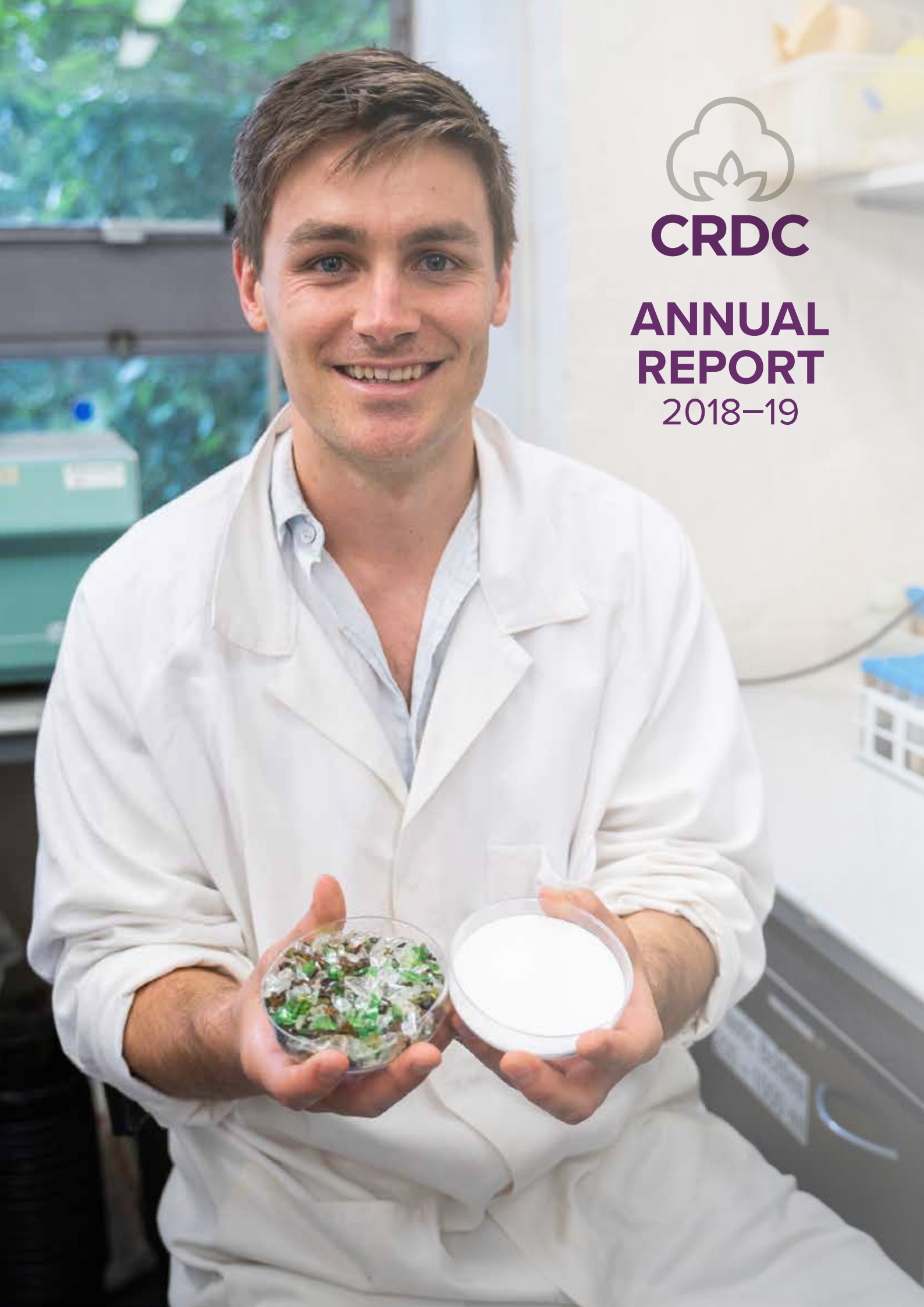


CRDC

ANNUAL REPORT 2018–19

Case study

War on waste yields groundbreaking technology

New research turning waste glass into everyday products could save tens of millions of tonnes of glass from going to landfill every year while providing benefits for cotton growers.

Drawing inspiration from the ABC TV's recent *War on Waste* series, CRDC-supported PhD candidate Rhys Pirie has made a breakthrough on what to do to with waste glass, and it is good news for farmers.

Rhys was awarded the CRDC-supported ABARES Science and Innovation Award for Young People in Agriculture, plus the Minister's Award, in 2018 for his focus on re-purposing organic wastes (such as livestock manure, biosolids and cotton gin trash) as fertilisers and soil ameliorants. His aim is to help growers optimise resource efficiency and improve their environmental impact.

Through his CRDC-supported PhD studies, Rhys – together with Professor Damien Batstone of the University of Queensland (UQ) – has developed a method to extract liquid silicate from waste glass that can be used to make thousands of products, including fertiliser.

"This glass-processing technology has the potential to revolutionise multiple supply chains. Rhys's work is a wonderful example of the unexpected but exciting turns that PhD studies can take," says CRDC's General Manager for R&D Investment, Allan Williams.

For more: read the full article in the Winter 2019 edition of CRDC's *Spotlight* magazine. www.crdc.com.au/spotlight.

CRDC

CRDC ANNUAL REPORT

2018–19

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

Steve Yeates

Contents

Cotton Research and Development Corporation
2 Lloyd Street (PO Box 282)
Narrabri NSW 2390
Phone: 02 6792 4088
Email: crdc@crdc.com.au
Website: www.crdc.com.au
ABN: 71 054 238 316

If you are interested in learning more about CRDC and our investments, visit our 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: CRDC-supported PhD candidate at the University of Queensland, Rhys Pirie. Rhys and his supervisor have developed a method to extract liquid silicate from waste glass, and it can be used to make thousands of products, including fertiliser for cotton growers. Image: The University of Queensland.

Published: November 2019
ISSN: 1039-3544


The University of Queensland

About CRDC & the Australian cotton industry

The Cotton Research and Development Corporation (CRDC) leads investment in cotton research, development and extension (RD&E) for the Australian cotton industry. A partnership between the Australian Government and cotton growers, CRDC exists to invest in, and deliver outcomes from, world-leading RD&E to benefit Australia's dynamic cotton industry and the wider community.

We invest in innovation and transformative technologies to deliver impact, and as an organisation we are ambitious, agile, and adaptive.

Cotton is a major contributor to the economic, environmental and social fabric of rural Australia. The industry's national exports generate an average of $1.9 billion in annual revenue, and the industry is a major employer in rural and regional communities.

Despite recent challenging seasonal conditions, the industry continues to go through a period of growth. In recent years, cotton has expanded from its predominate growing base in New South Wales (NSW) and Queensland (QLD) to Victoria (VIC), and commercial trials are underway in the Northern Territory (NT) and Western Australia (WA). During this year, for the first time in 15 years, a commercial cotton trial crop was harvested in the NT.

RD&E and its resulting innovations are a key driving force behind our industry's continued success, and CRDC's purpose is to power the success of Australian cotton through this world-leading RD&E.

Vision

Powering the success of Australian cotton through world-leading RD&E.

Mission

Investing in world-leading RD&E to benefit Australia's dynamic cotton industry.

Purpose

Outcome statement: Increased economic, social and environmental benefits for the Australian cotton industry and the wider community, by investing in knowledge, innovation and its adoption.

Renee Anderson

Investment, innovation, impact.

Report from the Chair and Executive Director

Investment, innovation, impact. These three words capture the very core of CRDC – investing in innovation to deliver impact for cotton growers, the cotton industry, the wider community, and the Australian Government.

The 2018–19 year was the first year of investment under our Strategic RD&E Plan 2018–23.

This year we took a renewed look at our investments, and sharpened our focus around our five new strategic priorities – increasing productivity and profitability on Australian cotton farms; improving cotton farming sustainability and value chain competitiveness; building the adaptive capacity of the Australian cotton industry; strengthening partnerships and adoption; and driving RD&E impact.

We invest in these areas to ensure our cotton growers, our communities, and the wider industry are all prepared to capitalise on the opportunities and overcome the challenges ahead.

CRDC plays a critical role in ensuring a strong future for Australia's cotton industry and the cotton innovation system, particularly in light of the current social licence challenges facing the industry and the commentary about the future of Australia's innovation system.

We deliver strength and stability, driving the RD&E agenda with a strong focus on the cotton industry: an industry that embraces RD&E and has a long-standing culture of innovation.

We pride ourselves on our strong relationships with cotton growers, research providers, government and other core partners. Collaboration is at the very heart of everything we do. There isn't a single research project we invest in that isn't delivered in partnership with our growers, researchers and partners. Of all the RD&E projects conducted in cotton, we are partners in over 80 per cent of them.

We also partner with those outside our sector, as we recognise the importance of cross-sectoral collaboration in solving issues that are bigger than the cotton industry alone. In 2018–19, 24 per cent of CRDC's investments were in cross-sectoral RD&E, tackling issues like climate variability, soil health and nutrition, irrigation, plant biosecurity, crop protection, farm safety, and human capacity.

Importantly, we recognise that for the industry to benefit from our research investments, the outcomes need to be rapidly extended and adopted, and where relevant, commercialised.

As such, in this report, we bring you an update on progress towards our strategic goals – our investments, our innovations, and our intended impacts – one year into our Strategic RD&E Plan 2018–23.

Richard Haire
CRDC Chair

Dr Ian Taylor
CRDC Executive Director

Former CRDC Executive Director, Bruce Finney, stepped down from the role in January 2019, following 14 years of service to CRDC. On behalf of the CRDC Board and staff, we thank Mr Finney for his enormous contribution to CRDC and the Australian cotton industry.

PROGRESS AGAINST CRDC STRATEGIC R&D PLAN 2018–23

Our Annual Performance Statement

The 2018–19 year marked the first year under the CRDC Strategic RD&E Plan 2018–23. This plan provides an ambitious roadmap for our 2018–23 investments: through this plan, we aim to contribute to creating $2 billion in additional gross value of cotton production for the benefit of Australian cotton growers and the wider community.

As such, the 2018–19 year marked a crucial year for CRDC. It ensured that the first round of strategic RD&E investments under this plan help set the future direction for the Australian cotton industry – one of innovation and impact through increased commercialisation and digital transformation.

To achieve this, during 2018–19 Australian cotton growers and the Australian Government co-invested $24.1 million through CRDC into cotton RD&E, across 285 projects and in collaboration with 116 research partners.

The investments were made in the five key areas identified in the Strategic RD&E Plan:

- increasing productivity and profitability on Australian cotton farms
- improving cotton farming sustainability and value chain competitiveness
- building the adaptive capacity of the Australian cotton industry
- strengthening partnerships and adoption
- driving RD&E impact.

This Annual Report outlines progress against these areas in the 2018–19 year.

Our progress is measured, and performance analysed, through evaluation techniques outlined in the CRDC Monitoring and Evaluation Framework and targets set in the Strategic Plan. The green, amber and red traffic light system is used to track overall performance against the CRDC Strategic Plan.

The specific measure has been achieved.

On target to deliver against the measure.

Not on target to deliver against the measure.

Further details about our performance aligned with the Strategic Plan and our key focus areas are outlined in Section 4 of this Annual Report: the RD&E portfolio.

Strategic Plan Measures	Result	2023 Targets	2018–19 progress comments
Increase productivity and profitability on cotton farms. Improved yield and quality.		Annual increase of 0.35 bales per hectare for irrigated cotton and 0.14 bales per hectare for dryland cotton.	Irrigated cotton yields are stable while dryland crop yields have been reduced as a result of extended dry conditions. Crop quality, however, has been above average.
Improve cotton farming sustainability and value chain competitiveness. CRDC collaborates in global leadership for sustainability initiatives.		Participates in six global initiatives.	CRDC currently participates in five global initiatives: Expert Panel on the Social, Economic and Environmental Performance of Cotton; Sustainable Agriculture Initiative; Sustainable Apparel Coalition; Better Cotton Initiative 'Project Delta'; and Cotton2040.
Build adaptive capacity of the cotton industry. Science and innovation capacity is strengthened and strategically fit for a digital future.		10+ new/early career researchers supported through strategic career pathways.	CRDC supported 15 PhDs and eight early career researchers in 2018–19.
Strengthening partnerships and adoption. Partnerships are strengthened to engage multi-disciplinary and multi-institutional resources.		40 per cent of annual RD&E investments are through cross-sectoral partnerships.	24 per cent of investments in 2018–19 were cross-sectoral.
Driving RD&E impact. CRDC monitors and evaluates RD&E impact.		One RD&E impact report per annum.	CRDC undertook benchmarking of water productivity and assessed investments under the Building Adaptive Capacity program.

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


Renee Anderson

Certification by the Executive Director

I, Dr Ian Taylor as the accountable authority of Cotton Research and Development Corporation (CRDC), present the 2018–19 Annual Performance Statement of CRDC, as required under paragraph 39(1) (a) of the *Public Governance, Performance and Accountability Act 2013*.

In my opinion, this Annual Performance Statement is based on properly maintained records, accurately reflects the performance of the entity, complies with subsection 39(2) of the PGPA Act 2013, and is in accordance with 16F of the PGPA Rule 2014.

Dr Ian Taylor
Executive Director
Cotton Research and Development Corporation

15 October 2019

CRDC General Manager Business and Finance Graeme Tolson, CRDC Executive Director Dr Ian Taylor, and CRDC Director Greg Kauter.

2018–19 investment and impact

The Australian cotton industry in 2018–19

280,000 hectares
planted into irrigated and dryland cotton, down 44 per cent on 2017–18

2.2 million bales
produced by the Australian cotton industry, down from 4.5 million the previous year

9.5 bales per hectare
the average yield for the 2018–19 crop, compared to 10.3 bales per hectare in 2017–18

(Source: ABARES)

CRDC's investment in 2018-19

116
research partners

285
RD&E projects

1
new Executive Director driving a new strategic direction for CRDC

$24.1 million
CRDC's investment in cotton RD&E on behalf of cotton growers and the Australian Government

5 – KEY PROGRAM AREAS

- Increasing productivity and profitability on Australian cotton farms,
- Improving cotton farming sustainability and value chain competitiveness,
- Building the adaptive capacity of the Australian cotton industry,
- Strengthening partnerships and adoption, and
- Driving RD&E impact.

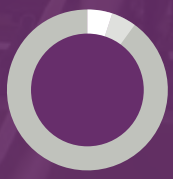
CRDC impact

$2 billion

The contribution CRDC's Strategic Plan 2018–23 aims to make towards the additional gross value of cotton production through our investments in RD&E.

82 per cent
the number of growers participating in *my*BMP.

24 per cent
the percentage of CRDC research that is in cross-sectoral RD&E.



5-10 per cent
the benefit in water-use efficiency of the use of the CRDC commercialised algorithm with canopy temperature sensors. In 2018-19, the sensors became commercially available through Goanna Ag.

3 major collaborative projects driven by CRDC

- More Profit from Nitrogen
- Cotton Landcare Tech-Innovations 2021
- Australian Agriculture: Growing a Digital Future

2460

the number of delegates at the 2018 Australian Cotton Conference: a new attendance record! The conference showcases the Australian cotton industry and CRDC-funded RD&E.

1st commercial cotton trial harvested in the NT in 15 years, supported by CRDC-led research.

46 per cent
the number of speakers at the 2018 Australian Cotton Conference who were supported in some way by CRDC – be it as a Director, team member or supported researcher.

100 per cent
the number of cotton growers who source information from CottonInfo.

1.1 million
the number of collective views that the 180 CRDC-supported best practice videos have amassed on the CottonInfo YouTube channel as at June 2019.

YEAR IN REVIEW

RD&E highlights

Ambitious new Strategic RD&E Plan

Our new strategic plan, the CRDC Strategic RD&E Plan 2018–23, began on 1 July 2018, following 15 months of development in close collaboration with the industry. The Strategic Plan provides a high-level overview of our strategic direction for the five years, and will guide all of CRDC's investments during this time. The aim of the plan is to contribute to creating $2 billion in additional gross value of cotton production through our investments in RD&E.

Delivering impacts for cotton growers

We conducted an analysis of the benefits delivered to cotton growers and the wider sector under our previous strategic plan, which ran from 2013 to 2018. Major impacts of our investment during this time included: the achievement of our target – a three per cent average growth in yield per hectare over the five years; the commercialisation of four new products (Sero X, CottonSpec, cotton contamination sensors for gins, and algorithms for stress-time thresholds); an increase in the number of growers participating in *my*BMP from 40 to 78 per cent; and a benefit-cost ratio of 8.3:1 for our investment in water-use efficiency RD&E – $8.30 in benefit to growers for every $1 invested in RD&E.

CRDC-supported innovation commercialised: algorithm for canopy temperature sensors

In 2017–18, CRDC successfully commercialised three new products, including algorithms for stress-time thresholds, with research partner CSIRO. At the time, we reported that using these algorithms with canopy temperature sensors could result in a 5–10 per cent benefit in water-use efficiency in climatically challenging seasons. In 2018–19, the canopy temperature sensors became commercially available through Goanna Ag, allowing cotton growers to refine irrigation scheduling, saving water while maintaining yields. The sensors monitor cotton plants in real time, allowing growers to make decisions in real time about irrigation scheduling before stress levels affect yield.

New leadership team to drive CRDC forward

The CRDC team said farewell to longstanding Executive Director (ED), Bruce Finney, during 2018-19, as he stepped down from the role in January 2019 following 14 years at the helm. Then CRDC General Manager, R&D Investment, Dr Ian Taylor, was appointed Acting ED in January, and was formally appointed to the ED role in March. His previous position was subsequently filled by CRDC R&D Manager Allan Williams, who officially took up the General Manager, R&D Investment role in June.

Delivery of three major CRDC-led collaborative projects

We have led three major collaborative projects this year – one under the Rural R&D for Profit program *More Profit from Nitrogen;* one under the National Landcare Program Smart Farming Partnership *Cotton Landcare Tech-Innovations 2021;* and one collaborative project born out of Rural R&D for Profit but continuing on as an RDC-led collaboration, *Australian Agriculture: Growing a Digital Future* – a follow-on project to *Accelerating Precision Agriculture to Decision Agriculture*.

Research on the agenda at the industry's major event: the Australian Cotton Conference

The 2018 Australian Cotton Conference – proudly supported by CRDC as a founding sponsor – provided a platform to showcase CRDC-supported cotton RD&E to the industry. At the conference, 46 per cent of speakers were supported in some way by CRDC – be it as a Director, team member, or supported researcher. The conference broke attendance records, with 2460 delegates, the largest gathering of industry participants since the event began.

CRDC-supported researchers recognised for contributions

CRDC-supported researchers Dr Joseph Foley, Dr Malcolm Gillies and Dr Alison McCarthy, all of the University of Southern Qld, were recognised for their major contributions to cotton RD&E as co-recipients of the 2018 CSD Researcher of the Year Award, presented at the 2018 Cotton Conference. Drs Foley, Gillies and McCarthy were all integral members of the CRDC-led *Smarter Irrigation for Profit* project team, which found that participating farmers from the dairy, cotton, sugarcane and rice industries could achieve a 10 to 20 per cent improvement in water productivity through adoption of new and existing precision irrigation technologies.

Tracking our water productivity

Early indications from the latest water productivity benchmarking study – supported by CRDC and led by NSW DPI – indicate continual improvement in water-use efficiency in the Australian cotton industry. Early indications have identified that water productivity appears to have slowly increased over the past 10 years, indicating that the industry has achieved steady improvement in yield with less water. On-farm Gross Production Water Use Index (GPWUI) was 1.174 in 2006–07; 1.139 in 2007–08; 1.120 in 2012–13, and is tracking around 1.2 bales/ML for 2017–18.

RD&E supporting continued industry expansion

Despite this season's challenging seasonal conditions, the Australian cotton industry continues to grow sustainably into both the north and south. In 2018–19, a new CRDC-supported pathologist was appointed to southern NSW, to further strengthen the research effort in the south. Meanwhile, in the north, 2017 Researcher of the Year, Steve Yeates, continues his role as cotton development and coordination leader for northern cotton; growers in the Ord (including CRDC- and Cotton Australia–supported Nuffield scholar Luke McKay) are into their second cotton season; and NT growers have harvested their first commercial cotton trial in 15 years.

Building adaptive capacity: support for industry leaders

In addition to 2018 Nuffield scholar Luke McKay, CRDC has also invested in other industry leaders during 2018–19, under the Strategic Plan goal of building adaptive capacity. These include 2019 Nuffield scholar, Emerald cotton grower and Cotton Australia regional manager Renee Anderson (co-supported by Cotton Australia); the CRDC-supported ABARES 2019 Science and Innovation Award winner, UQ researcher scientist Dr Dean Brookes; and the latest cohort of Australian Rural Leadership Program participants: Richard Malone and Tim Chaffey (course 24) and Fleur Anderson and John Durham (course 25), in conjunction with Cotton Australia and Auscott Ltd.

Extending R&D outcomes to growers: CottonInfo connecting growers with research

The industry's extension program, CottonInfo, undertook a review in 2018–19, capturing key highlights and achievements from its first six years of operation. The review found that CottonInfo has grown to become a trusted source of information for growers and consultants, with 100 per cent of growers now sourcing information from CottonInfo. Over the past six years, CottonInfo has run nearly 1000 extension activities, with a total 14,000 participants. Of 126 events where intention to change was evaluated, 1600 growers indicated they would change practices as a result of increased awareness or knowledge facilitated by CottonInfo.

Weed management app

A new weed identification mobile app was released in 2018–19, designed to assist growers and advisers in identifying 50 key weed species. *Weeds of Australian Cotton* was developed as part of a CRDC-supported project led by Dr David Thornby, with input from fellow weeds experts Graham Charles, Jeff Werth and Dr Ian Taylor. The app specifically includes cotyledon shapes as an important diagnostic characteristic, because weed identification in early growth stages is critical. The app is available to download from the Apple store and Google Play.

Mel Jenson

Letter of transmittal

15 October 2019

Senator the Hon. Bridget McKenzie
Minister for Agriculture
Parliament House
Canberra ACT 2601

Dear Minister

It is with great pleasure that I submit the Corporation's Annual Report for 2018–19, 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 RD&E Plan 2018–23, and are consistent with CRDC's 2018–19 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 PGPA Rule 2014. The report of operations was approved by a resolution of the Directors on 9 October 2019.

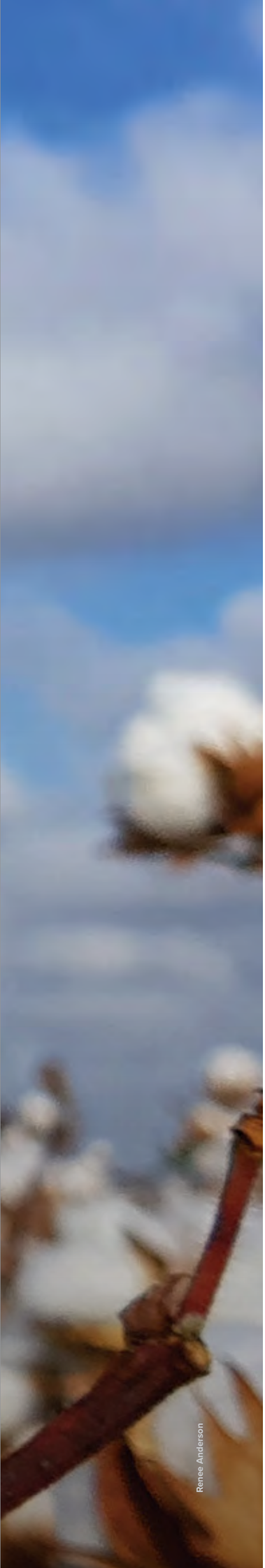
Yours sincerely

Richard Haire
Chair
Cotton Research and Development Corporation

COTTON RESEARCH AND DEVELOPMENT CORPORATION
office address 2 Lloyd Street, Narrabri NSW 2390, Australia **postal address** PO Box 282, Narrabri NSW 2390
P 02 6792 4088 **E** crdc@crdc.com.au ABN 71 054 238 316 **www.crdc.com.au**

SECTION 1 Executive Summary

Section 2
CRDC Business


Renee Anderson

Our 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.

Our corporate outcome is to achieve increased economic, social and environmental benefits for the Australian cotton industry, and the wider community, by investing in knowledge, innovation and its adoption.

We have four key stakeholders – the Australian Government through the Minister for Agriculture; the Department of Agriculture; the cotton industry's representative organisation, Cotton Australia; and cotton growers, including Cotton Grower Associations – and we are funded through an industry levy and matching Commonwealth contributions. In 2018–19, we invested $24.1 million in RD&E into 285 projects.

We recognise that collaboration is essential to the delivery of RD&E outcomes. As such, we partner with researchers, research organisations and growers to deliver RD&E projects and outcomes.

In 2018–19, CRDC partnered with 116 research partners, including some of the following:

- Department of Agriculture
- 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
- International partners, including Cotton Incorporated
- 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.

Our operations

We have five strategic outcomes that we seek to achieve under our 2018–23 Strategic RD&E Plan – these in turn are the key focus areas in which we invested during 2018–19:

GOAL 1: Increasing productivity and profitability on Australian cotton farms

GOAL 2: Improving cotton farming sustainability and value chain competitiveness

GOAL 3: Building the adaptive capacity of the Australian cotton industry

ENABLING STRATEGY 1: Strengthening partnerships and adoption

ENABLING STRATEGY 2: Driving RD&E impact

Our achievements against these outcomes are monitored, evaluated and reported annually – in both the Portfolio Budget Statement, and the Annual Report.

Strategic Plan Goals	Performance criteria	End of Plan targets (to achieve by 2023)	2018-2019 targets
GOAL 1: Increase productivity and profitability on cotton farms	Improved yield and quality	Increase in average bales/ha to 11.6 bales/ha for irrigated cotton, and 4.7 bales/ha for dryland cotton	Annual increase of 0.35 bales per hectare for irrigated cotton, and 0.14 bales per hectare for dryland cotton
GOAL 2: Improve cotton farming sustainability and value chain competitiveness	CRDC collaborates in global leadership for sustainability initiatives	CRDC participates in 6 global initiatives	CRDC participates in 6 global initiatives
GOAL 3: Build adaptive capacity of the cotton industry	Science and innovation capacity is strengthened and strategically fit for a digital future	50+ researchers supported through strategic career pathways	10+ new/early career researchers supported through strategic career pathways
ENABLING STRATEGY 1: Strengthening partnerships and adoption	Partnerships are strengthened to engage multi-disciplinary and multi-institutional resources (centres of excellence)	40 per cent of CRDC investments include cross-sectoral partnerships	40 per cent of CRDC investments include cross-sectoral partnerships
ENABLING STRATEGY 2: Driving RD&E impact	CRDC monitors and evaluates RD&E impact	CRDC delivers 5 RD&E impact reports	One RD&E impact report per annum

Setting the research priorities

We work 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 our strategic RD&E priorities, which are formalised under the 2018–23 CRDC Strategic RD&E Plan.

Industry accountability

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

We engage with Cotton Australia in a formal process of consultation in the development and implementation of the Strategic RD&E Plan, including R&D investments. This engagement ensures industry research priorities are regularly reviewed; emerging issues are actively considered; the uptake of research in the form of best practice is facilitated; and the overall performance of the Australian industry is enhanced.

Cotton industry priorities for RD&E:

- 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.

Our investment process

The process of deciding where to invest our annual RD&E funding is a collaborative one, involving all major stakeholders.

We work closely with the industry's peak representative body, 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 us on research projects and where research dollars should be invested, guided by the priorities established in the 2018–23 CRDC Strategic RD&E Plan.

In line with the plan, we hold a research priority forum annually, bringing together the Cotton Australia research and development advisory panels to identify the gaps in the existing research portfolio and opportunities for new research. We also hold a series of discipline forums with research partners to identify emerging research priorities.

From here, we issue a targeted annual call for research proposals against these identified priorities. In determining which proposals are successful, we again undertake 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 us and are delivered by our research partners. Critically, our success in delivering RD&E outcomes to growers and the industry is contingent upon strong relationships with our research partners.

RD&E priorities

The 2018–19 priorities forum, held in May 2017, identified key areas of focus for future RD&E investment. These key areas formed the basis of the targeted call, with 49 expressions of interest developed on these areas to guide researchers in developing their proposals. The key focus areas included:

- Control options for feathertop Rhodes grass and fleabane
- Ecology of silverleaf whitefly parasitic wasps
- Improving management and thresholds for silverleaf whitefly
- Plant hormones/fruit retention/defoliation under heat stress
- Compaction
- Decision support for irrigation
- Silverleaf whitefly resistance
- Managing and mitigating spray drift
- Alternative strategies for healthy water systems
- Building credibility for natural resource management social licence
- Understanding the impact of weather, harvest and storage on cotton colour
- Supply chain information needs and transfer
- Agribusiness workforce gaps and training needs
- The social science barriers to addressing best practice spray application.

Through the 2018–19 procurement process, we have invested in projects to directly target these key needs.

Importantly, in addition to immediate cotton industry priorities, we also identify and invest in longer-term priorities, specifically around ensuring a future for the industry that is profitable, sustainable and competitive.

Government accountability

We are accountable to the Australian Government through the Minister for Agriculture. The Government communicates its expectations of CRDC through Ministerial direction, enunciation of policy, administration of the *Primary Industries Research and Development (PIRD) Act 1989*, and priorities (Science and Research Priorities and Rural RD&E Priorities). We respond to government expectations through regular communication; compliance with the Funding Agreement, policy and legislated requirements; and the development of Strategic RD&E Plans, Annual Operational Plans, and Annual Reports.

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

The Science and Research Priorities

- Food*
- Cybersecurity
- Environmental change
- Soil and water
- Energy
- Health
- Transport
- Resources
- Advanced manufacturing

Rural RD&E Priorities

- Advanced technology
- Soil, water and managing natural resources
- Biosecurity
- Adoption of R&D

** The Food Science and Research Priority also includes fibre.*

Mel Jenson

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

The Australian, state and territory governments, Rural Research and Development Corporations (RDCs), 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 developed across primary industry and cross-industry sectors, including cotton, 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 and updated in 2019, this Vision uses a 20-year timeframe to ensure a long-term focus. The Vision 2029 elements (differentiated, responsible, tough, successful, respected, capable and innovative) were central to the development of the CRDC Strategic RD&E Plan, and continue to play a key role in guiding CRDC's investments each year to ensure CRDC is contributing to their achievement.

Collaboration and co-investment

Cooperation and collaboration are fundamental to our operation. We work in partnership with industry bodies, commercial entities and RDCs to achieve strategic outcomes for the industry, and to leverage higher returns for our investments.

This collaborative approach underpins our investment strategy. We partner in over 80 per cent of RD&E projects conducted in the cotton sector, and in 2018–19, 24 per cent of CRDC investments were in cross-sectoral RD&E.

CRDC's cooperation extends from national and international initiatives to cotton industry-specific and local initiatives – from participating in national cross-sectoral 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 research advisory panels aligned with CRDC's programs.

Research partners

All CRDC projects are delivered in partnership with key research partners. In 2018–19, CRDC partnered with 116 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 3 RD&E portfolio of this report.

Growers

In addition to the Cotton Australia research advisory panels, cotton growers also contribute to RD&E through participation in other industry committees, such as the Cotton Australia Transgenic and Insect Management Strategy (TIMS) Committee and Technical Panels, to provide practical guidance on the implementation of stewardship practices for GM traits.

Growers are also actively involved in RD&E by 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. Thirty-five per cent of growers host research trials on their farms, with growers contributing an average of 19 hours and $5500 towards their on-farm trials.

Cotton industry programs: CottonInfo and *my*BMP

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, plant biosecurity, 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 program.

Australian Government grants

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

CRDC managed two programs in 2018-19 under Government's grants, contributing a combined $7 million into RD&E funding across the life of the programs, for the benefit of the Australian cotton industry, the community and other industries.

- **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 program – round two).* Involves fellow RDCs Dairy Australia, Sugar Research Australia (SRA), and Horticulture Innovation Australia (HIA) and other research partners. Administered by the Department of Agriculture
- **New technologies to improve natural resources (biodiversity) on Australian cotton farms** *(funded 2018–22, led by CRDC up to $1,131,022 through the National Landcare Program; Smart Farming Partnerships initiative – round one).* Administered by the Department of Social Services Community Grants Hub.

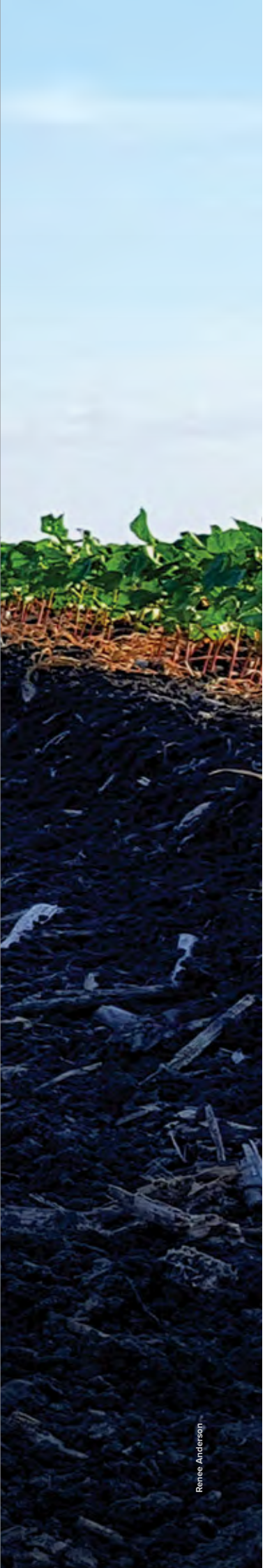
CRDC was also involved in four other programs through Rural R&D for Profit program grants led by other RDCs during 2018–19:

- **Digital technologies for more dynamic management of disease, stress and yield** *(funded 2016–20, led by Australian Grape and Wine Authority (AGWA); $3 million from the Rural R&D for Profit program - round two).*
- **Forewarned is forearmed: managing the impacts of extreme climate events** *(funded 2017–20, led by Meat & Livestock Australia Limited in partnership with CRDC through the Managing Climate Variability program; $6.2 million in funding from the Rural R&D for Profit program – round three).*
- **Improving plant pest management through cross-industry deployment of smart sensors, diagnostics and forecasting** *(funded 2017–20, led by Horticulture Innovation Australia in partnership with CRDC; $6.8 million in funding from the Rural R&D for Profit program – round three).*
- **Increasing farmgate profits, the role of natural capital accounts** *(funded 2017–20, led by Forest and Wood Products Australia in partnership with CRDC; $900,000 in funding from the Rural R&D for Profit program – round three).*

We were also involved in one program through the Control Tools and Technologies for Established Pest Animals and Weeds grant led by the NSW Department of Primary Industries:

- **Biological control and taxonomic advancement for management in the Noogoora burr complex** *(funded 2017–19, led by NSW DPI in partnership with CRDC; $559,700 from the Control Tools and Technologies for Established Pest Animals and Weeds program).*

Section 3
Corporate Operations


Renee Anderson

Business financials

Our investment in RD&E is funded through an industry levy and matching Commonwealth contributions. In 2018–19, we invested $24.1 million in cotton RD&E throughout the industry supply chain. In 2019–20, our estimated cotton RD&E expenditure will be $20.2 million.

Revenue

Cotton levy revenue is collected either on cotton lint bales at the point of ginning or on the export of seed cotton. Cotton farmers pay a levy of $2.25 for each 227-kilogram bale of cotton lint, or for seed cotton a levy of $4.06 per tonne of exported seed cotton. Australian ginning and export of seed cotton 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 of up to 50 per cent of the cumulative total eligible expenditure on RD&E. The maximum contribution is generally capped at 0.5 per cent of a three-year rolling average of the gross value of production for the cotton industry.

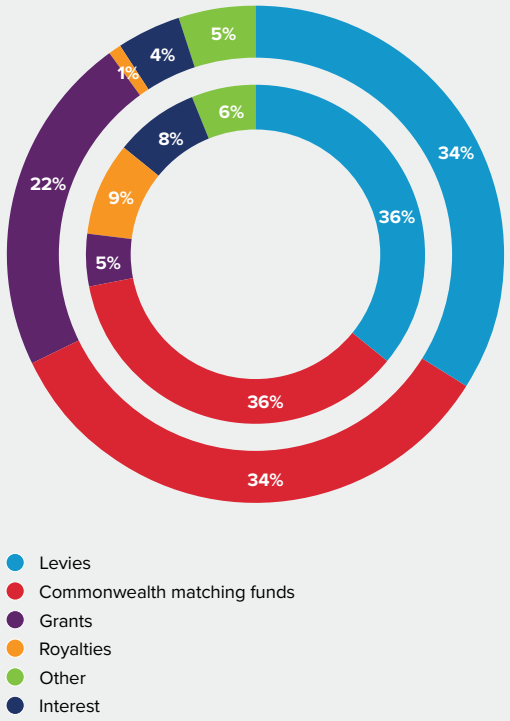
The setting and collection of the industry levy is enabled by the *Primary Industries (Excise) Levies Act 1999* and the *Primary Industries Levies and Charges Collection Act 1991*, respectively. The Australian Government matching contributions in 2018–19 were capped at the value of levies collected because it was lower than the 0.5 per cent of the three-year average gross value of production.

Revenue (Actuals)	2018–19 ($m)
Industry levies	$8.695
Australian Government	$8.680
Royalties	$0.204
Interest	$0.983
Research Grants	$5.480
Other	$1.142
TOTAL	**$25.184**

The following graph demonstrates the change in sources of revenue from 2014–15 to 2018–19. The proportion of grant revenue generated by partnerships with the Australian Government, RDCs and commercial enterprises has increased from 5 per cent of total revenue to 21 per cent of total revenue.

In 2018–19, the Australian Government's Department of Agriculture contributed a total of $3.5 million in revenue to CRDC, via the Rural R&D for Profit program ($2.8 million), the National Landcare Program's Smart Farming Partnership initiative ($0.4 million), and for the International Cotton Advisory Committee (ICAC) meeting ($0.3 million), which will take place in 2019–20. This revenue has also attracted additional grant revenue of $1.4 million from program partners, and $0.6 million from industry and cross-sectoral partners.

Change in CRDC revenue mix over five years: 2014–15 (inner circle) to 2018–19 (outer circle).



Total revenue for 2018–19 of $25.184 million was $2.253 million (10 per cent) above budget of $22.931 million. Total 2018–19 revenue comprised of:

- Industry levy revenue of $8.695 million, which includes $6.505 million (65 per cent) of the 2017–18 crop and $2.190 million (46 per cent) of the 2018–19 estimated crop.
- Australian Government matching contribution of $8.680 million was capped at the value of levies collected.
- $0.204 million in royalties from the sale of CRDC-funded CSIRO seed varieties, and commercialisation of intellectual property.
- Interest revenue of $0.983 million was 37 per cent above budget, due to the higher level of cash reserves under CRDC management generated by above-budget revenues in the prior years.
- External grants of $5.480 million included Rural R&D for Profit, other Commonwealth grants and co-investments from program partners.
- Other revenue of $1.142 million, which includes project refunds.

Expenditure and investment

Actual expenditure for 2018–19 was $24.143 million, which is $0.188 million below the budgeted expenditure of $24.331 million.

Actual ($m)	2018–19
Cotton Crop Size (millions of bales)	2.13*
Total Revenue	25.184
Industry levies	8.695
Australian Government	8.680
Royalties	0.204
Interest	0.983
Research grants	5.480
Other**	1.142
Expenditure total	24.143
Cotton RD&E activities	19.832
Total equity position	**38.840**

* ABARES estimate, Agricultural Commodities June 2019.
** 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 2018–19 was allocated to the following activities:

Cost Allocation Activity	2018–19
Direct R&D Expenditure (project costs)	$18,544,176
Indirect R&D Expenditure (administration costs)	$3,339,667
Grant-funded expenditure (R&D not eligible for Commonwealth Matching)	$2,259,146
Total Expenditure	**$24,142,989**

Portfolio Budget Statement

The CRDC Portfolio Budget Statement released in April 2019 provided an estimate of CRDC's outcomes, outputs, performance and financial position for 2019–20 to 2022–23. The statement was consistent with the CRDC Strategic R&D Plan 2018–23 and the Annual Operational Plan 2019–20.

Outcomes and outputs 2018–19

CRDC has one Australian 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	2018–19
TOTAL Budgeted Revenue	$22,931,000
TOTAL Actual Revenue	$25,183,753
TOTAL Budgeted Cost of Outputs	$24,331,000
TOTAL Actual Cost of Outputs*	$24,142,989

* 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.

Forecast expenditure

Future revenue from levies and Commonwealth-matching contributions are directly affected by cotton production. Commodity prices, water availability and water prices are significant factors in forthcoming cropping decisions. Below-average storage levels of public irrigation dams serving the Australian cotton-growing region, high water prices and low rainfall is expected to reduce the 2019–20 crop.

CRDC has budgeted for a $5.446 million operating deficit for 2019-20. This reflects revenue of $14.767 million and expenditure of $20.213 million. Industry levy revenue and Commonwealth contributions will continue to be drawn from two crop seasons, 2018-19 and 2019-20.

Forecast expenditure

Budgeted expenditure for 2019–20 is $20.213 million, which is $3.930 million below the 2018–19 actual expenditure. The forecast expenditure for the next two years is budgeted at $19.941 million in 2020–21, and $21.270 million in 2021–22.

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 $5.446 million in 2019–20, $3.991 million in 2020–21 and $4.432 million in 2021–22, to be funded from reserves.

Our investments in RD&E

We use the CRDC Strategic RD&E Plan 2018–23 to guide our investments. Through this Strategic Plan, in 2018–19, we invested to help increase productivity and profitability on Australian cotton farms; improve cotton farming sustainability and value chain competitiveness; build the adaptive capacity of the Australian cotton industry; strengthen partnerships and adoption; and drive RD&E impact.

We achieved a balanced RD&E portfolio that considers the distribution of our investment across:

- The RD&E strategies
- The type of research, including innovation, knowledge creation, knowledge transfer and application, benchmarking, industry capacity, and education
- In-project risks
- Researcher experience and capacity
- Research providers
- Timeframe to outcomes
- The likely return on investment for projects and programs
- Expenditure on RD&E management.

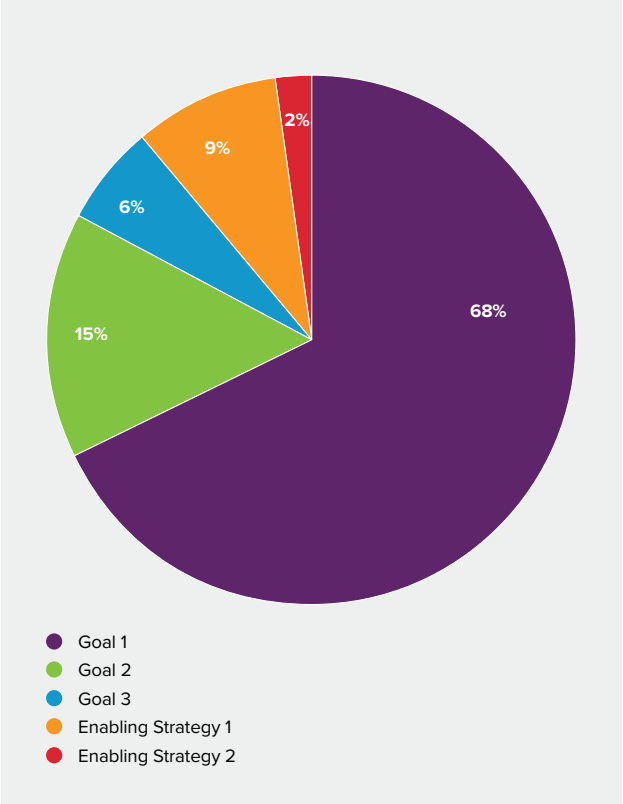
In 2018–19, we invested $19.8 million in RD&E. Of this, $7.7 million was invested in new research commencing in 2018–19.

Projects by CRDC program area

CRDC program	Goal 1	Goal 2	Goal 3	Enabling strategy 1	Enabling strategy 2	TOTAL
Number of projects	112	47	70	44	12	285
Program expenditure ($m)*	$13.5	$2.9	$1.1	$1.8	$0.5	$19.8
Program percentage (of expenditure)	68%	15%	6%	9%	2%	**100%**

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

Investment by program



Total number of CRDC projects

CRDC projects	2018–19
Active projects	130
New projects funded	148
Projects completed	143
Continuing projects	135

Further detail on CRDC's projects can be found in Section 4: RD&E Portfolio, and in Appendix 3: RD&E Portfolio.

Mel Jenson

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.

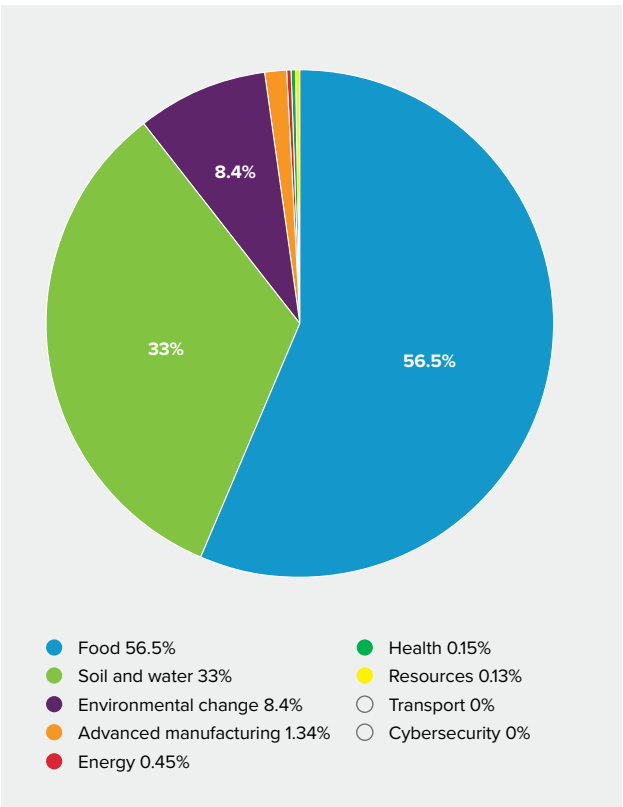
CRDC investment by Science and Research Priorities

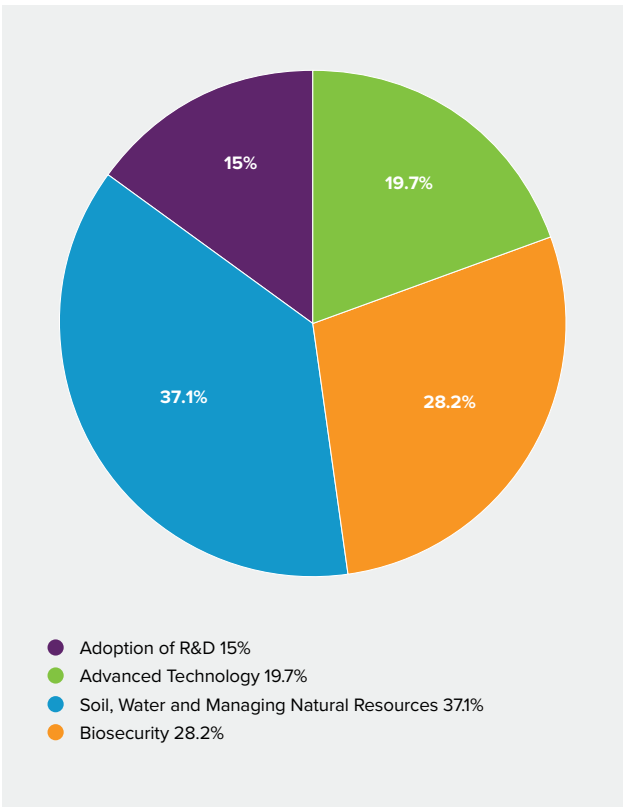
Science and Research Priorities (SRP)	CRDC investment ($'000)
Food (also includes Fibre)	$11,219
Soil and water	$6,540
Environmental change	$1,660
Advanced manufacturing	$266
Energy	$90
Health	$31
Resources	$26
Transport	$0
Cybersecurity	$0
Total	**$19,832**

CRDC investment by Rural RD&E Priorities

Rural RD&E Priorities	CRDC investment ($'000)
Advanced Technology	$3,924
Biosecurity	$5,594
Soil, Water and Managing Natural Resources	$7,355
Adoption of R&D	$2,960
Total	**$19,832**

Further detail on how CRDC's RD&E investments align with these priorities can be found in Appendix 1: Australian Government Priorities.





Section 4
RD&E Portfolio


80 pts
Lorem Ipsum

Section 4: RD&E Portfolio

Goal 1: Increase productivity and profitability on cotton farms

Increasing the productivity and profitability on Australian cotton farms by $1.5 billion by 2023 is CRDC's aim within this goal. To achieve this, CRDC focuses on investments in RD&E to deliver optimised farming systems, adapt transformative technologies, and protect our industry from biotic threats and environmental stresses.

In 2018–19, CRDC invested in 112 projects within this goal, accounting for 68 per cent of our total RD&E expenditure.

Performance against the Strategic Plan

Key Focus Areas	Outcomes	Performance Indicator	Measures	2018–19 progress
1.1 Optimised farming systems	1.1.1 Improved yield and quality	Increase in yield over 5 years	Assessment of average bales/ha	Irrigated cotton yields are stable (11.22 bales/ha) while dryland crop yields have been reduced (1.16 bales/ha) as a result of extended dry conditions. Crop quality, however, has been above average.
	1.1.2 Improved input efficiencies	Positive input/output ratios resulting from adoption of new practices	Assessment of bales per unit input for irrigated cotton (water productivity and nitrogen-use efficiency)	Early indications from the *Cotton Industry Water Productivity Benchmarking* project have identified improved water productivity compared to previous cycles. On-farm Gross Production Water Use (GPWUI) was 1.174 in 2006-07; 1.139 in 2007-08; 1.120 in 2012-13 and is tracking around 1.2 bales/ML for 2017-18. The 2018 Cotton Grower Survey found on average total nitrogen was reported as 335.9 kg N/ha (fully irrigated), 68.7 kg N/ha (partially irrigated), and 33.9 kg N/ha (rain-grown/dryland). The CRDC-led *More Profit from Nitrogen* project has contributed extensively to industry understanding on nutrition, and the 2018 review (Macdonald, B et al.) has identified research gaps to support industry improvement in nitrogen-use efficiency.
	1.1.3 On-farm sustainable development is supported	New farming systems are sustainable and productive	Number of bales produced on new farming systems	CRDC research is supporting development in new regions. Interest in Northern Australian cotton continues to increase. Two farms grew test cotton in the Northern Territory in 2018–19, and it is expected this will increase in 2019–20. CRDC is investigating new farming systems that involve winter planting and use of cover crops.
	1.1.4 Improved reliability of cotton production	Increase in five-yearly average production	Rolling annual average production (number of bales)	While the areas under cotton production are expanding, total production has been reduced as a result of the ongoing drought. The estimated five-year rolling average production following the 2018–19 season is 3.1 million bales.

1.2 Transformative technologies	1.2.1 New technologies are adapted for use in cotton	Increased number of technologies are available for cotton growers	Number of new technologies entering commercial use	CRDC undertook commercialisation activities in improved irrigation management and improved application of pesticides.
	1.2.2 Cotton farms are digitally enabled	Increase in on-farm use of digital technology	Percentage of farms utilising digital technologies	Through the CRDC-led, *Australian Agriculture: Growing a Digital Future* project – a follow-on project to *Accelerating Precision Agriculture to Decision Agriculture* – the basis for an industry digital strategy will be developed that will support enhanced adoption of digital technology.
1.3 Protection from biotic threats and environmental stresses	1.3.1 Increased understanding of the impact of pests, diseases and weeds, and environmental stresses	Impact information is available to inform improved management practices for growers and industry	R&D investments reflect the potential impact of biotic and environmental stresses to inform management practices	The industry disease survey is utilising a new approach to analytics to determine impact of disease for different systems/regions. Projects to reassess retention and pest threshold for high-yielding cotton have been established. Research into novel approaches to mitigate abiotic stresses, such as elevated temperatures and water deficits, is continuing.
	1.3.2 Improved identification, surveillance and management systems for pests, diseases and weeds, and environmental stresses	New management practices and systems are available for growers, consultants and industry	Economic impact of pests, weeds and diseases reduced by 40 per cent	CRDC has a number of projects investigating new management practices to reduce impact of pests, weeds and diseases.
	1.3.3 Industry is prepared for a biosecurity incursion	Delivery of effective biosecurity preparedness scenarios/exercises (undertaken by cotton industry)	Number of biosecurity preparedness activities undertaken	The first biosecurity scenario activity was planned during 2018–19 and will be conducted in August 2019.
			Percentage of participants reporting increased preparedness	44 per cent of cotton growers currently have a farm biosecurity plan (identifying hazards and an action plan) with a further 19 per cent currently developing a plan. Industry preparedness will be reported following planned biosecurity scenario activities.

RD&E highlights

Improving crop establishment, termination and weed control in dryland cotton farming systems (CRDC1937)

This project examines planting tactics that might improve the establishment of cotton seedlings. It also develops and tests the reliability of crop destruction tactics that minimise cultivation. To improve cotton planter designs, the Dryland Cotton Research Association (DCRA) built a planter bar with six different units on it to plant into varying moisture conditions and soil types. This piece of equipment, funded by CRDC and with units sourced from local suppliers, is available for demonstrations and field days. The DCRA aims to improve innovation and increase the adoption of new practices.

Managing cotton quality to maintain Australia's premium status (includes CottonInfo technical lead and *my*BMP module lead) (CRDC1924)

This project aims to preserve the premium status of Australian cotton, which has excellent fibre characteristics and low levels of contamination. The project has five main strands: investigating the effects of different nitrogen fertilisation rates; establishing the impact of stripper harvesting; evaluating defoliation practices; investigating the incidence and severity of seed coat fragments in cotton lint; and investigating the reasons for variability in gin trash composition. It provides technical leadership to CottonInfo and industry associations, as well as technical solutions and post-harvest support via forums, liaison with grower (valley) groups, field days and conferences.

Improving the nitrogen-use efficiency of cotton crops through better understanding the role of dissolved organic N (CSP1904)

Soil, a farm's most important asset, relies on its organic matter for soil health and fertility. But in many agricultural systems, organic matter is known to be declining because of management changes. If organic matter is declining, then so too is soil nitrogen. This project aims to quantify the uptake of dissolved organic nitrogen in different cotton varieties in high-yielding systems. The project outcome will improve cotton nitrogen management by determining the plant nitrogen preference (NO3-, NH4+ and DON) and how it can be managed in different crop environments. Better management potentially raises productivity and reduces environmental impacts.

Improving water-use efficiency in a changing climate (CSP1804)

Research supported by CRDC and CSIRO indicates that while higher CO_2 improves some aspects of cotton growth, there may also be negative impacts, such as rank growth and an increase in total water required. Focusing on the effects on cotton grown in higher temperatures and higher CO_2, this project has three strands: assessing the use of plant growth regulators to balance vegetative and reproductive growth; exploring canopy-level carbon and water fluxes; and assessing the capacity for current models to optimise yield and resource-use efficiency. Better management could capitalise on benefits of these conditions while minimising harm.

Optimising the management of manures in southern NSW cotton production II (DU1903)

In the southern region, an abundance of animal manure matches cotton growers' interest in using poultry litter for soil health. But there's limited information on its benefits and costs for the region's clay-loams and grey clays. Responding to the need to optimise inputs for profit and sustainability, this project addresses responsible soil management by improving soil quality and nutrient (NPKS) storage through integrated manure management. It evaluates nutrient-use efficiency benefits, plant development, fibre quality and yield. The project will recommend ways to integrate manure into conventional fertiliser programs, and measure success from productivity per N unit, per P unit, per ha of land.

Science leadership for cotton development in Northern Australia (CSP1903)

This project provides science leadership for potential new cotton developments in northern Australia. There is strong interest in cotton in East Kimberley, NW Qld and NT. Proposed summer cotton cropping enables winter double cropping, with grain/fodder and cottonseed as a protein source for beef cattle. This project will coordinate activities, including extension of past research and *NORpak* publications, to industry while providing technical support to new and recent commercial cotton investments in tropical Australia. Other activities include validating and calibrating modelling tools for climate risk assessment, and providing an assessment and support of crop protection risks unique to Northern systems, such as *Spodoptera litura*.

Quantifying the effectiveness of cover crops as a means of increased water infiltration and reduced evaporation in the northern region (GRDC1801)

In the northern region, more-effective rainfall capture and storage are major challenges. For dryland crops, only 20–40 per cent of rainfall is typically used, up to 60 per cent evaporates, and about 5–20 per cent runs off or drains. This cross-sectoral project trials the effectiveness of cover crops to increase infiltration, reduce evaporation, and increase plant-available water for dryland grain and irrigated cotton. Working under difficult conditions to establish and maintain trial crops, the project confirmed that suitable cover crops, removed at the right time, can boost net soil water, with gains of 15–38 mm measured. Yields have increased, well beyond that expected from greater soil-water storage.

Application of molecular tools for monitoring resistance alleles in *Helicoverpa* spp. (CSE1801)

The industry resistance management plan for Bt cotton is underpinned by resistance monitoring. This project, a partnership with Bayer and CSIRO, is developing molecular techniques to identify the diversity and relative frequencies of Bt resistance alleles in *Helicoverpa armigera* and *H. punctigera* with a view to developing a cost-effective, faster technique for monitoring. While the primary aim of the molecular techniques is to monitor resistance frequencies and detect new forms of resistance, the ability to test greater numbers of moths more easily will also inform what resistance looks like regionally and seasonally and enable elements of RMP to be tested.

Identifying sensors for better IPM in cotton (NEC1901)

Silverleaf whitefly (SLW), mites and aphids gathering under cotton leaves are not easily detected manually because of diurnal movement or patchy distribution. Left untreated, they can slash the value of a cotton crop, through feeding damage, or by depositing honeydew that reduces quality. Effective management relies on accurate and timely detection and quantification to identify the need for treatment. This project has successfully developed a proof-of-concept machine-vision sensing approach able to discriminate pest infestations. The algorithm includes machine learning based on thousands of SLW nymph image samples. The sensor has the potential to further improve management of these key pests.

Precise real-time automated cotton irrigation for improved water productivity (USQ1902)

The Australian cotton industry produces more than $2 billion of Australia's agricultural output, but is highly dependent on limited water resources. Water access and irrigation labour availability are significant limiting factors. USQ, with CRDC and Rural R&D for Profit funding, has developed automated, site-specific surface and pressurised irrigation systems. They integrate software and hardware, including low-cost sensors, optimisation control software (VARIwise), and actuation systems to analyse field data and implement site-specific irrigation.

System evaluations show a 10 per cent yield improvement, and water savings of 12 percent. The systems can automatically adapt irrigation to any crop, irrigation platform, soil type, crop, and weather profile.

Australian Agriculture: Growing a digital future – Developing digital agriculture maturity index and assessing digital maturity levels across all agricultural sectors (GDF1901)

Digital technologies have great potential to transform Australian agriculture, and increase productivity, profitability, and sustainability of food production. The implementation of digital agriculture across all Australian production sectors is estimated to create a gross economic benefit of $20.3 billion. To take full advantage of the value promised by digital technologies, agriculture industries need to embrace a systematic 'digital transformation' that is well planned, standardised and targeted at identified challenges. To contribute to the transformation, this project will develop a quantitative, standardised measure of digital capability – a Digital Maturity Index – that can be used for diagnostic, monitoring and evaluation purposes.

Transformation of *Verticillium dahliae,* causal agent of Verticillium wilt of cotton, with the GFP gene (DAN1809)

This project has developed a protocol to prepare cotton samples infected with GFP-tagged *V. dahliae* for confocal laser scanning microscopy (CLSM). Fluorescing-infecting fungal structures were visualised in-situ at high resolution. By investigating plant sections to explore the extent to which fungal penetration could be visualised, *V. dahliae* was found in the vasculature of root, stem, and leaf tissues. This means that CLSM, used with a GFP-tagged pathogen, allows tracking of infection, colonisation and possible sporulation of *V. dahliae* on cotton, and now potentially

with other host crops. This new technique will allow better understanding of this critical disease, leading to better disease management advice.

Improved management of silverleaf whitefly on cotton farms (DAQ1903)

Silverleaf whitefly is a serious pest for the industry because it has the ability to rapidly increase population size, readily develop resistance to insecticides, and significantly affect the quality of cotton. This project was developed in response to industry concern that management advice developed in Central Queensland was not adequate for other regions. The project is revising the action thresholds and sampling protocols for adults and nymphs based on population dynamics studies. The decision support package for silverleaf whitefly will also be informed by product screening trials with the aim to preserve beneficials and maintain quality.

Improving the management of cotton diseases in Australian cotton-farming systems (RRDP1724)

The cotton industry has historically conducted disease surveys separately in NSW and QLD to monitor disease severity and spread. This project brings together data across the industry to use new data approaches to the disease survey and analysis to improve management strategy advice. Farming system and management linked to microbial studies have helped to show how microbial diversity is important for disease suppression. While a bare fallow and corn rotation both yielded significantly better than cotton back to back, an analysis of microbial diversity suggests that fallows will have less capacity for disease resilience. Other field trials include rotation, soil solarisation (black plastic), and incorporation of sorghum residues.

Monitoring SLW insecticide resistance (DAQ1701)

The integrated pest management of silverleaf whitefly (SLW) in cotton relies on conventional insecticides, which, if poorly managed, can rapidly develop resistance. Slowing resistance and maintaining effective insecticides is a key IRMS goal. This project, being integral to the IRMS process, monitors resistance levels in SLW populations to help balance the risk of resistance with flexibility of control options. The early detection of pyriproxyfen resistance through this project enabled the TIMS committee to implement a 30-day regional window and issue a warning to industry. The 2018–19 monitoring results indicate that this industry response has slowed further resistance development.

Novel topical vegetable and cotton virus protection with BioClay (HIA1803)

Long-term sustainability and profitability of the Australian cotton industry depends on innovations that challenge old ways and create exceptional value. This project aims to minimise the economic impact of pest infestation on vegetables and on cotton through the development of an innovative topical protection medium, BioClay. The high-tech BioClay spray uses nanotechnology to deliver double-stranded RNA, which is anticipated to prime the plant's own defences, similar to the way a vaccine works, and helping the plant to naturally attack specific crop pests and pathogens. The project has a range of partners, including Hort Innovation.

Staying ahead of weed evolution in changing cotton systems (UQ1501)

This project aims to minimise the damage glyphosate-resistant or multiple-resistant weeds cause the cotton industry. It seeks to discover the drivers for resistance, evaluate new control tactics, and suggest management strategies for multiple resistance. While five weed species are resistant in some QLD and NSW regions, new research shows target site and some non-target site resistance (NTSR) mechanisms can cause glyphosate resistance, as with Australian barnyard grass. Weeds with some NTSR could become cross-resistant to other herbicides. To help growers, the free Weeds of Australian Cotton ID app, with ID database, images and information on 50 key species, can be downloaded.

Large-scale biosecurity scenario to support cotton industry preparedness (PHA1902)

While the cotton industry has had few major pest incursions, detections of whitefly and a defoliating Verticillium wilt demonstrate biosecurity is an ongoing threat. There are 15 High Priority Pests that would affect production if they were to become established in Australia. This highlights the need for strong links between industry and governments in managing incursion responses. This project supported the development of a simulation exercise, 'Cotton BluePrint', using a scenario based on detection of Cotton Blue Disease on the Darling Downs. It aims to identify key gaps in biosecurity preparedness, and then deliver and evaluate the effectiveness of activities to test or improve these areas.

Case study

Breakthrough in mealybug control

After years of CRDC-supported research, 2018–19 marked the first year that crop managers had the option of chemical controls for solenopsis mealybug.

CRDC began a ground-breaking research project with QDAF's Richard Sequeira in 2015 to investigate the possible chemical controls for mealybug, with the obvious remit that it must not disrupt integrated pest management (IPM) strategies.

Richard is the industry's foremost expert on cotton mealybug. He found three products that he says, "should be used as a last resort, when other IPM tactics, such as beneficial insects, aren't working".

During the 2018–19 season, growers had access to Sulfoxaflor (Transform), and spirotetramat (Movento), which are currently used in cotton to control other pests, with strict guidelines for use, as researchers identified that correct application was key to successful control. A permit allowing limited use of Buprofezin (Applaud) for mealybug control was also obtained for the industry (PER85053).

Richard says this is the most difficult project he has undertaken to date, for several reasons.

"It was a tough nut to crack, as we needed to succeed where researchers in India, Pakistan and other countries had failed to come up with chemical solutions that gave an economically acceptable level of control while also fitting in with IPM strategies," he explained.

"Firstly, we could test only products currently registered for use in cotton, or at least those with potential for rapid registration, so this limited our selection.

"There are many chemicals that have an effect on solenopsis mealybug but give poor (zero to 30 per cent) control. We also found that chemicals recommended for controlling other mealybug species (in other crops) showed no efficacy on solenopsis.

"It might seem a solution could be to say just increase the rate, but this is the next issue we faced – working with the companies' product guidelines and parameters based on toxicity studies and trade MRLs (maximum residue limits) that we had to adhere to."

The other main consideration was the effect of the control on beneficial insects and the IPM system as a whole. Prior to this CRDC-supported project, there were no viable options for mealybug control using insecticides, and their use comes with caution.

"Chemical control is the last thing you want to do, but growers may find themselves in situations where the usual controls are not working," Richard said.

"These chemical controls must fit in with the overall system or you will end up with a bigger issue than the one you started with, and we've seen that with mealybugs. Consequences of earlier actions can end up being more expensive propositions at the end of the season and in the long term.

"If you go chasing mealybug with chemicals at the wrong time in the wrong way, you can flare other pests, such as silverleaf whitefly (SLW), that does not cause direct yield loss but has the potential to damage the industry as a whole due to risk of honeydew contamination.

"If the underlying concern is managing risk and ensuring market access, whitefly is the biggest risk, and we need to keep that in mind when managing other pests."

Johnelle Rogan

For more: read the full article in the Summer 2018–19 edition of CRDC's *Spotlight* magazine www.crdc.com.au/spotlight.

Case study

Growing a digital future

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

The Australian agricultural sector has already examined the current and future state of digital agriculture in Australia via the Australian Government's Rural R&D for Profit program Accelerating Precision to Decision Agriculture (P2D) – a major collaborative project led by CRDC that brought together all 15 of Australia's RDCs for the first time.

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

CRDC Innovation Broker Jane Trindall says the report from the project made 13 recommendations in the areas of strategy, leadership, governance, digital literacy, and enablers to achieve these gains.

To implement the recommendations from P2D, 11 RDCs have collaborated in 2018–19 to begin the next stage of this project, *Australian Agriculture: Growing a Digital Future*.

"This project aims to lift the digital maturity of the sector from ad-hoc to competitive, lift economic growth, and prepare the workforce for the future," Jane said.

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

The project has three key focuses: the development of a digital transformation hub (a team of digital/data experts to initiate digital strategies and support their implementation); digital capability (upskilling those within and entering the industry via digital literacy, and providing learning pathways for data scientists); and foundational data and analytics (increase the interoperability of agricultural data).

The first year of the project has involved the establishment of a digital transformation taskforce for the Australian agricultural sector, including the development of the digital maturity, data governance, and digital capability frameworks with project partners.

This project is supported by funding from CRDC and its fellow RDCs Meat and Livestock Association, Sugar Research Australia, Australian Wool Innovation, Fisheries Research and Development Corporation, AgriFutures Australia, Wine Australia, Dairy Australia, Australian Pork Limited, Australian Eggs, and Horticulture Innovation Australia.

Melanie Jenson

For more: read the full article in the Autumn 2019 edition of CRDC's *Spotlight* magazine www.crdc.com.au/spotlight.

Ruth Redfern

Section 4: RD&E Portfolio

Goal 2: Improve cotton farming sustainability and cotton value chain competitiveness

Improving value chain competitiveness and sustainability to derive $0.5 billion in greater value for Australian cotton growers – and helping Australian cotton achieve its ambition to be the highest yielding, finest, cleanest and most responsibly produced cotton in the world – are CRDC's aims within this goal. To achieve this, CRDC focuses investments in RD&E to create higher value uses for cotton, to ensure the sustainability of cotton farming, and to support measurement and reporting through the value chain.

In 2018–19, CRDC invested in 47 projects within this goal, accounting for 15 per cent of our total RD&E expenditure.

Performance against the Strategic Plan

Key Focus Areas	Outcomes	Performance Indicator	Measures	2018–19 progress
2.1 Sustainability of cotton farming	2.1.1 Improved environmental footprint for cotton farms	Increase in sustainability metrics and improved carbon footprint	Percentage of farm native vegetation managed for conservation	As reported in CRDC's 2017–18 Grower Survey, the area of native vegetation not usually grazed was four per cent.
			Carbon footprint (kg of CO_2e per bale)	The CottonInfo Technical Lead for Climate and Energy supports industry adoption of R&D into energy efficiency, and CRDC maintains an extensive investment for improving nitrogen-use efficiency. The carbon footprint will be reported as one of the industry's key sustainability targets in the 2019 Australian Grown Sustainability Report.
2.2 Create higher value uses for cotton	2.2.1 Increased value for Australian cotton	Increase in the number of new commercialised products	Number of new commercialised products	Three commercialisation proof-of-concept activities were supported: testing the performance of cotton-rich compression athletic wear garments; improved handle of cotton fabrics; and enhanced microbial protection for outdoor fabrics.
	2.2.1 Increased understanding of market requirements and opportunities throughout the value chain	Information is publicly available on market requirements and value chain opportunities	CRDC research identifies opportunities to increase the value of cotton by 25 per cent	CRDC invested in research to scope the potential for higher value uses of cotton through blending with 'high-tech' man-made fibres. Preliminary studies were undertaken to assess whether cotton could be used as a raw material for carbon fibre production. The commercialisation activities (noted above) all have the potential to add value to cotton through use in higher value fabrics. CRDC also invested in two projects seeking to add value to cotton gin trash, a low-value by-product of the ginning process.

2.3 Measurement and reporting throughout the value chain	2.3.1 CRDC collaborates in global leadership for sustainability initiatives	Evidence of involvement in global initiatives	Number of global initiatives participated in	CRDC currently participates in five global initiatives: the Expert Panel on the Social, Economic and Environmental Performance of Cotton; Sustainable Agriculture Initiative; Sustainable Apparel Coalition; Better Cotton Initiative 'Project Delta'; and Cotton2040.
	2.3.1 The value chain is transparent and understood by participants to improve market opportunities	Economic and sustainability implications of transparency throughout the value chain are published and understood	Reports and sustainability information published	Industry sustainability targets have been established in collaboration with Cotton Australia and will be published in 2019–20. Projects have been established to enable reporting against those targets, including the development of appropriate social capital and well-being indicators. A project was initiated that will investigate strategies for improving labour conditions through the supply chain, and two PhD projects are underway that will investigate the information and transparency needs of the supply chain, in particular the retail/brand sector.

Case study

Taking technology to trees

A drone with the capacity to plant a hectare of trees in less than 20 minutes is just one of the revegetation methods set to be trialled by the new CRDC Landcare Tech-Innovations 2021 project.

Led by Dr Rhiannon Smith from the University of New England in collaboration with ecosystem restoration experts, the research aims to improve capacity for cost-effective revegetation on cotton farms by trialling new and improved direct seeding technologies using drones and tractors.

Under the National Landcare Program's Smart Farming Partnership initiative, CRDC secured a $1.3 million grant to implement the three-year *Cotton Landcare Tech-Innovations 2021 project*. The project will focus on four key research areas: innovation, technology, biodiversity, and collaboration.

"Your average cotton farm is in a semi-arid region and occurs on a very heavy clay soil that dries out very quickly, and combined with variability in rainfall and high temperatures, you get a huge natural impediment to getting native vegetation established," Rhiannon said.

"What this project is doing is investigating a number of innovative technologies, including drones, as an alternative to traditional expensive and time-consuming revegetation methods, such as tube stock planting or traditional direct seeding by tractors.

"In contrast, drones come into their own if you've got a saturated soil that's more likely to allow seeds to germinate and get established in floodplain species that naturally flower and seed after a flood event.

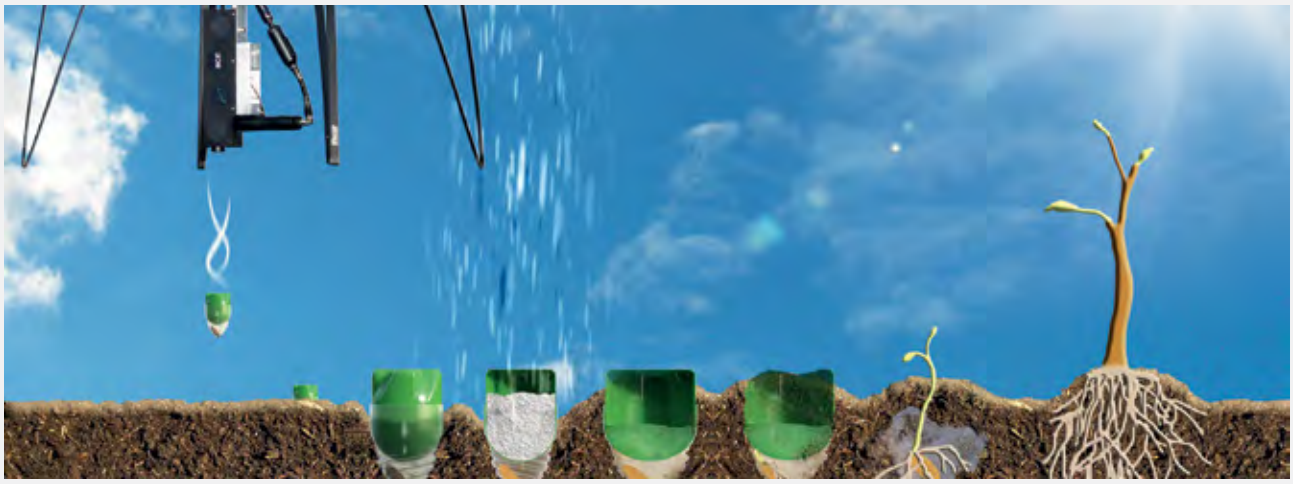
"We're planning on replicating natural conditions, so we're more likely to get successful establishment of native vegetation around cotton farms."

The drones being trialled have been developed by BioCarbon Engineering using technology built at Oxford University. The drones have a 15-kilogram payload with a modified air rifle that can shoot seeds into the ground at 40 metres per second while hovering two metres above the ground. This is all controlled by someone sitting in a vehicle – as opposed to the tree-planting teams usually required for large-scale revegetation.

The seeds being ejected by the modified air rifle are no regular seeds either. They're water-soluble seed capsules that are pumped full of seeds, fertiliser, microbial amendments and anything else that's required to get seeds germinated and established. The seeds are protected in that capsule until there's enough moisture at the site to break down the capsule and allow the seeds to germinate and establish.

Rhiannon will now move this planting methodology on cotton farms.

"Cotton growers understand the range of ecosystem services provided by native vegetation in the landscape. The benefits of biodiversity and native vegetation for sustainable agriculture in general are immense and go a long way in supporting healthy, vibrant environments for cotton-growing communities."



Landcare

For more: read the full article in the Winter 2019 edition of CRDC's *Spotlight* magazine www.crdc.com.au/spotlight.

RD&E highlights

Baselining Lower Namoi groundwater and evaluating Pilliga CSG developments (UNSW1601)

Sustainable access to groundwater is an ongoing concern for Lower Namoi irrigators. Groundwater research shows a hydraulic connection between the Lower Namoi Alluvium (LNA) and the underlying Great Artesian Basin (GAB). However, the extent of this connection and the transfer rate from the GAB to the LNA is largely unknown. This project combines groundwater chemistry, microbiology and groundwater hydrograph analysis to reveal more of the GAB–LNA connection. It will provide new information for the Water Sharing Plan (Lower Namoi Groundwater Sources), improve our capacity to assess the impact of coal seam gas production in the Pilliga, and help other river system catchments.

Cotton Landcare Tech-Innovations (NLP1901, NLP1902, NLP1903, NLP1904)

CRDC secured a $1.3 million grant under the National Landcare Program's Smart Farming Partnerships initiative to bring Cotton Landcare Tech-Innovations 2021 onto Australian cotton farms to improve natural resources (biodiversity). The project builds on international best practice to trial, implement and develop cutting-edge technologies, such as drone mapping and aerial seeding, acoustic monitoring and big data, to help Australian cotton better report on and improve on-farm biodiversity. Initial research has identified 315 threatened and iconic plant and animal species in cotton-growing regions, and provided management actions for those species.

Managing natural landscapes on Australian cotton farms to increase the provision of ecosystem services (GU1701)

The benefits of maintaining natural landscapes on cotton farms need to be measured. This project assesses the values and management strategies of natural landscapes to learn how they protect, restore and improve ecosystems. The information helps growers and the industry maximise the benefits of management actions and minimise the losses. The project focuses on two main aspects of ecosystems – natural and human factors, and management strategies – to improve the industry's capacity to record and demonstrate environmental performance. It combines spatial data (e.g. satellite imagery) with field studies of cropping and weed control to determine agro-ecological drivers of ecosystem services.

PhD: Improving precision agriculture and climate adaptation for the Australian cotton industry through fertiliser optimisation (ANU1602)

Many growers apply nitrogen through water-run urea, but how efficient is this method? This PhD project seeks to make nitrogen application more efficient in agriculture by studying the physicochemical behaviour of commonly used nitrogen-based fertilisers. Timing is key with water-run urea because it breaks down quickly when dissolved. While water temperature and the amount of soil interaction are important, soil microbial action is crucial. Early results indicate that while the water's microbes affect the urea mineralisation rate, the soil's microbial community is the primary driver of mineralisation.

PhD: Sustainable water extractions: Low flow refugia and critical flow thresholds (UNE1406)

When inland rivers flow, biodiversity thrives. But when there's low or no flow, waterholes (refugia) become refuges for fish, animals and plants, which maintains ecosystems and riverine diversity. In-channel flows help maintain connections between waterholes by facilitating dispersal and mediating water quality. Human activities, such as vehicle access and water pumping, increasingly threaten refugia, especially when flows are low. This project studies the locations, features, and functions of refugia to guide decision making about irrigation, management of rivers, and neighbouring landscapes. The project will make recommendations on appropriate strategies, including flow management and restoration of in-channel and riverbank areas.

Quantifying the nitrogen cycle: from farm gate to catchments, groundwater and atmosphere (ANSTO1801)

Because nitrogen is fundamental to cotton growing, the industry needs to understand its full role, especially given that high N inputs to waterways can raise the risk of eutrophication and algal blooms, mostly in inland rivers. This longitudinal study analyses the irrigation sector's impact on the nitrogen cycle, from the field to the atmosphere, surface waterways, and aquifers. It provides evidence that can be used to map the industry's nitrogen cycle footprint in three selected river catchments: Nogoa, Murrumbidgee and Namoi. This approach allows the collation of a comprehensive database documenting the condition of natural assets used by the industry.

Synthesis of natural resource assets in the cotton-growing region of eastern Australia (FWPA1801)

By creating a comprehensive database of the extent and condition of natural assets the industry uses in eastern Australia, this project lays a foundation for developing and reporting ecological sustainability. It helps to define values and drivers of natural landscapes management in cotton regions. The database includes information on biodiversity, vegetation areas, wetlands, groundwater-dependent ecosystems, corridors and connectivity. It is used to evaluate and prioritise 'relative conservation value' of native vegetation, and areas for restoration. A carbon stocks inventory, including soil organic carbon data, will help guide future land management scenarios and a biodiversity monitoring framework of the 'natural capital' of cotton regions.

Breathable cotton for compression fabrics phase 2: performance testing (DU1905)

While only 30 per cent of athletic apparel containing cotton is marketed as offering performance features compared to 92 per cent of synthetic garments, market research indicates that most people prefer a cotton alternative with similar features. Compression athletic wear (CAW), made from synthetic fibres, is well regarded for better fit and performance. An earlier project developed an innovative approach for making compression garments from Australian cotton to compete with currently available synthetic CAW; previously, there were no methods of making cotton-rich CAW. This project compares the cotton-rich CAW's performance against available products to determine whether it provides more comfort and better performance.

Developing renewable fine chemicals from cotton biomass (A profitable future for Australian agriculture: Biorefineries for higher-value animal feeds, chemicals and fuels) (SRA1601)

Australian agriculture must continually adapt to remain competitive in an era of rising production and compliance costs, climate variability, pests and disease, and changing global patterns of production and consumption. One path to a profitable future for Australian agriculture is to create biorefineries that generate higher value bioproducts from agricultural primary products, off-specification primary products, and low-value or waste byproducts. This project has developed technologies to convert cotton residues into an intermediate chemical product and subsequent high-value molecules with potential application as pharmaceutical precursors, adhesives and other products. The next stage is to investigate the feasibility of these technologies at commercial scale.

Potent mould and mildew resistance cotton fabrics (DU1802)

Outdoor textiles are a significant but often overlooked market that includes transport tarpaulins, caravan covers, awnings, camper trailer walls and roofs, and even livestock covers. However, outdoor textiles are, by definition, exposed to harsh conditions, such as mould in moist environments. It greatly affects serviceability of textiles due to issues such as discolouration, staining, and loss of strength. Working with a commercial partner, this project builds on previous investments that devised a novel coating for mould and mildew-resistant cotton fibre by anchoring an eco-friendly antimicrobial agent. This coating inhibits the growth of fungi cells, thus lengthening the product's life.

Microparticles generated from laundering of cotton and other fabrics (NCSU1702)

Clothes laundering releases microfibres and microplastics into waste waters that flow into oceans and lakes, prompting questions about the amount of microplastic in the ocean and their effect on marine life. Previous CRDC-supported research showed that while polyester and cellulose-based fabrics shed many microfibres, especially in hotter water and high detergent use, cellulose fibres degrade more quickly than polyester fibres. This current research investigates how dyes and finishes affect degradation rates, and whether cotton has an advantage over synthetics in this important area of microfibre pollution.

Strategies for improving labour conditions within the Australian cotton value chain (QUT1903)

To understand how the whole Australian cotton value chain functions, this project investigates the working conditions of key Asian and African garment industries and their relevance to the Australian industry. It considers the networks, regulatory frameworks, social context, and the parties that are best positioned to influence change to improve working conditions. It investigates ways through which our industry could strategically enforce external labour standards. The project will produce an evidence-based toolkit of strategies and resources that can improve compliance with labour standards along the chain. Its objective is to promote a pathway that leads to equitable conditions for workers.

Mel Jenson

Section 4: RD&E Portfolio

Goal 3: Build adaptive capacity for the cotton industry

Building the adaptive capacity of the Australian cotton industry and enabling the industry to achieve its future vision is CRDC's aim within his goal. To achieve this, CRDC focuses investments to deliver science and innovation capability and new knowledge, and to facilitate futures thinking.

In 2018–19, CRDC invested in 70 projects within this goal, accounting for six per cent of our total RD&E expenditure.

Performance against the Strategic Plan

Key Focus Areas	Outcomes	Performance Indicators	Measures	2018–19 progress
3.1 Science and innovation capability and new knowledge	3.1.1 Science and innovation capacity is strengthened and strategically fit for a digital future	Increase in the number of researchers supported through strategic pathways	Number of PhD, post-doctoral and early career researchers supported	CRDC supported 15 PhDs and eight early career researchers in 2018–19.
			Number of scientific exchanges	CRDC supported seven scientific exchanges in 2018–19.
	3.1.2 Increased understanding of and participation from the diverse human capital in regional communities	Information is available on the diversity of social networks (age, gender, roles, culture, range of service providers, occupations and skills)	Report released	A post-doctoral project aims to develop an understanding of the needs of a future cotton workforce. The digital literacy of people working in the cotton industry will be a key focus of the industry's Digital Strategy, building on the outcomes of the *Growing a Digital Future* project, a cross-RDC collaboration.
	3.1.3 Increased opportunities for innovation skills development	Degree to which innovation is supported by CRDC	Number of participants in innovation initiatives	CRDC supported the StartUp Alley at the 2018 Cotton Conference that showcased ideas from 12 start-ups to over 2600 delegates, in collaboration with Cotton-X. CRDC also supported AgFrontier, a new regional AgTech incubator that is targeting to support 10 regionally based start-ups.
			Number and details of new ideas generated that provide benefit for the cotton industry	Ideas are still being generated through initiatives such as AgFrontier. CRDC will support 15 cotton growers (one from each Cotton Grower Association) to participate in AgriFutures' EvokeAG in 2020.

3.2. Futures thinking	3.2.1 Australian cotton farmers are able to adapt to change	Growers report improved capacity to manage unknown or unexpected events (resilience)	Percentage of growers who report improved general resilience	CRDC supports Grassroots Grants that help cotton growers adapt to change and build resilience, and has a project investigating resilience thresholds in regional communities.
	3.2.2 Increased opportunities for strategic foresighting	Futures workshops lead to recommendations for future opportunities	Number of futures workshops	Futures workshops have not yet been held; a horizon scan, to be held in collaboration with Cotton Australia, is planned for 2019–20.
			Number and details of future opportunities to be followed up	Futures workshops have not yet been held; a horizon scan, to be held in collaboration with Cotton Australia, is planned for 2019–20.

RD&E highlights

Cotton industry leadership development: ARLP Course 24 (RIR1801)

Timothy Chaffey (Quirindi) and Richard Malone (Griffith) were cotton's graduates from the Australian Rural Leadership Program (ARLP), supported by CRDC, Cotton Australia and Auscott. They were among 33 diverse leaders in the 15-month program in Australia and Indonesia that immerses rural, regional and remote leaders in development experiences.

In the next cohort, John Durham and Fleur Anderson are cotton's representatives. Fleur's many responsibilities include Director of Cotton Australia and chair of Australian Cotton Conference 2019. So far, she found the Kimberley ARLP experience to be incredible, forcing a rethink of her strategies. ARLP challenges participants' thinking and actions, and helps build a network of supportive leaders.

Nuffield Australia Farming Scholarship 2017 (CRDC1711)

Wee Waa grower Daniel Kahl gathered many useful ideas during his Nuffield Scholarship. With farms struggling to fill management roles, the industry needs pathways to engage the next generation of managers in early secondary school, and guide them into agricultural management. Agriculture's future is in 'thinking jobs' with digital skills as well as traditional skills. To overcome farming's poor reputation (low wages, long days, and few career prospects), Daniel recommends that teaching packages use agriculture as a national vehicle for school STEM subjects. An outreach program allowing students to spend time on-farm is important for attracting people to the industry.

Nuffield Australia Farming Scholarship 2018 (CRDC1801)

Kimberley Agricultural Investment's farm manager Luke McKay is the cotton industry's most recent Nuffield Scholar. Luke's scholarship, supported by CRDC and Cotton Australia, focuses on issues relevant to tropical cotton-growing systems: double cropping, irrigation, rotation crops, staff and machinery needs, and resource and environmental management. He hopes to use the experience to help expand northern Australian agriculture and to create a sustainable industry. The Nuffield Scholarship involves overseas learning experiences. Luke's visits include The Netherlands, Brazil, South America, USA, and Canada to source information to bring back to share with the Australian industry.

Postdoc: Understanding and planning for the future cotton workforce (USQ1801)

The continued emergence of new technology on farms represents the changing face of agriculture. In future, driverless machines will replace low-skilled jobs, and augmented reality devices and drones will take higher skilled jobs. Is the industry prepared for the changes and new opportunities? This project seeks to identify the changing skills needed for the industry to reap the benefits. It takes account of factors such as the varying uptake of technology because of adaptability, trust, and the confidence to learn new ways. To build workforce capacity, farms must drive change and be early adopters of innovation within the industry and on-farm.

AgFrontier new regional agtech incubator (CRDC1943)

In a program designed for rural businesses with a practical understanding of agriculture, the AgFrontier Regional Agtech Incubator helps startups in regional Queensland and northern NSW. It combines events and co-working with workshops, intensive coaching and immersive experiences. The Queensland Central Highlands Development Corporation and X-Lab lead the innovative program, with support from CRDC. AgFrontier's 14-month program accesses international investor and peer networks, including an opportunity to travel to the USA. The 10 participating businesses will showcase their products or services at Emerald AgTeCH19 and Mungindi AgTeCH20 events. About 40 per cent of the products are market ready, and 25 per cent are prototypes.

2018–2021 Joint-RDC Health and Safety Farming Alliance (RIRDC1901)

The Rural Safety and Health Alliance is a new partnership of RDCs investing in a fresh approach to improve primary production's health and safety record centred on innovative research and extension. It replaces the former Primary Industries Health and Safety Partnership. The Alliance aims to generate positive change in the Australian agriculture industry's work health and safety record, using innovative research and extension to deliver practical health and safety solutions. Key objectives include setting clear priorities to better target research, development and extension, strengthening industry leadership, and developing a 'shark tank' funding model, where applicants work together to pitch projects for funding.

Grassroots Grant: Development tour for Northern Australian cotton (CGA1905)

This project introduced new and potential cotton growers in Northern Australian to best practice in southern Queensland and northern NSW growing regions. It focused on dryland crop management and best irrigation methods for northern soil and climate.

The NT Farmers group toured farms and businesses in Toowoomba, Goondiwindi and Narrabri to learn about and gain confidence in the industry – cotton is the crop of interest in the north. Since 2012, CRDC Grassroots Grants have supported 72 projects valued at $630,000. Grants (up to $10,000) are for industry groups and grower associations. Surveys show that participants want on-farm trials and the ability to run events at short notice.

Mel Jenson

Case study

Nuffield scholar ready for Ord cotton challenge

Luke McKay hopes to see cotton prosper in the Ord Valley one day. As a farm manager with Ord Stage 2 developer Kimberley Agricultural Investment, he is at the cutting edge of introducing cotton to the region. The signs have been promising for cotton's return to the Ord, with a second crop grown in 2018–19.

Mr McKay was awarded a 2018 Nuffield Scholarship, supported by CRDC and Cotton Australia, to study tropical cotton production. The program included a busy international travel schedule for research.

In June and July 2018, Mr McKay and other Nuffield scholars travelled to South East Asia, Europe and the USA before he continued on his own to Brazil to investigate cotton.

"I spent time with researchers and seed breeders, travelling to different farms and looking at how they do it over there," he said.

"Brazil was excellent for relating to what we are trying to do here. They have a very different soil type but the growing conditions are quite similar. I learnt a lot about how they manage their crops through the wet season.

"Because we are in the very early stages of cotton, I really wanted to see what options, methods and technologies are being used that we could adapt for the Ord."

Mr McKay, who grew up on a cotton farm in NSW, said the knowledge he had brought back from the study tour would hopefully play a part in cotton succeeding in the Ord.

"It is definitely going to help," he said. "I won't get all the answers out of it but it is a good start. Cotton up here has always been of interest because it has had a good fit but it hasn't quite had the stars align to make it work.

"Bollgard 3 has allowed us to plant earlier in the year and make better use of the temperature coming out of the wet season for a potentially higher yield, and better insect management.

"The Ord has a long history of being challenging but it is an exciting place to work because you are constantly trying to adapt and evolve to the conditions and what is happening each year," he said.

"What I have brought back from Nuffield is that we need to be really sharp on our efficiencies because to compete in the global marketplace we need to be very efficient. Everywhere we went there was a consistent theme and that was what the consumer wants and what they will pay for are two different things. We need to make sure we are the lowest cost producers we can be and still produce a high-quality product."

Luke is now finalising his report on tropical cotton production – particularly nutrient management, biosecurity and crop management – ahead of the Nuffield National Conference in September 2019.

Rourke Walsh Countryman newspaper

For more: read the full article 'Scholar is ready for Ord cotton challenge' in The West Australian - Countryman newspaper www.thewest.com.au/countryman.

Case study

Making an impact at the grassroots level for NT cotton growers

A group of farmers from the Northern Territory got their first look at a cotton crop recently on a tour 'down south'. The trip was supported in part by CRDC through its Grassroots Grants program, creating partnerships far and wide, sharing knowledge and growing the cotton industry.

Led by NT Farmers' Andrew Philip, the tour visited farms and businesses in Toowoomba, Goondiwindi and Narrabri to learn more about the cotton industry, as cotton has become the crop of interest for northern region farmers and industries.

"It was fantastic, and everyone we met was so helpful, engaging and open," Andrew said.

"Not only did we learn more about the way the crop is grown, but how the industry operates. The biggest thing it's given us is confidence that in the future we can go down south and learn even more. This is absolutely vital if we want to grow the industry up here.

"We've learned so much, and now through sharing our experience and word of mouth about the trip it's creating more interest and building momentum and enthusiasm. The Territory is virtually a greenfield site, so the experience has been invaluable in our efforts to move forward in the north."

Andrew said applying for the grant was a quick and simple process. Over the past seven years, CRDC Grassroots Grants have supported 72 projects valued at around $630,000. The grants (of up to $10,000) are available to industry groups and cotton grower associations.

"The value for industry and for us is in providing initiatives designed by growers and crop managers with their direct need and benefit needs in mind," CRDC Executive Director Ian Taylor said.

"Recent surveys have shown growers and consultants desire more on-farm trials and the ability to run events on short notice, often in response to seasonal issues, which can effect practice change."

Since the CRDC-supported tour, 'Tipperary Station' in the Douglas/Daly region of the NT has harvested their first commercial cotton trial: 50 hectares of semi-irrigated, and 10 hectares of dryland cotton – the first crop of cotton grown in the Territory in years.

"We are really pleased. The turnout was high – seven bales per hectare in the 50 hectares – which we didn't fully irrigate. It received only 80mm more water than the dryland that yielded four bales," said Bruce Connolly of the Tipperary Group.

The dryland was planted in early January 2018, and the semi-irrigated in late January.

Bales were transported to St George in South-West Queensland for ginning, which is where Bruce spent time contract farming in the cotton industry. Even though familiar with growing cotton, Bruce said the north poses unique and ever-changing issues that require taking a slightly different approach.

The region has a 60-inch rainfall, with defined wet and dry seasons with high humidity. Managing intense crop growth is a major factor, with potential fungal infections and boll rot in particularly wet seasons. This year the station received only half its average rainfall of about 30 inches, hence the decision to opt for semi-irrigated rather than a fully irrigated crop.

For more: read the full articles in the Winter 2019 and Spring 2019 editions of CRDC's *Spotlight* magazine www.crdc.com.au/spotlight.

Section 4: RD&E Portfolio

Enabling strategy one: Strengthening partnerships and adoption

Further strengthening our collaboration and relationships with our partners, and working together to ensure effective adoption pathways exist for research outcomes, are CRDC's aims within this enabling strategy. To achieve these, CRDC focuses investments in strengthening partnerships and collaboration, best practice through *my*BMP, and supporting innovation and commercialisation.

In 2018–19, CRDC invested in 44 projects within this goal, accounting for nine per cent of our total RD&E expenditure.

Performance against the Strategic Plan

Key Focus Areas	Outcomes	Performance Indicators	Measures	2018–19 progress
4.1 Partnerships and collaboration	4.1.1 Growers/ consultants value CRDC farming systems research outcomes	Maintain or increase the number of growers/ consultants that value CRDC research outcomes	Percentage of growers/consultants that report valuing CRDC outcomes	Our 2023 target is 85 per cent. At present, 77 per cent of cotton growers, and 72 per cent of consultants value CRDC's outcomes. This metric will be measured again in 2019–20.
	4.1.2 CottonInfo partnership is maintained and practice change improved	R&D outcomes are demonstrated through extension and adoption activities	Number of demonstration sessions	CottonInfo facilitated 170 activities during 2018–19.
			Percentage of participants that report increased knowledge, skills, and intention to change behaviour as a result	Intentions to change varied by region and subject matter. For bankless irrigation systems, 75 per cent of participants in forums held in southern regions indicated an intention to change, while 50 per cent of participants in northern forums indicated an intention to change. 82 per cent of attendees at an NRM forum in northern NSW indicated an intention to change vegetation management practices.
	4.1.3 Partnerships are strengthened to engage multi-disciplinary and multi-institutional resources (centres of excellence)	Evidence of effective collaborative projects	Percentage of investments that include cross-sectoral partnerships	24 per cent of investments in 2018–19 were cross-sectoral.
			Number of new international and national partnerships	Three new national partnerships were established in irrigation, digital agriculture and natural resource management.
			Partner satisfaction ranking	CRDC's current satisfaction ranking is 8.2 out of 10. Our 2023 goal is 8.5 out of 10. This metric will be measured again in 2019-20.

4.2 Best practice (*my*BMP)	4.2.1 Best practice is based on science and measured impact	*my*BMP practice modules reflect latest R&D outcomes	Percentage of topics within *my*BMP modules (that CRDC contributes to) that have been updated with CRDC R&D outcomes	50 per cent of relevant *my*BMP modules were updated during the year with R&D outcomes. Review of the remaining 50 per cent has commenced.
4.3 Innovation and commercialisation	4.3.1 Improved R&D innovation and commercialisation	CRDC supports researchers to innovate and become more commercially focused	Number of projects with commercialisation potential	26 projects have been identified with commercialisation potential.
		Research partners are supported through the commercialisation process (to ensure successful knowledge transfer)	Researchers report satisfaction with CRDC commercialisation support	A Commercialisation Manager (contractor) has been appointed to CRDC to review commercialisation approaches.
		Commercialisation and knowledge transfer is accelerated	Percentage improvement in duration from conception to market entry (per product category)	A Commercialisation Manager (contractor) has been appointed to advise and enact a process to reduce time from conception to market entry.

RD&E highlights

Benchmarking water-use efficiency (WUE) and crop productivity in the Australian cotton industry (DAN1505)

Water management is critical to the cotton industry. This five-year project aimed to improve on-farm water management and to boost farm productivity through efficient use of water resources. The project developed the IrriSAT technology, conducted crop productivity and irrigation benchmarking, undertook preliminary investigations of bankless channel irrigation systems, and provided a technical water specialist to lead and coordinate an industrywide WUE campaign. Industry data-sharing partnerships were also established to deliver data annually and determine longer term trends. Data from a continuous 10-year time series has shown that the cotton industry is producing more cotton from less water, highlighting the responsible use of this resource.

Climate and energy for cotton-farming businesses (including CottonInfo technical lead and *my*BMP project lead) (AE1801)

This project helps cotton growers mitigate production and climate risks by providing fortnightly newsletters with summarised and tailored weather forecast information for effective risk management. The service is highly valued by cotton growers who use it to improve climate risk management strategies and their productivity. Because production risk is strongly correlated to the weather and availability of irrigation water, investments in renewable energy minimise exposure to the price risk of traditional energy, and they also lower on-farm emissions. Therefore, this project also aims to help mitigate overall production risks by improving the industry's understanding of the gross margins for installing renewable energy systems.

AgVet collaborative forum, plant industries Phase 3 (RIRDC1701)

As new pests or diseases are identified, and plants develop resistance to existing technologies, access to safe and effective agricultural chemicals (AgChem) becomes critical. Increasing access to AgChem is the focus of this jointly funded project. The annual forum aims to promote information sharing, industry prioritisation, and co-investment opportunities for supporting applications for AgChem uses. The forum facilitates discussion between industry and chemical registrants. It also identifies opportunities for improving access to agricultural chemicals. In 2018, a total of 665 unique pest and disease issues were identified, with chemical solutions found for 541 of them.

WeedSmart Phase 4 (UWA1801)

WeedSmart is an Australian agricultural industry-led initiative to enhance on-farm practices and promote the long-term sustainability of herbicide use. The aim is to provide growers with tools and information to ensure weed management is at the forefront of farming practice. *WeedSmart* Week, held in Narrabri in August 2018, was promoted with the theme of 'Diversify and Conquer – manage weeds using the BIG 6'. Activities included a forum about using diversity to control weeds at Locharba Station, Narrabri, and farm visits, where attendees were able to talk directly to growers and farm managers about their farming systems.

Boyce cotton comparative analysis (BCA1901)

The *Australian Cotton Comparative Analysis* is a joint initiative with Boyce Chartered Accountants. It provides the industry benchmark for the economics of cotton growing in Australia. The 2018 report, the fourteenth annual edition, focuses on the economics of the 2018 crop from growers across the different cotton-growing valleys. It also presents trends measured against more than 10 years of data and, for the third year, includes per bale figures. The reliable, independent figures in the analysis provide the starting point for farmers to identify where daily effort should be directed to develop 'best practice'. The 2018 report is available at the CRDC website: www.crdc.com.au/publications.

Case study

Water productivity on the rise

The *Cotton Industry Water Productivity Benchmarking* project is one of CRDC's longest running collaborative projects, run in partnership with NSW DPI's David Perovic and CottonInfo irrigation technical lead Ben Crawley.

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

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

David and Ben have covered more than 200 cotton fields, approximating to 13,000 hectares and 48 cotton growers using their WaterTrack surveys during 2018–19, spread across the cotton-growing valleys.

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

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

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

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

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

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

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

A key component of the project has been data sharing with other industry partners.

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

Melanie Jenson

For more: read the full article in the Autumn 2019 edition of CRDC's *Spotlight* magazine www.crdc.com.au/spotlight.

Lisa Bird

Case study

CottonInfo – kicking goals with growers

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

One hundred per cent of growers now source information from CottonInfo. Over the past six years, CottonInfo has run nearly 1000 extension activities, with a total of 14,000 participants.

The industry's extension program has recently undertaken a review, capturing key highlights/achievements of CottonInfo's first six years under the first Strategic Plan 2012–18.

CottonInfo is a collaboration between CRDC, Cotton Australia and Cotton Seed Distributors (CSD) who together provide the future leadership and resourcing of CottonInfo and its team, in consultation with research partners.

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

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

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

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

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

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

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

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

CottonInfo

For more: read the full article in the Autumn 2019 edition of CRDC's *Spotlight* magazine www.crdc.com.au/spotlight.

Section 4: RD&E Portfolio

Enabling strategy two: Driving RD&E impact

Ensuring CRDC's investments deliver impact and effectiveness, therefore creating value for our stakeholders, is CRDC's aim within this enabling strategy. To achieve this, CRDC ensures our RD&E investments meet grower, industry and government needs and our projects align with stakeholder priorities.

In 2018–19, CRDC invested in 12 projects within this goal, accounting for two per cent of our total RD&E expenditure.

Performance against the Strategic Plan

Key Focus Areas	Outcomes	Performance Indicator	Measures	2018-19 progress
5.1 Impact and effectiveness	5.1.1 CRDC investments meet grower, industry and government needs	Funded projects align with CRDC research priorities	Percentage of aligned projects	93 per cent of new investments in 2018–19 aligned with grower panel advice.
		Positive stakeholder feedback about the relevance and value of CRDC investments	Percentage of positive responses	88 per cent of growers and 92 per cent of consultants have provided positive feedback about the relevance and value of CRDC's investments. Our 2023 goal is 95 percent. Feedback will be measured again in 2019-20.
	5.1.2 CRDC monitors and evaluates RD&E impact	Monitoring and evaluation evidence demonstrates RD&E impact	RD&E impact reported	CRDC has established an M&E Framework aligned with the Strategic RD&E Plan.
	5.1.3 CRDC-funded projects demonstrate value and return on investment	Positive return on investment (ROI)	Investments demonstrate a minimum ratio of benefit/cost	CRDC will invest in independent assessments of selected project ROIs.
	5.1.4 Growers, the cotton industry and government are informed and aware of R&D outcomes and CRDC's progress and performance	Stakeholders report that CRDC communications meet their needs	Communications satisfaction rating	CRDC's current communication satisfaction ranking is 8.3 out of 10. Our 2023 goal is 8.5 out of 10. This metric will be measured again in 2019-20.

RD&E highlights

Annual consultant qualitative and quantitative survey (CCA1901)

The annual qualitative and quantitative surveys measure the performance of research, production, practices and capacity critical to the Australian cotton industry. Crop Consultants Australia (CCA) collect the quantitative and qualitative data for the industry. The data plays an important role in informing the cotton industry, wider supply chain, the community and government of practice change within the sector, helping the industry to better tell its story. This project collected data for 2017–18 representing nearly 500 cotton growers and 293,785 hectares (56 per cent of the Australia cotton production area for the 2017–18 season). The report is available: www.crdc.com.au/publications.

CRDC Cotton Grower Survey (CRDC1733)

CRDC undertakes an annual survey of cotton growers to gather information about farming practices and growers' views on research, development and extension. This information helps to inform CRDC about the benefits of the research it invests in. Change in industry practice can be quantified by comparing information across the surveys conducted over the past 20 years. Published in February 2019, the 2018 survey indicated a high level of confidence and optimism about the industry's future, and strong support among cotton growers of CRDC and its research investments. The report is available at the CRDC website in PDF and interactive digital formats: www.crdc.com.au/growersurvey.

Reinventing Australian agricultural statistics (AFI1802)

This jointly funded project investigated the potential to improve Australia's current agricultural statistics system by using industry datasets. The project identified potential issues that may arise in response to using the datasets and found that data for the Australian agricultural sector is often incomplete, out of date, and irrelevant or purposeless. The report noted an urgent need to improve the collection, analysis and timely provision of agricultural statistics by taking innovative, cooperative action to improve the way this information is gathered and distributed. Eleven specific recommendations were made to improve the collection of agricultural statistics to mitigate risks.

Risk management in Australian agriculture (AFI1803)

Risk is a feature of Australian farming and agribusiness yet, in many respects, risk management systems in Australian agriculture are less developed than in other nations. This jointly funded project used available data to investigate the nature of risk in subsectors of Australian agriculture, and analysed options for risk management. It found, as an institutional risk mitigation 'product' is unlikely to be developed, there is no simple risk management solution on the horizon. Building financial resilience through farm business practice is the most effective way to mitigate risk by providing time to recover from unanticipated shocks. The project also made 10 specific recommendations.

Paul Grundy


245c
242
242

Case study

Cotton classed as young, vibrant industry in CRDC Grower Survey

The age of the average cotton grower in Australia is a sprightly 47.2 years and the vast majority of producers are upbeat about the future of their industry, according to the 2018 CRDC Grower Survey.

"We've long known our industry is dynamic and progressive and, as the 2018 CRDC Cotton Grower Survey shows, it's also pretty young compared to other ag industries, with our average age just 47," CRDC Executive Director Dr Ian Taylor said.

"The survey also shows that 95 per cent of growers are positive about the future of the industry. Yes, we're all going through a challenging time now with the prolonged dry conditions, but overall, our industry is one of optimism and resilience.

"Perhaps most importantly for us, the survey shows that 96 per cent of cotton growers believe research, development and extension drive continuous improvement of the Australian cotton industry. The industry's culture of innovation, supported by and embracing RD&E, has been a major contributor to its success to date."

The key results from the 246 respondees to the survey show:

- The average age of a cotton grower is 47.2 years.
- The average yield for fully irrigated cotton across all valleys was 11.22 bales/hectare in 2017–18.
- Central Queensland had 289 millimetres of in-crop rainfall; southern NSW had 113mm.
- 17 per cent of growers generate and use solar energy. The Macquarie Valley in central NSW has the highest percentage of growers who do so (38 per cent).
- Growers use an average of 133 litres/ha of diesel for in-field operations, and 111L/ha for pumping water.
- 44 per cent of all growers have a farm biosecurity plan – the highest in Central Queensland (64 per cent), followed by northern NSW (48 per cent).
- 100 per cent of large farms, and 90 per cent of small farms, control volunteer and ratoon cotton.
- 49 per cent of growers have confirmation of herbicide-resistant weeds. This is highest in southern NSW (56 per cent); northern NSW (52 per cent); and the Macintyre Balonne (48 per cent). Annual ryegrass is the worst offender.
- 29 per cent of cotton growers were affected by spray drift in 2018–19 – up 16 per cent on the 2013 results. The average financial cost of this was $47,009.

The Australian cotton industry in 2017–18 grew 500,000 hectares of irrigated and dryland cotton, just shy of the 2016–17 crop, which was the largest crop in five years. The industry produced 4.6 million bales in 2017–18 worth $2.92 billion in gross value.

Nuffield

For more: read the full article in the CottonInfo e-news and Grain Central www.graincentral.com/cropping/cotton.

Section 5

CRDC People and Governance

Mel Jenson

CRDC Board

Mr Richard Haire – Chair

FAICD, FAIM

Mr Haire has held many leadership positions within the cotton industry, most recently as Managing Director and regional head of Olam International, a global leader in the supply chain management of agricultural products and food ingredients. He was formerly the Chief Executive of Queensland Cotton Corporation Pty Ltd and a member of the Rabo Australia Food and Agribusiness Advisory Board. Mr Haire is a Fellow of the Australian Institute of Company Directors and the Australian Institute of Management. He formerly served as a Director on the CRDC Board from 2011 to 2014.

Appointed: 29/08/2016 until 29/08/2019
Reappointed: 29/08/2019 until 29/08/2022
Chair of the Remuneration Committee.

Ms Kathryn Adams – Deputy Chair

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

Ms Adams is a microbiologist and lawyer, and 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 and Data to Decisions CRCs. 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.
Reappointed: 01/10/2017 until 30/09/2020.

Mrs Elizabeth (Liz) Alexander – Non-executive Director

BA, MRurSysMgt, GAICD

Mrs Alexander specialises in finding collaborative and innovative solutions for regional challenges. She is the Agribusiness Development Coordinator for the Central Highlands Development Corporation (CHDC), and leads CHDC's Central Highlands Accelerate Agribusiness (CHAA) initiative, working with stakeholders to grow productivity and profitability for all agribusiness within the region. In her role, she developed and facilitates the AgTeCH events held annually in Emerald and Mungindi. She has extensive knowledge of dryland and irrigated cropping industries, and experience across natural resource management, agricultural extension, and water policy.

Mrs Alexander is currently the Deputy Chair of Plant Health Australia. Previously, she was a Director of Cotton Australia and the Chair of Theodore Water, the Theodore Irrigation LMA Interim Board, and Glencore's Clermont Open Cut Mine Groundwater and Environmental Reference Group. She obtained a Bachelor of Arts and a Masters of Rural Systems Management from The University of Queensland, is a member of the Australasia-Pacific Extension Network, and a graduate member of the Australian Institute of Company Directors.

Appointed: 20/10/2014 until 30/09/2017.
Reappointed: 01/10/2017 until 30/09/2020.
Chair of the Intellectual Property and Commercialisation Committee.

Mr Greg Kauter – Non-executive Director

BAgEc GradCertRuSc GAICD

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.
Reappointed: 01/10/2017 until 30/09/2020.
Chair of the Audit Committee.

Dr Jeremy Burdon – Non-executive Director

BSc (Hons), PhD, Hon DSc, FAA, FTSE, MAICD

Dr Burdon has an international reputation in evolutionary biology, combining interests and expertise in ecology, epidemiology and genetics to contribute solutions to problems in a wide range of areas of agriculture, including disease control, pre-breeding, weed biology, and ecological sustainability. His research has been recognised through a number of national and international awards and honours.

He has had extensive experience in research management and commercialisation, leading CSIRO-Plant Industry for many years. This gave him exposure to a broad swathe of important Australian agricultural industries, including cotton, grains, sugar, and various horticultural crops. Subsequently, he has served on the Board of Trustees of Bioversity International, as a director of the Grains Research & Development Corporation, as a member of Sugar Research Australia's independent Research Funding Panel, and as Chair of the Australian Academy of Science's National Committee for Agriculture, Fisheries & Food. In that role, he led the production of a Decadal Plan for Agricultural Science that was released in 2017.

Appointed: 01/10/2017 until 30/09/2020.

Emeritus Professor Les Copeland AM – Non-executive Director

Emeritus Professor Copeland has been conducting research and teaching in agricultural and food science in the University of Sydney for over 40 years. His research on plant, grain and food chemistry, and the origins of the human diet, has resulted in over 150 publications and 34 PhD completions. He is a member of the Research Advisory Committee of the Australian Farm Institute, and Editor-in-Chief of the scientific journals *Cereal Chemistry* and *Agriculture*. Emeritus Professor Copeland was Chair of the Cotton Catchment Communities Participants' Forum, and a Director of the Australian Cotton and Value Added Wheat CRCs. He is a former Dean of Agriculture, and he was the Foundation President of the Australian Council of Deans of Agriculture. He is the immediate past President of the University of Sydney Association of Professors.

Emeritus Professor Copeland holds BSc and PhD degrees from the University of Sydney and a Graduate Diploma from the Australian Institute of Company Directors. He has held research positions at Yale University, the University of Buffalo, the University of California in Davis, and the Australian National University. He is a Fulbright Alumnus, the recipient of an Excellence in Teaching Award from the American Association of Cereal Chemists-International, and has had international experience in capacity building. Emeritus Professor Copeland was awarded a Member (AM) in the General Division in the 2019 Queen's Birthday Honours, recognising his significant service to agricultural science as an academic and researcher.

Appointed: 01/10/2017 until 30/09/2020.

Ms Rosemary Richards – Non-executive Director

BAgEc, MBA

Ms Richards is an agribusiness consultant with extensive experience in broadacre cropping, in particular, oilseeds and downstream processing sectors. Ms Richards is principal of Bowman Richards & Associates, which undertakes strategic planning, supply chain management, and trade and market access services for private companies and industry and government organisations to support market and business growth.

She also has extensive experience in the biotechnology sector, and was actively involved in the introduction of GM canola to Australia as CEO of the Australian Oilseeds Federation. Ms Richards continues to be involved in biotechnology policy and advocacy through work with Australian and international representative organisations.

Ms Richards currently consults on trade and market access, commercialisation of biotech crops and business strategy. She is a passionate advocate for the agricultural sector and maintains close linkages with a range of agribusiness industry organisations.

Appointed: 01/10/2017 until 30/09/2020.

Mr Bruce Finney – Executive Director *to January 2019*

BScAg (MAICD)

Mr Finney has extensive experience in agricultural research and corporate agriculture in management and agronomy roles in Australia and in an advisory role in Argentina.

During his tenure at CRDC, Mr Finney was a member of the Cotton Innovation Network, the Agriculture Senior Officials Research and Innovation Committee, the Council of Rural RDCs Executive Committee, and a board member of The Gate (Global Ag-Tech Ecosystem). He is a past member of the Advisory Board QLD DAF program on Agricultural Robotics at QUT, chair of the Australian Cotton Growers Research Association, and 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.
Mr Finney attended the Audit, Intellectual Property and Remuneration Committees as an observer.
Appointed: August 2004 until January 2019.

Dr Ian Taylor – Executive Director *from March 2019*

BAppSc, PhD

Dr Taylor has extensive experience across the cotton RD&E pipeline, having worked as a researcher specialising in integrated weed management before progressing to management positions within the cotton industry's extension program, CottonInfo and CRDC. Prior to being appointed Executive Director, Dr Taylor performed the role of CRDC's General Manager of R&D Investments for five years, overseeing CRDC's investment in cotton RD&E to deliver impact, and leading the development of the CRDC Strategic RD&E Plan 2018–23.

Dr Taylor holds BAppSc and PhD degrees from The University of Queensland, is a graduate of the Australian Rural Leadership Program, and is Deputy Chair of the Summit Community Services board. He has extensive stakeholder management, strategy development, leadership and governance experience, combined with national and international networks, in part from his time as the Technology Development Lead and Asia-Pacific Technical and Stewardship Lead with Monsanto. In his former career, Dr Taylor was an avionics technician in the Australian Defence Force, where he developed a sound understanding of digital and advanced complex systems.

Appointed: 7 March 2019 by virtue of his appointment as Executive Director of CRDC. Dr Taylor was acting Executive Director from January to March 2019. He attends the Audit, Intellectual Property and Remuneration Committees as an observer.

Composition

CRDC has an eight-member Board, consisting of a Chair (appointed by the Minister for Agriculture), the Executive Director (selected by the Board), and six 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 2019

1	Mr Richard Haire, Chair
2	Ms Kathryn Adams, Deputy Chair
3	Mrs Elizabeth Alexander, Non-executive Director
4	Mr Greg Kauter, Non-executive Director
5	Dr Jeremy Burdon, Non-executive Director
6	Emeritus Professor Les Copeland, Non-executive Director
7	Ms Rosemary Richards, Non-executive Director
8	Dr Ian Taylor, 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 RD&E Plan, and relevant legislation.

The induction process is tailored to the needs of new Directors. It 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 Director's interests that is tabled and reviewed at each meeting.

Board Charter of Corporate Governance

The CRDC Board Charter assists Directors in carrying out their duties and setting out the 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 2018–19, 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 2018–19. 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	Date	Location
Meeting 4 – 2018	23 August 2018	Brisbane QLD
Meeting 5 – 2018	9 October 2018	Teleconference
Meeting 6 – 2018	8 November 2018	St George QLD
Meeting 7 – 2018	12 December 2018	Narrabri NSW
Meeting 1 – 2019	23 January 2019	Brisbane QLD
Meeting 2 – 2019	7 February 2019	Griffith NSW
Meeting 3 – 2019	3 April 2019	Canberra ACT
Meeting 4 – 2019	18 June 2019	Sydney NSW

Attendances at Board meetings

Director	Meeting 4 2018	Meeting 5 2018	Meeting 6 2018	Meeting 7 2018	Meeting 1 2019	Meeting 2 2019	Meeting 3 2019	Meeting 4 2019	TOTAL
Richard Haire	✓	✓	✓	✓	✓	✓	✓	✓	8 of 8
Kathryn Adams	✓	✓	✓	✓	✓	✓	✓	✓	8 of 8
Elizabeth Alexander	✓	✓	✓	✓	✓	✓	✓	✓	8 of 8
Greg Kauter	✓	✓	✓	✓	✓	✓	✓	✓	8 of 8
Jeremy Burdon	✓	✓	✓	✓	✓	✓	✓	✓	8 of 8
Les Copeland	✓	✓	✓	✓	✓	✓	✓	✓	8 of 8
Rosemary Richards	✓	✓	✓	✓	✓	✓	✓	✓	8 of 8
Bruce Finney	✓	✓	✓	✓					4 of 4
Ian Taylor					✓	✓	✓	✓	4 of 4


2018
AUSTRALIAN
COTTON
CONFERENCE
CRDC
COTTON RESEARCH AND
DEVELOPMENT CORPORATION
ANZ

Mel Jenson

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. Note: in addition to CRDC Directors, there is a skill-based appointee on the Audit Committee – Alex Keatinge for 2018 and Sam Skelton for 2019.

Intellectual Property and Commercialisation Committee

The role of the Intellectual Property (IP) and Commercialisation Committee is to assist CRDC's Board in fulfilling its responsibilities and strategic objectives for IP management and commercialisation of project outputs to maximise the benefits to the Australian cotton industry. The Committee's specific responsibilities are to review the operation of CRDC's IP and commercialisation policy and operating principles, and to consider IP and commercialisation matters directed to it by the Board for consideration. Note: in addition to CRDC Directors, there is a skill-based appointee on the Intellectual Property and Commercialisation Committee – Jarrod Ward from May 2019 onwards.

Attendances at Audit Committee meetings

Member/Observer	**13 Aug 2018** *In person*	**17 Oct 2018** *Teleconference*	**24 Oct 2018** *Teleconference*	**23 Jan 2019** *In person*	**15 May 2019** *In person*	**TOTAL**
Greg Kauter	✓	✓	✓	✓	✓	5 of 5
Rosemary Richards	✓	✓	✓	✓	✓	5 of 5
Jeremy Burdon	✓	✓	✓	✓	✓	5 of 5
Alex Keatinge	✓	✓	✓			3 of 3
Bruce Finney	✓	✓	✓			3 of 3
Sam Skelton				✓	✓	2 of 2
Ian Taylor				✓	✓	2 of 2

Attendances at Intellectual Property and Commercialisation Committee meetings

Member/Observer	**30 July 2018** *In person*	**10 Oct 2018** *Teleconference*	**13 Nov 2018** *Teleconference*	**24 Jan 2019** *In person*	**22 May 2019** *Teleconference*	**TOTAL**
Elizabeth Alexander	✓	✓	✓	✓	✓	5 of 5
Rosemary Richards	✓	✓	✓	✓	✓	5 of 5
Les Copeland	✓	✓	✓	✓	✓	5 of 5
Kathryn Adams	✓	✓	✓			3 of 3
Bruce Finney	✓	✓	✓			3 of 3
Ian Taylor				✓	✓	2 of 2
Jarrod Ward					✓	1 of 1

Remuneration Committee

The Remuneration Committee advises the Board on the Executive Director's remuneration and senior staff remuneration adjustments.

Attendances at Remuneration Committee meetings

Member/Observer	24 July 2018 *In person*	31 Oct 2018 *Teleconference*	28 May 2019 *Teleconference*	TOTAL
Richard Haire	✓	✓	✓	3 of 3
Kathryn Adams	✓	✓	✓	3 of 3
Jeremy Burdon	✓	✓	✓	3 of 3
Bruce Finney	✓	✓		2 of 2
Ian Taylor			✓	1 of 1

Statement of principles

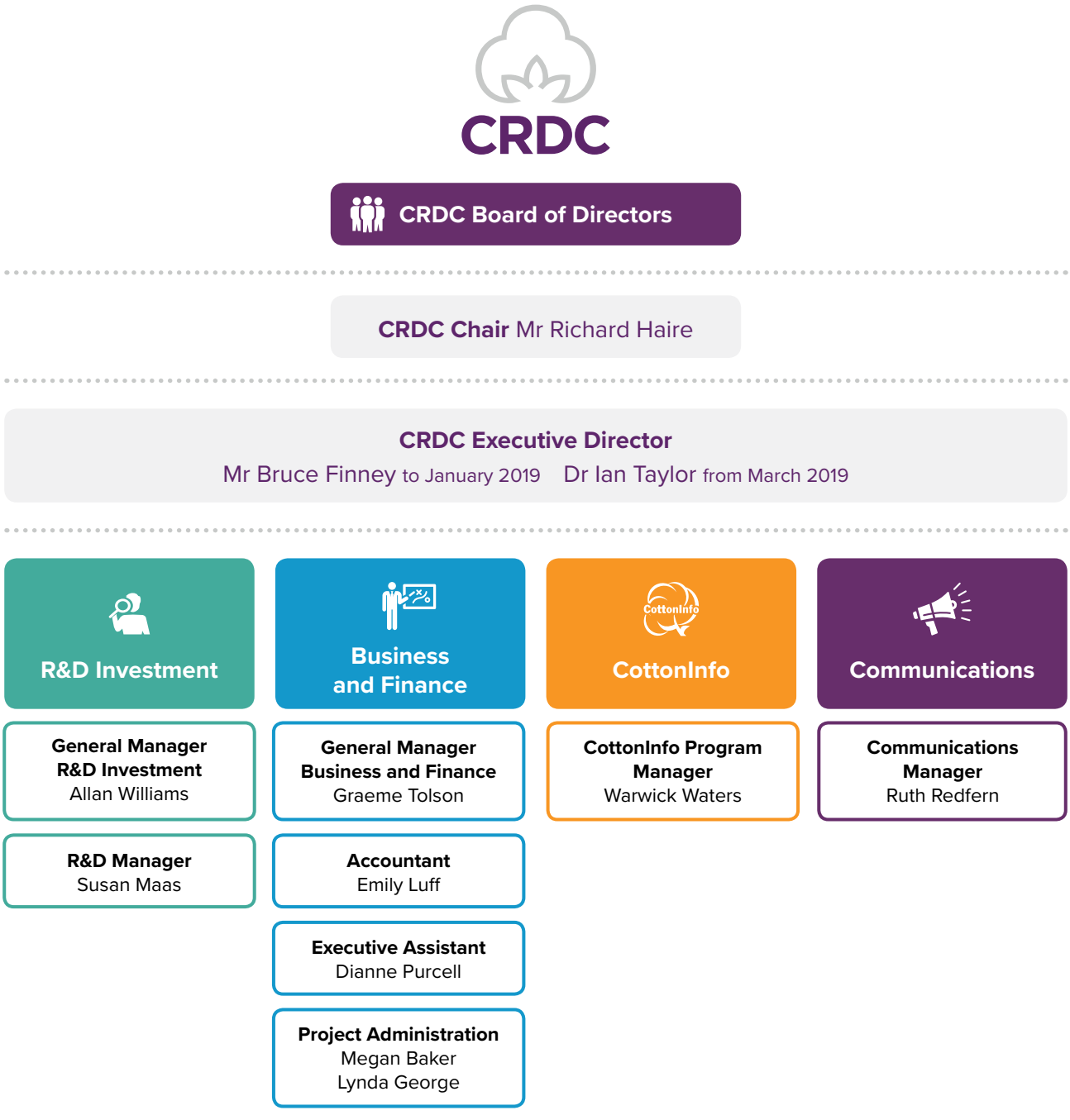
CRDC Directors and staff members are required to:

- 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 Employees

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

CRDC Organisational Structure as at 30 June 2019



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. The terms and conditions of employment incorporate the Fair Work National Employment Standards and the Australian Government Industry Award 2016. 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 nine full-time employees and one part-time employee as at 30 June 2019.

CRDC employees

Employee type	2014 –15	2015 –16	2016 –17	2017 –18	2018 –19
Full-time employees	11	11	11	11	9
Part-time employees	1	1	1	2	1
Parental leave	2	0	1	0	0
Casual	0	1	1	0	0
TOTAL employees*	**14**	**13**	**14**	**13**	**10**

*CRDC employees as at 30 June each year.

Staff training and development

In 2018–19, CRDC spent $54,328 on training and $102,119 on recruitment. Areas of direct training activities were team values, management coaching, AICD, Privacy Act, and ICT. 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. Staff members are chosen strictly according to their qualifications for the job.

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).


Mel Jenson

Key Management Personnel

During the reporting period ended 30 June 2019, CRDC had eleven key management personnel. These included seven non-executive directors, two executive directors and two senior executives. Their names and length of term as key management personnel are below:

Richard Haire	Chair	Full year
Kathryn Adams	Deputy Chair	Full year
Elizabeth Alexander	Non-executive Director	Full year
Greg Kauter	Non-executive Director	Full year
Jeremy Burdon	Non-executive Director	Full year
Les Copeland	Non-executive Director	Full year
Rosemary Richards	Non-executive Director	Full year
Bruce Finney	Executive Director	Concluded 18 January 2019
Ian Taylor	Executive Director Acting Executive Director General Manager R&D Investment	Appointed 7 March 2019 17 December 2018 to 6 March 2019 1 July 2018 to 16 December 2018
Graeme Tolson	General Manager Business & Finance	Full year
Allan Williams	Acting General Manager R&D Investment	Appointed 2 January 2019

The Chair and Non-executive Directors' remuneration is determined by the Remuneration Tribunal, an independent statutory authority established under the *Remuneration Tribunal Act 1973*. The Executive Director and Senior Executives' remuneration is determined by the Board.

In accordance with the PGPA Rule, the Key Management Personnel information in Note 3.2 of the Financial Statements is further disaggregated in the table below:

		Short-term benefits			Post-employment benefits	Other long-term benefits		Termination benefits	Total remuneration
Name	**Position title**	**Base salary**	**Bonuses**	**Other benefits & allowances**	**Superannuation contributions**	**Long service leave**	**Other long-term benefits**		
Richard Haire	Chair	$51,485			$4,891				$56,376
Kathryn Adams	Deputy Chair	$25,742			$2,446				$28,188
Elizabeth Alexander	Non-executive Director	$25,742			$2,446				$28,188
Greg Kauter	Non-executive Director	$25,742			$2,446				$28,188
Jeremy Burdon	Non-executive Director	$25,742			$2,446				$28,188
Les Copeland	Non-executive Director	$25,742			$2,446				$28,188
Rosemary Richards	Non-executive Director	$25,742			$2,446				$28,188
Bruce Finney	Executive Director	$118,566		$17,606	$12,915	$4,943			$154,030
Ian Taylor	Executive Director	$198,867		$18,638	$19,705	$24,006			$261,216
Graeme Tolson	GM Business & Finance	$168,002			$15,541	$10,939			$194,482
Allan Williams	Acting GM R&D Invest.	$83,493			$7,767	$13,156			$104,416
Total		**$774,865**	**-**	**$36,244**	**$75,495**	**$53,044**	**-**	**-**	**$939,648**

CRDC does not have any other senior executive staff or highly paid staff.

Ruth Redfern

Governance and accountability

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.

Mel Jenson

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. 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 are closely involved in the development of the CRDC Strategic RD&E Plan, which incorporates Australian Government and cotton industry RD&E priorities, as well as advice from the Minister and the Department of Agriculture.
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 to industry on RD&E activities coordinated or funded by the Corporation	CRDC reports formally to the Australian Parliament through its Annual Report. In addition, CRDC informs the Minister for Agriculture 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 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 RD&E 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 are 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.

There is also a separate levy for seed cotton exports of $4.06 per tonne of exported seed cotton.

Minister

CRDC has been accountable to the Australian Parliament through two Ministers in 2018–19: the Hon. David Littleproud MP as Minister for Agriculture and Water Resources from July 2018 to May 2019; and Senator the Hon. Bridget McKenzie as Minister for Agriculture from May 2019 onwards.

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 that 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 2018–19.

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, and Annual Report on the outcomes of investments, projects, operations and financials.

Policies, procedures and charters

CRDC has 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.

Corporate reporting

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

CRDC submitted the Annual Operational Plan for 2018–19 to the Hon. David Littleproud MP as the then Minister for Agriculture and Water Resources on 25 June 2018, with the plan commencing 1 July 2018. The Annual Report for 2017–18 was submitted to the Minister on 15 October 2018, and the Minister tabled the report in Parliament on 26 November 2018.

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.

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 2018–19.

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's 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 2018–19.

Significant changes in the state of affairs

CRDC had no significant changes in its state of affairs in 2018–19.

Judicial decisions

CRDC had no judicial decisions in 2018–19.

Reviews by outside bodies

Under the CRDC Funding Agreement with the Department of Agriculture, we are required to commission an independent review of our performance. The inaugural independent review was completed by Forest Hill Consulting in October 2018.

A typical review conducted by Forest Hill categorises recommendations as: critical (should be implemented as a matter of urgency in order for CRDC to meet its legal and regulatory obligations); important (actions that are expected to deliver significant benefits to the company and industry); or best practice (expected to deliver incremental performance improvements).

The CRDC independent performance review made eight recommendations in total: no critical recommendations; two important recommendations; and six best practice recommendations.

The CRDC Board responded to the Review Report in January 2019, welcoming the overall findings as an endorsement of CRDC's high level of organisational performance and valuing the recommendations as important guidance on areas for continuous improvement.

In addition, a formal review of the CRDC Board's performance was conducted by Directors Australia in March 2019, with feedback provided to Directors in April 2019.

Commercialisation

CRDC has detailed policies and procedures for determining its involvement in the commercialisation of the results of R&D projects where that is the preferred adoption pathway. Project technology that underwent commercialisation activities in 2018–19 included approaches to improved irrigation management, improved application of pesticides, testing of cotton-rich compression athletic wear garments, and enhanced microbial protection for outdoor fabrics.

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.

Mel Jenson

Work Health and Safety summary

Legislative reporting requirements Schedule 2 Part 4 of the ***Work Health and Safety Act 2011***	Action undertaken 2018–19
Initiatives during 2018–19 and outcomes	• An independent audit of WHS management, performance and compliance with CRDC's WHS policy and procedures. • Safety issues discussed at quarterly WHS staff 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.
Statistics of any notifiable incidents as defined by s38 of the WHS Act	• CRDC had no notifiable incidents in 2018-19.
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 2018–19, CRDC had no freedom of information requests. CRDC manages requests in accordance with the provisions of its freedom of information plan, in compliance with subsection 8(1) of the *Freedom of Information Act 1982*.

Categories of documents held

Category	Nature	Access
Administration	Files	D
Annual Operating Plans	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 as needed, and after background checks, to ensure proposed appointees have the necessary skills and experience. During 2018–19, CRDC spent $956,347, 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
Ardossi Pty Ltd	ICT consulting
Callida Consulting	Internal audit services
Carolyn Martin	Publication content
Chandler Macleod Group Ltd	Executive recruitment
Computers Now Pty Ltd	ICT services
Forest Hill Consulting	Performance review services
Gadens Lawyers	IP review
HWL Ebsworth Lawyers	HRM consulting
Keo Design	Web consultant
Melanie Jenson	Publication content
Jobs Australia Enterprises Ltd	Hire staff
Neil Deacon Design	Publication design
Nexia Court & Co	Internal audit services
Peel HR Consulting & Mediation	HRM services
Rachel Holloway	Program management services
Revolution IT	Software consultant
Rimfire Resources Pty Ltd	Recruitment
SapphireOne Pty Ltd	Software support

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

Cotton Australia is CRDC's industry representative body and cotton's declared representative organisation under the PIRD Act. In 2018–19, CRDC contributed $214,436 to Cotton Australia for industry consultation, capacity building of advisory panel members and RD&E projects. These funds included $74,500 for their industry consultation role, including several specific activities:

- Industry consultation and participation in CRDC forums to review RD&E funding applications and scoping of future directions in research.
- Support for capacity building and training for the Cotton Australia research advisory panels.
- 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.
- Joint publications with CottonInfo.

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 2018–19, CRDC contributed a total of $139,936 to Cotton Australia for the following co-funded project activities:

- $45,556 co-funding an industry horizon and environment scan to inform future RD&E investment.
- $29,216 co-funding the National Residue Survey
- $25,000 support for the 2018 Australian Cotton Conference to increase awareness in the Australian cotton industry of research outcomes.
- $20,000 co-funding *my*BMP database software upgrade. *my*BMP is the Cotton Australia owned and managed industry portal.
- $15,000 co-funding of the start-up alley at the 2018 Australia Cotton Conference to develop the skills of new innovators and provide exposure of new innovations to the cotton industry.
- $5,000 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.
- $164 co-funding for meetings to help develop a response to Khapra beetle.

Selection Committee Report

CRDC

Joe Robinson
Presiding Member
Cotton Research and Development Corporation

Board Selection Committee

September 2019

Senator the Hon. Bridget McKenzie
Minister for Agriculture
Parliament House
Canberra ACT 2601

Dear Minister

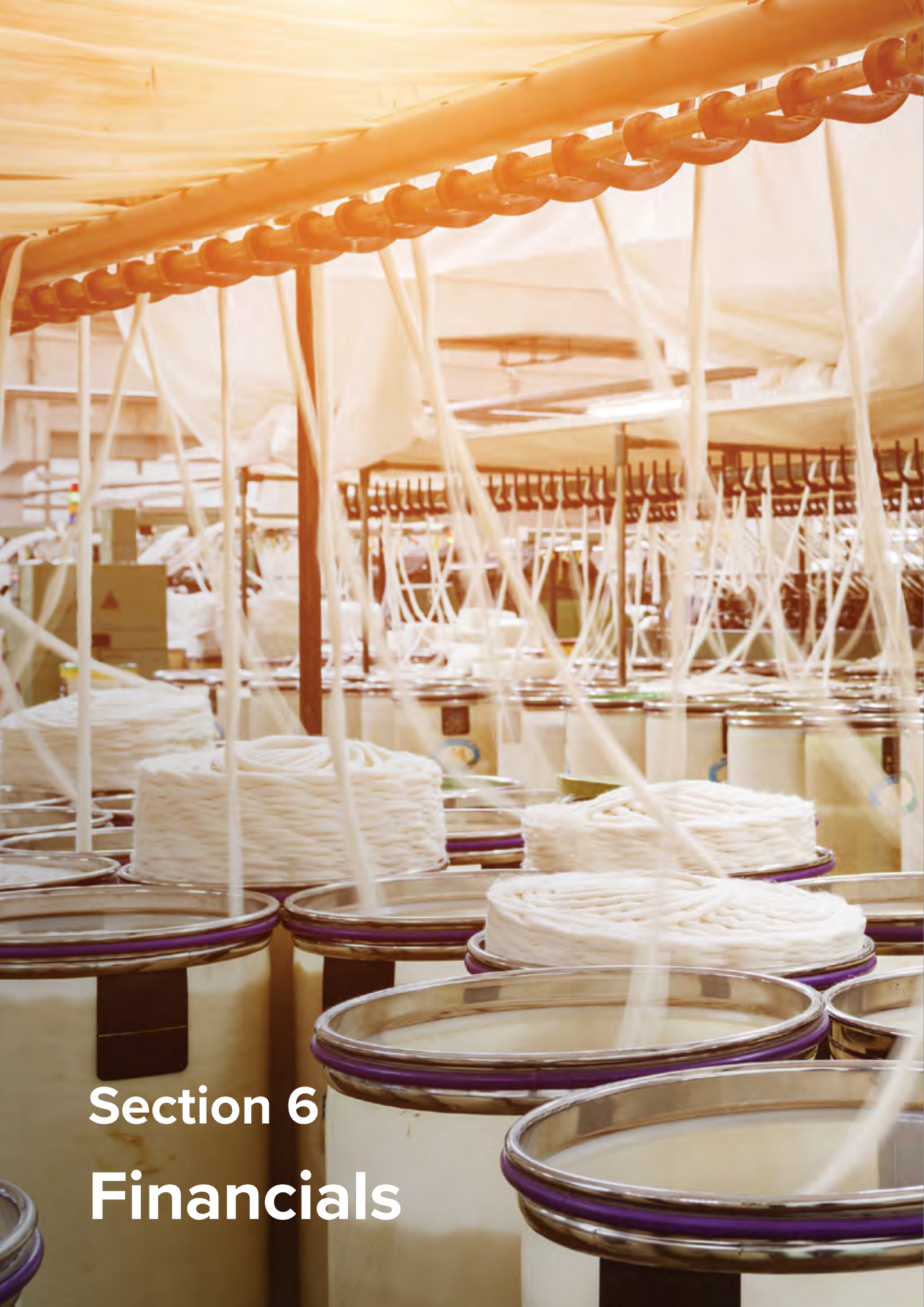
In accordance with the requirements of section 141 of the *Primary Industries Research and Development Act 1989* (PIRD Act), I write to advise that there were no activities performed by the Cotton Research and Development Corporation (CRDC) Board Selection Committee during the year 1 July 2018 to 30 June 2019.

Yours sincerely

Mr Joe Robinson
Presiding Member

COTTON RESEARCH AND DEVELOPMENT CORPORATION
office address 2 Lloyd Street, Narrabri NSW 2390, Australia **postal address** PO Box 282, Narrabri NSW 2390
P 02 6792 4088 **E** crdc@crdc.com.au ABN 71 054 238 316 **www.crdc.com.au**

Lisa Bird



Section 6
Financials

Contents

INDEPENDENT AUDITOR'S REPORT

To the Minister for Agriculture

Opinion

In my opinion, the financial statements of the Cotton Research and Development Corporation ('the Entity') for the year ended 30 June 2019:

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

(b) present fairly the financial position of the Entity as at 30 June 2019 and its financial performance and cash flows for the year then ended.

The financial statements of the Entity, which I have audited, comprise the following statements as at 30 June 2019 and for the year then ended:

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, comprising a summary of significant accounting policies and other explanatory information. Basis for opinion

I conducted my audit in accordance with the Australian National Audit Office Auditing Standards, which incorporate the Australian Auditing Standards. My responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Statements* section of my report. I am independent of the Entity in accordance with the relevant ethical requirements for financial statement audits conducted by the Auditor-General and his delegates. These include the relevant independence requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants (the Code) to the extent that they are not in conflict with the Auditor-General Act 1997*. I have also fulfilled my other responsibilities in accordance with the Code. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Accountable Authority's responsibility for the financial statements

As the Accountable Authority of the Entity, the Board is responsible under the Public Governance, Performance and Accountability Act 2013 (the Act) for the preparation and fair presentation of annual financial statements that comply with Australian Accounting Standards – Reduced Disclosure Requirements and the rules made under the Act. The Board is also responsible for such internal control as the Board determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board is responsible for assessing the ability of the Entity to continue as a going concern, taking into account whether the Entity's operations will cease as a result of an administrative restructure or for any other reason. The Board is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the assessment indicates that it is not appropriate.

GPO Box 707 CANBERRA ACT 2601
19 National Circuit BARTON ACT
Phone (02) 6203 7300 Fax (02) 6203 7777

Auditor's responsibilities for the audit of the financial statements

My objective is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian National Audit Office Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of the financial statements.

As part of an audit in accordance with the Australian National Audit Office Auditing Standards, I exercise professional judgement and maintain professional scepticism throughout the audit. I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control;
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Entity's internal control;
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Accountable Authority;
- conclude on the appropriateness of the Accountable Authority's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Entity's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my auditor's report. However, future events or conditions may cause the Entity to cease to continue as a going concern; and
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

I communicate with the Accountable Authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Australian National Audit Office

Mark Vial Senior Director
Delegate of the Auditor-General
Canberra
22 August 2019

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 2019 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

Richard Haire
Chair
21 August 2019

Signed

Greg Kauter
Director
21 August 2019

Signed

Ian Taylor
Executive Director
21 August 2019

Signed

Graeme Tolson
Chief Financial Officer
21 August 2019

STATEMENT OF COMPREHENSIVE INCOME

for the period ended 30 June 2019

	Notes	2019 $	2018 $	Original Budget $
NET COST OF SERVICES				
Expenses				
Employee Benefits	1.1A	**1,964,199**	2,050,606	2,449,000
Suppliers	1.1B	**1,122,357**	1,178,146	1,238,000
Grants	1.1C	**20,803,322**	21,555,513	20,342,000
Depreciation and amortisation	2.2A	**234,060**	277,714	302,000
Write-down and impairment of assets	1.1D	**12,970**	-	-
Losses from asset sales		**6,081**	-	-
Total expenses		**24,142,989**	25,061,979	24,331,000
OWN-SOURCE INCOME				
Own-source revenue				
Interest	1.2A	**983,475**	896,533	720,000
Royalties	1.2B	**204,396**	1,080,040	1,221,000
Research grants	1.2C	**5,480,197**	4,273,184	2,900,000
Other revenue	1.2D	**1,140,523**	816,006	250,000
Total own-source revenue		**7,808,591**	7,065,763	5,091,000
Net (cost of)/contribution by services		**16,334,398**	17,996,216	19,240,000
Revenue from Government				
PIRD Act 1989 Contribution	1.2E	**8,679,831**	9,088,958	8,920,000
Levies and penalties	1.2F	**8,695,331**	9,092,767	8,920,000
Total revenue from Government		**17,375,162**	18,181,725	17,840,000
Surplus/(Deficit) attributable to the Australian Government		**1,040,764**	185,509	(1,400,000)
OTHER COMPREHENSIVE INCOME				
Items not subject to subsequent reclassification to net cost of services				
Changes in asset revaluation surplus		**-**	18,251	-
Items subject to subsequent reclassification to net cost of services				
Gain/(Losses) on financial assets at fair value through other comprehensive income		**82,476**	(22,412)	-
Total other comprehensive income/(loss)		**82,476**	(4,161)	-
Total comprehensive income/(loss) attributable to the Australian Government		**1,123,240**	181,348	(1,400,000)

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

STATEMENT OF COMPREHENSIVE INCOME (CONTINUED)

for the period ended 30 June 2019

Budget Variances Commentary

Statement of Comprehensive Income for not-for-profit Reporting Entities

The original budget is the Corporation's 2018-19 Portfolio Budget Statements (PBS).

Employee expense decreased by $0.485 million due to reduction in the average full-time equivalent staffing during the year.

Grants expense increased by $0.461 million due to additional grant projects contracted as part of new unbudgeted collaborative grants and additional projects approved by the Board.

Interest income increased by $0.263 million as a result of holding term deposits for longer terms at interest rates above average market rate for short term deposits.

Royalty revenue decreased by $1.017 million as a result of the cessation of the seed trait royalty agreement.

Research Grant revenue increased by $2.580 million as a result of receiving new grants from the Rural R&D for Profit and Smarter Farming programs from the Department of Agriculture and contributions from the program partners.

Other revenue increased by $0.891 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, decreased by $0.465 million as a result of a decrease 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 2019

	Notes	2019 $	2018 $	Original Budget $
ASSETS				
Financial assets				
Cash and cash equivalents	2.1A	**15,882,926**	7,037,525	5,112,000
Investments held to maturity	2.1B	**24,500,000**	28,000,000	31,000,000
Trade and other receivables	2.1C	**3,246,974**	5,123,189	2,911,000
Other investments	2.1D	**170,064**	87,588	-
Total financial assets		**43,799,964**	40,248,302	39,023,000
Non-financial assets				
Land and buildings	2.2A	**713,497**	725,000	861,000
Plant and equipment	2.2A	**310,360**	242,820	547,000
Computer software	2.2A	**153,150**	299,892	252,000
Total non-financial assets		**1,177,007**	1,267,712	1,660,000
Total assets		**44,976,971**	41,516,014	40,683,000
LIABILITIES				
Payables				
Suppliers	2.3A	**115,180**	112,359	200,000
Grants	2.3B	**5,656,353**	3,163,012	4,000,000
Other payables	2.3C	**52,234**	72,455	-
Total payables		**5,823,767**	3,347,826	4,200,000
Provisions				
Employee provisions	3.1A	**313,106**	**451,330**	**447,000**
Total provisions		**313,106**	451,330	447,000
Total liabilities		**6,136,873**	3,799,156	4,647,000
Net assets		**38,840,098**	37,716,858	36,036,000
EQUITY				
Reserves		**273,654**	273,654	255,000
Other reserves		**60,064**	(22,412)	-
Retained surplus		**38,506,380**	37,465,616	35,781,000
Total equity		**38,840,098**	37,716,858	36,036,000

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

STATEMENT OF FINANCIAL POSITION (CONTINUED)

as at 30 June 2019

Budget Variances Commentary

Statement of Financial Position for not-for-profit Reporting Entities

The original budget is the Corporation's 2018-19 Portfolio Budget Statements (PBS).

Cash and cash equivalents and Investments held to maturity above PBS by $4.271 million as a result of increase in the surplus and increase in grants payable.

Trade and other receivables above PBS by $0.336 million is represented by increases in industry levies collected and held by the Department in June 2019 and matching Commonwealth contributions and partly offset by decreases in interest and GST receivable.

Plant and equipment below PBS by $0.237 million as a result of delayed replacement of ICT infrastructure.

Grants payable above PBS by $1.656 million is represented by an increase in completed project milestones that have not been invoiced by research organisations.

STATEMENT OF CHANGES IN EQUITY

for the period ended 30 June 2019

	2019 $	2018 $	Original Budget $
RETAINED EARNINGS			
Opening balance			
Balance carried forward from previous period	**37,465,616**	37,280,107	37,181,000
Comprehensive income			
Surplus/(Deficit) for the period	**1,040,764**	185,509	(1,400,000)
Closing balance as at 30 June	**38,506,380**	37,465,616	35,781,000
ASSET REVALUATION RESERVE			
Opening balance			
Balance carried forward from previous period	**273,654**	255,403	255,000
Comprehensive income			
Other comprehensive income	**-**	18,251	-
Closing balance as at 30 June	**273,654**	273,654	255,000
OTHER RESERVES			
Opening balance			
Balance carried forward from previous period	**(22,412)**	-	-
Comprehensive income			
Other comprehensive income	**82,476**	(22,412)	-
Closing balance as at 30 June	**60,064**	(22,412)	-
TOTAL EQUITY			
Opening balance			
Balance carried forward from previous period	**37,716,858**	37,535,510	37,436,000
Comprehensive income			
Surplus/(Deficit) for the period	**1,040,764**	185,509	(1,400,000)
Other comprehensive income	**82,476**	(4,161)	-
Total comprehensive income	**1,123,240**	181,348	(1,400,000)
Closing balance as at 30 June	**38,840,098**	37,716,858	36,036,000

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 2018-19 Portfolio Budget Statements (PBS).

Surplus for the period above PBS deficit by $2.441 million is a result of the increased grant revenues as noted in the budget variance commentary on the Comprehensive Income Statement.

CASH FLOW STATEMENT

for the period ended 30 June 2019

	Notes	2019 $	2018 $	Original Budget $
OPERATING ACTIVITIES				
Cash received				
Industry levies and penalties		**9,690,360**	8,714,558	8,920,000
Commonwealth contributions		**9,541,298**	8,878,026	8,920,000
Royalties		**222,435**	1,175,411	1,221,000
Grants		**5,955,770**	4,693,002	3,190,000
Interest		**928,195**	1,154,502	720,000
Net GST received		**1,487,759**	1,811,556	1,772,000
Other		**1,111,684**	920,797	397,000
Total cash received		**28,937,501**	27,347,852	25,140,000
Cash used				
Employees		**2,126,064**	2,016,622	2,449,000
Grants		**20,048,495**	23,440,494	22,376,000
Suppliers		**1,255,136**	1,287,741	1,414,000
Total cash used		**23,429,695**	26,744,857	26,239,000
Net cash from/(used by) operating activities		**5,507,806**	602,995	(1,099,000)
INVESTING ACTIVITIES				
Cash received				
Proceeds from sales of property, plant and equipment		**93,909**	-	-
Investments		**66,500,000**	62,000,000	42,000,000
Total cash received		**66,593,909**	62,000,000	42,000,000
Cash used				
Purchase of property, plant and equipment		**256,314**	526,545	505,000
Investments		**63,000,000**	70,000,000	42,000,000
Purchase of Shares		**-**	110,000	-
Total cash used		**63,256,314**	70,636,545	42,505,000
Net cash from/(used by) investing activities		**3,337,595**	(8,636,545)	(505,000)
Net increase/(decrease) in cash held		**8,845,401**	(8,033,550)	(1,604,000)
Cash and cash equivalents at the beginning of the reporting period		**7,037,525**	15,071,075	6,716,000
Cash and cash equivalents at the end of the reporting period	2.1A	**15,882,926**	7,037,525	5,112,000

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

CASH FLOW STATEMENT (CONTINUED)

for the period ended 30 June 2019

Budget Variances Commentary

Statement of Financial Position for not-for-profit Reporting Entities

The original budget is the Corporation's 2018-19 Portfolio Budget Statements (PBS).

Industry levies and Commonwealth contributions increased by $1.392 million as a result of a decrease in industry levies collected and held by the Department in June 2019 and matching Commonwealth contribution determined in accordance with the PIRD Act 1989.

Royalty receipts decreased by $0.999 million as a result of the cessation of the seed trait royalty agreement.

Grant receipts increased by $2.766 million as a result of new research grants being contracted.

Interest receipts increased by $0.208 million as a result of financial reserves being invested at above budgeted interest rates.

Net GST receipts decreased by $0.284 million as a result of an increase in project milestones payable to research organisations.

Other receipts increased by $0.715 million as a result of an increase in surplus project funds returned by research organisations.

Grant payments increased by $2.575 million as a result of new RD&E projects being contracted as part of the new Government grants received during the year, and additional projects approved by the Board.

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.

OVERVIEW

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);* and

b) Australian Accounting Standards and Interpretations – Reduced Disclosure Requirements 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.

New Australian Accounting Standards

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.

Taxation

The Corporation is exempt from all forms of taxation except Fringe Benefits Tax (FBT), the Goods and Services Tax (GST) and was exempt from State payroll taxes from the 1 April 2019.

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

In the process of applying the Corporation's accounting policies, management has made a number of judgements and applied estimates and assumptions to future events. Information around judgements and estimates which are material to the financial statements are found in the following notes:

- Note 4.1 Available-for-sale financial assets

1. FINANCIAL PERFORMANCE

This section analyses the financial performance of the Corporation for the year ended 2019.

1.1 EXPENSES

	2019 $	2018 $
1.1A: EMPLOYEE BENEFITS		
Wages and salaries	**1,841,437**	1,725,528
Superannuation:		
Defined contribution plans	**145,911**	153,703
Defined benefit plans	**31,115**	32,323
Leave and other entitlements	**(54,264)**	139,052
Total employee benefits	**1,964,199**	2,050,606

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	**206,760**	163,928
Consultants	**173,094**	363,880
Corporate services	**29,399**	28,615
Information technology	**300,401**	210,584
Legal services	**59,084**	77,617
Levy management	**20,061**	33,095
Personnel services	**172,689**	51,187
Property services	**72,563**	77,417
General administration	**59,196**	55,973
Total goods and services supplied or rendered	**1,093,247**	1,062,296
Goods supplied	**120,488**	126,831
Services rendered	**972,759**	935,465
Total goods and services supplied or rendered	**1,093,247**	1,062,296
Other suppliers		
Operating lease rentals	**-**	94,456
Remuneration of auditors	**26,000**	18,000
Workers compensation expenses	**3,110**	3,394
Total other suppliers	**29,110**	115,850
Total suppliers	**1,122,357**	1,178,146

1.1 EXPENSES (CONT)

	2019 $	2018 $
1.1C: GRANTS		
Public sector:		
Australian Government entities	**3,578,286**	4,492,956
State and Territory Governments	**5,861,671**	6,154,949
Universities & Colleges	**5,424,842**	6,075,849
Corporate extension activities	**970,989**	647,256
Private sector:		
Commercial entities	**4,967,534**	4,184,503
Total grants	**20,803,322**	21,555,513
Research 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.		
Internally funded	**14,116,506**	11,726,315
Funded through research grant revenue	**13,754,308**	5,955,862
Total research grant commitments payable	**27,870,814**	17,682,177
Note 1.1D: Write-down and Impairment of Other Assets		
Impairment of property, plant and equipment	**12,970**	-
Total write-down and impairment of other assets	**12,970**	-

1.2 OWN-SOURCE REVENUE AND GAINS

OWN-SOURCE REVENUE	2019 $	2018 $
1.2A: INTEREST		
Deposits	**983,475**	896,533
Total interest	**983,475**	896,533

Accounting Policy

Interest revenue is recognised by using the effective interest method.

1.2B: ROYALTIES		
Royalties	**204,396**	1,080,040
Total royalties	**204,396**	1,080,040

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	**5,480,197**	4,273,184
Total research grants	**5,480,197**	4,273,184

Research grant commitments receivable

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 and project milestones.

Rural R&D for Profit – Smarter irrigation for profit	**-**	159,288
Rural R&D for Profit – More profit from nitrogen: enhancing the nutrient use efficiency of intensive cropping and pasture systems	**1,187,215**	3,102,870
Rural R&D for Profit – Smarter irrigation for profit phase 2	**9,210,664**	-
National Landcare Program Smart Farming Partnerships – New technologies to improve nature resources (biodiversity) on Australian cotton farms	**706,552**	-
Other research grant commitments	**327,000**	740,000
Total research grant commitments receivable	**11,431,431**	4,002,158

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 (CONT)

	2019 $	2018 $
1.2D: OTHER REVENUE		
Project refunds	**1,140,523**	804,622
Rental income	**-**	5,000
Other revenue	**-**	6,384
Total other revenue	**1,140,523**	816,006
REVENUE FROM GOVERNMENT		
1.2E: REVENUE FROM GOVERNMENT		
Department of Agriculture:		
PIRD Act 1989 Contribution	**8,679,831**	9,088,958
Total revenue from Government	**8,679,831**	9,088,958
1.2F: LEVIES AND PENALTIES		
Industry Levies	**8,679,831**	9,088,958
Penalties	**15,500**	3,809
Total levies and penalties	**8,695,331**	9,092,767

Accounting Policy

Revenue from Government

Funding received or receivable from non-corporate Commonwealth entities (appropriated to the Department of Agriculture 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 is recognised on an accrual basis from the date that the Department of Agriculture 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 1989 Act* (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

	2019 $	2018 $
2.1A: CASH AND CASH EQUIVALENTS		
Cash on hand or on deposit	**15,882,926**	7,037,525
Total cash and cash equivalents	**15,882,926**	7,037,525
2.1B: INVESTMENTS HELD TO MATURITY		
Term deposits	**24,500,000**	28,000,000
Total investments held to maturity	**24,500,000**	28,000,000

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	**157,068**	47,603
Total goods and services receivables	**157,068**	47,603
Government receivables		
Department of Agriculture		
- PIRD Act 1989 Contributions receivable	**1,467,734**	2,329,200
- Industry levies receivable	**1,296,843**	2,291,872
Total government receivables	**2,764,577**	4,621,072
Other receivables:		
GST receivable from the Australian Taxation Office	**185,607**	370,073
Interest	**139,722**	84,441
Total other receivables	**325,329**	454,514
Total trade and other receivables	**3,246,974**	5,123,189

No indicators of impairment were found for trade and other receivables.

2.1 FINANCIAL ASSETS (CONT)

	2019 $	2018 $
2.1D: OTHER INVESTMENTS		
Shares in unlisted companies	**170,064**	87,588
Net other investments	**170,064**	87,588

Accounting Policy

The Corporation has invested in seed preference shares in an unlisted start-up company over which it does not have significant influence or control. The company has been established for the purpose of commercialisation of intellectual property that may benefit the Australian cotton industry and other agriculture sectors in Australia and worldwide.

Investments in unlisted companies are accounted for in accordance with AASB 9 *Financial Instruments*, and have been designated as 'investments in equity instruments at fair value through other comprehensive income' financial assets, and are expected to be recovered in more than 12 months. (See note 4.1 for further information)

2.2 NON-FINANCIAL ASSETS

2.2A: RECONCILIATION OF THE OPENING AND CLOSING BALANCES OF PROPERTY, PLANT, EQUIPMENT AND INTANGIBLES

	Land $	Buildings $	Material plant & equipment $	Minor plant and equipment $	Total plant and equipment $	Computer software[1] $	Total $
As at 1 July 2018							
Gross book value	**190,000**	**535,000**	173,201	264,271	**437,472**	**826,026**	**1,988,498**
Accumulated depreciation, amortisation and impairment		-	(949)	(193,703)	**(194,652)**	**(526,134)**	**(720,786)**
Net book value 1 July 2018	**190,000**	**535,000**	172,252	70,568	**242,820**	**299,892**	**1,267,712**
Additions – Purchases	-	**2,080**	182,633	64,230	**246,863**	**7,371**	**256,314**
Revaluations recognised in other comprehensive income	-	-					-
Impairments recognised in net cost of services						-	-
Depreciation and amortisation		**(13,583)**	(29,641)	(36,723)	**(66,364)**	**(154,113)**	**(234,060)**
Disposals:							-
Gross book value	-	-	(111,452)	(103,227)	**(214,679)**	-	**(214,679)**
Accumulated depreciation and impairment	-	-	11,462	90,258	**101,720**	-	**101,720**
Net book value 30 June 2019	**190,000**	**523,497**	225,254	85,106	**310,360**	**153,150**	**1,177,007**
Net book value as of 30 June 2019 represented by:							
Gross book value	**190,000**	**537,080**	244,382	225,274	**469,656**	**833,397**	**2,030,133**
Accumulated depreciation, amortisation and impairment		**(13,583)**	(19,128)	(140,168)	**(159,296)**	**(680,247)**	**(853,126)**
Total net book value as at 30 June 2019	**190,000**	**523,497**	225,254	85,106	**310,360**	**153,150**	**1,177,007**

1. The carrying amount of computer software included $71,698 (2018 $108,649) purchased software and $81,452 (2018 $191,243) internally generated software.

No indicators of impairment were found in 2018 (2017: $nil).

No non-financial assets are 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 30 June 2018, an independent valuer conducted the revaluation of land and buildings.

Land valuation has not changed.

A revaluation increment of $nil for buildings on freehold land (2018: $18,251) was credited to the asset revaluation surplus by asset class and included in the equity section of the Statement of Financial Position.

Accounting Policy

Fair value measurement of non-financial assets are based on Level 2 inputs that are observable for the asset, either directly or indirectly. The fair value of these assets do not have quoted prices in active markets (Level 1 inputs).

Land is assessed using market comparables being the sale prices of comparable land for similar land size and long-term land appreciation rates.

Buildings on freehold land are assessed using the discounted cash flow of future potential rental income adjusted for the market rate of interest.

Motor vehicles in material plant and equipment is assessed using quoted prices for similar motor vehicles.

Other material plant and equipment are assessed using the depreciated replacement cost based on market prices of similar assets less depreciation.

2.2 NON-FINANCIAL ASSETS (CONT)

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 less subsequent accumulated depreciation and accumulated impairment losses. 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 of land and buildings 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:

	2019	2018
Buildings on freehold land	**40 years**	40 years
Plant and equipment	**3 to 10 years**	3 to 10 years

Impairment

All assets were assessed for impairment at 30 June 2019. 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.

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 (2018: 3 to 5 years).

All software assets were assessed for indications of impairment as at 30 June 2019.

2.3 PAYABLES

	2019 $	2018 $
2.3A: SUPPLIERS		
Trade creditors and accruals	**115,180**	112,359
Total suppliers	**115,180**	112,359
Settlement is usually made within 30 days.		
2.3B: GRANTS		
Grants:		
Public sector:		
Australian Government entities	**887,575**	628,152
State and Territory Governments	**681,109**	533,821
Universities and Colleges	**1,526,947**	1,233,320
Other research organisations	**307,500**	-
Private sector:		
Other	**2,253,222**	767,719
Total grants	**5,656,353**	3,163,012
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		
PAYG & FBT payable	**52,234**	63,009
State payroll tax	**-**	9,446
Total other payables	**52,234**	72,455

3. 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.

3.1 EMPLOYEE PROVISIONS

	2019 $	2018 $
3.1A: EMPLOYEE PROVISIONS		
Leave	**313,106**	451,330
Total employee provisions	**313,106**	451,330

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.

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.

3.2 KEY MANAGEMENT PERSONNEL REMUNERATION

Key management personnel are those persons having authority and responsibility for planning, directing and controlling the activities of the Corporation, directly or indirectly, including any director (whether executive or otherwise) of the Corporation. The Corporation has determined the key management personnel to be the Directors, Executive Director and General Managers. Key management personnel remuneration is reported in the table below:

	2019 $	2018 $
Short-term employee benefits	**811,109**	760,928
Post-employment benefits	**75,495**	72,110
Other long-term employee benefits	**53,044**	51,069
Total key management personnel remuneration expenses	**939,648**	884,107

Notes: The total number of key management personnel that are included in the above table is 11 (2018: 10).

3.3 RELATED PARTY DISCLOSURES

The Corporation is an Australian Government controlled entity. Key management personnel include the directors and executive management.

Given the breadth of Government activities, related parties may transact with the government sector in the same capacity as ordinary citizens. These transactions have not been separately disclosed in this note.

Certain key management personnel 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:

	2019 $	2018 $
TRANSACTIONS WITH RELATED PARTIES		
Kathryn Adams is a non-executive director of D2D CRC Ltd which received funding from CRDC for project:		
RRDP1705 "Precision to decision - data systems" for the project term of 1/7/2016 to 30/12/2017.	**-**	70,146
Elizabeth Alexander is a non-executive director of Plant Health Australia (PHA) which received funding from CRDC for membership to PHA and collaborative plant biosecurity projects.	**90,934**	11,090
Elizabeth Alexander is employed as an Agribusiness Development Coordinator of Central Highlands Development Corporation (CHDC) which received funding from CRDC for sponsorship of the AgFrontier new regional Agtech incubator.	**30,000**	-
Total transactions with related parties	**120,934**	81,236

4. MANAGING UNCERTAINTIES

This section analyses how the Corporation manages financial risks within its operating environment.

4.1 FINANCIAL INSTRUMENTS

	2019 $	2018 $
4.1A: CATEGORIES OF FINANCIAL INSTRUMENTS		
Financial Assets under AASB 139		
Held-to-maturity investments		
Term deposits		28,000,000
Total held-to-maturity investments		28,000,000
Available-for-sale financial assets		
Shares in unlisted companies		87,588
Total available-for-sale financial assets		87,588
Loans and receivables		
Cash and cash equivalents		7,037,525
Trade and other receivables		132,044
Total loans and receivables		7,169,569
Total Financial Assets		35,257,157
Financial Assets under AASB 9		
Financial assets at amortised cost		
Cash and cash equivalents	**15,882,926**	
Term deposits	**24,500,000**	
Trade and other receivables	**296,790**	
Total financial assets at amortised cost	**40,679,716**	
Financial assets at fair value through other comprehensive income (investments in equity instruments)		
Shares in unlisted companies	**170,064**	
Total financial assets at fair value through other comprehensive income (investments in equity instruments)	**170,064**	
Total financial assets	**40,849,780**	
Financial Liabilities		
Financial liabilities measured at amortised cost		
Grants payable	**5,656,353**	3,163,012
Suppliers payable	**115,180**	112,359
Total financial liabilities measured at amortised cost	**5,771,533**	3,275,371

4.1 FINANCIAL INSTRUMENTS (CONT)

4.1A: CATEGORIES OF FINANCIAL INSTRUMENTS (CONTINUED)

CLASSIFICATION OF FINANCIAL ASSETS ON THE DATE OF INITIAL APPLICATION OF AASB 9.

	Note	AASB 139 original classification	AASB 9 new classification	AASB 139 carrying amount at 1 July 2018 $	AASB 9 carrying amount at 1 July 2018 $
FINANCIAL ASSETS CLASS					
Cash and Cash Equivalents	3.1A	Held-to-maturity	Amortised Cost	**7,037,525**	**7,037,525**
Term deposits	3.1B	Held-to-maturity	Amortised Cost	**28,000,000**	**28,000,000**
Trade receivables	3.1B	Held-to-maturity	Amortised Cost	**132,044**	**132,044**
Shares in unlisted companies	3.1C	Available-for-sale equity instruments	FVOCI Equity instruments	**87,588**	**87,588**
Total financial assets				**35,257,157**	**35,257,157**

RECONCILIATION OF CARRYING AMOUNTS OF FINANCIAL ASSETS ON THE DATE OF INITIAL APPLICATION OF AASB 9.

	AASB 139 carrying amount at 30 June 2018 $	Reclassification $	Remeasurement $	AASB 9 carrying amount at 1 July 2018 $
FINANCIAL ASSETS AT AMORTISED COST				
Held to maturity				
Term deposits	**28,000,000**	-	-	**28,000,000**
Loans and receivables				
Cash and cash equivalents	**7,037,525**	-	-	**7,037,525**
Trade and other receivables	**132,044**	-	-	**132,044**
Total amortised cost	**35,169,569**	-	-	**35,169,569**
Financial assets at fair value through other comprehensive income				
Available for sale–equity instruments				
Shares in unlisted companies	**87,588**	-	-	**87,588**
Total fair value through other comprehensive income	**87,588**	-	-	**87,588**

There are no changes to the carrying amount of financial assets on reclassification from AASB 139 to AASB 9.

4.1B: FAIR VALUE INFORMATION BY FINANCIAL ASSET CLASS

Available-for-sale financial assets have been valued under the following fair value hierarchy:

- Level 3: inputs that are not observable and involve significant judgement.

	2019 $	2018 $
Movements in available-for-sale financial assets		
Opening balance	**87,588**	-
Purchases of shares in unlisted companies	**-**	110,000
Fair value gains/(losses) through other comprehensive income	**82,476**	(22,412)
Closing balance of available-for-sale financial assets	**170,064**	87,588

4.1 FINANCIAL INSTRUMENTS (CONT)

Accounting Policy

Financial assets

With the implementation of AASB 9 *Financial Instruments* for the first time in 2019, the entity classifies its financial assets in the following categories:

a) financial assets at fair value through profit and loss;
b) financial assets at fair value through other comprehensive income; and
c) financial assets measured at amortised cost.

The classification depends on both the entity's business model for managing the financial assets and contractual cash flow characteristics at the time of initial recognition. Financial assets are recognised when the entity becomes a party to the contract and, as a consequence, has a legal right to receive or a legal obligation to pay cash and derecognised when the contractual rights to the cash flows from the financial asset expire or are transferred upon trade date.

Comparatives have not been restated on initial application.

Financial Assets at Amortised Cost

Financial assets included in this category need to meet two criteria:

1. the financial asset is held in order to collect the contractual cash flows; and
2. the cash flows are solely payments of principal and interest (SPPI) on the principal outstanding amount.

Amortised cost is determined using the effective interest method.

Effective Interest Method

Income is recognised on an effective interest rate basis for financial assets that are recognised at amortised cost.

Financial Assets at Fair Value Through Profit or Loss (FVTPL)

Financial assets are classified as financial assets at fair value through profit or loss where the financial assets either doesn't meet the criteria of financial assets held at amortised cost or at FVOCI (i.e. mandatorily held at FVTPL) or may be designated.

Financial assets at FVTPL are stated at fair value, with any resultant gain or loss recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest earned on the financial asset.

Financial Assets at Fair Value Through Other Comprehensive Income (FVOCI)

Financial assets measured at fair value through other comprehensive income are held with the objective of both collecting contractual cash flows and selling the financial assets, and the cash flows meet the SPPI test.

Any gains or losses as a result of fair value measurement or the recognition of an impairment loss allowance are recognised in other comprehensive income.

Significant accounting judgements and estimates for unlisted companies

The shares in the unlisted companies are valued on an earnings before interest and tax (EBIT) basis of management's view of potential cash flow outcomes. The estimates are based on the best information available (Level 3 inputs) due to the start-up phase nature and that future cash flows are uncertain.

Impairment of Financial Assets

Financial assets are assessed for impairment at the end of each reporting period based on Expected Credit Losses, using the general approach which measures the loss allowance based on an amount equal to lifetime expected credit losses where risk has significantly increased, or an amount equal to 12 month expected credit losses if risk has not increased.

The simplified approach for trade, contract and lease receivables is used. This approach always measures the loss allowance as the amount equal to the lifetime expected credit losses.

A write-off constitutes a derecognition event where the write-off directly reduces the gross carrying amount of the financial asset.

Financial liabilities

Financial liabilities are classified as either financial liabilities 'at fair value through profit or loss' or other financial liabilities. Financial liabilities are recognised and derecognised upon 'trade date'.

Financial Liabilities at Fair Value Through Profit or Loss

Financial liabilities at fair value through profit or loss are initially measured at fair value. Subsequent fair value adjustments are recognised in profit or loss. The net gain or loss recognised in profit or loss incorporates any interest paid on the financial liability.

Financial Liabilities at Amortised Cost

Financial liabilities, including borrowings, are initially measured at fair value, net of transaction costs. These liabilities are subsequently measured at amortised cost using the effective interest method, with interest expense recognised on an effective interest basis.

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).

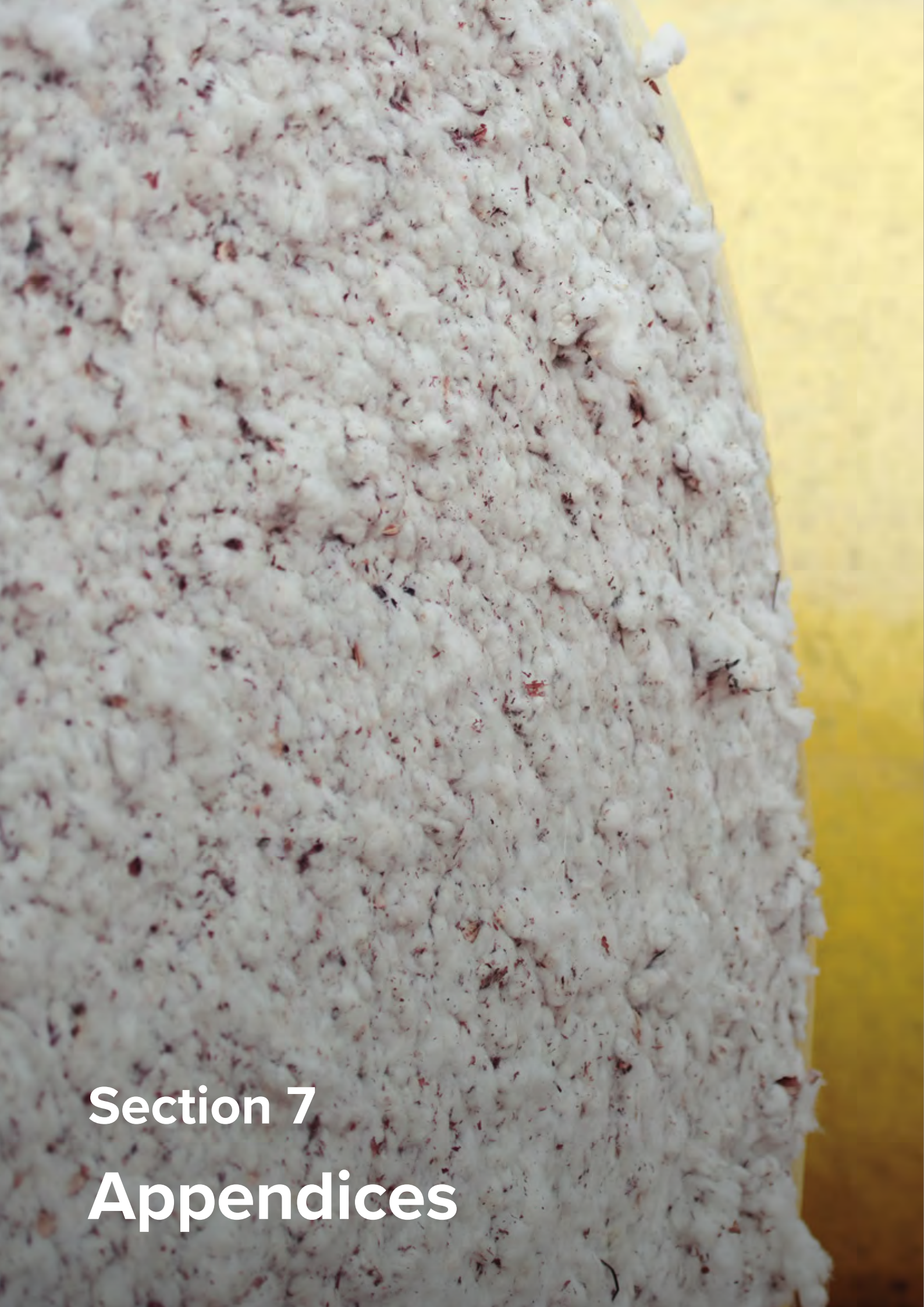
4.1 FINANCIAL INSTRUMENTS (CONT)

	2019 $	2018 $
4.1C: NET GAINS OR LOSSES ON FINANCIAL ASSETS		
Financial assets at amortised costs		
Interest revenue	**983,475**	896,533
Net gain on financial assets at amortised cost	**983,475**	896,533
Investments in equity instruments at fair value through other comprehensive income		
Gain/(Losses) recognised in equity	**82,476**	(22,412)
Net gains/(losses) on investments in equity instruments at fair value through other comprehensive income	**82,476**	(22,412)
Net gain from financial assets	**1,065,951**	874,121

5. OTHER INFORMATION

5.1 AGGREGATE ASSETS AND LIABILITIES

	2019 $	2018 $
5.1A: AGGREGATE ASSETS AND LIABILITIES		
Assets expected to be recovered in:		
No more than 12 months	**43,629,900**	40,160,714
More than 12 months	**1,347,071**	1,355,300
Total assets	**44,976,971**	41,516,014
Liabilities expected to be settled in:		
No more than 12 months	**5,967,092**	3,665,687
More than 12 months	**169,781**	133,469
Total liabilities	**6,136,873**	3,799,156



Section 7
Appendices

Appendix 1: Australian Government Priorities

CRDC's investments in RD&E during 2018–19 supported the achievement of the Australian Government's Science and Research Priorities and Rural RD&E Priorities, as outlined below.

Rural RD&E Priorities	Science and Research Priorities	CRDC RD&E outputs and outcomes 2018–19
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	CRDC continued to invest collaboratively in the *Growing a Digital Future* project, which will support the development of an industry-specific digital strategy focused so that the cotton industry can take full advantage of the value promised by digital technologies. Other projects invested in to address these outcomes include: • Use of molecular tools to monitor resistance alleles in cotton pests • Using sensors to better detect cotton pests for enhanced IPM • Machine vision spot spraying • A novel topical vegetable and cotton virus protection system • The use of sensors to improve fibre quality management • Smart autonomous irrigation, with evaluations showing up to 10 per cent yield improvement and 12 per cent water savings • Hyperspectral and multispectral analysis of crop nitrogen status • Development of a spray hazard warning system • Cotton fabrics with enhanced microbial protection • Cotton-rich compression athletic wear • A novel and more cost-effective approach to glass recycling. Past CRDC research has supported advanced technology, including automation. Just over one in three (35 per cent) of growers currently use automation on-farm and a further 40 per cent have reported they are considering options.

Rural RD&E Priorities	Science and Research Priorities	CRDC RD&E outputs and outcomes 2018–19
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	CRDC, along with other plant-based RDCs, have continued their partnership with Plant Health Australia, and the Department of Agriculture in the Plant Biosecurity Research Initiative. The aim of this collaboration is to coordinate funding of biosecurity R&D. An example of PBRI activity that CRDC is contributing to is the Rural R&D for Profit project iMapPESTS, that aims to validate a proof-of-concept surveillance system which can rapidly monitor and report the presence of pests and diseases. CRDC is also collaborating with Hort Innovation on applying a novel technology, Bioclay, to support management of exotic and endemic pests. Development in Northern Australia presents new risks in terms of biosecurity, and CRDC is supporting crop protection research in Northern Australia as well as virus and vector surveillance linked to Northern Australia Quarantine Strategy activities. In addition to supporting biosecurity extension through CottonInfo, CRDC is investing in industry capacity through a biosecurity scenario activity. 44 per cent of cotton growers currently have a farm biosecurity plan (identifying hazards and an action plan) with a further 19 per cent currently developing a plan.
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	CRDC continues to invest in projects seeking to improve the environmental footprint of Australian cotton, with a particular focus on nitrogen use and water efficiency. Preliminary results indicate that the water productivity of Australian cotton production continues to improve, with nearly all growers now achieving better levels of water productivity than the leading growers were 20 years ago. CRDC continues to invest in the cross-sectoral *Managing Climate Variability* program, and provides fortnightly climate information to growers to help them manage climate risk. Research is also on-going that investigates the potential management strategies for coping with increased temperatures and carbon dioxide levels. CRDC has a number of projects to report against industry sustainability metrics across soil, water and natural resources.
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	During 2018–19, CottonInfo engaged with 6988 industry personnel across 170 activities. CottonInfo conducted forums on the development and use of bankless irrigation systems, focused on the pros and cons of installing such systems. In addition, focused campaigns were conducted on natural resource management, integrated pest management (IPM) and spray drift management. CottonInfo facilitated the running of Area-Wide Management groups (to enhance IPM) via peer-to-peer learning. These initiatives have been recognised by other industries who have requested presentations on peer-to-peer learning (reef extension group) and area-wide management (macadamia industry). Participation in the industry's best management practice program, *my*BMP, is currently 82 per cent – up from 78 per cent the year prior.

Science and Research Priorities per CRDC RD&E program 2018–19 ($'000)

Science and Research Priorities	Food	Soil and Water	Transport	Cyber security	Energy	Resources	Advanced Manufacturing	Environmental Change	Health	Total
Goal 1	$7,417	$5,385	$0	$0	$0	$4	$8	$678	$0	**$13,492**
Goal 2	$993	$972	$0	$0	$0	$0	$58	$885	$0	**$2,908**
Goal 3	$898	$14	$0	$0	$0	$0	$173	$6	$20	**$1,112**
Enabling Strategy 1	$1,449	$169	$0	$0	$90	$22	$27	$90	$11	**$1,858**
Enabling Strategy 2	$462	$0	$0	$0	$0	$0	$0	$0	$0	**$462**
TOTAL*	$11,219	$6,540	$0	$0	$90	$26	$266	$1,659	$31	**$19,832**

* Excludes budgeted employee and supplier expenditure 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.

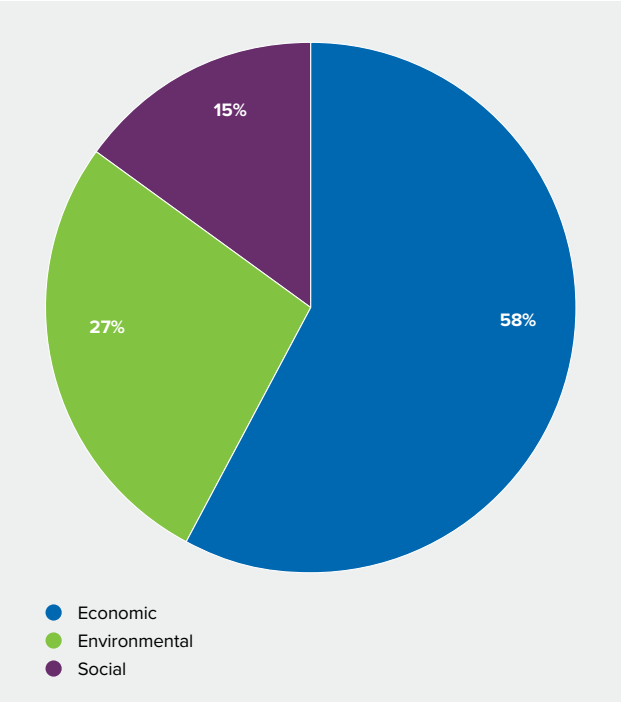
Rural RD&E Priorities per CRDC RD&E Program 2018–19 ($'000)

Rural RD&E Priorities	Advanced Technology	Biosecurity	Soil, Water, and Managing Natural Resources	Adoption of R&D	Total
Goal 1	$2,782	$5,167	$5,130	$413	**$13,492**
Goal 2	$0	$22	$1,972	$294	**$2,907**
Goal 3	$185	$127	$209	$592	**$1,113**
Enabling Strategy 1	$338	$253	$18	$1,249	**$1,858**
Enabling Strategy 2	$0	$25	$25	$412	**$462**
TOTAL*	$3,924	$5,594	$7,354	$2,960	**$19,832**

* Excludes budgeted employee and supplier expenditure 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 2: 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 RD&E Plan) consider triple bottom line outputs. In line with this, the Annual Operational Plan 2018–19 was designed to ensure RD&E investments provide measurable economic, environmental and social benefits to the cotton industry and the wider community.



CRDC RD&E investments across economic, environmental and social performance outcomes 2018–19

Performance outcomes	CRDC investment
Economic	58%
Environmental	27%
Social	15%
TOTAL	**100%**

CRDC program contribution to economic, environmental and social outcomes 2018–19 ($'000)

Contributions	Economic	Environmental	Social	Total
CRDC programs	**Investment total**	**Investment total**	**Investment total**	**Investment total**
Goal 1	$8,793	$3,298	$1,401	**$13,492**
Goal 2	$1,111	$1,160	$637	**$2,908**
Goal 3	$405	$189	$518	**$1,112**
Enabling Strategy 1	$1003	$576	$279	**$1,858**
Enabling Strategy 2	$253	$95	$114	**$462**
TOTAL*	$11,566	$5,317	$2,949	**$19,832**
Percentage	58%	27%	15%	100%

* Excludes budgeted employee and supplier expenditure, and corporate research activities that support R&D planning and adoption.

Appendix 3: RD&E Portfolio

CRDC 2018–19 Project List (as at 30 June 2019)

GOAL 1: INCREASED PRODUCTIVITY AND PROFITABILITY ON COTTON FARMS

Project title	Project code	Researcher	Organisation	Start date	Cease date
1.1 Optimised farming systems					
1.1.1 Improved yield and quality					
Improving crop establishment, termination and weed control in dryland cotton farming systems	CRDC1937	Annabelle Guest	DCRA	Jan-19	Apr-20
Increased yield through improved management of soil constraints in cotton farm	USQ1903	John Bennett	USQ	Jun-19	Jun-22
Major Capital Item: Felix F-750 produce quality meter	CMSE1802C	Robert Long	CSIRO	Dec-18	Jun-19
Managing cotton quality to maintain Australia's premium status (includes CottonInfo technical lead and *my*BMP module lead)	CRDC1924	Rene van der Sluijs	Textile Technical Services	Oct-18	Sep-20
Precision management for improved cotton quality	CMSE1802	Robert Long	CSIRO	Jun-17	Jun-20
1.1.2 Improved input efficiencies					
A biological alternative to nitrogen fertiliser in cotton	UN1901	Grace Scott	U Nottingham & Azotic Technologies Limited	Sep-18	Sep-19
Automation of recycle system – IREC field station	IREC1701	Rob Houghton	IREC	Mar-17	Aug-18
Improving the nitrogen-use efficiency of cotton crops through better understanding the role of dissolved organic N	CSP1904	Bennett Macdonald	CSIRO	Jul-18	Jun-21
Improving water-use efficiency in a changing climate	CSP1804	Katrina Broughton	CSIRO	Jul-17	Jun-20
IREC field station automated irrigation	IREC1801	Emma Ayliffe	IREC	Apr-18	Jun-19
Management of irrigation and energy projects	CRDC1906	Peter Smith	Sapphire Irrigation Consulting	Jul-18	Jun-18
More Profit from Nitrogen: enhancing nutrient-use efficiency in cotton	RRDP1712	Graeme Schwenke	NSW DPI	Jul-16	Jun-21
More Profit from Nitrogen: Improved nitrogen-use efficiency through accounting for deep soil and mineralisable nitrogen supply, and deployment of enhanced efficiency fertilisers to better match crop nitrogen demand	RRDP1717	Lukas Van Zwieten	NSW DPI	Jul-16	May-20
More Profit from Nitrogen: Improving dairy farm nitrogen efficiency using advanced technologies	RRDP1715	Helen Suter	UM	Jul-16	Nov-19
More Profit from Nitrogen: Increasing nitrogen-use efficiency in dairy pastures	RRDP1714	David Rowlings	QUT	Jul-16	Nov-19
More Profit from Nitrogen: Mid-Term evaluation	RRDP1736	Jeff Coutts	Coutts J&R	Jun-18	Sep-18
More Profit from Nitrogen: New technologies and managements – transforming nitrogen-use efficiency in cane production	RRDP1719	Matt Redding	QDAF	Sep-16	Jun-21
More Profit from Nitrogen: Nitrogen-use efficiency indicators for the Australian cotton, sugar, dairy & horticulture industries	RRDP1901	Dio Antille	CSIRO	Mar-19	Jul-19

More Profit from Nitrogen: Optimising nitrogen and water interactions in cotton	RRDP1713	Alice Melland	USQ	Jul-16	Oct-18
More Profit from Nitrogen: Optimising nutrient management for improved productivity and fruit quality in cherries	RRDP1721	Nigel Swarts	UTAS	Aug-16	Jun-21
More Profit from Nitrogen: Optimising nutrient management for improved productivity and fruit quality in mangoes	RRDP1720	Tony Asis	NTDPIF	Aug-16	Jun-21
More Profit from Nitrogen: Potentially mineralisable nitrogen soil analysis	RRDP1812	Marguerite White	CRDC	Mar-18	Dec-18
More Profit from Nitrogen: Project Communications	RRDP1735	Allan Williams	CRDC	Jul-16	Apr-20
More Profit from Nitrogen: Quantifying the whole farm system's impact of nitrogen best practice on dairy farms	RRDP1716	Richard Eckard	UM	Jul-16	Apr-20
More Profit from Nitrogen: Rural R&D for Profit program video and project case study	RRDP1813	Marguerite White	Department of Agriculture	May-18	Dec-18
More Profit from Nitrogen: Smart blended use of enhanced efficiency fertilisers to maximise sugarcane profitability	RRDP1718	Weijin Wang	DSITI	Jul-16	Apr-20
More Profit from Nitrogen: YourData platform	RRDP1727	Jeff Coutts	Coutts J&R	Feb-17	Jun-21
More Profit from Nitrogen: Science leadership and project coordination	RRDP1711	Marguerite White	Consultant	Nov-16	Jun-20
More Profit from Nitrogen: PMC Meetings	RRDP1722	Allan Williams	CRDC	Jul-16	Jun-20
Novel transgenic approaches to control silverleaf whitefly	UQ1801	Gimme Walter	UQ	Jul-17	Jun-19
Optimising the management of manures in southern NSW cotton production	DU1603	Wendy Quayle	DU	Jul-15	Sep-18
Optimising the management of manures in southern NSW cotton production II	DU1903	Wendy Quayle	DU	Jul-18	Jun-21
PhD: Electrophysiology and molecular identification of novel biopesticides	UWS1601	Michell Mak	UWS	Jul-15	Jun-20
PhD: Monitoring soil water dynamics for improving water-use efficiency	UNSW1801	Ehsan Zare	UNSW	Jul-17	Jun-20
PhD: Next-generation fertilisers for nutrient stewardship in cotton production	UQ1702	Rhys Pirie	UQ	Jan-17	Jan-20
PhD: The impact of irrigation methods and management strategies on nitrogen fertiliser recovery in cotton in southern QLD	UQ1502	John Smith	UQ	Jul-14	Dec-20
Utilising plant-based sensing techniques for improving water profitability in fully and partially irrigated cotton: Stage 1	CSP1906	Hizbullah Jamali	CSIRO	Jul-18	Jun-19
Where does water go? Visualising irrigation efficiency by time-lapse water monitoring	UNSW1802	John Triantafilis	UNSW	Jul-17	Jun-20
1.1.3 On-farm sustainable development is supported					
National RD&E water use in agriculture cross-sector strategy	DA1701	Catherine Phelps	Dairy Australia	Nov-16	Dec-18
Northern Australia cotton development & coordination leader	CSP1602	Steve Yeates	CSIRO	Oct-15	Sep-18
Science leadership for cotton development in Northern Australia	CSP1903	Steve Yeates	CSIRO	Oct-18	Sep-21
1.1.4 Improved reliability of cotton production					
A sprayable water barrier to line irrigation channels: Scoping study	CSE1802	Keith Bristow	CSIRO	Oct-17	Sep-18

Minimising yield variability to maximise yield	DAN1801	Guna Nachimuthu	NSW DPI	Jul-17	Jun-21
Opportunities for dryland cotton with Bollgard 3	DAQ1703	Paul Grundy	QDAF	Jul-16	May-18
Optimising seedling emergence	DAN1701	Deb Slinger	NSW DPI	Jul-16	Jun-19
PhD: Utilising novel plant growth regulators to develop resilient future cotton systems	CSP1604	Claire Welsh	CSIRO	Apr-16	Sep-19
Quantifying the effectiveness of cover crops as a means of increased water infiltration and reduced evaporation in the northern region	GRDC1801	David Lawrence	QDAF/ GRDC	May-17	Apr-20
Trial to compare mechanical and chemical tactics for effective crop termination of herbicide-tolerant cotton	CRDC1904	Annabelle Guest	AGDel	Jul-18	Jun-19
1.2 Transformative technologies					
1.2.1 New technologies are adapted for use in cotton					
Agri-innovation: Driving productivity for Australian cotton growers through partnerships and digital technologies	JT1901	Jane Trindall	Jane Trindall Consulting	May-19	Jun-22
Application of molecular tools for monitoring resistance alleles in *Helicoverpa spp*.	CSE1801	Tom Walsh	CSIRO	Jul-17	Apr-21
Assessing the potential of a new monitoring tool ("Zappa" trap) for managing sucking pests on cotton	DAN1902	Robert Mensah	NSW DPI	Jul-18	Jun-19
Commercial development and evaluation of a machine vision-based weed spot sprayer	NEC1402	Cheryl McCarthy & Stephen Rees	USQ	Jul-13	Apr-19
Future Farm (phase 2): Technology solutions for improved nitrogen application	QUT1902	Peter Grace	QUT	Jul-18	Jun-22
Gwydir Valley demonstration of the application of the latest digital technologies for precise automated irrigation	GVIA1901	Louise Gall	GVIA	Jul-18	Jun-19
Identifying sensors for better IPM in cotton	NEC1901	Alison McCarthy	USQ	Jul-18	Jun-21
Major Capital Item: ACRI cotton picker and precision-variable rate fertiliser technology to support cotton R&D in northern and southern NSW	DAN1905	Rod Jackson	NSW DPI	Nov-18	Dec-19
PhD: Characterisation of brassinosteroid effects and brassinosteroid-responsive genes in cotton for growth and stress tolerance enhancement	UNE1605	Anahid A Essa Al-Amery	UNE	May-14	Nov-19
Precise real-time automated cotton irrigation for improved water productivity	USQ1902	Joseph Foley	USQ	Jul-18	Jun-19
Precise real-time automated cotton irrigation for improved water productivity	DU1902	John Hornbuckle	DU	Jul-18	Jun-19
Precision to Decision 2: Support application framework and design	CRDC1836	Paul Barnett	Barnett Consulting	Jun-18	Aug-18
The platform for monitoring and analysis of cotton canopy nitrogen status and yield projection using calibrated aerial and satellite imagery	FLUR1801	Anastasia Volkova	FluroSat	Dec-17	Aug-18
The platform for monitoring and analysis of cotton canopy nitrogen status and yield projection using calibrated aerial and satellite imagery (Phase 2, incorporation of NutriLOGIC)	FLUR1901	Anastasia Volkova	FluroSat	Nov-18	Jun-19
Travel: International Cotton Advisory Committee (ICAC) 77th Plenary Meeting, present	DAN1904	Robert Mensah	NSW DPI	Oct-18	Dec-18
1.2.2 Cotton farms are digitally enabled					
Australian Agriculture: Growing a digital future – Communications	GDF1908	Jane Trindall	CRDC	Jun-19	Sep-19
Australian Agriculture: Growing a digital future – Developing digital agriculture maturity index and assessing digital maturity levels across all agricultural sectors	GDF1901	Airong Zhang	CSIRO	Jan-19	Sep-19

Australian Agriculture: Growing a digital future – Developing transparency and trust for producers through Australian agricultural data governance framework and action plan	GDF1902	Leanne Wiseman	GU	Jan-19	Sep-19
Australian Agriculture: Growing a digital future – Developing transparency and trust for producers through Australian agricultural data governance: principles	GDF1903	Jay Sanderson	USC	Jan-19	Sep-19
Australian Agriculture: Growing a digital future – Digital capability framework for the Australian agriculture sector	GDF1906	Georgie Aley	KPMG	May-19	Sep-19
Australian Agriculture: Growing a digital future – Inception meeting	GDF1905	Jane Trindall	CRDC	Mar-19	Apr-19
Australian Agriculture: Growing a digital future – meeting assistance	GDF1904	Julia Skinner	Consultant	Mar-19	Sep-19
Australian Agriculture: Growing a digital future – National Forum	GDF1907	Jane Trindall	CRDC	Jun-19	Sep-19
Capital: Sundown smart farm development	CRDC1928	Nick Gillingham	Sundown Pastoral	Nov-18	Oct-20
Travel: AgTech Finder – Workshop 1	CRDC1935	Brooke Sauer	Intellect Ag Pty Ltd	Jan-19	Feb-19
1.3 Protection from biotic threats and environmental stresses					
1.3.1 Increased understanding of the impact of pests, diseases and weeds, and environmental stresses					
Additional Support: Fulbright Scholarship to study Verticillium Wilt	CGA1911	Shelby Young	Lower Namoi CGA	Jun-19	May-20
Integrated weed management options for weed control in cotton farming systems (including CottonInfo technical lead and *my*BMP module lead)	DAN1901	Eric Koetz	NSW DPI	Jul-18	Sep-19
IPM to support the management of emerging pests	CSP1905	Simone Heimoana	CSIRO	Jul-18	Jun-21
PhD: Biology of *Amaranthus hybridus, A. mitchellii,* and *A. powellii:* emerging weeds of cotton systems	UQ1703	Asad Khan	UQ	Jan-17	Dec-19
Transformation of *Verticillium dahliae*, causal agent of Verticillium wilt of cotton, with the GFP gene	DAN1809	Aphrika Gregson	NSW DPI / UQ	Dec-17	Jun-20
Understanding the ecology of reniform nematodes in cotton	DAQ1803	Linda Smith	QDAF	Nov-17	Jun-19
1.3.2 Improved identification, surveillance and management systems for pests, diseases and weeds, and environmental stresses					
Agronomy for resilient future cotton systems	CSP1601	Michael Bange	CSIRO	Jul-15	Jun-19
Biological-based products for improved cotton production	UWS1901	Brajesh K Singh	UWS	Jul-18	Mar-22
Biological control and taxonomic advancement for management in the Noogoora burr complex	DAN1805	Graham Charles	NSW DPI	Jul-17	Jun-19
Conventional insecticide resistance in *Helicoverpa*: monitoring, management and novel mitigation strategies in Bollgard 3	DAN1506	Lisa Bird	NSW DPI	Jul-14	Jun-19
CottonInfo IPM Technical Lead and pest management for high-yield research (including *my*BMP module lead)	DAQ1902	Paul Grundy	QDAF	Jul-18	Jun-21
Development of a spray drift hazard prediction system	MRES1701	Graeme Tepper	MRES	Jul-16	Jun-19
Hyperspectral sensing (VNIR and SWIR range) for detection of chemical spray drift	CPU1901	David Wright	Collaboration Process Utility Pty Ltd	Oct-18	Feb-19
iMapPESTS: Sentinel Surveillance for Agriculture	HIA1802	Wee tek Tay Dean Brookes	HIA	Feb-18	May-22

Improved management of silverleaf whitefly on cotton farms	DAQ1903	Richard Sequeira	QDAF	Jul-18	Jun-21
Improving the management of cotton diseases in Australian cotton farming systems	RRDP1724	Linda Smith	QDAF	Jul-16	Dec-19
Innovative solutions to cotton diseases	DAN1703	Duy Le	NSW DPI	Jul-16	Dec-20
Managing Climate Variability Program – Phase 5	MLA1701	Doug McNicholl	MLA	Jul-16	Jun-21
Managing Verticillium risk for cotton	RRDP1723	Karen Kirkby	NSW DPI	Jul-16	Dec-19
Mirid and mealybug best practice management	DAQ1802	Richard Sequeira	QDAF	Jul-17	Jun-20
Monitoring SLW insecticide resistance	DAQ1701	Jamie Hopkinson	QDAF	Jul-16	Jun-19
Novel topical vegetable & cotton virus protection BIOCLAY	HIA1803	Neena Mitter	HIA/UQ	2017	Jun-20
PhD study: Developing the weed control threshold	DAN1601	Graham Charles	NSW DPI	Nov-15	Jun-19
PhD: Building climate change resilience in cotton through translational physiology	ANU1704	Demi Gamble	ANU	Feb-17	Mar-20
Plant Health Australia Membership Subscription 2018-19	PHA1901	PHA	PHA	Jul-18	Jun-19
Project Agreement AGWA: Digital technologies for dynamic management for disease, stress and yield program	AGWA1701	Liz Waters	AGWA	Aug-16	Dec-19
Ready-to-use soil test to manage black root rot risks	MLAB1901	Maria Manjarrez	Microbiology Labs Aust	Jul-18	Jun-20
Reducing the impact of weather, insects and microbes on cotton colour	CSP1901	Simone Heimoana	CSIRO	Jul-18	Jun-21
Resistance research and monitoring to enhance stewardship of Bt cotton and management of *Helicoverpa* spp.	CSE1701	Sharon Downes	CSIRO	Jul-16	Jun-19
Review of Spray Drift Hazard alert and Prediction system	CRDC1927	Dallas Gibb	TechMAC	Oct-18	Nov-18
Southern Cotton Crop Protection (including CottonInfo Disease Technical Lead and *my*BMP module lead)	DAN1903	Tim Green	NSW DPI	Jul-18	Oct-21
Staying ahead of weed evolution in changing cotton systems	UQ1501	Jeff Werth & Bhagirath Chauhan	UQ	Jul-14	Jun-19
Surveillance and studies for endemic and exotic virus diseases of cotton	DAQ1601	Murray Sharman	QDAF	Jul-15	Jun-19
The sustainable chemical control and resistance management of aphids, mites and mirids in Australian cotton, 2014–2019	DAN1507	Grant Herron	NSW DPI	Jul-14	Jun-19
The use of area-wide management, IPM, detergents and oils for the suppression of whitefly population in cotton for the reduced reliance and use of chemical controls	CRDC1803	Emma Ayliffe	Elders Griffith	Jul-17	Jun-19
Travel: Attend 2018 FUSCOM, presenter	CRDC1913	Maria Manjarrez	Microbiology Labs Aust	Aug-18	Aug-18
1.3.3 Industry is prepared for a biosecurity incursion					
Khapra Beetle response	CA1708	Sally Ceeney	Cotton Australia	Jan-17	Dec-19
Large-scale biosecurity scenario to support cotton industry preparedness	PHA1902	Stephen Dibley	PHA	Aug-18	Dec-19
Plant Biosecurity Research Initiative	HIA1801	Jo Luck	HIA	Jun-17	Jun-20
GOAL 1 TOTAL: $13.5 MILLION					

GOAL 2: IMPROVE COTTON FARMING SUSTAINABILITY AND VALUE CHAIN COMPETITIVENESS

Project title	Project code	Researcher	Organisation	Start date	Cease date
2.1 Sustainability of cotton farming					
2.1.1 Improved environmental footprint for cotton farms					
2018–2019 Cotton Map	CA1904	Sally Ceeney	Cotton Australia	Jul-18	Jun-19
Access Bird of Cotton App	CRDC1940	Nic Hinwood	Keo Design	Apr-19	May-19
Appropriate land-use methodology for Australian cotton LCA assessments	UQ1701	Francois Visser	UQ	Jul-16	Jun-19
Baselining Lower Namoi groundwater and evaluating Pilliga CSG developments	UNSW1601	Bryce Kelly	UNSW	Jul-15	Dec-18
Cotton Landcare Tech Innovations: Communications Support	NLP1903	Bernadette Pilling	House of Communi-cations	Nov-18	Mar-22
Cotton Landcare Tech Innovations: Improved natural capital (biodiversity) on Australian cotton farms	NLP1901	Erin Peterson	QUT	Jan-19	Nov-21
Cotton Landcare Tech Innovations: Improved natural capital (biodiversity) on Australian cotton farms	NLP1902	Rhiannon Smith	UNE	Jul-18	Nov-21
Cotton Landcare Tech Innovations: Mapping and MERI Framework	NLP1904	Julian Wall	2rog Consulting Pty Ltd	Jan-19	Jun-19
Development of next-generation evaporation mitigation technology with increased resistance to wind	UM1801	Greg Qiao	UM	Sep-17	Aug-18
Evaporation mitigation solutions for Australian cotton farm water storages	UM1901	Greg Qiao	UM	Jul-18	Jun-19
Feasibility study of managed aquifer recharge for improved water productivity for Australian cotton production	ANU1901	Anthony Jakeman	ANU	Aug-18	Aug-21
Improving the ability of the Australian cotton industry to report its sustainability performance	QUT1705	Erin Peterson	QUT	Oct-16	Oct-19
Managing natural landscapes on Australian cotton farms to increase the provision of ecosystem services	GU1701	Samantha Capon	GU	Jul-16	Jun-19
National residue survey for cotton	CA1705	Sally Ceeney	Cotton Australia	Feb-17	Feb-19
PhD: Farm-wide microgrid decision support system for the Australian cotton industry.	UTS1901	Yunfeng (Forrest) Lin	UTS	Aug-18	Jun-21
PhD: Improving precision agriculture and climate adaptation for the Australian cotton industry through fertiliser optimisation	ANU1602	James Latimer	ANU	Feb-16	Jun-19
PhD: Sustainable water extractions: Low flow refugia and critical flow thresholds	UNE1406	Marita Pearson	UNE	Jan-14	Aug-20
POST: Professor of soil biology	UNE1403	Oliver Knox	UNE	Jan-14	Jun-19
Quantifying the nitrogen cycle: from farm gate to catchments, groundwater and atmosphere	ANSTO1801	Dioni Cendon	ANTSO	Jul-17	Jun-20
Quantifying the potential environmental impacts of pesticides used on cotton farms	DAN1803	Mick Rose	NSW DPI	Jul-17	Jun-20
Review of international water footprints and their assessment of Australian agriculture	CRDC1923	Tim Grant	Life Cycles Strategies Pty Ltd	Oct-18	Jul-19
Soil System Research – physical, chemical and biological processes for plant growth and nutrient cycling down the whole soil profile	UNE1601	Oliver Knox	UNE	Jul-15	Jun-19

Synthesis of natural resource assets in the cotton-growing region of eastern Australia	FWPA1801	Julian Wall	Eco Logical Aust Pty Ltd	Jul-17	Jun-20
Understanding environmental impacts and resource impacts with changing demand for Australian cotton, assessed using a change modelling life cycle assessment approach	CRDC1911	Stephen Wiedemann	Integrity Ag and Environment Pty Ltd	Aug-18	Feb-20
2.2 Create higher value uses for cotton					
2.2.1 Increased value for Australian cotton					
An eco-friendly treatment to improve the look and handle of cotton fabric	DU1701	Rangam Rajkhowa	DU	Oct-16	Mar-19
Breathable cotton for compression fabrics phase 2: performance testing	DU1905	Maryam Naebe	DU	Jan-19	Dec-19
Comparison of Australian dye quality	CMSE1901	Stuart Gordon	CSIRO	Jul-18	Jun-19
Continuous mercerisation of loose-stock cotton without fibre shrinkage	RMIT1802	Rajiv Padhye	RMIT	Jan-18	Dec-18
Developing renewable fine chemicals from cotton biomass (A profitable future for Australian agriculture: Biorefineries for higher-value animal feeds, chemicals and fuels)	SRA1601	William Doherty	QUT	Jul-15	Apr-19
High sound-absorbing composites from recycled cotton	DU1901	Chris Hurren	DU	Oct-18	Sep-19
Identifying technical benefits in producing regenerated cellulose fibres from cotton for carbon fibre production: Phase 2	DU1801	Nolene Byrne	DU	Jul-17	Oct-18
PhD: Exploring nanofibrous coating on cotton fabric with versatile protection and dynamic comfort	RMIT1702	Olga Gavrilenko	RMIT	Feb-17	Apr-20
Potent mould and mildew resistance cotton fabrics	DU1802	Xin Lui	DU	Mar-18	Apr-19
Scoping study: Identifying opportunities for blending cotton with high tech/novel textile materials	CMSE1902	Menghe Miao	CSIRO	Jul-18	Jun-19
2.2.2 Increased understanding of market requirements and opportunities throughout the value chain					
Bio-degradation of dyed cotton fabrics	NCSU1701	Nelson Vinueza	NCSU	Jan-16	Dec-19
Joint RDC community trust project	RIRDC1903	Jennifer Medway	AgriFutures	Jun-19	May-21
Measuring the pulse of Australian cotton – perceptions, issues and opportunities	CA1901	Brooke Summers	Cotton Australia	Oct-18	Jun-19
Microparticles generated from laundering of cotton and other fabrics	NCSU1702	Richard Venditti	NCSU	Jan-17	Dec-19
Strategies for improving labour conditions within the Australian cotton value chain	QUT1903	Alice Payne	QUT	Jun-19	Jun-22
2.3 Measurement and reporting throughout the value chain					
2.3.1 CRDC collaborates in global leadership for sustainability initiatives					
Cotton industry report on social capital wellbeing sustainability indicators	UC1901	Jacki Schirmer	UC	Jun-19	Jun-22
Green and efficient textile dyeing and finishing technology using nanocellulosic fibres	UG1801	Sergiy Minko	University of Georgia US	Jan-18	Dec-18
Membership of the Sustainable Agriculture Initiative (SAI) Platform – Australian chapter	CRDC1902	Selwyn Heilbron	SAI Platform (Aust) Inc	Jul-18	Jun-20
PhD: Textile supply chain transparency and accountability	UL1901	Mark Sumner	University of Leeds	Oct-18	Sep-21
Sustainability metrics for the cotton industry	CRDC1944	Chris Cosgrove	Sustenance Asia	Jun-19	Jun-22
Sustainable Apparel Coalition membership	CRDC1817	Glenn Robinson	SAC	Aug-17	Jun-21

2.3.2 The value chain is transparent and understood by participants					
Engagement for Australian cotton industry contribution and perception scan report	CRDC1948	Robert Poole	KPMG	Jun-19	Jul-19
PhD: Sustainable value chain analysis of the Australian cotton industry	QUT1901	Zoe Mellick	QUT	Jul-18	Jul-21
GOAL 2 TOTAL: $2.9 MILLION					

GOAL 3: BUILD ADAPTIVE CAPACITY OF THE COTTON INDUSTRY

Project title	Project code	Researcher	Organisation	Start date	Cease date
3.1 Science and innovation capability, and new knowledge					
3.1.1 Science and innovation capacity is strengthened and strategically fit for a digital future					
2015 Horizon Scholarship	RIRDC1503	Scott Nevison	AgriFutures	Mar-15	Dec-18
2016 Horizon Scholarship	RIRDC1602	Sam Knight	AgriFutures	Jul-15	Dec-19
2017 Horizon Scholarship	RIRDC1702	Holly Chandler	AgriFutures	Jul-16	Dec-19
2019 and 2020 Science and Innovation Awards for young people in Agriculture, Fisheries and Forestry	ABA1901	2019 Dean Brookes 2020 TBA	ABARES	Jun-20	Jun-20
AgCatalyst 2018	CSP1805	Gavin Purtell	CSIRO	May-18	Aug-18
Agri-intelligence in cotton production systems: Stage 1	QUT1701	Andrew Simpson	QUT	Jan-17	Dec-18
Australian Future Cotton Leaders Program 2018	CA1806	Jo Eady, Ruralscope	Cotton Australia	Mar-18	Dec-18
Australian Rural Leadership Program Course 25	RIR1901	Fleur Anderson	ARLP	Jul-18	Oct-19
Australian Rural Leadership Program Course 25	RIR1902	John Durham	ARLP	Jul-18	Oct-19
Australian Rural Leadership Program: Course 26, Course 27, Trail 2019, Trail 2020	RIR1903	Matilda Ferguson	ARLP	May-19	Dec-20
Coordination services in the building adaptive capacity goal and *my*BMP module reviews	CRDC1919	Rachel Holloway	Rachel Holloway	Jul-18	Jun-19
Cotton industry leadership development: ARLP Course 24	RIR1801	Timothy Chaffey	ARLP	Aug-17	Oct-18
Cotton industry leadership development: ARLP Course 24	RIR1802	Richard Malone	ARLP	Aug-17	Oct-18
Cotton Young Farming Champions Program 2017	CRDC1728	Lynne Strong	PYIA	Dec-16	Jan-19
CRDC Science Forum: Build adaptive capacity of the cotton industry	CRDA1903	Ian Taylor	CRDC	Nov-18	Nov-18
Facilitate Start Up Alley, Cotton Conference 2018	XL1802	Tim Parsons	XLAB	May-18	Aug-18
Honours: Baselining river water nitrogen compounds in the Murrumbidgee irrigation district	UNSW1901	Jessica Watson	UNSW	Feb-19	Dec-19
Honours: Establishing precision/digital agriculture at 'Llara'	US1802	Bradley Ginns	USYD	Jan-18	Nov-18
Honours: Estimating soil water use in cotton systems	CSP1803	Harry Gaynor	USYD	Jan-18	Nov-18
Honours: Evaluation of relative damage caused by two-spotted mite and strawberry mite in cotton	DAN1808	Chris Shafto	NSW DPI	Jan-18	Dec-19
Honours: Soil coalescence & compaction in southern NSW	US1903	Jonathon Moore	USYD	Jan-19	Dec-19
Nuffield Australia Farming Scholarship 2017	CRDC1711	Daniel Kahl	Nuffield	Apr-16	Sep-18

Nuffield Australia Farming Scholarship 2018	CRDC1801	Luke McKay	Nuffield	Apr-17	Sep-19
Start Up Alley at the 19th Australian Cotton Conference	CA1805	Fleur Anderson	Cotton Australia	May-18	Aug-18
Summer Scholarship: Design of versatile protective cotton fabrics with colour and patterns	RMIT1801	Olivia Williamson	RMIT	Feb-18	Nov-18
Summer Scholarship: Developing drought-protection technologies for the industry	GU1901	Kate Kingston	GU	Dec-18	Mar-19
Summer Scholarship: A novel approach to monitor soil moisture in an irrigated cotton system	US1902	Si Yang Han	USYD	Dec-18	Apr-19
Support development of TOR for key areas of investment in P2D2	CRDC1907	Rohan Rainbow	Crop Protection Australia	Jul-18	Sep-18
Travel: 3rd International Whitefly Symposium Australia 2018, presenter	DAQ1805	Richard Sequeira	QDAF	Jun-18	Sep-18
Travel: 3rd International Whitefly Symposium, attend	CSP1807	Simone Heimoana	CSIRO	Jun-18	Sep-18
Travel: 3rd International Whitefly Symposium, attend	CCA1902	Damien Erbacher	CCA	Jul-18	Sep-18
Travel: Attend International Mycological Congress; Congress of Plant Pathology 2018	UTS1801	Pearl Dail-Daigle	UTS/ NSW DPI	Jun-18	Aug-18
Travel: Present Sustainable Economic Growth for Regional Australia (SEGRA) Conference 2019	CRDC1942	Jennifer Moffatt	Jennifer Moffatt Consulting	May-19	Sep-19
3.1.2 Increased understanding of the diverse human capital in regional communities					
AACS 2019 Australian Cotton Research Conference	CRDC1939	Oliver Knox	AACS	Apr-19	Dec-19
People in Agriculture	DA1502	Shane Hellwege	Dairy Australia	Jul-14	Mar-21
Post-doc: Understanding and planning for the future cotton workforce	USQ1801	Nicole McDonald	USQ	Oct-17	Oct-20
Rural Women's Award 2019	RIRDC1904	Allanards Williams	AgriFutures	Jul-18	Dec-19
Travel: 2018 AgriFutures Rural Women's Award Gala Dinner	CRDC1918	Ruth Redfern	CRDC	Sep-18	Oct-18
Understanding motivational factors for improved spray application on farms	UNE1901	Don Hine	UNE	Jul-18	Jun-19
3.1.3 Increased opportunities for innovation skills development					
AgFrontier new regional Agtech incubator	CRDC1943	Sonya Comiskey	CHDC	Jun-19	Dec-19
Catapult program CRDC innovation Phase I	XL1801	Allen Haroutounian	XLAB	Apr-18	Jun-19
Sponsorship: 6th Australian National Soil Judging Competition	CRDC1925	Jim Payne	Soil Science Australia	Oct-18	Nov-18
Sponsorship: CRDC Horizon Scholar attendance at the 19th Australian Cotton Conference 2018	CRDA1901	Sam Knight & Scott Nevison	CRDC	Aug-18	Aug-18
Travel: 2018 Cotton Conference, attend	UNE1902	Bernice Kotey	UNE	Aug-18	Aug-18
Travel: 2018 Cotton Conference, present	CRDC1910	Ben Henley	UM	Jul-18	Aug-18
Travel: 2018 Cotton Conference, present	CRDC1915	Louisa Ferrier	Birchop Cropping Group	Jul-18	Aug-18
Travel: 3rd Agriculture and Climate Change Conference 2019, Budapest, Hungary, attend	CSP1902	Katie Broughton	CSIRO	Nov-18	Mar-19
Travel: 77th Plenary meeting of the International Cotton Advisory Committee, Ivory Coast, attend	CLW1901	Tom Walsh	CSIRO	Nov-18	Dec-18
Travel: CRDC Board, Exploiting IP – investors perspective	CRDA1904	Sarah Nolet	AgThentic	Jan-19	Feb-19
Travel: ICSD 2019 Conference, Rome, Italy, attend and present	DU1904	Kamyar Shrivan Moghaddam	DU	Dec-18	Sep-19
Travel: Present and attend ABARES Regional Outlook Conference 2018	CRDC1834	Rohan Rainbow	Consultant	May-18	Oct-18

3.2 Futures thinking					
3.2.1 Australian cotton growers are able to adapt to change					
19th Australian Cotton Conference Foundation Sponsorship	CA1804	Fleur Anderson	Cotton Australia	Dec-17	Sep-18
2018–2021 Joint-RDC Health and Safety Farming Alliance	RIRDC1901	Jennifer Medway	AgriFutures	Jul-18	Jun-21
Grassroots Grant: 2 Mary O'Brien Spray drift workshops	CGA1909	Richard Avendano	Upper Namoi CGA	Dec-18	Dec-18
Grassroots Grant: 2019 Grower development and extension programs and off-target spray drift mitigation	CGA1903	John Durham	Southern Valley CGA	Nov-18	Sep-19
Grassroots Grant: Assist Upper Namoi cotton growers to investigate efficiency and productivity of on-farm irrigation water use and management	CGA1901	Alexandra Dalton	Upper Namoi CGA	Nov-18	Mar-19
Grassroots Grant: Central Highlands weather station network	CGA1906	Aaron Kiely	Central Highlands CGA	Sep-18	Jun-19
Grassroots Grant: Development tour for Northern Australian cotton	CGA1905	Andrew Phillip	NT Farmers Association	Nov-18	Mar-19
Grassroots Grant: Improving drought resilience	CGA1907	Bernie Bierhoff	Walgett CGA	Jan-19	Jul-19
Grassroots Grant: Improving skills and capacity of Darling Downs growers	CGA1810	Adam McVeigh	Darling Downs CGA	Feb-18	Nov-18
Grassroots Grant: Improving skills and capacity of Darling Downs Growers	CGA1908	Georgie Krieg	Darling Downs CGA	Feb-19	Jun-19
Grassroots Grant: Macintyre Valley weather station network and upgrades	CGA1809	Cate Wild	MacIntyre Valley CGA	Dec-17	Jun-19
Grassroots Grant: On-farm evaluation of the Internet of Things technologies	CGA1910	Amanda Thomas	Macquarie CGA	Jan-19	Jun-19
Grassroots Grants: Field assessment of the impact of late-season thrip infestations	CGA1902	Lou Gall	Gwydir Valley CGA	Oct-18	May-20
Nuffield Australia Farming Scholarship 2019	CRDC1901	Renee Anderson	Nuffield	Apr-18	Sep-20
Peter Cullen Trust: Science to Policy Leadership Program 2018	PCT1901	Glen Smith	Peter Cullen Trust	Sep-18	Nov-18
Thresholds for resilience in regional communities	UM1902	Ruth Nettle	UM	Sep-18	Jul-20
3.2.2 Increased opportunities for strategic foresight					
2018–19 Grower RD&E Advisory Panels: Capacity building	CA1902	Sally Ceeney	Cotton Australia	Jul-18	Jun-19
2018–19 Grower RD&E Advisory Panels: R&D consultation	CA1903	Sally Ceeney	Cotton Australia	Jul-18	Jun-19
BoardEffect governance platform hosting 2018–19	CRDC1949	Sally Ceeney	CRDC	Jul-18	Jun-19
GOAL 3 TOTAL: $1.1 MILLION					

GOAL 4 (ENABLING STRATEGY 1): STRENGTHENING PARTNERSHIPS AND ADOPTION

Project title	Project code	Researcher	Organisation	Start date	Cease date
4.1. Partnerships and collaboration					
4.1.2 CottonInfo partnership is maintained and practice change improved					
Benchmarking water-use efficiency and crop productivity in the Australian cotton industry	DAN1505	David Perovic	NSW DPI	Jul-14	Jun-19
Bt and Insecticide Stewardship Technical Lead	SC1901	Sally Ceeney	Consultant	Jul-18	Oct-18
Climate and energy for cotton-farming businesses (including CottonInfo technical lead and *my*BMP project lead)	AE1801	Jon Welsh	AgEcon	Jul-17	Jun-20
Communicating cotton best production practices with video	DAQ1901	Tonia Grundy	QDAF	Jul-18	Jun-21
Cotton industry database management	CRDC1804	Lee Armson	Making Data Easy Pty Ltd	Jul-17	Jun-20
CottonInfo irrigation field days	CSD1901	Kieran O'Keeffe	CSD	Dec-18	May-20
CottonInfo NRM Technical Lead and extension campaigns (including *my*BMP module lead)	CRDC1805	Stacey Vogel	Consultant	Jul-17	Jun-20
CottonInfo Technical Lead – Nutrition (includes *my*BMP module lead)	DAN1906	Jon Baird	NSW DPI	Jan-19	Jun-21
CottonInfo: Monitoring and evaluation support system	CRDC1818	Jeff Coutts	Consultant	Jul-17	Jun-19
CottonInfo: Science communication training	CRDC1938	Jennifer Metcalfe	Econnect	Mar-19	Mar-19
CottonInfo: Scoping study – accounting for climate variability in Australian cotton production data	CSD1903	Jon Welsh	CSD	Jun-19	Jun-19
CottonInfo: Spray Drift Forums – St George, Mungindi, Mallawa and Ashley	CSD1902	Andrew McKay	CSD	25/03/19	25/04/19
Extension coaching and external review for CottonInfo	CRDC1946	Sean Kenny	Rural Consulting Group	Jun-19	Jun-20
Grassroots Grant: Assessing black root rot treatments in the Lachlan and Murrumbidgee valleys	CGA1904	John Durham	Southern Valley CGA	Nov-18	Aug-19
National biosecurity and disease extension and coordination, and CQ regional extension (including CottonInfo technical lead and *my*BMP module lead)	DAQ1801	Sharna Holman	QDAF	Jul-17	Jun-20
Proofreading *Cotton Pest Management Guide 2018*	CRDC1905	Helen Dugdale	Helen Wheels HR	Jul-18	Jul-18
4.1.3 Partnerships are strengthened to engage multi-disciplinary and multi-institutional resources					
2019 ICAC Plenary Meeting: Conference Venue	ICAC1903	Kate Nicols	Sofitel Brisbane	Oct-18	Dec-19
2019 ICAC Plenary Meeting: Event Management	ICAC1901	Jann George	By George Consulting Pty Ltd	Oct-18	Dec-19
2019 ICAC Plenary Meeting: Supporting activities	ICAC1902	Jann George	By George Consulting Pty Ltd	Oct-18	Dec-19
2019 ICAC Plenary Meeting: Welcome reception venue and catering	ICAC1904	Jann George	QAGOMA	May-19	Dec-19
AgVet collaborative forum, plant industries Phase 3	RIRDC1701	Jennifer Medway	AgriFutures	Jul-16	Dec-19
Climate Research Strategy for Primary Industries (CRSPI) 2017–2020	CCR1801	Anwen Lovett	CRSPI	Jul-17	Jun-20
Co-Investment in PIEFA membership for the cotton industry 2018–19	CRDC1947	Ben Stockwin	PIEFA	Jul-18	Jun-19

Extension for impact in the Agricultural RD&E system	CRDC1926	Vivienne McCollum	AGKServices	Oct-18	Nov-18
PBRI Plant Biosecurity Research Symposium 2019	HIA1901	Jo Luck	HIA	Nov-18	Aug-19
Phase 2: $100bn growth strategy	RIRDC1902	Jennifer Medway	AgriFutures	Nov-18	Jun-19
Sponsorship: 10th Australasian Soilborne Disease Symposium 2018 – Adelaide	CSE1901	Gupta Vadakattu	CSIRO	Jul-18	Sep-18
Sponsorship: APEN Conference 2019	CRDC1933	Graham Harris	APEN	Nov-18	Sep-19
Travel: 10th Australasian Soilborne Diseases Symposium (ASDS)	CRDC1916	Todd Peach	CRDC	Aug-18	Sep-18
Travel: 10th Australasian Soilborne Diseases Symposium (ASDS), attend	CRDC1914	Brendan Warnock	CRDC	Aug-18	Sep-18
Travel: FUSCOM 2018 & 10th Australasian Soilborne Diseases Symposium (ASDS), present	CRDC1917	Shelby Young	Texas Tech	Aug-18	Sep-18
WeedSmart Phase 4	UWA1801	Lisa Mayer	UWA	Jul-17	Jun-20
4.2 Best practice (*my*BMP)					
4.2.1 Best practice is based on science and measured impact					
Boyce cotton comparative analysis	BCA1901	Simon Sellars	BCA	Jul-18	Jun-19
*my*BMP Human Resources and Work Health Safety Review	CRDC1921	Sonja O'Meara	AG HR	Sep-18	Feb-19
Review of *my*BMP database: Caspio set up	CA1807	Rick Kowitz	Cotton Australia	Jun-18	Mar-20
Review of *my*BMP database: Phase 2	CRDC1830	Mel Ziarno	Consultant	Jun-18	Mar-20
4.3 Innovation and commercialisation					
4.3.1 Improved R&D innovation and commercialisation					
Assess patentability of Smarter Irrigation IP	USQ1901	Erin Rayment	USQ	Oct-18	Nov-18
Biomass processing exploitation plans	CRDC1931	Dallas Gibb	TechMAC	Jul-18	Jun-19
Commercial Plan for spray hazard towers network due diligence	CRDC1934	Dallas Gibb	TechMAC	Nov-18	May-19
Commercialisation management tasks	CRDC1941	Jarrod Ward	Ahurei Pty Ltd	Apr-19	Jun-19
Deakin Uni exploitation plans	CRDC1932	Dallas Gibb	TechMAC	Jul-18	Jun-19
IP management and reviews	CRDC1929	Dallas Gibb	TechMAC	Jul-18	Jun-19
Smarter Irrigation exploitation plans	CRDC1930	Dallas Gibb	TechMAC	Jul-18	Jun-19
Sponsorship: Joint RDC representation at evokeAG Conference	RDC1901	Tim Lester	CRRDC Secretariat	Oct-18	Feb-19
GOAL 4 TOTAL: $1.8 MILLION					

GOAL 5 (ENABLING STRATEGY 2): DRIVING RD&E IMPACT

Project title	Project code	Researcher	Organisation	Start date	Cease date
5.1 Impact and effectiveness					
5.1.2 CRDC monitors and evaluates RD&E impact					
Annual consultant qualitative and quantitative surveys	CCA1901	Fiona Anderson	CCA	Mar-18	Dec-20
Communications support projects	CRDC1744	Bernadette Pilling	House of Communications	Jun-17	Jun-19
CRDC Cotton Grower Survey	CRDC1733	Michael Sparks	Intuitive Solutions	Mar-17	Dec-19
Edit and proofread the CRDC monitoring and evaluation framework	CRDC1908	Carolyn Martin	Carolyn Martin	Jul-18	Aug-18
Graphic design services: CRDC monitoring and evaluation framework	CRDC1922	Kristy Fielder	Black Canvas	Sep-18	Oct-18
Longitudinal assessment of the cotton industry's People investments	CRDC1710	Jennifer Moffatt	Consultant	Jul-16	Dec-18
Measuring and reporting the value of capacity building on farms and in research	CRDC1701	Gordon Stone	QualData	Jul-16	Jun-19
Proofreading *Australian Cotton Production Manual 2019*	CRDC1936	Helen Dugdale	Helen Wheels HR	Apr-19	Apr-19
Reinventing Australian agricultural statistics	AFI1802	Mick Keogh	AFI Ltd	Apr-18	Nov-18
Risk management in Australian agriculture	AFI1803	Mick Keogh	AFI Ltd	Apr-18	Nov-18
Summaries of CRDC Research	CRDC1945	Bernadette Pilling	House of Communications	Jun-19	Sep-19
5.1.4 Growers, the cotton industry and government are informed and aware of RD&E outcomes					
Final report summaries and M&E database	CRDC1920	Sally Knight	Consultant	Jul-18	Jun-19
GOAL 5 TOTAL: $0.5 MILLION					

TOTAL INVESTMENT IN RD&E: $19.8 million

Appendix 4: Glossary and Acronyms

Term	Description
AACS	Association of Australian Cotton Scientists
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACRI	Australian Cotton Research Institute
AFI	Australian Farm Institute
AgriFutures	AgriFutures Australia Ltd
AGWA	Australian Grape and Wine Authority
ANTSO	Australia's Nuclear Science and Technology Organisation
ANU	Australian National University
APEN	Australasia-Pacific Extension Network
APVMA	Australian Pesticides and Veterinary Medicines Authority
ARLF	Australian Rural Leadership Foundation
ARLP	Australian Rural Leadership Program
BCA	Boyce Chartered Accountants
BMP	Best Management Practices program
Bollgard 3®	Cotton varieties contain three genes resistant to *Helicoverpa* spp.
Bollgard II®	Cotton varieties contain two genes resistant to *Helicoverpa* spp.
Bt	*Bacillus thuringiensis* (crystal protein gene expressed in Bollgard II® and Bollgard 3® cotton varieties, resistant to *Helicoverpa* spp.)
CA	Cotton Australia
CCA	Crop Consultants Australia Inc.
CGA	Cotton Grower Association
CHDC	Central Highlands Development Corporation
CMSE	CSIRO Materials Science and Engineering
CottonInfo team	Team of regional extension officers, technical leads 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
CRDC	Cotton Research and Development Corporation
CRRDC	Council of Rural Research and Development Corporations
CRSPI	Climate Research Strategy for Primary Industries
CSD	Cotton Seed Distributors Ltd (a grower-owned cooperative)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCRA	Dryland Cotton Research Association
DSITI	Department of Science, Information Technology and Innovation (Queensland)
DU	Deakin University

GM	Genetically Modified
GRDC	Grains Research and Development Corporation
GU	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
IDM	Integrated Disease Management
IP	Intellectual Property
IPM	Integrated Pest Management
IREC	Irrigation Research and Extension Committee
IRMS	Insecticide Resistance Management Strategy
IWM	Integrated Weed Management
KPI	Key Performance Indicator (measure of success)
M&E	Monitoring and Evaluation
MDB	Murray-Darling Basin
ML	megalitre
MLA	Meat and Livestock Australia
MP	Member of Parliament
MRES	Micro Meteorology Research and Education Services
NCSU	North Carolina State University
NFF	National Farmers' Federation
NPIRDEF	National Primary Industries RD&E Framework
NRM	Natural Resource Management
NSW DPI	NSW Department of Primary Industries
NTDPIF	Northern Territory Department of Primary Industry and Fisheries
PBS	Portfolio Budget Statements
PGPA Act	*Public Governance, Performance and Accountability Act 2013*
PHA	Plant Health Australia
PhD	Doctor of Philosophy
PIEFA	Primary Industries Education Foundation Australia
PIRD Act	*Primary Industries Research and Development Act 1989*
Postdoc	Post-Doctorate
PYIA	Picture You in Agriculture
QAAFI	Queensland Alliance for Agricultural and Food Innovation
QAGOMA	Queensland Art Gallery and Gallery of Modern Art
QDAF	Queensland Department of Agriculture and Fisheries
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
RMP	Resistance Management Plan
RRDP grants	Rural R&D for Profit grants
SAC	Sustainable Apparel Coalition
spp.	species
TIMS	Transgenic and Insect Management Strategy Committee
UC	University of Canberra
UM	University of Melbourne
UNE	University of New England
UNSW	University of New South Wales
UQ	University of Queensland
USC	University of the Sunshine Coast
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
WHS	Work Health and Safety

Appendix 5: Annual reporting requirements

The following table details the contents of the CRDC Annual Report and the associated requirements under the PIRD Act, the PGPA Act and the CRDC Funding Agreement.

Annual Report item	PIRD Act	PGPA Act	Funding Agreement
SECTION 1: EXECUTIVE SUMMARY			
About CRDC	S28(a)(vii)	s17BE (k) & (l) (and s17BE (s))	
Report from Chair & ED	s28(a)(iii)	s17BE (p)	
Progress against Strategic RD&E Plan 2018–23: our Annual Performance Statement	s28(a)(i) s28(a)(iii) s28(a)(iib) s28(b)	s39(1) (b) s17BE (a) & (b) s17BE (g)	Clause 11.10(a) Clause 11.10(g) Clause 11.10(h)
2018-19 investment & impact		s39(1)(b) s17BE (g)	Clause 11.10(h)
Year in review: RD&E achievements	s28(a)(iv)	s39(1)(b) s17BE (g)	Clause 11.10(a) Clause 11.10(g) Clause 11.10(h)
Letter of transmittal		s17BB	
SECTION 2: CRDC BUSINESS			
CRDC role	S28(a)(vii)	s17BE (k) & (l) (and s17BE (s))	
CRDC operations		s17BE (n) & (o)	
Setting the research priorities	s28(d)	s17BE (n) & (o)	Clause 11.10(a)
Collaboration & co-investment	s28(a)(iv) s28(a)(vi)	s17BE (n) & (o)	Clause 11.10(d) Clause 11.10(j)
SECTION 3: CORPORATE OPERATIONS			
Business financials	s28(d)		Clause 11.10(f)
Investments in RD&E	s28(d) s28(a)(iib)		Clause 11.10(e) Clause 11.10(b)
Investments against Government priorities	s28(a)(iib)		Clause 11.10(e) Clause 11.10(b)
SECTION 4: RD&E PORTFOLIO			
Investments, innovations & impacts: Goals 1-3, Enabling Strategies 1&2	s28(a)(i)	s39(1)(b)	Clause 11.10(c) Clause 10.2(b)(iii) Clause 11.10(h) s28(a)(i)

SECTION 5: CRDC PEOPLE AND GOVERNANCE			
CRDC Board		s17BB s17BE (j) s17BE (m)	
CRDC employees		s17BE (k) & (l) (and s17BE (s))	
Governance & accountability	s28(a)(iv) s28(a)(v) s28(a)(vi) s28(c)	s17BB s17BE (a), (b), (c), (d), (e)	
Selection Committee report	s141(1A)		
SECTION 6: FINANCIALS			
Independent Auditor's Report		s17BB s43(4) s17BE (r)	
Statement by the Accountable Authority, ED & Finance Officer		s17BB	
Financial statements	s28(a) (viii) s28(d)	s43(4) RMG 138/139 *	
Notes of the financial statements	s28(a) (viii) s28(d)	s43(4)	
SECTION 7: APPENDICES			
Appendix 1: Australian Government priorities	s28(a)(i)	s17BB	Clause 11.10(a) Clause 11.10(g) Clause 11.10(h) Clause 11.10(i)
Appendix 2: Environmental performance			Clause 11.10(a)
Appendix 3: RD&E Portfolio list	s28(a)(i)		
Appendix 4: Glossary & acronyms		s17BD	
Appendix 5: Annual reporting requirements		S46(3) s17BD s17BE (u)	Clause 10.2(b)(iii)

CRDC

www.crdc.com.au