: FARMERS Profitable Futures					
Future Farm: Intelligent decisions—Improving farmer confidence in targeted N management through automated decisions	GRDC1601	GRDC		1/02/16	30/06/18
PhD: A national regulatory framework governing big data in primary production	UNE1606	UNE	Gina Wood	1/02/16	31/01/19
PhD: Characterisation of brassinosteroid effects and brassinosteroid—responsive genes in cotton for growth and stress tolerance enhancement	UNE1605	UNE	Anahid A Essa Al-Amery	1/05/14	30/04/17
Reducing cotton discolouration risk	IDF1601	Invention Development Management Company, LLC	Paul Levins	1/01/16	30/06/16
OUTCOME 1: FARMERS TOTAL: $9,419,242					

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
PROGRAM 2: INDUSTRY Respected Stewardship					
April TIMS Bt Technical Panel meeting	CRDA1603	CRDC	Susan Maas	20/04/16	20/04/16
Can genetic diversity predict the potential for emergent glyphosate resistance?	UQ1301	UQ	James Hereward	1/07/12	28/08/15
Conventional insecticide resistance in *Helicoverpa*—monitoring, management and novel mitigation strategies in Bollgard 3®	DAN1506	NSW DPI	Lisa Bird	1/07/14	30/06/19
CottonMap 2015–16	CA1604	CA	Nicola Cottee	2/11/15	31/05/16
Economic risk assessment of resistance management strategies for Bt cotton	CSE1404	CSIRO	Stuart Whitten	1/05/14	30/06/16
Helicoverpa egg collecting in cotton regions to support Bt and insecticide resistance monitoring	CCA1401	CCA	Fiona Anderson	1/07/13	30/06/16
Helicoverpa punctigera in inland Australia—what has changed?	UNE1502	UNE	Peter Gregg	1/07/14	30/06/17
Honey bees in cotton: a literature review of benefits to beekeepers and cotton growers	CLW1501	CSIRO	Saul Cunningham	13/10/15	31/12/15
Insecticide Resistance Management Strategy technical panel	CRDA1605	CRDC	Susan Maas	18/05/16	18/05/16
Investigating the on-farm risks of aflatoxin contamination of cottonseed	DAN1406	NSW DPI	Kathy Schneebeli	1/01/14	31/12/16
Managing Bt resistance and induced tolerance in Bollgard 3® using refuge crops	CSE1601	CSIRO	Mary Whitehouse	1/07/15	30/06/18
Managing Bt resistance, *H. punctigera* movements and cotton-planting windows	CSE1306	CSIRO	Mary Whitehouse/ Geoff Baker	1/07/12	30/06/16
Monitoring to manage resistance to Bt toxins	CSE1402	CSIRO	Sharon Downes	1/07/13	30/06/16
PhD: Evolution of viral diversity and virus ecology in the management of resistance to biopesticides	QUT1402	QUT	Christopher Noune	12/01/14	30/06/17
Plant Biosecurity RD&E Strategy 2015–16	PHA1602	PHA	Rodney Turner	30/05/16	30/05/17
Postdoc: Ecology of *Helicoverpa punctigera* revisited: implications for Bt resistance	CRC1109A	UNE	Kris Le Mottee	1/05/11	30/06/14
Provision of the independent technical, secretarial and operational services to the National Working Party on Pesticide Applications 2014–15, 2015–16	PHA1502	PHA	Nicholas Woods	20/07/14	31/05/16
Silverleaf whitefly resistance monitoring 2013–2016	DAQ1403	QDAF	Jamie Hopkinson	1/07/13	30/06/16
Stewardship of biotechnologies and crop protection (CottonInfo technical specialist and *my*BMP module lead)	SC1601	Ceeney Agricultural Consultants	Sally Ceeney	1/07/15	30/06/18
Substitutes for pupae busting—commercial-scale trials of moth busting	UNE1301	UNE	Peter Gregg	1/07/12	31/12/15

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
Surveillance and studies for endemic and exotic virus diseases of cotton	DAQ1601	QDAF	Murray Sharman	1/07/15	30/06/19
Surveillance for exotic cotton viruses: Multiple targets in and nearby Australia	DAQ1405	QDAF	Cherie Gambley	1/07/13	30/06/16
Technical editing: *2015–16 Cotton Pest Management Guide*	SC1602	Ceeney Agricultural Consultants	Sally Ceeney	1/07/15	16/09/15
The sustainable chemical control and resistance management of aphids, mites and mirids in Australian cotton 2014–2019	DAN1507	NSW DPI	Grant Herron	1/07/14	30/06/19
PROGRAM 2: INDUSTRY Responsible Landscape Management					
Baselining lower Namoi groundwater and evaluating Pilliga coal seam gas developments	UNSW1601	UNSW	Bryce Kelly/ Charlotte Iverach	1/07/15	30/06/18
Cotton industry adaptation to extreme weather and climate change	UWS1301	UWS	Brajesh K Singh	1/07/12	31/12/15
Cotton RiverCare Champion	CRDC1602	Capricorn North Pty Ltd	Mark Palfreyman	1/09/15	30/06/18
Critical thresholds for riparian vegetation regeneration in the northern Murray–Darling Basin	GU1401	GriffithU	Samantha Capon	1/07/13	30/06/16
Demonstration of novel evaporation mitigation technology in large-scale trials	CRCP1401	CRC Polymers	David Solomon	1/07/13	30/06/16
Developing the groundwater health index as an industry-wide monitoring tool	MQ1501	MacquarieU	Grant Hose	1/07/14	30/06/17
Managing climate variability program	GRDC1401	GRDC	Beverly Henry	1/07/13	30/06/16
Managing riparian corridors on cotton farms for multiple benefits	UNE1602	UNE	Rhiannon Smith	1/07/15	30/06/18
Measuring deep drainage from a cotton/ wheat trial	CLW1301	CSIRO	Anthony Ringrose-Voase	1/07/12	30/06/16
National cotton NRM technical specialist (CottonInfo technical specialist and *my*BMP module lead)	CRDC1501	Stacey Vogel Consulting	Stacey Vogel	1/07/14	30/06/17
National facility for cotton climate change research	CSP1402	CSIRO	Michael Bange	1/07/13	31/12/16
PhD: Effects of climatic fluctuation and land use change on soil condition in the Lower Lachlan	US1403	USYD	Patrick Filippi	3/03/14	2/03/17
PhD: Keeping pest populations lower for longer: Connecting farms and natural systems	CSE1501	CSIRO	Vesna Gagic	1/07/14	30/06/18
PhD: Spatial and temporal importance of diffuse and stream recharge in semiarid environments: implications for integrated water management	UNSW1403	UNSW	Calvin Li	1/03/14	28/02/17

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
PhD: Sustainable water extractions: Low flow regia and critical flow thresholds	UNE1406	UNE	Marita Pearson	1/01/14	30/12/19
Quantifying the uncertainty associated with predicting coal seam gas production impacts	UNSW1401	UNSW	Bryce Kelly	1/07/13	30/06/16
The impact of improved water-use efficiency on paddock and catchment health	DNRM1401	DNRM	Mark Silburn	1/07/13	31/12/16
PROGRAM 2: INDUSTRY Sustainable Futures					
Resilience assessment of the Australian cotton industry at multiple scales	CRDC1502	Bel Tempo	Francesca Andreoni	1/07/14	30/06/17
OUTCOME 2: INDUSTRY TOTAL: $3,577,945					
PROGRAM 3: CUSTOMERS Assured Cotton					
A review of emission methodologies for the Australian cotton industry and development of a detailed study for north west NSW	DAN1508	NSW DPI	Pip Brock	1/07/14	1/12/15
Determining the shelf life of round modules and impact on cotton quality	CMSE1501	CSIRO	Menghe Miao	1/07/14	30/11/16
Enhancing and testing the Cotton Carbon Management Tool (CCMT)	UQ1503	UQ	Francois Visser	1/07/14	30/06/17
Raising the quality of Australian cotton through post-harvest initiatives	CMSE1503	CSIRO	Rene van der Sluijs	1/07/14	30/06/17
Sustainable Apparel Coalition 2015 membership	CRDC1608	SAC	Scott Miller	18/08/15	18/08/16
Traceability of Australian cotton pilot study	TSW1401	TSW Analytical	Chris May	1/05/14	31/12/14
PROGRAM 3: CUSTOMERS Differentiated Products					
Breathable cotton for compression athletic wear	DU1601	DeakinU	Maryam Naebe	1/07/15	30/12/17
Design of thermal cotton/wool fabrics made from Australian fibre	DU1301	DeakinU	Xungai Wang	1/07/12	30/06/15
Ever-dry self-cooling cotton fabrics	DU1402	DeakinU	Tong Lin	1/01/14	31/12/15
Identifying the glass transition temperature behaviour of Australian cotton	CMSE1201	CSIRO	Chantal Denham	1/07/11	31/12/15
Measuring and managing fibre elongation for the Australian cotton industry	CMSE1504	CSIRO	Shouren Yang	1/01/15	31/12/16
Novel anti-wetting and self-sterilising cotton fabrics	DU1501	DeakinU	Xin Liu/Yan Zhao	1/07/14	30/06/17
Novel spinning technologies for fine and high-quality Australian cotton yarns	DU1502	DeakinU	Xungai Wang	1/07/14	30/06/17
PhD: Effects of cotton cellulose structure and interactions on dye uptake	CMSE1308	CSIRO	Genevieve Crowle	1/07/12	31/12/16

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
PhD: High-value bio-extractives and bioethanol from cotton gin trash	DAN1504	NSW DPI	Mary Egbuta	1/07/14	31/08/17
PhD: Improving length, strength and fineness of cotton fibre	DU1401	DeakinU	Rechana Remadevi	1/07/13	31/12/16
PhD: Low-wax Australian cotton—reducing the scouring requirements of cotton fabric	CMSE1403	CSIRO	Katherine Birrer	1/04/14	31/03/17
Smart cotton/carbon fabrics for electromagnetic interference shielding	DU1602	DeakinU	Jin Zhang	1/07/15	30/06/18
The contribution of cotton cellulose crystallites to fibre strength	CMSE1502	CSIRO	Stuart Gordon	1/07/14	30/06/16
PROGRAM 3: CUSTOMERS Competitive Futures					
Developing renewable fine chemicals from cotton biomass	SRA1601	QUT	William Doherty	1/07/15	30/06/18
Supply chain optimisation including traceability	CMFG1501	CSIRO	Simon Dunstall	10/06/15	31/12/15
Supply chain optimisation including traceability: Industry engagement role	CRDC1532	Tracey Byrne-Morrison	Tracey Byrne-Morrison	26/06/15	30/09/15
Cotton rapid customisation feasibility study	QUT1502	QUT	Jared Donovan	26/06/15	31/03/16
Regenerated cotton to carbon fibre	CMFG1601	CSIRO	Ilias Louis Kyratzis	1/08/15	30/06/16
Direct dissolution and spinning of cellulose from ionic liquid	CMFG1602	CSIRO	Ilias Louis Kyratzis	1/08/15	30/06/16
OUTCOME 3: CUSTOMERS TOTAL: $1,975,662					
PROGRAM 4: PEOPLE Workforce Capacity					
2016 ABARES Science and Innovation Awards for Young People	ABA1501	ABARES	Yvonne Chang	1/07/14	30/06/17
Aboriginal Employment Strategy student scholarships	CRDC1613	AES	Natalie Tighe	1/12/14	30/11/16
Aboriginal Employment Strategy student scholarships	AES1601	Merced Farming	Montana Jones	4/02/16	1/12/17
Australian Rural Leadership Program longitudinal evaluation study	RIR1602	ARLF	Matt Linnegar	1/06/16	30/03/17
Co-Investment in Primary Industries Education Foundation Australia membership for the cotton industry 2014–15 and 2015–16	CA1503	CA/PIEF	Adam Kay	1/07/13	30/06/16
Cotton Industry Leadership Development Strategy—ALRP Scholarship Jamie Iker	RIR1401	ARLF	Jamie Iker	1/07/13	30/06/16
Cotton Industry Leadership Development Strategy—ARLP Scholarship Sean Boland	RIR1401	ARLF	Sean Boland	1/07/13	30/06/16
Cotton Industry Young Professionals Program	USQ1501	USQ	Kay Lembo	1/01/15	29/02/16
CRDC Summer and Honours Scholarships: Benefits of plastic clad cotton	US1504	USYD	Elizabeth Shakeshaft	1/11/14	30/11/15

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
CRDC Summer and Honours Scholarships: Determining emission factors for cotton residue-induced N_2O emissions using 15N isotope tracers	QUT1603	QUT	Stephen Leo	1/02/16	30/11/16
CRDC Summer and Honours Scholarships: Efficacy of robotic methods for the detection and treatment of herbicide resistance cotton weeds	QUT1602	QUT	Simon Thomas	22/02/16	16/11/16
CRDC Summer and Honours Scholarships: How wet and dry cycles affect mineral nitrogen supply from conventional and enhanced efficiency fertilisers	USQ1601	USQ	Kyra O'Sullivan	11/01/16	26/02/16
CRDC Summer and Honours Scholarships: Identifying and testing commercial root endophytes in cotton	QUT1601	QUT	Nathaniel Crane	29/02/16	18/11/16
CRDC Summer and Honours Scholarships: Identifying potential lepidopteran pests in Bt cotton	CSE1604	CSIRO	Edwina Murray	7/12/15	26/02/16
CRDC Summer and Honours Scholarships: Investigation of soil properties that have changed root soil profile exploration in cotton	UNE1504	UNE	Fanny Tisseau Des Escotais	1/01/15	30/11/15
CRDC Summer and Honours Scholarships: Landscape effects on riparian tree growth on cotton farms	GU1601	GriffithU	Anita Nahuysen	4/01/16	19/02/16
CRDC Summer and Honours Scholarships: Locating leaky abandoned exploration wells in the Lower Namoi and Pilliga regions	UNSW1602	UNSW	Elisa Ginty	1/11/15	30/06/16
CRDC Summer and Honours Scholarships: Monitoring leaf hydration of cotton non-destructively with ZIM-probes during irrigation cycles	US1601	USYD	Anna Holcombe	4/01/16	31/05/16
CRDC Summer and Honours Scholarships: Stoichiometric ratios of cotton soils under different land management practices	ANU1601	ANU	Katie McPherson	1/01/15	30/06/16
CRDC Summer and Honours Scholarships: Using the green and infiltration model on cracking clay soils with central pivot and lateral move sprinklers	NEC1502	NCEA	Simon Kelderman	2/03/15	13/11/15
CRDC Summer and Honours Scholarships: Water-use efficiency, economics, yield and quality of cotton in wide and conventional row spacing	US1503	USYD	Timothy Bartimote	21/11/14	30/04/15
Developing education capacity for the Australian cotton industry	CSE1602	CSIRO	Trudy Staines	1/07/15	30/06/18
Grower RD&E Advisory Panels—capacity building	CA1602	CA/PIEF	Nicola Cottee	1/07/15	30/06/16
Horizon Scholarship 2013—Alana Johnson	RIRDC1305	RIRDC	Alana Johnson	30/04/13	31/12/17
Horizon Scholarship 2013—Charlie French	RIRDC1303	RIRDC	Charlie French	30/04/13	31/12/15

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
Horizon Scholarship 2013—Emily Miller	RIRDC1306	RIRDC	Emily Miller	30/04/13	31/12/16
Horizon Scholarship 2013—Paul Sanderson	RIRDC1304	RIRDC	Paul Sanderson	30/04/13	31/12/16
Horizon Scholarship 2015—Camilla a'Beckett	RIRDC1504	RIRDC	Camilla a'Beckett	31/03/15	31/12/17
Horizon Scholarship 2015—Scott Nevison	RIRDC1503	RIRDC	Scott Nevison	31/03/15	31/12/18
Horizon Scholarship 2016—Sam Knight	RIRDC1602	RIRDC	Sam Knight	22/02/16	31/12/19
Horizon Scholarships 2012—Billy Browning	RIRDC1201	RIRDC	Billy Browning	1/01/12	31/12/15
Horizon Scholarships 2012—Kirsty McCormack	RIRDC1201	RIRDC	Kirsty McCormack	1/01/12	31/12/15
Horizon Scholarships 2013—Jessica Kirkpatrick	RIRDC1302	RIRDC	Jessica Kirkpatrick	30/04/13	31/12/16
Horizon Scholarships 2014—Alana Martin	RIRDC1404	RIRDC	Alana Martin	31/03/14	31/12/16
Horizon Scholarships 2014—Felicity Taylor	RIRDC1401	RIRDC	Felicity Taylor	31/03/14	31/12/17
Horizon Scholarships 2014—Grace Scott	RIRDC1402	RIRDC	Grace Scott	31/03/14	31/12/16
Horizon Scholarships 2014—Michael Wellington	RIRDC1405	RIRDC	Michael Wellington	31/03/14	31/12/17
Horizon Scholarships 2014—Sam Johnston	RIRDC1403	RIRDC	Sam Johnston	31/03/14	31/12/17
Inside Cotton and the CRDC final reports	CRDC1620	Warrenbri Farming Partnership	Sally Knight	22/10/15	30/06/16
Nuffield Scholarship 2015—Matthew McVeigh	CRDC1413	Nuffield Australia	Jim Geltch	1/06/14	30/09/16
Nuffield Scholarship 2015—Thomas Quigley	CRDC1516	Nuffield Australia	Jim Geltch	1/10/14	30/09/16
People in farming—employment starter kit (ESKi) website	DA1502	DA	Shane Hellwege	1/07/14	30/06/17
Peter Cullen Trust Science to Policy Leadership Program 2015—Adam Harris	PCT1601	Peter Cullen Trust	Adam Harris	1/07/15	30/06/16
PhD: Career motivational factors of cotton growers' attraction to and retention in the cotton industry	USQ1401	USQ	Geraldine Wunsch	1/07/13	31/12/16
PhD: Investigating cotton farm workers' experiences of job satisfaction using social cognitive career theory	USQ1403	USQ	Nicole McDonald	28/01/14	27/01/17
PhD: Skills profile and labour supply structure on cotton farms	UNE1402	UNE	Will Winter	1/07/13	29/08/17
Scholarship: Explore Leadership Development Capacity	CRDC1614	FRDC	Eric Perez	1/09/15	1/09/16
Smart technology for best practice work health and safety by cotton growers	US1501	USYD	Tony Lower	1/07/14	30/04/16
Sponsorship of Wee Waa High School—2016 FIRST robotics competition	CRDC1616	Wee Waa High School	George Frangos	1/12/15	30/04/16
The impact of farm workforce turnover in the cotton sector	UM1501	UMELB	Geoff Kuehne/ Ruth Nettle	1/07/14	31/12/15
UNE Cotton Production Course	UNE1604	UNE	Brendan Griffiths	1/07/15	30/06/18
Workforce Development Strategy	CRDC1530	AFSS	Ross Ord	11/05/15	13/07/15

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
PROGRAM 4: PEOPLE Networks					
18th Australian Cotton Conference Foundation sponsorship	CA1601	CA	Stuart Armitage	1/07/15	30/09/16
2016 RIRDC Rural Women's Award national dinner sponsorship	RIRDC1605	RIRDC	John Harvey	17/05/16	24/08/16
2016 RIRDC Rural Women's Award national dinner sponsorship: support for industry leaders to attend	CRDC1609	RIRDC	Jennifer Medway	9/09/15	10/09/15
AgVet Collaborative Forum	RIRDC1601	RIRDC	Simon Winter	11/11/15	30/06/16
Association of Australian Cotton Scientists: 2015 Australian Cotton Researcher Conference	CRDC1520	AACS	Paul Grundy	30/01/15	31/10/15
BoardEffect governance platform hosting 2015–16	CRDC1603	BoardEffect LLC	BoardEffect LLC	14/07/15	7/05/16
BoardEffect governance platform hosting 2016–17	CRDC1631	BoardEffect LLC	BoardEffect LLC	28/06/16	7/07/17
CCRSPI	CCR1201	RIRDC	Heather Hemphill	1/07/13	30/06/16
Cotton crop protection in 20 years	CRDA1606	CRDC	Susan Maas	17/05/16	17/05/16
CRDC Grassroots Grants: Gwydir Valley dryland planting date row configuration trial	CGA1602	Gwydir Valley CGA	Ben Dawson	1/07/15	31/12/16
CRDC Grassroots Grants: In-field research trial comparing dryland cotton to dryland sorghum on various row configurations	CGA1601	Mungindi CGA	Jo Weier	1/08/15	30/06/16
CRDC Grassroots Grants: In-field trials to address local barriers to cotton growing and exposure to the cotton industry	CGA1605	Upper Namoi CGA	Jon Welsh	1/10/15	30/01/17
CRDC Grassroots Grants: Irrigation scheduling training using canopy sensors	CGA1607	Lower Namoi CGA	Geoff Hunter/ Steve Madden	15/10/16	30/06/17
CRDC Grassroots Grants: Local weather data access	CGA1604	Dawson Valley CGA	Damien Erbacher	31/10/15	30/09/16
CRDC Grassroots Grants: Optimised irrigation row configuration	CGA1603	Gwydir Valley CGA	Jake Cutcliffe	1/07/15	30/06/16
CRDC Grassroots Grants: Seasonal benchmarking with canopy temperature sensors	CGA1609	CottonInfo	Amanda Thomas	1/08/15	1/08/16
CRDC Grassroots Grants: Stickybeak farm tour	CGA1610	Dawson Valley CGA Inc.	Bronwyn Christensen	1/02/16	29/02/16
CRDC Grassroots Grants: Strengthening CGA policy and procedures	CGA1608	CHCGIA	Emma McCullagh	1/10/15	31/12/16
CRDC Grassroots Grants: Upgrade to Darling Downs weather station network and chemical application days	CGA1606	Darling Downs CGI	Chris Barry	1/01/16	30/09/16

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
CRDC Grassroots Grants: weigh trailer for southern NSW cotton trials	CGA1611	Southern Valley CGA	Kate O'Callaghan	1/01/16	30/06/16
Grower RD&E Advisory Panels—R&D consultation	CA1603	Cotton Australia	Nicola Cottee	1/07/15	30/06/16
IREC field station upgrade (jointly funded with CSD)	IREC1501	IREC	Rob Houghton	1/07/14	30/06/17
National Soil RD&E Implementation Committee membership and contributions	DAFF1401	CSIRO	Mike Grundy	1/06/14	30/06/17
Plant Health Australia membership 2015–16	PHA1601	PHA	PHA	1/07/15	30/06/15
Primary Industries Health and Safety Partnership	RIRDC1301	Joint Partnership RIRDC	Simon Winter	28/08/12	30/06/17
Research and Innovation Network for Precision Agriculture Systems	UNE1507	UNE	David Miron	1/05/15	31/12/15
Travel and scientific exchange: ACSA EMD seminars	ACSA1601	ACSA	Stuart Gordon	29/05/16	4/06/16
Travel and scientific exchange: Association of Australian Cotton Scientists Research Conference	CRDC1606	CRDC	Paul Grundy	8/09/15	10/09/15
Travel and scientific exchange: Association of Australian Cotton Scientists Research Conference	CRDC1612	Barnett Consulting	Paul Barnett	10/09/15	11/09/15
Travel and scientific exchange: Association of Australian Cotton Scientists Research Conference	CCA1602	CCA	Fiona Anderson	7/09/15	11/09/15
Travel and scientific exchange: CRDC Horizon Scholar attendance at 2016 Cotton Conference	RIRDC1606	CRDC	Trudy Staines	2/08/16	4/08/16
Travel and scientific exchange: International Congress of Entomology, Florida	CSP1603	CSIRO	Lewis Wilson/ Simone Heimoana	4/01/14	2/10/16
Travel and scientific exchange: International Congress of Entomology, Florida	DAN1602	NSW DPI	Robert Mensah	16/12/15	2/10/16
Travel and scientific exchange: Visit to ACRI by Dr Steven Naranjo, USDA, Arizona	CSP1702	CSIRO	Lewis Wilson	3/12/16	9/12/16
Travel and scientific exchange: Workforce Development Strategy and Research Forum, Brisbane	CSE1603	CSIRO	Trudy Staines	10/12/15	11/12/15
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	US1603	USYD	Patrick Filippi	30/04/16	9/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	USQ1602	USQ	Luz Angelica Suarez Cadavid	30/04/16	9/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	UQ1601	UQ	Dean Brooks	30/04/16	9/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	US1602	USYD	Daniel Tan	30/04/16	9/05/16

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	CSE1606	CSIRO	Gupta Vadakattu	30/04/16	9/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	RRR1602	RRR	Guy Roth	30/04/16	7/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	CSP1608	CSIRO	Susan Jaconis	30/04/16	9/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	DAQ1602	QDAF	Linda Smith	30/04/16	15/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	CSP1605	CSIRO	Michael Braunack	30/04/16	7/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	DAQ1603	QDAF	Richard Sequeria	30/04/16	10/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	ANU1603	ANU	Robert Sharwood	30/04/16	9/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	CSE1605	CSIRO	Sharon Downes	30/04/16	7/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	CSP1606	CSIRO	Stephen Yeates	24/04/16	10/05/16
Travel and scientific exchange: World Cotton Research Conference 2016, Brazil	CLW1601	CSIRO	Tom Walsh	30/04/16	7/05/16
PROGRAM 4: PEOPLE Communication					
Australian cotton production and best practice documentaries	DAQ1302	QDAF	Paul Grundy	1/07/13	30/06/16
Australian Cotton Production Manual 2016 proofreading	CRDC1626	Helen Wheels HR	Helen Dugdale	10/05/16	30/06/16
Building an online publication infrastructure	CRDC1627	KeoDesign	Nic Hinwood	1/06/16	31/08/16
CCA 2013–14 survey support	CRDC1610	Weemalah WriteAbility	Elizabeth Tout	1/07/15	27/08/15
Cotton industry database—data review	CRDC1518	Making Data Easy	Lee Armson	15/10/14	31/7/15
Cotton industry database—management	CRDC1605	Making Data Easy	Lee Armson	1/08/15	30/06/16
Cotton Pest Management Guide 2015–16 proofreading	CRDC1601	Helen Wheels HR	Helen Dugdale	10/08/15	12/08/15
CRDC 2014–15 Annual Report support	CRDC1528	Carolyn Martin	Carolyn Martin	28/04/15	30/11/15
CRDC 25th anniversary publication support	CRDC1625	Seftons	Robbie Sefton	3/05/16	31/07/16
Stimulating private-sector extension in Australian agriculture to increase returns from R&D	DA1601	DA	Ruth Nettle	1/07/15	30/06/18
OUTCOME 4: PEOPLE TOTAL: $1,502,631					

Project title	Project Code	Research Organisation	Principal Researcher	Start Date	Cease Date
PROGRAM 5: PERFORMANCE Best Practice					
'Science into best practice', linking research with CottonInfo (CottonInfo technical specialist)	CSP1504	CSIRO	Sandra Williams	1/07/14	30/06/17
PROGRAM 5: PERFORMANCE Monitoring and Evaluation					
Annual Cotton Grower Practices Surveys: 2014, 2015 and 2016	RRR1501	RRR	Ingrid Roth	1/07/14	31/05/17
Annual qualitative and quantitative surveys for the Australian cotton industry	CCA1601	CCA	Liz Todd	1/07/15	30/06/18
Australian Cotton Comparative Analysis 2014–15	BCA1501	BCA	Phil Alchin	17/06/15	30/06/16
CottonInfo monitoring and evaluation support system	CRDC1617	Coutts J&R	Jeff Coutts	1/07/15	30/06/16
Improving perceptions—Part of the Blueprint for Australian Agriculture	CRDC1422	NFF	Sophie Keatinge	6/05/14	30/06/16
Integrated economic environmental and social performance reporting of cotton industry	RRR1403	RRR	Guy Roth	1/07/13	30/10/16
PROGRAM 5: PERFORMANCE Reviews					
CRDC Leadership Program Review	CRDC1622	Inner Compass Pty Ltd	Zoe Routh	18/03/16	30/06/16
Future RD&E models	CRDC1604	Strategis Partners	Jay Horton	5/08/15	31/10/15
Impact assessment of selected clusters of projects	CRDC1623	Agtrans Research and Consulting	Peter Chudleigh	2/05/16	23/09/16
Potential socio-economic impacts of a new seed cotton exports	RRR1601	RRR	Guy Roth	1/08/15	31/10/15
Review of CottonInfo	CRDC1619	ACIL Allen Pty Ltd	Jan Paul van Moort	16/12/15	14/03/16
Stakeholder engagement survey 2016	CRDC1630	Intuitive Solutions	Michael Sparks	6/06/16	30/08/16
Update to the Cotton Innovation Network's Research Pathways investment analysis	CRDC1531	ACIL Allen Pty Ltd	Jan Paul van Moort	19/06/15	14/08/15
OUTCOME 5: PERFORMANCE TOTAL: $576,130					

TOTAL CRDC RD&E INVESTMENT $17,051,610

Appendix 5: Glossary and Acronyms

Term	Description
AACS	Australian Association Cotton Scientists
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACIC	Australian Cotton Industry Council
ACRI	Australian Cotton Research Institute
ACSA	Australian Cotton Shippers Association
AECL	Australian Egg Corporation Limited
AES	Aboriginal Employment Strategy
AFI	Australian Farm Institute
AFM	atomic force microscopy
AFSS	AgriFood Skills Solutions
AgSOC	Agriculture Senior Officials Committee
AGWA	Australian Grape and Wine Authority
ai/ha	active ingredient per hectare
ALS	Australian long-staple cotton
AMPC	Australian Meat Processing Council Limited
ANU	Australian National University
APL	Australian Pork Limited
App	Application program available from smart devices such as mobiles
APVMA	Australian Pesticides and Veterinary Medicines Authority
ARLF	Australian Rural Leadership Foundation
ARLP	Australian Rural Leadership Program
AUSAgLCI	Australian Agriculture Life Cycle Inventory
AVG	aminoethoxyvinylglycine
AWI	Australian Wool Innovation Limited
BCA	Boyce Chartered Accountants
BIPL	Blast Industry Pty Ltd
BMP	Best Management Practices program
Bollgard II®	Cotton varieties contain two genes resistant to *Helicoverpa* spp.
Bollgard 3®	Cotton varieties contain three genes resistant to *Helicoverpa* spp.
Bt	Bacillus thuringiensis (crystal protein gene expressed in Bollgard II® and Bollgard 3® cotton varieties, resistant to *Helicoverpa* spp.)
BS	Budget Statements
C	carbon
CA	Cotton Australia
CBTV	Cotton Bunchy Top Virus
CCA	Crop Consultants Australia Inc.
CCMT	Crop Carbon Management Tool
CCRSPI	National Climate Change Research Strategy for Primary Industries
CDI	Corporate Development Institute
CGA	Cotton Grower Association
CGT	Cotton Gin Trash

Term	Description
CMSE	CSIRO Materials Science and Engineering
Corporation, the	Cotton Research and Development Corporation
Cotton CRC	Cotton Catchment Communities Cooperative Research Centre
CottonInfo team	Team of regional extension officers, technical specialists and *my*BMP specialists, formed under a joint venture between CRDC, Cotton Australia and CSD
CottonLEADS	Australian and United States program to lead responsible cotton production sustainably
CQ	Central Queensland
CRC	Cooperative Research Centre
CRC Polymers	Cooperative Research Centre for Polymers
CRDC	Cotton Research and Development Corporation
CRRDC	Council of Rural Research and Development Corporations
CSD	Cotton Seed Distributors Ltd (a grower-owned cooperative)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Dairy Australia Limited
DeakinU	Deakin University
DEDJTR	Department of Economic Development, Jobs, Transport and Resources (Victoria)
DMA	dynamic mechanical analysis
DNRM	Department of Natural Resources and Mines (Queensland)
DSC	differential scanning calorimeter
ELS	Extra-long staple
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EPI	Environmental Performance Indicator
ESD	Ecologically sustainable development
F1	F1 screens involve testing the offspring of single-pair matings between moths from Cry2Ab-resistant strains maintained in the laboratory (sP15 for *H. armigera* and Hp4-13 for *H. punctigera*) and moths raised from eggs collected from field populations
FRDC	Fisheries Research and Development Corporation
FWPA	Forest and Wood Products Australia Limited
g/ha	grams per hectare
GIS	Geographic Information System
GM	Genetically Modified
GPWUIfarm	Gross Production Water Use Index farm
GRDC	Grains Research and Development Corporation
GriffithU	Griffith University
GVIA	Gwydir Valley Irrigators Association
ha	hectare
Helicoverpa spp.	Cotton's major insect pests (*H. armigera* and *H. punctigera*)
HIA	Horticulture Innovation Australia
HRMS	Herbicide Resistance Management Strategy
HVI	High-Volume Instrument
ICAN	Independent Consultants Australia Network

Term	Description
ICT	Information and Communications Technology
IDM	Integrated Disease Management
IP	Intellectual Property
IPM	Integrated Pest Management
IREC	Irrigation Research and Extension Committee
IRMS	Insecticide Resistance Management Strategy
IT	Information Technology
IWM	Integrated Weed Management
K	potassium
KPI	Key Performance Indicator (measure of success)
LCA	Life Cycle Assessment
LiveCorp	Australian Livestock Export Corporation Limited
M&E	Monitoring and Evaluation
MacquarieU	Macquarie University
MCF	Mill Correction Factor
MDB	Murray–Darling Basin
ML	megalitre
MLA	Meat and Livestock Australia
MP	Member of Parliament
*my*BMP	Best Management Practices Program
N	nitrogen
NAQS	Northern Australia Quarantine Strategy
NCEA	National Centre for Engineering in Agriculture
NFF	National Farmers' Federation
NPIRDEF	National Primary Industries RD&E Framework
NPSI	National Program for Sustainable Irrigation
NQ	North Queensland
NRM	Natural Resource Management
NSW	New South Wales
NSW DPI	NSW Department of Primary Industries
NWPPA	National Working Party of Pesticide Application
NZ	New Zealand
P	Phosphorus
PBS	Portfolio Budget Statements
PGPA Act	*Public Governance, Performance and Accountability Act 2013*
PHA	Plant Health Australia
PhD	Doctor of Philosophy
PIB	Peak Industry Body
PICSE	National Primary Industry Centre for Science Education
PIEF	Primary Industries Education Foundation
PIHSP	Primary Industries Health and Safety Partnership

Term	Description
Pima cotton	*Gossypium barbardense*. Related to Egyptian cotton, having extra long and fine staples. Limited Australian production.
PIRD Act	*Primary Industries Research and Development Act 1989*
PISC	Primary Industries Standing Committee
Plant Biosecurity CRC	Plant Biosecurity Cooperative Research Centre
Postdoc	Post-Doctorate
PwC	Pricewaterhouse Coopers
QAAFI	Queensland Alliance for Agricultural and Food Innovation
QDAF	Queensland Department of Agriculture and Fisheries
QLD	Queensland
QTT	Quick Test Technology
QUT	Queensland University of Technology
R&D	Research and Development
RD&E	Research, Development and Extension
RDC	Rural Research and Development Corporation
REO	Regional Extension Officers
RH	relative humidity
RIC	Research and Innovation Committee
RINPAS	Research and Innovation Network for Precision Agriculture Systems
RIRDC	Rural Industries Research and Development Corporation
RMP	Resistance Management Plan
RRDP grants	Rural R&D for Profit grants
RRR	Roth Rural and Regional Pty Ltd
S	sulphur
SAC	Sustainable Apparel Coalition
SLW	silverleaf whitefly
spp.	species
SRP	Science and Research Priorities
SRA	Sugar Research Australia
Tg	glass transition
TIMS	Transgenic and Insect Management Strategy Committee
TRAIL	Training Rural Australians in Leadership
TSW	TSW Analytical
UA	University of Adelaide
UMELB	University of Melbourne
UNCGA	Upper Namoi Cotton Growers Association
UNE	University of New England
UNSW	University of New South Wales
Upland cotton	*Gossypium hirsutum*. Comprises the vast majority of the Australian cotton crop, with Pima cotton comprising the remainder
UQ	University of Queensland
USDA	United States Department of Agriculture

Term	Description
USQ	University of Southern Queensland
USYD	University of Sydney
UTAS	University of Tasmania
UTS	University of Technology, Sydney
UWA	University of Western Australia
UWS	University of Western Sydney
VCG	Vegetative Compatibility Group
VIC	Victoria
WHS	Workplace Health and Safety
Wincott	Women's Industry Network—Cotton
WUE	Water-use efficiency
Zn	zinc

Appendix 6: Annual Reporting Requirements

CRDC prepared this Annual Report in accordance with the provisions of section 28 of the *Primary Industries Research and Development Act 1989*, section 46 of the *Public Governance, Performance and Accountability Act 2013*, and extracts from sections 11.8, 11.9 and 11.10 of the Funding Agreement 2015–2019.

Additional information beyond the requirements of the PGPA Act required to meet the requirements of the Funding Agreement were provided to the Commonwealth separately by the CRDC.

This Annual Report includes the following items in respect to 2015–2016:

- a report on CRDC's contribution to the implementation of relevant Industry sector and cross-sectoral strategies under the RD&E Framework;
- the rationale for the mix of projects included in the Balanced portfolio;
- a report on CRDC's research extension activities;
- collaboration with Industry and other research providers;
- sources of income allowing for separate identification of Research and Development payments, Commonwealth Matching payments and any other forms of income and, if applicable Marketing payments and Voluntary Contributions;
- the full cost of the Research and Development programs, with costs being allocated in accordance with the Cost Allocation policy;
- progress made in implementing R&D plans, including progress against key performance indicators and the achievement of key deliverables and associated outcomes specified in the plans;
- an assessment of the efficiency and effectiveness of CRDC's investments;
- progress in implementing the guidelines;
- consultation with the Corporation's representative organisation on its R&D and Annual Operational Plans, Research and Development and Extension activities and marketing activities; and
- other relevant matters notified to CRDC by the Commonwealth.

Annual Report means a report prepared by the Directors of CRDC in accordance with section 46 of the public *Governance, Performance and Accountability Act 2013*, section 28 of the *Primary Industries Research and Development Act 1989* and clause 11.8 to 11.10 of the Funding Agreement 2015–19.

Balanced Portfolio means a Research and Development investment portfolio incorporating issues of critical national importance based on government and Levy payer priorities and balancing long-term, short-term, high and low risk, and strategic and adaptive research needs and includes consideration of regional variations and needs.

CRDC prepared this Annual Report in accordance with the *Primary Industries Research and Development (PIRD) Act 1989*.

(a) This Annual Report includes the following particulars as instructed by directors during 2015–16:

(i) the R&D activities that it co-ordinated or funded, wholly or partly, during the period; and

(ia) if a levy attached to the Corporation had a marketing component during the period the marketing activities that it coordinated or funded, wholly or partly, during the period; and

(ii) the amount that it spent during the period in relation to each of those activities; and

(iib) the impact of those activities on the primary industry or class of primary industries in respect of which the Corporation was established; and

(iii) revisions of its R&D plan approved by the Minister during the period; and

(iv) the entering into of agreements under sections 13 and 14 during the period and its activities during the period in relation to agreements entered into under that section during or prior to the period; and
(v) its activities during the period in relation to applying for patents for inventions, commercially exploiting patented inventions and granting licences under patented inventions; and
(vi) the activities of any companies in which the Corporation has an interest; and
(vii) any activities relating to the formation of a company; and
(viii) significant acquisitions and dispositions of real property by it during the period; and

(b) an assessment of the extent to which its operations during the period have:
(i) achieved its objectives as stated in its R&D plan; and
(ii) implemented the annual operational plan applicable to the period; and

(c) an assessment of the extent to which the Corporation has, during the period, contributed to the attainment of the objects of this Act as set out in section 3; and

(d) in respect of the grain industry or such other primary industry or class of primary industries as is prescribed in the regulations, particulars of sources and expenditure of funds, including:
(i) commodity, cross commodity and regional classifications; and
(ii) funds derived from transfer of assets, debts, liabilities and obligations under section 144.

(e) Accountability to representative organisations.
CRDC provides representative organisations a copy of the CRDC Annual Report as soon as practicable after the Corporation's annual report has been submitted to the Minister and tabled in Parliament.

CRDC prepared this Annual Report in accordance with the PGPA Rule 2014 section 17BE requirements during 2015–16.

This Annual Report includes the following particulars as instructed by directors during 2015–16:

(a) details of the legislation establishing the body;

(b) both of the following:
(i) a summary of the objects and functions of the entity as set out in the legislation;
(ii) the purposes of the entity as included in the entity's corporate plan for the period;

(c) the names of the persons holding the position of responsible Minister or responsible Ministers during the period, and the titles of those responsible Ministers;

(d) any directions given to the entity by a Minister under an Act or instrument during the period;

(e) any government policy orders that applied in relation to the entity during the period under section 22 of the Act;

(f) if, during the period, the entity has not complied with a direction or order referred to in paragraph (d) or (e)—particulars of the non-compliance;

(g) the annual performance statements for the entity for the period in accordance with paragraph 39(1)(b) of the Act and section 16F of this rule;

(h) a statement of any significant issue reported to the responsible Minister under paragraph 19(1)(e) of the Act that relates to non-compliance with the finance law in relation to the entity;

(i) if a statement is included under paragraph (h) of this section—an outline of the action that has been taken to remedy the non-compliance;

(j) information on the accountable authority, or each member of the accountable authority, of the entity during the period, including:
  (i) the name of the accountable authority or member; and
  (ii) the qualifications of the accountable authority or member; and
  (iii) the experience of the accountable authority or member; and
  (iv) for a member—the number of meetings of the accountable authority attended by the member during the period; and
  (v) for a member—whether the member is an executive member or non-executive member;

(k) an outline of the organisational structure of the entity (including any subsidiaries of the entity);

(l) an outline of the location (whether or not in Australia) of major activities or facilities of the entity;

(m) information in relation to the main corporate governance practices used by the entity during the period;

(n) the decision-making process undertaken by the accountable authority for making a decision if:
  (i) the decision is to approve the entity paying for a good or service from another Commonwealth entity or a company, or providing a grant to another Commonwealth entity or a company; and
  (ii) the entity, and the other Commonwealth entity or the company, are related entities; and
  (iii) the value of the transaction, or if there is more than one transaction, the aggregate value of those transactions, is more than $10 000 (inclusive of GST);

(o) if the annual report includes information under paragraph (n):
  (i) if there is only one transaction—the value of the transaction; and
  (ii) if there is more than one transaction—the number of transactions and the aggregate of value of the transactions;

(p) any significant activities and changes that affected the operations or structure of the entity during the period;

(q) particulars of judicial decisions or decisions of administrative tribunals made during the period that have had, or may have, a significant effect on the operations of the entity;

(r) particulars of any report on the entity given during the period by:
  (i) the Auditor-General, other than a report under section 43 of the Act (which deals with the Auditor-General's audit of the annual financial statements for Commonwealth entities); or
  (ii) a Committee of either House, or of both Houses, of the Parliament; or
  (iii) the Commonwealth Ombudsman; or
  (iv) the Office of the Australian Information Commissioner;

(s) if the accountable authority has been unable to obtain information from a subsidiary of the entity that is required to be included in the annual report—an explanation of the information that was not obtained and the effect of not having the information on the annual report;

(t) details of any indemnity that applied during the period to the accountable authority, any member of the accountable authority or officer of the entity against a liability (including premiums paid, or agreed to be paid, for insurance against the authority, member or officer's liability for legal costs);

(u) an index identifying where the requirements of this section and section 17BF (if applicable) are to be found.

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