

Cotton Research & Development Corporation

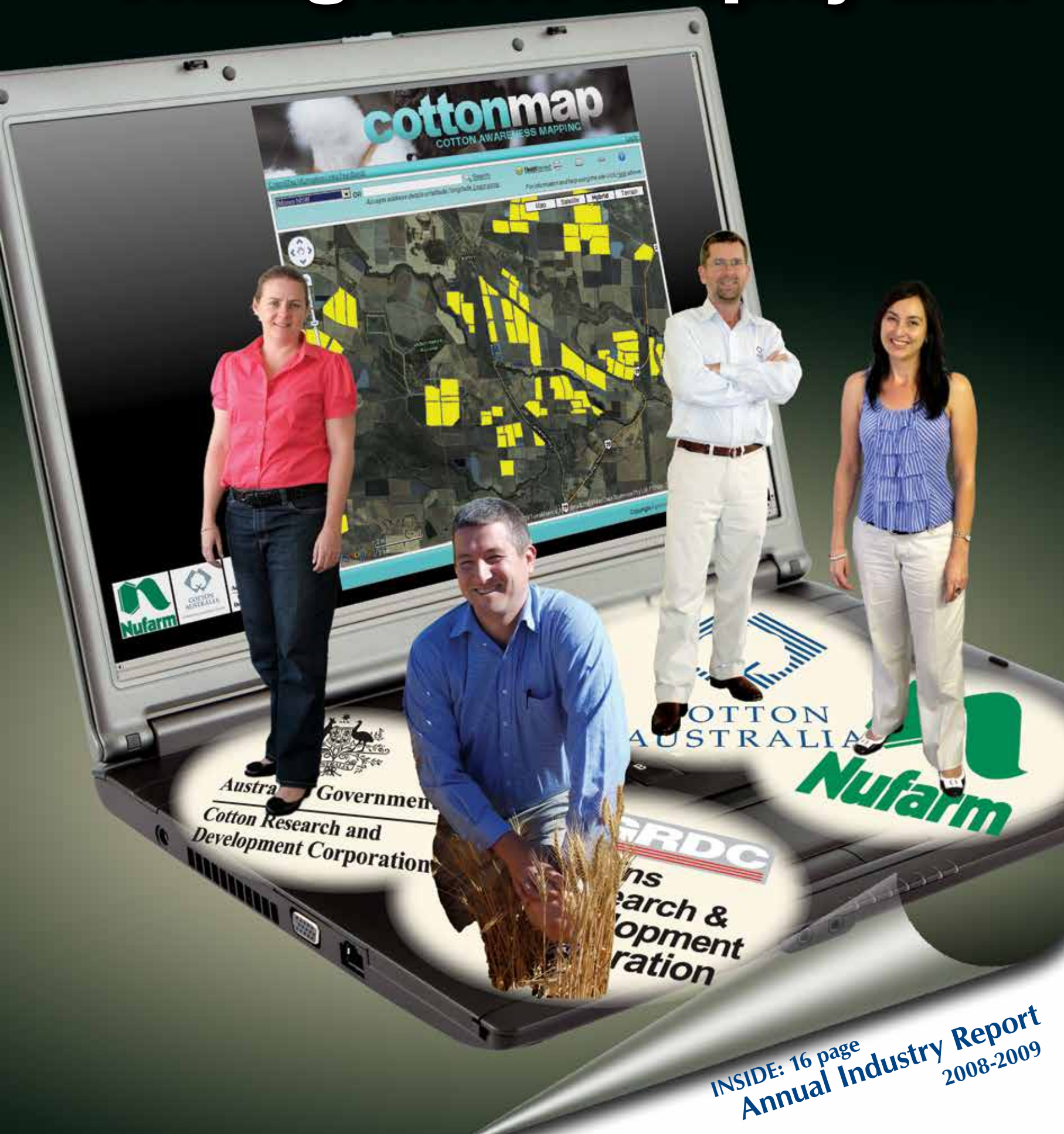


Spotlight

Summer 2009

on Cotton R&D

Joining forces on spray drift



INSIDE: 16 page
Annual Industry Report
2008-2009



Australian Government
Cotton Research and
Development Corporation

Summer, 2009

Cotton Research & Development Corporation

Spotlight

on Cotton R&D

Bruce Finney Executive Director, CRDC



As we approach the end of the year, on behalf of CRDC I would like to wish all our readers season's greetings and all the best for a prosperous new year.

As we head into a new year, we can rest assured that the industry is in good hands, judging by the current crop of current Australian Future Cotton Leaders outlined in this issue.

The group of 10, dynamic future leaders share their achievements through the course so far as well as their goals which they hope will impact on the industry in a positive way going into the future.

We also catch up with some past participants to see where they are now and how participation in the course has helped them achieve their goals and progress the industry.

Building the capacity of the future and current leaders of our industry is an important aspect of the current CRDC Strategic Plan. Investment in the Australian Future Cotton Leaders program and the Australian Rural Leadership Program is part of that commitment.

Mungindi cotton farmer Barb Grey recently completed the Australian Rural Leadership Program, with support from CRDC and her literal journeys as part of this experience are inspiring. Barb is already a leader in the cotton industry, who, with husband Ralph runs one of the most innovative farms around.

These two programs are but examples of investment in the future human capacity of the cotton industry and its communities. Ensuring the industry continues to fosters its culture of innovation and learning is a strategic goal for CRDC.

Also at this time of year, attention invariably moves toward the period when herbicide damage to cotton crops starts to occur. In fact drift damage has already been seen in Central Queensland.

According to Cotton Australia, last season, more 16,000 hectares of cotton was damaged or destroyed by 2,4D drift, with a damage bill of over \$9 million.

A collaborative effort between Nufarm, CRDC, Grains Research and Development Corporation and Cotton Australia saw the launch of the the CottonMap on-line cotton field registration program in November.

Designed to alert users of phenoxy and other chemicals to the presence of cotton fields, the response was nothing short of amazing, with more than 120,000 hectares mapped by the end of November.

It is hoped growers can talk with their neighbours and alert them to the existence of the website, while some re-sellers of phenoxy-based products will give printed maps from CottonMap to their customers.

The website is an important, up-to-date link in the awareness program to protect crops.

The subject of crop protection encompasses many facets, and another of those is biosecurity.

An area of strategic investment for CRDC is supporting the industry's preparedness to deal with biosecurity threats.

In this edition we have outlined the Key Insect Pest threats to the Australian cotton industry so producers and others in the industry can be alert to their presence and understand the potential damage from an incursion. This feature follows last edition's inclusion of the six Key Disease Threats.

Also on offer in this issue are reports of some of the latest research results, including some breakthroughs into fusarium wilt research, weed thresholds and soil borne fungal diseases and measuring the effects of both irrigation system and soil type on disease severity.

In closing I highlight the report from Bruce Pyke, the CRDC General Manager for R&D Investment who recently attended the International Cotton Advisory Committee's (ICAC) 68th Plenary Meeting in Cape Town, South Africa, where he presented a paper on the Impacts of Carbon Trading on the Cotton Industry, as a member of an invited panel. The messages Bruce brings back to the Australian industry from the meeting make for thought provoking reading.

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Spotlight is brought to you by Australia's cotton producers and the Australian Government through the publisher Cotton Research & Development Corporation (CRDC).

CRDC is a research and development partnership between the Australian cotton industry and the Australian Government.

Cotton Research and Development Corporation

ABN: 71 054 238 316

Our vision: A globally competitive and responsible cotton industry

Our mission: Invest and provide leadership in research, innovation, knowledge creation and transfer.

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

Corporate background: CRDC was established in 1990 under the Primary Industries and Energy Research and Development Act 1989 (PIERD Act.) which outlines its accountability to the Australian Government and to the cotton industry through the Cotton Australia. CRDC is responsible to the Australian Government through the Minister for Agriculture, Fisheries and Forestry, Tony Burke MP.

CRDC is committed to fulfil its legislated charter to: Invest in and manage an extensive portfolio of research, development and extension projects to enhance the ecological, social and economic values associated with cotton production systems and to benefit cotton industry participants, regional communities and the Australian community.

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Further information: ? Where this symbol appears, readers are invited to access further information from the identified source.



B&W's Cameron Huggins and Senior Agronomist/Director Peter Birch have been helping growers, agronomists and consultants map cotton fields this season with the new CottonMap program.

Online CottonMap counters drift risk industry wide

In an unprecedented show of support for a campaign to stamp out Group I (phenoxy) herbicide damage to cotton, the online CottonMap service registered more than 120,000ha of cotton fields within two weeks of its launch.

The launch and uptake of CottonMap is testament to the effectiveness of collaboration between research and development corporations, industry and agribusiness.

An investment by CRDC, GRDC, Nufarm and Cotton Australia, the CottonMap site has enjoyed huge support from most resellers and consultants. By mid-November the Gwydir and Mungindi regions were fully-mapped.

CottonMap, at www.cottonmap.com.au, is an all-new system spearheaded by growers, resellers and consultants to map placement of this season's cotton fields and to eliminate off target pesticide drift.

For CottonMap to be a fully effective tool, all of this season's cotton fields are earmarked to be mapped (with about 25 percent to go by November end) and that best practice in the application of crop protection pesticides is universally practiced by all farmers.

A key player in this huge uptake has been B&W Rural Moree. Off their own bat, the company undertook to ensure all cotton crops in the Moree and Mungindi districts were

registered on CottonMap, a task they achieved within a few weeks.

B&W's Peter Birch said this involved following up all consultants and agronomists involved with cotton and encouraging them to log on to CottonMap and add their fields. B&W staff also mapped for outside consultants and individual growers, whether a client or not. "CottonMap is a fantastic system," Mr Birch said.

"It is easy to input information and acts as a safeguard which can be easily accessed by those using phenoxy-based products so the risk of damaging cotton crops can be minimised.

"And while Cottonmap is revolutionary in terms of an awareness tool, to ensure drift damage is a thing of the past, correct spraying procedures in terms of weather and nozzle choice is critical.

"The first port of call really, though, is for people to talk widely with neighbours in the area. Most drift seen here in the past, as far as we could tell, was not caused by an immediate neighbour."

Resellers will also provide CottonMaps to those buying Group I (phenoxy) based herbicides, and also provide information on best practice crop protection.

Nufarm Business Development Manager for the Central Region, Marg Castleden, said the new on-line system was one aspect of a multi-

faceted approach by the company.

"Beyond initiatives like the CottonMap, we encourage users of our products to consult the Spraywise Decisions service prior to engaging in any spray activity. We also have a comprehensive Spraywise program with tools and information to better understand the basics of correct spraying procedures, also including encouraging growers to get along to one of Bill Gordon's workshops," Ms Castleden said.

"We have also asked our customers (resellers) to print district maps from the CottonMap website to send out with chemical deliveries or hand out at the counter, and our territory managers have updated consultants about the CottonMap website via their regular newsletters."

Spraywise Decisions is an innovative internet service that allows landholders and contractors to better plan and match the timing of chemical applications to prevailing local weather conditions.

According to Cotton Australia, last season more than 16,000 hectares of cotton was damaged or destroyed by Group I (phenoxy) herbicide drift, with a damage bill surpassing \$9 million – for what is an entirely preventable problem.

"Cotton Australia needs as many cotton fields as possible mapped in order to make best use of this new service, so please do your bit and go

to the CottonMap site today," said CEO Adam Kay.

"Positive grower feedback says cottonmap.com.au is simple to use, secure and accurate. Simply type in your farm address and follow the prompts to start mapping."

GRDC Manager, Extension and Grower Programs Tom McCue said using internet technologies to improve the accessibility of information to farmers is of upmost importance to the GRDC.

"Having Cottonmap available is a first step to ensure effective application techniques and to minimise risk," he said.

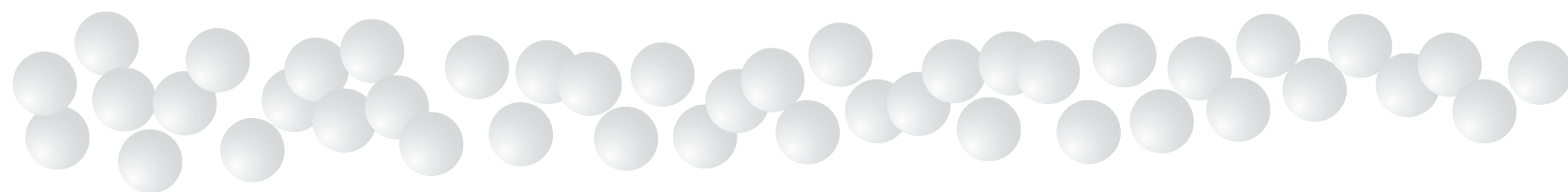
"It will help to ensure well informed farmers checking their local regions to assist their spray application programs, to minimise drift and maximise efficacy.

"To date we have received a strong response from farmers and their consultants to map their paddocks and GRDC will also promote the website through GRDC updates and other grains industry activities."

Cottonmap will remain online until 30 April 2010 and will resume after planting for the 2010-11 season.

🔍 Your vital websites:

www.grdc.com.au
www.cottonmap.com.au
www.cottonaustralia.com.au
www.spraywisedecisions.com.au
www.billgordonconsulting.com



Managing and preventing spray drift

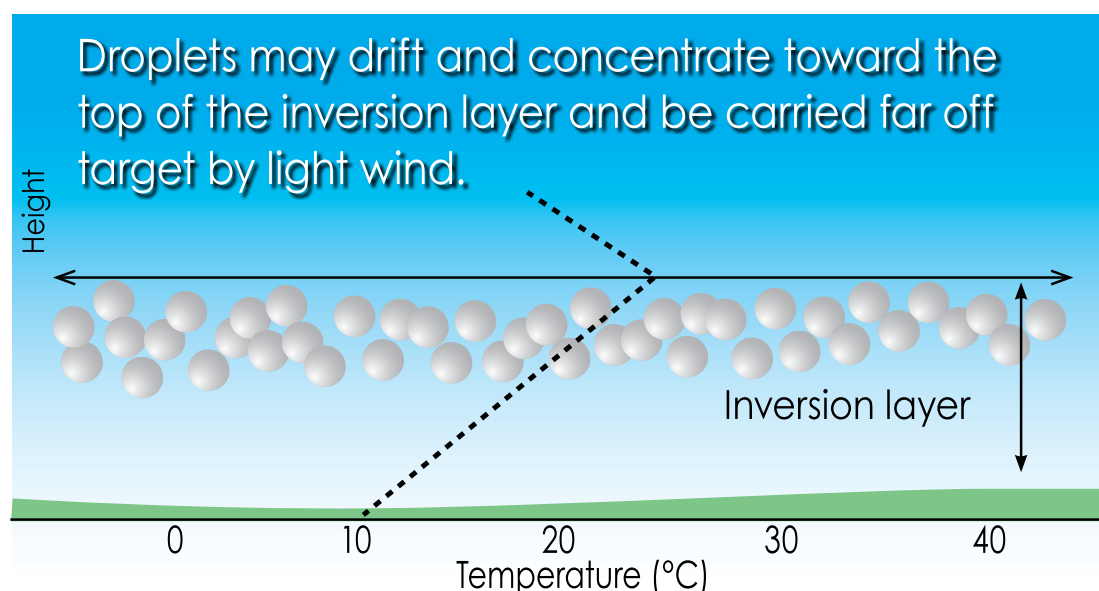
Courtesy Bill Gordon and illustrations Australian Government Bureau of Meteorology.

Steps to reducing drift

- Read the drum label and follow the guidelines.
- Know what sensitive crops are in the vicinity
- Monitor and record weather conditions every 20-30 minutes – if the wind stops at night – stop spraying immediately
- Reduce boom height (Increasing boom height from 50cm to 70 cm will increase the amount of chemical left in the air by up to four times and doubling the boom height from 50cm to 100cm will increase the amount of chemical left in the air by up to 10 times)
- Use integrated weed management strategies to reduce the summer weed burden and utilise alternative control methods where practical.
- Avoid using wetters that increase drift (such as non-ionics)
- Use the coarsest nozzle that will provide efficacy.

Why does drift land where it does?

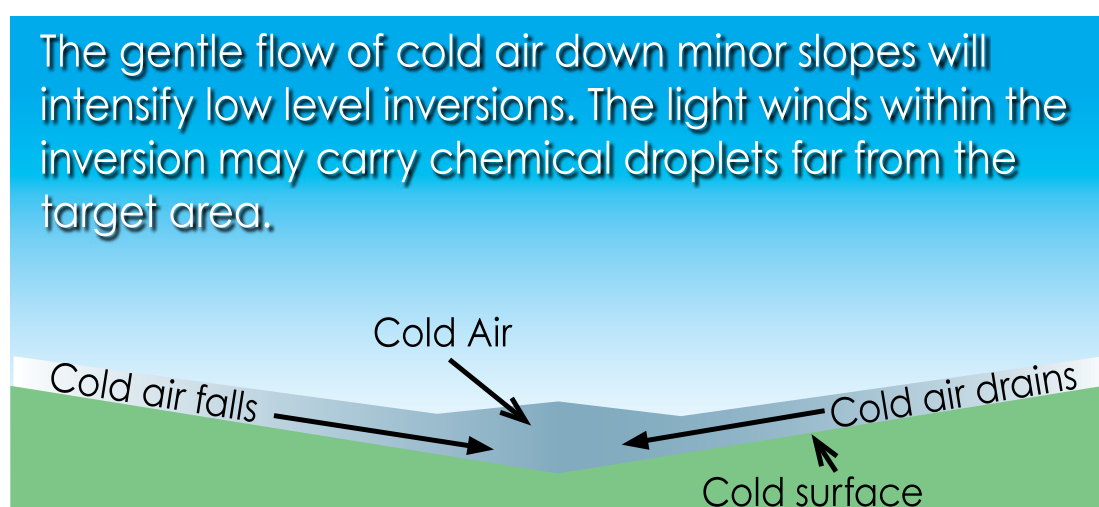
- Inversions form every night, only the height changes.
- On a large flood plain the slopes are very gentle and air movement under an inversion can be very slow for extended periods over night (too dangerous for spraying).



- When the air moves slowly under the inversion layer, it is more likely to be laminar, or move parallel to the ground.
- The air can further separate into distinct layers close to the ground and any droplets left in the air can become trapped within these layers.

Why does drift land where it does?

- At night the cool air behaves like water and drains to lower points in the catchment, and if chemical is suspended in it, then that will move as well.
- Hence anywhere where you can harvest water, is a likely point for air borne chemical to move to and settle.



Potential for damage – 1 hour no wind

- A spray rig with a 36m boom traveling at 27 km/h will comfortably cover around 100 ha per hour.
- With a 5000 L tank, this means the machine can continuously spray for 1 hour @ 50L/ha.
- If the machine is fitted with nozzles that produce a coarse spray quality, this means it will still produce about 7-10% of it's volume in droplet sizes that can move where ever the wind takes them.
- Even if only 1% of that chemical remains airborne, for each hour sprayed under those conditions each machine will leave a lot of chemical in the air.

Potential for damage – 1 hour no wind

- If the wind speed is 2-3 km/h, that is how far the chemical will travel down the slope each hour.
- One hour of spraying with 700mL/ha Surpass 475, leaving 1% in the air = 332.5 g.a.i of 2,4-D
- Spread evenly through a stable air-mass this could easily deposit 4 g.a.i / ha of 2,4-D onto a sensitive cotton crop (6-12 nodes)= 25% + yield loss to over 83 ha
- = \$66,400 loss from a single drift spray event from one hour of spraying. (a s s u m e expected yield @ 10 bales/ha @ \$400).

'No data was available to growers, consultants and even manufacturers, about best management practice for glyphosate use in cotton.'

'Intelligent' weed management now a reality

By Melanie Jenson and Graham Charles

Cotton farmers have developed weed management systems which are less reliant on residual herbicides and non-herbicide methods of weed control, such as cultivation and hand hoeing, but many of these newer systems are glyphosate-centric and subject to failure.

Using glyphosate as the principal, or in some cases only method of weed control has contributed to improved crop yields and has reduced some of the environmentally negative aspects of cotton production. However, farming systems that rely too heavily on a single weed management tool are not sustainable, with inevitable shifts to weed species that are tolerant of the management tool.

Where the single management tool is a herbicide such as glyphosate, selection of herbicide resistant weed species to that regime is also likely. This was demonstrated recently with the discovery of glyphosate-resistant barnyard grass in a cotton field in South East Queensland.

To counter these issues, Industry and Investment NSW Weeds Research Agronomist, Graham Charles, undertook a project with CRDC investment support to develop weed control thresholds for transgenic cotton.

The main aim of the research was to develop 'intelligent' weed management systems for transgenic cotton that could optimise herbicide use and achieve better yields. The work also studied maintenance of the value of glyphosate in the farming system by minimising the selection pressure for species shift and glyphosate resistant weeds, according to Mr Charles.

In attempting to overcome this problem however, no data was available to growers, consultants and even manufacturers, about best management practice for glyphosate use in cotton.

"The primary need we have is to drive weed numbers down by using integrated weed management which utilises multiple weed management tools," Mr Charles said.

"This reduces pressure on glyphosate.

"It is pure mathematics, the fewer plant numbers you have in a field, the less chance you have of resistance being present in the field, provided you achieved low weed numbers using a variety of weed

management tools, not just a single tool.

"This is best management practice for weeds.

"While some cotton growers are using glyphosate at the correct time of weed growth, there are some spraying too late in their cotton, suffering yield loss and others spraying too early which can lead to chemical wastage (costing money) and increases the risk of species shift and glyphosate resistance developing.

"The problem was that with the introduction of Roundup Ready Flex cotton, there was no data on weed control thresholds for growers or the corporate companies either."

Industry recognises Graham Charles' work to have significantly progressed the science of weed management in the Australian cotton industry while providing guidelines for best practices for weeds.

Information on the weed control threshold and sampling techniques has now been incorporated into the industry publication WEEDpak – and is also available on the Cotton CRC website, www.cottoncrc.org.au

Experiments

Graham Charles' concept used a series of field experiments to develop a weed control threshold based on the critical period for weed control.

Weed density and the size of weeds were assessed to determine spray times.

Information on weed growth, development and seed production were also produced to provide guidance for the control of weed populations which are below threshold, ensuring that weeds are controlled before they set seed.

Ongoing work looks at developing a simplified sampling technique for the threshold using an electronic sensor to estimate weed biomass and from that, weed competitiveness.

"This would allow a more rapid and accurate evaluation of weed size and population over a much larger percentage of a field, as only so much can be assessed visually," he said.

When to bail out

A second aspect to Mr Charles' research was to provide cotton growers with information to



Graham Charles (right) inspecting cotton crops damaged by phenoxy drift last season as part of his research to help growers make better informed management decisions for herbicide damaged crops

allow them to assess the likely effects of herbicide damage on a cotton crop in terms of final yield and maturity, and subsequently to make better informed management decisions for herbicide damaged crops – should they be ploughed out or persevered with, what could be the delay in maturity, and what are the final yields likely to be?

"We needed to get real data on what the potential future of a crop was," Mr Charles says.

"I had seen crops with minimal damage which were ploughed in and others with substantial damage that went on to be productive crops.

"I had the experience of seeing a glyphosate-damaged crop and a grower putting a lot of resources into nursing that crop, ultimately to the detriment of the whole farm. Sacrificing the worst of the damaged crop would have been the best option on that occasion.

"This happened because there was no data for informed decisions.

"Having looked at some of the phenoxy damage at Pilliga last season – a damaged crop that I followed did achieve a good yield in the long run but maturity was delayed by two months and it required additional insecticides and water.

"I'm pleased to say that this outcome was consistent with the data I have collected. Herbicide damaged crops can recover if given enough time, but sometimes the resources would be better used elsewhere"

A series of Dr Charles' field experiments explored the effects of a range of phenoxy and other herbicides on post-damage crop growth and development, including leaf, square and boll production, crop maturity and final yield.

Herbicides have been applied at varying rates and stages of crop development. This information has been published in WEEDpak, along with information assisting cotton growers to compare the post-damage symptoms for a range of herbicides on the Cotton CRC website.

Experiments have also explored post-damage crop management options, but to date have found no options which improve crop recovery.

📞 Graham Charles, 02 6799 1524
graham.charles@industry.nsw.gov.au



Irrigation Australia Limited Chairman Peter Toome and NPSI Program Manager Guy Roth congratulate researcher Tamara Jackson on her receipt of the travel fellowship, at the recent IAL Swan Hill conference.

Irrigation travel fellowship pursues practice change drivers



The National Program for Sustainable Irrigation (NPSI) provides \$10,000 each year to support the Irrigation Australia Ltd travel fellowship, which was awarded to Tamara Jackson at the annual conference of IAL in Swan Hill recently.

Factors influencing the water-energy-emissions nexus in terms of policy and practice will be now investigated as part of the travel fellowship which will involve travel to the US, Turkey and Israel in February.

Recently Tamara completed a PhD in Applied Hydrology involving a study of water use, energy consumption and greenhouse gas emission relationships for different irrigation systems, and the influence of uncertainty surrounding water supplies.

CRDC has been a NPSI partner since its formation and this year took on the role of managing partner.

"Collaborative investment in R&D vehicles such as NPSI provides an opportunity for a diverse group of partners to invest in R&D that is

of broad need and application in irrigated agriculture," said CRDC's Bruce Pyke.

"Investment in research like Tamara's has helped gain a much richer picture of complex areas that have so far not received the attention they deserve due to the major focus on improving water use efficiency."

Tamara is currently employed at the Wagga Wagga campus of Charles Sturt University's International Centre of Water for Food Security.

Her study put Tamara in contact with a number of irrigators and helped her understand the complexity of influences on production plans and irrigation technologies.

"Looking at irrigation in more than water use terms reveals why changes are made or not made," she said.

"Changing from gravity-fed to a pressurised drip irrigation system, for example, could mean water savings but a big leap in energy costs. Other considerations might include uncertainty about water allocations or how to get best value from the limited water available."

Tamara said it was forward-thinking for the National Program for Sustainable Irrigation to support not only research into aspects like water, plant and soil interactions and application technologies, but also to take an interest in the human dimension.

"This has become vital with the growing impact of policy on farm management and the need for good knowledge and leadership as climate change and water scarcity increase in importance," she said.

"The fellowship will allow me to meet leading researchers working on the water-energy emissions nexus in irrigated agriculture and will extend my network of industry contacts," she said.

"I also intend meeting irrigators in other countries to gain an understanding of influences on their practices and to share ideas."

National Program for Sustainable Irrigation
www.npsi.gov.au
 Guy Roth Program Manager
 0417 223 179
guyroth@roth.net.au

CRDC Annual Report on-line



The Annual Report of CRDC was tabled in Parliament in November and is now available on the CRDC website in a new format that allows readers to access it one page at a time without having to download the whole document.

Of special interest in this report are new tables that show the extent of collaborative investments that CRDC makes with other rural R&D corporations, state and federal government agencies, numerous joint ventures in R&D in fields such as biosecurity, irrigation efficiency and climate change research. The CRDC Annual Report provides a comprehensive summary of the broad range of R&D investments made by CRDC on behalf of industry and Government and how these investments directly contribute to the consistently strong productivity growth by the Australian cotton industry.

In this edition of Spotlight we have also included the 'condensed' Annual Report as the 16-page Report to Industry.

Through this, the Corporation aims to provide an accessible snapshot that covers the financial year 2008-2009, however by definition, a summary report is not the real thing and as a result, a substantial proportion of what is required by CRDC to meet its statutory reporting requirements are not present in the pages 25-40 of this edition.

If you would also like to see the full report go to www.crdc.com.au, to view the new user-friendly and accessible e-Publication format. Printed and bound copies of the full report are also available and shall to be mailed upon request to CRDC.

Barb Grey on her visit to the India Vision Foundation, with young village women involved in an education/microfinancing program.



Mungindi Cotton farmer Barb Grey has just celebrated graduating from the 18-month long Australian Rural Leadership Program (ARLP).

Cotton farmer Barb graduates in rural leadership

By Mary Ann Day

Barb Grey was one of 35 people from all over Australia, from all walks of life, to be specially selected to take part in the unique program. The ARLP is aimed at creating a network of highly skilled leaders with a view to making a difference in rural and regional Australia.

"This has been an exciting opportunity, which has taken my professional and personal development from zero to 100 in a very short time – which is quite a life-changing experience," she said.

The dynamic 50-year-old who leads a hectic life as a farmer and mother to three daughters, aged 18 to 25, was sponsored by Cotton Australia, Auscott Ltd and CRDC.

The scholarship, valued at approximately \$60,000, has enabled Barb to have access to an Australia-wide alumni of several hundred people.

"Many positive, productive people involved in the cotton industry are graduates of the program," she explained.

"It's very much about values-based leadership.

"It's about leaving your perceptions and assumptions behind, a willingness to relearn, rework your attitudes and address your values."

The program has taken Barb to some unusual places, including the

Kimberley, for a survival exercise and more recently on an international leadership study in India.

"It has been an amazing experience," Barb says.

"In particular, I found India a fascinating country of contrasts. I think the opportunities in India are exciting, both at a philanthropic level and a commercial level.

"It has a population of nearly 1.2 billion people and is growing at the rate of 20 million people per annum, in a land area half that of Australia.

"But India has this huge population of energetic, entrepreneurial and aspirational people, with 73 percent of its population under the age of 35."

Barb pointed out that India has no welfare system and 90 percent of farmers are illiterate – so consequently very poor. But she felt there was nevertheless a huge push at the village level for women's empowerment, through the process of micro-financing.

"The scheme is extremely successful," she said.

Additionally, the program has given her the opportunity to be addressed by a vast array of speakers such as World Vision CEO Tim Costello and Simon Longstaff, executive director of the St James Ethics Centre.

"We've worked with the homeless

in Sydney, we've visited Australia's most prestigious privately-owned thoroughbred stud to discuss the Equine Influenza outbreak, and we've been behind the scenes of the ABC Adelaide radio and television studios," Barb enthused.

Barb and husband Ralph have been farming for 25 years on their 1729 hectare farm, of which 1174 ha has been developed for irrigation, primarily in cotton production.

Barb's current role, which includes office administration, payroll, accounts, financial management; data entry and HR policy formulation and implementation, as well as active involvement with on-farm operations, is a far cry from the varied experiences she has encountered on the exciting ARLP program.

As the current Chair of Wincott Barb has several areas of interest.

"I firmly believe in encouraging the increased participation of regional and rural women through information sharing and developing networks, particularly in my roles with Wincott and the Women and Leadership Australia Advisory Board," she said.

"I am concerned about the negative perception held by the urban population about Aussie agriculture.

"My solutions focus on elevating our profile and relevance, through positive marketing and promotion

– taking our message back over the Great Divide."

Barb is convinced that the issue is about communicating the positive stories of sustainable farming, and healthy regional lifestyle, saying "I look for fresh ideas and new perspectives to address traditional problems".

The program has also assisted with understanding collaborative leadership and the challenges of leading those who are not necessarily 'on the same page'.

"This had helped me to value the importance of understanding oneself and how one's behaviours can affect others, understanding the different leadership styles," she said.

"It has been instrumental in changing my outlook and building my confidence and my knowledge.

"One important mental exercise I regularly implement is the concept of the view from the balcony versus the view from the dance floor.

"Quite often we are head down - tail up, involved in the day-to-day activities, the 'argy-bargy'.

"It helps to step back - up on to the balcony, so to speak - to gain distance and perspective, to reflect and ask ourselves the why and wherefore of what we are doing."

Barb Grey
rgr33982@bigpond.net.au

Future cotton leaders line up for challenge

By Mary Ann Day



Back from left: Sinclair Steele, Tracey Farrell, Belinda Duddy, Elissa Wegener, Jo Eady (course facilitator), Tobin Cherry, Matthew Norrie, Nick Gillingham, Barb Grey (presenter), Bruce Finney CRDC Executive Director. Seated left to right: Susan Maas, Anna Power, Joanne Grainger (Cotton Australia Chair), Kevin Bagshaw.

"It's an amazing industry, an industry that wants to move forward and advance, to lead the way. The industry has a thirst for knowledge, which is fantastic. I especially love to work with the ginner and make advancements where possible."
Kevin Bagshaw

A group of future leaders from across the cotton industry have signed up for the challenge of a lifetime and joined up for the unique Australian Future Cotton Leaders Program (AFCLP).

The 2009–10 program participants, which include five men and five women were selected to take part in the 18-month scheme. The program is an initiative of Cotton Australia that is delivered in partnership with CRDC.

Its key aim is to support and develop and help ensure the dynamic future leadership of the cotton industry.

"This is a national leadership program for the Australian cotton industry," explains Jo Eady, program developer and facilitator.

"The program has four stages including Leadership Development, Individual Skill Development and Integrated Industry Leadership Project, Leading Change and Contributing to Industry.

"It is an innovative program supporting individual commitment to creating and leading change in the Australian cotton

industry. It assists and works with emerging leaders to develop, implement and evaluate their own leadership development project with the ongoing support of a leadership facilitator and industry partner."

The participants come together for three face-to-face sessions, including the Australian Cotton Conference next year. In between times they communicate online and via teleconference.

"This program is committed to developing leadership skills and covers personality styles, communication styles, working with others, group development, media and advocacy, industry issues, enterprise case studies, and industry leader case studies," Ms Eady said.

"Candidates get to network with industry leaders on projects and are matched with a mentor to support industry development and one-on-one coaching sessions, group sessions, and online discussion forums."



Belinda Duddy, 28, "South Callandoon", Goondiwindi Qld.

Belinda has focused her project on further enhancing communications in everyday family business, with a focus on communication processes.

Working in the family farming business, Belinda's project goal is to develop communication knowledge and skills to be able to apply to the family business.

How has AFCL helped you so far?

"The course has been beneficial in many aspects so far; in making new contacts, meeting

and hearing from the industry leaders and improving my communication skills through recognition of personality types, and therefore building more effective relationships.

Long term aim

"I am also focusing on researching other family businesses from within and external to agriculture, of a similar size and investigating their core principles and systems of communication.

"My long term aim is to continue within the family business and being on this program has helped widen my horizons."



Matthew Norrie, 27, cottongrower, Narrabri NSW.

Matthew is a partner in the 4500 acre family business which is mixed farming, including cotton, cattle and winter crops. His project goal is to engage young irrigators and stakeholders in the Namoi Valley in water policy issues.

Matthew chose this project as he felt there was a need for young stakeholders to be informed about the history, current and future issues affecting irrigators and their community.

How has AFCL helped you so far?

"So far I have acquired a greater knowledge of how industry representative groups function within the industry and why it is important to have grower input and strong leadership.

Long term aim

"I am hoping this will not just help myself but get others involved in water policy issues and identify other possible future leaders."

Nick Gillingham, 33, Cropping Manager “Keytah” Moree.

Nick’s project goal is to establish a senior management career pathway plan, choosing this project as he has become involved at a senior management level in a large cotton farming organisation.

How has AFCL helped you so far?

“This has been really useful in helping me understand my personal leadership/management strengths and weaknesses and how to interact with other people’s

leadership/management styles to achieve a positive outcome.

“I have also discovered the value of different management tools to improve the management relationship between people in the cotton farming environment”

Long term aim

He said he envisaged his goal helping him as a future leader in the cotton production environment as well as involvement in industry organisations.

**Susan Maas, 29, Regional Cotton Extension Officer with Qld Department of Employment, Economic Development and Innovation, Queensland Primary Industries and Fisheries and Cotton CRC, Emerald.**

Susan has focused her project on developing leadership in Central Queensland, with regard to growers managing risk of herbicide resistance in weeds through adoption of Integrated Weed Management strategies.

How has AFCL helped you so far?

“This is a great opportunity to develop personally and to improve the way I work. So

far I have learnt a lot about my personality and communication styles and I have discovered more about the way I interact with others

“I have learnt a number of tools, strategies and habits to improve my work structure and organisational skills.”

Long term aim

“I feel this course will help me to improve my ability to lead and influence in the future.

“The risk of herbicide resistance becoming a problem for the industry is high, particularly as there is reliance on one group of herbicide. I think it is an issue that needs to be highlighted and I want to help ensure the industry is on the front foot and ready.”

**Kevin Bagshaw, 40, CSIRO Technical Officer – Gin Research at Materials Science and Engineering at Belmont, Victoria.**

Kevin’s project goal is to advance the quality of the fibre at the gin by informing cotton growers about what they can do at their end to allow for greater outturn and quality.

He said he chose this project as he has a passion for cotton ginning and improving the quality of the cotton fibre at the gin.

“I would like to assist growers to make them aware of the issues surrounding modules containing high trash levels – quality and financial.”

How has AFCL helped you so far?

Kevin said that through the AFCL program he has also learnt about networking, about understanding personality types and how to go about achieving goals.

Kevin, who is doing a Masters at the USQ on the gin stand, “for fun”, said he loved to think about new

ideas and nut out solutions.

“I believe in treating others the way you want to be treated,” he said. “I believe in the adage: Tell me and I’ll forget, show me and I may remember, involve me and I’ll understand. I believe that if you’re going to do research then you need to make sure that the results get to those that can use it.”

Long term goal

“I want to understand issues within the cotton grower/ginner cycle and work with this community to improve the quality and profits associated with the cotton. It will also give me a greater understanding of issues that growers are faced with and allow for tailor made programs for individuals or groups facing the same issue.

Long term aim

“In time - with a pocket-full of knowledge, I want to be able to be there for the ginners and growers to inform them or suggest methods to improve outcomes,” he added

**Elissa Wegener, 22, Marketing Services Officer, Queensland Cotton, Dalby Qld.**

Elissa’s project looks at sharing ways for young people passionate about the cotton industry to get involved. Her role is to identify the opportunities that exist and share the experiences of other people.

How has AFCL helped you so far?

Elissa has learned that effective communication is essential in everything we do.

“I have grown to realise the importance of understanding that people take in information in all sorts of ways and to really be aware of that when trying to convey information.

What has been interesting is looking at our personality traits and how that can influence the way we make decisions and behave in certain situations.

Long term aim

“I believe that there are young people in the industry who would like to be more involved in active roles but simply don’t have the tools or know-how to take opportunities that already exist.

“By completing this project I hope to be able to help myself and other like minded young people to become more involved in industry issues and organisations.”





Anna Power, 37, Smith Bros Agriculture, Yelarbon, QLD.

Anna is working on developing two communication workshops. One targets high school agricultural students, while the other is an on-farm four-hour workshop.

“My goal is to help children and adults recognise their communication style and develop ways to enhance how they already communicate.

“I would also like to develop a process to follow up with people who do the course, as any behaviour modification is a difficult process that takes time and practice to achieve.”

How has AFCL helped you so far?

Anna’s project and participation in the AFCL Program has encouraged self-reflection in the areas that she needs to work on personally and professionally.

“We are all leaders in our own life and whilst no one is ever going to be perfect, we can always try and do better!”

Anna has learnt how important it is that all areas of an industry work together to ensure a sustainable and vibrant future.

“Going through personal and industry development with a diverse group of people builds long term relationships that will benefit the cotton industry.”

Long term aim

“Staff attrition, personal stress and work inefficiencies, are just a few examples of problems that may manifest when issues are not dealt with quickly and effectively,” she explained. “I realise courses are already available in this area, but feel I can bring a real life feel to the workshop as someone with hands on experience in a few industries who also lives on farm.”



Tobin Cherry, 29, Procurement & Relationship Manager, Dunavant Enterprises, Darling Downs.

Tobin has focused on a project to establish a logistics process for ginning round cotton bales, because “As the industry progresses with change, so do we as merchants have to learn to adapt to the changes going on in the industry”.

How has AFCL helped you so far?

“I have learned that AFCL is a great program that allows us to interact with other members from different aspects of the cotton industry. We have learnt many different techniques in helping us to

better prepare to be a leader.”

Long term aim

Looking at the future, he said the course has helped him to understand the many different areas of the cotton industry.

“This course has shown me how best to interact and communicate with each section of the industry.

“Cotton is a very passionate industry that looks strongly at progressing with changes and keeping the competitive edge. Doing this program has made me realise this.”



Tracey Farrell, 32, Program Manager, Cotton Research and Development Corporation, Narrabri NSW.

Tracey’s project aims to strengthen the link between industry funded research and the regional Cotton Growers’ Associations.

“The fact that the cotton industry has a network of local organisations in which everyone within the industry can come together to work on a relevant issue, is a huge asset.”

How has AFCL helped you so far?

Like others on the course, Tracey has identified communication as a core leadership skill. “When we take time to analyse our own actions and behaviour, as well as those of others, it is the simple things, like communication, that make the real difference.

“The course allows me to work with a group of highly motivating people from across the industry, many of whom I may never have met, if it wasn’t for FCL. No doubt contact with those in the group will continue in the future.”

Long term aim

“I want to work with the local CGA to identify opportunities where the CGA can better tap into industry-funded initiatives. The flip side is that active CGAs provide industry organisations like CRDC with feedback on the types of initiatives that are needed. In closer partnership with CGAs I hope that the industry can achieve more from its research and development investments.”



Sinclair Steele, 27, Branch Manger, AgnVet Services, Warren NSW.

Sinclair’s project focuses on conducting a communication audit of Warren AgnVet and developing a communication strategy which includes policies and procedures for general communication practices, with a view to increasing consistency in communication and workplace outcomes and more effective communication with farmers.

How has AFCL helped you so far?

“The course has helped me to highlight my personal strengths and weaknesses and how to best use and manage them to provide myself as an efficient and respected leader.

“This course has been a fair eye opener, and it has

helped me to see how many people rely on the cotton industry in this area and been really useful for developing industry contacts. It has shown me just how advanced and proactive the Australian cotton industry is.

“My true belief is that this has arisen because there are so many passionate people willing to share ideas concepts and knowledge to achieve a higher goal and to provide a staircase for people like ourselves to climb our way into the industry.”

Long term aim

“To provide a link between innovative new practices and changes within the industry and the growers in the Macquarie Valley that may be unaware of some of these developments.”

New leaders confident on industry stage

Dallas King, Director of Western Rivers Agriculture, St George Queensland.



“Since the program, I feel I have taken a huge step forward in self awareness. I am much more focused. Because of this course, I feel that I am performing at a much higher standard and making some great ground in my career”

Proof that investment in future industry leadership pays big dividends, successful graduates of the AFCL program recount how it has benefited their career.

Philip Firth, 49, is a farmer from the Lower Namoi who lives in Wee Waa. He was nominated for the future leaders program after encouragement from one of the Cotton Australia executives.

“As I was encouraging someone to nominate for the present program, I told them: ‘I think it is the most positive thing that I have done in 2007,’” Philip said.

“The program helped me to focus in on my personal strengths and weaknesses and to look at ways of building on the strengths and overcoming the weaknesses. It was an opportunity to think about how I could contribute to the industry and to mix with a group of quality young people. The process was energizing and invigorating.”

Since the formal program, Philip has become one of the Lower Namoi Representatives to Cotton Australia, plus a member of the Human Capacity Advisory Panel.

“I am member of the committee to organise the 2010 Cotton Conference,” he explained.

“I am active in the Lower Namoi Cotton Growers’ Association, particularly in improving the communication between growers and researchers in the Namoi Valley.”

Business wise, Philip is looking around for some more farming ground, as the major property that he had a share in farming has been sold.

“The industry has been very supportive and given me opportunities to express my views and become involved in representing growers and their interests at various levels,” he said.

“I am still excited about the people within this industry and think they are its greatest strength, they have kept

it moving forward in very difficult times and they will continue to be the foundation of its future.”

Dallas King, 35 is the Director of Western Rivers Agriculture, a company established in St George, South West Queensland.

As an agricultural consultant Dallas provides agronomic services for irrigation and dryland farmers in the Lower Balonne and Border Rivers region. Dallas has also been contracted to the Cotton CRC to disseminate best and recent practices in farming to cotton growers in these regions.

“I gained many positives from participating in the Australian Future Cotton Leaders program. Through the course I have developed a greater confidence in my own abilities, and as such am more committed to being involved in an industry that has presented me with a number of great opportunities and challenges,” Dallas said.

“The friendships that have evolved from this program have proven to be invaluable when requiring advice and ideas to face these challenges.

“It was due to this program that I applied for, and was successful in obtaining, the Cotton Scholarship for the Australian Rural Leadership Program, a truly amazing program which focuses on the personal development of individuals from rural industries and communities. I would highly recommend to all.

“It is because of the level of commitment and determination I have witnessed from the other participants that I know the Australian cotton industry is assured of a bright future.”

Fleur Anderson, 27, is a cotton farmer and new mum from Theodore.

Fleur’s industry leadership program focused on developing a career pathway to become an effective member of the cotton industry.

Specialising in media, policy and

branding, has helped her become more focused on the jobs she takes.

“I am much more aware of what it is that attracts me to opportunities and how they fit with what I want to achieve,” Fleur said.

“It’s still a struggle most days to not chase every rainbow, but I feel that I am getting better at it.”

Fleur is still on family property with her husband Kirk and her new nine-month-old baby.

“Tilly is our first child and I am working from home doing some consulting work, including working for Crop Consultants Australia,” Fleur said.

“I am also involved in small business support. In addition, I own a boutique in Theodore.

“Since the program, I feel I have taken a huge step forward in self awareness. I am much more focused. Because of this course, I feel that I am performing at a much higher standard and making some great ground in my career (whatever that may be!)

“Although they are not award based or achievement focused outcomes, I feel they are something I am proud of and definitely a result of FCL.”

As for plans for the future, based on what she has learned, Fleur plans to continue her work in event management, marketing, and small business support and to find a way in which she can combine these skills with her passion for the cotton industry and rural communities.

“I would also like to increase my support role to my husband on farm,” Fleur added. “Before FCL, I was considerably hazy as to where my role in the industry could be or should be, considering my location and family commitments.

“Now I feel I know in which direction I want to move and the grand plan is in place!”



Prepare for a safe picking

Cotton harvest is the culmination of a year's work. Each year many people new to the process work in what can be a hazardous environment if correct safety procedures are not made clear and adhered to.

"During harvest, cotton fields can be dangerous and every year many operators are injured and occasionally someone is killed," says Cotton Research and Development Corporation's Helen Dugdale.

In an effort to reduce the risk of injury during this busy time, the CRDC has produced a Harvest Safety DVD, designed for growers and contractors to demonstrate how the risk of injury can be minimised when a crew remains alert to potential dangers and works to minimise everyday hazards.

"Employers have an obligation to provide a safe workplace and to train their employees," Ms Dugdale says.

"Equally everyone working in the harvest operation needs to follow recommended procedures.

"To put it plainly we don't want any deaths on cotton farms."

The video outlines:

- being ready for work
- communication in the work group
- the danger of powerlines
- harvest equipment operations
- maintenance
- working at night
- fire hazards
- travelling and transport equipment

The content for the DVD was

decided in consultation with Mike Finucane, Auscott Narrabri's Occupational Health and Safety Coordinator.

Mr Finucane is well versed in the issue of health and safety on cotton farms, joining Auscott in the early 80s and working specifically on OH&S for the past 10 years.

Involved in producing the first harvest safety video back in the 80s, he said the time was here for the information to be updated as the industry had changed a lot over that time.

He hopes that all the growers and contractors can use the DVD to help train their people at harvest time, particularly as it is one of the busiest times of the year and often involved hiring large numbers of inexperience people.

"We see a lot of seasonal labour come into the industry at that time of year," Mr Finucane said.

"Picking is the most labour intensive time we have and there is a tendency to use backpackers or seasonal staff.

"And every so often you hear of silly accidents which cause great harm or death - we want to get rid of silly accidents on cotton farms and this DVD is designed to help."

Mr Finucane said farmers often don't have time or knowledge to develop their own induction processes, so the DVD provided a succinct, 15-minute induction to the dangers and strategies to avoid accidents at picking.

"We consulted with growers

and took into account the larger corporate and small farmer points of view.

"This year we have also consulted with contractors.

"As a result, we have compiled everything together on one DVD which offers a standardised approach to harvest safety."

Mr Finucane believes that growers and contractors should take the approach that accidents are avoidable.

"There are a lot of common easily identifiable hazards, for example powerlines, guarding machinery and so on.

"The grower is still the controller of the workplace and has the responsibility to provide a safe workplace for the contractor and their workers.

"Furthermore, from an efficiency and productivity point of view, a trained workforce is of greater value to a grower.

"For the sake of showing a 15 minute DVD, it gives workers an indication of what to expect at harvest time, so they can work more safely and more efficiently."

The DVD will be sent to cottongrower associations for distribution to growers.

"We would also like to encourage growers to get some extra copies to distribute to their contractors," Mr Finucane concluded.

John Deere and Case IH dealers
helen.dugdale@crdc.com.au

Power lines

Every year there are numerous serious incidents involving power lines and cotton harvest machinery, as module builders, pickers, boll buggies and tipping trucks can all reach powerlines.

Contacting, or coming too close to powerlines most often causes death.

All operators should refer to Workcover's Code of practice - Work Near Overhead Powerlines for comprehensive details.

You don't need to touch powerlines to be injured as high voltage can cause electricity to jump gaps and the chances of surviving are low.

There are several ways to guard against this:

- Use a farm map to identify the fields and roads where powerlines are.
- Orange balls attached to the lines can highlight powerlines and hazard signs identify the most dangerous locations.
- Position the module builders in the field so the pickers, boll buggy, tramper and module retriever operate well clear of powerlines.
- Always lower the mast on module builders before travelling.

If powerlines are touched:

- All metal parts on a machine become live, so try to break the contact.
- Never try to get out of machinery in contact with live wires unless you're in danger - in which case jump clear without touching both the equipment and the ground at the same time. Land with your feet together and shuffle 15 metres away.
- Keep at least eight metres away from machinery that's still in contact with live wires.
- And isolate the machine that's made contact and keep it cordoned off at a distance of 300 metres radius for 24 hours.

Calcium-magnesium ratio links to fusarium wilt

By Chrissy Brown

A preliminary investigation into soil factors that may affect the occurrence of fusarium wilt in cotton has found a significant negative correlation between disease incidence and soil calcium/magnesium ratio.

Dr Bo Wang of CSIRO is carrying out the CRDC research project and says that the results so far “are preliminary and pretty premature although they look promising”.

The research was prompted by reports that fusarium wilt diseases on a range of other crops can be effectively managed by changing soil abiotic factors (non-living but rather the chemical and physical components), for example liming which adds calcium carbonate to the soil.

Dr Wang explained that previous studies showed that disease control could be due to the increase of soil pH.

“However, little is known about the influence of calcium and other minerals on the disease either alone or in certain combinations,” he said.

“We noticed that in Australia fusarium wilt of cotton varies among fields even though they are next to each other, they undergo the same cultivation practices, and they share recycled irrigation water, suggesting complexity of soil impacts on the disease.”

In order to gain greater insight into this mystery, in August 2007 Dr Wang and his team began the first step in the three part research project, collecting soils from many fields infested with the disease *Fusarium oxysporum f.sp. vasinfectum* (Fov), which causes fusarium wilt in cotton.

The fields selected were from Moree, Boggabilla, and the Darling Downs areas and represented a range of different soil types. Samples were taken to Canberra and tested for disease incidence in a glasshouse.

The final stage in this initial part of the investigation was to carry out

extensive correlation studies between the field soil samples and the disease looking at over 20 soil characteristics including texture, organic carbon, nitrogen sources, exchangeable minerals and electrical conductivity.

One of the most important results of these tests is that a significant negative correlation was found between Fov disease incidence and soil calcium/magnesium (Ca:Mg) ratio. Or put simply, it was found that the disease was less severe in soils of a high Ca:Mg ratio.

“Our data show that in general the Ca:Mg ratio of cotton field soils varies in the range of 1.2 to 2.5,” Dr Wang said.

“Although further works are necessary before a clear impact of Ca:Mg ratio can be determined, the results from our correlation analyses do suggest that the disease appears much favoured by a Ca:Mg ratio below two.

“Low soil Ca:Mg ratio appears to be common in the fields where fusarium wilt is a problem.”

Dr Wang says a Ca:Mg ratio of less than two was observed in six out of 14 samples collected in 2007 and in 11 out of 18 collected in August 2008.

The research also suggests that a low Ca:Mg ratio (less than two) may be related to water movement.

Dr Wang explains that “We found that the ratio was higher in the soil of head ditch than tail drain areas. This may reflect the difference in solubility of calcium and magnesium. “Soil magnesium cations are more easily carried in irrigation water compared to calcium cations therefore magnesium is carried from the head ditch to tail drain areas more readily than calcium.

“The magnesium then accumulates in the tail drain when logged water eventually evaporates. As a result, the ratio of calcium to magnesium is higher in the head ditch soil but is



Bo Wang.

reduced in the tail drain soil.

“This hypothesis is consistent to the fact that, generally speaking, the occurrence of fusarium wilt tends to be much lighter in head ditch areas and more severe in tail drain areas.”

Dr Wang is now carrying out the second stage of the research which is to confirm the correlation between Ca:Mg ratio and Fov incidence by carrying out a relatively more precise trial.

This will involve using different soils collected from disease free areas and introducing identical quantities of inoculum into the soils so that all Fov levels are the same across the different types of soil.

If the initial findings are confirmed, the third and final step will be to determine whether the disease can

be controlled through some sort of manipulating soil Ca:Mg ratio.

Dr Wang says he cannot give growers any practical suggestions whilst the research is still in the early stages however, he says that if the negative impact of soil Ca:Mg ratio on fusarium wilt is confirmed that he believes growers should take this into account when they choose fertilisers (no or low Mg would be good in terms of disease management).

Secondly, soil testing could be used to monitor the changing of soil Ca:Mg ratio, and extra attention given to those areas or spots where the ratio drops below two as they are more likely to develop into hot spots of disease and plant loss.

Dr Bo Wang, CSIRO Plant Industry
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Being prepared for exotic pest threats

By Tracey Farrell, CRDC Farming Systems Investment Manager

An area of strategic R&D investment for CRDC is supporting the industry's preparedness to deal with biosecurity threats.

One of the ways CRDC aims to achieve this is by building the expertise of the industry's researchers. Overseas exchanges enable the researchers to gain first-hand experience with the exotic pest, often in the field, and the responses of the local industry to the issue.

CRDC has recently provided the opportunity for industry researchers to visit cotton areas in the US to investigate diagnostics and management for *Bemisia tabaci*, Q biotype.

Researchers from Queensland's whitefly resistance monitoring team, Zara Ludgate and Richard Lloyd travelled with Simone Heimoana from CSIRO at Narrabri to visit Arizona and California where there is long term experience with managing silverleaf whitefly and they have now been effectively managing Q-biotype for a number of years. The US industry has well established insecticide resistance monitoring programs in place for whitefly to support the development of management strategies.

The researchers saw how Q biotype has never established in the field in the US and even in closed systems like glasshouses B biotype generally displaces Q biotype. Q biotype has major fitness costs, even in the presence of high insecticide pressure.

In the US there are insecticide options available that have efficacy against Q biotype. These insecticides are solely for the management of Q biotype to preserve the efficacy of these products. Visits to a range of research institutes confirmed that Australia has a comparable standard of monitoring insecticide resistance in whitefly to the US laboratories.

"We have gained confidence in our methodology and interpretation of results," Ms Ludgate said.

"While there are no major changes required to any aspects of the project, small changes to methodologies will be made that can increase the efficiency of the operation and minimise experimental error in bioassay testing.

"For example, using only the first true leaf of cotton in bioassays rather than several leaves off a plant may minimise variability between replicates.

"Adults should never be removed from leaves during feeding because their stylet could be damaged in the process and cause mortality in bioassays."

Latest information gained on cross commodity management and resistance testing will be of enormous benefit to the cotton industry in Australia as well as assist in skills development of the research team.

Coming scientific exchanges for industry researchers include:

- A visit to Argentina in February 2010 for cotton pathologist, Alison Seyb, I&I NSW, to attend an expert workshop on fusarium wilt. The visit would also include opportunities for Alison to see blue disease of cotton in the field and learn about management strategies employed to limit its impact.
- A visit to Israel and Spain for I&I NSW plant pathologist, David Nehl, to

develop Australian diagnostic capacity for defoliating strains of verticillium wilt.

• A visit to California for cotton pathologist, Linda Smith, I&I NSW, to gain expertise in the recognition and identification of defoliating strains verticillium wilt using PCR-based techniques and Vegetative Compatibility Group analysis.

In recent years CRDC has also facilitated a number of scientific exchange projects that involve producers, researchers and industry extension officers in visits to countries and regions where some of our most serious emergency plant pests exist in situ. To date exchanges have been to the US, South America and Pakistan.



Want to know more about the National Cotton Industry Biosecurity Plan?

Version 2 of the Plan is due for release late this year. Keep a look out for it on the Cotton Australia website www.cottonaustralia.com.au

Key Insect Pest threats to the Australian cotton industry



Photo: Alton Sparks

Cotton boll weevil (*Anthrenus grandis*)

Cotton boll weevil is specific to cotton. Adult weevils are 8mm long, can fly, and spread quickly. In the US, control of cotton boll weevil using insecticides costs hundreds of millions of dollars.

Damage

Feeding causes large yield losses. The larvae develop inside a young boll, reducing the number of bolls that contribute to yield. Adult feeding can cause young squares to shed and lint production to be reduced when developing bolls are targeted.



Photo: Melina Miles

Melon aphid (*Aphis gossypii* exotic strains)

While this is the same species of aphid that most commonly found in Australian cotton, exotic strains of the species may carry exotic diseases such as blue disease. There is also a risk that new aphid strains entering the country will have different insecticide resistance profiles, making control more difficult.

Damage

Aphids damage cotton by feeding on young leaves and bolls which can reduce yield. They produce a sticky residue that can cover leaves resulting in reduced photosynthesis and contamination of lint as bolls open, reducing the crop's value.

Whitefly (*Bemisia tabaci* B-biotype or Q-biotype)

Although B-biotype whitefly (Silverleaf whitefly) is common in Australia and there have been isolated reports of Q-biotype, there remains a risk of other strains entering the country. Exotic strains may have different insecticide resistance profiles or ability to multiply more rapidly on cotton. In other parts of the world whiteflies have shown their potential to be a very invasive and economically damaging pest.

Damage

Exotic strains of whitefly can damage cotton in several ways. Feeding can reduce boll size resulting in direct yield loss. The quality of lint can be downgraded by sticky residues and sooty moulds. Whiteflies are also vectors of exotic viruses such as cotton leaf curl disease.

Photo: Neil Forrester



Indian Green Jassid (*Amrasca devastans*)

Indian green jassid is a sap-sucking insect pest that can cause yield losses of up to 25 percent. While several 'jassid' species are found in Australian cotton the damage they cause is relatively minor, rarely if ever affecting yield. Hairy-leaved varieties are used in parts of Africa and the sub-continent where cotton is hand harvested to provide effective resistance against green jassids. Such varieties are not suitable for mechanical harvest as the leaf hairs cause excessive leaf trash in the cotton lint.

Damage

Green jassids inject a toxin as they feed that causes leaves to yellow, crinkle and curl. Bolls are aborted and plant growth may be stunted.



Tarnished plant bug (*Lygus lineolaris*)

The tarnished plant bug is a pest of over 250 plant species. Adults are small insects 5–6 mm of varied colour that fly and spread easily. There are 2–5 generations per year enabling the species to quickly build up to high levels.

Damage

In cotton, it feeds on all parts of the plant causing yellowing, distorted growth and stem or leaf wilting. Heavy feeding causes die-back of shoots and stunting. Feeding on bolls can cause seed abortion or later lead to poor seed germination.

Photo: Jack Kelly Clark
University of California



Spider mites (Tetranychid mites)

Several species are found in Australian cotton, the most common of which is the two-spotted spider mite. However, overseas there is a range of other species that have different host preferences, cause more severe damage or have resistance to some of our key acaricides.

Damage

Mites feed on the undersides of leaves, sucking out the cell contents. Their damage causes a characteristic bronzing of leaves, and if uncontrolled can dramatically reduce yield and fibre quality.

Photo: Jack Kelly Clark
University of California



Cotton Industry Diagnostic Services at the ready

If you have spotted any of these pests or any insects you can not identify, immediately contact:

- Dr Melina Miles, Senior Entomologist, Queensland Primary Industries and Fisheries, 07 4688 1369, melina.miles@deedi.qld.gov.au
- Zara Ludgate, 07 4688 1436, zara.ludgate@deedi.qld.gov.au
- Cotton Australia, www.cottonaustralia.com.au
- Plant Health Australia, Exotic Plant Pest Hotline 1800 084 881, www.planthealthaustralia.com.au.

Ag science careers go online

The Primary Industry Centre for Science Education (PICSE) concept unfolded in 1998 as a program designed to successfully attract top-notch students to study science, an area which is suffering from major skills shortages and struggling to fill tertiary places. From there it has gathered momentum and relevance for the agricultural R&D sector, according to PICSE director Dr David Russell.

PICSE has recently launched a website which offers a brilliant resource to back up the already successful program.

A clickable map directs users to colour-themed sub sites for each of the Activity Centres, detailing up to date information from the activity at UWA, UTAS, UNE, USQ, USC, GrowSmart and Flinders University. Students and teachers can gather information and download application forms and flyers for the Industry Placement Scholarship, Science Investigation Awards and Teacher Professional Developments.

PICSE Science Education Officers visited schools, interviewing students, arranging and promoting the Teacher Professional Development to produce the 177 page website, www.picse.org, complete with photos from the most recent activities.

The \$8 million national PICSE program is showcasing careers and opportunities in Australia's primary industries sector, by way of camps, industry placements, scholarships, professional development and life experience.

The hands-on program is being delivered in regional and metropolitan centres and universities throughout Australia.

PICSE is being supported for the first time through a three-year CRDC investment beginning in 2009-10. The CRDC initiative complements the existing Cotton CRC schools initiative in its Communities Program, and the work of education officer Trudy Staines, and Catchments Communities Program Manager, Dr Paula Jones.

Six universities are also PICSE participants including Flinders University, University of Tasmania, University of Western Australia, University of New England, University of Sunshine Coast and University of Southern Queensland. The CRDC investment plan centres on the University of New England and supports the existing cotton courses under the direction of John Stanley.

David.Russell@utas.edu.au
03 6430 4517
www.picse.org



Former BMP Program Manager Louise Adcock, recipient Brian Strand, Cotton Australia Chair Joanne Grainger, Mark Hickman and recipients Stuart Higgins and Jason Sinclair at the presentation of the BMP Manager's Award at the 2008 Australian Cotton Conference.

NSW Govt supports BMP Farm Manager Award

By Chrissy Brown

The NSW government has agreed to throw its weight behind the cotton industry's new BMP Farm Manager Award by reducing the cost of assessment by 80 percent from \$2550 per person to \$500. Available only for a limited time, funding is provided through a joint federal and state government initiative called Productivity Placement Program (PPP), and now brings NSW in line with PPP funding already established in Queensland.

Individuals implementing cotton Best Management Practice (BMP) can have their skills and knowledge formally acknowledged with recognised a vocational qualification. Assessment involves a farm visit from an assessor from Tocal College (NSW) or AACC (Australian Agricultural College Corporation, QLD) including an informal discussion and farm tour allowing the applicant to draw on both current and lifelong learning.

A limited amount of preparation and follow up is required and there are no written knowledge tests or exams. This makes the process a relatively quick and straightforward method of achieving industry recognition and management qualification. The assessment process is known as recognition of prior learning (RPL) assessment.

Growers, managers and workers actively involved in the day-to-day and strategic management of cotton farm operations may be eligible to undertake the assessment. If the farm has been audited and awarded BMP status, individuals can be assessed and personally may obtain the Certified BMP Farm Manager Award in addition to a Diploma in Agriculture (specialising in cotton production).

If the farm has not gained BMP status but implements BMP on the property, participants may still be eligible for the Diploma of Agriculture, but not the industry award - until such time as the farm gains BMP status.

Eight individuals from Queensland have already received the Diploma in Agriculture (Specialising in

'...these formal qualifications create a culture of professional development among producers'

Cotton Production) and Certified BMP Farm Manager Award, while one individual in NSW has been a dual award recipient. PPP funding was arranged for the award in QLD in August 2009 and since then a further five individuals from that state have embarked on the process.

Mark Hickman, National Training Coordinator for Irrigated Farming Systems with the Queensland Department of Employment, Economic Development and Innovation (DEEDI), was responsible for developing the award by illustrating alignment of the BMP manual with a variety of units from the relevant, nationally recognised training packages.

He said that one key attraction, particularly to farm managers, is these qualifications are a marketable asset to individuals. They will be recognised by future employees and industry bodies where demonstrated knowledge and experience in cotton BMP is highly regarded.

Mr Hickman said industry benefits from individuals gaining these formal qualifications by creating a culture of professional development among producers and stimulating innovation.

"The award highlights the value of educational development of its members through the implementation of industry BMP at field level," he said.

"Furthermore, gaps in skill development can be formally identified assisting industry with directing funding for education and training."

Growers interested in finding out more about eligibility and applying for the diploma or award can contact Mark Hickman directly or Charlie Bell, Tocal College for NSW producers or Rick Whistler AACC for Queensland producers.

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Forums forge new fibre vision



The primary value a Post Farm Gate Forum was the opportunity for members of all segments of the industry to share their knowledge and to contribute their ideas as to how to solve the industry's issues, according to Cotton Ginners Association chairman Jeff Ballentine.

"It's the only time that members of all segments which include growers, marketers, warehousemen and seed breeders, have the opportunity to sit in the same room and gain an understanding of the industry activities and pressure points throughout the value chain," Mr Ballentine said.

The second forum in CRDC's Value Chain series, the Post Farm Gate Forum was held at the Cotton Collective in Narrabri during August and was attended by merchants, ginners, warehousemen, classers and trucking company representatives along with leading researchers.

Discussions covered a range of research initiatives affecting the post farm gate sector and potential issues which need further work and investigation.

"Post farm gate processing and management of cotton plays a key role in delivering the best possible quality cotton to Australia's customers," said organiser Pete Johnson, former Australian Cotton Shippers Association chair, who now heads the industry's Premium Cotton Initiative and value chain forums.

"Developing new market opportunities for premium cotton requires partnerships throughout the value chain and this forum was designed to strengthen those partnerships through information sharing and discussion.

"The session from the ginners was very productive, with a key outcome involving discussion of storage and handling BMPs, which was a follow on from the previous value chain forum in late November.

"A big part of quality assurance in the value chain is BMP Programs and ginners and classers already know the value of being involved in the development of those."

BMPs for ginning and classing are now being used and will continue to be refined and improved. The opportunity exists to extend BMPs to storage and handling of cotton to help secure the integrity of cotton across the value chain.

"2009 was the first year that CSIRO performed a certification audit on participating gins and the results were very encouraging," Jeff Ballentine said.

"CSIRO found that gins were engaged in the process and reported a high level of participation and interest.

"The Ginners' BMP is a 'work in progress' and the Association is committed to refining the standard in future seasons.

"We developed the current standard in 2007 and now continually review it with guidance from other stakeholders in the supply chain."

The Value Chain Best Management Practices

(BMP) program provides the ideal framework for protecting the value of cotton through production, processing, classing and the storage and handling of cotton.

And like the ginning sector, Cotton Classers Association Australia (CCAA) members are committed to best management practice by continuing to promote repeatability between all HVI instruments in Australia.

As part of its BMP, all classing members have to participate in the CCAA check test program.

Chair Greg Parle said the Association is currently involved in two check testing programs.



Greg Parle

"One of the programs involves all CCAA classing members sending two samples every two weeks during the classing season," Mr Parle said.

"These samples are both HVI and visually classed and results sent to CSIRO's Rene van der Sluijs in Geelong.

"All HVI instruments that are testing for grower evaluation must participate in this check test program.

"Rene sends a report to all members with their individual

results and comparison against average for all HVI properties of Length, Length Uniformity, Micronaire, Strength, Colour Rd and Colour +b."

The second program the CCAA is involved with is Commercial Standardisation of Instrument Testing of Cotton (CSITC).

This initiative was set up by International Cotton Advisory Council (ICAC) and a task force was established to facilitate the adoption of universal testing standards and procedures by all testing centres around the world. Results for all the tests are collected by the USDA and evaluated by the Bremen Fibre Institute.

This year, for the first time, the average results achieved by the Australian instruments in one of the many tests were better than the average world results in all fibre properties.

"We would like to continue this trend in future CSITC trials," Mr Parle said.

"Given the internal and external check test programs CCAA classing facilities participate in, we are confident that our HVI instruments are as reliable, or better, than any in the world.

"Cotton growers and spinners know they can rely on HVI testing on all properties."

A part of CCAA BMP involves having all facilities randomly audited against all CCAA guidelines during classing, which is also performed by Rene van der Sluijs, with funding support from CRDC.

The CCAA acknowledged this and thanked Rene for his involvement within the Association.

? For a full report on the last of the CRDC/ACSA forums, a BMP workshop for storage and handling, see March 2010 *Spotlight*.



CSIRO Materials Science and Engineering's Robert Long (left) and Michael Bange of CSIRO Plant Industry

Looking at farming decisions through textile quality

By Tristan Viscarra Rossel

A recently completed research project has firmed links between management decisions made on-farm and how these go on to influence textile performance.

Involving CSIRO researchers from Narrabri and Geelong in a research project supported by the Cotton CRC and CRDC, the work concluded that crop management, the growing environment together with post-harvest processes all significantly affect fibre and textile quality.

According to the research findings, these insights would be regarded as vital knowledge when the quality of Australia's raw cotton is on the line as it is purchased for a premium based upon quality and consistency.

Fibre quality measures such as high micronaire, high nep counts and excessive short fibre have caused spinners some concerns in recent years, and while growers feel the direct impact of high micronaire through price penalties, the impact of other quality attributes have remained less clear-cut.

Over time, any negative aspects of fibre quality generated from our raw cotton could affect the reputation of the Australian industry with textile manufacturers while it decreases our cotton's value in global markets. Recognition of this threat has helped initiate the research that investigates how farm practices influence quality, and how these translate into textile processing.

The challenge for change now is to see where management practices can be refined further by assessing both fibre quality measurements and textile performance. Specifically, this project aimed to explore issues relating to micronaire, neps counts and variety performance from a textile perspective.

Management impacts on micronaire

One of the project's principal investigators, Dr Michael Bange of CSIRO Plant Industry in Narrabri, explained how it was important to achieve a balance between canopy size and boll number to achieve optimum micronaire.

He said micronaire is a combination of fibre linear density and fibre maturity.

"Low micronaire cotton may have immature fibres and high micronaire cotton is considered coarse. The ideal micronaire range is 3.8–4.5, or 3.8–4.2 for premium fibre. The consequences of low micronaire from a textile perspective may mean that fibres are immature (leading to breakages and difficulties with dye uptake), while high micronaire may indicate coarse fibres, which means there are less fibres in the cross section of a yarn, lowering its strength," he said.

"Matching the crop size with the right boll load is important. A big canopy with too few bolls may result in high micronaire, for example.

Dr Bange said growers need to be aware that many crop management considerations can influence plant size and boll load (see Table 1).

"Choice of variety, fertiliser rates, insect management, time of sowing, and the use of plant growth regulators can all have an effect. Growers need to ensure that management choices aim to balance vegetative and fruit growth," he said.

As part of the project, a series of field experiments explored how fibre micronaire could be manipulated in different climates by measuring the effect and interaction of four variables: variety, sowing date, plant size during boll development, and boll load.

In the first season at Narrabri, sowing time, variety, manipulation of plant size and fruit removal all significantly affected micronaire. Yield was significantly affected by sowing time, variety and fruit removal, but not from manipulation of plant size.

Substantially delayed sowing time (ie late October – early November) reduced both micronaire and yield.

Three varieties were trialled, each with different average micronaire values: Sicot 71 BR (micronaire 4.7), Sicot 70 BRF (micronaire 4.2) or Sicot F-1BRF (micronaire 4.1). Choice of variety was found to have a strong effect on fibre micronaire and yield.

Removal of half the fruit increased micronaire compared with no fruit removal, but lowered yield.

Researchers attempted to increase plant size (ie create a larger leaf area index) by tipping out the plant prior to first square, and by using the Sicot F-1BRF variety. To achieve a smaller plant size, the plant growth regulator, mepiquat chloride (Pix), was applied around early flowering. Smaller plant size raised micronaire, which Dr Bange said was unexpected and maybe a result of an interaction of variety and Pix. Only Sicot 70 BRF had higher micronaire with reduced plant size. Researchers are waiting for the second season of data analysis to confirm this response.

Dr Bange said that researchers would combine data collected from other sites (Goondiwindi, Moree and St George) following completion of fibre quality analyses, and use this information to assist in predicting the micronaire outcomes of different management practices. The information also aims to provide insights on how a crop may be managed to optimise micronaire when the vegetative–fruit ratio is unbalanced.

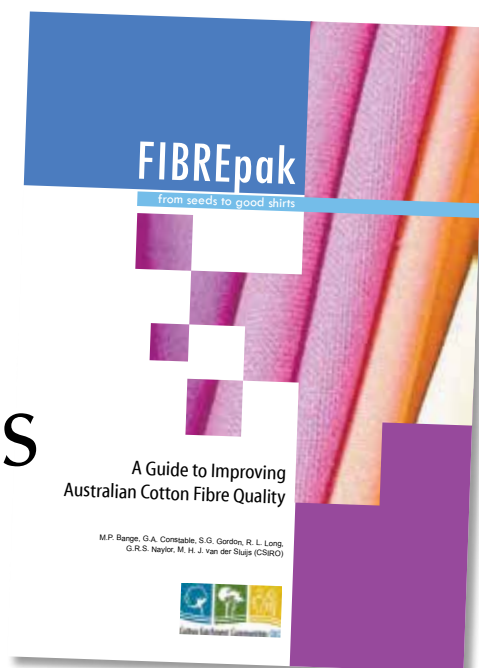
Manipulating nep counts

A nep is an entanglement of fibre with a hard, central knot that can cause light coloured flecks on finished fabrics, lowering their value. Fibre linear density, fibre maturity and the level of biological contamination can all lead to formation of neps. Improper harvesting and ginning can also affect the amount of neps too.

'Fibre maturity' refers to the thickening of a fibre. Insufficient carbohydrate for cellulose production can cause immature fibres, which are then more prone to nep formation during harvesting and ginning.

Dr Bange listed a number of factors that can lead to immature fibres, including early termination of the crop through early defoliation or a spell of severe cold weather at the end of the season. Excessive late growth can also contribute to more immature bolls.

A field experiment explored the impact of early





defoliation on nep levels. Over three seasons, the timing of defoliation was varied to generate different amounts of immature fibres and neps. Earlier defoliation increased neps, and the amount of neps was better related to fibre linear density, rather than fibre maturity. When the cotton seed was subsequently ginned, an additional lint cleaning passage contributed an additional 95–141 neps/g, and a second passage contributed an additional 101–181 neps/g. The results supported the current recommendation of applying harvest aids at 60 percent open bolls in uniformly maturing cotton crops, and showed that both yield and quality attributes were consistently reduced prior to 60 percent open bolls.

At CSIRO Materials Science and Engineering in Geelong, Robert Long leads activities that are processing these experiments from a textile perspective. There cotton is spun into yarn, knitted into fabric and subsequently dyed. Results from the first experiment showed no significant differences across treatments for important yarn performance characteristics (eg yarn strength).

However, more mature fibres from later defoliation treatments (from 42 percent open bolls) absorbed more blue dye and appeared a more intense blue hue.

Variety textile performance

Dr Bange said that it was important for growers to ensure that they are matching their choice of variety to their region and their cropping situation to optimise quality.

If you choose a variety with poor fibre quality, management and processing cannot improve the fibre quality. Starting with a variety with good quality traits provides some insurance against unfavourable conditions, but careful management and processing are still required to preserve fibre quality.

“In short season regions, earlier maturing varieties can offer insurance that the crop will mature and be harvested before the onset of cold wet conditions,” Dr Bange said.

“In long season regions, there is more flexibility. The use of Bollgard II provides more opportunity to sow later in the season to optimise both fibre length and micronaire.”

As part of the project, researchers conducted two experiments in Narrabri over two consecutive seasons to compare the field and textile performance of current and future potential Australian cotton varieties.

The experiment included commercially available

Upland varieties (Sicot 71BR, Sicala 350B) and the Pima variety Sipima 280, and experimental upland breeding lines. Seed cotton was machine harvested and ginned before being transported to CSIRO in Geelong for processing.

Researchers found that the strongest yarns were produced using genotypes with the longest and finest fibre and that micronaire was an inferior indicator of yarn performance. The results showed that all of the varieties tested produced high quality yarn and that some breeding lines were superior, indicating that the breeders were on track in meeting market demands.

This information is being used by the breeders to help develop strategies for plant selection to improve quality that seek to exceed market expectations and reduce potential industry concerns by spinners (eg neps and short fibre content).

Along with other research and industry initiatives, such as FIBREpak, this research continues to assist the industry to improve fibre quality at all levels of the production chain.

? For further information, contact: Dr Michael Bange, Principal Research Scientist, CSIRO Plant Industry, 02 6799 1500, michael.bange@csiro.au, www.cottoncrc.org.au, www.csiro.au

Table 1: Key in-field management considerations for optimising fibre quality.

Objectives	Pre-planting	Sowing to first flower	First flower to open boll	Open boll to harvest	Harvest to gin
Realising the genetic potential for fibre length	Variety selection; strategic planning for irrigation availability; consider skip row for dryland	Monitor soil moisture and schedule irrigation to optimise plant vegetative size	Monitor soil moisture schedule irrigation to optimise plant vegetative size and to avoid stress on developing fibres	–	–
Maintaining fibre strength	Variety selection	–	Maintain healthy crop	–	–
Producing fibre with mid-range micronaire to avoid fibres that have too high linear density or are immature	Variety selection	Monitor soil moisture and schedule irrigation to optimise plant vegetative size; sow at appropriate date for the region to avoid early crops in hot areas or late crops in cool areas	Management of plant vegetative size, structure and balance with boll setting pattern; achieve uniform boll set by having the appropriate plant type for the variety, region and climate; optimise agronomic management such as water, fertiliser and growth regulators; adopt IPM to protect fruit, and leaves	Timely harvest to avoid bad weather; use appropriate nitrogen fertiliser rates to match crop and fertiliser cut out; schedule last irrigation to leave soil at refill point at defoliation; use appropriate timing, product and rate for defoliation	–
Reducing the incidence of neps	Variety selection				Spindles and doffers maintained daily; reduce spindle twist by not picking too wet
Delivering clean white cotton with no stickiness	Weed management	Weed management	–	Fertiliser, irrigation and defoliant management (as above); refer to IPM guidelines for aphid and whitefly management	Setup picker to avoid pin trash and bark; follow guidelines for module placement, construction, tarping and transport; keep good module records
Preventing contamination	Farm hygiene to avoid contamination during harvest; weed management	Weed management	–	–	Farm hygiene; picking height; hydraulics on pickers and builders checked and maintained

Source: Bange MP et al (2009). FIBREpak: From Seeds to Good Shirts. A Guide to Improving Australian Cotton Fibre Quality, The Cotton Catchment Communities Cooperative Research Centre, Narrabri.

Kate Lightfoot worked with growers in the Namoi to assist them in implementing all aspects of the BMP Land and Water Management module.

Namoi Valley growers map for land and water BMP



By Tristan Viscarra Rossel



Paula Jones

Thanks to an ambitious 30-month project started in September 2006, an additional 120,000ha of farming land in the Namoi Valley is now represented by 83 up-to-date property maps, the starting point of BMP's Land and Water Management module.

The project was an initiative of the Namoi Catchment Management Authority (Namoi CMA) and the Cotton Catchment Communities Cooperative Research Centre (Cotton CRC), in partnership with Cotton Australia and CRDC.

It set out to support the adoption of the BMP program's Land and Water Management module by growers in the Namoi Valley, as well as fostering clearer links between the BMP program and the Namoi CMA's Catchment Management Plan.

To deliver and implement the BMP program in the Namoi Catchment, the project employed Kate Lightfoot as its full-time BMP Officer. In her work, Ms Lightfoot worked with growers to assist them with implementing all aspects of the Land and Water Management module.

Spreading the word

To begin raising awareness, three workshops were facilitated in Narrabri, Wee Waa and Walgett with Cotton Australia's Grower Services Manager. These workshops introduced growers to the module and helped them complete preliminary pre-certification audit tasks, such as creating property plans and actions plans.

Twenty-four growers attended the workshops and 80 percent then had further contact with the Ms Lightfoot to complete the preliminary tasks. Building on feedback from the workshop, the plan to deliver six workshops evolved into one-on-one farm extension visits, which growers said they valued more.

Offering extension visits to growers personalised the service and minimised the time they spent off farm; it also accelerated the completion of the preliminary tasks. Over the course of the project, the BMP Officer made more than 100 on-farm extension visits.

Creating property plans

Producing relevant, accurate farm maps and being able to interpret them is a critical component of the Land and Water Management module. It is the foundation of the module and a building block for all BMP action plans.

Originally the project aimed to develop 81 property plans, and Ms Lightfoot was able to work with growers to complete 83 property plans throughout the catchment.

All growers who used the services of the BMP Officer to develop property plans improved their skills in resource management and developed action plans to identify issues on their properties

that needed addressing. Several growers also went on to secure incentive funding for their NRM improvements.

Feedback from growers clearly demonstrated that they understood the management benefits from having a relevant, accurate property plan.

Keeping up-to-date

After the three workshops initially, and throughout the on-farm extension visits, the BMP Officer remained in contact with growers on a range of topics via telephone and email, and regularly distributed event invitations and technical updates by email. Through a working relationship with the Lower and Upper Namoi Cotton Growers Associations, Ms Lightfoot was also able to tap into those networks.

During the project, she helped to highlight best management practices at more than 15 field days and workshops. Topics covered included water use efficiency and water quality, managing natural resources in an agricultural landscape, soil health and sampling, drought management and pest management.

Working together

A unique feature of the project – and the key to its success – was the ability of the BMP Officer to draw on a wide range of resources provided by both the Namoi CMA and the Cotton CRC. This integrated approach helped boost best practice management and sustainable management of resources in the Namoi Valley.

At the initial workshops, Ms Lightfoot worked with Cotton Australia and specialist staff from local councils, Industry and Investment NSW and Namoi CMA to provide the technical knowledge that growers needed to implement the module.

Workshops and field days throughout the project were run predominantly in collaboration with Namoi CMA operations and education staff, a process that also helped to up skill these people on a range of technical topics and industry-specific issues.

Namoi CMA and Cotton CRC officers worked closely together to promote the catchment targets and adopt a combined approach to NRM best practice extension to growers. This increased the number of growers willing to be involved in the BMP program, and encouraged existing BMP growers to progress their activities and seek incentive funding to support their work.

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Feedback from growers clearly demonstrated that they understood the management benefits from having a relevant, accurate property plan.

All in a day's work: Demystifying fungal diseases

Soil borne fungal diseases are some of the most recalcitrant problems facing the cotton industry in Australia.

The pathogens that cause black root rot, *Verticillium* wilt and *Fusarium* wilt all survive for long periods of time in the soil and to date there are no means of effective eradication. Industry research aims to learn how the pathogens interact with the soil and with the cotton plant to find economically and ecologically sustainable management strategies.

Plant pathologist with I&I NSW and the Cotton CRC, Dr Alison Seyb, worked last season with support from CRDC to measure the effects of the irrigation system and soil type on disease severity, specifically their effects on *Thielaviopsis basicola*, the pathogen responsible for black root rot.

On five farms across the Darling Downs, Gwydir, Lower Namoi and Upper Namoi valleys, lateral move and furrow irrigated fields were studied to compare differences in disease risk between the systems. All farms have a long history of cotton production.

Cotton plants under the lateral move had on average four times the volume of roots in the top 20cm of soil than plants irrigated in a furrow system. This is relevant to disease development as pathogen inoculum is generally thought to be in the top 20cm of soil.

"Soil cores taken last season confirmed that pathogen inoculum was mostly in the top 20cm in both lateral move and furrow irrigated fields, however significant amount of disease was only present on one of the five farms," Dr Seyb said.

"The lack of significant levels of pathogen inoculum on three of the farms raises questions about environmental factors, such as 'are soil conditions limiting disease build-up?'"

The question about soil type was

developed in response to anecdotal evidence from growers in the Upper and Lower Namoi valley that within a field, cotton growing in red soils is less affected by black root rot than cotton in brown soils.

In a series of glasshouse trials, soils collected were loaded with known amounts of *Thielaviopsis basicola* inoculum, and the cotton plants grown in the soil were assessed.

"The effect of soil type differed depending on the field where the soil was collected, however in general the red soils had less disease than the heavier 'brown' soils when treated with known amounts of inoculum," Dr Seyb said.

However the nature of the observed disease suppression was not clear.

"In many of the soils, steaming to eliminate biological influences removed the suppressive effect of the red soil but from other fields it did not. This suggests an abiotic factor may be influencing disease development, such as pH or clay content," Dr Seyb explained.

Soil nutrient tests showed nitrate may affect black root rot disease development, however glasshouse trials have not been conclusive. The effect of soil pH, clay content and the presence of antagonistic organisms on disease development are now the focus of ongoing work.

This season Dr Seyb will continue to investigate the impact of soil factors on black root rot, *Verticillium* wilt and *Fusarium* wilt. Work is currently underway looking at the survival of the pathogens under different environmental conditions, with particular attention on the nutrient status of the soil.

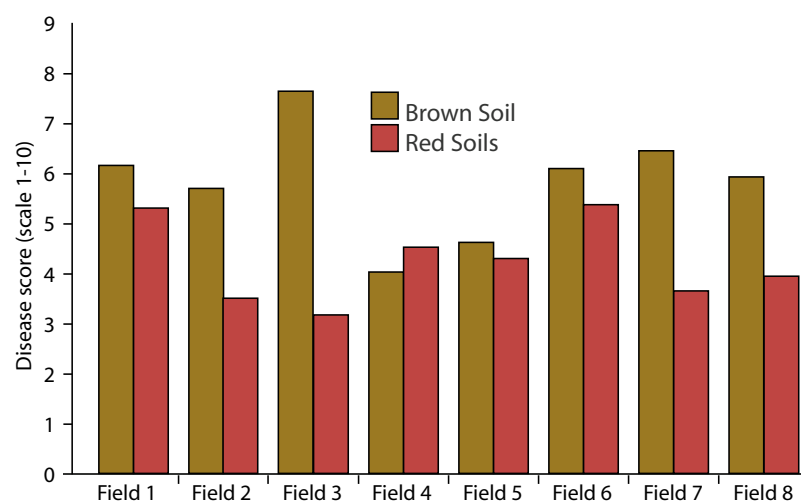
This closely ties into another research area in the project, the influence of crop rotation on inoculum levels in the soil.

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Dr Seyb washes cotton roots in preparation for analysis using the WinRhizo. The WinRhizo measures diameter, volume, surface area, length and branching of the cotton roots. It also differentiates between healthy and diseased roots saving time and sanity in the research lab and delivering precise, accurate and detailed data.

Courtesy David Larsen, I&I NSW and Cotton CRC.



Severity of black root rot symptoms on cotton plants growing in soils from cotton fields with known quantity to *Thielaviopsis basicola* inoculum.



The Australian delegation at the September ICAC annual meeting in Cape Town South Africa – (at back) Adam Kay, Ralph Schulze, Mike Logan, Bruce Pyke. At front are Richard Haire, Peter Ottesen and Terry Townsend, Executive Director of the Washington, DC-based ICAC.

ICAC Plenary 2009

"It is difficult to measure emissions in agricultural systems ... Equipment for measuring emissions accurately is quite expensive for individual farmers, so we would be better off working on areas in which we know a difference can be made."

Emission research complex, but needed

By Mary Ann Day

CRDC General Manager of R&D Investment Bruce Pyke, told delegates at the International Cotton Advisory Committee's (ICAC) 68th Plenary Meeting in Cape Town, South Africa that the cotton industry need to step up its capacity to measure carbon emissions.

Bruce Pyke was a panelist during a breakout session on the Impacts of Carbon Trading on the Cotton Industry.

The session also found that greater R&D investment in nitrogen management, crop rotations and soil sequestration were key parts of the same carbon measurement dilemma facing cotton globally.

The session was chaired by Australian delegation member Richard Haire during the ICAC Plenary Meetings – the week-long annual events involving delegates representing the governments of the 40 member countries of ICAC.

Australia was represented with a six-person delegation.

"Among the key issues we discussed on the impacts of carbon trading was the need to standardise methodologies, and share data," Mr Pyke said.

"Some data from the recently completed Life Cycle Assessment of an Australian Cotton T-shirt was presented which indicated that campaigns to reduce the impact of the use phase of cotton products and recycling opportunities such as pyrolysis and bio-fuel may be important opportunities for the cotton industry.

"The cotton industry was also encouraged to lobby for a better deal for agriculture post-Kyoto. Currently agriculture is out in the cold in terms of carbon trading

and Copenhagen is the best opportunity the world has to address that deficiency."

Most European countries don't include agriculture in their emissions trading and the US will not require their farmers to account for carbon emissions under their proposed emissions trading scheme.

"It is difficult to measure emissions in agricultural systems," Mr Pyke explained.

"Equipment for measuring emissions accurately is quite expensive for individual farmers, so we would be better off working on areas in which we know a difference can be made.

"For example we could focus on where we can make the biggest reductions, such as matching nitrogen use to best meet crop needs, planting legume rotations and reducing tillage to increase soil carbon storage.

"As outlined in the Spring 2009 edition of CRDC's *Spotlight on Cotton R&D*, we already have indications that cotton contributes less than polyester to global warming – the on-farm emissions are low compared to whole of life emissions.

"Consequently it is to be hoped any new agreement struck at Copenhagen will take such factors into account and give agriculture more recognition in the role it can play in reducing emissions," Mr Pyke said.

"However, in order for the cotton industry to exploit its opportunities in a world where carbon is a tradable commodity, more Life Cycle Assessments will be

ICAC Plenary 2009

Maintaining communication among the World's cotton producing and consuming nations

needed for cotton systems in different countries, to better understand different production systems, soil types, climate, manufacturing, use patterns, and so on."

The Australian delegation told the meeting that production was expected to increase to 427,000 tons in 2009/10, reflecting improved irrigation water availability, but would remain lower than its 2001 peak of 825,000 tonnes. Ongoing dry conditions in many cotton growing districts and the impacts of the global financial crisis continue to affect cotton production in Australia.

"It was reported that the Australian cotton industry has strong research and development capabilities that had developed improved varieties and management of water, nutrition and crop rotation, allowing yield increases in recent years," Mr Pyke said.

"The head of the Australian delegation, Peter Ottesen from the Crops, Horticulture, Irrigation and Wine Branch of DAFF (Department of Agriculture, Fisheries and Forestry) told the meeting that to respond to climate change, the Australian government was expecting to implement a Carbon Pollution Reduction Scheme (CPRS)," he said.

"Agriculture will remain outside of this scheme until at least 2015, but in the interim, the government has implemented initiatives that will help reduce carbon pollution and assist farmers to adapt to a changing climate.

"The government is also exploring the potential to open new areas for agriculture in the north of the country, where water is in greater supply.

"Australian governments are in the process of developing a water market where irrigation water entitlements can be traded in order to improve water efficiency and management. The Australian government has also started a program called 'Water for the Future', which will affect all uses of water."

Mr Pyke said that in addition to the ICAC break-out sessions, plenary sessions during the week discussed issues such as world cotton consumption and production. The role of cotton in providing income security in many developing nations which contributes to food security for millions, improving cotton production of small holders, and the need for a satisfactory conclusion of the Doha Round were all key topics at the ICAC meeting.

As well as attending the plenary Sessions, it was a busy week for the Australian delegation as there was a range of other meetings and breakout sessions held. Delegation representative Richard Haire participated in the Private Sector Advisory Panel (PSAP) meeting, and presented a paper titled *Biotech Cotton in International Trade* at an open technical session.

The Committee on Cotton Production Research of the ICAC organised a Technical Seminar on Biosafety Regulations, Implementation and Consumer Acceptance.

"It is estimated that more than half of world cotton area was planted to biotech varieties in 2008/09," Mr Pyke explained.

"No new trait has been commercialised since the adoption of herbicide tolerant and insect resistant cotton almost 15 years ago.

"However, the benefits of these existing traits are spreading to more countries and growers. Among the key issues they raised was the need for consistent biosafety regulations to be in place to introduce, test and commercialise biotech cotton crops.

"These plenary meetings are important annual events for maintaining communication among the world's cotton producing and consuming nations."

One of the highlights of the event was the inaugural awarding of the ICAC Cotton Researcher of the Year to Dr Keshav Kranthi of India. He has carried out considerable development of molecular test kits, for example for identifying insecticide resistant insects and to determine whether or not cottonseed contains Bt genes.

In addition to Mr Ottesen and Mr Pyke the Australian delegation included Queensland Cotton CEO Richard Haire, Cotton Australia CEO Adam Kay, CRDC Chair Mike Logan and Ralph Schulze, a member of the ICAC task force for Commercial Standardization of Instrument Testing of Cotton – CTSIC.

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General Manager



Australian Government
Cotton Research and
Development Corporation



- ▲ Cotton Industry
- ▲ General Manager - Best Practice & Research Implementation
- ▲ Excellent Package - Narrabri N.W. NSW

The Cotton Industry is looking to fill the role of General Manager to lead Best Practice & Research Implementation within the industry. This is a new key industry position based in Narrabri, NSW. Collaboratively supported by Cotton Research and Development Corporation, Cotton Australia and the Cotton Catchment Communities CRC Ltd. This position will be responsible for promoting the uptake of research and best practices for the Australian cotton industry and to enable the industry to measure practice change, rates of adoption and performance.

The successful candidate will have a track record of proven leadership and management skills plus a tertiary qualification in Business / Marketing / Science / Agriculture would be desirable. In addition the successful candidate will ideally have experience in the agricultural industry at senior levels and have held roles that required leadership and direction setting with a group of talented people. They will enjoy the challenges of interfacing with a variety of stakeholders and will have networks at senior levels of government and industry. Knowledge of the cotton industry and the management of intellectual property will be an added benefit.

This is an outstanding opportunity to make your mark in the cotton industry at a senior level. An excellent package will be negotiated with the successful candidate. If you enjoy the challenge of leading change within an industry and importantly your own career, then we would like to talk to you.

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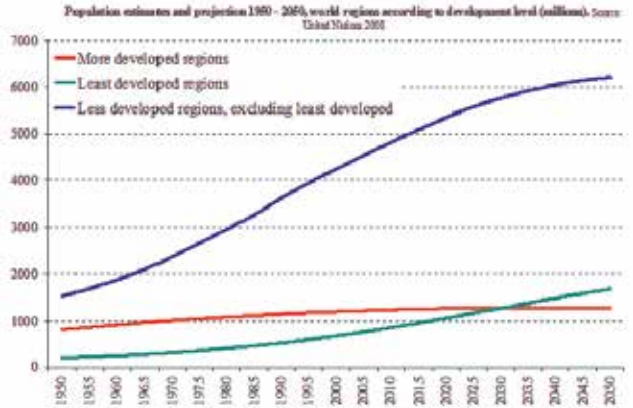
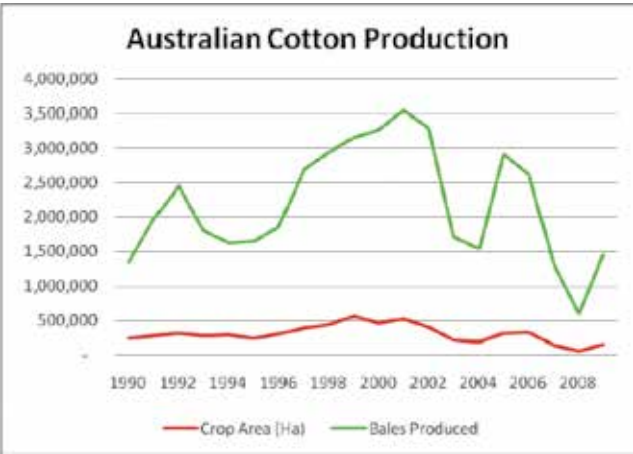
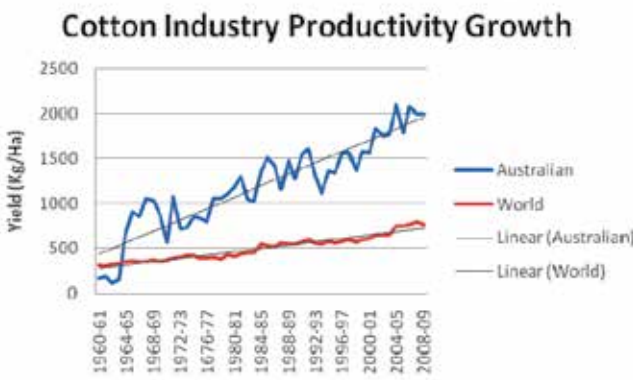


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Panel debate: considering how rural R&D needs to respond to the challenges of global food security, climate change and slowing agricultural productivity.



Meeting future rural R&D challenges



What role will Rural R&D play in meeting key national and global challenges into the future?

The Rural R&D Corporations recently hosted a panel debate at the National Press Club involving some of Australia’s leading thinkers, scientists and rural policy experts considering how rural R&D needs to respond to the challenges of global food security, climate change and slowing agricultural productivity. The panel members (pictured above) included Reverend Tim Costello AO, CEO of World Vision Australia, Professor Penny Sackett, Chief Scientist for Australia; Dr Brian Fisher, economist and former chief of ABARE, Enzo Allara, Chair of the Council of Rural R&D Corporations and Ms Barb Madden, RIRDC Queensland Rural Woman of the Year.

The event was opened by the Hon. Tony Burke MP, Minister for Agriculture, Fisheries & Forestry. The Minister’s address clearly indicated the connectedness of the issues as well as the scale and scope of the challenges ahead for Australia and the world.

The outcome of the panel discussion was the emergence of three key themes that inform the future direction for rural R&D.

Merging of climate change and food security challenges

Climate is the single biggest known threat to agricultural productivity over the next 20 years. At the same time world population

growth and demand for higher quality food is posing significant challenges for global food security.

Productivity

Increased farm productivity is an urgent priority to assist Australian farmers adapt to climate change but equally because Australia and other nations have a profound moral obligation to feed the world’s poor.

Trade

Beyond productivity increases the world will need to remove blockages to the free flow of agricultural trade that deepen the plight of the world’s poor. Further Australia will need to understand how climate change will fundamentally change global trade flows overtime and be in a position to respond.

A number of Cotton Australia and Cotton R&D Corporation representatives attended the function and considered how the cotton industry and its R&D could contribute. According to Mr Mike Logan, Chair of CRDC, “rural R&D has a proven track record in supporting world leading productivity growth, however the significance of the challenges of food security and climate change requires a quantum shift in productivity gains and new thinking as to how the cotton industry and its R&D can play. As an industry we have already begun to think at this level. We are well into the process for developing a vision for the future to meet these challenges”.

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"An Environment of Change"



Australian Government
**Cotton Research and
Development Corporation**

Annual Industry Report 2008–2009

The Minister for Agriculture, Fisheries and Forestry, Tony Burke, tabled the CRDC Annual Report for 2008–09 in the Australian Parliament on November 12.

In this 'Report to Industry — An Environment of Change', we have distilled the R&D information from that comprehensive public document to a 16-page snapshot view of R&D investment by CRDC 2008-09 in the Summer Spotlight magazine.

This report is not seeking to replace the comprehensive Annual Report 2008-09. That publication remains available as a 156 page printed book that is available upon request to CRDC.

As a further innovation, the 2008-09 CRDC Annual Report is also on the website in an all-new e-publication format. This version can be viewed one page at a time and you will find it easily read on screen, it is searchable to find what you want, or you can personally print it in whole, or in parts. Go to www.crdc.com.au to find this new accessible e-publication format.



"An Environment of Change"



CRDC Chair Mike Logan and Executive Director Bruce Finney.

WANT TO KNOW MORE?

The full CRDC Annual Report 2008–09 can be found at www.crdc.com.au. Contact the following people for further information about what you read in this report:

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FROM THE CHAIR AND EXECUTIVE DIRECTOR

Challenging Times

The 2008–2009 year was the first directed by the CRDC Strategic R&D Plan 2008–2013. As the industry is only too aware, the five years of R&D investment under the previous R&D Plan were conducted entirely under the influence of the longest and increasingly severe, drought on record. However it is now clear that these harsh conditions brought their own opportunities to institute R&D-driven adaptations and improvements that will forge a future for the industry, based on a new sustainable competitive advantage which is distinctly different but perhaps equally bright.

Under the new Strategic Plan, a three-part R&D strategy addresses future cotton farming systems and a responsive value-chain beyond the farm gate that delivers greater value to industry participants and an industry that has the human capacity to apply and adopt the technologies and knowledge in which it invests.

During the 2003–08 plan, cotton farming systems became significantly more complex because of the need to respond to new operating conditions such as climate change, water availability and the boom in soft commodities (other crops). While total production waned, the industry achieved remarkable productivity growth with yield gains of 25 percent. Farms are now typically more energy efficient, using finely tuned management and agronomic decisions that derive increasingly greater efficiency of water use under irrigation or dryland systems. Best practice across a farm is now more likely to include varying row spaces, annual irrigation practices and crop agronomy throughout the season in response to changing water allocations, seasonal rainfall and the market prices for cotton relative to other crops on the farm. Best practice also commenced an evolution to extend beyond environmental performance to assure the high quality of Australian cotton throughout the industry supply chain.

Lower production but inching up

Historically low cotton production also meant a large reduction in funds CRDC had to invest in R&D over the past several years, inhibiting the capacity to meet the growing R&D needs. Despite this, CRDC's prudent management ensured core R&D capacity was retained, while at the same time the Corporation met the financial challenges by improving the efficiency and effectiveness of its operations.

The 2008–09 season saw the first signs of a recovery in the area planted to cotton. The accumulated impact of persistent drought across the regions where Australia's cotton is grown resulted in the 2007–08 crop being the smallest in over 30 years. Improved rainfall during the 2008–09 season saw the planted area bounce back to 160,000 hectares. This recovery in area planted, together with continued improvements in productivity, served to highlight the great resilience and adaptive capacity that underpins the Australian industry as it prepares for the new challenges of climate change.

Value Chain

CRDC investment in value-chain R&D during 2008–09 was principally for the outcome of better intelligence on cotton-mill and market needs. New conversations leading to a shared and greater understanding throughout the industry of its value-chain are vital early steps in facilitating the application of R&D innovations in creating greater value to stakeholders. The opportunity to conduct R&D with international spinning mills and brand owners in demonstrating the value of the Australian cotton industry world's best production practices, its unique fibre qualities and R&D technologies is now widely recognised.

Farming Systems

R&D investments in 2008–09 within farming systems have successfully targeted the need for continuous improvement in productivity growth, environmental performance and biosecurity. A background of global financial crisis, water scarcity, climate change and increasing concerns for food and fibre security has placed rising importance on the outcomes of R&D in meeting industry, community and national challenges. Collaboration has grown in recognition of these linkages and benefits in developing integrated R&D responses.

Human Capacity aiding adoption

CRDC's attention has also turned to how R&D outputs of new technologies, practices and knowledge could be better delivered, and through which channels, as key considerations in maximising the effectiveness of future R&D investments.

In 2008–09 a stronger emphasis was placed on the development of human capacity to better facilitate R&D adoption. Improving education, professional development and training raises the skills necessary to achieve this.

CRDC invested in industry participation in skills-related processes, particularly by young people, women and cotton communities. Skills development is an important element of a strategy that seeks to result in attraction, retention and development of the best and brightest for our agricultural sector and, in particular, cotton production.

Outcomes

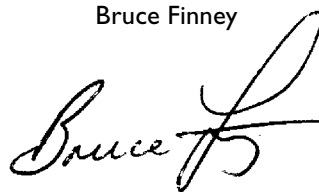
The results of this first year of the plan have been both concrete and promising, from the exciting development of new technologies, practices and knowledge gained, to capacity built through new alliances and more skilled people. Throughout, the partnership in R&D between the Australian cotton industry and Australian government has underpinned the capacity of the cotton industry and its communities to adapt to the ongoing environment of change with optimism.

Mike Logan



Chair

Bruce Finney



Executive Director

CRDC Directors took the opportunity of a recent Board meeting in Goondiwindi to visit the Corish property 'Mundine' to look at the irrigation storage and discuss related farming issues such as managing limited water. Board meetings are regularly held throughout cotton growing regions, as well as at major research institutions, so Directors can learn about local issues, especially as they relate to CRDC's R&D program. Left to right: Mike Logan, Leith Bouilly, Juanita Hamparsum, Peter Hayes, Mary Corbett, Kerry Aaby and Bruce Finney.



The Year's Highlights

A new strategic plan in action

In 2008–09, CRDC staff and Directors had the responsibility and privilege of implementing the Strategic R&D Plan 2008–2013. This Plan broadly considers the challenges and opportunities for the industry's future. The new plan was developed under a comprehensive consultative process involving participants representing producers and industry supply chain, together with industry advice and government and industry R&D priorities. In addition, advice from the Minister and the Australian Government Department of Agriculture, Fisheries and Forestry provided clear insight of the public need.

A change in industry stakeholder

A merger during the year between the CRDC's gazetted industry stakeholder, Australian Cotton Growers Research Association (ACGRA) and the industry representative body Cotton Australia, saw the 'new' Cotton Australia formally take over all CRDC industry stakeholder roles. While ACGRA had reviewed all 2008–09 R&D proposals on behalf of the industry earlier in 2008, in early 2009 Cotton Australia reviewed planned activities for the 2009–10 year.

A new Board appointed

The reporting year saw the appointment by the Minister for Agriculture, Fisheries and Forestry, Tony Burke, of a new CRDC Board in October 2008. Leith Bouilly was appointed Vice Chair with Mike Logan continuing his role as Chair.

The new directors brought a wide range of skills and experience that enable the Corporation to implement the Strategic R&D Plan 2008–2013 effectively and meet the industry's future directions and challenges as they arise. New Board members were Kerry Adby, Mary Corbett, Juanita Hamparsum and Peter Hayes.

Dick Browne, David Conners and Dr TJ Higgins retired as Directors in September 2008. The Board, staff and management thank them for their immense contribution to our R&D program.

CRDC's Executive Director, Bruce Finney, with administrative staff, Dianne Purcell, Margaret Wheeler and Lee-Anne Melbourne. Chloe Pokarier (front) is gaining paid work experience at CRDC as part of a school-based traineeship program developed by CRDC with the Aboriginal Employment Strategy and the Cotton CRC



A new program manager

Tracey Farrell began work at CRDC in December 2008 as Manager for Farming Systems Investment. Tracey, a 2008 Australian Cotton Industry Awards Finalist, brings a wealth of experience to the role, having worked with the Office of the Gene Technology Regulator. Most recently, she was a District Agronomist for the NSW Department of Primary Industries (now Industry & Investment NSW) for five years, providing advice and support to cotton growers and the local industry.



CRDC's new Farming Systems Investment Manager, Tracey Farrell.

Contemporary market intelligence

New industry supply chain partnerships were developed with CRDC's support in 2008–09. The participants collectively explored and built new market knowledge of the opportunities to add value to the Australian cotton industry with premium products and new market segments into the future. Bringing together Australian cotton growers, agribusiness, researchers, international spinners and brand owners to explore product and market innovation continues to be a significant capacity building initiative.



Cotton and grains: a review of collaboration opportunities

Recognising that cotton is almost always grown as part of an integrated farming system involving grains, CRDC and Grains R&D Corporation (GRDC) formally investigated collaboration opportunities.

The two organisations completed a preliminary investigation of the opportunities for greater collaboration in R&D, focusing on opportunities for improved R&D outcomes, considering options ranging from enhancing current research interactions to the formal merger of the entities. The investigation concluded that for grains and cotton there are significant areas of commonality where R&D collaboration would reap benefits but, equally, there are crop and industry-specific research needs, particularly relating to the supply (value) chain, where it would not. The Australian cotton industry, represented by Cotton Australia, did not support the option of a full merger of CRDC and GRDC on the basis that it may undermine the focus, responsiveness and effectiveness of cotton grower investment in R&D. Separately, the investigation did not identify a cost-benefit from structural changes such as establishing a new entity, or the partial and full merger options. CRDC and GRDC are addressing the opportunities identified for improvement to existing collaboration through better alignment of planning and investment processes at a management level in farming systems research.

The CRDC R&D investment and GRDC Practices Program management teams met to consider opportunities for a broad range of collaborations. These included progress with current and planned joint or collaborative investments, for example existing collaborations including the National Program for Sustainable Irrigation, Farm Health and Safety, CCRSPI, greenhouse gas emissions, monitoring Helicoverpa resistance, management of glyphosate resistance in cotton/grain systems and participation in the glyphosate sustainability working group, as well as two new projects to be contracted for commencement in the 2009–10 financial year on reducing spray drift, and potassium and phosphorus nutrition R&D.

Opportunities were also identified for new collaborative programs or projects and extending programs beyond those that are only focused on cotton or grains at present. Some of the key areas where opportunities exist for greater collaboration include Central and North Queensland grain/cotton/sugar farming systems, the National Invertebrate Pest Initiative (NIPI), national integrated weed management initiative, best management practices packages, sabbaticals for senior researchers, extension programs and sharing methodology on program evaluation and impact analysis. More than 30 issues were identified for development in 2009–10.

Broader collaboration to maximise outcomes

CRDC continued to seek to build collaborative links and partnerships where these are likely to maximise investment outcomes or where there is a need to respond to a broader issue or challenge facing agriculture or the cropping sector.

Collaboration with other Rural R&D Corporations (RDCs) at both strategic and conceptual levels is an important means for CRDC to leverage higher returns from grower and government investments in our R&D program. CRDC participates in activities including joint national strategic R&D planning with the Primary Industries Standing Committee (PISC), communication and impact evaluation.

A great deal of collaboration and cooperation takes place through the Council of Rural Research & Development Corporations' Chairs, which is a forum for supporting the RDCs to collectively maximise their ongoing contribution to

a sustainable and profitable Australian agricultural sector. This collaboration extends well beyond co-investment - cooperation, coordination and communication are equally important to avoiding duplication in research and maximising the impact of research outcomes.

The scale of this collaboration extends from large national research programs to small local projects and administration. This brings a national focus in dealing with climate change, soil health, irrigation, crop protection, farm safety and human capacity. CRDC has participated in joint activities that include national strategic R&D planning with the PISC, impact evaluation and communication.

As in the previous year, CRDC's largest financial collaborative investment in collaboration in 2008–09 was through the Cotton Catchment Communities CRC. CRDC invested \$4 million in the CRC, with all but \$100,000 of that tied to specific projects which were required to directly address both CRDC's and the CRC's strategic objectives through this collaborative research framework.

At the local level, community collaboration in 2008–09 included continuation of an Aboriginal school-based traineeship program, developed by CRDC with assistance from the Aboriginal Employment Strategy. CRDC collaborated with external organisations such as Rotary in supporting a range of science-related activities for primary and secondary school students.

Additionally, CRDC was involved with all RDCs in an investigation of the opportunities to harmonise the efficiency and effectiveness of administration resources and practices between RDCs and, in general, within public sector research, development and extension. CRDC actively supports the ongoing development of approaches to issues such as improving administration, standardising contracts, intellectual property management, program management and information systems.

Major new role for CRDC in irrigation R&D

With the closure of Land and Water Australia announced, CRDC successfully sought to take on the Managing Agent role for the National Program for Sustainable Irrigation and will begin this role in 2009–10. CRDC believes a long-term plan and commitment to irrigation R&D that services the broad needs of agriculture is of national significance and looks forward to this role.



Industry leadership – looking to the future

The Australian cotton industry has always been well served by its leadership, however CRDC identified a particular need to support younger industry participants – tomorrow's leaders – in enhancing their skills that will take the industry forward. Based on the success of the inaugural Australian Future Cotton Leaders Program in 2007–08, CRDC has made an ongoing commitment to leadership development through this proven approach. A further 10 people began the course in May 2009 and will complete it in the coming year.

Half of the competitively selected participants in the Future Leaders Program are women, reflecting the growing leadership role taken by women in the cotton industry and wider agricultural sector. In 2008–09, CRDC also sponsored a female cotton grower to participate in the Australian Rural Leadership Program, four women to attend the CSIRO Field to Fabric course and continue sponsorship of a female student in the Cotton Catchment Communities CRC Cotton Production Course at The University of New England.



World's best R&D for the Australian cotton industry

Who we are and what we do

As one of 16 Rural R&D Corporations, CRDC is based in Narrabri, NSW – the heart of one of Australia's major cotton growing regions and home to the Australian Cotton Research Institute. The Corporation is a research and development partnership between the Australian cotton industry and the Australian government.

CRDC invests in and manages a portfolio of R&D projects funded principally through producer levies that are matched by government contributions. In managing these investments, the Corporation takes a broad view in seeking to enhance the environmental, social and economic values associated with cotton production systems and also increase benefit to cotton industry participants, regional communities and the Australian people.

CRDC is keen to see the outputs of its investments adopted on farm and throughout the industry's value chain post-farm-gate that links cotton products on-farm to consumers.

To ensure adoption of knowledge and technologies based on its R&D investments, CRDC works across industry to coordinate development of knowledge beyond the original research. Many researchers are also actively involved in the dissemination of research results and directly assisting innovation that is applied in all facets of the industry. This process is directly supported by experienced and capable industry extension personnel working in regions and across industry within their fields of special knowledge.

This results in technical and non-technical documents, field guides and is testing a range of new online information tools such as myBMP, industry websites and e-Newsletters. e-Learning for improved access to professional development opportunities is another innovation that was spearheaded in 2008-09 by CRDC to support technology adoption. Workshops, seminars and field days continue to provide valuable forums to have leading technology transferred to industry and for industry to apply this and all the other channels of information with their practical experience to create a culture of innovation that is a hallmark of the Australian cotton industry.



Our Vision

A globally competitive and responsible cotton industry

Our Mission

The quest for sustainable competitive advantage

Our Purpose

Enhancing the performance of the Australian cotton industry and community by investing in research and development, and its application.

Our Outcome

A more sustainable, profitable and competitive cotton industry providing increased environmental, economic and social benefits to regional communities and the nation.

Our main research partners

- Cotton growers
- The Cotton Catchment Communities Cooperative Research Centre
- Rural Research and Development Corporations
- CSIRO
- Universities
- Cooperative Research Centres (CRCs)
- Industry and Investment NSW
- Queensland Department of Primary Industries and Fisheries
- Other State Government Departments
- The Crop Consultants Association
- Agribusinesses

Changing of the guard

Since the establishment of CRDC in 1990, the Australian Cotton Growers' Research Association (ACGRA) has been our formal industry representative body. ACGRA has provided advice on research issues after canvassing the views of its grower representative organisations on the relevance to their needs of research funding submissions received by CRDC each year, reviewed the progress of research projects and taken part in the formulation of our five-year strategic plans.

Following the merger of Cotton Australia and ACGRA late last year, Cotton Australia took over this role. Cotton Australia research advisory panels reflect the R&D programs established under the CRDC Strategic Plan 2008–2013 – Value Chain, Farming Systems and Human Capacity – and address each of the CRDC Strategic Research Priorities under those programs.

Members' nominated representatives are asked to nominate specific areas of research interest and are then allocated to the appropriate advisory panel. These panels consider relevant research applications in detail and report their views to the organisation as a whole at the annual research review meeting. These views are conveyed to CRDC, who also attend the annual meeting.

In addition to its role as CRDC's industry representative body, Cotton Australia is now formally responsible for liaising on research issues generally for the cotton industry and has taken over all functions formerly performed by ACGRA, including advising the Cotton Catchment Communities CRC.

The Transgenic and Insect Management Strategy Committee (TIMS) is a sub-committee of Cotton Australia and is responsible for developing, in close consultation with the relevant scientific experts and technology providers, the resistance management strategies for conventional insecticides, herbicides and transgenic cotton.

Cotton Australia also convenes the Industry Biosecurity Group, which oversees implementation of the Cotton Industry

Cotton Australia Directors, Andrew Parkes and Cleave Rogan, Joanne Grainger (Chair, Cotton Australia) and Ben Stephens (Chair, ACGRA) at the Extraordinary General Meeting that formalised the merger of ACGRA and Cotton Australia in 2008

Biosecurity Plan and addresses key exotic pest threats and mitigation and contingency plans in the event of an emergency, as well as NORCOM (industry development in Northern Australia), an industry-based stewardship committee.

Cotton Australia will take over ACGRA's role for the 15th Australian Cotton Conference, to be held in 2010. The 2008 conference was, for the first time, held jointly with the Australian Cotton Shippers Association (ACSA) to formalise the R&D focus on the entire production chain that had been a feature of recent conferences. This partnership will continue between Cotton Australia and ACSA.

Value Chain

R&D activities

Investments to achieve this program's strategic objective produced some very promising results in 2008–09. Even more promising for the future, this work represented an involvement by the industry's entire production chain and a joint commitment to collaborative future action.

Previous investments in farm productivity and BMP have resulted in large efficiency, environmental and production gains at the farm level. As a result, Australian growers enjoy a reputation as world leaders in the sustainable production of some of the highest quality upland cotton available. Worldwide, the quality of upland cotton is ever increasing, particularly in countries such as the US, India and Brazil, and, as a result, Australia must develop strategies to maintain and improve its competitive advantage.

CRDC's Strategic R&D Plan provides for greater investment in post-farmgate research, including development of 'demand pull' strategies for Australian cotton fibre in order to generate greater value within our industry. One key focus under the new strategic plan is to understand how best to develop and promote new premium cotton types. The industry is seeking to develop collaborative links with domestic and international processors and brand owners to help secure, improve and share the premiums gained for Australian cotton.

'We're Aussie, Wear Aussie'

CRDC convened the 'We're Aussie, Wear Aussie' forum in May 2009. This Sydney meeting attracted an interactive audience of people representing many facets of the cotton industry supply chain.

The purpose of the meeting was to challenge a number of assumptions the industry has made over potential market leverage points for Australian fibre, and to apply this learning to chart a course for the future.

The forum posed a number of questions and challenges for the industry, including the need to identify clearly 'the problem that needs solving'; who the industry is targeting, as well as to describe the need for the industry to generate an agreed market focus.

The meeting found that much is still needed to adapt to meet spinners and consumers needs. A clear message about Australian cotton fibre quality and the high standards of our production values were also essential, the meeting found.

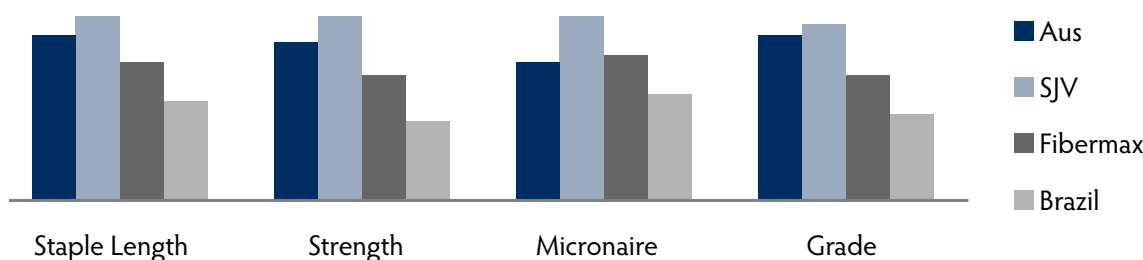
What do the mills need?

In 2008–09, CRDC worked in collaboration with the Australian Cotton Shippers Association (ACSA) to monitor spinning mills' quality requirements. Surveys were conducted in Korea and Japan (the results from Japan are still to be collated). The Korean survey revealed some interesting findings. The mills' perceptions of quality parameters for Australian cotton when compared with our key competing growths indicated that they believe SJV cotton remains a superior fibre. However, for parameters such as contamination, trash, and neps, Australian cotton has an equal or better reputation. For short fibre content, SJV is still seen as significantly better than Australian cotton, showing that this is an important area to consider for future R&D investment.

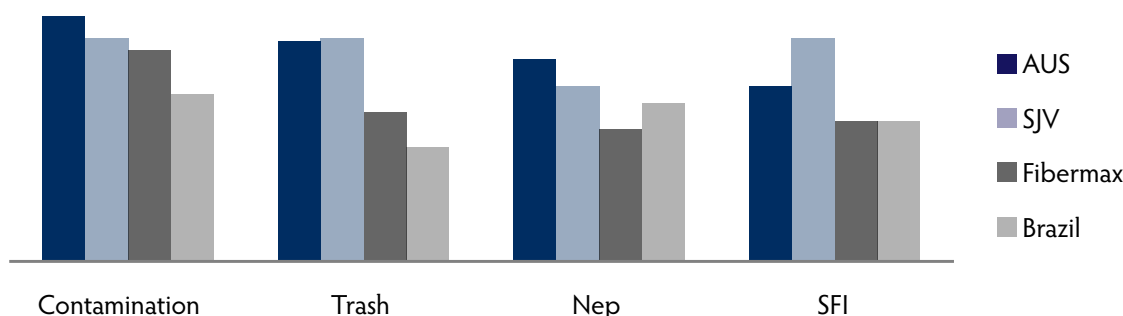
As a result of the survey of Korean spinning mills, a supply chain map has been developed for two major mills. This shows their supply links to four clothing manufacturers. In turn, these supply over 30 well-known brand names in the US and Australia. Similar supply chain maps are to be developed for other countries to which Australia supplies cotton.

Both CRDC and ACSA are working for future trials with our new premium cotton types. The aim is to establish links with

Average mill perceptions of key Contracted quality specifications



Average mill perceptions of key Non-Contracted quality specifications



VALUE
CHAIN

PROGRAM GOAL

Add value to the Australian cotton industry with premium products in improved routes to market

OUTPUTS/ MEASURES OF SUCCESS

- Markets, risks and opportunities for Australian cotton products are clearly defined and understood within the industry
- New partnerships between industry, researchers and end-users
- Post farm-gate best management practices are developed and adopted
- New and improved products, processes and measurements.
- Assessments of the competitive advantage of the Australian cotton industry

OUTCOME

High quality consumer-preferred Australian cotton products in the world marketplace

another three or four major premium production mills across China, Thailand, Japan and Indonesia.

The improved market knowledge developed by CRDC, ACSA and Cotton Australia during 2008–09 has also begun to highlight to industry where adoption would be promoted on the outcomes of fibre processing and fibre testing R&D.

14th Australian Cotton Conference

CRDC invested as a Foundation Sponsor of the 14th Australian Cotton Conference, New Beginnings – Cotton in a Climate of Change in August 2008.

For the first time, the Conference combined with the Australian Cotton Spinners' Association (ACSA) and this formalised and enhanced the R&D focus on the entire production chain as a theme. Despite the industry having just experienced its lowest production year in many decades, this was a well-attended conference and it reinforced the industry's awareness of the importance of producing high quality fibre that meets spinning mill needs.

A paper presented at the conference by CSIRO's Geoff Naylor, Stuart Gordon, Robert Long and Rene van der Sluijs highlighted the results of CRDC investments in value chain R&D, which is developing new understanding of the spinning capabilities and market potential for new high quality CSIRO varieties likely to be grown in Australia within the next five years.

Premium cotton Initiative

CRDC is a key driver of the industry's Premium Cotton Initiative, which is developing partnerships across the cotton value chain to secure higher value markets for Australia premium cotton varieties. It was born of the success of the CSIRO breeding program in developing a number of new varieties that offer superior fibre quality attributes. This initiative brings together these varieties with new textile processing knowledge and fibre measurement tools developed with CRDC investment.



Sicala 350B cotton is fed into the mill in India for its first commercial trials

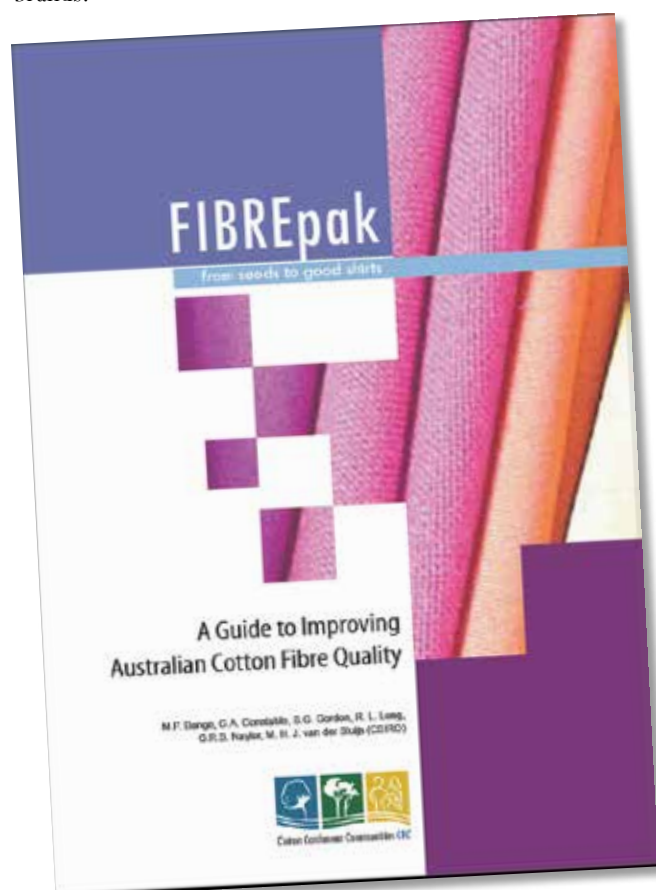
PREMIUM COTTON INITIATIVE

CSIRO Plant Industry's Sicala 350B variety commercialised by Cotton Seed Distributors has outperformed all expectations at recent commercial milling trials in India, giving weight to the need for further research into growing Australia's first commercial Long Staple Upland variety.

A key aim of the Premium Cotton Initiative has been to link industry textile experts with international mills, to assess the use of cotton varieties with improved fibre quality and determine whether they provide the opportunity for mills to produce high quality yarns and fabrics. CSIRO Materials Science and Engineering researcher, René van der Sluijs, travelled to Northern India in March to work with Vardhman Textile Limited: one of the largest textile groups in India, with numerous processing mills in different parts of the country. Vardhman produce a large range of staple fibres, with cotton accounting for 85 per cent of their production in either 100 per cent cotton, or blended cotton.

The collaborative program demonstrates that Australian growers may at some time in the future have the opportunity to develop a niche market for such new premium varieties for which there is a 10 to 15 per cent premium operating in the market.

CRDC is also working with a number of industry organisations, including ACSA, Cotton Australia, CSIRO and Cotton Seed Distributors Limited, to assess the opportunities that exist for establishing new premium cotton product development and marketing initiatives. The collaboration is exploring the business case for developing specific premium brands for Australian cotton. The role for CRDC is to provide technical support and investment for the development of new products, technologies and practices that are required to support such brands.



CRDC, in partnership with the Cotton Catchment Communities CRC, has invested in a project that assessed agronomic factors that affect fibre quality and links fibre to yarn and fabric quality. The research involved a mixture of basic fibre development research with applied practice change research. In 2008–09, outcomes of this research were collated into the new decision support package for cotton growers, FIBREpak.

Value-adding with new products

R&D for the development of novel products has focused on three key areas: biotechnology for fibre development, biotechnology for cottonseed improvement and cotton spinning technologies and practices.

CRDC has invested in a project at the University of Adelaide which identified a gene that provides potential improvements in fibre elongation: an important fibre property that allows for production of higher quality yarns.

CRDC investments in CSIRO research into healthier cottonseed oil has centred on the potential for commercial development of cottonseed oil with high oleic content derived from genetically modified cotton plants. Following approval by the Office of the Gene Technology Regulator (OTGR), seed increase trials were conducted in 2009, with 1.5 tones of the GM cottonseed produced. This seed is expected to be used in cottonseed oil trials

At the gin

A major problem in maintaining moisture during ginning has been a lack of accurate measurement of moisture before and after the cotton undergoes ginning. In a joint investment with CRDC in a Cotton Catchment Communities CRC project, CSIRO researchers have developed a new moisture sensor. A provisional patent has been lodged for the technology and preliminary discussions 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 project investigating changes to the lint cleaner. A change in the method of flow of cotton from the gin stand may enable more effective techniques to be developed for adding moisture to cotton prior to cleaning. The new sensor is expected to play a key role in automating any new moisture management system developed for gins.

Tackling neps

Data collected by CSIRO through a CRDC investment has found higher nep levels than expected: a problem that will need to be addressed if the industry wishes to develop higher premiums in the future. Data developed from the survey of some 1000 cotton samples has been analysed using different ginning techniques and, where possible, traced back to individual farms and growing regions. This data will provide better guidance on the key factors leading to the development of neps and short fibre content and, in turn, provide an indication of where best to target future research.

Links have been established with the Hong Kong Polytechnic University to investigate opportunities for developing new spinning technology. The university had developed and commercialised technology for developing low twist yarns and CRDC is interested in working with them to assess how such technology can best be used with Australian premium cottons, either alone or in combination with other fibres.

Measuring fineness and maturity

The majority of international mills that produce premium fabric and garments pay particular attention to the quality of cotton they purchase to ensure it meets their needs for a particular product they are producing, so uniform, reliable measurement of important quality characteristics is important. Currently

available commercial instruments cannot directly measure these two important fibre properties.

CRDC has invested over the past several years in the development of two new instruments: SiroMat, which measures maturity, and Cottonscan, which measures fibre fineness.

SiroMat is due for commercial release in 2011 to both domestic and international cotton classing rooms and mills. The technology may also prove to be a useful research tool in understanding the impact of fibre maturity on cotton processing. Both dye uptake and neps generation have been shown to correlate to fibre maturity and these two aspects should provide evidence of the value of the new measurement to mills and dyeing houses.

Cottonscan measurements have been shown to offer a significant improvement over traditional High Volume Instrument (HVI) measurement. The CSIRO Cottonscan developers have now reduced the time required for sample preparation and testing with Cottonscan to approximately one minute, which is a much more acceptable sampling time for use with HVI equipment. These faster instruments have been tested with Australian commercial collaborators, as well as the United States Department of Agriculture and another research institution in the USA.

BMP through the value chain

The development of BMPs for various sections of the value chain is critical to securing the value of cotton and obtaining premiums. In collaboration with the respective industry groups, classing BMPs have been further developed and BMPs for ginning have been initiated. An audit of compliance with the classing BMPs has allowed the development of procedures for assessing fibre properties and a comparative assessment of standard cotton samples.

After completion of two separate audits by CSIRO, it is evident that the Australian classing sector offers a standard equivalent to, or better than, similar testing services used internationally. An additional benefit of the audit process is that it has identified inconsistencies that exist between classing rooms, thereby assisting the industry to improve its performance. An initial audit of compliance with ginning BMPs has been completed and the results will be used to further develop the BMPs and supporting R&D. Completion of an initial draft of BMPs for transport and storage is expected in early 2010.



**VALUE
CHAIN**



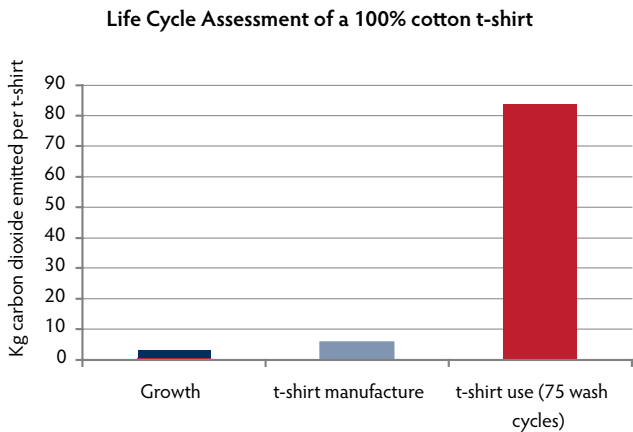
CSIRO Materials Science and Engineering Project Leader in cotton Research, Dr Stuart Gordon, and Hy Hwang of BSE Electronics at the launch of SiroMat at the Australian Cotton Conference in August 2008

Farming systems

R&D activities

Establishing cotton’s environmental footprint

In a study commissioned by CRDC, together with investment support from the Australian Government Department of Climate Change, the Institute for Sustainable Resources and Queensland University of Technology, completed a draft Life Cycle Assessment (LCA) that evaluated the environmental impacts of a 100 per cent cotton t-shirt throughout its life cycle.



The carbon footprint of a cotton t-shirt illustrated in this graph shows the dominance of the 'use' component, which indicates that major gains in reducing greenhouse gases could be made by researching how Australians could become more environmentally friendly in the washing, drying and ironing of the clothing. (Data source for graph: Professor Peter Grace, Queensland University of Technology)

Agriculture and an ETS

In 2008–09, CRDC, Australian Wool Innovation and Dairy Australia commissioned the Australian Farm Institute to conduct a study on the potential economic impacts of an Emissions Trading Scheme (ETS) on agricultural industries in Australia. A range of models were used to estimate the change in output that might result from an ETS for a range of industries compared to their continuing with 'business as usual'.

The results indicate that the potential impact on the cotton industry could be relatively low, but still significant compared with business as usual, even if agriculture remained an uncovered sector. Nevertheless, it is important for agricultural industries to attempt to understand the challenges posed by climate change and how they can contribute to reducing national greenhouse gas emissions without reducing their competitive advantage or productive capacity.

Energy use in ginning

A postgraduate project with the University of Southern Queensland reviewing energy consumption in cotton ginning systems, commenced in 2008–09. Six cotton gins actively participated enabling the initial development of national benchmarks. From this limited study, an initial estimate of greenhouse gas emissions associated with the cotton ginning process was calculated at 57 kilograms of carbon dioxide per bale. The study shows that with improved measurement and benchmarking, there is potential for cotton gins to improve their energy use efficiency.

Ecosystem services

Data was collected during the course of a PhD study on the provision of four ecosystem services (carbon sequestration, biodiversity conservation, erosion mitigation and forage production) by five vegetation types (river red gum, coolibah, myall, native/derived grasslands and mixed tree and shrub plantings) in different condition states and under different management at some 85 sites. These were conducted on cotton farms and travelling stock routes between Boggabri and Walgett on the lower Namoi floodplain. The photographic series from this project is expected to prove a powerful tool for illustrating the effect of different management on vegetation.

Summer 2007



Summer 2008



These photographs were taken in exactly the same spot on the lower Namoi floodplain twelve months apart and show the recovery of vegetation despite the drought

Facilitating best practice natural resource management

The productivity benefits that flow from commitments to best practice natural resource management on-farm are being extended successfully to cotton growers. Cotton industry extension has facilitated the development of 83 property plans, covering 120,000 hectares of farming land in the Namoi Valley.

Other outcomes include a strong collaborative relationship between the industry and the Namoi CMA to achieve joint natural resource management targets within the catchment. This involves a range of agricultural industries, including irrigated cotton and grains. There is also heightened community awareness of the beneficial relationship between the Cotton BMP program and the Namoi CMA catchment and management targets through extension visits, collaborative workshops and extension involvement in grower groups.

GOAL

Cotton in a highly productive farming system with improved environmental performance

OUTPUTS

- Climate and natural resource management risks and opportunities for Australian cotton producers are defined and understood
- Climate and natural resource policy implications are interpreted
- Collaborations and partnerships within and between rural industries delivering innovation, capacity and knowledge for farming systems
- Benchmarking, assessing and reporting on productivity and environmental performance of cotton farming systems
- An industry capable of managing its biosecurity responsibilities

OUTCOME

A more resilient, profitable and competitive cotton farming system



A project has assessed interactions between streams in the Maules Creek catchment (part of the Namoi catchment), and the underlying aquifer. The outcomes from this study have implications for understanding the impacts of groundwater abstraction, such as the intermittent stream flow due to enhanced stream-fed aquifer recharge, and for estimating the sustainable extraction of groundwater from the regional aquifer. The project achieved close collaboration with many other irrigation and deep drainage researchers. It has also enabled leverage of other funding sources, including the initiation of five PhD studies.

The concepts and results of the project were presented for local growers at Darren Eather's farm in the Maules Creek catchment at a very well attended meeting with presentations sparking interesting questions and discussions.

Collaborating on climate change

In 2008–09, CRDC continued to invest in and support the National Climate Change Research Strategy for Primary Industries (CCRSPI). CCRSPI has played an important role in identifying cross industry issues in relation to climate change that require further R&D investment. It has coordinated the establishment of successful broad R&D collaborative programs and projects dealing with carbon emission and adaptation to climate change, funded under the Australian Government Department of Agriculture, Fisheries and Forestry's Climate Change Research Program.

In the continuation of a long term cotton–legume cropping systems experiment, a study by the Cotton Nutrition Research Group and the Plants and Soils National Priority Team monitored nitrogen use efficiency (NUE) confirmed that nitrogen fertilisers can be used much more efficiently in the cotton industry.

In the five-year study, NUE has been similar in differing crop rotations averaging about 12 kilograms of lint per kilogram of crop nitrogen uptake. Nitrous oxide emissions were measured at the start of the growing season and indicated substantial emission from the nitrogen-fertilised plots but no detectable emission from the (unfertilised) plots where cotton is grown in rotation with legumes.

In addition, soil organic carbon levels have increased in all of these cropping systems (continuous cotton, cereal and legume rotations) over 10 years at about one tonne of carbon dioxide equivalent per hectare each year, which is consistent with the carbon dioxide emitted from average cotton farming enterprises. It should be possible to grow carbon-neutral cotton where legume rotations are used to reduce nitrous oxide emissions, while assisting in the sequestration of soil organic carbon.

A third season of greenhouse gas data collection was completed in 2008–09, with information now available on the emissions from a relatively high intensity cotton-grains system with reduced fallows. The full season estimate was less than 0.5 per cent: the nitrous oxide emission factor used in the Australian National Greenhouse Gas Inventory. The estimated loss of carbon dioxide from the experimental site is consistent with a farming system that has sequestered carbon, which is not typically found in traditional cotton monoculture cropping.

This project has provided the impetus for the Australian

government to fund a new national program to examine greenhouse gas emissions from agricultural systems. Professor Peter Grace will lead the three-year program, principally funded by the Department of Agriculture, Fisheries and Forestry under its 'Australia's Farming Future' initiative. Within this initiative, a cotton-grains experiment will be undertaken at Kingsthorpe, west of Toowoomba, on a GRDC/CRDC-funded site.

Custom designed static chambers for measuring nitrous oxide and carbon dioxide were installed at the long-term cotton cropping systems experiment at Narrabri, with staff training and initial measurements undertaken during the 2008–09 cotton season. Initial measurements suggest treatment effects of the cropping systems are greater than can be accounted for by the variability among chambers



Dr Ian Rochester, CSIRO, is lead researcher in a study of nitrogen use in cotton production, which has shown that growers can safely reduce nitrogen fertiliser inputs by up to 25 per cent, providing environmental and economic benefits

Scoping on-farm energy use

The National Centre for Engineering in Agriculture (NCEA), University of Southern Queensland, has leveraged an initial investment by CRDC to develop tools and methodologies for assessing on-farm energy use through the Queensland Farmers Federation (QFF).

NCEA has further developed the on-farm energy assessment process, which now includes different levels of assessment, ranging from a general overview of energy consumption to a detailed, site-specific investigation of energy intensive farming operations. NCEA also developed an improved version of the original EnergyCalc software, now available for industry use.

R&D for adaptive and resilient farming systems

A major Farming Systems strategic objective is to enhance the capacity of the industry to adopt resilient and adaptive farming systems. In 2008–09 this was achieved through a focus on water and making the most of limited supplies, nutrition and soils crop rotations and improving production and environmental performance.

Solving complex problems with 'systems thinking'

In December 2008, CRDC convened a workshop to apply systems thinking to how the cotton farming system works and determine whether any key points of intervention or leverage for future investment in R&D and/or other action could be



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Dr Guangnan Chen of the University of Southern Queensland, Craig Baillie, Deputy Director of NCEA, and Keytah manager, Andrew Parkes, worked together to calculate energy usage in the farming systems at Keytah, near Moree. Keytah crop history data was evaluated using the energy assessment software, EnergyCalc, which was developed with the aid of CRDC investment. A 12 per cent energy saving was observed at Keytah as a result of reduced tillage operations. Farm Managers are experimenting with how the farming system can move further towards zero till, with a potential further energy saving of some 12 per cent identified.

The changes in practices have been achieved without adverse effects on the yields. There are opportunities for increasing farm productivity through greater stability in the number of hectares planted annually, even in below average rainfall years.

Back in 2000, the most significant uses of energy in the Keytah farming system were in soil preparation and irrigation. Progressively, through the implementation of minimum tillage practices, energy use for soil preparation has reduced while the amount of energy for irrigation has remained the same over time. Given that irrigation now represents the greatest proportion of energy use on-farm (50 to 62 per cent), future efforts to reduce on farm energy will be focused in this area.

identified or mapped. The workshop provided training on systems thinking and the use of certain tools such as systems maps to enable complex interactions to be visualised and more easily understood.

The workshop identified 25 potential key intervention or leverage points where further development or investment in R&D could lead to considerable improvements in cotton/grains farming systems. Of the intervention points identified, 14 were related to human capacity and/or communication capacity, but only four dealt with more conventional technological science-based solutions to improving farming systems. In future years, CRDC plans to further investigate the role systems thinking can play in analysing and developing responses to the intervention points identified.

Deep drainage – getting the balance right

Deep drainage occurs in cotton farming systems but varies considerably from year to year based on climatic and management decisions. Following a decade of CRDC investments in R&D and extension in this area, cotton growers in general are more aware of deep drainage.. This has resulted in greater understanding on the need to balance water losses from the system and that deep drainage is a natural process of the soil.

CRDC and the Cotton CRC held a whole of industry research forum in 2009 to bring together the outcomes of all deep drainage research from the past 10 years and to consider the key needs for future investment.

One of the highest research priorities identified was the need to improve understanding of the water movement below the root zone. In particular, the movement of water through the regolith (the layer of unconsolidated rocky material covering bedrock) and understanding when deep drainage becomes groundwater recharge.

Water use efficiency on cotton farms

The results of an CRDC-supported program to benchmark water use on cotton farms were reported at the Australian Cotton Conference in August 2008. A total of 37 farms provided data to the project in 2008 and the researchers used a number of industry standard water use indices to enable equitable comparisons of performance.

The results were also compared to a similar program run previously, with encouraging results. Production and water use data from 25 cotton farms and over 200 individual fields over three seasons, 1996–97, 1997–98 and 1998–99 found the industry average Gross Production Water Use Index (GPWUI) at that time to be 0.79 bales of cotton produced per megalitre of water used. The data collected in the new survey shows an improvement of around 40 per cent in GPWUI to 1.13 bales per megalitre.

A project supported by CRDC and GRDC through the National Program for Sustainable Irrigation continued in

2008–09. This project also attracted additional funding from the National Water Initiative to increase the number of farms included in future benchmarking surveys.

Other research also aimed to identify irrigation scheduling practices based on both soil and plant based measurements for optimising the yield response to water in Bollgard II.

This highlighted the need for well planned and well informed decision-making for irrigating Bollgard II cotton. Research has also quantified the impact of seasonal variations in climate on the yield responses that can be expected from a range of irrigation frequencies, chosen based on soil moisture measurement.

Combating weeds

In 2008–09, WEEDpak – the industry’s major weeds resource –focused on developing a comprehensive resource enabling growers to diagnose symptoms of herbicide damage in cotton crops. As well as extensive pictorial identification tool and symptom descriptions, WEEDpak also provides indications of yield loss associated with damage, as influenced by the type of herbicide, the severity of the damage symptoms and the age of the crop at the time the damage was sustained. This resource aims to assist growers to make prudent economic decisions about the management of crops affected by herbicide drift.

Weed species in cotton fields on farms across the industry were surveyed in 2008–09 through a CRDC investment and compared with surveys from past years. Studies are focused on seed characteristics such as dispersal, dormancy and conditions for germination, including testing influence of temperatures, shading, soil moisture, soil type and stubble cover.

Better spray application to minimise drift

A drift management extension strategy for Northern NSW was devised and delivered in 2008–09 by Bill Gordon Consulting. Milestones within this project involved the development of information specific to different spray application scenarios common in cotton farming. The findings were incorporated into content for a series of workshops on spray application management and also presented as independent technical updates at advisor forums such as the Crop Consultants Australia technical updates and grower group meetings.

Efficient fertiliser use

A survey of consultants representing approximately 25 percent of the Australian cotton area indicates that growers are changing their practices relating to fertiliser use. The use of techniques to promote efficient fertiliser use, such as soil testing, splitting applications and adjusting fertiliser applications in response to test information, have all become much more common practice over the past five years. Further evidence for these improvements is shown by the significant number of growers and consultants accessing NutriLOGIC (developed with CRDC assistance) on the Cotton Catchment Communities CRC website, www.cottoncrc.org.au.

Long-term cropping experiments have enabled the development of a Nitrogen Use Efficiency Index (NUEI) for benchmarking the efficiency with which nitrogen is used in Australian cotton production. In practical terms, the findings show that on average, the amount of nitrogen applied to the field as fertiliser could be reduced by 50 kilograms per hectare without loss of yield.

It is worth noting that while nitrogen use efficiency presents a significant ongoing challenge for the industry, the independent analysis of CRDC research investments 2003–08 found that improved nutrient management (driven by previous R&D and extension investments) was one of the five major drivers of improved cotton yields per hectare over the period

myBMP – accessible self assessment

The 2008–09 year saw extensive development of the online portal to support myBMP, the web-based version of the industry’s environmental management system, Best Management Practices. myBMP is designed to enable cotton growers to self-assess their performance and practices against industry agreed standards. It will enable growers to access streamlined information packages and tools as they seek to improve practices and their business. The web-based system intends to provide a pathway for delivering R&D knowledge, providing targeted support for adoption and evaluating the impact of R&D on practice change.

The goal for 2008–09 was to providing direct links between the extensive sources of contemporary R&D information and the BMP framework. Under the project, industry’s research resources were systematically captured and uploaded into myBMP. Producers and extension officers participated in a national roadshow during February 2008 to provide feedback on the functionality of the myBMP system and on the assembled knowledge resources. This feedback resulted in the development of a more robust model for online information delivery.

Benchmarking agronomic performance

CRDC has established a new three-year consultancy with Crop Consultants Australia. The data collected from the 2008–09 crop details most inputs to production on the majority of cotton farms, including Bt and herbicide-tolerant cotton and will allow industry to compare the most recent crop with past and future crops.

Biosecurity keeping Australia safe

The Australian cotton industry is recognised globally as a leader in the areas of pest resistance management and integrated pest management. Research investments under this strategic objective are aimed at ensuring the industry remains proactive and responsive to biosecurity threats.

The National Cotton Biosecurity Plan (IBP) was launched in November 2006 and version two of the Cotton IBP, developed with CRDC involvement, is scheduled for release in late 2009. Surveillance for high priority cotton pathogens is now part of the annual cotton disease surveys of cotton areas in NSW and Queensland.

International scientific exchanges

CRDC supported a number of international scientific exchanges for industry researchers to investigate diagnostics and management of high priority pests and diseases where they currently occur. In late 2009 researchers visited the US to investigate *Bemisia tabaci* (Q biotype) and sending seed samples of native *Gossypium* species to Pakistan for screening against cotton leaf curl disease.

Monitoring resistance

Insecticide resistance monitoring programs continued to provide cotton growers with early warning signals to enable proactive changes to pest management strategies before the negative effects of resistance occur in the field. Proactive management of resistance reduces the industry’s use of pesticides and encourages the sustainable use of chemicals. Monitoring from 2008–09 indicated that the occurrence of resistance in cotton aphid, mites and *Helicoverpa* had fallen for the majority of chemicals. Resistance in silverleaf whitefly remained at low levels.

Over the past two cotton seasons, monitoring for resistance to the Bt toxins in Bollgard II® cotton varieties showed an increase from baseline levels in the species *Helicoverpa punctigera*.

While levels were far below those which would enable insects to survive in the field, CRDC coordinated an industry-wide contingency plan to tighten current resistance management efforts in the event that the trend continued.

In addition to supporting the industry’s management of Bt and insecticide resistance, CRDC convenes annual REFCOM (Research and extension in Bt resistance) forums involving resistance researchers, growers, commercial technology providers and industry bodies. Following a REFCOM meeting in February 2009, a precautionary contingency plan was developed for resistance to Cry2Ab. *Helicoverpa* populations are being monitored in remote regions such as the Queensland channel country to determine whether changes in resistance frequencies in these remote areas are consistent with those in cotton growing areas.

Exploring new options for refuge management

The most popular refuge option at present is unsprayed pigeon pea; however, this represents a significant cost of production and provides few other benefits to the grower. New refuge crop options for both irrigated and dryland production systems were being evaluated.

Research also tested some of the core assumptions upon which the refuge management strategy depends, with the aim of increasing understanding of how the refuge strategy impacts on resistance management at the landscape scale. Early work confirmed that random mating of moths from different host plants occurs and that refuges acted as a network across the landscape, rather than as individual crops, to produce a population of moths that can act to reduce any resistance that is selected in Bollgard II crops. This suggested that growers are not only reliant on their own actions but also on the actions of other growers, so that area wide management of refuges is critical.

Combating diseases

Diagnostics services identified no new properties with fusarium wilt in the 2008–09 season; however, the spread of the disease within farms was confirmed at a number of locations. A database of Fusarium strains and their confirmed locations is being maintained.

The impacts of farming practices on the incidence of fusarium wilt continue to be evaluated through on-farm, glasshouse and laboratory research. The management of cotton trash post-harvest was found not to influence the expression of Fusarium in the following spring, enabling growers to make decisions about trash management based on outcomes for soil condition and moisture conservation, without increasing disease risk. Soil type studies are indicating that abiotic characteristics may influence disease survival. More detailed studies are now underway to identify whether any of the causative characteristics are ones that can be influenced by farm management practices.

Black root rot continues to appear frequently in disease surveys across NSW growing regions and is now present in all regions. Its spread, and the occurrence of severe symptoms in localised areas, is fuelling the need for research to continue to investigate farming practices that contribute to disease risk.

Supporting research in the field of proteonomics has identified defence proteins expressed in cotton seedlings and proteins expressed by the pathogen that are potential virulence factors.

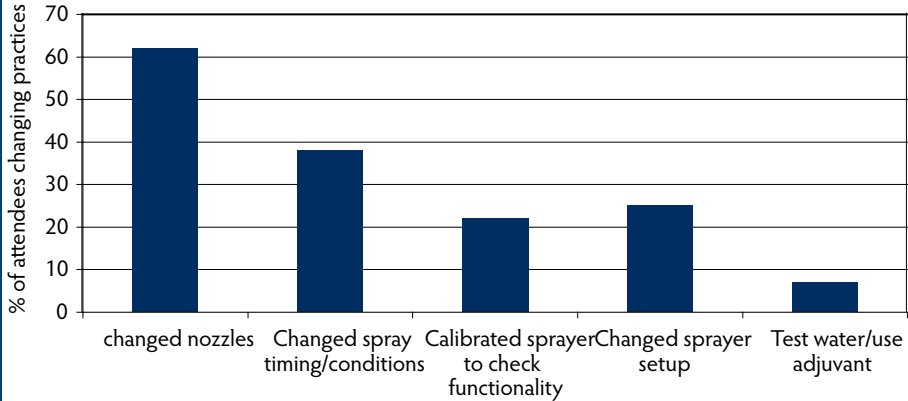
CRDC is represented on the fusarium wilt research coordination committee, FUSCOM, which includes pathologists, growers, consultants, and representatives of the seed industry and funding bodies. A range of research priorities has now been developed for Fusarium, encompassing resistance ranking, biosecurity, soil biology and extension activities.



**FARMING
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Evaluation of a series of CRDC-sponsored spray application workshops in northern NSW in 2008–09 demonstrated a high degree of learning. Six months after their attendance at the workshops, 80 per cent of surveyed attendees reported a change in their spraying behaviour, leading to an active reduction in the risk of offsite movement of agricultural chemicals. As many of the participants are landowners, farm staff and spray contractors, a significant area of cropping is now being managed with improved spraying practices.

Changes in spraying behaviour by attendees at spray application workshops



Weed control

Post-emergence herbicides, such as glyphosate, bring the advantage that they are applied to a known weed population; however, the application timing of post-emergent herbicides remains an issue. Growers must balance spraying too often against spraying too little. Research in this area has led to the development of guidelines for the critical periods for weed control which clearly define the period during which weed control is required, and conversely, the periods during which weeds cause insufficient yield loss to justify their control.

Human Capacity

Goal

A culture of innovation and learning

Outputs/Measures of Success

- Industry and R&D capacity needs identified and gaps being addressed
- An industry with the capacity to deliver our future R&D innovation needs and their adoption
- The adoption of a shared vision for the cotton industry’s future
- An industry with the capacity to deliver our future R&D innovation needs and their adoption.
- The adoption of a shared vision for the cotton industry’s future
- Assessments of industry capacity to innovate, lead and adapt

Outcome

Innovative people in the cotton industry and community, creating a sustainable industry and viable regional communities

An evolving role for extension

The Australian Cotton Extension Team, unique among our agricultural industries, served the industry well over a considerable time and continued to do so in 2008–09. However several years of drought, coupled with rapid changes in how information is generated and how it can be delivered led to a comprehensive industry-wide review of how to best support the delivery of information and adoption of R&D knowledge and technologies within the cotton industry. Integration of extension services with the industry’s emerging online-BMP system, and also a renewed focus on the role of consulting agronomists and agribusiness were both identified as significant future opportunities.

Findings from a study commissioned by CRDC, in collaboration with the Queensland Department of Employment, Economic Development and Innovation and the Cotton Catchment Communities CRC, indicated a shift in producer preferences for extension activities to focus mostly on ‘big picture’ support and not just the day-to-day agronomic and localised support services that have been a feature of past years.

While the Extension Team will remain an important conduit for delivery of knowledge and information, a range of new and innovative methods that specifically address newly defined grower and industry needs will enhance the overall approach.

Assessing future human capacity needs

Scoping studies in 2008–09 have assessed future human resource needs and defined future investments that will generate the Strategic Plan outcome required for Program Three. The scoping studies identified three core themes for future investments to address gaps in human capacity:

1. Skills

Existing resources for training and skills enhancement available to industry, as well as systems for aggregating the data covering the many social indicators that industry would require in the future, were scoped. Pilot projects in 2009–10 will further test and validate this approach. The cotton industry continues to pioneer formal acknowledgement of prior learning and knowledge of best practice cotton production with the formulation of a Certified BMP Farm Manager Diploma.

2. Communities of interest and practice

Studies have shown that future investments to address human capacity gaps should rely on strengthened communities and the creation of new communities of practice to underpin delivery of knowledge and shortened time to adopt technologies and the outputs of R&D.

The Big Day Out in Cotton, a CRDC initiative held in February 2009, focused on demonstrating opportunities to optimise inputs for cotton production. Researchers challenged producers to adopt best practice irrigation, tillage management and integrated weed control.

3. Systems

A range of new technologies is available to create and deliver the outputs of R&D through new technologies and systems. In a first for the cotton industry, CRDC collaborated with Flexible Learning Australia and with two experienced registered training organisations, Australian Agricultural Colleges Corporation in Queensland, and Tocal College in NSW, to secure an e-Learning trial in 2009.

A promising new system is being trialled to aggregate industry knowledge in the Web2 environment as an online-portal. This is being piloted as a knowledge delivery system supporting the new online Best Practices Management, myBMP.

Timely knowledge leading to adoption

CRDC investments and personnel were central to a pilot project designed to shorten the time and reduce the complexity involved in discovering up-to-date information on cotton R&D. This was developed for the 14th Australian Cotton Conference in August 2008. Organisers provided all delegates with a USB memory stick that allowed them to upload conference presentations, video of many presentations and the papers from presenters.

In another example, CRDC collaborated with GRDC, Cotton Australia and Nufarm to create industry-wide maps of cotton fields and provided this information to all farming regions to assist in reducing the impact and incidence of spray drift. The success of this program has developed into the recently launched CottonMap on-line mapping system.

Training and professional development

CRDC continued to invest in employment of the National Cotton Training Coordinator and the range of training and professional development activities that he designs, produces and coordinates. Key courses include the University of New England/Cotton Catchment Communities CRC Cotton Production Course, the Cotton Field to Fabric Training Course, the Cotton and Grains Irrigation Management course and Vocational Education Training in Schools (Certificates II to IV).

Professional development for cotton producers and their staff is often a very hard fit for day-to-day operations, with some businesses resorting to professional development when there is sufficient quiet time in the business. To address this, the industry endorsed an e-Learning pilot program to be conducted by the Australian Agricultural Colleges Corporation and Tocal College. The first projects will be short: six months of testing followed by development of a pilot system that the industry can build on. The first pilot project will assess needs in on-farm human resource management and will be followed by the development of new modules addressing the technical skills needed in future farming systems.

DEVELOPING THE INDUSTRY'S LEADERS

Australian Future Cotton Leaders Program

Following the successful inaugural Australian Future Cotton Leaders Program, initiated by Cotton Australia with the support of CRDC and the Australian Government's Department of Agriculture, Fisheries and Forestry, CRDC has made an ongoing commitment to leadership development through this proven approach. A further 10 people began the course in May 2009 and will complete it in the coming year.

Pictured: The 10 2009 Future Cotton Leaders

Left to right: Sinclair Steele, Tracey Farrell, Belinda Duddy, Elissa Wegener, Jo Eady (course facilitator), Tobin cherry, Matthew Norrie, Nick Gillingham, Barb Grey (presenter), Bruce Finney (CRDC). Seated left to right: Susan Maas, Anna Power, Joanne Grainger (chair, Cotton Australia), Kevin Bagshaw



CAPACITY



The Australian Rural Leadership Program

In 2008–09, CRDC invested in two scholarships to the Australian Rural Leadership Program (ARLP). Barb Grey, a Mungindi cotton producer, began the ARLP program in 2008, and Dallas King, a Cotton Consultant and Industry Development Officer, began the program in 2009. Dallas King is pictured here with other 2009 ARLP participants on a three-day trek in the Kimberleys.

"Although my journey in the Australian Rural

Leadership Program has just begun, it has already provided me with a greater insight into the unique and varied people who help build rural Australian communities and industries. From what I have experienced already, I believe I will have the confidence to become a more active participant in ensuring positive change within the cotton industry and my local community."

Dallas King
St George/Mungindi

The Field to Fabric Training Course

CRDC once again sponsored industry participants to attend the two Field to Fabric Training Courses held in 2008–09 at CSIRO Materials Science and Engineering in Geelong. The course provided participants with an opportunity to see first hand how cotton is processed from a bale into fabric. CSIRO has both full scale and miniature versions of the equipment used in cotton processing factories used overseas including drawing and carding machines, spinning frame, weaving machines, and dyeing facilities.

'Understanding how these processes occur helps participants understand the importance of quality standards and how our actions impact on the value chain'.

Brendon Warnock
Cotton Grower, Narrabri



Participants at the Field to Fabric training course in Geelong.

Engaging with school students

Five Indigenous students from Narrabri and Wee Waa High School continue to undertake paid work experience at the Australian Cotton Research Institute and CRDC in Narrabri. This program is part of a school-based traineeship program developed by CRDC, with the assistance of the Aboriginal Employment Strategy and the Cotton Catchment Communities CRC. In addition to providing the participants with office skills, this capacity-building project aims to foster greater engagement between the Indigenous community and the cotton industry.

CRDC continued to foster the enthusiasm of school age children in science-related subjects in 2008–09 by providing financial and logistical assistance to a range of projects. This included a Moree Rotary tour of the Australian Cotton Research Institute and Australian Cotton Exhibition Centre by high school students and children from the region's public schools attending the RiverHealth Conference. CRDC supported the Combined Schools Careers Expo in Tamworth and Armidale in April 2009.

Capacity building in irrigation

CRDC continued to invest in the hallmark Knowledge Management capacity building irrigation technology initiative in 2008–09 through the National Program for Sustainable Irrigation (NPSI).

This capacity building exercise means that producers are able to effectively benchmark their own irrigation efficiency performances against similar enterprises in the industry. Courses in irrigation performance, coordinated by the National Cotton Training Manager, continue to an important driver for irrigation performance by producers and their consulting agronomists.

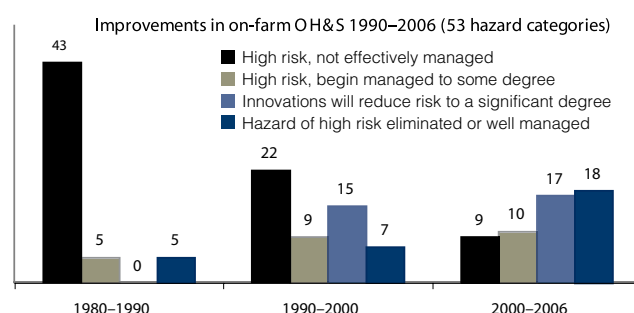
On-farm safety and wellbeing

CRDC continued its investment in the Collaborative Partnership for Farming and Fishing Health and Safety, managed by the Rural Industries Research and Development Corporation (RIRDC). This program began in 2007–08. The partnership aims to invest in research and development to improve the physical and mental health of farming and fishing workers and their families and improve the safety of the environment and work practices.

CRDC and The University of Sydney's Australian Centre for Agricultural Health and Safety have completed a project to document and quantify the impact new technologies have had on health and safety in the industry and document the industry's capacity to adapt to these changes.

The study identifies extensive change and improvement in safety on-farm, as a direct consequence of the impact of new technologies and practice change encouraged through the adoption of Best Management Practices.

CRDC has also worked with John Deere, with the support of Case IH, to complete the process of updating the Safe Harvesting of Cotton video into a new DVD format, which will be released soon.



Forums for innovation and best practice

The Big Day Out in Cotton

Held in February 2009 at 'Keytah' near Moree, this was a significant technology adoption-focused event that provided producers and cotton consultants with a forum to identify technologies that have the potential for impact their own enterprises. Researchers challenged producers to adopt best practice irrigation, tillage management and integrated weed control. The forum was focused on demonstrating opportunities to optimise inputs for cotton production.

The Big Day Out host, farm manager Andrew Parkes, 2008 Australian Cotton Industry Innovator of the Year, detailed the changes to the production of irrigated cotton on "Keytah", implemented in recent years to combat low water availability and rising input costs. The field day proved how changing farm practice can lead to significant energy savings and inputs.



Kicking off the Big Day Out at Keytah.

We're Aussie, Wear Aussie

CRDC sees strong strategic importance in developing contemporary knowledge and intelligence about products, markets and supply chains by facilitating new engagement mechanisms for industry and end users. A 2009 CRDC forum, 'We're Aussie, Wear Aussie', held in support of the domestic market approach being developed by ACSA and Cotton Australia succeeded in identifying new channels of communication and greater capacity for dialogue between participants. This approach goes beyond building relationships with spinning mills to seek opportunities through the retail sector. The outcome was that local brand owners who participated were enthusiastic for an Australian cotton product and believed that there was a strong fit for their marketing and branding efforts.



Developing a consensus 'on post-farmgate marketing issues facing the industry and a shared view of future action at the 'We're Aussie, Wear Aussie' forum

The 14th Australian Cotton Conference

CRDC R&D Program staff members participated in a range of research-related activities at the Conference. For the first time, CRDC's Communication and Human Capacity Manager played a key role in planning, managing, creating content, media liaison and distributing information, which helped to optimise the use of the Conference to disseminate outcomes from CRDC R&D investments.