Cotton Catchment Communities

Cooperative Research Centre Limited

Annual Report

2009–2010

Cotton Catchment Communities CRC

COTTON CATCHMENT COMMUNITIES CRC LIMITED

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ACKNOWLEDGEMENTS

Photographs were principally supplied by the Cotton CRC staff, CRC-funded researchers and extension staff. Thank you all.

Edited and designed by Weemalah Writeability
Printed by Union Offset

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CEO'S CERTIFICATION

CEO'S CERTIFICATION

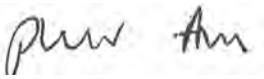
I hereby certify that the information provided to the Department of Innovation, Industry, Science and Research by Cotton Catchment Communities CRC in:

- the CD section of the CRC's 2009–10 Annual Report;
- the CRC's online milestone tables for the 2009–10 financial year;
- the CRC's online financial tables for the 2009–10 financial year;
- the CRC's online 2009–10 Management Data Questionnaire; and
- the four Quarterly Reports provided online for the financial year, submitted on 16 October 2009, 5 February 2010, 3 May 2010 and 16 July 2010, respectively

provides a true and fair view of the matters reported on therein.

I certify that the application of Commonwealth funding and Researcher/Participant Contributions were for the Activities of the CRC as specified in Schedule 1 of the Commonwealth Agreement and that the CRC has met its obligations in relation to the treatment of Intellectual Property. I also certify that the Chairman of the Board meets the requirements of independence set out in the Commonwealth Agreement and that the majority of Board members are not Research Providers.

I am aware that giving false or misleading information is a serious offence.



Philip Armytage

Chief Executive Officer
Cotton Catchment Communities CRC Limited

15 September 2010

EXECUTIVE SUMMARY

David Anthony

CHAIRMAN'S REPORT

Operational Environment

A strong mood of optimism prevails across the Australian cotton industry, with most Queensland water storages already at high levels of capacity following last summer's rain events. Many NSW storages have seen significant inflows through winter, with water allocations for the coming 2010–11 crop probably near the highest they have been since the Cotton Catchment Communities CRC (Cotton CRC) commenced in 2005.

In March 2010 the Australian Cotton Industry Council, which represents all major organisational sectors in the cotton industry from production through research to processing, marketing and shipping, released its strategic plan *Cotton Industry Vision 2029*. The outcomes that the Cotton CRC has been delivering fit very well within the vision and theme of the industry plan which is *'Australian cotton, carefully grown, naturally world's best'.*

Vision 2029 envisions an industry that is differentiated, responsible, tough, successful, respected and capable. The alignment of the Cotton CRC's activities with the plan are significant, and include internationally competitive cotton farming systems (successful); best practice cotton enterprises delivering sustainable ecosystems and reduced impacts on catchments (responsible); mutually beneficial interactions between industry and regional communities (respected and tough); high quality consumer-preferred cotton (differentiated); and increased adoption of new knowledge and enhanced decision-making capability of people working in or with the cotton industry, its catchments and communities (capable).

Strategy

During the year the CRC remodelled the information delivery system to maximise the effectiveness of the conduit between research findings and practice change. The outcome has been a commercially oriented delivery system, ensuring the knowledge created within the industry is packaged into user friendly, outcome focused products.

Public benefit issues have been high on the list of achievements through 2009–10, especially in the catchment and communities programs. In particular, the communities work has gained significant momentum including the release of important socio-economic work: the series of Stubbs reports leading to an overall assessment of the importance of water for a large number of regional communities. The reports added considerable information on how water provides significant jobs at the farm level and, most importantly, through the service and value adding industries in the Murray Darling Basin.

The significant increase in the Community Program has been very pleasing and has vindicated the decisions to commission and seek external collaborations to assist in meeting our agreed milestones. The Cotton CRC team has now built up considerable skills and momentum in this program, which will be of prime importance to regional communities.

Cotton CRC Board

With the Cotton CRC having two years to run, the Board and Management team are focused on the delivery of outcomes and ensuring any new work undertaken will be completed within this time frame.

During the year Barbara Gray was appointed to the Board as a Director to replace the retiring Stuart Higgins. Barbara brings considerable experience to the board, with a background in irrigated cotton farming and expertise in rural skills development and leadership. Stu, meanwhile, continues close linkages to the Cotton CRC through his position as *my*BMP general manager. The Board appreciates Stu's contribution to our organisation.

On internal governance and administration matters, the Cotton CRC has maintained robust procedures and controls in the management of its affairs. Despite the impact of the drought on some participants and contributors, the management team, working closely under the overarching guidance of the Board, has been able to maintain an active program well managed within the budget parameters. The diligence of the Audit Committee, chaired by Kathryn Adams, is to be complimented as is the HR Committee, chaired by John Herbert, which works closely with the CEO to support a competent and committed management team.

Thanks

On behalf of the Board I would like to thank all members of the management team and the program and sub-program leaders and their researchers who, with great commitment to collaboration, contribute so much to the success of this CRC.

We look forward to another successful year in 2010–11, with the promise of favourable weather conditions.

David Anthony
Chair

Philip Armytage

CHIEF EXECUTIVE OFFICER'S REPORT

CRC Overview

As the Cotton CRC moves into its fifth year of operation, we have many great news stories. Our collaborative research has begun to deliver and the CRC's clear focus now is to ensure the subsequent development and delivery of the outcomes in our Commonwealth agreement.

During the last three years the participants of the Cotton CRC have felt the impacts of drought, low commodity prices, the global financial crisis and a public sector research and development expenditure contraction. With the run down of infrastructure and human capital in the wider industry, the pools of skilled and semi skilled workers for all vocations are significantly depleted. This is further exacerbated in the production sector by increasing competition from the mining and extractive industries for regionally based skilled labour. The lack of skilled, experienced people and the desperate need for science-based information adds to the challenge of the Cotton CRC.

Despite these challenges, we are now seeing a major resurgence of the cotton industry, with widespread general rainfall in the last quarter of the 2009–10 year, irrigation water storages filling rapidly and buoyant commodity pricing. Couple this with the introduction of an end-point royalty scheme for biotechnology licence fees and cotton is proving to be a popular crop, not only for the irrigation industry, but also in regions where cotton can be rain grown.

Changes for the future

Given the current issues, as well as the Cotton CRC entering into its final phase of delivery, a major change in the approach to delivering outcomes has been required. Collaborating with Cotton Research Development Corporation (CRDC) and the peak grower body Cotton Australia, the Cotton CRC has led a significant initiative to build a completely new campaign-based development and delivery structure for the industry. This new approach utilises various combinations of new delivery tools including agribusiness, contracted delivery specialists, existing regional generalist extension staff and the recently relaunched best management practices system, *my*BMP. Importantly, the system has been structured to be able to operate after the Cotton CRC ends in June 2012. Implemented by the industry's new General Manager, Best Practice and Research Implementation, Ken Flower, the 2010 Cotton Production Guide, Cotton Pest management Guides and the launch of *my*BMP have been the first campaigns of the new initiative.

Outcomes

As part of delivering the outcomes of the Cotton CRC, extensive economic work has commenced on identifying the impact of the CRC projects and programs. This information is being built into the monitoring and evaluation systems of the delivery programs.

In this last year we have seen significant progress from within The Community program, with peer reviewed social research providing independent information into the very important national discussion on the impacts of water scarcity in the Murray Darling Basin.

While the Cotton CRC is focused on public good outcomes, major benefits are also being seen from projects in the diagnostic, insect control, soil moisture monitoring and ginning areas that have a commercial impact. The development and commercialisation of these emerging technologies is being carefully managed by the Cotton CRC and its commercial partners.

Future direction

Reflecting on the structure of the Cotton CRC, the operating environment since commencement in 2005 has become much more integrated across production, environmental and social issues and there is recognition that independent best practice science has a strong place in government policy development. In some ways this is a vindication of the motives for the initial bid to create the CRC in the first instance. Given these changes to the operating environment, we believe there is a compelling case for applying to extend the operations of the Cotton CRC for a period beyond 2012 to address some of the new exceptional circumstances that have become apparent since commencement. However, in early 2011 the Cotton CRC will commence implementing the early stages of the wind up plan to ensure that there is adequate time, not only for ensuring the organisations contracted outcomes are well delivered, but that the CRCs legacy is effectively managed.

Progressing towards June 2012, the Cotton CRC Company Management Team, supported by the skills of the Board of Directors of the CRC, have been implementing careful new management practices to allow the flexibility to achieve maximum impact of the CRC while still ensuring rigorous corporate governance and financial management.

Thanks

The achievements of the Cotton CRC would simply not be, without the contributions and engagement of the participant organisations and the intelligence, persistence, dedication and generous spirit of collaboration of the research community and its support organisations. I would like to recognise the massive contribution of the Board of the Cotton CRC for their personal support, strategic foresight and the world class skills they add to the organisation. In particular, I would like to note the core management team of the CRC who are a dedicated, highly functional and professional team who effectively make the operations of the CRC seamless.

A great organisation, great people, great achievements and a great season coming.

Philip Armytage
Chief Executive Officer

Cotton CRC Director, Di Bentley, Program Manager, Paula Jones and CEO Philip Armytage on a visit to Alice Springs for the CRCs Association conference

HIGHLIGHTS 2009–10

- The Sustaining Rural Communities Conference – a joint initiative with the Cotton Research and Development Corporation (CRDC) was a huge success, with more then 300 people attending. It explored how rural communities can remain sustainable into the future. As a result of the conference five grants were awarded to attending communities to help kick start change in their community.

Sustaining Rural Communities Conference organiser, Paula Jones, and facilitator, Jo Eady

- Publication of the *Australian Cotton Production Manual 2010* provides a key resource, with advice on how to sustainably and successfully grow high yielding cotton, using either dryland or irrigation means of production.

- The Cotton CRC, in conjunction with I&I NSW and the Namoi CMA, released the *Fishes on Cotton Farms* guide.

- The development of a web-based glyphosate resistance toolkit allows growers to assess their on-farm risk easily and at their convenience. If growers can prevent or delay the onset of glyphosate resistant weeds on their farms, they will continue to derive maximum benefit from glyphosate, with the cost-effectiveness benefits this brings.

- Cotton CRC researchers and extension played a major role in the identification of the exotic species, *Phenacoccus solenopsis*, commonly known as the Solenopsis mealy bug. Mealy bugs are sucking pests, feeding on the plant's sap, and large populations can severely debilitate plants because the bugs compete with the plant for assimilate. CRC scientists helped growers in the Emerald and Burdekin to assess short term options to help manage and contain the mealy bug outbreak in the 2009–10 season.

- Extension of knowledge through the new *Farm Biosecurity Manual for the Cotton Industry* and the major update of the *Cotton Pest Management Guide.*

- Cottonscope, developed by CSIRO, the CRC and CRDC to improve the quality of fibre produced by Australian cotton growers and yarn quality in overseas spinning mills, has now been commercialised. Cottonscope combines two technologies developed by the same R&D partners – SiroMat (which measures fibre maturity) and Cottonscan (which measures fibre fineness) – and automatically measures cotton fineness and maturity, directly and accurately, in about 25 seconds.

- Findings from groundwater research help to define how groundwater levels and salinity vary, both spatially and temporally, within the Namoi Catchment. These findings will be used to further develop strategic monitoring guidelines for use by the Namoi CMA.

- A portable water quality test kit which quickly identifies the presence or absence of herbicides and insecticides in water has been commercialised.

- The Enviro Reader competition attracted 403 entries from 25 schools across six catchments, providing primary school students with basic environmental knowledge of their local areas.

- The first three students graduated from the joint Aboriginal Employment Strategy and Cotton CRC traineeship program.

- 57 storages had been assessed for evaporation and seepage losses from across the cotton industry. Findings show that only a small proportion of storages have seepage losses exceeding five millimetres a day.

- The suite of tools in CottASSIST continues to expand, with the addition of the new *Mite yield loss estimator*, which allows growers or consultants to enter mite census data and access likely yield loss and need for control.

BIG DAY OUT 2010
CREATING A RESILIENT FARMING SYSTEM

Following in the footsteps of the inaugural cotton industry Big Day Out, held at 'Keytah' in 2009, CRDC and Cotton CRC joined forces again in 2010 to present a Big Day Out with the winners of the Innovative Cotton Grower of the year, Jamie and Susie Grant, at their property, 'Kielli', Jimbour Queensland.

The 2010 event was a huge success, with over 130 people attending, including landholders from cotton communities such as St George, Dirranbandi, Dalby, Goondiwindi, Walgett, Narrabri, Moree Wee Waa, Warren, Bourke and Hillston.

The day provided an opportunity for growers to take an up-close look at how the Grant's dryland farming business has evolved over time to drought-proof itself and increase the reliability of annual operating profit.

Jamie spoke in detail about the changes that 'Kielli' has made in order to adapt to the current environment, such as growing millet cover crops to improve fallow efficiency, adopting 153 centimetre (60 inch) row spacing and relying on soil mineralised nitrogen.

The day showcased many topics and speakers, linking research and farm practice on important issues such as managing glyphosate resistance, measuring soil water and making cotton planting decisions, as well as the Great Picker debate – the pros and cons of current module building systems and the new round bale picking technology.

The Big Day Out aims to update past, current and future cotton growers on emerging research and provide growers with the opportunity to get involved in the industry and see the inner workings of a leading farming enterprise first hand.

The Australian cotton industry has a strong history of applying outcomes of research to meet its challenges. The day concluded with a discussion led by growers from across the industry, which captured perceptions on where farming systems research needs to be directed for a sustainable future.

Top: Jamie Grant with some of the enthusiastic participants. *Middle*: inspecting the millet cover crop. *Bottom*: Modules or round bales – the big debate

AWARDS

Jose Payero
DEEDI

Best Honourable Mention Paper Award presented at The World Environment and Water Resources Congress in Rhode Island, May 2010

Jose's paper was entitled, *Variability Analyses of Alfalfa-Reference t Grass Reference Evapotranspiration Rations in Growing and Dormant Seasons.*

Habibullah Bahar
UNE

Awarded the Keith and Dorothy Mackay Travelling scholarship to attend and present articles at two conferences:

- Entomological Society of Manitoba and Canada Annual Conference, Winnipeg, Canada, October 2009
- Tropentag, Hamburg, Germany, October 2009

Willem Vervoort and Dawit Berhane
University of Sydney

Awarded first prize in the category of academic merit at the Centenary Research Symposium, Sydney, June 2010

Robert Mensah
I&I NSW

Finalist, Cotton Industry Researcher of the Year

Nilantha Hulugalle
I&I NSW

Finalist, Cotton Industry Researcher of the Year

Trudy Staines
Cotton CRC

Certificate of appreciation from Wee Waa High School for Contribution to Education at Wee Waa high School

Certificate of recognition from NSW Education & Training for invaluable support of school science and environmental education programs and excursions.

CSD ACGRA RESEARCHER OF THE YEAR AWARD

Michael Bange
CSIRO Plant Industry

Dr Michael Bange's career in cotton research spans over 12 years and has led to his current role of Research Scientist with CSIRO and the Cotton CRC.

His studies have included agronomy, decision support systems for the Australian cotton industry, crop physiology, cotton cropping systems and crop modelling for Northern Australia.

His research has provided numerous positive outcomes for the Australian cotton industry, and has greatly improved knowledge across many facets of cotton growing. He is currently exploring and implementing methods to improve the cotton industry's access to climate information, and is instigating a program that will help improve understanding and integration of the impacts of environment and crop management on fibre quality. Michael has also undertaken research into plant population and sowing time effects on Bollgard II® cotton.

Over the years Michael has mentored many young researchers and industry personnel. His overall expertise in cropping systems research was acknowledged in 2004 when he was awarded with a distinguished Fulbright Scholarship.

Mike's continuing work on the CSIRO OZCOT crop development model and CottASSIST has been highly beneficial to the industry.

CONTEXT AND MAJOR DEVELOPMENTS

COTTON CRC SCIENCE FORUM AWARDS

CRC Collaboration/Corporate Citizens

Trudy Staines
Cotton CRC

For facilitating collaboration between diverse contributors to achieve outcomes in school education

John Stanley
UNE

For facilitating collaboration between diverse contributors to achieve outcomes in university education

Lewis Wilson
CSIRO

For exceptional contributions to the management of the CRC, and for outstanding achievements in research and extension

Science and Innovation

Graham Charles
I&I NSW

Long term achievements in developing weed thresholds and management strategies

Impact on Adoption

Susan Maas
DEEDI

Sally Ceeney
I&I NSW

Dedication and persistence in servicing on-ground industry needs

Best Researcher Paper

Richard Sequeira
DEEDI

For Sequeira, RV & Naranjo, SE (2008) 'Sampling and management of *Bemisia tabaci* (Genn.) biotype B in Australian cotton.' Published in *Crop Protection* 27, 1262–1268

Best Student Presentations

James Herewerd
University of Queensland

For his presentation on 'Movement, geneflow, host-plant interactions and species limits of green mirid, *Creontiades dilutus*'

Anna Greve
University of NSW

For her presentation, 'Monitoring soil moisture changes and deep drainage with 3D resistivity tomography'

Chris Anderson
I&I NSW

For his presentation, 'Diversity of *Rhizochtonia* associated with cotton in NSW'

INDUSTRY CONTEXT

The Cotton CRC provides research, extension and education activities that benefit the Australian cotton industry and the catchments and communities in which cotton is grown.

Australia's cotton is recognised internationally for its excellent quality and production, in line with Best Management Practices; consequently, it is in high demand and commands a premium in world markets.

The Australian Cotton industry saw the area allocated to cotton increase in the 2009–10 season, with 182,000 hectares being planted compared to only 146, 000 hectares planted in 2008–09 .

Looking toward to the upcoming season, cotton is going from strength to strength, with many storages full as a result of favourable winter rains. The planted area for 2010–11 is estimated at 400,000 hectares, which includes 120,000 hectares of dryland cotton.

OPERATIONAL RISKS AND IMPEDIMENTS

Although the past season was the largest the cotton industry has seen in many years the economic impacts of the drought has affected funding from some of the affiliates and participants of the Cotton CRC, who are directly reliant on production. This is particularly the case with the Cotton CRC's largest participant, CRDC, so the company management team and Boards of the Cotton CRC and CRDC are working together closely to manage ongoing funding of existing projects and commissioning of any new research.

KEY STAFF APPOINTMENTS

Jane Macfarlane joined the Cotton CRC to take over the management of the Catchment Program. Jane most recently came from the Namoi Catchment Management Authority and Cotton CRC partnership, where she worked with growers to improve the management of natural resources on Namoi cotton farms. Prior to this, Jane worked for over ten years with the NSW Government on natural resource management, policy and planning. Jane has a keen understanding of the need of the end users of the Catchment Program research to improve decision making and sustainable management of natural resources.

Peter Verwey started work with the Cotton CRC in mid November 2009 as the new Cotton Catchment Officer, a position jointly funded by the Namoi CMA and Cotton CRC. Peter will work with Namoi cotton growers to develop and deliver the resources that growers require to successfully implement natural resource management activities. This will include working closely with the grower associations, developing property plans, assisting with monitoring groundwater quality, and to provide technical advice in natural resource management and the industry best practices through face to face meetings and grower workshops. The position will work as a means of communicating the research outcomes of the Cotton CRC to the grower community and also to help growers partner with the CMA through their Incentive Programs.

Ken Flower has been appointed the new General Manager of Best Practice and Research Implementation for the Cotton CRC, CRDC and Cotton Australia. This is a new position which aims to align and deliver these organisations research and extension goals. Ken's appointment will ensure continuing progress in the adoption of the Cotton CRC's research across all five program areas as well as implementing aspects of CRDC and Cotton Australia's strategic plans

MAJOR DEVELOPMENTS

In conjunction with key industry bodies the Cotton CRC, Cotton Research & Development Corporation and Cotton Australia remodelled the information delivery structure to maximise the effectiveness of the conduit between the research work findings and practice change. The outcome is a commercially oriented delivery system with a Development and Delivery Team, funded collaboratively by the three key organisations to ensuring the knowledge created exceeds the life of the current CRC.

AUSTRALIAN COTTON GROWING REGIONS

The major production areas in NSW stretch south from the Macintyre River on the Queensland border and encompass the Gwydir, Namoi and Macquarie valleys in the north, stretching along the Barwon and Darling Rivers in the west and the Lachlan and Murrumbidgee rivers in the south.

In Queensland, cotton is grown mostly in the south – the Darling Downs, St George, Dirranbandi and Macintyre Valley regions – with the remainder grown near Emerald, Theodore and Biloela in Central Queensland and the Burdekin in north Queensland.

NATIONAL RESEARCH PRIORITIES

AUSTRALIAN GOVERNMENT NATIONAL RESEARCH PRIORITIES

National Research Priorities and CRC research	
National Research Priority	CRC Research (%)*
AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies	
Water – a critical resource	15
Overcoming soil loss, salinity and acidity	5
Sustainable use of Australia's biodiversity	8
Responding to climate change and variability	5
PROMOTING AND MAINTAINING GOOD HEALTH Promoting good health and preventing disease, particularly among young and older Australians	
Strengthening Australia's social and economic fabric	5
FRONTIER TECHNOLOGIES FOR BUILDING AND TRANSFORMING AUSTRALIAN INDUSTRIES Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research	
Frontier technologies	10
Smart information use	5
Promoting an innovation culture and economy	5
SAFEGUARDING AUSTRALIA Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems	
Protecting Australia from invasive diseases and pests	20

*Note: These percentages do not add up to 100 per cent as not all Cotton Catchment Communities CRC research is directly related to the National Research Priorities.

OUR PARTNERS

About our partners

The Cotton Catchment Communities CRC Limited is a registered company formed through the collaboration of private sector, federal and state government agencies, industry associations and universities. The Cotton CRC has entered into a formal agreement with the Commonwealth Government that outlines the agreed milestones to be achieved over a seven year term. The Commonwealth provides a certain level of funding each year to assist in the undertaking of the agreed activities. The Commonwealth Agreement also identifies the contributions (including cash and in-kind) that will be made by the Cotton CRC participants.

The Cotton CRC's partners have committed significant funding, resources and research expertise to the Cotton CRC's research, education and extension agenda.

Cotton Australia

Cotton Australia is the peak body for Australia's cotton growing industry, servicing growers in NSW and Queensland. Just prior to the reporting year, Cotton Australia merged with the Australian Cotton Grower's Research Association (ACGRA), which was formerly a partner of the CRC. Cotton Australia is now legislated representative organisation in the cotton industry to the Cotton Research and Development Corporation (CRDC). In this role, Cotton Australia advises both the Cotton CRC and CRDC on cotton grower priorities in research, development and extension areas, and lobbies research issues on behalf of cotton growers. Cotton Australia participates directly in two projects of the Cotton CRC but advises on many more.

The Cotton CRC works with Cotton Australia to develop and implement the industry's Best Management Practices (BMP) program, which is industry's commitment to the world's best practice in cotton production. BMP is a voluntary farm management system that provides self assessment mechanisms, practical tools and auditing processes to ensure that cotton is produced with best practice across a range of focus areas.

CRDC

Australian Government
Cotton Research and Development Corporation

The Cotton Research and Development Corporation (CRDC) is a partnership between the Australian cotton industry and the Australian people, through the Australian Government. CRDC, aided by the advice of Cotton Australia, invests in and manages a portfolio of research, development and extension projects that seek to enhance the ecological, social and economic values associated with cotton production systems. CRDC is a significant investor in, and the largest commercial partner of, the Cotton CRC, currently investing in 45 research and adoption projects across all programs except The Community.

Cotton Seed Distributors

Cotton Seed Distributors (CSD) is the industry's largest supplier of cottonseed, from improved varieties bred in Australia. CSD works closely with CSIRO Division of Plant Industry to have available the best possible varietal performance in conventional material and the transgenic market, combining the attributes of the conventional varieties with the best possible biotechnology performance.

CSIRO

CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is Australia's national science agency. CSIRO brings expertise and infrastructure through its Plant Industry (PI), Entomology, Materials Science and Engineering (MSE), Land & Water, and Sustainable Ecosystems divisions. CSIRO researchers are involved in 22 research projects across all research programs of the Cotton CRC.

The University of Sydney

The University of Sydney

The University of Sydney, founded in 1850, has an international reputation for outstanding teaching and research excellence. Based in Sydney the University has ten different campuses spread throughout the heart of the CBD. The Cotton CRC works closely with the Faculty of Agriculture through 13 collaborative projects.

The University of New England

une
University of New England

The University of New England (UNE) is one of Australia's leading regional universities, and a major provider of distance education, serving over 17,000 students globally. Based in Armidale, NSW, UNE is the closest university to major cotton growing regions. UNE researchers and students are involved in 19 research projects across all research programs. The Cotton CRC Cotton Production Course is facilitated by UNE.

University of New South Wales

The University of New South Wakes (UNSW) was established in 1949. It has expanded rapidly and now has close to 40,000 students. The University offers more than 300 undergraduate and 600 postgraduate programs. The Cotton CRC works with the School of Biological, Earth and Environmental Science and the UNSW Water Research Laboratory. UNSW researchers are involved in four projects with the Cotton CRC, primarily in The Catchment program.

University of Technology Sydney

The University of Technology Sydney (UTS) is a dynamic and cosmopolitan university that marks the gateway to Sydney. The Cotton CRC currently has two research projects with UTS, both within The Catchment program.

Industry & Investment NSW

NSW I&I incorporates the former Department of Primary Industries and acts in partnership with industry and other public sector organisations to foster profitable and sustainable development of primary industries in New South Wales. With a staff of 3500 based at over 130 locations across the state, the department delivers a wide range of services to primary industries and rural communities.

The partnership between the Cotton CRC and NSW I&I is crucial, as it provides the support need to extend research and promote adoption within the Australian cotton industry. The Cotton CRC is headquartered at the Australian Cotton Research Institute at Myall Vale, near Narrabri, which is operated by NSW I&I. Staff from I&I NSW are currently involved in 12 research and adoption projects within the Cotton CRC.

Queensland Department of Employment, Economic Development and Innovation

The new Queensland Department of Employment, Economic Development and Innovation (DEEDI) includes the former Department of Primary Industries and Fisheries. It promotes profitable primary industries for Queensland by providing expertise and support to assist Queensland's food and fibre industries to increase productivity, improve sustainability, grow markets and adapt to change. The partnership with the Cotton CRC is crucial, as it provides the support needed to extend research and promote adoption within the Australian cotton industry. Staff from DEEDI are involved in 11 research projects with the Cotton CRC, in The Farm and The Adoption programs.

Western Australian Department of Agriculture and Food

WA DAF assists Western Australia's agriculture, food and fibre sectors to be sustainable and profitable, with a clear focus on export-led growth. The Department enhances the international competitiveness of the state's agribusiness by working with them to meet the increasingly demanding standards for safety and quality of food and fibre products produced in a sustainable way. The Cotton CRC currently has one project with staff of WA DAF, centred on the Ord River region of Western Australia.

GOVERNANCE AND MANAGEMENT

OUR CRC

Our structure

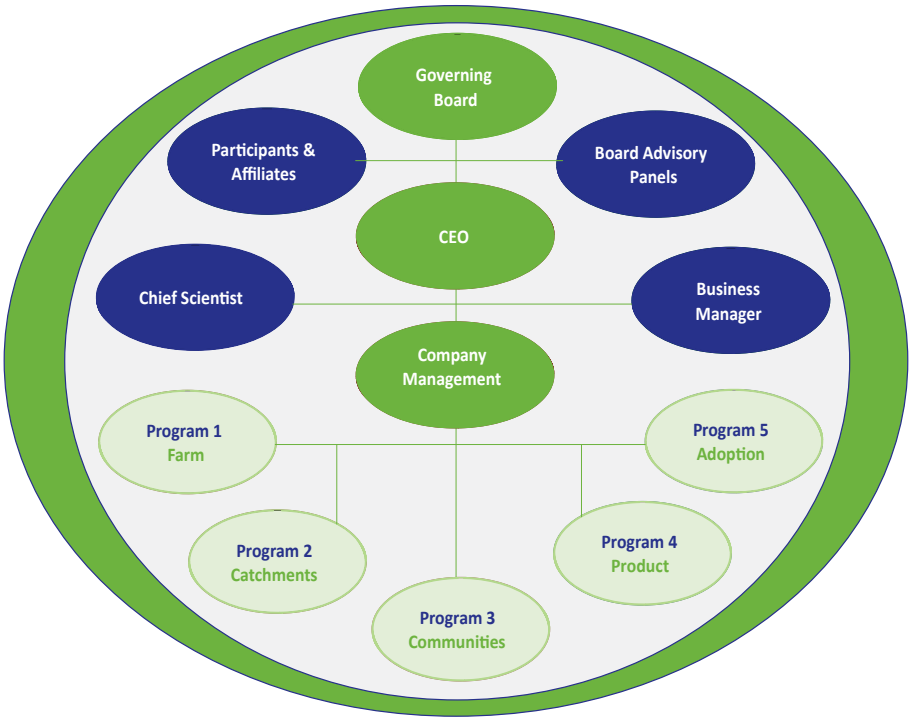
The Cotton Catchment Communities CRC (Cotton CRC) is an incorporated company limited by guarantee. It is subject to Corporations law and has an independent, skills-based Board and an independent Chair.

The Cotton CRC has eleven core participants and 36 affiliate partners. These participants give the Cotton CRC a local, as well as a national, focus. The partnerships, which include R&D providers, industry, universities, catchment and community organisations enhance the Cotton CRC's ability to deliver outcomes to a wide range of end-users across Australia.

Cotton CRC Company Management Team

The Company Management Team supports and advises the board on operational issues relating to research, commercialisation, communication, and education and training. The Company Management Team (CMT) is comprised of the CEO, Chief Scientist, Business Manager and Program Managers. The CMT meets monthly to deal with arising issues and the day-to-day decisions of the Cotton CRC.

Cotton CRC Management Structure



Members of the CMT 2009–10

Name	Position
Philip Armytage	CEO and CMT Chair
Peter Gregg	Chief Scientist
Kym Orman	Business Manager
Belinda Graham	Accountant
Paula Jones	Community Program Leader
Yvette Cunningham	Adoption Program Leader
Lewis Wilson	Farm Program Leader
Graham Harris	Farm Program Leader
Dallas Gibb	Product Program Leader
Lynda George	Project Management Officer

Directors' attendance at meetings

	Directors' Meeting		Audit Committee		HR Committee	
Director	No. eligible to attend	Number attended	No. eligible to attend	Number attended	No. eligible to attend	Number attended
David Anthony	5	5			4	4
John Herbert	5	5			4	4
Barbara Grey	4	4			3	3
Gary Fitt	5	5				
Kathryn Adams	5	5	3	3		
David Hamilton	5	5	3	3		
Diane Bentley	5	5			4	4
Robert Dugdale	5	5	3	3		

The Cotton CRC Board

The Governing Board sets policy and strategic directions for the Cotton CRC and monitors overall performance, acting in the best interests of the Company (the Cotton Catchment Communities CRC Limited). The Board is responsible for optimising the Company's agreed outputs and outcomes and for maintaining the operating values and principles set by the members

The shareholders appoint eight directors to the Cotton CRC Board. The Board represents a range of expertise, including research and development management, commercialisation and IP management, education and training, finance and business management, cotton growing, cotton marketing, catchment and communities interest, natural resource management and corporate governance.

There was one change to the Board during 2009–10: Barbara Gray, a cotton grower from Mungindi, NSW replaced Stuart Higgins, who resigned in May 2009.

Our Board meet five times during 2009–2010 (August and October, 2009 and February, June 2nd and June 10th, 2010).

Board Committees

Audit and Governance Committee

Kathryn Adams *Chair*
Kym Orman
David Hamilton
Robert Dugdale
Des Boucher *Independent Non-Board member*

The Finance and Audit Committee is responsible reviewing the integrity of the Company's financial reporting and overseeing the independence of the external auditors, ensuring that best practice governance standards are identified and recommended. . It consists of a chair who is independent and not the chair of the board and has three members, none of whom are executive management. The Finance and Audit Committee met three times in 2009–2010.

Human Resource Committee

John Herbert *Chair*
Barbara Grey
Dianne Bentley
David Anthony

The Human Resources Committee is responsible for making recommendations for the selection and maintenance of appropriate personnel, entitlements and working environments, in order to achieve Cotton CRC goals. The committee consist of four members. The HR Committee met four times in 2009–10.

Centre Forum

The Board receives strategic input and advice from the Centre Forum, which comprises all partners and associated affiliates. This is a very important activity for communication and dialogue on key aspects of the Cotton CRC's progress, activities, commercialisation and other key issues identified by the members, partners and Board.

Board Members

Mr David Anthony *Chair*
B.Sc. Agr. GAICD

David Anthony has 33 years background of science in agriculture. In the past, he was Vice Chairman of the Australian Cotton Growers Research Association for 15 years, Treasurer of Cotton Seed Distributors Limited for nine years, a Director of Cargill Australia for seven years and Director/ Vice Chairman of the Cotton Research and Development Corporation for nine years. Currently, David is the Managing Director of Auscott Limited and Chairman of the Cotton Catchment Communities CRC since its inception. He is a member of the Cotton CRC Human Resources Committee.

Mr John Herbert *Deputy Chair*
FAICD FAIM

John Herbert has had a lifetime experience in agribusiness at CEO and Director level. This has included significant experience in research management and commercialisation in the private and public sectors. He has a strong interest in and a practical approach to effective corporate governance. John has served on the Board of RIRDC and Golden Casket Lottery Corporation and as Chair of the Rice CRC and the CRC for Tropical Plant Protection. In addition to his role on the Cotton CRC Board he is Chair of the Right Mind Pty Ltd. He is Chairperson of the Cotton CRC Human Resources Sub-Committee.

Ms Kathryn Adams
B.Sc. Agr (Hons), M.Env Stud, M.Bus, LLM, FAICD

Kathryn Adams is a Senior Research Fellow with the Australian Centre for Intellectual Property in Agriculture at Griffith University. She has served on several Research and Development Corporation Boards, including the Cotton Research and Development Corporation, and has held a range of senior executive positions. Kathryn's expertise encompasses intellectual

property, corporate governance, R&D investment, business development and environmental management. She is Chairperson of the Finance and Audit Committee.

Ms Diane Bentley
B.Sc.Agr., GAICD

Diane Bentley has extensive expertise and interest in sustainability issues in relation to agriculture and natural resource management, policy development and research and development investment. She is Assistant Commissioner of the Natural Resources Commission of NSW, a Director of Land and Water Australia, Deputy Chair of the Grains Research and Development Corporation Northern Panel and a Member of the CB Alexander Foundation. Diane is Chair of the Cotton CRC Catchment and Communities Specialist Advisory Panel and a member of the Human Resources Committee.

Mr Robert Dugdale
DipApSci(Ag), GAICD

Robert Dugdale has 30 years experience in Research, Sales, Marketing and Management within companies such as Shell Australia Limited and AgrEvo Limited. Currently the CEO of Cotton Growers Services Limited, a member of the Australian Cotton Industry Council and The Cotton Agricultural Products Association. Formerly a Director of Cotton Communications Limited. Special interests include marketing, commercialisation and strategy implementation. Rob is a member of the Cotton CRC Audit Committee.

Dr Gary Fitt
BSc (Hons), PhD, ATSE, AICD

Dr Gary Fitt has extensive experience in the science agricultural sector. Prior to his appointment as Senior Principal Research Scientist and Deputy Chief, CSIRO Entomology, he was the Strategy Director of CSIRO Entomology, Chief Executive Officer for the Australian Cotton CRC and a Program Leader Cotton, CSIRO Plant Industry. Gary is a fellow of the Royal Entomological Society of London, Australian Entomological Society, British Ecological Society and the Academy of Technological Sciences and Engineering. Gary is Chairperson of the Cotton CRC Science and Education Specialist Advisory Panel.

Ms Barbara Grey
GAICD

Barb Grey is an irrigation cotton farmer from Mungindi, south west Qld. She is Chair of Wincott, a member of the Rural Skills, Training and Labour Strategy Industry Advisory Group, on the Australian Cotton Conference Committee and the cotton Industry Awards Taskforce.

Barb is a graduate of the Australian Rural Leadership Program and the Australian Institute of Company Directors. She also has an Advanced Diploma of Business and is currently enrolled in an external MBA program with the International Graduate School of Business, the University of South Australia. Barb is a member of the Human Resources Committee.

Mr W. David Hamilton
B Agr Sc , MS (Agron), FAICD

David Hamilton has extensive experience and interest in field crop agriculture and the application of technology. He has particular interests in research, development, extension and education, especially in the cotton industry, having previously served on the Cotton Research and Development Corporation Board. He is the elected Board representative of Queensland Department of Employment, Economic Development and Innovation, Industry and Investment NSW and WA Department of Agriculture and Food. David is a member of the Finance and Audit Committee.

RESEARCH ACTIVITIES

THE FARM

Program Leaders

Graham Harris
Queensland Department of Employment, Economic Development and Innovation

Lewis Wilson
CSIRO

Peter Gregg
Cotton CRC

Goal

Enable the cotton industry to improve profitability and sustainability of production.

Sub-programs

- Integrated Pest Management
- New Tools and Technologies
- Water Use Efficiency
- Plants and Soils
- Farming Systems.

Dr Lewis Wilson, Graham Harris and Professor Peter Gregg

Our Research Program

The Farm is the largest program within the Cotton CRC, and includes most of the research related to production and sustainability issues on-farm. There are currently 52 research projects active within The Farm program.

Research and Partners

The Cotton Research and Development Corporation (CRDC) is the largest single investor in The Farm, currently investing, or co-investing with other partners, in a total of 23 projects in all sub-programs except New Tools and Technologies.

The Grains Research and Development Corporation (GRDC) is another significant partner in The Farm. Private sector investors include Growth Agriculture Pty Ltd, Ag Biotech Australia Pty Ltd, Cotton Seed Distributors (CSD) and Monsanto Australia Ltd.

The Australian Government, through the National Water Commission, and the Queensland Government Water Corporation, SunWater Ltd, contribute to our research projects. Other research providers for The Farm include major partners such as CSIRO Ecosystem Sciences, CSIRO Plant Industry, Industry & Innovation NSW, Queensland Department of Employment, Economic Development and Innovation, Western Australian Department of Agriculture and Food, The University of Sydney and University of New England. Most of these organisations are involved in multiple projects across all the sub-programs of The Farm.

Affiliate research providers include the University of Queensland, Central Queensland University and the University of Southern Queensland. Commercial affiliate organisations providing in-kind support as well as cash for particular projects within The Farm include Ag Biotech Australia Ltd., Growth Agriculture Ltd., Cotton Australia, the Crop Consultants Association, Monsanto Australia Ltd., CSD and Incitec Pivot Ltd.

Program Activities

Management of transgenic cotton, both insect resistance and herbicide tolerance, remains a major research focus. The finding in 2009 of higher than expected levels of resistance to one of the *Bt* toxins, the *Cry2Ab* protein, found in Bollgard II® cotton created considerable discussion within the industry and refocused research on the background level of resistance in *Helicoverpa* spp. to these proteins.

Research in inland Australia in August 2009 by Professor Peter Gregg (UNE) and Colin Tann, Tracey Parker and Susan Thomas (CSIRO) showed that levels of resistance in the presumably non-selected populations of *H. punctigera* were generally lower than in the cropped regions, but still much more frequent than desirable. This indicates that the resistance to *Cry2Ab* was essentially pre-existing, for unknown reasons. These findings have also put the spotlight on the Resistance Management Plan (RMP), to ensure that it is robust enough

to prevent resistance continuing to develop. One of the most important components of the RMP is the provision of 'refuge' crops to produce moths not selected with *Bt* toxins, which can dilute any resistance that develops.

Research by Dr Geoff Baker, Dr Mary Whitehouse and Colin Tann (CSIRO) indicates that there is significant variability in the productivity of refuges. Split planted cotton was disappointing this year as the later plantings failed to produce many moths, however, the potential for this option deserves further experimentation. The productivity of different types of refuges on nine farms from the Namoi and Emerald valleys indicated that while pigeon pea may attract more egg lays, it did not always produce many more moths than conventional cotton and late planted cotton produced many larvae but only a few of these emerged as moths. As a result, a new approach to refuges is being trialled, in which refuge productivity is measured directly rather than estimated from crop type.

The uptake of glyphosate resistant cotton has been very high, due to the convenience and flexibility it offers growers; however, the development of resistance by weeds and species shift (the increase in abundance in weed species tolerant of glyphosate tolerant species) are real threats.

Detection of resistance to glyphosate in Awnless Barnyard Grass has similarly highlighted the need for ongoing proactive strategies to avoid escalation. Experiences from the USA show that it is possible to generate significant challenges to industry. The emergence of resistance in Palmer's Amaranth, a large plant with prolific seed production that, fortunately, does not occur in Australia, highlights what can go wrong. Another area of significant effort has been in the development of management strategies for glyphosate tolerant species and in the refinement of weed thresholds for use of glyphosate by Graham Charles (I&I NSW). Fleabane, in particular, is tolerant of glyphosate and its biology and ecology are being investigated by PhD student Todd Green (UNE) to provide greater understanding of other management strategies that may be effective in reducing the threat from this weed.

Diseases remain an important challenge to cotton production. Some, such as black root rot, are unlikely to prevent cotton production, but their rapid spread and effects on seedling establishment can delay growth and potentially reduce yield. Research of Lily Pereg (UNE) has continued to try to understand the process of root colonisation and growth of this disease, using low pathogenicity mutants as a comparison. Her student, Ali Getachew (UNE) is refining this understanding by investigating the growth rates and colonisation rates of wild types and the low pathogenicity mutants. He found that on media, growth rates are similar. However, though the initial colonisation rates on roots are similar, the progressive effect on cell damage was far greater for the wild type, suggesting differences in enzymes involved in fungal growth after colonisation.

Input by Chris Anderson (I&I NSW), Stephen Allen (CSD) and Peter Lonergan (I&I NSW) into the annual survey of diseases in cotton continues to play an important role in understanding changes in threats and effectiveness of management recommendations. Surveys following harvest this year found that the incidence of Fusarium wilt disease had declined in most regions, possibly due to later planting into warmer conditions, more resistant varieties and use of the BION® seed treatment that activates the seedlings defences against pathogens.

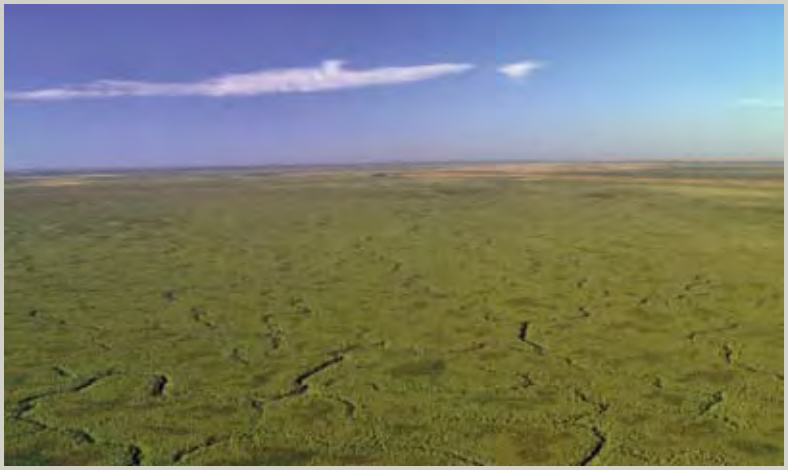
Completion of the limited water research in cotton and wheat by Dr Jose Payero (DEEDI) has shown clearly the impact of water stress on the yield and quality of these crops. Bollgard II is particularly sensitive to early water stress, as shown by the research of Steve Yeates (CSIRO) and Marcelo Paytas (UQ), which showed that in the presence of moderate *Helicoverpa* damage Bollgard II® cotton uses less water than conventional cotton because the latter grew longer to compensate for damage. Where insect damage is minimal there was no difference because the plants were morphologically identical; however, where early tipping of the main-stem was the only insect damage to the


Fleabane

INLAND EXPEDITION GUARDS AGAINST RESISTANCE THREAT

In the Channel Country of far western Queensland lives an insect pest which threatens production of conventional cotton but at the same time helps the production of transgenic *Bt* cotton. This is because it supplies susceptible genes to dilute resistance to the *Bt* toxins in the cotton areas. We have known since the 1980s that large numbers of *Helicoverpa punctigera* moths can breed on the daisies of the inland desert and the plants of the inland floodplains, then migrate to cotton producing areas. *Bt* cotton is effective against *H. punctigera* but in the 2008–09 season there were disturbing trends in the frequency of resistance to one of the two genes in the current generation of *Bt* cotton, Bollgard II®. This suggested that something had gone wrong with the migration system that brought *H. punctigera*, with its susceptible genes, to the cotton areas. So Professor Peter Gregg, CRC Chief Scientist, set out with three other CRC entomologists to investigate whether the moths were still in the Channel Country and whether they were still susceptible to *Bt*.

The researchers found extensive areas of the main host plant, annual verbine, following the record floods in the Diamantina and Georgina/Eyre Creek floodplains. These hosts supported large numbers of *H. punctigera* larvae. Some were taken back to the lab for resistance testing by Sharon Downes of CSIRO, who found that while *Bt* resistance was present, it was at a much lower level than in the cotton crops. The researchers were able to predict that, because a large population with few resistant genes was present in the outback, resistance in the cotton growing areas would eventually be diluted by susceptible immigrants. Preliminary data for the 2009–10 season suggest that this has already happened.



Above: Tracey Parker, Cotton CRC and CSIRO entomologist, collecting *H. punctigera* from annual verbine in the flood plain of Eyre Creek, west of Birdsville. The plants in the foreground have been extensively damaged by the caterpillars, which breed on this and other native host plants in inland Australia, and then migrate as moths to cotton producing areas

Below: Part of the Eyre Creek floodplain near Bedourie in western Queensland, showing extensive growth of H. *punctigera* host plants after record floods

conventional variety, it had the highest yield and WUE due to improved canopy structure.

Steve Yeates' (CSIRO) research also showed that cotton yields and water use efficiency (WUE) could be improved by varying irrigation deficits, if linked to measures of water stress in response to seasonal conditions. When conditions were hot and dry, thus drying flowering, as in the 2006–07 season, frequent irrigation of Bollgard II® cotton increased yield by 17 per cent and water use efficiency (WUE) by eight per cent compared to the commonly used deficit. In contrast, in the 2007–08 season, where there was greater in-crop rainfall during flowering and lower evaporative demand, stretching irrigation during flowering (54 to 78mm deficits) maximised yield, WUE and captured more in-crop rainfall than irrigating at a 40mm deficit. However, irrigation application efficiency is farm and field specific and needs to be measured before adopting small deficits as an irrigation strategy.

At the end of May 2010, 57 storages had been assessed for evaporation and seepage losses from across the cotton

industry, in a project funded through the National Water Commission, and managed by David Wigginton (USQ). This project has found only a small proportion of storages had seepage loses exceeding five millimetres a day; however, some of these losses were very significant and growers will be considering amelioration strategies.

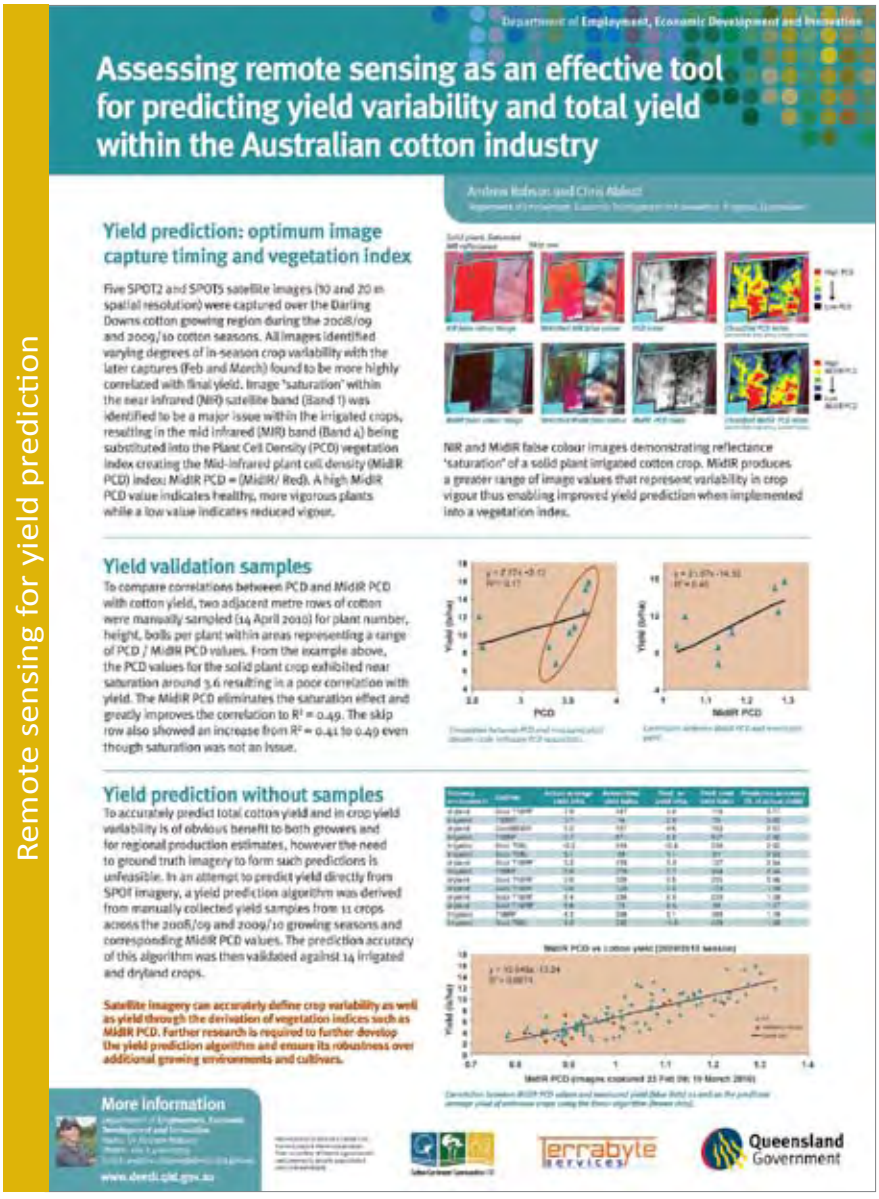
The automated furrow irrigation research by PhD student, Richard Koech (USQ) has concluded that flexible fluming, in conjunction with pipes through the bank of the head ditch, is the alternative most readily adapted to automation. Demonstration trials of the flexible fluming were conducted at Auscott in the Gwydir Valley as part of the furrow automation demonstration trial. This trial provided a convincing demonstration of: (i) the ease with which furrow irrigation can be automated, and (ii) the benefits of using flexible fluming to deliver water uniformly to the furrows. Further commercial scale trialling is planned for the coming season.

Research projects in crop nutrition and soil health nearing completion include those of PhD student, Meredith Errington (USYD), who has been researching nutrient cycling within Bollgard® II cotton varieties to better understand their nutrient demand. This will help develop timely and effective fertiliser programs for maximising yield and fibre quality. John Bennett (USYD) has been examining the use of gypsum and lime in addressing sodicity in irrigable soils within the Macquarie and Lachlan valleys, and James Quilty (USYD), has evaluated the effectiveness of a range of organic soil amendments being promoted within the cotton industry.

Research by Dr Ian Rochester (CSIRO) will investigate the impact on cotton growth, yield and quality of alternative stubble management options, use of nitrogen-fixing legume crops in rotation with cotton and the use of less nitrogen fertiliser. This will entail detailed investigations of changes in soil organic carbon levels, soil tilth (including impacts on structure and water-holding capacity), soil microbial biomass, crop nutrition and water use-efficiencies. The aim is to provide the industry with the knowledge and alternative management options for achieving resilient high yielding cropping systems through improvements in soil health and optimised crop nutrition. A new research project by PhD student Tim McLaren will investigate phosphorus and potassium nutrient use efficiency in cotton systems on problem sodic vertosols.

The Farming Systems sub-program has continued to expand, with research projects in the following areas:

The development and evaluation of 'dynamic deficits', which will refine irrigation scheduling to reduce the effects of stress during periods of high evaporative demand and save water during periods of low evaporative demand (Rose Broderick, CSIRO).



Growing high quality cotton in the Burdekin

The incorporation of cotton and grain crops within the sugar farming system of the Burdekin (Paul Grundy, DEEDI, and Steve Yeates, CSIRO)

Achieving reliable wheat yields within the cotton farming system (Verity Gett, NSW I&I and Brendan Griffiths)

Assessment and evaluation of current and proposed precision agriculture tools for commercial broad acre applications to the cotton and grains industry (Brooke Sauer, UNE, Andrew Robson, DEEDI, and Jon Medway, Terrabyte)

Investigating the climate change impacts on cotton production and planning and evaluating the likely effectiveness of adaptation strategies (Katie Broughton, USYD)

The effect of selected crop and soil management practices (rotation crops; soil amendments; stubble retention) on carbon sequestration, soil quality, drainage and nutrient leaching; and growth, yield and profitability. System characteristics such as water use efficiency and carbon sequestration will be related to indicators which can be measured by cotton growers and consultants (such as ground cover, rotation frequency and tillage intensity) and that these qualitative indicators could be used as surrogate indices of soil carbon sequestration, nitrogen and water use efficiency (Nilantha Hulugalle, NSW I&I).

Our achievements

During the year, 14 major projects were completed in The Farm. Final reports are available on the Cotton CRC website, www.cottoncrc.org.au. Results have been made available to Cotton CRC extension staff and disseminated through other channels have also been instrumental in informing the development of the new *my*BMP program.

Researchers from The Farm have generated numerous publications in refereed scientific journals, as well as in publications such as *The Australian Cottongrower* and CRDC's *Spotlight*, that are so important in driving adoption in the cotton industry. These publications are listed on page 67. Notable outputs include a revision of the *Cotton Pest Management Guide,* the foremost reference for growers making pest control decisions.

The suite of tools in CottASSIST continues to expand and this year a new 'Mite yield loss estimator' was added, which allows growers or consultants to enter mite census data and access likely yield loss and the need for control. Plans are also underway to develop 'Whitefly Tools' to help growers and consultants manage this pest. Scientists from the Farm have also been instrumental in development of the new *Australian Cotton Production Guide 2010* and the *Farm Biosecurity Manual for the Cotton Industry*.

Our researchers have contributed extensively to industry conferences such as the biennial Australian Cotton Conference, Crop Consultants Association conferences and the annual Cotton CRC Science Forum. Many entomologists, weed scientists and pathologists have contributed significantly to industry-based committees such as the Transgenic and Insecticides Management Strategies committee (TIMS), REFCOM and FUSCOM, which ensure that industry strategies to deal with pests and diseases are strongly science-based, and the Cotton Biosecurity Group.

Outcomes

A key outcome has been the ongoing capability to manage existing pest threats and respond rapidly to new threats. Last season there were outbreaks of mealy bug in cotton crops in the Emerald and Burdekin regions of an exotic species, *Phenacoccus solenopsis*, commonly known as the Solenopsis mealy bug. Large populations can severely debilitate plants because the bugs compete with the plant for assimilate. CRC scientists helped growers to assess short term management options. Following the season, a survey commissioned by the Cotton CRC identified several factors associated with mealy bug outbreaks, including poor field hygiene and the use of broad spectrum insecticides early in the season, which decimated beneficial populations. This is likely to be important as in other parts of the world where this pest is a problem the local beneficial populations have been important in bringing the pest under control. Research by Melina Miles, Zara Ludgate, Richard Sequeira and Moazzem Khan (DEEDI) is seeking to identify how this pest overwinters and to provide advance information on the likely threat for 2010–11.

Completion of drainage research has highlighted the variable nature of these losses within our irrigated farming system. By-pass flow is important in the process early in the irrigation season, as is the amount and timing of rainfall events. Marcelo Paytas' PhD project has clearly demonstrated the importance of maintaining adequate soil water early in the growth of high retention cotton; even modest early water deficits can significantly affect yield and lint quality. This response is due to the importance of early season irrigation in increasing the supply of assimilates available for the use of high retention cotton post flowering.

Research by Andrew Robson (DEEDI) demonstrated strong correlations between Normalised Difference Vegetation Index (NDVI) ratios with cotton yields in Darling Downs fields in the past season. This research is determining if yield prediction is possible from NDVI data captured by satellite.

Research by Paul Grundy (DEEDI) and Steve Yeates (CSIRO) has demonstrated significant potential to grow high yielding, premium quality cotton in the Burdekin despite wetter than average seasonal conditions. These researchers continue to work on developing an appropriate agronomic management package for cotton production in north Queensland.

Challenges

The advent of insect resistant and herbicide tolerant cotton places the industry in a strong position as far as improved management of insect and weed pests is concerned. However, resistance in *Helicoverpa* spp. to the *Bt* proteins, especially *Cry2Ab*, remains a major challenge. Monsanto Australasia recently released information about the development of Genuity® Bollgard III, containing a third pest resistance gene that should deliver more stable pest management within a few years; however, to realise this potential we must maintain susceptibility to the two current *Bt* genes until the new varieties are released. Management of resistance still hinges strongly on the twin strategies of pupae control in winter and growing of refuge crops. Research to investigate alternatives to pupae 'busting' by cultivation is a priority and is considered a key issue for the developing Cotton CRC extension bid.

Refuge productivity also remains a key issue, with growers seeking to reduce areas in order to reduce costs and researchers seeking to ensure the refuges are adequate. Cotton CRC research is making a vital and ongoing contribution. Similarly, the emergence of glyphosate-resistant weeds highlights the challenge to improve management of this herbicide to preserve its value, including in transgenic systems. Cotton CRC scientists are making key contributions to these discussions through industry organisations such as the TIMS and the refuge discussion group, REFCOM. These groups advise the Australian Pesticides and Veterinary Medicines Authority (APVMA) to ensure that industry strategies to deal with transgenic management are based on the best available science.

Emerging pests remain an ongoing challenge. Silverleaf whitefly has continued to spread south and is a potential pest in all regions. This highlights the need to understand more of its ecology and management in southern regions, which is the focus of a new research effort led by Lewis Wilson (CSIRO). The emergence of the Solenopsis mealy bug provides a further challenge and it will be important that the Cotton CRC leads research to resolve the likely threat from this pest and, if necessary, the development of IPM strategies for its effective management.

The loss of water through evaporation from on-farm storages is a significant obstacle to improving whole farm water use efficiency. Initial investment by the Cotton CRC in collaborative research with the CRC Polymers and CRC Irrigation Futures set the groundwork for a new improved monolayer product for the reduction of evaporative losses, which is undergoing field testing during the 20010–11 season. The improved situation with water supplies in much of the industry will benefit this and other water research this coming season.

HERBICIDE RESISTANCE: TAKING THE BATTLE ONLINE

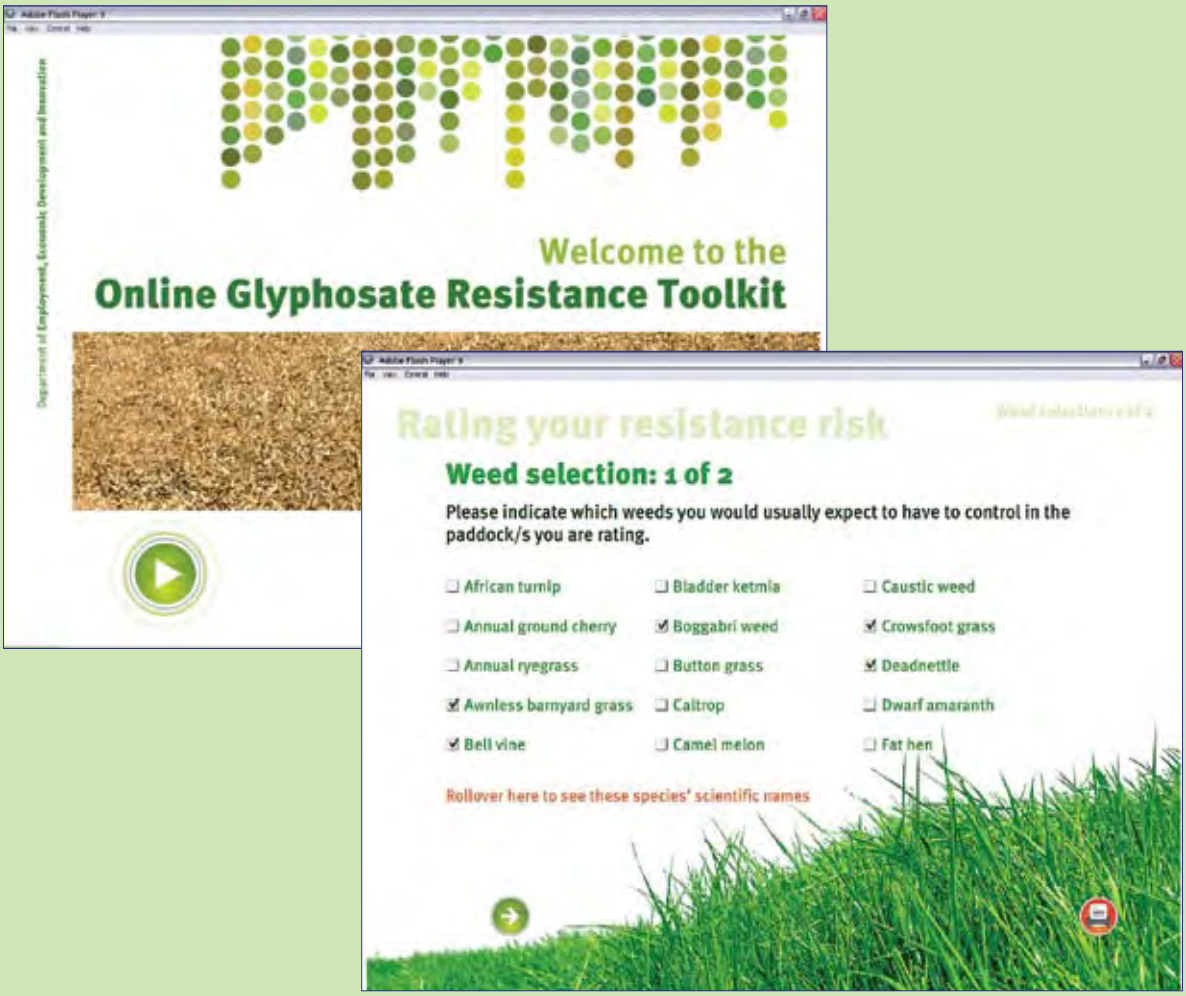
Glyphosate resistance is a significant threat to farming profitability, and the recent emergence of glyphosate resistant weed populations in northern cotton and grains farming systems has a direct cost to affected growers. If growers can prevent or delay the onset of glyphosate resistant weeds on their farms, they will be able to continue to derive maximum benefit from glyphosate, with the cost-effectiveness benefits that this brings. Risk assessment is an essential part of any grower's response to the resistance threat, and DEEDI's new online resistance toolkit allows growers to assess their on-farm risk easily and at their convenience.

The risk assessment tool allows growers and their advisors to enter information on their current practices (including crop rotation, crop density, and weed control tactics) and identify which weed species they typically control. The tool will then calculate a glyphosate resistance risk score for each paddock, and a level of risk for each weed identified. The tool also provides information on how risky each of the phases in the grower's rotations are, which helps growers identify where they may be able to make useful changes.

Non-identifying information entered into the tool (such as postcode and industry sector) is collated into a database. This data will be used to measure whether risk and knowledge levels are changing over time, and whether they vary between industry sectors or by location.

The toolkit is free to use and available to all and can be found at www.dpi.qld.gov.au/26_16653.htm

David Thornby, Jeff Werth, and Matt Curr (DEEDI) produced the glyphosate resistance toolkit as part of a Cotton CRC project. Funding support from the CRC, CRDC and Monsanto is gratefully acknowledged.



THE CATCHMENT

Program Leader

Jane Macfarlane *Cotton CRC*

Goal

Enable best practice cotton enterprises to deliver sustainable ecosystems and reduced impacts on catchments.

Sub-Programs and Leaders

- Integrated management of river systems
  Dr Glenn Wilson *The University of New England*
- The dynamics and connectivity of groundwater systems
  Assoc Professor Bryce Kelly *University of NSW*
  Professor Ian Acworth *University of NSW*
- Managing on-farm water storages for irrigation and environmental purposes
  Professor Ivan Kennedy *The University of Sydney*
- Managing biodiversity and ecosystem services on farms
  Dr Nancy Schelhorn *CSIRO*
- Integrated farm and catchment management resources
  Stacey Vogel *Namoi CMA*


Jane Macfarlane

Our Research Program

To date, nearly $8.5 million has been invested in the Cotton CRC's Catchment Program. Over half of this has been invested by 24 external organisations.

There has been a total of 52 collaborative research projects commissioned in The Catchment since the start of the current Cotton CRC. Of these, 31 have now been completed, including nine post graduate scholarships. The remaining 17 current projects are spread across the cotton growing regions of NSW and Queensland and also a range of research topics.

Research and Partners

Over the last 12 months, the existing suite of Catchment research projects continue to involve numerous researchers, investment partners and end users, with a total of 50 different organisations engaged. This includes individual growers, industry bodies, catchment bodies, state and federal government agencies, research institutions and community organisations. New projects initiated this year:

- A partnership to employ a Regional Landcare Facilitator in the Gwydir Valley;
- Research to boost natural pest control at the landscape scale;
- Research to establish the impact of climate change on surface and ground water.

We are working to formalise new partnership arrangements with New England North West Landcare Network, the Gwydir Valley Cotton Growers Association and Border Rivers-Gwydir Catchment Management Authority (CMA) to employ a Regional Landcare Facilitator in the Gwydir Valley. This position will work with new and existing cotton growers to increase the uptake of *my*BMP in the Gwydir Valley, particularly the Natural Assets module.

A new research project led by Dr Nancy Schelhorn (CSIRO Ecosystem Sciences), titled: *Bt cotton in pest suppressive landscapes,* follows on from previous Cotton CRC research and aims to investigate how increasing proportions of *Bt* cotton in the landscape alters the pest pressure of *Helicoverpa* spp. and egg parasitism and predation rates in *Helicoverpa*-susceptible crops. This will provide the know-how for the cotton and grain industry to boost natural pest control at a landscape level. The project is funded by the Cotton CRC and has been supported by the Swiss Government Science Fellowship and GRDC-funded research.

Ian Ackworth from the University of NSW is leading the second new research project in the Catchment Program. The project *The impact of climate change on surface water and groundwater resources: Maules Creek Case Study* aims to undertake geological and hydrogeological modelling of the surface water and

SEEING IN 3D: MANAGING SURFACE AND GROUND WATER BETTER

Bryce Kelly
University of NSW

University of NSW Connected Waters Initiative team members have developed a new approach for constructing 3D conceptual hydrogeological models at a catchment scale.

The benefits of analysing catchment groundwater data in 3D are that it allows for increased communication of complex information to stakeholders and improved management of water at a catchment level.

This project focused on Maules Creek, a small catchment near Narrabri, within the Murray-Darling Basin. However, the methodologies can easily be scaled to catchments of any size.

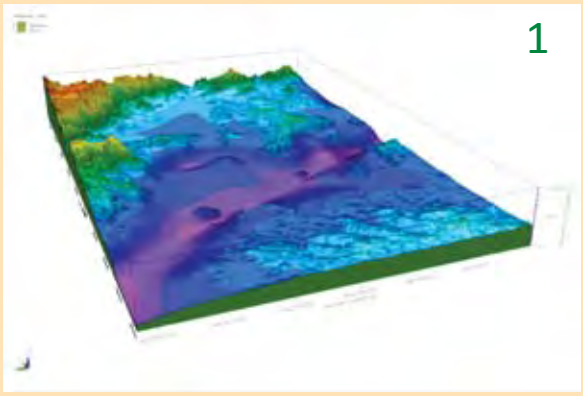
Developed for this project were a series of Mathematica applications that help with the improved visualisation and interpretation of catchment water data, in particular advancing the way we spatially analyse standing water level information and driller logs. The new visual methods help with conceptualising the catchment hydrogeology, and guide the construction of catchment water balance models.

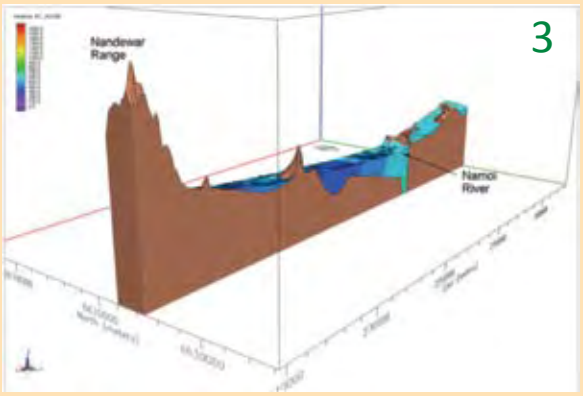
The project also demonstrated the value of collecting a comprehensive suite of water chemistry parameters for quantifying the coupling between the rivers and underlying aquifers and for delineating the zones of mixing within an aquifer system.

Understanding the 3D distribution of aquifer sediment types and their associated hydraulic properties is critical when coupling water chemistry and ecological processes to the movement of water movement through a catchment. 3D modelling will yield improved insights on recharge pathways, groundwater contributions to river baseflow, the impact of irrigation extraction, water quality characterisation and the possibility of examining climatic variability and change on groundwater availability.

This project has considerably advanced our conceptualisation of river and aquifer connectivity in the Maules Creek region and demonstrated the impact of the groundwater irrigation extractions. Presentations of the results at cotton industry forums and trade shows and at community meetings have all been well received, often giving irrigators a new understanding of surface water and groundwater processes.

Maules Creek 3D geological models





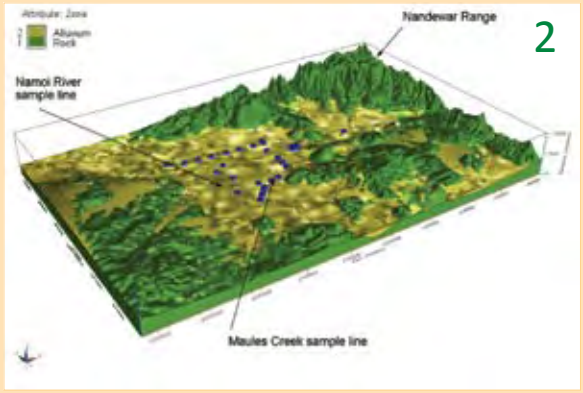


Figure 1: 3D geological model with the alluvial zone removed to show the prehistoric valleys at depth

Figure 2: The alluvial sediments are the yellow regions and the outcropping rocks the green regions. The blue cubes indicate the locations of groundwater monitoring boreholes

Figure 3: A slice of the Maules Creek 3D electrical conductivity model of the alluvial aquifer water. The vertical exaggeration has been increased to a factor of 10 to highlight the water quality changes in the alluvial aquifer

Maules Creek workshop

The Maules Creek Groundwater Forum held at Maules Creek in the Namoi valley in November 2009 was based on nearly three years of groundwater research conducted by the University of NSW and funded by the Cotton CRC. The forum was attended by 60 participants, including local landholders (irrigators and non-irrigators), as well as CMA and Landcare personnel. The workshops provided an opportunity for local landowners to hear results on such topics as geological modelling as a foundation for assessing the groundwater resource, interconnectivity between surface water and groundwater, sources of recharge from rivers and streams, rain and deep drainage under irrigated fields, and integrated modelling of the catchment water resource.

The University of NSW Connected Waters Initiative team at the Maules Creek workshop. *Back row (left to right)*: Bryce Kelly, Martin Andersen, Andrew McCallum, Anna Greve and Gabriel Rau. *Front Row*: Ian Acworth and Beatrice Giambastiani

groundwater system in the vicinity of Elfin Crossing at Maules Creek, NSW. The groundwater model will be used to establish the impact of climate change on the interconnection of surface water and groundwater exchange. In a significant expansion of the groundwater monitoring capacity of earlier Cotton CRC work, this research will provide the field evidence to constrain models of surface water/ groundwater exchange in other cotton growing valleys.

Program Activities

Researchers and extension staff have undertaken a variety of activities this year to reach the end users the Catchment Program research. These include:

- development of the *myBMP* Natural Assets module;
- the Maules Creek Groundwater Forum;
- production of the *Fishes on Cotton Farms* Guide;
- development grazing management in wetlands guidelines; and
- trials to test fish screens for pumps throughout the Murray-Darling Basin.

Researchers and extension staff have used research undertaken in The Catchment program to develop the *my*BMP Natural Assets module, which will assist growers to manage their natural resources sustainably. Peter Verwey joined the Cotton CRC in November 2009 as the Cotton Catchment Officer, continuing the work of Kate Lightfoot. this position is funded by the Namoi Catchment Management Authority (CMA), as part of the tremendously successful partnership the Cotton CRC has with the CMA. Peter is working to increase the participation of Namoi cotton growers in the Natural Assets module of *my*BMP by assisting growers to prepare a property plan and monitor their groundwater quality.

Fish Ecologists from Industry & Investment NSW with Oregon Fish and Wildlife Officers, inspecting fish screening technologies in the Columbian River Basin, September 2010

NSW Industry and Investment are currently running trials to test and refine ways of screening fish from diversion points throughout the Murray-Darling Basin. The research is a collaborative effort between Industry and Investment NSW, the Murray-Darling Basin Authority, Cotton CRC and Namoi CMA. Researchers have worked closely with irrigators and local manufacturers to refine an experiment to test a number of screen designs for Australian conditions. A field day held earlier this year showcased some of the techniques being used. This group recently returned from a trip to the Columbian Basin in the USA where they met with the Farmers Conservation Alliance and Oregon Fish and Wildlife Officers and inspected a variety of fish screening installations. The Columbian River Basin has been running a cost-share fish screening program with irrigators for almost 70 years now and it seems their technology will be applicable to the Murray-Darling Basin at both small and large diversion channels and pump sites.

Our achievements

Groundwater

In the last 12 months, a number of research projects have drawn to a close in The Catchment program, particularly in the groundwater and ecosystem services subprograms.

A joint study to monitor groundwater levels and quality commissioned by the Namoi CMA and Cotton CRC has been completed. The University of NSW Water Research Laboratory (WRL), in association with the consulting entity GHD Hassall, carried out the study. Around 70 groundwater samples were collected from growers and WRL sampled priority state government monitoring bores for major ion analysis over the 2009 growing season. The research helps to define how groundwater levels and salinity vary both spatially and temporally within the catchment. This project further developed strategic monitoring guidelines for use by Namoi CMA but equally useful for any regional body and the industry body and was integrated into the *my*BMP Natural Assets module. The grower attitude survey showed that improved communication of groundwater information to growers, particularly at the beginning of the growing season, is required and Peter Verwey (Cotton CRC) is working with this group to extend the research results to Namoi growers early in the 2010–11 growing season.

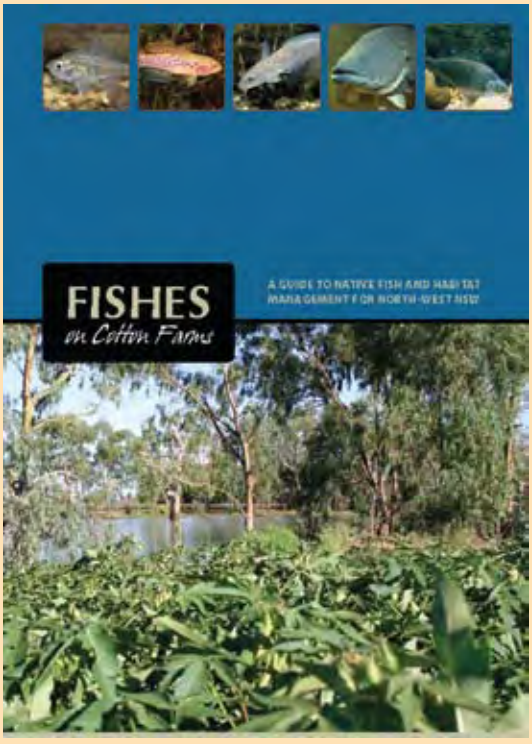
FISHES ON COTTON FARMS GUIDE 'HELPING FARMERS HELP FISH'

Irrigators and anglers in North West NSW will be able to learn more about how they can help native fish and their habitat with the release of the new *Fishes on Cotton Farms* book. This glove-box guide identifies management activities cotton growers, landholders and anglers in north west NSW can undertake to protect and rehabilitate fish habitat and conserve local native fish populations.

Fishes on Cotton Farms provides information about fish-friendly practices that landholders can use to improve the health of waterways and give native fish a better opportunity to feed and breed. The guide explores simple and clear messages such as 'fish need trees', to show the connection between land and the water and highlight the importance of this connection for native fish.

The guide also contains information on common species of fish in north west NSW, as well as details about their appearance, habitat and distribution and some interesting 'fishy facts'. It will allow landholders and anglers to identify fish in their local area, giving them an idea of how healthy the waterways are on their property or at their local fishing spot and allowing them to monitor this over time.

The book was funded by the Australian Government Department of Agriculture, Fisheries and Forestry Industry Partnership Program, Industry and Investment NSW, Namoi CMA and the Cotton CRC, supported by Roth Rural Regional Pty Ltd, and launched at a field day with local growers at the Australian Cotton Research Institute, Narrabri, in late 2009.



GWYDIR WETLANDS: IMPACTS OF WATER REGIME AND GRAZING ON FLOODPLAIN WETLANDS

Peter Berney
The University of New England

My PhD project examined how floodplain plant communities in the Gwydir Wetlands respond to disturbances such as flooding and drought, and how the response to these events interacts with grazing. Extensive floodplain wetlands are a characteristic feature of major rivers in the Murray-Darling Basin (MDB). Plant communities in these wetlands are dynamic in nature, having evolved under a highly variable pattern of flooding. However, water resource developments have significantly altered the frequency, duration and extent of flooding in wetlands across the MDB. Environmental water allocations are used to mimic historical patterns of inundation of wetlands across the MDB but there is an increasing need for accountability in how this water is used. This project aimed to develop a better understanding of the mechanisms underlying plant community change in the Gwydir Wetlands. The information gained can contribute to guiding the adaptive management process that managers and stakeholders employ in the management of environmental water allocations for wetlands and also assist agencies such as CMAs to set goals for on-ground projects with landholders in wetland environments.

The major findings were:

- Hydrology is the main determinant of plant community composition in the wetlands.
- During periods of flood recession, grazing by domestic livestock can alter plant community composition but these changes are usually temporary and are overridden in the next flood period.
- The plant communities studied were found to have an abundant and diverse soil seedbank, which enhances their resilience to the variable cycle of flooding and drought that they experience.

Grazing activity was monitored using global positioning system (GPS) tracking collars on cattle. The GPS data revealed that cattle showed a strong preference for grazing in plant communities containing water couch (Paspalum distichum). This concentration of grazing activity increases grazing pressure on these plant communities and has important management ramifications, since water couch meadows are experiencing invasion by lippia (Phyla canescens) in many catchments in the Murray Darling Basin.

A study examining the competitive interactions between water couch and lippia found that both water couch and lippia could negatively influence each other's growth. However, water couch could only tolerate competition from lippia under wet conditions. Lippia became competitively dominant under dry conditions.

The major findings of the study were used to develop two conceptual models: the first to explain plant community response to flooding and dry conditions and the second to summarise plant community responses to past and present land use activities and manipulation of the wetland hydrology. These models may help develop a shared knowledge base among stakeholders in wetland management and may form the basis for developing testable hypotheses in future research in the Gwydir Wetlands and other wetland systems in the MDB. In addition, a series of guidelines for grazing management in wetland situations have been produced by NSW Industry and Investment, encompassing views from landholders, agency staff and researchers.

PhD Supervisor:

Dr Glenn Wilson
The University of New England, Armidale

Wetlands are transformed as the plant community responds to flooding. The temporary fence exclosures in the photographs allow a comparison of changes in plant community composition between grazed and ungrazed sites

The *Surface & Groundwater: Upper Namoi* project led by Ian Ackworth, University of NSW, and funded by the Namoi CMA, Cotton CRC and the National Water Initiative, was finalised this year. During the course of the project, state-of-the-art research methods such as 3D geological analysis and imaging and isotope tracer techniques were applied. In addition, novel methodologies were developed, such as a resistivity method for monitoring moisture changes in cracking clay soils and a temperature tool for measuring leakage rates into streambeds and reservoirs. Methods developed as part of this project make 3D geological modelling and hydrograph analysis accessible to all government agencies, contractors and research institutions. CMAs and other water managers will be able to operate the software system to manage water more effectively and use as an extension tool. An access database and GIS database with all of the information has been supplied to the Namoi CMA to operate the software system. This data is available to other organisations provided data sharing arrangements are established. The research group is working with the National Water Commission and the NSW Office of Water (NOW) to place the 3D images on the NOW website.

Ecosystem Services and Biodiversity

Dr Alan House, CSIRO Ecosystem Sciences finished his project *Healthy Cotton Catchments*, which was funded by the Cotton CRC, Condamine Alliance and Queensland Murray Darling Commission. The project had two components: a landscape-scale view of the responses of biodiversity to the variety of land uses in mixed farming landscapes and a finer-scale look at how ants relate to cropping activities and the role of native vegetation in providing a source of beneficial predators. This research has improved our understanding of biodiversity and ecosystem services on cotton farms, particularly in Southern Queensland. Simple take-home messages, which can be distilled from the results, are useful for growers, extension staff and NRM bodies to determine best-practice guidelines for managing terrestrial biodiversity and ecosystem services on farms. This will be a focus for extension activities and products next year to support the *my*BMP Natural Assets module.

David Perovic from Charles Sturt University finished his PhD this year, funded by the Cotton CRC and CRDC. David's thesis investigated the benefits of non-crop vegetation for enhancing natural pest control in cotton landscapes in the Macquarie Valley and examined how cotton landscapes could be managed and designed to maximise natural enemies in cotton crops. Some of the techniques utilised in this thesis were introduced to conservation biological control for the first time. Overall, David's thesis demonstrated the importance of non-crop areas in agroecosystems to enhance the activity of natural enemies and the need for a landscape level perspective in habitat management.

Outcomes

In the last 12 months the Catchment Program has achieved some really exciting outcomes:

- The first commercial product, a tool for rapid pesticide detection;
- Research to assist environmental water management;
- A significant legacy of groundwater research.

The first commercial products was developed in the Catchment Program this year. Ivan Kennedy and Angus Crossan, from the University of Sydney have collaborated with the Tianjin University of Science and Technology in China to develop a quick test for pesticide detection. Pesticide use brings the potential for off-target contamination and the quick tests will enable rapid certification that such contamination is below hazardous levels. Pesticide analysis has typically been an expensive process because of the costs associate with collection, transport and quantification and quick test will eliminate the need for a large proportion of samples to be collected and analysed at a laboratory. Quick tests would therefore enable significant savings of time and money over the current analytical systems. The research group is now working towards a multi-variate test for pesticides for both the cotton and sugar industries. The tests could be used to validate benefits from improved practices, such as *my*BMP growers in the cotton industry and may one day provide a critical step in green or eco-labelling of Australian cotton.

Sue Powell from ANU is working on the *Development of a model of flood dynamics for water management in the Gwydir Wetlands* for her PhD. This research has an emphasis on the analysis and application of remotely sensed data to the modelling of wetland flooding and vegetation response. Further data analysis has been undertaken on a second catchment, the lower Lachlan, to test the application of the methodology. The research outcomes from this PhD is being used to inform the further development of the Decision Support System model, IBIS, currently being undertaken by the iCAM group at ANU for use by the Department of Environment, Climate Change and Water NSW in managing environmental water for the Gwydir wetlands.

A project undertaken in collaboration with the Namoi CMA *Understanding wetland habitats at reach to catchment scales: Namoi wetland remote sensing* developed multi-scale remote sensing techniques to determine the location, extent and hydrological function of wetlands in the Namoi. Key recommendations were presented to the Namoi CMA and the NSW Office of Water and the data generated was provided to the Namoi CMA, who are now able to integrate

this information into their planning and investment programs to improve natural resource management in the Namoi catchment.

Two major groundwater projects in the Namoi catchment, *Benchmarking sustainable management of groundwater quantity and quality* and *Surface & Groundwater: Upper Namoi* have been completed. As a result, there are four significant legacies from the Cotton CRC's groundwater research sub-program:

Several Cotton CRC projects when combined have allowed the refined definition and quantification of surface water and groundwater processes that underpin Groundwater Management Plans prepared by the NSW Office of Water. They provide a definitive science on the implications on management decisions that allow stakeholders to reach consensus.

The six Cotton CRC groundwater fact sheets reinforce the need for a scientific basis for the development and management of groundwater as well as the associated infrastructure.

The continuing research by the University of NSW Connected Waters program funded by the Cotton CRC has the potential to add clarity to the groundwater flow modelling developments from the National Water Commission Losing Stream Project collaborative project.

The 3D Aquifer Visualisation has demonstrated the strengths and weaknesses of groundwater data manipulation and in part led to the significant Bureau of Meteorology funding of an Australia wide roll out using ARCGIS Groundwater.

The full import of many of the CRC Cotton projects will not be realised for several years as management issues are addressed by jurisdictions. This is likely to be the case for groundwater dependant ecosystems and the social impact of water trading.

Challenges

Whilst we have made some great progress in the last year, the challenge for The Catchment program is still the effective delivery of science to the end users. These are a diverse group ranging from growers, industry groups and CMAs to state and federal government agencies. Each group requires a different approach and has different information needs.

We are working to form a new partnership with Landcare to increase the participation of Gwydir cotton growers in the Natural Assets module of *my*BMP, extend the research findings of The Catchment program and assist growers to manage their natural resources. This will enlarge the geographical coverage of the delivery of the research to two catchments.

We are also working to integrate findings from the ecosystem services and biodiversity subprogram into a new product for growers incorporating the *Pest and Beneficial Guide* and key principles from the Integrated Pest Management manual, plus the research findings of this subprogram that relate to natural pest control. This will integrate ecosystem services best management practises into growers' day to day management of pests and beneficial insects on-farm.

THE COMMUNITY

Program Leader

Dr Paula Jones *Cotton CRC*

Goal

Enable mutually beneficial interactions between industry and regional communities.

Sub-Programs

- Document the cotton industry's contribution to the economic and social fabric of cotton growing regions
- Identify opportunities for, and assist with, the implementation of strategies for enhancing the flexibility and resilience of cotton communities, including labour, and regional business resources
- Identify ways in which the community and industry can address and contribute to future natural resource policy issues collectively in cotton catchments, including greater knowledge of the impacts that changing water allocations and natural resource management have on socio-economic issues.

Our Research Program

The last five years of the Cotton CRC Community program have seen a total of 42 projects commissioned, of which 18 are completed and six are due to start in the 2010–11 financial year. The current Community projects address a broad range of Cotton CRC strategic outcomes, including understanding innovative businesses in the regions, improving engagement with indigenous communities, natural resource management governance issues and promoting science and agriculture in schools.

Research and Partners

During the last 12 months the Community program has continued to work with its investment partners, researchers and the community to start eight new projects, two of which were commissioned and reported in last year's annual report. Three new and very exciting projects that commenced during 2009–10 include one led by Dr Wendy Shaw from the University of New South Wales, another led by Dr Roel Plant from the University of Technology, Sydney and finally a large collaborative suite of three projects led by Professor Tony Jakeman from the Australian National University.

Dr Wendy Shaw leads the project entitled *A historical geography of cotton farming in NSW and Queensland: adaptation and adoption*. This project aims, first, to understand how farmers have adapted their farming practices to local growing conditions and to technological innovations over time and, second, to improve our understanding of how cotton communities have also adapted in response to these changes over time. Currently, cotton communities are facing increased pressure because of issues of water usage, long dry spells (droughts), fluctuating cotton prices and global economic crises and, most recently, potentially reduced water availability through government policy. This project seeks to tap into existing farmer and community knowledge of similar challenges in the past to capture the histories and the lessons that might be learned. The project will develop relevant publications and a documentary DVD, which will be handed back to cotton communities for current and future generations.

'*Australian Cotton Futures: Building capacity for resilient and adaptive communities*' is the title of the project led by Dr Roel Plant. This project explores how the industry is likely to change and what capacity the community has to evolve with these changes. Building community and industry capacity to cope with, and benefit from, future change requires an understanding of the future and its uncertainties in terms of demographics, the work force, new technologies, emerging rural industries, climate change impacts and water stress. The research emanating from this project will form the foundation for further work to develop and explore future scenarios and the resources or mechanisms required to foresee and cope with challenges the future may present.

Professor Tony Jakeman leads the project *An integrated assessment of the socio-economic impacts of climate change, technology and water policy*

drivers in cotton catchments. This project also includes two PhD projects undertaken by Madeleine Hartley (*The legal framework for economic-environmental water trade-offs in the Namoi under climate change and variability*) and Alison Wilson (*Economic-environmental water trade-offs in the Namoi under climate change and variability*), both enrolled at the University of Western Australia. This is a large, collaborative project involving the Australian National University, Charles Sturt University and the University of Western Australia, and has strong linkages to the National Centre for Groundwater Research and Training. Collectively, these projects will focus on assessing the social, economic and environmental consequences of climate change and the potential for adaptation at the farm and policy levels to avoid negative consequences.

Program Activities

Apart from the development of new research projects, the last 12 months saw the Community program undertake two significant information delivery activities. The first was a Communities Day held in August 2009 at the Crossing Theatre in Narrabri. The day was designed to bring together social researchers both within and outside the Cotton CRC, growers, Regional NRM Bodies, Local Government and community members to learn more about the current research being undertaken in cotton growing regions. The day was hugely successful with over 100 people attending.

Building on the response from participants at Community Day, the Cotton CRC in conjunction with the Cotton Research and Development Corporation (CRDC) instigated a much larger 'Sustaining Rural Communities' Conference. This conference was the first of its kind in terms of specifically addressing the social issues of rural communities. This was originally intended to be a one off event however given the incredible response from over 250 participants over the three days, a second conference will be held in March 2011. The event also gained significant financial and in-kind support from a range of organisations both within and outside the Cotton CRC. The organisations collaborating with the Cotton CRC on this event included the Cotton Research and

COTTON INDUSTRY TRAINEES GRADUATE

The Cotton CRC, in conjunction with CRDC and the Aboriginal Employment Strategy (AES), has been piloting a school-based traineeship program for indigenous students in the cotton industry for the past two years.

The AES school-based traineeship program provides an opportunity for local indigenous students currently enrolled in Years 11 and 12 at Wee Waa and Narrabri High Schools to gain paid work experience, a nationally recognised qualification, credit towards their Higher School Certificate and exposure to the different career opportunities available in the cotton industry.

December 2009, saw the first three AES trainees graduate in a ceremony held in Newcastle, NSW. The ceremony, with an audience of about 80, acknowledged the completion of their traineeship, as well as their TAFE course. CRDC and Cotton CRC subsidised the students' and families' travel and accommodation and CRDC R&D Implementation Manager, Helen Dugdale, was on hand to represent the cotton industry and the students' individual employers.

The three graduates were enthusiastic about encouraging other eligible students to apply for a traineeship as they found it built their confidence, exposed them to great work experience whilst allowing them to be paid.

All three graduates have gone on to further study, or to employment in the area in which they were trained through the AES program.

The cotton industry has employed two new trainees in 2010–11. Both are undertaking Business Skills Cert II at TAFE, as part of their HSC studies.

Meet the 2009 graduates

Chloe Pokarier-Baker, Narrabri, Business Skills Cert II. Chloe is going on to further tertiary studies. Her advice:
'Work, learn and get paid at the same time'

Beau Quirk, Narrabri, IT Skills Cert II. Beau hopes to find work locally in IT. His advice:
'*Go for it, learn from it and enjoy it'*

Bronwyn Scott, Wee Waa, Rural Studies Cert II. Bronwyn, gained full time work at the Cotton Research Centre and hopes to do further studies. Her advice:
'Take up a traineeship and don't give up'

SUSTAINING RURAL COMMUNITIES CONFERENCE A HUGE SUCCESS

In recent years, rural communities have been faced with significant challenges, including severe ongoing drought, changes in government policy – especially those relating to water and carbon – and the mineral resource boom. To address these topics, the Cotton CRC and CRDC held a *"Sustaining Rural Communities National Conference"* in Narrabri, NSW.

This conference was a key event, which provided participants the opportunity to meet, discuss and act upon the broad range of social research that has been undertaken in regard to rural communities. Speakers discussed many topical issues that rural communities face on a day-to-day basis.

Judith Stubbs, from Stubbs and Associates, discussed the impacts of federal water policy and climate change on irrigated agricultural communities in the Murray Darling Basin, a project funded through the CRC. Judith pointed out that agriculture accounts for one-third of employment in local areas in the Murray Darling Basin and if a major reduction in water availability occurred and crops such as cotton were replaced by dryland cropping or dryland grazing, between 2,000 and significant job losses may occur in those communities.

Peter Shergold, a Macquarie Group Foundation Professor from the Centre for Social Impact, University of NSW, addressed the need for strong leadership skills in rural Australia**.** Peter outlined the five qualities that lead to successful leaders: collegiality, execution, persistence authenticity and pride.

The conference attracted delegates from around Australia, including representatives from all agricultural industries, along with a number of delegates from government and industries such as mining, manufacturing, finance, tourism, transport, science, education and health.

As a result of the conference, five grants were given to attending communities to help kick start change in their local areas. Next year, it is hoped that the conference will again come together and explore the projects that were implemented and how they were received by the wider community.

At the conference:

Paula Jones and David Anthony (Cotton CRC), former Member for Gwydir and Deputy Prime Minister, John Anderson, and Phil Armytage and Di Bentley (Cotton CRC)

Interactive brainstorming session at the conference

AES CEO Danny Lester, Dr Linda Botterill, National Institute for Rural and Regional Australia, and Dr John Buchanan, University of Sydney

Development Corporation (CRDC), Agrifoods Skills Australia, Namoi Catchment Management Authority, The University of New England, Narrabri Shire Council, Westpac, Regional Development Australia – Northern Inland NSW, the Murray Darling Basin Authority, Santos, Downland College, National Australia Bank and The Community Mutual Group.

Throughout the year researchers within the Community program have continued to work with community groups such as Local Government, Growers, Chambers of Commerce and local businesses to undertake research and also deliver research findings more informally.

Our achievements

Over the last 12 months, the research portfolio of the Community program has increased, with much of this research involving active community participation. This research effort, coupled with the Community Day, Sustaining Rural Communities Conference and work with local schools, has significantly raised the profile of Cotton CRC social research in cotton communities. By way of an example, projects within the Community program were profiled in over 35 newspaper articles, 15 radio interviews and numerous community newsletters and websites.

Outcomes

One of the most significant outcomes from the Community program so far has been gaining broader recognition by the community of the importance and relevance of research in the social disciplines. This has typically been a challenge for this program and the efforts over the last 12 months have gone a long way to addressing this issue. This has been particularly timely, given that over the last 12 months irrigation communities have waited for the Murray Darling Basin Plan to be developed and released. The research by Judith Stubbs and Associates, examining the impacts of reduced water availability, has been of considerable interest to many communities. As this was a very participatory research project, many community members made significant and important contributions to the eight cases being developed. They are eagerly awaiting the guide to the basin plan, due for release in October 2010.

Challenges

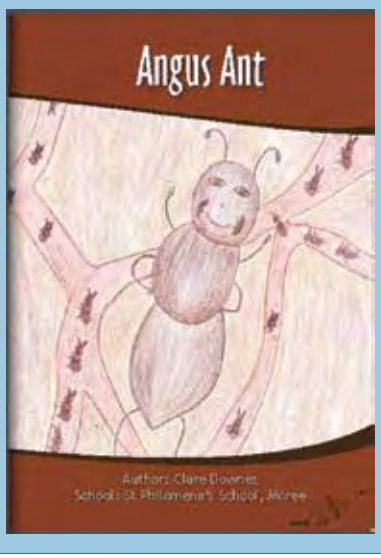
Last year, it was reported that the two major challenges to the Community program were firstly, the need to continue to develop new research projects that satisfy both communities and program requirements and secondly, the need to engage better with the community and end-users of the Community program research. Over the last 12 months we have largely addressed the first challenge with the commissioning of a range of new projects which involve strong research teams and new organisations and are collaborative.

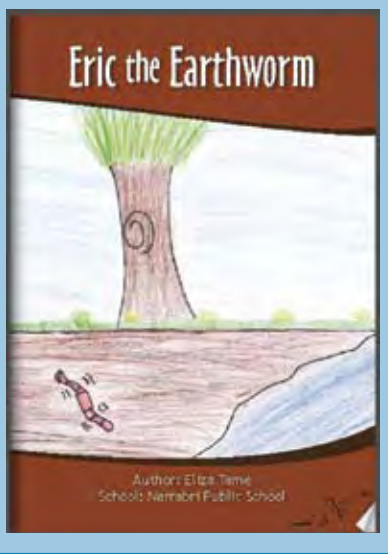
The second challenge of gaining greater engagement with the community still continues however events like the hugely successful 'Sustaining Rural Communities' Conference offer a way in which to deliver the Community program research to the broader community in a forum which motivates people to apply it in their communities. Given the complexity of issues rural communities currently face, it continues to be important to create opportunities for passionate community members to come together to develop solutions using the best knowledge developed from quality social research. Given the success and clear need for this type of conference, the Cotton CRC will continue to drive this event to 2012. The challenge for the next two years will be to find and develop the capacity of suitable organisations in the community to continue to drive this work.

THE ENVIRO-READER COMPETITION

The Enviro-Reader competition is a fun literacy program to promote science and environmental education in primary schools. This year's theme was 'Creepy Crawlies…Life underground', giving students in grades Three to Seven an opportunity to research and illustrate a story about their favourite underground creepy crawlies, like worms, centipedes, spiders and ants. The response was overwhelming, with 403 entries from 25 schools across six catchments.

Winning entries are published and distributed throughout the nine cotton growing communities from the Fitzroy basin in north Queensland to the Murrumbidgee in southern NSW.





THE PRODUCT

Program Leader

Dallas Gibb

Goal

Enable the industry to produce high quality consumer-preferred cotton.

Sub-Programs

- Fibre quality and agronomic factors,
- Harvesting and ginning process
- Marketing initiatives
- Reducing contamination
- Value adding.

Our Research Program

As the world moves out of the global recession, demand for higher quality fabrics is expected to increase. This demand is expected to occur at a time when world cotton stocks for high quality cotton are in limited supply. While the USA has previously dominated world exports in high quality cotton, key areas of their production have declined as growers move to alternative cropping systems.

Together with the supply of quality cotton, consumer demand for products that are produced through environmental sound management practices is also expected to increase significantly over the next five years. This consumer demand has seen major domestic and international brand owners develop new partnerships with industry groups that can supply environmental sound cotton.

These changes in the supply and demand for quality cotton and consumer market trends place Australia in an ideal position to secure its reputation for the supply of high quality, environmental sound cotton.

The primary aim of The Product program is not only to ensure that growers have the capacity to deliver to their customers cotton of the highest quality but also to support industry marketing activities with information and technology regarding the classification of Australian cotton and the environmental management systems that are used in the production and processing of Australian cotton. This is being achieved by undertaking research in five key sub-programs: Fibre quality and agronomic factors, harvesting and ginning process, marketing initiatives, reducing contamination and value adding.

Key research areas include:

- Development of new cotton classification systems based on new fibre measurement technologies;
- Preserving fibre length through improving ginning technology;
- New fibre measurement technology that allows improvements in fabric dyeing and spinning efficiency;
- Developing novel spinning software to improve the spinning efficiency and the quality of yarn;
- Reducing contamination of Australian cotton through developing new monitoring technology and implementation of BMP strategies;
- Reducing short fibre content and neps (fibre tangles) ensuring higher premiums are achieved and maintained;
- Integrating production and environmental performance outcomes of on-farm BMP strategies in the support of Industry marketing activates.
- The program also develops guidelines for the production of silver perch in on-farm water storages to add value to agricultural production systems where cotton is grown.

Research and Partners

The Cotton CRC has contributed to 14 projects over the last three years, to support objectives within The Product. The total value of cash commitments made to these projects is $3.4 million, of which the Cotton CRC has contributed 52 per cent and in-kind contributions exceed $3.6 million. Investments for 2009–10 totalled $0.8 million.

Key partners involved in the program are CRDC, CSIRO Materials Science and Engineering, CSIRO Plant Industry, Auscott Pty Ltd, Australian Cotton Classers Association, Cotton Australia, the Queensland Department of Employment, Economic Development and Innovation (DEEDI) and Industry & Investment NSW (I&I NSW).

Program Activities

Throughout 2009–10, a number of activities have been completed that will directly support the core goal of the program:

- Completion of research into fibre measurement with the development of SiroMat technology
- Improved methods for moisture monitoring within cotton gins to allow improved management of cotton within gins. The technology has been patented.
- Development of new software management systems for use by international spinning mills. The technology highlighted that value of Australian cotton in regard to fibre length, maturity and fineness and how these attributes can play a significant role in optimising yarn and fabric quality.

Retaining fibre quality through the value chain

On the farm

A major collaborative project with CRDC has investigated the key agronomic factors that affect fibre development and subsequent spinning efficiency. In linking agronomic factors that affect fibre quality to yarn and fabric quality, research has involved a mixture of basic fibre development research and applied practice research.

One important component assessed in 2009–10 has been the effect on fibre quality of crop conditions at the time of harvest. The work has shown that harvesting a crop that has a high level of immature bolls can have a significant effect on nep content (small knots or clusters of entangled fibres) detected past the ginning phase and through the spinning process. Defoliation of a crop with more than 50 to 60 per cent immature bolls was shown to increase nep levels and reduce fibre micronaire, fibre fineness and crop yields. Nep content is an area where Australian cotton must improve its performance and this project provides valuable knowledge about possible on-farm causes.

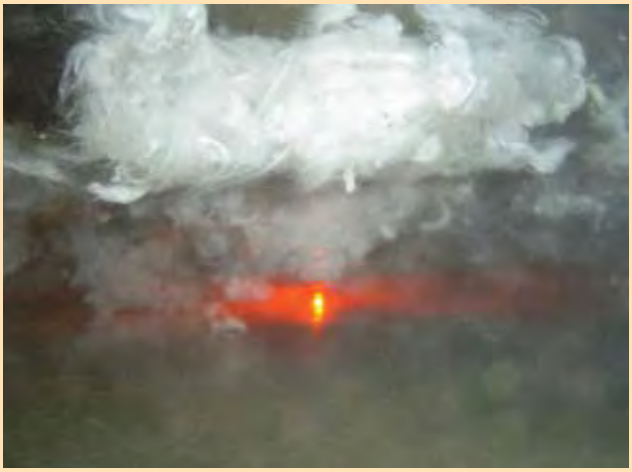
Outcomes of this research have being collated into a new decision support package, FIBREpak, released in August 2009.

In the gin

Cotton CRC ginning research activities aim to preserve fibre length, while improving ginning efficiency and preventing the overall damage to the fibre as measured through the content of neps and short fibre content. As part of this research, it is recognised that moisture assessment and management is a fundamental problem in the ginning process: as the cotton dries, it becomes more prone to damage. One key problem in maintaining moisture has been a lack of accurate measurement of moisture before and after ginning. CSIRO researchers, in a joint investment with CRDC, have developed a new moisture sensor, Siroduct. A provisional patent has been lodged for the technology and preliminary discussions have taken place with a potential commercial developer.

The opportunity also exists to combine the sensor with a new cotton flow system being developed as part of a

SIRODUCT MOISTURE SENSOR



Cotton in the new Siroduct moisture sensor *(top)* is a spectacular sight

Below: Siroduct installed in a gin

project investigating changes to the lint cleaner. A change in the method of the flow of cotton from the gin stand may enable more effective techniques to be developed for adding moisture to cotton prior to cleaning.

The four key areas of ginning-related fibre quality investment centre on gin stand efficiency, the lint cleaning progress, contamination assessment and moisture management throughout the gin. Lint cleaning is a major mechanical process that separates trash from cotton fibre. Lint cleaning can be a major source of neps, by damaging and tangling immature fibres. Final evaluation of the new lint cleaner was conducted in 2009–10 and included the development of two new devices that were fitted to a commercial gin. Outcomes of the evaluation showed marginal improvements in fibre quality with improvement in removal of trash content. The results will be used for future discussions with commercial partners for development of the technology, both domestically and internationally. The technology has been patented.

Processing the cotton

New research has been initiated into the development of a yarn or fibre quality index that will include use of SiroMat and other novel fibre measurement technology.

Various types of cotton are blended at the spinning mill, depending on the quality of fabric being developed. Australian cotton is often used alone or with other lower grade cottons. To help mills improve their efficiency and encourage the use of Australian premium cotton types, the Cotton CRC objective will be to develop a computer model that allows mills to improve the selection of cotton for production of specific yarns and fabric. This software technology, Cottonspec, will be used across five major mills in China in 2010–11 as a final assessment of the technology. The CRC is working with the industry's Premium Cotton Initiative (PCI) to develop a commercial plan for release of the technology in a manner that best benefits Australian growers.

Aquaculture for value-adding

Cotton farms contain a number of water storages and the aim of the Cotton CRC activities is to assess the merits of using such storages for silver perch production. To be effective, development of a highly flexible system was needed. The research has focused on small-scale cage production systems. Assessment of all aspects of raising the perch, such as stocking density, feeding rates, diets, disease management, and cage design is part of the project.

The CRC investments in aquaculture will be completed in 2010 and is expected to have developed a set a management guidelines for silver perch production by that time.

Our Achievements

Over the past 12 months The Product saw the commercialisation of SiroMat technology, which will improve the value of Australian cotton by allowing its differentiation in the market place. This may lead to higher premiums for Australian cotton. Commercial partner for the technology will market the technology under the name Cottonscope. During 2010–11, the technology will be further improved with the addition of new fibre fineness technology developed from investment made by CRDC. The combined technology will provide significant advantage for mills in the processing of cotton.

Another significant commercial development is the new moisture sensor, expected to play a key role in automating new moisture management systems developed for

Cottonscope

CSIRO Materials Science and Engineering researcher, René van der Sluijs with the newly commercialised Cottonscope instrument that measures fineness and maturity quickly and accurately

gins. One company that has expressed interest in the technology is the US company Samuel Jackson Pty Ltd, who are key manufacturers of gin moisture restoration equipment. A proposal to support the commercial development of the technology has been submitted to Commercialisation Australia. If successful, use of the technology may expand outside the cotton industry.

Modification of the lint cleaner within cotton gins has been successful in gaining small improvements in fibre length and a reduction in neps. These fibre properties are key determinants of fibre quality for international mills. Patents have been lodged, based on these modifications, and commercialisation plans will be developed for the technology in 2010.

The aquaculture research has led to the development of a new cage design that improved productivity of silver perch production for on-farm water storages.

Outcomes

A key development in 200910 has been integration of outcomes from the adoption of the BMP program across the value chain, from the grower, gin, classing room and transport systems of cotton. Promotion of Best Management Practices for the quality aspects of Australian cotton has led to the establishment of new partnerships with domestic and international mills and brand owners.

CRC research outcomes that contribute to the marketing message developed by industry:

- Fibre quality assessment: contamination is of significant commercial value to the industry in promoting/securing markets. Data on the levels of contamination will provide direct evidence of how implementing BMPs across the value chain can benefit mill customers;
- Environmental performance data in regard to water use efficiency, energy use, carbon emissions, and overall production efficiency. These data are key resources that brand owners can use in the marketing of cotton.

Challenges

Australian cotton is already amongst the world's best with regard to quality but a number of challenges remain that could have significant impact on Australia's competitiveness. A key challenge for the Australia industry is to retain its competitive advantage over international cotton in respect to fibre quality. The activities of the Cotton CRC will help secure the industry reputation; however, key fibre properties such as neps and short fibre content are still issues facing the industry. The Cotton CRC is refocusing its agronomic and ginning research to better assess these two aspects of fibre quality.

Research conducted in collaboration with overseas mills indicates that we have already reached the target of reducing fibre contamination by 50 per cent. The challenge now is to build on that achievement, in order to stay ahead of our international competitors who are also reducing the incidence of contamination in their cotton.

Another key challenge for the industry relates to adoption of its R&D outcomes by its international customers. As an example, the development of new fibre measurement and spinning software technology will require international promotion. The Cotton CRC is working with the Australian Cotton Shippers Association to help achieve international recognition of the technologies, by linking with other industry programs centred on assessment of new cotton varieties by international mills.

Silver perch aquaculture

PhD student, David Foley, with cages developed for silver perch aquaculture

COTTONSPEC: DEVELOPING NEW MARKETS AND PREMIUMS FOR AUSTRALIAN COTTON

CSIRO, together with the Cotton CRC, CRDC and the Australian Cotton Shippers Association (ACSA), is working on building a database and model called Cottonspec that can be used to predict the quality of fine count yarns from fibre properties measured by high volume instruments (HVI) and the Cottonscope instrument. Cottonscope, which was developed by CSIRO, CRDC and the Cotton CRC, measures both cotton fineness and maturity. The Cottonspec project is being carried out in close collaboration with several spinning mills in China whose process and spinning data are being used in the model. Hundreds of fibre samples from these mills, representing growths from around the world, are being collected and tested in Australia on HVI and Cottonscope. The primary purpose of Cottonspec is as a tool to develop new markets and premiums for Australian cotton. The information collected will also provide vital information on the fibre properties important to spinners, which can then be used to develop new breeding strategies.

To validate the model, trials using high quality Australian fibre are being conducted in each mill. In these trials, bales of Australian cotton are spun and dyed into fine count yarns by teams dedicated to this task in each of the mills. Personnel from the Chinese mills have been very keen and happy to provide data for the Cottonspec model and to assess the fibre measurements used to predict yarn quality and the performance of high quality Australian cotton. To this end, over the last 12 months, CSIRO scientists Dr Shouren Yang and Dr Stuart Gordon have spent long periods in China leading these trials and collecting data for the model's database. Over the next 18 months, further development and validation trials will be conducted before Cottonspec's planned release to industry through next year and early 2012.

Top: Australian fibre as roving on way to Ne 50 high quality fine count yarn in the Three Gorges Mill in Wenzhou, Chongqing in February 2010

Bottom: Blended, dyed Australian fibre during carding at the Shandong Tianrong Mill in Wenshang, Shandong, in March 2010

THE ADOPTION

Goal

Increase adoption of new knowledge and enhanced decision-making capability of people working in or with the cotton industry, its catchments and communities

Program Leader, Extension and Knowledge

Yvette Cunningham Cotton CRC

Our Research Program

The Adoption program aims to increase adoption of emerging science-based information and knowledge in order to enhance the decision-making capabilities of people working in or with the cotton industry, its catchments and communities. The program delivers this through a combination of extension services, education pathways (including schools, vocational and tertiary), information products, electronic tools and a range of communication channels.

Research and Partners

During 2009–10 the National Cotton Extension Team underwent some major changes with the CRC, CRDC and Cotton Australia working collaboratively to restructure and refocus the extension and knowledge system services, resulting in the establishment of a Development and Delivery Team. The new team has moved away from regionally based extension to focus more on specific target areas at a national level. Members of the team will continue to operate across all cotton growing regions by implementing target-based campaigns, such as Integrated Pest Management (IPM), weeds, nitrogen use, farm hygiene and innovative farming systems, all which are fully integrated with the industry's new Best Management Practices system, *my*BMP.

The Development and Delivery Team members are employed through Queensland DEEDI, I&I NSW, CSIRO, Cotton Australia, Cotton Seed Distributors and Namoi CMA and are predominantly funded through the Cotton Research and Development Corporation (CRDC) and the Cotton CRC.

Activities

Across The Adoption program a number of workshops, field days and activities were delivered, as a direct response to industry needs. All activities were run in conjunction with research staff, consultants and other independent service providers.

Dryland Cotton Grower Meetings

As a result of good rain and full soil profiles interest was sparked across the industry in dryland cotton production. In conjunction with Cotton Seed Distributors (CSD), meetings were held at Burren Junction and Mallawa which aimed to give growers the confidence and knowledge to grow dryland cotton successfully by utilising best farming practices. Dallas King of the Development and Delivery Team gave a presentation on the different tools and research available from the Cotton CRC website. In addition, Monsanto, CSD, Cotton Australia and Crop Consultants Australia also spoke about relevant issues for the upcoming season.

Whitefly Management Meetings

In 2009, Silverleaf whitefly was identified as an emerging pest in cotton growing regions. This pest can damage cotton plants through its

feeding but the primary problem is honeydew, the sticky substance they secrete. Once honeydew is on the open cotton bolls it can contaminate the lint, resulting in poorer quality cotton and price discounts.

Whitefly management meetings were held at the beginning of the 2009–10 cotton season in Emerald, St George, Dirranbandi, Warren, Narromine, Narrabri and Moree. Lewis Wilson (CSIRO), and Zara Ludgate and Melina Miles (DEEDI) spoke about how to identify parasitised Silverleaf whitefly nymphs, control options and the need to destroy any possible hosts, such as volunteer (self-sown) cotton to stop the 'green bridge' from season to season.

Combating Silverleaf whitefly

A whitefly management meeting conducted by Development and Delivery Team members

Mealy bug and volunteer cotton activities

Due to the identification of Solenopsis mealy bug, *Phenacoccus solenopsis*, in Central Queensland in early 2010, the Development and Delivery Team acted quickly to raise the issue with researchers, growers and consultants. To raise awareness and share knowledge about this exotic mealy bug, team members organised and facilitated field walks and bus tours to affected farms in Central Queensland.

In addition, several workshops and technical talks provided growers with control mechanisms and appropriate biosecurity protocols to stop the spread of the mealy bugs. The team was also heavily involved in the surveying of affected farms, biosecurity guidelines implementation and trial work surrounding the outbreak.

> ' It has been great having access to information and protocols to control an exotic pest in such a short space of time. Hopefully it will help us put a stop to them making a meal out of our cotton'
>
> Mealy bug-affected grower, Emerald

Dryland cotton farming workshop

Good pre-season conditions mean planting dryland cotton has become a more attractive option for the 2010–11 season. At a series of dryland cotton workshops such as this one at Mallawa in north west NSW, current and potential dryland growers received the information they need to make a decision about the coming season

BEST PRACTICE GOES ONLINE WITH *my*BMP

The cotton industry's Best Management Practice (BMP) program was revamped in 2009–10, with numerous changes to existing modules and newly developed segments. The new web-based system was launched as *my*BMP.

*My*BMP offers growers access to an extensive array of tools that are updated regularly. The tools:

- outline grower minimum legal requirements;
- help improve production performance through access to the latest research, resources and technical help;
- better manage business risks;
- share information;
- demonstrate responsible and sustainable natural resource management.

To ensure that the system was ready to be launched, *my*BMP underwent an extensive five-week testing phase, conducted with the help of 16 growers from across the key cotton growing areas of eastern Australia. This testing was vital to ensure that the system worked under the wide-ranging telecommunications and computer options used by Australian cotton growers and also provided important feedback on content, functionality and ease of use. The testing phase revealed there was a high level of confidence that *my*BMP will be reliable, efficient, simple to use and ultimately offers real value for the grower.

*my*BMP was officially launched at the 2010 Australian Cotton Conference.

The *my*BMP support team consists of four core members led by Ken Flower, the General Manager for Best Practice & Research Implementation. Allison Davis, the *my*BMP Service Manager, who is responsible for the management and operations of the site and for ensuring growers receive quality, timely support. Sandra Deutscher manages the partnership between *my*BMP and the industry's research community and Jim Wark, as Business Lead, is responsible for marketing, grower relations and communications. The core team is widely supported by an extensive industry group including the CSIRO, CRDC, Cotton CRC, Cotton Australia and the Development and Delivery Team, who have all had significant input into the development and implementation of *my*BMP.

Boggabri cotton grower, John Watson, with new cotton industry Best Practice and Research Implementation General Manager, Ken Flower

Cotton growers took the opportunity to 'learn all about it' at the *my*BMP launch at the 2010 Australian Cotton Conference. The new BMP system was overwhelmingly greeted with enthusiasm for its user-friendly, dynamic and interactive qualities

The Big Day Out

The Australian Cotton Industry's Big Day Out is an annual field day hosted by the previous year's winner of the "innovative cotton grower of the year' award. The 2010 Big Day Out took place at Susie and Jamie Grant's property, 'Keilli', on the Darling Downs in Queensland. The day was a huge success, with over 130 people attending, including landholders from all cotton communities such as St George, Dirranbandi, Dalby, Goondiwindi, Walgett, Narrabri, Moree Wee Waa, Warren, Bourke and Hillston.

The Development and Delivery Team is heavily involved in the planning and implementation of the Big Day Out. Team members spoke on a number of topics which link research and farm practice, such as Nitrogen Use Efficiency, rotation crops and weed resistance.

Additional extension activities

The Development and Delivery Team has been proactive in updating modules for the new online *my*BMP program, which can be found at www.mybmp.com.au, and will be rolled out progressively over the 2010–11 growing season. Team members were also involved in a range of additional activities in 2009–10:

- Darling Downs Cotton Grower of the Year farm walk in Dalby, Queensland;
- Area wide meetings in Emerald, Queensland;
- Mirid meetings, Warren, NSW;
- Biological farming field walk in Hillston, in southern NSW;
- Drought Cotton Options meetings in St George, Queensland;
- Soil Nutrition workshop in Dalby, Queensland;
- Spray Application Technology and Spray Drift Management workshops in St George and Dirranbandi, Queensland;
- Refuge trial work in Central Queensland, the Darling Downs, and the Balonne and Macquarie valleys;
- Macquarie Valley Centre Pivot Lateral Move Irrigation workshop, and Surface Irrigation and Evaluation/Drip Irrigation Workshop.

Our achievements

Many of the extension projects involving the Development and Delivery Team are ongoing and team members continue to implement a range of successful activities. Of particular note is the release of the first edition of the *Australian Cotton Production Manual*. This publication gives growers, new and old alike, key information to help successfully and sustainably grow high yielding and high quality cotton, with advice on where to obtain more detailed information and tools when necessary.

The manual seeks to achieve for farming systems in cotton production what the *Cotton Pest Management Guide* has achieved for Integrated Pest Management: that is, to provide all relevant information in one package. The *Australian Cotton Production Manual* is one of the first in a series of key products to be delivered by the newly created Development and Delivery Team.

In addition, 2010 saw publication of the 13th edition of the *Cotton Pest Management Guide,* released by NSW I&I, in conjunction with the Cotton CRC. Growers, consultants and agronomists use this guide throughout the cotton season as the main point of reference for insecticide and herbicide use, resistance management, Integrated Pest Management information and management plans for GM technologies.

The Big Day Out

2010 Big Day Out host, Jamie Grant, speaks about his innovative and sustainable dryland farming enterprise at the 2010 Big Day Out at 'Keilli", Jimbour, with a millet cover crop in the background

EXOTIC BUG BITES CENTRAL QUEENSLAND COTTON

Growers from west of Emerald reported the presence of mealy bug in cotton crops early in the 2009–10 season, as reports increased it became clear their presence was becoming a serious problem. As a result, the Cotton CRC along with DEEDI and Biosecurity Queensland formed an Industry working group and initiated a range of actions to protect the cotton industry.

The mealy bug was identified as being an exotic (imported) pest. This species, *Phenacoccus solenopsis*, was also identified in Texas in 1990 and Pakistan and India in 2004 and has caused significant economic loss within those cotton industries. However, since then, this species has succumbed to a large degree of predation by a range of native predators including lacewings and ladybirds and, in particular in India and Pakistan, an accidentally introduced parasitic wasp.

The Cotton CRC funded a survey in the Emerald region to determine the extent of the infestation, the amount of damage and also to identify any factors which could be associated with presence or absence of infestations which might provide indicators to assisting the management of this threat. The initial survey covered 27 of the 28 farms west of Emerald and 25 of the 27 farms assessed had some degree of mealy bug presence. Of the approximately 80 fields affected, 25 had a significant presence and only around six fields have a significant crop loss. Certain factors predispose areas of cotton to be more susceptible to infestation. These factors include:

- the presence of ratoon cotton over the fallow period;
- weedy drains/fields (especially pigweed, sespania, parthenium and bladder ketmia);
- stressed areas of cotton (either waterlogged/soak areas; dry areas such as shallow, sandy or duplex areas within clay fields, or nutrient stressed areas);
- multiple in-crop ground operations (which can spread mealy bug throughout the field); and
- destruction of predators through pesticide usage.

Mealy bug can travel by air currents (at the small crawler stage), irrigation and tail water or contaminated vehicles, animals and personnel entering the field. Although little can be done to prevent spread by the former two methods, we can guard against infestation through control of vehicular and personnel movement within and between fields.

A beneficial insect in action against the Solenopsis mealy bug, *Phenacoccus solenopsis*

Having said this, knowledge of wind direction, areas perennially subject to stress conditions and those areas adjacent to possible sources of mealy bug can be useful in planning how best to concentrate monitoring efforts on farm. The earlier an infestation can be identified, the easier it will be to control without having to resort to pesticide usage.

The Solenopsis mealy bug in cotton in the first detected Australian outbreak, near Emerald in Central Queensland during the 2009–10 growing season

The 2009–10 Cotton Pest Management Guide saw the introduction of:

- new biosecurity pages identifying exotic pests and disease that are threats to the Australian cotton industry;
- a profiling of cotton stainers;
- a descriptions of Q-biotype in whitefly profile;
- an explanations of neonicontinoid resistance in aphids.

The Adoption program aims to inform industry and growers of emerging research, upcoming events and activities which encourage on-ground change. During 2009–10, the Development and Delivery Team had 40 media articles published across the Australian cotton growing areas, which serve as an important part as their role as the link between the researchers and agricultural community.

Outcomes

A comprehensive reworking and broadening of the previous BMP program into the online *my*BMP system was finalised in time for its launch at the 2010 Australian Cotton Conference, with a comprehensive support structure in place to ensure its smooth rollout in 2010–11 and provide support to growers as they adopt the new system.

Cotton CRC researchers, and Development and Delivery Team membershave had input to all *my*BMP modules, which reflect the most up-to-date research findings. The outcome for growers is that they can tailor myBMP to their own needs: anything from using it to work on an individual production performance or environmental risk management issue right up to completing all modules. Growers can also choose the option to be audited if they wish.

Growers in the Macquarie valley are putting together a proposal for the Irrigation Modernisation Scheme. Centre Pivot Lateral Move Irrigation, Surface Irrigation and Evaluation and Drip Irrigation workshops held in the conjunction with NSW I&I water staff in the Macquarie valley have provided them with information to help design

FROM THE NEW COTTON PEST MANAGEMENT GUIDE

their on-farm plans. Depending on the outcome of the proposals, it is possible that many will be able to implement the changes to improve water use efficiency on their farms.

The 2010 Big Day Out field day, held at 'Keilli' on the Darling Down, featured for the first time an innovative farming system that includes dryland cotton as a major and profitable component. Dryland cotton production is now an important part of the cotton industry, with expectations of greater dryland production in the 2010–11 season due to favourable pre-season conditions.

Although the cotton farming system at Keilli is exclusively dryland, attendance at the Big Day Out included irrigated cotton producers from Central Queensland and the Macquarie, Namoi, Gwydir and MacIntyre valleys interested to learn about dryland water use techniques, such as the use of cover crops, that can be applied to their own farming systems to improve their water use efficiency.

The exotic Solenopsis mealy bug, which has caused significant yield losses in countries such as Pakistan and India, was first identified in the Emerald district in early 2010. The rapid and effective extension response to the crisis was extremely collaborative, with Emerald-based Development and Delivery Team member, Susan Maas, working effectively with growers and agronomists, as well as Cotton Australia, the Cotton CRC, CRDC, Plant Health Australia and Biosecurity Queensland to contain the outbreak. The Central Highland Cotton Growers and irrigators Association research and tech committee collaborated with the cotton industry working group to develop the Come Clean Go Clean Protocol that was critical in enabling picking contractors to enter and leave the area without spreading the exotic mealy bugs to other areas.

Susan Maas worked with local growers to amend their previous Fusarium wilt protocol to incorporate farm hygiene procedures required for the mealy bug and DEEDI entomologists conducted research to identify the most appropriate product to use for machinery clean down. Pulse® was identified as a suitable washdown product and Cotton Australia pursued an emergency permit to be used as a washdown product. As a result of these measures, contractors and growers in other areas had the confidence to allow pickers into the area, with no delay to the picking of the 17,000 hectares of cotton in the Central Highlands.

Challenges

The transformation of the Australian Cotton Extension Team into a Development and Delivery Team is delivering many benefits; however, its lengthy roll-out has meant team members must make a number of ongoing adjustments to the focus and structure of their operations, including some members who were previously employees becoming private contractors. It is anticipated, though, that when the new approach is fully bedded down, the national focus will provide a more targeted and streamline approach to information delivery.

The prospect of many more farmers growing dryland cotton in the 2010–11 season is exciting but will mean that entrants to the industry will need considerable support as they familiarise themselves with their new crop. This, however, is the type of positive challenge that the industry, the Cotton CRC and the Development and Delivery Team welcome.

Combating the Solenopsis mealy bug

A mealy bug information session in Emerald, Central Queensland

RESEARCH COLLABORATIONS

The cooperative nature of the Cotton CRC ensures that all projects reflect collaborations with various combinations of researchers, end-users and other stakeholders. These involve cotton industry bodies, small and medium enterprises, catchment management organisations and community stakeholders. The Cotton CRC has a range of mechanisms in place to enable a positive communication process designed to maintain an active 'community of interest' among all partners.

The Cotton CRC has entered into a wide range of formal and informal collaborations during 2009–10:

- The Cotton Research and Development Corporation is a significant investor of grower and Australian Government funds;
- Cotton Australia, Cotton Seed Distributors, Dunavant, Monsanto Australia, Incitec Pivot and the Australian Cotton Shippers Association add further industry input, commercialisation prospects and their own networks of people;
- The CSIRO brings expertise and infrastructure through its Plant Industry, Entomology, Material Science and Engineering, and Sustainable Ecosystems divisions;
- State agriculture departments in NSW, Queensland and Western Australia play important roles in research and adoption, as do catchment bodies such as Namoi Catchment Management Authority (CMA), Condamine Alliance, Border Rivers-Gwydir CMA, Queensland Murray Darling Committee and Central West CMA;
- A new partnership with New England North West Landcare Network, the Gwydir Valley Cotton Growers Association and Border Rivers-Gwydir CMA to employ a Regional Landcare Facilitator in the Gwydir valley;
- The Grains Research and Development Corporation (GRDC) is a significant partner in contributing to research on high yielding grains in irrigated cotton farming systems;
- The Australian Government, through the National Water Commission, is a significant investor in the Water Use Efficiency sub-program, providing approximately $1 million for a project on reducing water losses from on-farm storages;
- The development of the 2010 Enviro-Reader Competition saw the establishment of several new partnership throughout 2009–10 between the Cotton CRC, Peek Designs, Central West CMA and I&I NSW;
- Collaboration with the University of Tasmania continued as part of the Primary Industry Centre for Science Education (PICSE), which it manages, and CRDC to promote science and agriculture in schools;
- Successful collaboration continues with the Aboriginal Employment Strategy and CRDC in facilitating the Student Traineeships Program;
- The Universities of Sydney, New England and Queensland are critical to the education activities;
- The University of NSW, University of Technology Sydney, University of Central Queensland, Australian National University, SunWater and Aquatech continue to contribute new skills in water management;
- The Cotton CRC is working with community organisations such as Narromine, Warren, Narrabri, Millmerran and Inverell Shire Councils through The Community program;
- The Cotton CRC also supports Wincott (Women's Industry Network Cotton), an organisation that aims to provide, information and resources to support women within the cotton industry. This occurs through information days, general interest field days and opportunities for skill building within the cotton industry.

These collaborations add value to the Cotton CRC, as they ensure that Cotton CRC research is meeting the needs and priorities of the end-users. Throughout 2009–10, the Cotton CRC has strengthened collaboration with end-users.

International Collaborations

The Cotton CRC provides a scientific exchange program to enable researchers to interact with their international peers. This program allows researchers to travel overseas and, alternatively, for international visitors to spend time in Australia.

USA

PhD Student Merry Errington (Sydney University) attended the 16th International Plant Nutrition Colloquium, held from 25–30 August, at the Sacramento Convention Centre. Merry presented a the paper *Nitrogen allocation in high yielding Bollgard II ® cotton* as a poster.

Australia

Dr Mary Whitehouse was awarded a scientific exchange scholarship to assist in the organising and execution of the 2010 Australasian Society for study of Animal Behaviour (ASSAB) conference, which attracted 72 delegates from around Australia and New Zealand. The Cotton CRC scientific exchange scholarship provided student presentation prizes and travel bursaries

ECOLOGICAL RISK ASSESSMENT OF AGROCHEMICALS: A SCIENTIFIC EXCHANGE TO CANADA AND USA

Mitchell Burns
The University of Sydney

Mitchell Burns undertook a scientific exchange to the University of Guelph in Canada, and DuPont and Waterborne Environmental Inc. in the USA. The exchange enabled him to work under the supervision of world leading toxicologists, Professors Keith Solomon and Mark Hanson, who are leaders in ecological risk assessment of agrochemicals. A toxicity experiment was conducted that investigated the potential recovery of two species of Duckweed (*Lemna gibba* and *L. minor*) following exposure to the herbicide Diuron®. When the macrophytes were exposed to a range of concentrations, Diuron was found to reduce the population growth rate (widely considered a significant toxicology endpoint for aquatic macrophytes and algae), which is not new; however, following exposure the macrophytes were found to recover to a point that is not significantly different to the population growth rate of the control cultures. These results highlighted questions about whether standard toxicity data adequately represent exposure scenarios that are commonly observed in catchments.

At DuPont and Waterborne, Mitchell gained experience in the development and running of a spatial exposure model developed by these organisations. Under the supervision of Dr. Aldos Barefoot and Dr. Gerco Hoogeweg he was able to participate in the simulation modelling and data gathering processes. It is hoped that he will be able to use these same models to predict spatial environmental fate and exposure in the Gwydir River catchment.

The scientific exchange provided an invaluable opportunity to work with world leaders in an area of research that would not be possible in Australia.

Mitch Burns on scientific exchange to the University of Guelph in Canada. As part of his exchange, Mitch also gained invaluable experience at DuPont and Waterborne Environmental Inc. in the USA

EDUCATION AND TRAINING

Background

A dynamic education and training program is essential in attracting and retaining the best new students and scientists for the long-term benefit of the Australian cotton industry. Flexible and innovative training courses for industry personnel will ensure the Australian cotton industry builds its internal technical skills so it can be well placed to retain its leadership in world's best practice cotton production.

EDUCATION ACTIVITIES

Staff Development

The Cotton CRC is committed to helping staff reach their full potential. We promote professional development through formal training courses. Throughout 2009–10, Cotton CRC staff completed the following training:

- Senior first aid;
- Challenging conversations;
- Coaching skills;
- Communicating with diplomacy and professionalism;
- Fire training;
- Communicating science;
- Manual handling.

The Postgraduate program

The Cotton CRC works hard to make students feel part of a Cotton CRC research community. This is achieved by ensuring that they have adequate opportunities to present their work at scientific forums, by facilitating training in communication and leadership, including IP management, and by conducting meetings and teleconferences across all Cotton CRC programs to ensure that student needs are met.

This year saw continued strong growth in the postgraduate program, with 42 current postgraduate students working across the four research programs. The CRC has now reached its target for enrolments, with over 50 postgraduate students enrolled and an additional three students starting in 2010–11. They are enrolled in 10 partner and affiliate universities, the main ones being The University of New England, The University of Sydney and the University of Queensland. The CRC partnered with The University of Western Australia for the first time and enrolled two PhD students in 2009-10.

University course

Cotton CRC Cotton Production Course

The Cotton CRC continues to develop and deliver the only specialised university-level qualification in cotton production in Australia. The Cotton CRC's Cotton Production Course (undergraduate diploma and graduate certificate) is run through The University of New England and is highly regarded throughout the industry as a key avenue to gaining essential skills in the production of cotton. Crop Consultants Australia has recognised the course as a criterion for the accreditation of Certified Practicing Cotton Consultants. Since the start of the CRC, 40 students have completed the requirements for the Cotton Production diploma or certificate.

The first unit of the course, Applied Cotton Production, is also offered in several modes for students doing agriculture-related degrees at The University of Sydney, The University of New England and University of Queensland. This unit gives a relatively large proportion of Australia's agriculturally oriented graduates a good look at the Australian cotton industry before entering the workforce.

Completed PhD and Masters Students 2009–10

Name	Project Title	Degree	Current Occupation
Guy Roth	Sustainability Indicators for the Australian Cotton Industry	PhD	Working Roth Regional and Rural Pty Ltd
Anna Greve	Development of a 3D geological mapping and database interface to support interconnected groundwater and surface water management	PhD	Working as a postdoc in NCGRT - UNSW water lab August 2010
Marcelo Paytas	Modulation of Pre-flowering vegetative biomass by water and nitrogen supply to enhance assimilate supply for high fruit retention of *Bt* cotton	PhD	Instituto Nacional de Tecnologia Agropecuaria (INTA), Reconquista Experimental Station
Rhiannon Smith	Benefits of Establishing and Managing Native Vegetation on Cotton Farms in the Namoi Catchment	PhD	School of Environmental and Rural Science, Ecosystem Management, University of New England
Floris van Ogtrop	Assisting production decisions on the floodplain in unregulated rivers under climate uncertainty	PhD	

A PhD PERSPECTIVE

Olive Hood
University of Queensland

Governance, Governmentality and Institutions are the cornerstones of my thesis. Interesting, hey? Before you say no, you should know they share little meaning in academia with how they are colloquially expressed. When I started this thesis I thought governance was about how something was managed and by what principles and how that management was made accountable. However, governance, in terms of political theory is a term that is used to capture the increasing role of non-government actors in the management of government portfolios. Health, education, and, more recently, environmental portfolios have been increasingly co-managed by multiple organisations and groups. For example, the increasing role of mining companies in the governance of development in rural and regional Australia. Institution is also a tricky concept. When I first set out I thought institutions were organisations like schools, hospitals and banks. This is fundamentally flawed when it comes to social theory.

Institutions are the organising instruments of human behaviour. They may be formal like laws, regulations and treaties. They also may be informal like cultural norms, folklore and socially proper ways of behaving within certain contexts. It is not surprising that the latter of the two tends to be the 'stickier' to change, because informal institutions are often unconsciously upheld as self evident.

It is also stands to reason that formally developed institutions are generally an extension of the informal laws because of Governmentality. Governmentalities are the subjectivities (or mental models) that make something governable and therefore are the lens through which governmental techniques, like formal institutions such as legislative frameworks, are produced. My thesis is going to place me within the main water governance regime in the Condamine catchment region, from the local to the federal (and hopefully even international) levels. In order to characterise the water governance in this region, I aim to explore how inclusive and connected the centres of deliberation between non-government and government stakeholders are. I will then seek to expose how the governmental trends within these spaces are shaping formal institutional design in a bid to develop greater insight into this formation process. Such insight is critical to adaptive and reflexive environmental governance because it has generally been seemingly rational behaviour within seemingly rationally developed institutions that have proved perverse in terms of environmental outcomes.

The possibility of combining a systems view of governance with a contextual view of institutional development has received little scholarly attention. Further, the application of the concept of governmentalities in this manner constitutes a contribution to an emerging scholarship in the literatures concerning rural and urban planning and development.

Summer Scholarships and Honours programs for undergraduates

The Cotton CRC awarded summer scholarships to three university students to focus on the problems impacting on the cotton industry during the 2009–10 summer. Summer scholarships foster student development and create opportunities for young people in the cotton industry. Students came from a variety of different universities including The University of New England, The University of Sydney, University of Southern Queensland, Australian National University and University of NSW.

TRAINING ACTIVITIES

There have been a number of training-based workshops or seminar series aligned to vocational education and training standards that have been developed through the Cotton CRC in 2009–10, as follows.

The Cotton Field to Fabric Training Course

The field to fabric course was developed to increase cotton producer and industry personnel understanding of spinners' requirements to help the Australian cotton industry continue to deliver quality cotton and maintain a competitive position in international markets. To date, over 217 people from various industry sectors (including a number of international students) have attended the course. The course is targeted from growers through to knitters and weavers (end users) of cotton yarn or fabric and includes three days of lectures, discussions and practical demonstrations from leading researchers and cotton industry experts.

Industry gains Recognition of Prior Learning

Processes are in place that allow cotton producers to gain a Certified BMP Farm Manager award , which

PhD, Honours and Masters enrolments 2009–10

Name	Project Title	Degree	Supervisor	Organisation
Tim McLaren	Improving P and K fertiliser use efficiency in depleted or sodic vertosols	PhD	Dr Chris Guppy	UNE
Madeleine Hartley	The legal framework for economic environmental water trade off in the Namoi under climate change and variability	PhD	Professor Alex Gardner	UWA
Alison Wilson	Economic-environmental water trade-offs in the Namoi under climate change and variability	PhD	Professor David Pannell	UWA
Brendan Griffith	Addressing agronomic constraints in irrigated wheat production in northern grain regions	PhD	Dr Chris Guppy	UNE
Stephen Yeates	The development of sustainable coastal north Queensland	PhD	Greg Constable	CSIRO
Olive Hood	Collective NRM and socio-economic scenarios in cotton communities	PhD	Leith Boully, Dr Toni Darbas, Dr Christine King	UQ

Completed Honours, Masters and Summer Scholarship enrolments 2009–10

Name	Project Title	Degree	Supervisor	Organisation
Carl Zimmermann	Characterisation of groundwater-surface water connections in the Namoi Basin (NSW) using hydrogeochemical methods	Honours	Dr Marc Norman Dr Natasha Herron	ANU
Thomas Watson	Impact analysis of Cotton CRC IPM projects	Summer Scholarship	Janine Powell	ANU
Lisa Gooley	Digital soil mapping (DSM) the available water content (AWC) across the Trangie and Warren districts using legacy ancillary data	Summer Scholarship	Dr John Triantafilis	UNSW
Lisa Howie	Micro-bubbles – their contribution to soil respiration under different soil moisture conditions	Summer Scholarship	Prof David J Midmore	CQU
Joel Eulenstein	Evaluating flush sampling for *Helicoverpa* moths	Summer Scholarship	Professor Peter Gregg	UNE

is equivalent to a Diploma of Agriculture Certificate II. In 2009–2010, the Recognition of Prior Learning process lead to the award of ten new Diplomas (expecting all to be issued Certified BMP Farm Manager status once cross-checked with Cotton Australia) and seven Advanced Diplomas of Agriculture and/or Rural Business Management: significant results for an industry newly exposed to this vocational process.

Cotton Irrigation Workshop Series

Vocationally aligned workshops were developed in cooperation with the Cotton CRC, I&I NSW, DEEDI, Sustainable Irrigation, Irrigation Futures CRC, CRDC and GRDC, targeted at improving the management skills of cotton and grains irrigators and advisors.

Centre Pivot Lateral Move Irrigation, Surface Irrigation and Evaluation Drip Irrigation workshops were delivered in the Macquarie and Central Queensland during 2009–10. Each workshop was well attended, with over 25 growers in attendance in total, receiving information on how to improve their irrigation systems.

The Field to Fabric training course

CSIRO Materials Science and Engineering's commercial scale cotton spinning, fabric formation and dyeing and finishing mills are used extensively to demonstrate effects on fibre quality to participants in the Field to Fabric Training Course.

THE COTTON PRODUCTION COURSE

Cotton Production course students from University of New England and University of Sydney joined forces in Narrabri.

Top: Michael Carberry addressing students at 'Cardale'

Below, left: Students visiting Cotton Seed Distributors, Wee Waa, Narrabri

Below, right: Wee Waa cotton grower, James Kahl, explains irrigation scheduling to students

Lunchtime learning in Central Queensland

Due to the common occurrence of pest and disease breakout in Central Queensland, a number of Disease and Entomology training lunches were held for agronomists.

Diseases

Stephen Allen(CSD), Linda Smith, Linda Scheikowski, Murray Sharman and Susan Maas (DEEDI) presented early season disease survey update results from last season's boll rot research in Central Queensland and other disease issues, including training for new agronomists in symptoms identification

Pests

Dave Murray and Zara Ludgate (DEEDI) held a training session on how to identify parasitised Silverleaf whitefly nymphs, identification of mealy bug infestations and control options.

> 'This sort of training increases my understanding, giving me more confidence in sticking to the recommended threshold for whitefly'
>
> Whitefly training participant

Spray Application Technology and Spray Drift Management

Spray drift damaged a number of cotton crops throughout NSW and Queensland in 2009–10. To reduce the potential damage, Spray Application Technology and Spray Drift Management workshops were coordinated in conjunction with Bill Gordon Consulting and conducted in Warren, Narromine, St George and Dirranbandi. These workshops highlighted the importance of nozzle selection, application technique and ideal spraying conditions.

'CottonMap', which allows cotton growers to plot their own cotton fields in any industry location, has played a big part in helping reduce 2,4-D damage this year. This allows other farmers and spray operators to easily check online on the location of 2,4-D sensitive crops in their area.

SCHOOLS PROGRAM

The future of Australian science and agricultural lies with the youth of today. The Cotton CRC schools program has thrived since the appointment of an Education Officer (Trudy Staines) through CSIRO. 2009–10 saw a range of activities:

- Co-ordination and implementation of a National Primary Industry Centre for Science Education (PICSE) Industry Placement Scholarship, which involves a five-day student placement with a team of scientists in specific industries or research organisations. At the end of the placement, students provide a report to other scholarship students, industry mentors, involved universities and parents;
- Organisation and facilitation of a visit from the Rotary Youth Agricultural Group (RYAG) from Moree and Wee Waa High Schools to the Australian Cotton Research Institute (ACRI) to explore science and agricultural career opportunities. RYAG is a four-day cotton camp that offers students an overview of the cotton industry and job availability and gives guidance and direction for career paths into the cotton industry;
- The hosting of Narrabri Public School, Narrabri TAFE, Wee Waa and Narrabri High Schools and home school groups at ACRI;
- Assisting the Armidale UNE PICSE SEO with the Science Investigation awards (SIA) in Armidale. SIAs students conduct their own science investigation and present it at a culminating event;
- Hosting a visit from Calrossy Anglican and Macintyre High Schools. The students are given a tour of the ACRI and talks by leading scientists in the fields ofpPlant breeding and entomology;
- Organisation, design and facilitation of a Cotton CRC cotton careers display stand and brochures for the Tamworth and Armidale Careers Expos, attended by over 3800 students across three cotton catchments;

Cotton map is an initiative of Cotton Australia, CRDC and Nufarm. The Cotton CRC D&D Team promotes it as a tool to be utilised in their spray drift workshops

- A presentation to the University of Southern Queensland (USQ) PICSE Teachers' professional development workshop to illustrate the connection between the science taught in classrooms and the science used locally in primary industries and research and development organisations;
- Organisation of local schools to attend a River Rally conducted by Industry and Investment NSW (I&I NSW) and developed by environmental education experts from I&I NSW, Namoi Catchment Management Authority and NSW Waterwatch. River Rallies is a unique environmental education initiative: environmental education experts take children out of the classroom to provide first hand learning experiences of the riparian environment;
- The Science and Engineering Challenge: an outreach program conducted nationally by the University of Newcastle. This program is designed to inspire students to study science and engineering at a senior level. Each challenge day, students participate in a series of exciting competitive activities designed to demonstrate the varied and practical elements of a career in the science and engineering industries.

NARRABRI SCIENCE WEEK FESTIVAL … A FEAST OF SCIENCE FUN AND LEARNING

Representatives from local science and education institutions including the Cotton CRC, CSIRO and other local organisations paved the way for claiming the title of 'Country Science Capital' and presented the inaugural Narrabri Science Festival, to coincide with National Science Week 16–23 August 2009, which was themed around the International Year of Astronomy. The weeks events included:

- 'snag a scientist', where locals could meet and mingle with mad professors;
- a school science fair, where students had the opportunity to present and display their science projects to the wider community;
- science trivia to kick-start the brain;
- 'a night with the stars', in which Narrabri residents got to identify their favourite constellation through telescopes;
- a celebration of the 40th anniversary of the moon landing and free screening of the movie, *The Dish*
- 'astro hot seat', an amusing and educational quiz about the search for the asteroid that could destroy civilisation.

Looking slightly silly in the good cause of science, Merry Errington, Marilyn Smith and Michael Braunack of the Cotton CRC were snagged at the 'snag a scientist' event in Narrabri in August 2009

COTTON TURNING GREEN

A new industry award and qualification based on green skills has been created for Australian cotton growers.

In 1990s the cotton industry developed a voluntary, self-regulated approach to the protection of resources and environmental management in the cotton growing industry, known as Best Management Practices (BMP). The BMP system provides self assessment mechanisms, along with practical tools and auditing processes, to ensure that cotton is produced with best practice across a range of focus areas.

It was discovered through the BMP process that many farmers were utilising green skills in the day to day running of their farms. By working with the vocational education system the cotton industry developed a new Diploma of Agriculture based on life-long learning and practical implementation of green skills.

Cotton Growers are keen to implement the latest technology and research to maximise the productivity of their farms without damaging their land.

Professional Development Manager Mark Hickman believes Australian cotton growers are early adopters of green skills

COMMERCIALISATION AND UTILISATION

STRATEGIES AND ACTIVITIES

The Cotton Catchment Communities CRC has a number of Commercialisation and Technology Transfer Systems well established to deliver outcomes to a diversity of end-users. Quite often, as with many other agricultural and environmental CRCs, the pathways to adoption are not always through third party commercial products but rather through direct uptake and utilisation by the grower to add commercial benefit to their business. Public domain outcomes and the outcomes which benefit a large number of small to medium enterprises (such as cotton farms) are more effectively delivered through adoption channels such as communication, extension and education.

Pathways to adoption

Adoption pathways within the Cotton CRC are multi-directional and utilise numerous communication channels and participative learning options to facilitate the uptake of emerging research. Knowledge emerging from science and practice management is developed (by extension, education and training, communication and knowledge management staff) into integrated product suites tailored to meet the needs of the respective audiences. End-users are an integral part of this product development through trials, working groups and steering committees, which ensure greater grower ownership that leads to increased adoption levels and more targeted scientific outcomes for the industry.

The Cotton CRC, CRDC, I&I NSW and Queensland DEEDI have in the past had a collaborative approach to investment in extension services. During 2009–10, the CRC, CRDC and Cotton Australia worked collaboratively to restructure and refocus extension and knowledge system services, resulting in the establishment of a Development and Delivery Team that will continue to operate in all cotton regions in a way that is fully integrated with the industry's new Best Management Practices system, *my*BMP (see below).

Partnering public and private sectors

The Cotton CRC engages a range of public and private sector organisations (see participants' list) in adoption and commercialisation of research. These fall broadly into two categories:

- *Decision-makers*

  A critical component of the adoption and commercialisation strategy is building the capacity or scientific basis on which government and catchment management bodies are making investment and management decisions. End-user organisations such as Catchment Bodies, NSW Department of Water and Energy and QLD Department of Natural Resources and Water are actively involved in funding and delivery of a range of collaborative projects through steering committees, direct investment, working groups and extension activities.

- *Agribusiness and Consultants*

  Supporting and building the capacity of private sector consulting services are key parts of the Cotton CRC's adoption and commercialisation strategy. There are a large number of private crop consulting enterprises serving cotton production. Their 300-strong peak representative body, Crop Consultants Australia Ltd, is a partner in the Cotton CRC. Additionally, specific members participate in a number of project steering committees, directly in the research being undertaken or as a targeted audience in a participative learning activity, such as building capacity in irrigation services in the Condamine catchment. Engagement in this area allows the Cotton CRC to capitalise on its limited resources by building understanding in a smaller audience of advisors that, in turn, can facilitate on-ground change with their numerous clients.

Best Management Practices Program

Over the past decade, the BMP Program has been highly successful and has positioned the Australian cotton industry well. Due to this success and a continuing need for such an industry program, the Cotton CRC along with CRDC and Cotton

Extending knowledge at the Big Day Out

David Lester and Duncan Weir adressing the Big Day Out field day participants, communicating the importance of nitrogen use efficiency

Australia continues its commitment to the future evolution of BMP. The new online *my*BMP program has been successfully piloted in all cotton growing areas, with positive grower feedback demonstrating value. *It* will be rolled out progressively over the 2010–11 growing season . In future, *my*BMP will include the BMPs for ginning and classing and is designed to interface with the Grains industry BMP system.

Evaluation of investments

An evaluation of the impacts of Cotton CRC investments in industry will be conducted at a range of levels for all Cotton CRC research, education and extension, using a strategic evaluation framework. A monitoring and evaluation framework consistent with the DIISR model for the third year review has been established and includes all Cotton CRC DIISR outcomes and Cotton CRC strategic goals and targets. All Cotton CRC projects are included, and benchmark data is being collected to monitor progress to date and provide a reference for future progress.

COMMERCIALISATION

The Cotton CRC now has twelve research projects either completed, terminated or in progress, in which commercial partners are involved or are being sought. In several cases these projects are based on discrete IP or third party project agreements. These partners are making significant cash and/or in kind contributions towards the development of commercial products.

Measuring the impact of the CRC

The CRC is well on the way to achieving many of its targets and will begin reporting on the economic impact of the industry adopting research outputs.

An initial impact assessment completed by the BDA group for the 3rd year review suggested that $720 million in benefits would be generated

QUICK TEST IDENTIFYING PESTICIDES IN WATER ... FAST

Quick Test is a newly developed lateral flow device that uses established immunogold or similar detection techniques to analyse for a target chemical in water or dilute organic solvent. Users add a small amount of test liquid to the Quick Test device which then shows a sequence of colour patterns depending upon if the target chemical is present at a preset concentration.

Key features and benefits of the technology are:

- Detects the presence (yes) or absence (no) of herbicides and insecticides in water at a suitable concentration;
- Easy to use, no prior knowledge of analytical chemistry is required;
- Quick results, expected to take less than five minutes in total, including water sampling;
- Single or multiple analyses can be performed in each test, which can be marketed individually or in multi-analyte format;
- Results of analyses obtained immediately to facilitate timely and more effective management;
- Potential for rapid development of this technology, water matrices will be targeted because it is an easier substrate on which to produce reliable ELISA results;
- The analyte targets and the level of response of the test kits can be tailored as required, enabling the certification of a predetermined quality benchmark. For example, local water quality guidelines or maximum residue limits (MRLs) for trade purposes.

Intellectual property

The combination of the experiment team and the previous experience of Cotton CRC projects have led to the development of the project intellectual property (IP). The IP in this application is described in the provisional patent application and is owned by the Cotton CRC. It is envisaged that Quick Test will be developed to complete tests for a series of herbicides, specifically, prometryn, flumeturon, and glyphosate. These will also be used for tests of insecticides, including OPs and OCs, which includes endosulfan, to provide broad testing ability.

Dr Angus Crossan and Professor Ivan Kennedy of The University of Sydney viewing an LC-MS-Time of Flight mass spectrometer at Tianjin University of Science and Technology with Professor Shuo Wang

as a result of the activities of the CRC. Further economic analysis indicates an impact of $1 billion may be achievable.

In order to analyse the impact of the CRC, the uptake of research needs to be understood. Relevant practice changes for each target have been benchmarked since 2005 to help to define the influence of CRC research and extension activities. These benchmarks are conducted via industry surveys, trials and research focus groups.

One tool being used to measure the impact of practice change at a farm level is the recently completed whole farm budget, representative of a typical farm in the lower Namoi valley in NSW. The representative farm and corresponding research report have been developed by Cotton CRC Research economist, Janine Powell, in conjunction with I&I NSW economist, Fiona Scott. Initial analysis involved sensitivity-testing farm profitability to commodity prices, nitrogen and diesel prices. The tool will also be used to analyse the effect of specific practice changes on farm profitability.

Specialist environmental and social economists are being engaged to understand the economic impacts of the CRC's Catchment and Community programs.

IP MANAGEMENT

The Cotton CRC has adopted policies for IP management at Board, Management and research project levels. Most significantly the 'Cotton CRC Intellectual Property Management Tool Kit', 'adapted (with permission) from the Tool Kit prepared for CRDC by the Australian Centre for Intellectual Property in Agriculture (ACIPA). This Board-approved document gives comprehensive advice on IP discovery, planning and monitoring. Background and potential IP from Cotton CRC projects are identified as part of the development and recommendation stages of all new project applications, and is continually monitored through the six monthly project reporting process. The Final report of finalised projects is again thoroughly scrutinised for potential IP before the project is marked as completed. During the 2009-10 Financial Year the Audit Committee and Board developed and approved the implementation of 'Commercialisation Policy and Procedures' this document is used by the Commercialisation Team to manage and report IP developments to the Board and Participants.

IP National Principles and the Cotton CRC

There are nine national principles of intellectual property management for publicly funded research. The Cotton CRC has addressed these by:

National Principle	Cotton CRC action
Institutional Policies	Cotton CRC has policies approved by the Governing Board relating to the ownership, protection and exploitation of IP
Identification of IP	Cotton CRC has procedures that provide support to researchers so that they can recognise when their discoveries may have potential commercial value and provide for a review process to identify IP that can be protected and/or exploited
Protection of IP	Cotton CRC has policies to ensure participants have policies that make clear to staff their responsibilities in relation to IP protection including, where appropriate the maintenance of research laboratory records and the prevention of premature public disclosure of research results prior to obtaining IP protection
Ownership of IP	An IP ownership policy has been agreed by participants and is described in the participants' agreement
Assessment of Existing IP	Procedures are in place to guide researchers in assessing the existing IP in the field that is likely to affect their research in order to determine their freedom to operate in that field of research
Management of IP	Cotton CRC has procedures for the regular review of IP and associated commercial activities and outcomes arising from publicly funded research. Research institutions will have procedures in place to provide advice to the creators of the IP on the options that are available for commercialising IP
Sharing of Benefits	Cotton CRC has agreed policies that recognise the rights and needs of all stakeholders involved in the research supported by public funds. (These are described in detail in the participants agreement)
Transparency and Reporting	Cotton CRC reports annually on IP management to participants and DEST
Potential Conflict of Interest	Cotton CRC has policies and procedures that provide guidance in relation to potential conflicts of interest concerning ownership, management, protection and exploitation of IP

Most of the IP produced from projects in the Cotton CRC is Centre IP that is IP legally owned by the Cotton CRC on trust for Participants as tenants in common. Although the Board can approve discrete IP projects, defined as IP where significant background IP is present from core participant's to the project, in these cases the IP is owned by the project participants in proportion to their project contributions. There are two Discrete project agreements existing within the Cotton CRC both involving Ginning of cotton specifically moisture and contamination and lint cleaning and SiroMat a cotton fibre maturity measurement instrument.

The Cotton CRC has three Third Party IP Agreements in place, developed and Board-approved under negotiation with prospective and existing commercial partners, most with exciting potential. Third Party IP Agreements involve commercial partners (non participants) and the Cotton CRC sharing ownership of potential IP developed and Board-approved. The Cotton CRC has third party agreements with commercial partners AgBiotech Pty Ltd, Growth Agriculture Pty Ltd and Native Fire Limited (now lapsed) involving semio-chemical IP.

Developing and existing IP is reported in six-monthly written project reports completed by the project leaders themselves and at Board, Audit Committee and management team meetings. The Cotton CRC maintains a register of actual and potential IP and there are already 136 projects with background, centre and/or potential IP records.

Cotton CRC Intellectual Property agreements

Project name	Status	Agreement Type	Partner	Partner funding	Progress
Quick Tests for herbicides in water	In Progress	Under Negotiation	Under Negotiation	None	Provisional Patent ready to file, EIO process underway
Nitrogen fertiliser use efficiency	In Progress	None	None	None	Delivered from existing Project – Provisional Patent Filed
Chemical ecology of insects	Completed	Third party	Ag Biotech	$118,700 cash plus in kind	Magnet® is fully registered, with royalty income being generated.
Apparatus and process for Measuring Ginning Properties	In Progress	Under Discussion	Under Discussion	None	International Patent Lodged.
Managing green mirids with plant extracts (pilot)	Completed	Third Party now Terminated, MOU in place	Native Fire	None	Project abandoned Cotton CRC is supporting inventors to achieve Commercial Partner.
Behaviour modifying plant extracts	Complete	Third party	Growth Agriculture	$365,200 cash plus in-kind	Project now complete . Provisional Patent filed. Commercialisation phase commenced.
Electrical imaging of soil water	Complete	Centre IP	Under discussion	None	International Patents lodged, Commercialisation Plan underway
Bioremediation enzymes	Complete	Centre IP		None	Under negotiation to publish in public domain
Measuring fibre maturity	Complete	Discrete IP	BSC Electronics Pty Ltd	None	Commercial partners contracted, royalties received
New ginning technology	In progress	Discrete IP	Under discussion	Under discussion	Under negotiation
Management of cotton	Complete	None	None	None	Provisional Patent Lapsed. Published in Public Domain.
Polymers to reduce evaporation	Complete	Third Party	None	None	Provisional Patents Lapsed, no significant IP

END-USER INVOLVEMENT AND CRC IMPACT ON END-USERS

Wherever possible the Cotton CRC engages with end-users at the start of projects to help improve the usability of the outputs and increase the level of uptake of the research results. The following table provides some examples.

End-user name	Relationship with CRC	Type of activity and end-user location	Nature / scale of benefits to end-user	Actual or expected benefit to end-user
Ag Biotech Pty Ltd	Industry Affiliate	Commercialisation	Licence to use CRC research Project 1.05.02 'Chemical ecology of insects' for a period of time to undertake product development	Sales of product. Royalties are earned by the Cotton CRC from these sales and are commercial in confidence
Aquatech	Industry Affiliate	Contract research to the CRC	Participation in water use efficiency and water storage projects will raise profile and increase sales of monitoring equipment	Project recently commissioned. Cotton growers benefiting from predicted water use efficiency gains
Cotton Seed Distributors	Industry Participant	Adoption of CRC research. Assistance with extension of research outputs	Increased sales of cotton seed through a more productive and expanded cotton industry	Current limitations in the availability of water make it difficult to assess long term benefits at this stage
Dunavant Enterprises Pty Ltd	Industry Affiliate	Adoption of CRC research	Reduced contamination in Australian cotton will mean fewer quality discounts and a better reputation in the marketplace	Project has already identified areas in which contamination can be reduced
Incitec Pivot Ltd Nutrient Monitoring Systems	Industry Affiliate Project Partner	Adoption of CRC research	Increased revenue from more effective methods of soil testing and better decisions	Fertiliser sales and cost savings for growers
Monsanto Australia Inc	Industry Affiliate	Adoption of CRC research	Increased use of transgenic cotton, generating more license revenue and improved sustainability of GM technology	Approximately 95% of the Australian crop is now transgenic, and Cotton CRC research underpins the sustainability. Monsanto have increased their contribution to the CRC
Growth Agriculture Pty Ltd	Project Partner	Commercialisation	New product and sales	Product Sales
Borders Rivers-Gwydir Catchment Management Systems	Project Partner	Adoption of CRC research	Ability to meet catchment targets	Improved water use efficiency Improved farm practice Improved riparian and environmental outcomes
Aboriginal Employment Strategy Pty Ltd	Community Affiliate	Employment	Improved ability to place Aboriginal job seekers in cotton-related work	Project underway with two student traineeships based at the Australian Cotton Research Institute
Australian Cotton Shippers Association	Industry Affiliate	Adoption of CRC research	Reduced contamination in Australian cotton will mean fewer quality discounts and a better reputation in the marketplace	Project has already identified areas in which contamination can be reduced
Cotton Australia	Industry Participant	Advising on research directions and strategy and providing on-ground resources for grower trials Adoption of CRC research	Training programs will upskill operators in several sections of the industry	Implementation of BMP program, which has economic outcomes for growers

End-user name	Relationship with CRC	Type of activity and end-user location	Nature / scale of benefits to end-user	Actual or expected benefit to end-user
Crop Consultants Australia Inc. (Formerly Cotton Consultants Australia)	Industry Affiliate	Adoption of CRC research, contracted research from CRC	CRC adoption projects will transfer knowledge to consultants, who are key agents in knowledge transfer to growers. CCA also contracted to survey growers for triple bottom line monitoring	Increased knowledge and capacity for members and member grower customers
National Water Commission	Project Partner	Adoption of CRC research	Improved water use efficiency and reduced evaporation and seepage losses	CRC water research is expected to improve WUE by 50%
Namoi Catchment Management Authority	Catchment Affiliate	Adoption of CRC research	Ability to meet catchment targets	Improved water use efficiency Improved farm practice Improved riparian and environmental outcomes
Central West Catchment Management Authority	Project Partner	Adoption of CRC research	Ability to meet catchment targets	Improved water use efficiency Improved farm practice Improved riparian and environmental outcomes
Condamine Alliance	Catchment Affiliate	Adoption of CRC research	Ability to meet catchment targets	Improved water use efficiency Improved farm practice Improved riparian and environmental outcomes
Queensland Murray Darling Committee	Catchment Affiliate	Adoption of CRC research	Ability to meet catchment targets	Improved water use efficiency Improved farm practice Improved riparian and environmental outcomes
SACOA Pty Ltd	Project partner	Adoption of CRC research	CRC research will enable the use of petroleum spray oils against new insect pests, thus increasing revenue	Product sales
Inverell Shire Council	Community Affiliate	Adoption of CRC research	Improved ability to predict and target local government services to meet regional community needs	Socio Economic study understanding of benefits of a cotton to the community
Millmerran Shire Council	Community Affiliate	Adoption of CRC research	Improved ability to predict and target local government services to meet regional community needs	Socio Economic study understanding of benefits of a cotton industry to the community
Narrabri Shire Council	Community Affiliate	Adoption of CRC research	Improved ability to predict and target local government services to meet regional community needs	Socio Economic study understanding of benefits of a cotton industry to the community
Narromine Shire Council	Community Affiliate	Adoption of CRC research	Improved ability to predict and target local government services to meet regional community needs	Socio Economic study understanding of benefits of a cotton industry to the community

COMMUNICATION STRATEGY

Background

The Cotton CRC pursues all opportunities to effectively engage and communicate with its wide range of partners and affiliates, stakeholders and end-users.

Communications is linked heavily to the Cotton CRC Adoption program, in particular to the Development and Delivery Team who are responsible for providing the latest research and extension information to Cotton CRC end users. In 2009–10, the Cotton CRC developed and organised a number of opportunities to showcase science and extension achievements.

Website

The Cotton CRC website continually changes and evolves to meet the demands of its visitors and to showcase its extensive library of resources. Google analytics allows us to monitor what information is most popular and how it is being accessed and as a result of these metrics, we have changed and diversified the layout of information. 2009–10 saw the development of *Fishes on Cotton Farms: A guide to native fish and habitat management in North-West NSW* and *Birds on Cotton Farms* into interactive web-based tools. These tools allow visitors to sort fish or birds by size, habitat and common name. *Common Plants of Grazing Pastures on the Lower Namoi Floodplain* will also be updated as a web tool in 2010.

Media

Media releases are a key component of the Cotton CRC communication strategy. In the past twelve months, the Cotton CRC has produced a range of media releases to promote the research, extension and on-ground changes in the cotton industry. As a result, stories on Cotton CRC activities and research were picked up over 200 times across both broadcast and print media.

New interactive online tools on the Cotton CRC website

Screen shots of the *Birds on Cotton Farms* ID tool and *Fishes on Cotton Farms* interactive guide

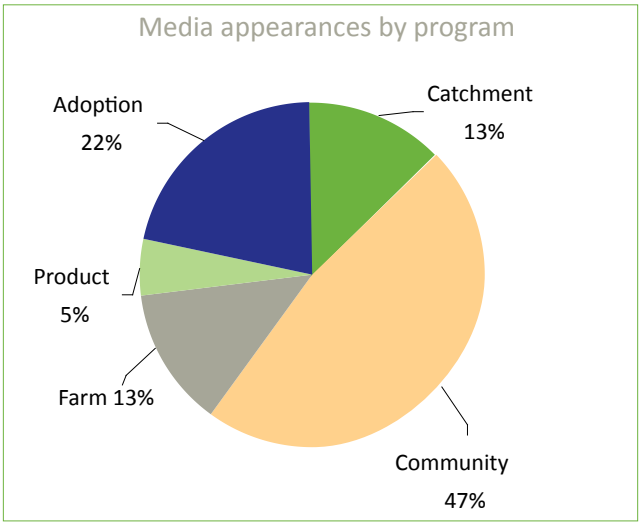
The Community program dominated the media again in 2009–10. Stories surrounding the inaugural Sustaining Rural Communities Conference sparking interest across Australia, with 50 media articles spreading from Emerald to Perth and Hobart. The Farm and Adoption programs were not far behind, with timely information regarding mealy bug, Silverleaf whitefly and new threshold techniques and water saving updates appearing in a range of publications as a consequence of Cotton CRC communication activities.

To ensure cotton growers are kept informed of emerging research and how it relates to their specific region, the Development and Delivery Team regularly produces and distribute the technically-based *Cotton Tales*, which the industry regards highly for its short, timely and relevant nature.

Two electronic newsletters continued during 2009–10. *Cotton CRC Chat* is distributed to all Cotton CRC participants, affiliates, researcher and extension staff, and highlights projects, extension activities, upcoming events and research and extension achievements. *Cotton E-News* is a regular electronic newsletter, aimed more specifically at industry organisations and cotton growers.

Field days, farm walks, workshops, seminars, school visits and community forums provide more interactive communication channels. Newspaper and magazine articles, radio and TV interviews, and presentations and lectures by Cotton CRC staff provide other avenues for communication.

The Cotton CRC has worked closely with a range of small and medium enterprises, including *The Australian Cotton Grower*, *Cotton Outlook*, The Northwest Courier Group, Rural Press, ABC Radio, Prime television and Radio 2VM, all of which have actively promoted Cotton CRC research and events.



CottASSIST – ASSISTING COTTON MANAGEMENT VIA THE WEB

The CottASSIST website, www.cottassist.cottoncrc.org.au, is constantly evolving, with some significant enhancements in the past year. This has lead to a substantial increase in the use of the decision aids: statistics show a 16 per cent increase in site visits (a total of 15834) and a 35 per cent increase in unique visitors (801). The standout tools were the Crop Development Tool (158 per cent increase in use), NutriLOGIC Soil Analysis (82 per cent), the Last Effective Flowering tool (76 per cent), and the Day Degree calculator (24 per cent).

New tools and improvements to the CottASSIST suite are:

- NutriLOGIC, which includes improved analysis when working with variable petiole data, changes to thresholds for the soil analysis, new graphical output for leaf analysis; and changes which allow for the saving of petiole, leaf and soil sample data;
- The 'Mite Yield Loss Estimator', which allows crop managers to enter mite population and infestation details and obtain an estimate of the likely effect on lint yield. Ongoing entry of new mite counts, which may result from control measures or changes in crop development stage, enables this estimate to be adjusted. It also allows for the effects of predators or parasites on mite build-up. This work has been conducted in collaboration with Dr Lewis Wilson, CSIRO.
- The 'Seasonal Climate Analysis Tool', which collates SILO Patched Point climate data to enable users to obtain summaries of climate data relating to cotton growth for their own location. This includes current and long-term data for day degrees, cold, hot, and frost days. Users can also define temperature thresholds and select data for daily, weekly, monthly, or seasonal summaries. Previously these summaries were only available for a limited number of locations through industry publications.

AUDITOR'S STATEMENT

NEXIA COURT & CO
CHARTERED ACCOUNTANTS

NEXIA INTERNATIONAL

The Board of Directors
Cotton Catchment Communities CRC Limited
Locked Bag 59
NARRABRI NSW 2390

28 September 2010

Dear Board Members

Auditor's Independence Declaration under section 307C of the *Corporations Act 2001*

In accordance with section 307C of the *Corporations Act 2001*, I am pleased to provide the following declaration of independence to the directors of Cotton Catchment Communities CRC Limited.

As lead audit partner for the audit of the financial statements of Cotton Catchment Communities CRC Limited for the financial year ended 30 June 2010, I declare that to the best of my knowledge and belief, there have been no contraventions of:

(a) the auditor independence requirements of the *Corporations Act 2001* in relation to the audit; and

(b) any applicable code of professional conduct in relation to the audit.

Yours sincerely

Nexia Court & Co
Chartered Accountants

Ian Stone
Partner

Sydney

Limited Liability by a scheme approved under professional standards legislation.

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Sydney, NSW 2000
P O Box H195
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FINANCIAL STATEMENTS

Cotton Catchment Communities CRC Limited

ABN 14 116 310 957

Statement of Financial Position

As at 30 June 2010

	Note	2010 $	2009 $
ASSETS			
Current assets			
Cash and cash equivalents	7	6,336,893	7,657,774
Trade and other receivables	8	786,436	723,123
Other current assets	9	35,610	39,900
Total current assets		7,158,939	8,420,797
Non-current assets			
Plant and equipment	10	160,510	85,524
Total non-current assets		160,510	85,524
TOTAL ASSETS		7,319,449	8,506,321
LIABILITIES			
Current liabilities			
Trade and other payables	11	1,925,315	2,066,380
Employee benefits	12	61,997	34,135
Current tax payable	6	52,159	102,797
Provisions	13	841,967	661,110
Deferred income	14	3,296,660	4,729,044
Total current liabilities		6,178,098	7,593,466
Non-current liabilities			
Employee benefits	12	13,587	28,189
Total non-current liabilities		13,587	28,189
TOTAL LIABILITIES		6,191,685	7,621,655
NET ASSETS		1,127,764	884,666
EQUITY			
Retained earnings		1,127,764	884,666
TOTAL EQUITY		1,127,764	884,666

The accompanying notes form part of the financial statements

Cotton Catchment Communities CRC Limited

ABN 14 116 310 957

Statement of Changes in Equity

For the Year Ended 30 June 2010

	2010 $	2009 $
Total equity at the beginning of the year	884,666	511,254
Total comprehensive income	243,098	373,412
Total equity at the end of the financial year	1,127,764	884,666

The accompanying notes form part of the financial statements

Cotton Catchment Communities CRC Limited

ABN 14 116 310 957

Statement of Comprehensive Income

For the Year Ended 30 June 2010

	Note	2010 $	2009 $
Revenue	2	27,731,556	28,670,394
Employee benefits expense*	3	(1,060,693)	(813,291)
Depreciation and amortisation expense	3	(48,179)	(22,115)
Project expenses:			
- The Farm		(13,449,407)	(12,964,873)
- The Catchment		(4,245,322)	(5,688,422)
- The Communities		(930,096)	(389,878)
- The Product		(2,282,723)	(1,827,446)
- The Adoption		(5,368,614)	(6,679,311)
Administration expenses		(348,040)	(281,871)
		(27,733,074)	(28,667,207)
Results from operating activities		(1,518)	3,187
Finance income	4	294,557	430,054
Finance expenses	4	-	(317)
Net finance income		294,557	429,737
Surplus before income tax		293,039	432,924
Income tax expense	5	(49,941)	(59,512)
Surplus for the year		243,098	373,412
Other Comprehensive Income			
Other Comprehensive Income for the Year		-	-
Total Comprehensive Income		243,098	373,412

* Employee Benefits expense 2010 include industry funded General Manager, Best Practice & Research Implementation, short and medium term contracted casual employees for development, delivery, extension and BMP.

The accompanying notes form part of the financial statements

APPENDIX I

PARTICIPANTS AND SPECIFIED PERSONNEL 2009–10

COTTON CRC PARTICIPANTS 2009–10

Participants	
Participant's Name	Commonwealth Approval
Cotton Seed Distributors Ltd	Yes
Cotton Australia Ltd	Yes
Cotton Research and Development Corporation	Yes
CSIRO	Yes
Industry & Investment NSW	Yes
Queensland Department of Employment, Economic Development and Innovation	Yes
Western Australia Department of Agriculture and Food	Yes
The University of New England	Yes
The University of New South Wales	Yes
The University of Sydney	Yes
The University of Technology, Sydney	Yes

COTTON CRC SPECIFIED PERSONNEL 2009–10

CEO and Governing Board Members		
Name	Organisation	Cotton CRC Position / Role
David Anthony	Independent	Chairman
John Herbert	Independent	Deputy Chair
Robert Dugdale	Industry Participants group	Director
Dianne Bentley	Independent	Director
Dr Gary Fitt	Research providers group	Director
Kathryn Adams	Independent	Director
Mr David Hamilton	Government departments group	Director
Barbara Grey	Independent	Director
Philip Armytage	Cotton CRC	Chief Executive Officer

Program Leaders		
Name	Organisation	COTTON CRC Position / Role
Professor Peter Gregg	Cotton CRC	Chief Scientist
Dr Paula Jones	Cotton CRC	Community Program Leader
Yvette Cunningham	Cotton CRC	Adoption Program Leader
Dr Lewis Wilson	CSIRO	Farm Program Leader
Dallas Gibb	CRDC / Techmac	Product Program Leader
Graham Harris	DEEDI	Farm Program Leader

APPENDIX II

PUBLICATIONS 2009–10

Book Chapters

Bange, M.P., Constable, G.A., McRae, D., & Roth, G. (2010) Cotton. In Stokes, C. & Howden M. (eds.) *Adapting agriculture to climate change: preparing Australian agriculture, forestry and fisheries for the future*, CSIRO Publishing; Collingwood; Australia pp. 49-66.

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Coumans, J.V.F., Moens, P.D.J., Poljak, A., Al-Jaaidi, S., Pereg, L., & Raftery, M.J. (2010) Plant-extract-induced changes in the proteome of the soil-borne pathogenic fungus *Thielaviopsis basicola*. *Proteomics*, **10**, 1573-1591.

Del Socorro, A.P., Gregg, P.C., Alter, D., & Moore, C.J. (2010) Development of a synthetic plant volatile-based attracticide for female noctuid moths. I. Potential sources of volatiles attractive to *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae). *Australian Journal of Entomology*, **49**, 10-20.

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Hulugalle, N.R., Weaver, T.B., Finlay, L.A., Luelf, N.W., & Tan, D.K.Y. (2009) Potential contribution by cotton roots to soil carbon stocks in irrigated Vertosols. *Australian Journal of Soil Research*, **47**, 243-252.

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Najar-Rodriguez, A.L., McGraw, E.A., Mensah, R.K., Pittman, G.W., & Walter, G.H. (2009) The microbial flora of *Aphis gossypii*: Patterns across host plants and geographical space. *Journal of Invertebrate Pathology*, **100**, 123-126.

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Foley, J.L., Silburn, D.M., and Greve, A. (2010). Resistivity imaging across native vegetation and irrigated Vertosols of the Condamine catchment—a snapshot of changing regolith water storage. *19th World Congress of Soil Science*, 1-6 August 2010, Brisbane, Australia.

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GLOSSARY OF TERMS

ACGRA	Australian Cotton Growers Research Association (*now merged with Cotton Australia)*
ACIPA	Australian Centre for Intellectual Property in Agriculture
ACRI	Australian Cotton Research Institute
ACSA	Australian Cotton Shippers Association
ANU	Australian National University
AWA	Department of Agriculture and Food, Western Australia
BMP	Best Management Practices program
Bollgard II®	Cotton containing two genes resistant to the pest *Helicoverpa* spp.
CARE	Centre for Agricultural and Regional Economics
CCA	Crop Consultants Australia Ltd *(formerly Cotton Consultants Australia Ltd)*
CCAA	Cotton Classers' Association of Australia
CMSE	CSIRO Materials Science and Engineering
CRC	Cooperative Research Centre
CRC IF	CRC for Irrigation Futures
CTFT	CSIRO Textile and Fibre Technology. *(now a program within CSIRO Materials Science and Engineering)*
CMA	Catchment Management Authority
Cotton CRC	Cotton Catchment Communities Cooperative Research Centre
CRDC	Cotton Research and Development Corporation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSU	Charles Sturt University
CWA	Country Women's Association
DBIRD	Northern Territory Department of Business, Industry and Resource Development
DEEDI	Queensland Department of Employment, Economic Development and Innovation *(includes the former Queensland Department of Primary Industries and Fisheries)*
DERM	Queensland Department of Environment and Resource Management *(includes the former Department of Natural Resources and Water)*
DEST	Australian Government Department of Education, Science and Training *(now the Department of Education and Workplace Relations. Formerly administered the Australian Government CRCs Program)*
DIISR	Australian Government Department of Industry, Innovation, Science and Research *(Now administers the Australian Government CRCs Program)*
FUSCOM	Fusarium Committee
GM	Genetically modified
GRDC	Grains Research and Development Corporation
I&I NSW	Industry & Investment NSW *(includes the former NSW Department of Primary Industries)*
IP	Intellectual Property
IPM	Integrated Pest Management
IWM	Integrated Weed Management
LGA	Local Government Authority
LWA	Land and Water Australia
NCEA	National Centre for Engineering in Agriculture, University of Souther Queensland
NHT	National Heritage Trust
NRM	Natural resource management
NSW DET	New South Wales Department of Education and Training
NSW DPI	New South Wales Department of Primary Industries *(Now part of Industry & Investment NSW)*
NSW TAFE	New South Wales Technical and Further Education
PICSE	National Primary Industry Centre for Science Education
QDPI&F	Queensland Department of Primary Industries and Fisheries *(now part of the Queensland Department of Employment, Economic Development and Innovation)*
QDNRW	Queensland Department of Natural Resources and Water *(now part of the Queensland Department of Environment and Resource Management)*
QUT	Queensland University of Technology
TIMS	Transgenic and Insect Management Strategy Committee
UCQ	University of Central Queensland
UNE	The University of New England
UNSW	University of New South Wales
UQ	University of Queensland
US	The University of Sydney
UTS	University of Technology, Sydney
WUE	Water Use Efficiency