

COTTON RESEARCH & DEVELOPMENT CORPORATION



Spotlight

SUMMER 2014-15

on Cotton R&D

RAMPING UP R&D COLLABORATION



Best Practice





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IN THE SPOTLIGHT



The New Year is well and truly with us, and with it has come some welcome rain to many growing regions.

In this edition of *Spotlight* we highlight some of

our major achievements, many which culminated late last year, after much previous groundwork and planning. The Australian cotton industry Futures Forums have been a highlight, with exciting outcomes and a clear map being drawn to steer our industry to an even more profitable and sustainable future. The series of forums mapped 28 trends affecting the cotton industry and identified novel research ideas with the potential to triple the value of Australia cotton production.

One of the major achievements was the delivery of the Australian Grown Cotton Sustainability Report. This document is significant, not only because it is an indicator of how seriously our industry takes its role in ensuring the sustainability of growing, processing and marketing this great commodity, it shows that Australia is leading the way in terms of assessing and reporting our credentials.

The report was held up to the international cotton community by CRDC's Allan Williams at the ICAC annual meeting in Greece, to demonstrate how a global effort to agree on a core set of indicators can be used by a national industry to promote the performance of cotton nationally and internationally. The report is an important document for industry, which will be continuously updated as we continue to examine and report our industry's progress.

While CRDC is proud of the calibre and scope of research undertaken for the industry, we never lose sight of the need to make sure this information and innovation is delivered to the people who need and want it. The formation of the UNE Cotton Hub has involved CRDC working more closely with one of our partners, The University of New England, to expand the delivery of important cotton industry research. .

Resources created through collaborations like this with UNE are not new for the cotton industry. The collaboration of CRDC, Cotton Australia and Cotton Seed Distributors to form the CottonInfo team is a prime example. Through our regional development officers we are seeing even stronger linkages between growers and research, while at the same time the team continues to listen to growers' needs in terms of information delivery. A series of nitrogen trials, energy efficiency initiatives and the RDO's constant contact with growers is testament to that – you asked and we responded.

Collaboration with international researchers is highly valuable in delivering the best possible results for growers. It was wonderful to hear the encouraging comments from the visiting US researchers late last year in relation to the calibre of our pathologists and research capabilities. To receive these compliments is a credit to the Australian cotton industry and our people.

As the season progresses towards harvest we wish success to all and looking forward to catching-up with growers and sharing the outcomes of research at the forthcoming regional field days.

Bruce Finney

IMAGE: RUTH REDFERN



At the announcement of the formation of the new UNE Cotton Hub were long-time cotton industry researcher Dr Rhianon Smith and hub co-ordinator Dr Oliver Knox.



**Australian Government
Cotton Research and
Development Corporation**

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

Our outcomes:
Farmers: Cotton is profitable and consistently farmers' crop of choice.
Industry: The Australian cotton industry is the global leader in sustainable agriculture.
Customers: The Australian cotton industry captures the full value of its products.
People: Capable and connected people driving the cotton industry.
Performance: Measured performance of the Australian cotton industry and its RD&E drives continuous improvement.
Corporate background: CRDC was established in 1990 under the Primary Industries Research and Development Act 1989 (PIRD 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, Barnaby Joyce.

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NEW FACES FOR CRDC BOARD

IN OCTOBER CRDC WELCOMED THE APPOINTMENT OF FIVE DIRECTORS TO ITS BOARD BY THE MINISTER FOR AGRICULTURE BARNABY JOYCE.

led by incumbent Chair Dr Mary Corbett and CRDC Executive Director Bruce Finney, Cleave Rogan and Dr Michael Robinson were reappointed to the board, along with previous director Kathryn Adams and new directors Liz Alexander and Greg Kauter.

The directors come from a diverse range of backgrounds across the cotton, agriculture and commercial sectors.

“The role of CRDC is to invest in research, development and extension (RD&E) on behalf of cotton growers and the Australian Government,” Mary Corbett said.

“One of the great strengths of the CRDC Board has long been its diversity of directors, who bring to the table a range of skills to help drive the organisation forward.

“I look forward to working with the directors over the coming years to ensure CRDC continues to achieve strong outcomes on behalf of growers, the government and broader industry.

“Our role in working with the industry to set and invest in research priorities is critical – ensuring our industry remains profitable, sustainable and competitive into the future.”

Mary also paid tribute to CRDC’s outgoing board, whose term finished on September 30 2014.

“I thank outgoing deputy chair Hamish Millar and directors Dr Lorraine Stephenson and Richard Haire for their contribution to the board and the cotton industry over the past three years,” Mary said.

“The focus for the new board will be to ensure the cotton industry is well prepared to capitalise on the opportunities and overcome the challenges ahead and look forward to working with my fellow CRDC directors to achieve this.”

Bruce Finney:
Bruce.finney@crdc.com.au



The new CRDC Board of Directors Liz Alexander, Cleave Rogan, Mary Corbett, Bruce Finney, Kathryn Adams and Greg Kauter (Michael Robinson absent).

CRDC BOARD

Dr Mary Corbett (BSc, PhD, FAICD, AFAIM) - Chair

CRDC’s Chair Dr Mary Corbett has more than 17 years’ experience as a company director in the scientific research and development area, and in education and training. Mary has significant board and corporate governance experience gained across a range of organisations and is Managing Director of Australian Business Class, an organisation specialising in executive leadership development. Mary has been a CRDC Board Director since 2008 and Chair since 2013.

Bruce Finney (BSc Ag, MAICD) - Executive Director

CRDC’s Executive Director Bruce Finney has extensive experience in the agricultural sector, having worked in corporate agriculture in various corporate, management and agronomy roles in Australia and in an advisory role in Argentina. He’s a past chair of the Australian Cotton Growers Research Association and a past director of the Cotton Catchment Communities CRC and the Irrigation Association of Australia. Bruce has been Executive Director of CRDC since 2004.

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

Dr Michael Robinson has extensive experience in primary industries and natural resources research, development and extension. Michael is currently CEO of

the Plant Biosecurity Cooperative Research Centre, and was formerly the Executive Director of Land & Water Australia, Centre Director of the Primary Industries Climate Challenges Centre and Chair of the National Climate Change Research Strategy for Primary Industries. Michael has been a CRDC Director since 2011.

Cleave Rogan (MAICD) – Director

Cleave Rogan is a cotton grower at St George in Queensland, where he has been farming and marketing cotton and grains for 30 years. Cleave has acted in an advisory role to CRDC, working on research projects related to biosecurity, insects, weeds, diseases, cotton fibre processing and quality enhancement. Cleave was formerly a Director of Cotton Australia and has been on the Board of CRDC since 2011.

Kathryn Adams (BSc Agr (Hons), LLM, M Bus, M Env Stud, Grad Dip Leg Pract, Prof Cert Arbitration, Practitioners Cert Mediation & Conciliation, FAICD) – Director

Kathryn Adams is a microbiologist and lawyer, specialising in intellectual property management, commercial/industry application of R&D and corporate governance. Kathryn has extensive experience in R&D investment from the perspective of a researcher, research institute director and an investor – and was the first Registrar of Plant Breeder’s Rights in Australia.

Kathryn is a former CRDC Director who has been reappointed to the Board in 2014.

Elizabeth Alexander (BA, M Rur Sys Mgt, GAICD) – Director

Elizabeth (Liz) Alexander specialises in finding collaborative and innovative solutions for regional challenges. As principal consultant for Blue Dog Agribusiness, she undertakes community-based planning, research, project management, communication and extension services for dryland and irrigated cropping industries, natural resource management groups, local government and the rural training industry. Liz was formerly a Director of Cotton Australia.

Greg Kauter (B AgEc, Grad Cert RuSc, GAICD) – Director

Greg Kauter is an agricultural consultant with more than 30 years of cotton industry experience. He has had extensive experience in cotton research administration and industry stewardship and has planned and developed extension strategies to facilitate the adoption of new technology and knowledge. Greg has experience with industry representative bodies in developing both strategic priorities and policy responses.



CRDC-FUNDED RESEARCH ON NATIONAL TELEVISION

In late October, ABC's *Landline* accompanied growers and researchers on a field walk in Emerald for an on-the-ground look at the 'climate opportunities for more reliable boll filling' research project (also known as the 'cotton under plastic' trial - featured in the 2014 Winter *Spotlight*).

The aim of the research project is to investigate the outcome of growing cotton under biodegradable plastic film - bringing forward planting window to August, rather than September, to allow the cotton to flower earlier.

Bringing forward flowering helps the cotton to avoid the adverse weather conditions that can occur on the Central Highlands in January and February, and promotes fruit retention and boll filling to allow a much higher proportion of the bolls to be present for the better period of weather during the new year.

The trial site was planted in August and achieved first flower in late October. The field walk enabled local growers in the region to witness the impact of the plastic film on the crop.

The project is being conducted by researchers Paul Grundy and Gail Spargo from the QLD Department of Agriculture, Fisheries and Forestry, Steve Yeates from CSIRO, Jamie Iker from Spackman and Iker Ag Consulting and Ngaire Roughley from CottonInfo - with funding from CRDC.

The group hopes to repeat the study for at least the next three years to gain a full range of seasonal variability.

You can watch the ABC *Landline* story in full, or read the transcript, on-line at www.abc.net.au/landline

see our website



RENEE ANDERSON

At the field day and Landline filming: grower Dougall Millar, CSIRO's Steve Yeates David McGrath of EnviroPlas Australia, DAFF Senior Research Scientist Paul Grundy, consultant Jamie Iker and grower Carlos Strangherlin.

\$5000 ON THE HORIZON FOR SCHOOL LEAVERS!

SCHOOL LEAVERS LOOKING TO START AN AGRICULTURE-RELATED UNIVERSITY DEGREE ARE BEING ENCOURAGED TO APPLY FOR THE RIRDC HORIZON SCHOLARSHIP, WITH APPLICATIONS FOR 2015 NOW BEING ACCEPTED.

The scholarships, proudly supported by CRDC on behalf of the cotton industry, provide \$5000 per year for the duration of the student's university degree. Students also have the opportunity to undertake annual work placements, giving them first-hand exposure to agriculture, access to industry leaders, professional development workshops and opportunities to network and gain knowledge at a range of industry events.

To be eligible, students must be entering their first year of university and studying a degree related to agriculture (such as agricultural science, rural science, agri-business or plant science). Students must also have started their tertiary studies no longer than two years after leaving high school.

CRDC is a founding supporter of the Horizon program and in 2014 is sponsoring five Horizon scholars: Grace Scott, Castle

Hill NSW; Michael Wellington, Toowong QLD; Alana Martin, Perth, WA; Sam Johnston, Forbes, NSW and Felicity Taylor of Moree NSW.

TO APPLY

Applications close January 30 2015. Shortlisted applicants must be available for a telephone interview in late February, with awardees announced at the end of February.

Application forms are available from the RIRDC website:

www.rirdc.gov.au/horizon

or contact RIRDC - 02 6271 4132.

see our website



Felicity Taylor, from Moree in Northern NSW is a 2014 CRDC-supported Horizon Scholar studying agricultural economics at the University of Sydney.



FORUM MAKES INROADS TO AUSTRALIAN COTTON'S FUTURE SUCCESS

A SERIES OF CRDC FORUMS HAS IDENTIFIED NOVEL RESEARCH IDEAS WHICH COULD POTENTIALLY ADD \$4BILLION PER YEAR TO THE VALUE OF AUSTRALIAN COTTON PRODUCTION.

The Australian cotton industry is internationally recognised as innovative, dynamic and hugely successful, due in part to the willingness of the industry to invest in world-class research and rapidly adopt the emerging science, innovations and technology.

However, the environment in which the industry operates is rapidly changing – be it at the farm, industry or international scale. Increased volatility in production, prices and climate, combined with rising input costs, shortages of skilled staff, cotton's declining share of the global fibre market, greater consumer awareness and rapidly emerging technologies all suggest that the future for the industry is going to be increasingly complex and uncertain.

CRDC has outlined three 'Futures Themes': Profitable futures; Sustainable futures; and Competitive futures, in its 2013-18 R&D Strategic Plan, which provide a clear framework through which CRDC can invest in long-term innovations to address its goal.

As a result, a key aspect of CRDC's research and development focus over coming years is investment in areas that ambitiously seek to transform the industry to ensure it is profitable, sustainable and competitive in 20 years' time and beyond. The challenge for CRDC is how and where to focus these investments.

To assist in the narrowing of this focus, a Futures Forum was held by CRDC in late 2013 with 80 invited delegates from across the industry to help identify areas of priority and possibility. This was followed by three forums in late 2014 bringing together 36 experts from inside the cotton industry and 21 from outside to identify priority areas for CRDC's Cotton Futures investment.

"The forums aimed to challenge the assumptions about the way Australian



PHOTO COURTESY CHRIS LARSEN

CRDC FUTURE RESEARCH THEMES

Profitable futures delivering innovations in cotton production to build the long-term profitability of cotton farmers.

Sustainable futures finding solutions for the challenges and opportunities that will impact on the future sustainability of cotton in Australia.

Competitive futures transforming the way in which customers demand Australian cotton products, and providing innovations which continue to make Australian cotton competitive.

The Forums aimed to challenge the assumptions about the way Australian cotton is produced and used; and identify new ways in which cotton could be produced and used into the future.

cotton is produced and used; identify new ways in which cotton could be produced and used into the future; and identify the points along the supply chain where CRDC could focus its investment," CRDC Executive Director Bruce Finney said.

"The outcomes have been extremely positive and exciting for the industry, as we were able to map 28 major trends affecting cotton including increasing costs, increasing demand for fibre, new markets, the rise of informatics and automation.

"By identifying these trends, we were then able to prioritise 24 research ideas with the potential to add \$4billion per annum worth of value to our industry.

"This is on top of the \$2billion per year in gross value of production already generated by the Australian industry.

"Some of these blue-sky opportunities include autonomous farming, agri-intelligence, plant-scale manage-

ment, chemical ginning, cotton-based carbon fibre and customised cotton additive 3-D printing.

"Importantly, we were also successful in developing a framework to manage these ambitious opportunities."

CRDC is now designing the futures investment process, including undertaking feasibility studies around the priority areas. From there, CRDC will then start the process of calling for, and investing in, specifically targeted futures research.

More information

The *Futures Forum Delegate Report* gives some clear guidance as to where potential investments may now lie and the *Designing a future for Australian cotton* identifies priority areas for CRDC's Cotton Futures investment.

Both are available at

www.crdc.com.au/cotton-futures



IRRIGATION EXPERTS TO TOUR INDUSTRY

COTTON INDUSTRY IRRIGATION RESEARCHERS WILL TOUR GROWING REGIONS IN FEBRUARY TO SHOWCASE INNOVATIVE SCHEDULING AND AUTOMATION TECHNOLOGY.

Bringing the researchers to growers at trial sites at Emerald, Moree and Nevertire, the 2015 Cotton Irrigation Technology Tour will provide an opportunity for growers to hear about, question and see the latest research in action.

New research is offering exciting options for growers to improve efficiency and yield through more precise scheduling and application technology.

“The researchers will explain how their irrigation technology works and how it may be applied on individual grower’s farms,” CRDC R&D Manager Jane Trindall said.

“We are also keen to hear feedback on what growers think about current irrigation research and any particular areas where they see gaps in scheduling and application information and technology.”

The tour will showcase:

- Scheduling with dynamic deficits - Dr Rose Brodrick, CSIRO
- Canopy temperature sensors - Dr Onoriode Coast, CSIRO and Lance Pendergast, CottonInfo QLD Water Use Efficiency Technical Specialist
- IrriSAT – Weather-based irrigation scheduling - Dr John Hornbuckle, CSIRO; Janelle Montgomery, CottonInfo NSW Water Use Efficiency Technical Specialist
- EM38 surveys - For soil-moisture measurements and the potential for future use - Dr Jenny Foley, QLD DERM
- VARIwise - Optimal, adaptive irrigation - Dr Alison McCarthy, NCEA
- Smart automation in furrow irrigation - Professor Rod Smith, Dr Malcolm Gillies, NCEA; David Robson, Rubicon



New automated flow irrigation technology will be on the agenda for discussion with researchers at the 2015 Irrigation Technology Tour.

TOUR DATES:

EMERALD TUESDAY FEBRUARY 10
MOREE WEDNESDAY FEBRUARY 11
NEVERTIRE THURSDAY FEBRUARY 12

For more information on the 2015 Cotton Irrigation Technology Tour contact: Janelle Montgomery 0428 640 990; janelle.montgomery@dpi.nsw.gov.au www.cottoninfo.net.au

PUTTING PERFORMANCE FIRST

PUMP PERFORMANCE EVALUATION IS A HOT TOPIC IN THE COTTON INDUSTRY AS RISING ENERGY COSTS ENCOURAGE IRRIGATORS TO LOOK EVEN MORE CLOSELY AT THE EFFICIENCY OF THEIR IRRIGATION PUMPING EQUIPMENT.

To reduce emissions and avoid the increased costs of burning excess diesel or electricity, pumps need to be running at peak efficiency.

An irrigation pumps workshop at “Keytah” near Moree in the Gwydir Valley in late October was aimed at irrigation consultants, to demonstrate the tools and necessary theory to improve their knowledge and understanding of pump evaluation. Participants heard from experts in this field including Peter Smith from NSW DPI and Joseph Foley, Gary Sandell and Phil Szabo from the National Centre for Engineering in Agriculture (NCEA).



NCEA's Gary Sandell discussing fuel flow measurement at the irrigation pump workshop held at “Keytah”.

NCEA has been conducting irrigation pump evaluations across the industry and have found various issues affecting pump performance, from oversized diesel engines to undersized suction pipes. Often pumps are run at maximum RPM thinking they are achieving maximum flow, but this is not always the case. Like all things, measurement is the key. A pump evaluation will measure different variables needed to assess pump efficiency and to find the “sweet spot” - the maximum water for best fuel consumption.

CottonInfo Water Use Efficiency Technical Specialist (NSW) Janelle Montgomery said there is currently a shortage of irrigation consultants who have the skills to evaluate pump performance and the cotton industry would like to see more consultants take up pump evaluation as a service for their clients. However workshops at like that held at “Keytah” are helping the process of alleviating the shortage.

The workshop was funded by the Department of Industry as part of the Energy Efficiency Information Grants Program and Sustainable Rural Water Use and Infrastructure Program.

Need a pump evaluation? Contact Phil Szabo at NCEA Phillip.szabo@usq.edu.au



Want more info on energy use efficiency? Visit the cottoninfo website www.cottoninfo.net.au





SUSTAINABILITY REPORT SHOWS CLEAR COMMITMENT

THE AUSTRALIAN GROWN COTTON SUSTAINABILITY REPORT SHOWS AN INDUSTRY COMMITTED TO THE HIGHEST STANDARDS OF PERFORMANCE, FROM FIELD TO FABRIC.

Launched by CRDC and Cotton Australia in November, the *Australian Grown Cotton Sustainability Report* tracks the environmental, social and economic impact of Australian cotton against a set of sustainability indicators. The report has come about as the result of recommendations from the industry's Third Environmental Assessment undertaken in 2012.

In a first for the Australian cotton industry, the report was prepared according to the principles and framework of the Global Reporting Initiative for Sustainability Reporting, reporting data on 45 economic, environmental and social attributes. Utilising this international framework allows the industry to adhere to best practice in sustainability reporting, and ensures that all relevant considerations are taken into account in preparing the report.



CHRIS LARSEN

CRDC Executive Director Bruce Finney, CRDC Chair Mary Corbett, Cotton Australia Chair Lyndon Mulligan, Cotton Australia CEO Adam Kay launched the *Australian Grown Cotton Sustainability Report* in November last year.

"The Australian cotton industry has a 23-year history of independent environmental assessments and is unique among Australian agricultural industries in documenting performance and practice change over such a period," CRDC Chair Dr Mary Corbett said.

"Cotton Australia and CRDC are committed to continuing an independent, evidence-based assessment of cotton industry's sustainability and environmental performance and reporting outcomes to stakeholders and industry.

"With the release of this report we are taking that commitment one step further to tracking and publicly recording our economic and social credentials, as well as environmental.

"It's about ensuring we continue to always be proactive in recognising and responding to societal concerns – and that we can not only meet, but importantly exceed, these expectations."

Delivering this report shows a clear industry commitment to sustainability and sophistication in measuring, managing and transparently demonstrating our sustainability.

"We are committed to continue to improve and to engage with stakeholders to refine our sustainability indicators and goals over time and report this biennially," Mary said.

Best practice

There are more than 1800 cotton farms in Australia and in an average year Australia's cotton farmers produce enough cotton to clothe 500 million people. Consumers, government and communities around the world are increasingly interested in the sustain-

ability of agriculture and its products. In the past 15 years, Australian farmers have reduced the volume of water needed to grow a tonne of cotton by 40 per cent and cut chemical use tenfold using genetically modified varieties. Furthermore, 93 percent of farmers use integrated pest management (IPM).

Australian yields are also high by international standards, almost three times the world average. These yields reached record levels in 2012-13 at 10.73 bales/ha (2436 kg/ha).

Australian growers' participation in *myBMP* underpins the industry's ability to demonstrate our commitment to sustainability and at the time of the report 45 percent of our cotton is grown on farms participating in the *myBMP* program and this figure is rapidly increasing.

The value of the *myBMP* system is in being able to demonstrate the industry's preparedness to invest resources (time and money) into demonstrating our growers' commitment to responsible and sustainable production techniques.

myBMP is a key component in the Australian industry's strategy to better meet stakeholder needs, and Cotton Australia has recently joined two international sustainability partnerships: the Cotton Leads Program and the Better Cotton Initiative (BCI).

myBMP accreditation is one of the prerequisites for growers to opt in to BCI and more Australian cotton growers are seeing the benefits of opting in and selling their cotton within the BCI program.

continued over page





The sustainability report has already been referenced internationally, helping the Australian cotton industry secure its access to valuable markets and demonstrate its commitment to a sustainable future.

The report was recently used by CRDC R&D Manager Allan Williams at the International Cotton Advisory Committee (ICAC) meeting in Greece, in his report as Chair of the Expert Panel on the Social, Economic and Environmental Performance of Cotton (SEEP) to highlight the importance of collecting and reporting information on the sustainability performance of cotton. The report was used to demonstrate how a global effort to agree on a core set of indicators can be used by a national industry to promote the performance of cotton nationally and internationally.

Furthermore, as an export dependent industry, having secure international markets for our cotton is critical, says cotton grower and Cotton Australia Chair Lyndon Mulligan.

“That’s why we are involved in both the Cotton LEADS and Better Cotton Initiative programs – programs about

THE REPORT WAS USED INTERNATIONALLY TO DEMONSTRATE HOW A CORE SET OF INDICATORS CAN BE USED BY A NATIONAL INDUSTRY TO PROMOTE THE PERFORMANCE OF COTTON...

stewarding global standards and committing to the supply of responsibly produced cotton.

“The Australian cotton industry is dedicated to becoming the producer of the most environmentally and socially responsible cotton in the world.

“Both programs require us to demonstrate our credentials on the world stage – and the Sustainability Report will play a critical role in this: highlighting our industry’s economic, social and environmental performance to the world.”

The industry will continue to develop sustainability targets that:

- Boost farm productivity.
- Increase water use efficiency.
- Reduce the carbon footprint.
- Enhance biodiversity.

- Reduce work related injuries and fatalities.
- Facilitate increased sustainability reporting across the supply and value chain for cotton.

The cotton industry’s strong research and development culture is a key component in reaching these targets. Over the past 24 years, CRDC has invested \$200 million in research, development and extension on behalf of Australian cotton growers and the Australian Government, which delivered an estimated minimum \$1.4 billion benefit back to growers on their farms, and double that value to the wider community.

More information

The *Australian Grown Cotton Sustainability Report* is available at www.crdc.com.au/publications/australian-grown-cotton-sustainability-report



For more information on opting in to the Better Cotton Initiative, go to Cotton Australia’s website www.cottonaustralia.com.au



ENVIRONMENTAL CATEGORY

The environmental aspects for this report included soil health, water use, groundwater, biodiversity, riparian land management, integrated pest management, pesticide use and greenhouse gas emissions.

- Farmers are taking action to improve soil health**
- Water is critical to maximise crop yields and fibre quality.**
 - The proportion of farmers monitoring groundwater quality has increased significantly from 20 percent in 2006 to 62 percent in 2011.
 - 40%** increase in cotton water productivity over the last decade.
 - The whole farm irrigation efficiency index improved from 57 percent to 70 percent.
 - The crop water use index is above three kg/mm/ha, high by international standards.
 - 96 percent of irrigators have improved their furrow irrigation system or changed to an alternate irrigation system.
- Comparing 5 year averages for the periods 2008-13 and 1998-03, the amount of insecticide used has reduced from 5.12 kg to 0.55 kg active ingredient per hectare.
 - 82 percent use new round module pickers.
 - 99% of transgenic traits for insect and weed management.
 - 70 percent of farmers use soil moisture probes, up from 40 percent in 2006 (highest of all agriculture industries in Australia).
 - 90 percent using satellite navigation systems in tractors.
 - 84 percent use a smart phone or tablet for accessing information about their farming system.
 - 93 percent of farmers use integrated pest management (IPM).
- Nitrogen fertilisers and energy consumed on farms are a major source of greenhouse gas emissions, and the industry continues to invest in research, demonstration trials and decision support tools focused on improving nitrogen and energy use efficiency.
- 89%** The cotton industry has achieved an 89 percent reduction in insecticide use.

SOCIAL CATEGORY

Key social aspects for the cotton industry include education levels, demographics, employment, health, social capital, research and development and legal compliance.

The number of cotton growers with a diploma level or above qualification has risen from 30 percent in 1990 to 50 percent in 2011. These qualification levels are higher than other agricultural sectors and above the average Australian population.

- 10,000 people** COTTON AUSTRALIA ESTIMATES 10,000 PEOPLE ARE DIRECTLY EMPLOYED BY THE COTTON INDUSTRY IN A NON-DROUGHT YEAR.
 - There are about 6.6 people per farm (1.6 employees/100 cotton hectares, with a highly variable range across regions).
 - Cotton represents less than 0.02 percent of all claims in agriculture for injuries less than four days and five-plus days.
 - Overall cotton growers are much younger than farmers in other agricultural industries in Australia.
 - HIGH SOCIAL CAPITAL**
 - The Australian Cotton Conference is one of the largest conferences of any agricultural industry in Australia with more than 1800 delegates.
- 60%** The proportion of women working in key industry organisations is 60%.

On average cotton farms have approximately 42 percent of their land dedicated to native vegetation. More than 42,000 birds representing 48 species were found on farm water storages in the Great Valley, 133 bird species were found in natural vegetation in the Namoi Valley. 450 species of invertebrates have been recorded in one cotton field during the summer.

The purpose of the report is:

- To demonstrate economic, environmental and social credibility to supply chain markets, government and policy makers and the community (domestically and globally).
- To guide research priorities and investment to enable practice change and continual improvement.
- To evaluate outcomes of research investments.
- To benchmark current performance and trends over time at the farm and industry scale.
- To inform and respond to policy development.



NEW RESEARCH COLLABORATION TO BETTER SERVE THE INDUSTRY

CRDC IS INCREASING ENGAGEMENT WITH THE TERTIARY SECTOR THROUGH A NEW PARTNERSHIP MODEL WITH THE UNIVERSITY OF NEW ENGLAND TO BETTER SERVE THE COTTON INDUSTRY.

The UNE Cotton Hub is acting as a forum for researchers from many disciplines across the University to discuss both specific and non-specific cotton research to strengthen the industry's ability to respond to issues affecting cotton production and cotton communities.

The range of cotton-related research underway at UNE is broad, with projects on insect and fungal disease control; nutritional aspects of production; on-farm business diversification; regional productivity and governance issues; precision agriculture; and ecosystem services. The Cotton Hub is bringing together research supported from many funding sources across UNE, identifying its relevance to cotton production systems or rural communities and assisting with getting this information out to the industry – via such partnerships as CottonInfo - so it can be put into practice.

According to soil scientist Dr Oliver Knox who is co-ordinating the initiative, the long term aims of the cotton hub are to “ensure we provide cross-disciplinary responses to issues affecting cotton production that make the best use of the skills available within UNE and through our wider collaborative links”.

“The hub will act as a conduit to quickly disseminate initial findings of UNE’s cotton-relevant research to the industry,” he said.

“We aim to improve the dissemination of research through publications such as Spotlight and through programs like CottonInfo, while also engaging the broader community through interaction with social media programs at UNE and through engagement at industry and farm-based events.

“The hub will provide a means to put industry challenges to interested parties within the university and to identify experts within the hub to provide comment and action on issues and questions from within the industry.”

Formation of the Cotton Hub came about as a result of discussions between UNE and CRDC.



Long-time cotton industry researcher Dr Rhiannon Smith and UNE Cotton Hub co-ordinator Dr Oliver Knox.

UNE has a long history of working with the cotton industry through past and present research projects, support of the Cotton Co-operative Research Centres and the Cotton Production Course.

Dr Oliver Knox
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IMAGE: RUTH REDFERN



COTTONINFO DELIVERING RESEARCH AND INNOVATION TO GROWERS

COTTONINFO, THE INDUSTRY'S JOINT EXTENSION PROGRAM, BRINGS YOU INFORMATION WHEN AND WHERE YOU NEED IT. IT'S ABOUT HELPING THE INDUSTRY IMPROVE PRACTICES AND PRODUCTIVITY, SAYS MANAGER WARWICK WATERS. HERE'S WHAT THE COTTONINFO TEAM HAVE IN STORE FOR 2015



COURTESY Alice Devlin

Nitrogen rate trials are underway with CottonInfo's regional development officers. They are focusing on understanding the range of factors that impact nitrogen loss and the efficiency of its use by the plant.

COTTONINFO'S THREE KEY PRIORITIES:

- 1. Improving industry practice** through promoting R&D knowledge and encouraging its adoption, including delivery of R&D through the myBMP system.
- 2. Improving R&D communication** by making R&D information, trusted advice and specialist technical knowledge readily available, in part through the provision of regionally facilitated support and by enhancing communication between researchers, growers, consultants, agribusiness, NRM and industry organisations.
- 3. Improving industry responsiveness** by building the capacity of the CottonInfo team, researchers, growers, consultants, agribusinesses, NRM and industry organisations to respond to emerging or emergency issues.

“The CottonInfo team are an on-the-ground network to help connect growers with researchers as well as consultants, agribusinesses, NRM bodies and cotton and other industry organisations.

In 2015, the team's focus continues to be on delivering the outcomes of industry research and development (R&D) and innovation to growers. This means working closely with researchers through the CottonInfo technical specialists, with growers and the wider industry through its regional development officers, and turning R&D into best practice through the CottonInfo-linked myBMP team.

“CottonInfo has three key priorities: improving R&D communication, improving industry practices and improving responsiveness to emerging or emergency issues,” Warwick said.

“The cotton industry and the Government are investing \$24 million in cotton R&D through CottonInfo partner CRDC during 2014-15 alone, so our key focus is on ensuring the outcomes from this research reach the people who need it most: cotton growers.

“While the current crop may be smaller in planted area than in previous years, there's still a huge amount of research and trial activity underway to help improve the productivity and sustainability of cotton – and our aim is to bring you as much info about these as possible this year.

“One of the key ways we are improving R&D communication in 2015 is by launching our new CottonInfo website www.cottoninfo.net.au where you will find information across all the CottonInfo areas, from nutrition, soil health and water use efficiency to disease management, stewardship and NRM – plus newsletters, podcasts, videos, and a range of industry publications.

“We will also shortly be joined by a new myBMP manager Rick Kowitz, who as part of his role with CottonInfo partner Cotton Australia, will be working within the CottonInfo team to ensure myBMP continues to cement its place as the source of industry best practice information.

“And, we're also involved in many opportunities for growers to learn from other growers in 2015, like the Grower of the Year field day, which we support, and the Big Day Out events, which we're running, plus other smaller events run by our local teams,” he said.

Improving industry practices is another key focus for the team during 2015, says Warwick.

“It's clear from our world leading production levels that the Australian cotton industry is doing a lot of things right – so, our focus on practice change is not on the simple rules of thumb, like fertiliser rate recommendations, but rather on the more complex, site-specific problems that growers might be experiencing,” Warwick said.

“A great example of our problem solving capability is our nitrogen rate trials, which are not about finding that one ideal rate for all, but rather focusing on understanding the range of factors that can impact on the loss of nitrogen and the efficiency of use by the cotton plant.

“Growers have told us that they want to be able to ‘ground-truth’ the research in their own areas, and so that's what our team are doing: demonstrating proof of concept



of current research results across all the cotton growing valleys.

“Another area growers would like us to look at is managing production variability, both within fields and between fields. So, in 2015, we are looking to better understand the capacity of precision agriculture.

“It’s about practically managing water and nutrient uniformity, and optimising the potential profit from these inputs.”

The final goal of the CottonInfo team – improving responsiveness – is in many ways the most critical, says Warwick.

“While no one wants to have a pest or disease outbreak, the industry must be prepared to respond.

“A review of the mealybug outbreak in the St George area last season has highlighted a number of opportunities for us to improve our responsiveness as an industry and as a result, we’ll be working with Cotton Australia and the relevant authorities to ensure our processes are up to scratch, and we have the capacity to respond if or when an issue arises.

“And we’ll also be making sure we’re all aware of our roles and responsibilities for future pest and disease incidents.”

CottonInfo is a joint industry program, supported by partners Cotton Seed Distributors, Cotton Australia and CRDC.

For more, visit www.cottoninfo.net.au



COTTONINFO'S NEW WEBSITE!

The new CottonInfo website – www.cottoninfo.net.au – is now live! At the site you will find information across all the CottonInfo topics: nutrition, soil health, water management, pesticide use efficiency, energy use, carbon, biosecurity, disease and insect management, NRM, stewardship and weed control. You’ll also find the full range of industry publications – from our flagship publications the Australian Cotton Production Manual and the Cotton Pest Management Guide, to the PAK series of publications, fact sheets and eventually a full database of all publicly available CRDC research reports. You can also download and subscribe to our CottonInfo e-news and moisture manager newsletters, listen to our audio podcasts Cotton Conversations, click through to our extensive range of videos on our YouTube channel, and add an event to our on-line events calendar.

SAVE THE DATE



Australian Cotton Awards' AgriRisk 2014 High Achiever of the Year Brendon Warnock will attend the Energy Big Days Out to share his experiences and management techniques.

Details

Date:
Tuesday
Feb 24 2015
Time:
2-6pm
Location:
Ian and Anne
Brimblecombe's
“Burgorah” St
George QLD

Date:
Wednesday
Feb 25 2015
Time:
2-6pm
Location:
Scott Morgan's
“Kensal Green”
Gunnedah NSW.

ENERGY FOR BIG DAYS OUT

Cotton growers will research the latest renewable energy sources and learn how to reduce on-farm energy bills at two CottonInfo Big Days Out in St George and Gunnedah in February 2015.

Both information and demonstration days, hosted by CottonInfo with support from the Commonwealth Department of Industry, will feature presentations by AgriRisk High Achiever of the Year Brendon Warnock and will kick off at 2pm and wind up with a barbeque at 6pm.

Speakers at the St George day will cover topics including solar power and energy audits, and visitors will be able to tour Brimblecombe's existing solar power installation.

The Gunnedah day will cover energy audits, how to optimise NSW power tariffs and the latest in renewable energy options.

GROWER OF THE YEAR FIELD DAY HEADS SOUTH



2014 Cotton Industry Awards Monsanto Grower of the Year Tim Watson and 2013 High Achiever of the Year Glenn Rogan of St George at the judging for the 2014 awards.

Details

Date:
Thursday March 12 2015
Location:
Tim and Sally Watson's “Lane's Bridge”
Hillston

The 2015 Grower of the Year Field Day will be held on March 12 at Hillston in southern NSW.

Tim and Sally Watson of Hillston's Sunland Ag were named the 2014 Monsanto Cotton Growers of the Year at the annual Cotton Industry Awards held last August and as such will host this year's Grower of the Year Field Day.

The Watson's have been growing cotton near Hillston in the Riverina for 14 years. This enterprise is not confined by conventional thinking and is achieving outstanding results.

The Watson's grow cotton, watermelons, beetroot and wheat based on a highly secure water supply of excellent quality. The cotton yields are impressive, with an eight-year average of 12.2 bales per hectare, with up to 12.8 bales last season. This yield is even more impressive given the gross margin per hectare, which puts it at better than the top 20 percent of farms participating in a benchmarking study. Tim's philosophy is to always be the least cost producer of the highest quality fibre. The field day, taking place on Thursday March 12, gives all growers the opportunity to go on the Watson's farm and learn what makes Tim and Sally the 2014 growers of the year.

More information

For more information on the cotton industry award recipients and nominees, go to www.australiancottonawards.aom

For more information on the field days go to www.cottoninfo.net.au





YOUNG FARMERS COMMITTED TO INDUSTRY

THIS YEAR CRDC AND COTTON AUSTRALIA HAVE SPONSORED TWO YOUNG COTTON GROWERS, TOM QUIGLEY AND MATT MCVEIGH TO BE PART OF THE NUFFIELD AUSTRALIA FARMING SCHOLARSHIP PROGRAM.

“Nuffield’s Scholarship program allows innovative growers to learn differing and advanced farming methods and ideologies from around the world and bring this information back so other Australian farmers can implement them,” CRDC Executive Director Bruce Finney said.

“CRDC is pleased to support these scholarships as Nuffield contributes to the cotton industry’s progress and sustainability in key areas such as water and fertiliser use efficiency, farming systems and management for better environmental outcomes.”

“We are really appreciative of the contribution of past graduates Andrew Watson from Boggabri and Nigel Corish from Goondiwindi, who both brought valuable information to our industry as well as being impressive advocates and innovators.

“We are really looking forward to hearing about Matt and Tom’s journeys and sharing their new knowledge and information.”

www.nuffield.com.au
enquiries@nuffield.com.au



OPTIMISING OVERHEAD IRRIGATION

Tom Quigley is from Trangie in the Macquarie Valley in Southern NSW. With his family, Tom manages Quigley Farms, a 6000-hectare mixed farm of up to 600 hectares of cotton, 2400 hectares of winter crop and grazing.

Under government incentives, over the past two years Tom’s family has converted 40 percent of their irrigation area from furrow to lateral move irrigation. With this change came new challenges, which Tom is keen to explore further under his Nuffield Scholarship.

“Many experienced cotton growers have installed some sort of overhead irrigation infrastructure in the recent past to deliver better water use efficiency and higher yield, but conventional management methods are not delivering these outcomes under these systems,” Tom says.

“We have seen a 10 percent yield increase on our farm with our management system, so I think there is potential there for other growers too with these overhead systems.

“I’m looking at farming systems in Australia and overseas specifically suited to growing cotton under sprinkler irrigation, particularly in regard to crop rotations and sequencing, cover crops, growing cotton on the flat, minimum and strip tillage and crop nutrition, with the aim to deliver higher yields and better water use efficiency.”

Tom will travel to the US, which is considered the home of centre pivot irrigation, as well as China and Israel to achieve this aim.

“I believe overhead sprinkler irrigation has a highly productive future if we tweak our management and farming system to suit,” Tom said.

Follow Tom on his journey via Twitter: @farmingwithtom



FOCUS OF FIBRE QUALITY

Matt McVeigh will research methods of improving the quality of Australian cotton.

“My dream would be to see Australia growing the highest yielding and highest quality cotton that is available to any merchant/mill,” he said.

Matt is part of his family’s mixed-cropping business, farming about 6000 hectares of irrigated and dryland country near Dalby in Queensland.

Cotton is the major source of income from the operation and Matt sees maintaining the fibre quality of their cotton as being critically important.

“I’m going to research cotton quality and what the end user requires, particularly in regards to length and colour, which can cost a producer a great amount of money in a short period of time,” he said.

“Agronomic and weather related issues such as row spacing, climate, defoliation, picking and packaging also all relate to quality and I would love to be able to compare different countries to Australia to see how we could improve on this.”

To achieve this aim, Matt will visit China, Korea, India, Brazil, Argentina, Egypt and the US a part of his scholarship.

The young farmer says market forces are also at play in the viability of a cotton operation, with the main importer of Australian cotton, China, beginning to push for better quality at the same price.

“However the upside of providing a higher quality product for sale while also maintaining the consistency of the fibre may be greater profits for farmers.

“I really see some tough challenges for the industry at the present and want to see it be sustainable for many generations, yet discounts cost us a great deal and put us on the same level as most other countries in terms of quality.

“I want Australian growers to be able to produce the best quality, highest yielding cotton in the world.”

This year Matt says they have changed back to a single-skip configuration and are trialling nitrogen and irrigation flow rates in their irrigated cotton to help maintain fibre quality.

“Hopefully this can show some positive signs for my research,” Matt says, “however this research won’t combat our biggest threat which is colour downgrades at harvest due to rain, which is big focus for me.”

Follow Matt on his journey via Twitter: @grainsandfibre.





FUSCOM ENROLS INTERNATIONAL EXPERTISE



COURTESY LINDA SCHEIKOWSKI

THE INDUSTRY'S ANNUAL PATHOLOGY FORUM HIGHLIGHTED WHAT THE AUSTRALIAN INDUSTRY IS DOING WELL IN TERMS OF DISEASE MANAGEMENT; AND WAYS TO ENSURE A MORE RESILIENT INDUSTRY.

FUSCOM was held in Toowoomba, Queensland in November, with focused presentations from international guests and Australian pathologists targeting current pathology issues and potential future issues.

The Fusarium Wilt of Cotton Research and Extension Coordination Committee (FUSCOM) was initially established in response to the outbreak of fusarium wilt and to control its spread across the Australian cotton industry. This annual meeting has now expanded to cover all aspects of cotton pathology, where researchers come to share research on current cotton disease issues.

DAFF (formerly QLD DAFF) pathologist Dr Linda Smith chairs FUSCOM and told *Spotlight* this year's highlight was the inclusion of four international experts.

"FUSCOM provides an excellent opportunity to discuss current cotton disease issues, and this year we were very fortunate to secure funding from CRDC to invite four cotton pathology experts from the US to share their knowledge with us," Linda said.

"They provided a really worthwhile perspective to discussions around key industry issues such as reniform nematode, black root rot and wilts, and were able to contribute constructive suggestions to practical aspects of our research."

Some of these US researchers were able to join Australian cotton pathologists on a tour to see the impact of reniform nematode at Theodore in Queensland, fusarium wilt on the Darling Downs and black root rot and verticillium wilt near Narrabri in Northern NSW. The visitors had many words of praise and advice for the local industry.

CRDC R&D Manager Susan Maas told *Spotlight* this year's program was an excellent initiative and the organising committee should be commended.

"It was a really engaging forum," Susan said. "It was great to hear the international guests positive comments not only about the success of the meeting, but also about the calibre of research and the strong industry-researcher integration here."

Professor Terry Kirkpatrick from

the University of Arkansas in the US specialises in nematode research, and said the cotton disease research group here has an enviable network for annual surveys and a long track record of alerting growers of the presence, movement, and significance of cotton diseases.

"This is why reconfirm nematodes were found early while they are still localised and I believe this network will also continue to work hand-in-hand with the growers," he said.

Professor Craig Rothrock, also of the University of Arkansas, said the Australian research presented a comprehensive and co-ordinated approach to the management of major cotton diseases in Australia.

"It was obvious from the presentations by growers that research is responsive to growers concerns," he said.

Equally important to the success of this meeting was this local participation.

"Participation by growers, consultants and others in the industry was extremely valuable and helps to ensure that our research stays focused on industry issues, both present and future," Linda said.

"My highlight really had to be the brainstorming of research gaps and opportunities on the last day, where some great ideas were suggested."

DAFF Plant Pathologist Bartley Bauer, visiting US Associate Professor and Extension Plant Pathologist Jason Woodward, DAFF's John Lehane, Auscott's Bill Back, Dr Stephen Allen and US nematologist Professor Terry Kirkpatrick at Auscott Narrabri discussing the company's farming practices as part of this year's FUSCOM visit.



WHAT THEY SAID...

Nematode expert **Professor Terry Kirkpatrick** of the University of Arkansas specialises in evaluation and application of precision agriculture technology to manage nematodes in cotton and soybeans.

He believes the cropping systems research outlined by the Australian pathologists at FUSCOM will be fundamental to helping growers adopt effective nematode management strategies.

"I encourage this group to compare Australian populations genetically with those from other geographic regions and to exploit progress that is already being made in the cotton breeding program with diploid cottons to search for sources of reniform resistance," Terry said.

Professor Craig Rothrock's specialty is seedling diseases, in particular black root rot at the University of Arkansas. His research is directed toward developing sustainable cropping systems for cotton and other field crops. His current research includes *Thielaviopsis basicola*, the cause of black root rot and the synergistic interaction between *T. basicola* and nematode.

Craig said the Australian research presented a comprehensive and co-ordinated approach to the management of major cotton diseases in Australia.

"In terms of emerging disease problems, researchers will need to focus efforts on the characterisation of the problem and prioritise management options to involve the appropriate researchers and use resources efficiently," he said.

"Plant pathologists here are working closely with the breeders for the introgression of novel genetic material for disease resistance into Australian cotton germplasm.

"In addition to addressing immediate



Visitors to this year's FUSCOM were US disease experts Jason Woodward, Professor Craig Rothrock, Dr Mike Davis and Professor Terry Kirkpatrick.

problems, research also is addressing issues of sustainability and soil health essential for long-term viability of the industry.

"I enjoyed the opportunity to visit with Australian cotton researchers again."

Mike Davis is a professor at UC Davis in California. Mike has worked extensively in fusarium wilt research and extension investigating crop epidemiology. He identified a new race of fusarium wilt of cotton and is involved in developing resistant cultivars.

"I think the industry and researchers are working together extremely well; the breeding and screening programs for the development of resistance to fusarium wilt are exemplary," Mike said.

"In a relatively short amount of time, the industry has received new cultivars from breeders with good levels of resistance.

"In addition, researchers have eliminated the use of susceptible cultivars, which is also one of the most important strategies for long-term management of the disease.

"I'd like to thank you for the invitation and hospitality."

Associate Professor and Extension Plant Pathologist **Jason Woodward's** focus is verticillium wilt and his research interests include the development of integrated disease management strategies, evaluating the efficacy of fungicides at Texas Tech University, Lubbock, Texas.

"I was extremely impressed with the level of collaboration among scientists, growers, consultants/agronomists and all other facets of the industry.

"The quality of the historical data from the disease surveys shows that your pathology team has their finger on the pulse of disease issues within the industry, allowing them to readily identify and respond to issues such as reniform nematodes."

More information

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HIGHLIGHTING LOCAL THREATS

CRDC R&D Manager Susan Maas (pictured) said the US perspective at FUSCOM has highlighted some particular threats and mitigation strategies for managing disease spread that are relevant to the Australian industry.

"My take home message from Terry Kirkpatrick was that reniform nematode is a serious threat for the whole industry and should not be viewed as just a Central Queensland problem," Susan said.

"Terry warned that 'just because, for example, Narrabri is cooler, doesn't mean reniform nematodes can't spread there'.

"He said reniform nematode was originally being viewed as a tropical pest, limited

to the US Gulf Coast, but it then spread up the Mississippi Delta with quite serious yield impacts.

"This is concerning for our industry and important for CRDC and key researchers when devising a suitable strategy to respond to this pest.

"Craig Rothrock and Mike Davis' presentations highlighted that we shouldn't underestimate the impact of soil diseases and black root rot; and should consider evaluating the impact of seed fungicides, and monitor for resistant or intolerant pathogen strains.



"Mike also highlighted the opportunity to take advantage of molecular tools to better understand fusarium wilt.

"Jason Woodward's verticillium wilt research highlighted the opportunity to use spatial surveys to better understand the interaction between disease and agronomic management such as nutrition, soil management and irrigation."



ENLISTING OVERSEAS EXPERIENCE FOR NEMATODE MANAGEMENT

MEETING WITH AN EXPERT FROM THE US HAS PROVIDED GREATER UNDERSTANDING FOR GROWERS BATTLING THE RENIFORM NEMATODE IN CENTRAL QUEENSLAND.

Irrigated cotton growers Peter and Diana French of 'Nandina', Theodore hosted the field walk with growers, agronomists and researchers to discuss reniform nematode management options with the DAFF plant pathology team and visiting nematologist Professor Terry Kirkpatrick from The University of Arkansas in the US.

Reniform nematode were first detected in the Theodore area in November 2012, during the DAFF (formerly QLD DAFF) annual disease surveys when Damien Erbacher of Dawson Ag Consulting alerted pathologists to areas of stunted cotton plants with root swellings.

Testing of root samples by DAFF's Jenny Cobon identified the presence of *Rotylenchulus reniformis*. Over the following season, every field in the Theodore irrigation area was extensively sampled. Some level of parasite damage was detected in nearly every field. In an effort to generate as much data as possible surrounding reniform nematode behaviours, the DAFF plant pathology team has also been conducting on-farm trials to assess management options suitable to Australian soil types, conditions and crop varieties.

DAFF Pathologist Dr Linda Smith says that in the US, reniform nematode has been a production threat to cotton growers there since the 1930s; with the use of expensive nematicides, crop rotations or fallowing recommended as the best management strategies.

"Despite extensive research, no commercial cotton cultivars with resistance to reniform nematode have been developed, with the focus now shifting to breeding for tolerance," Linda said.

"According to Terry Kirkpatrick,

tolerant cultivars won't suppress the reniform nematode population; however they can help to reduce economic losses by preventing significant yield reductions in infested fields."

For Australian growers, control mechanisms are focused on farm hygiene and strict enforcement of Come Clean. Go Clean. procedures to minimise potential spread.

"Experience from the US shows that reniform nematode has the unique ability to survive in very dry soil for extended periods of time - a possible explanation for their rapid spread throughout the mid-south of Central Queensland," says CottonInfo's Technical Specialist Ngaire Roughley, who is based in Emerald.

"Anything that can move contaminated soil, such as farm equipment, birds, flooding or even dust, can contribute to the spread of this nematode.

"In line with industry Best Management Practice, any person, vehicle or machinery that has entered contaminated fields should be cleaned thoroughly before entering 'clean' fields."

This means using high pressure water and a decontaminant such as Castrol Farmcleanse, to clean all vehicle surfaces (including foot pedals and mats) of any dust, mud or trash; and don't forget shoes and tools used in the infested field.

Research has shown rotations with non-host crops such as corn and sorghum after every cotton crop will also help to reduce the base population, thereby creating an environment where the reniform nematode is kept at manageable levels. Given that stressed plants are more susceptible



to yield damage, the practice of best management basics such as avoiding waterlogging, enhancing soil conditions and plant nutrition, managing other insect pest interactions will also go a long way in reducing the impact of damage in affected areas.

Peter French said he found the field walk to be extremely beneficial in terms of delivering the latest research from the DAFF plant pathology team and also from the experiences of the cotton industry in the US.

"Terry validated our management plan of rotating cotton with non-host crops such as corn to provide biodiversity above ground and below ground," Peter said.

"Our aim is to create an environment where the reniform nematode can be kept at manageable levels.

"They say knowledge is power, and this is certainly true for us. The more we understand about the reniform nematode, the more effective our management solutions will be."

Nematode expert Professor Terry Kirkpatrick from The University of Arkansas in the US, discussing nematode management options with with cotton grower Peter French "Nandina", Theodore and his employee Matt Anning.

More information

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"EXPERIENCE FROM THE US SHOWS THAT RENIFORM NEMATODE HAS THE UNIQUE ABILITY TO SURVIVE IN VERY DRY SOIL FOR EXTENDED PERIODS OF TIME".



A CLOSER LOOK AT HILLSTON

TWELVE YEARS AFTER AN INITIAL SOIL SURVEY AROUND HILLSTON IN THE LOWER LACHLAN VALLEY OF SOUTHERN NSW, CRDC IS SUPPORTING ANOTHER BENCHMARKING STUDY TO SEE WHAT'S CHANGED...

Associate Professor in Soil Science Stephen Cattle of the University of Sydney undertook the original soil survey 12 years ago and is now overseeing the latest research being undertaken by PhD student Patrick Filippi.

The results from this follow-up survey will be particularly telling, as the exact locations of the original test sites are being resampled as Stephen had geo-referenced the original 114 sample sites in the initial study which encompassed nearly every cotton farm in the region. New sites have been added for the latest study where land manage-

ment has changed significantly.

"Growers we have initially spoken to have been enthusiastic and keen to find out what the new survey results will tell us," Stephen said.

"Farmers in the region have had to adapt with the changing availability of irrigation water and we want to see what impact that has had on the soil.

"We are trying to separate the effects of land management and climate so will have sampling sites in agricultural fields (dryland and irrigated) and under native vegetation

"We hope to find out what soil features have changed more as a result of management practice and what soil

"WE ARE TRYING TO SEPARATE THE EFFECTS OF LAND MANAGEMENT AND CLIMATE..."

In arid and semi-arid zones like Hillston, less rainfall means less soluble salts are leached out of the topsoil, which can result in salinity and sodicity building up in the soil profile.

features have changed more as a result of the weather patterns, as the middle years of the 2000s were dry, followed by some very wet years."

In arid and semi-arid zones like Hillston, less rainfall means less soluble salts are leached out of the topsoil, which can result in salinity and sodicity building up in the soil profile. The initial study found that subsoil sodicity and structural instability posed the greatest potential threat to cotton production in the Lower Lachlan.

"Other potential soil limitations which required consideration included subsoil alkalinity and low organic carbon and subsoil phosphorus concentrations, so it will be interesting to see how these issues have progressed," Stephen says.

"It will be really useful to also com-



Patrick Filippi

RESEARCH FOCUS ON SOUTHERN REGION

AS THE COTTON INDUSTRY EXPANDS IN SOUTHERN NSW, WORK HAS BEEN UNDERTAKEN TO EVALUATE CURRENT SOIL MANAGEMENT PRACTICES AND IDENTIFY REGION-SPECIFIC SOIL KNOWLEDGE GAPS.



ON SOILS

A CRDC-funded scoping study undertaken by NSW DPI has raised awareness of Southern NSW soil types in cotton growing areas and the issues growers face and the information available to manage their soil.

“We commissioned this study due to a limited understanding of the soils being used for cotton growing and the associated soil management practices in Southern NSW from a cotton perspective,” CRDC R&D Manager Allan Williams said.

“It was recognised there was a need to identify knowledge gaps, to establish research questions relating to soils under cotton and their management in Southern NSW and to determine what information is currently available to these growers.

“The report from this scoping study will assist us in setting the direction of future soils research for this expanding region of the cotton industry, as well as help us understand what soils information is currently available to the growers and consultants in the region.”

Unique challenges

The soils under irrigated cotton around Griffith, Hay, Hillston and Condobolin in Southern NSW are quite different to those in the growing regions in Northern NSW and Queensland. In Southern NSW the soils are highly variable and the region has a distinctly shorter growing season which creates some soil management challenges. Parts of the region also include rice cropping or have a history of rice growing and this has further implications for growing cotton.

“A number of soil factors create significant challenges for growers and consultants on how to best manage their soils in Southern NSW,” says NSW DPI soil scientist Dr Jonathan Holland, who with consultant Dr Callum Eastwood undertook the scoping study.

“The major challenges identified in the study related to sodicity; soil compaction; crop establishment; and a

variety of soil fertility/nutrient management issues.

“As part of the study we evaluated available cotton soils research data and reviewed previous soil surveys for the Southern NSW region.

“The information was coupled with face-to-face meetings with growers and consultants of varying levels of growing experience and who are managing areas of varied production size, which encompass a wide range of soil types.

“We found that in some instances there is limited experience among growers and consultants as cotton had only been grown for around three years, and even in areas where cotton has been grown for longer periods, there was still insufficient understanding around specific soil management issues due to the lack of local soils research.”

Connecting with research from the past

Jonathan says the scoping study showed there is a significant amount of soils research data available from other regions of the cotton industry.

“Therefore, we think there are some opportunities to translate these results and understanding to the cotton-growing soils in Southern NSW.

“For instance, some key regional factors such as mineralogy or soil pH strongly influence major soil processes.

“Likewise we found that the benefits of soil management practices often relates to specific influential soil factors: this was confirmed when we looked at the information on soil management practices from the longer established regions of the cotton industry.”

pare whether overall soil condition has improved or declined.

“Some of the Hillston growers have been very proactive in trying new management practices to improve topsoil health and condition and the results from this project should give us an idea of how effective these practices have been.

“More generally, the outcomes of this project should indicate the ongoing effects of irrigated agriculture on the soils of this semi-arid region, allowing land managers to adjust their agronomic practices accordingly.

“In this environment, irrigated cotton production effectively quadruples the amount of water that would normally percolate into the soil over the course of a year.”

More information

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Patrick Filippi:
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GREATER UNDERSTANDING OF PHOSPHORUS AND POTASSIUM ACQUISITION AND GROWTH REQUIREMENTS IS NEEDED TO IMPROVE LONG TERM NUTRIENT MANAGEMENT.

BETTER UNDERSTANDING THE NUTRIENT-YIELD RELATIONSHIP

Declining levels of phosphorus (P) and potassium (K) in deep soil layers on cotton farms, coupled with inconsistent responses to these fertilisers, has led researchers to further investigate the interaction between the availability of these key nutrients through the soil profile and what effect plant uptake has throughout the growing season.

Trials were carried out in the 2013-14 season as part of a CRDC funded project led by Dr Mike Bell (pictured opposite), Principal Research Fellow with QAAFI's Centre for Plant Science, looking to find more effective methods of applying P and K fertilisers to produce yield responses in cotton and to determine soil test critical values for these nutrients. He has been working with Dr David Lester, Duncan Weir and DAFF technical staff.

The trials were designed to explore different application methods - broadcasting prior to hilling up, versus banding into preformed hills - as well as different rates and combinations of P and K. Trials were conducted under irrigated cotton at Goondiwindi in the Macintyre Valley as well as in dryland cotton east of Moree in the Gwydir Valley and under irrigation at Warra on the Darling Downs. The dryland sites had the P and K treatments banded at 20cm after a previous wheat harvest and a long fallow.

Results from the first year of trials are represented using raw cotton yield as there were no significant differences in turnout or quality that could be related to treatment.

Phosphorus

Measurements of biomass and nutrient uptake were taken throughout the growing season for phosphorus and it was found that treatments with phosphorus applied had 30 percent increased biomass at first flowering and plant tissue P concentration was also higher than the nil treatments with the combined effect being an extra 1kg P/ha into the crop (equivalent to a 45 - 50 percent increase in crop uptake at that early growth stage).

"However, any advantage in early growth and P uptake did not appear



Early responses to P treatments in trials at "Yambocully" Goondiwindi. The high P treatment is in the foreground with the nil P treatment at rear. These early differences produced no yield responses at harvest.

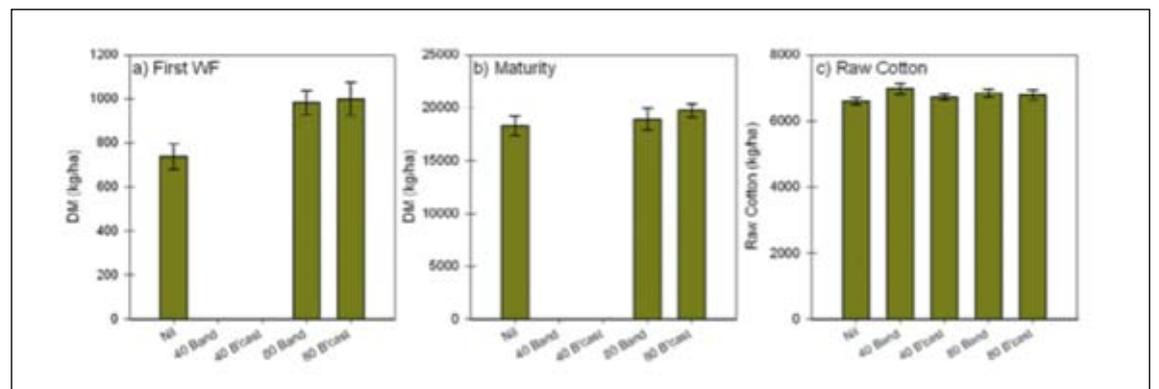


Figure 1. Dry matter at (a) first flower, (b) maturity and (c) raw cotton yields from a phosphorus placement by phosphorus rate irrigated trial at Goondiwindi in 2013-14.

to be of benefit to yield with measurements taken at later stages of crop development revealing that biomass and plant tissue concentrations of P were virtually the same across the treatments (including the nil P applied)," Mike said.

Potassium

As with phosphorus, the project has found that in many cases when potassium is applied in irrigated production systems it makes a small contribution to early growth and nutrient uptake from the hill, however once the crop enters peak dry matter and nutrient accumulation after flowering, the K fertiliser applied has little net effect on crop growth or nutrient uptake.

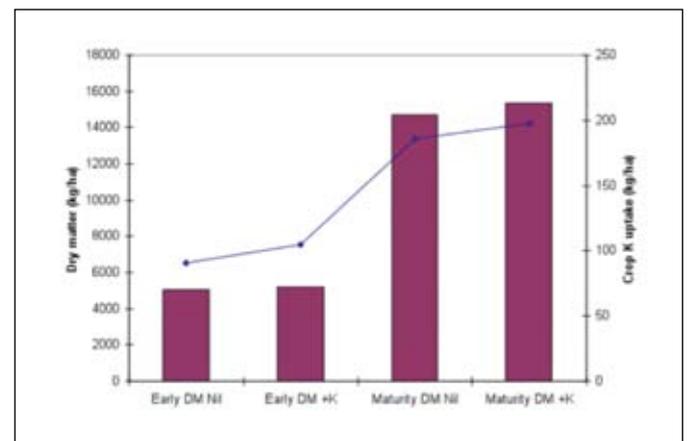


Figure 2. Dry matter production and crop K uptake from high rates of K fertiliser applied prior to the previous cotton crop under irrigation at Warra in 2012-13 season.



Dryland differences

However a deep-placed K-rate experiment in a dryland cotton crop near Moree in Northern NSW in 2013-14 provided a very different response.

“Here early season responses to applied potassium did carry through to significant yield increases in a very drought affected crop (1-2 bales/ha),” Mike said.

“However these results should be considered in context - the additional K uptake was similar to that in other trials (ie small) and the size of the yield response (around 0.6 - 0.7 bales) was about what could be expected from that additional K uptake.

“Unlike in the irrigated trials, where most of the biomass and K uptake occurred after flowering, there was much less growth and very limited K uptake in this seriously water stressed crop.

“Our research has shown that that for each additional 1kg/ha of K that is taken up by a cotton crop raw cotton produced increases by up to a maximum of 50kg/ha, with this efficiency of conversion falling as K availability increases.

“The key is to get enough extra potassium into the crop.”

“SIMPLY APPLYING P AND K DOES NOT NECESSARILY MEAN THESE NUTRIENTS WILL REACH THE ZONES OF DEPLETION OR EVEN BE TAKEN UP BY THE CROP.”

WHERE TO NEXT WITH P AND K RESEARCH?

FOR THE RESEARCHERS, THE RESULTS FROM THESE RECENT STUDIES RAISE THE QUESTION AS TO WHY COTTON RESPONDS TO P AND K APPLICATIONS IN EARLY STAGES OF DEVELOPMENT, BUT DOES NOT CONTINUE TO TAP INTO THOSE PARTS OF THE SOIL PROFILE WHEN THE CROP IS OLDER – EVEN WHEN THERE IS WATER AVAILABLE.

The project team are now considering this and looking closely at activity of the plant’s root system in different parts of the soil profile as the crop develops. The findings of this work will be critical to the development of effective P and K fertiliser application strategies that deliver efficient crop nutrient uptake and use.

“What is known is that P and K are effectively immobile in our clay soils and stay where they are in the soil profile, regardless of water movement,” Mike said.

“Parent materials and natural soil formation gave us a starting condition, but processes such as fertiliser and manure application, crop uptake, removal in harvested product and residue return all modify the amount and positioning of that nutrient in the soil.”

Crops acquire most of their P and K via a process called diffusion, where dissolved particles move from an area of high concentration (a fertiliser band or unexplored soil) towards an area of low concentration, for example around an active root. The bigger the difference in concentrations, the faster the process of diffusion tends to occur. Uptake is generally greatest in layers where there are lots of roots and enough soil water to allow that diffusion to occur efficiently.

“Our trials confirm that in the early growth stages cotton plants have a small root system tapping into a small volume of soil so a high concentration of P or K is required in this root zone which is in the upper layers of the soil profile,” Mike says.

“However in the later growth stages a large root system develops that explores a large soil volume, so even low soil P and K concentrations can meet demand if the soil volume is big and accessible.”

Mike says that in most cotton soils the inherent deep fertility reserves have until now provided this ‘large volume with lower concentration’.

“However, as we deplete these natural soil P and K reserves, as they must be with unreplenished removal from the field, we are being increasingly

forced to rely on imported nutrients to meet demand and we have limited options for application and placement.

“The latter is limited to the depth of cultivation, but for immobile nutrients like P and K most of the depletion seems to be going on below that, in the subsoil.”

“We now know that simply applying P and K fertilisers does not necessarily mean that these nutrients will reach the zones of depletion or are even taken up by the crop.”

Mike says there are still many unknowns before improvements can be made. For example, does the non-exploitation of P and K in the bed occur because the crop can still find adequate reserves deeper down? If so, will the crop be able to change its feeding patterns as those reserves are depleted? Also, is the crop simply not able to use those enriched topsoil layers later in the season as the root system in those layers has ceased to be functional? If so, can we change management or genotype to influence this?

Ongoing research will investigate these questions further while also trying to better define the soil nutrient levels below which fertiliser application will deliver a more reliable yield response.

“Further research is required to understand the dynamics of plant P and K supply and demand from flowering onwards and how these demand characteristics relate to root activity and nutrient acquisition in different parts of the soil profile,” Mike says.

“It would appear that understanding these factors is a major precursor to delivering improved nutrient management systems.”

More information

Phosphorus, potassium and cotton: Where are we up to? - 2014 Australian Cotton Conference Proceedings www.crdc.com.au/publications/17th-australian-cotton-conference-research-papers-e-summaries





NEW LINKS TO LONG-TERM FORECASTING

COTTONINFO'S CARBON AND CLIMATE TECHNICAL SPECIALIST JON WELSH RECENTLY UNDERTOOK GROUND BREAKING RESEARCH WHICH UNCOVERED LONG-RANGE WEATHER PREDICTABILITY TOOLS FOR THE CENTRAL QUEENSLAND CLIMATE, WHICH WILL HELP GROWERS IN THE REGION BETTER MANAGE CLIMATE RISK AND THEIR CROPS.

Due to the monsoonal effect on weather in the Central Queensland region, growers often battle with cloudy, low light conditions during their growing season which currently runs from September to February. Importantly these conditions often persist in crucial times of crop maturity such as during boll filling and harvest.

The extra good news for growers is Jon's research gives them predictions for levels of solar radiation (sunlight) looking six-months ahead.

Using what is known as Niño sea surface temperature (SST) indices, Jon found clear signals for predicting seasons in Central Queensland (August to January) of either high light intensity or high moisture and low levels of solar radiation (sunlight). Unlike the commonly referenced Southern Oscillation Index (SOI) which is regularly used by farmers to manage risk, Niño SST is a more reliable indicator with much longer lead times.

"Timing the growing season to coincide with periods when solar radiation is high makes sense for cotton growers, however, neutral years still remain a challenge," Jon said.

"One of the key drivers of solar radiation is the Niño SST which is measured in a particular zone of the western Pacific Ocean known as the Niño 4 SST.

"As the Fitzroy Valley in Central Queensland is the closest cotton growing region to this zone, it naturally feels the effects of this anomaly most intensely.

"With the Niño 4 SST predictions available with six-month lead times, growers can at least make some adjustments to calculating the level of risk in years where a clear signal exists for poor growing conditions, by taking opportunities to plant early, forward marketing with a degree of caution or increase exposure to rain-grown cotton planting opportunities."

Changing rainfall patterns in the Fitzroy Valley

While adjustments to licensing agreements have enabled growers to plant earlier in the season, bringing defoliation and picking forward into January to avoid the monsoon rain, Jon's analysis of historical data showed that rainfall patterns are also changing

in the Fitzroy Valley.

"In the last 10 years, rainfall reliability has varied somewhat through Queensland growing regions - more southern growing regions are showing improvement in growing season reliability, while in the north reliability is decreasing," he said.

In the Emerald and St George regions, rainfall in the traditional growing season between September and February in the period 2004-2014 is trending towards greater variability from the long term average, while reliability is improving in the Condamine, Goondiwindi and Dalby regions. (Figure 1)

Jon's analysis of monthly rainfall distribution and reliability at Emerald through the growing season also showed (from a historical viewpoint) that the arrival of rain is changing.

"There are noticeable trends throughout the northern cotton belt. Winter and early spring rainfall is becoming far less reliable, while in

contrast, peak summer rainfall has become more reliable in the last 10 years (Figure 2) in comparison to the long-term average.

An analysis of the change in mean rainfall shows both quantity and reliability have increased during the key months of December and January with an improvement in rainfall reliability in February. Figure 2 confirms the inherent difficulties of aligning a suitable planting window with typically clear fine weather as the crop matures, with picking occurring in a wetter, more reliable monsoon period. The last 10-year analysis period shows early season rainfall is trending towards greater unreliability, coupled with decreases in monthly averages during the months of August and October.

The El Niño-Southern Oscillation

Understanding El Niño-Southern Oscillation (ENSO) variability in an historical context is another tool for growers to form a greater understanding of the risks associated with

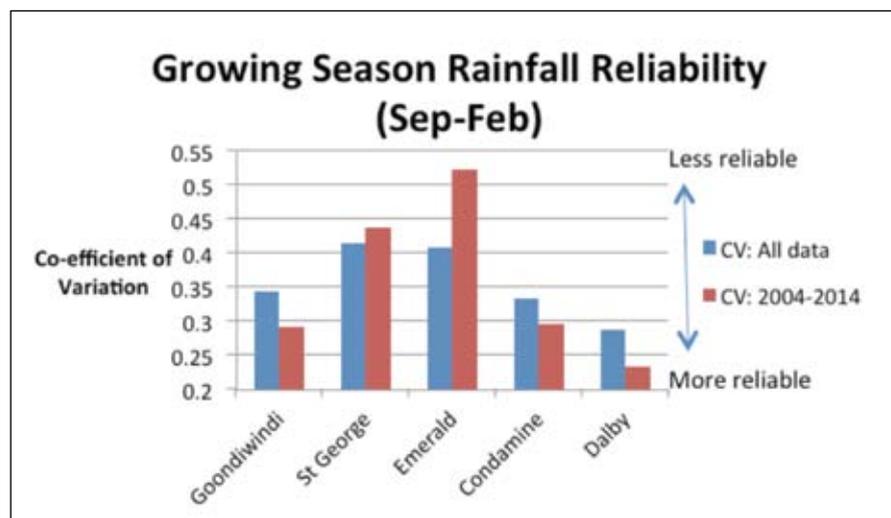


Figure 1 Co-efficient of variation (CV) of five Queensland cotton growing regions' growing season rainfall showing all available data for the period 2004-2014.

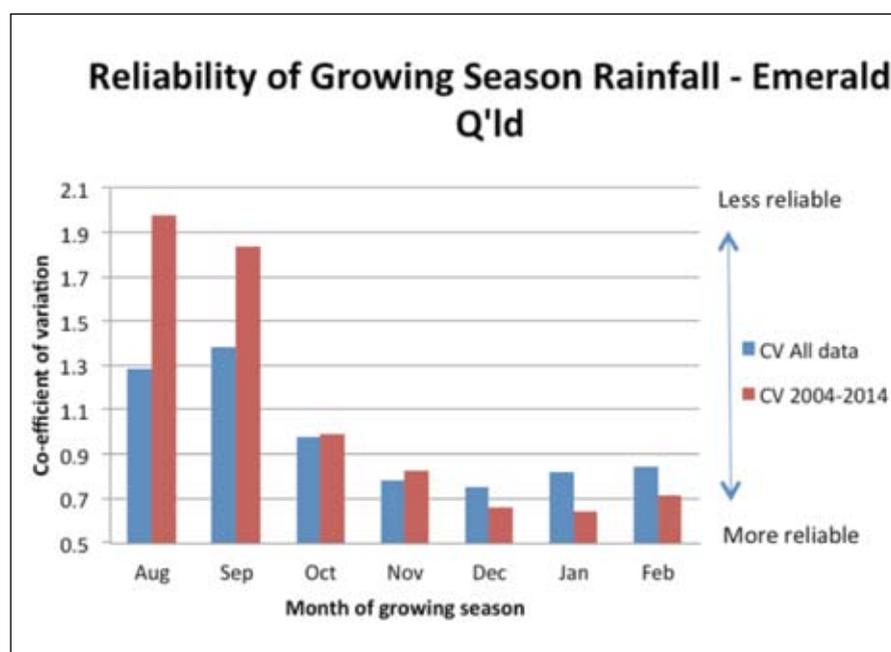


Figure 2 Reliability of growing season rainfall for Emerald QLD with all data (blue) and the last 10 years (red).



FOR CENTRAL QUEENSLAND GROWERS

extremes in seasonal elements.

The ENSO is tracked and quantified by the Niño SST indices (including Niño 4) which is essentially a measurement of the spatial distribution of warm convective tropical moisture in the western zone of the tropical Pacific.

A number of agencies, including the Australian Bureau of Meteorology regularly publish six-monthly predictions of all Niño SST anomalies and Jon says the provision of these skilful forecasts allows those affected by these events to prepare for changes in rainfall and impending droughts associated with ENSO variability.

“In a region like Central Queensland which is strongly affected by ENSO variability, climate risk management is actually anticipating this variability to better manage climatic extremes,” Jon said.

“Successful forecasts of El Niño and La Niña events using SST have been made on lead times of six months and as far ahead as two years.

“Long-lead time forecasts of these Niño SST indices can be monitored by farmers with a reasonable degree of confidence, as opposed to using the SOI as an atmospheric indicator which can be farm more problematic for lead times of any more than just 14 days.”

This is because for several months of the year the SOI measurements can be affected by cyclonic activity, short bursts from trade winds on the equator or other localised events at measuring stations in Darwin and Tahiti.

While the Niño 4 SST index can be a useful longer-term tool for assessing risk of key climatic variables, for shorter term management decisions around climate, the relationship between the Niño 4 SST index and solar radiation shows an almost perfect linear trend (Figure 3).”

The results of Jon’s analysis show the strongest linear relationship of key variables in November. This means there is a high probability growing conditions in Central Queensland in November will oscillate from wet/average/dry with the Niño SST index.

POTENTIAL ON-FARM STRATEGIES TO MANAGE EXTREMES

Jon’s research has given growers in the Fitzroy Valley a new ability to better predict weather pattern six-months ahead which has many implications for crop management. These include:

• Optimising planting time

The opportunity to plant in August during El Niño years appears to be a possibility, however, without alignment on minimum temperatures from August to December considerable risks still remain. Without

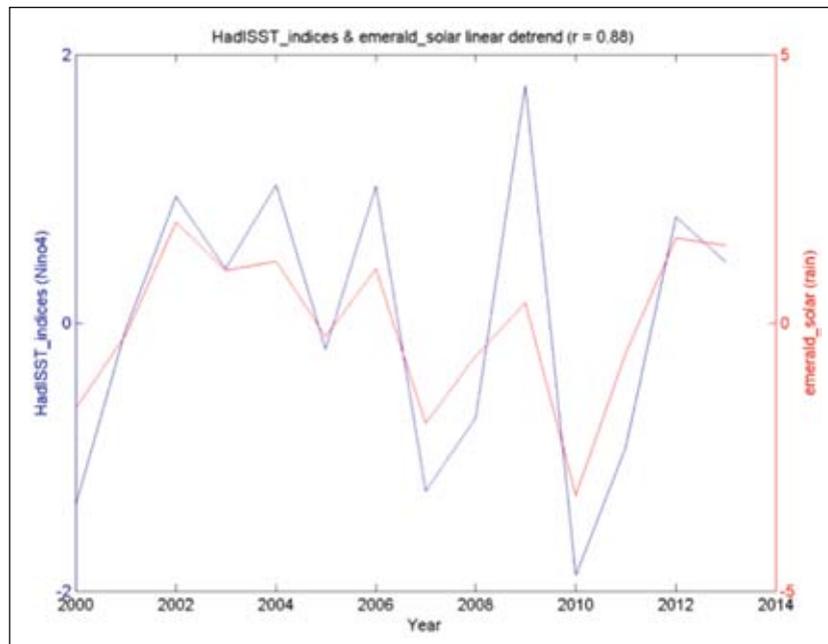


Figure 3. Niño 4 SST indices vs Emerald Solar Exposure 2000-2014. (Source: Bureau of Meteorology)

investigating the contribution of maximum temperatures to overall soil temperatures, it is difficult to align an early sowing practice with a high degree of confidence.

“A later sown crop in November during wet years may be an alternative to missing the increasingly reliable summer rainfall,” Jon says.

“This would push the defoliation/picking window into the autumn period Historical observations for solar radiation and maximum temperatures during April are more than 10 percent higher than any other cotton growing region further south.”

• Fertiliser programs

The risk of a waterlogging during a defined La Niña ENSO phase is high, based on the strength of the connection with ENSO (Niño 4) during the growing season. Matching crop nitrogen supply with demand during these years is required to avoid denitrification occurring from waterlogging

• Crop maturity

Favourable growing conditions for crop development and yield maximisation are increased sunlight (solar radiation) and higher temperatures which occur during positive Niño 4 or El Niño ENSO years. Forward selling product in La Niña years experiencing reduced day degrees and increased rainfall should be met with caution.

• Harvest operations

“Rainfall reliability analysis suggests picking a crop in January when the monthly totals and reliability is improving seems counter-intuitive,” Jon said.

“The difficulties of anticipating extreme rainfall events are increasingly complex due to disconnect between climatic elements and ENSO indices during January and February.

“However, the case for defoliating and picking during January, the peak calendar month for solar radiation and temperature has positive implications for fibre quality and farming logistical challenges.”

WHAT IS ENSO?

ENSO is the state of air pressure and sea surface temperatures in the Tropical Pacific Ocean. Classifications by scientists on the random oscillation between wet and dry include; El Niño, Neutral and La Niña phase. Neutral does not mean average, a neutral year means there is no obvious signal for approaching wet or dry conditions.

WHAT IS NIÑO 4?

Niño 4 Sea surface temperature anomalies measure the distribution of warm and cold water in the western tropical Pacific Ocean. Scientists use these values in assessing thresholds of various phases of ENSO together with atmospheric conditions such as the Southern Oscillation Index (SOI).

KEY POINTS

- Niño SST is aligned with light levels and to a lesser extent rainfall
- Niño SST offers longer range predictions of up to six months ahead
- Central Queensland is unique in that it is one of the few cotton growing regions in Australia able to use SSTs (specifically the Niño 4) with a reasonable degree of confidence for predicting variables affecting growing conditions

More information

Growers can sign up to receive the CottonInfo fortnightly moisture manager e-newsletter, bringing you the latest weather news and information, at www.cottoninfo.net.au

Or contact Jon Welsh jon.welsh@cottoninfo.net.au

see our website

email us



BUILDING FUTURE CAPACITY

THE COAST HAS MET COTTON THROUGH A SCHOOL ART PRIZE; LEAVING A POSITIVE AND LASTING IMPRESSION ON STUDENTS AND TEACHERS AT THIS HIGH SCHOOL FAR AWAY FROM COTTON COUNTRY.

Entry into this year's Archibull Prize has given agriculture and art students and their teachers at Grafton High School on the NSW Mid-Coast a first-hand view of the cotton industry and opened their eyes to a previously 'foreign' industry.

The students combined to complete their cotton-themed Archibull Prize entry named "Tiddalick" with the theme "Sustainable cotton landscapes".

The Archibull Prize is an in-school agricultural and environmental-themed art competition supported by Cotton Australia and industry which involves students being given a bare mold of a cow and a theme from the organisers to be conveyed on the beast. The prize aims to improve communication between rural providers and city consumers by providing opportunities for students to meet young farmers and to gain knowledge and skills about food, fibre and the environment.

"Before being allocated our topic 'sustainable cotton', most of us had no idea of cotton or what it even looked like," Grafton High agriculture teacher Keith Brown says, "most of the students had never been west of the Great Dividing Range."

Once given their sustainable cotton theme, the school started by growing cotton plants in its agricultural plot and researching the cotton industry. They then took a trip over The Range to the Namoi Valley for their first visit to a cotton farm before starting on their entry.

Through the initial research the school realised the importance of water to the industry and were keen to explore how the industry sustainably managed this resource. Then in August a small group of the art and agricultural students and teachers took a three-day trip to Narrabri and Wee Waa to explore a cotton growing area.

Along with CottonInfo Education Officer Trudy Staines and CottonInfo Natural Resources Technical Specialist Stacey Vogel, the students visited the Norrie family's farm "Molle" Narrabri and Gary Coulton's "Federation Farm" near Wee Waa.

"Our visitors met and talked with Matt Norrie and Gary and both growers were able to demonstrate their on-farm water use efficiency activities as well as how they were managing riparian biodiversity," Stacey said

"It was a really rounded trip of the industry, with visits to Cotton Seed Distributors (CSD) at Wee Waa, the Australian



Archibull Prize: Grafton High School Science & Agriculture Teacher Keith Brown, Art4Agriculture judge Wendy Taylor, student project leader Lauren Prior, Brandon Robinson, Jarrah Skinner-Hookey, Jarrod Sowter, Dee Hilton Art Teacher, Dylan Brown.

Cotton Research Institute and Wee Waa High School where they met other agriculture and art students and were given a tour of the school's ag plot by the local students.

"This visit must have had an impact as you can see the theme of water and biodiversity comes across strongly in their artwork on Grafton High's entry."

"Everything on the entry was influenced by what we saw, heard and read about," Grafton High School art teacher Dee Hilton says.

"The program was a great opportunity for everyone involved, which included more than just the students in the program learning about cotton, as I think most of the school wandered into

the art room to contribute to Tiddalick at some time and I had masses of students eating lunch in my art room for a week!"

Student project leader Lauren Prior said the experience had stimulated her interest in agriculture and opened her eyes to the cotton industry.

"The most surprising thing I learned was that this is a large scale industry and how many complex technical processes are involved in growing cotton.

"I never realised how few pesticides are being used and that most producers are growing GM cotton."

More information
staceyvogel.consulting@gmail.com
or call 0428 266 712



Information when you need it

Pathways to NRM collaboration

Are you interested in building partnerships with local cotton growers?

Currently, the Australian cotton industry's joint extension program, by hosting a series of workshops to improve the delivery of NRM best practice information to cotton growers, & to achieve better environmental outcomes in cotton catchments.

If you're a regional interest group in a cotton growing region, then the Pathways to NRM collaboration using myBMP workshop is for you!

Join with CottonInfo's NRM technical specialist Stacey Vogel, key ecosystem service researchers Dr Nancy Schellhorn (CSIRO) & Dr Phaedon Smith (UNSW), & digital technologies & myBMP support specialist Peter Sneyd (NSW DPI) for this half day workshop and gain:

- an introduction to myBMP & its accreditation process;
- an overview of the modules in myBMP;
- the opportunity to meet local CottonInfo team members;
- research summary and question and answer sessions with Dr Schellhorn & Dr Smith.

myBMP: Please direct all enquiries and RSVPs to CottonInfo's Stacey Vogel by **January 31, 2015**

RSVP: Please direct all enquiries and RSVPs to CottonInfo's Stacey Vogel by **January 31, 2015**

Ph: 0428 266 712
E: staceyvogel.consulting@gmail.com

This project is supported by funding from the Federal Government.

Emerald	Toowoomba	Griffith	Narrabri	Narrabri
17 Feb	19 Feb	24 Feb	25 Feb	26 Feb

Agenda:

- Best start
- Collectively NRM campaigns and programs
- Introduction to myBMP and its accreditation process
- Overview of the modules in myBMP

Workshop fee - meet your local cotton industry contacts

- Online registration/reception service research outcomes
- National assets module of myBMP

Even more

REVISED NATURAL ASSETS MODULE NOW AVAILABLE

Cotton growers are always on the look-out for new ways to improve their 'natural assets'.

"As a result the industry has completed a review and update of the Natural Assets module of myBMP to capture best practice recommendations from industry groundwater, riverine and ecosystems service research undertaken over the past five years," says CottonInfo Natural Resources Technical Specialist Stacey Vogel. "The new module also captures changes in natural resource legislation in QLD and NSW and contains new resources and tools to assist growers implement best practices for natural resources on their farm."

To improve delivery of this NRM best practice infor-

mation to cotton growers, CottonInfo will be running a series of workshops with regional NRM groups in cotton growing regions in February 2015. CottonInfo will also hold grower myBMP natural assets workshops later in 2015.

Interested in attending a workshop or like more information about the Natural Assets module?

www.myBMP.com.au
www.cottoninfo.net.au
Stacey Vogel 0428 266 712 or
staceyvogel.consulting@gmail.com

Or your local Regional Development Officer





FLOODS CRUCIAL FOR ONGOING ACCESS TO GROUNDWATER

NEW RESEARCH IN SOUTH-EAST QUEENSLAND IS DEVELOPING A CLEAR UNDERSTANDING OF THE SIGNIFICANCE OF FLOODING FOR SUSTAINABLE GROUNDWATER USE.

Researchers Dr Bryce Kelly from The University of NSW and Dr Dioni Cendon from the Australian Nuclear Technology and Science Organisation are analysing the chemistry of groundwater in the Condamine Catchment to map where and when the Condamine River Alluvial Aquifer is being recharged.

In the Condamine Catchment and other catchments throughout the Murray-Darling Basin, floods over millions of years have created the level landscape ideal for broadacre farming. Flooding rains transported weathered material from the volcanic and sedimentary rocks that surround the Condamine plain and deposited the sedimentary grains that formed the fertile grey and black cracking soils, known as vertosols. These soils are unique in their capacity to hold water throughout our harsh dry spells and to sustain high-yielding crops.

Bryce says over the past 50 years there has been considerable debate about the amount of groundwater that can be allocated to sustain irrigated agriculture, and there has been a desire to have a single figure for groundwater allocations.

"It is clear from our research that ongoing access to groundwater will be related primarily to flood frequency," Bryce said.

"How many floods will we have in the next few decades? Nobody knows: we can make an estimate by looking at past rainfall and stream flow records, but our climate is dynamic and will continue to change.

"The climate throughout the 1960s to today will not exactly match what we experience in the next few decades or centuries.

"We will always need to monitor groundwater levels, and to manage allocations in balance with our economic and environmental goals during times of both rising and falling groundwater levels."

By studying the isotopic composi-

tion of the oxygen and hydrogen atoms that form water molecules and analysing the salts that are dissolved in rain, surface and ground water, the origin of the water can be traced.

"The chemistry of groundwater from irrigation bores throughout the Condamine Catchment indicates that recharge to aquifer depths from which groundwater is pumped occurs only following rainfall of at least 400 millimetres per month - yet this occurs on average once every four years," Dioni Cendon said.

"Such rainfall is usually associated with extra-tropical lows in spring and autumn, and the remnants of tropical cyclones in summer.

"Meanwhile, contributions to groundwater recharge from irrigation deep drainage, rainfall over the wider landscape or river leakage under normal streamflow conditions are small and recharge from hard rock aquifer systems, in particular the Great Artesian Basin, is small.

"Floodwater is the primary, and in some places only source of groundwater recharge."

Dating and tracing water movement using Tritium

Interestingly, by measuring levels of tritium, a byproduct of nuclear bomb testing, scientists can measure whether recharge has occurred before or after tests were undertaken in the 1950s and '60s.

The concentration of tritium increased in the atmosphere after these nuclear tests, and this tritium is incorporated into raindrops. Higher tritium activity (an indirect measure of concentration) in groundwater indicates recharge must have occurred within the last 70 years.

Tritium activity measurements from groundwater samples throughout the Condamine Catchment indicate that recharge to the Condamine River Alluvial Aquifer system is primarily along the river corridor.

"This corridor must be protected



from developments that may hinder aquifer recharge during floods," Dioni said.

"We can refine the mapping of recharge zones and enhance the recharge during major floods,

"While some may argue that the floodwater is needed further down the Darling River system, skimming a small portion of the floodwaters and enhancing recharge to the alluvial aquifer would have both economic and environmental benefits.

"We are underutilising the dams already created by nature, and unlike new surface dams, we would be storing water in an evaporation-free environment.

"There are some studies exploring managed aquifer recharge as part of optimising catchment water management, but much more needs to be done.

"Groundwater is critical for the economic viability of many farms throughout the Condamine Catchment and many other cotton growing catchments in Australia.

"Groundwater geochemical studies, such as this project just undertaken in the Condamine, will help us to sustainably manage groundwater and we aim to investigate other catchments of interest for the cotton industry using similar techniques."

UNSW honours student Lucienne Martel and Dr Dioni Cendon sampling irrigation bore water.

More information

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WELL WATERED REFUGES PROVIDE STRONGEST SUPPORT TO RESISTANCE MANAGEMENT

A WELL WATERED REFUGE IS MORE LIKELY TO SUSTAIN LARVAE TO PUPATION AND CONSEQUENTLY BE MORE EFFECTIVE AT DELAYING BT RESISTANCE.



Glasshouse pot trials show the effect of nutrients and water on pigeon pea. The pale green plant on left was a nil-nitrogen/normal water treatment, while the plant at right was treated with nitrogen and low water.

Refuge crops are arguably the most important tactic of the Australian cotton industry's resistance management strategy for Bollgard II cotton. In a season where the industry has reduced cotton plantings due to low water allocation, there is an increased risk that the management standard of refuges drops.

Spotlight spoke with CottonInfo IPM and Stewardship Technical Specialist Sally Ceeney about the impact of having poorly managed refuges on resistance management for the industry.

"Refuges are particularly important in dry seasons, when there is reduced natural, non-structured refuge, and so the selection potential from Bollgard II is higher," Sally said.

"In the past, seasons that have been hot and dry have also coincided with a reduction in compliance of refuge management as water is applied to the commercial cotton crops, and refuges are left water stressed."

Sally says that for refuges to be most effective at managing resistance, they need to produce large numbers of susceptible *Helicoverpa* moths.

"While much work has been

done on assessing the attractiveness of pigeon pea and unsprayed non-Bt cotton refuges to adult female *Helicoverpa*, the number of eggs laid in a refuge does not necessarily tell us how well that refuge is performing, or how many moths it is producing," she says.

"Several factors may contribute to the production of moths from refuges, including management."

Best management for best survival

A CRDC-funded PhD study by Dominic Cross and The University of Sydney with CSIRO investigated how varying rates of water and fertiliser can impact survival rates of *H. armigera* larvae in pigeon pea and non-Bt cotton refuges. In glasshouse experiments, non-Bt cotton and pigeon pea plants were grown under varying water and fertiliser rates, and the number of eggs laid and survival rates of *H. armigera* were observed and analysed alongside the characteristics of the plants on which they were tested.

Results show that varying rates of water and fertiliser significantly impact the survival of *H. armigera* larvae on non-Bt cotton and pigeon pea plants.

"For pigeon pea, larval survival was lowest on plants watered at a wilting rate, and highest on plants watered at the normal level, particularly when they were also provided with adequate fertiliser," Dominic said.

"Similar results were seen on non-Bt cotton where larval survival was again lowest on plants watered at a wilting rate, and highest on plants watered at the normal level.

"The addition of nitrogen fertiliser had a larger impact on non-Bt cotton plants than on pigeon pea plants, with highest larval survival on the treatments with the optimum fertiliser rate. "Adding fertiliser at rates in excess of optimum levels did not increase survival rates of larvae."

Sally says these results show that water is absolutely critical to the maximum production of pupae.

"A well-watered refuge is more likely to sustain larvae to pupation and consequently produce more moths and be more effective at delaying Bt resistance than minimally watered pigeon pea or cotton refuges," she said.

Importance of reproductive plant parts
Another aspect of Dominic's PhD study was investigating which parts of the plant were essential to the develop-

"THE EFFECTIVENESS OF PIGEON PEA IS DEPENDENT ON THE PRESENCE OF THE PLANT'S BUDS, FLOWERS AND PODS."



THE NEW WAY TO HELP PROTECT HONEY BEES

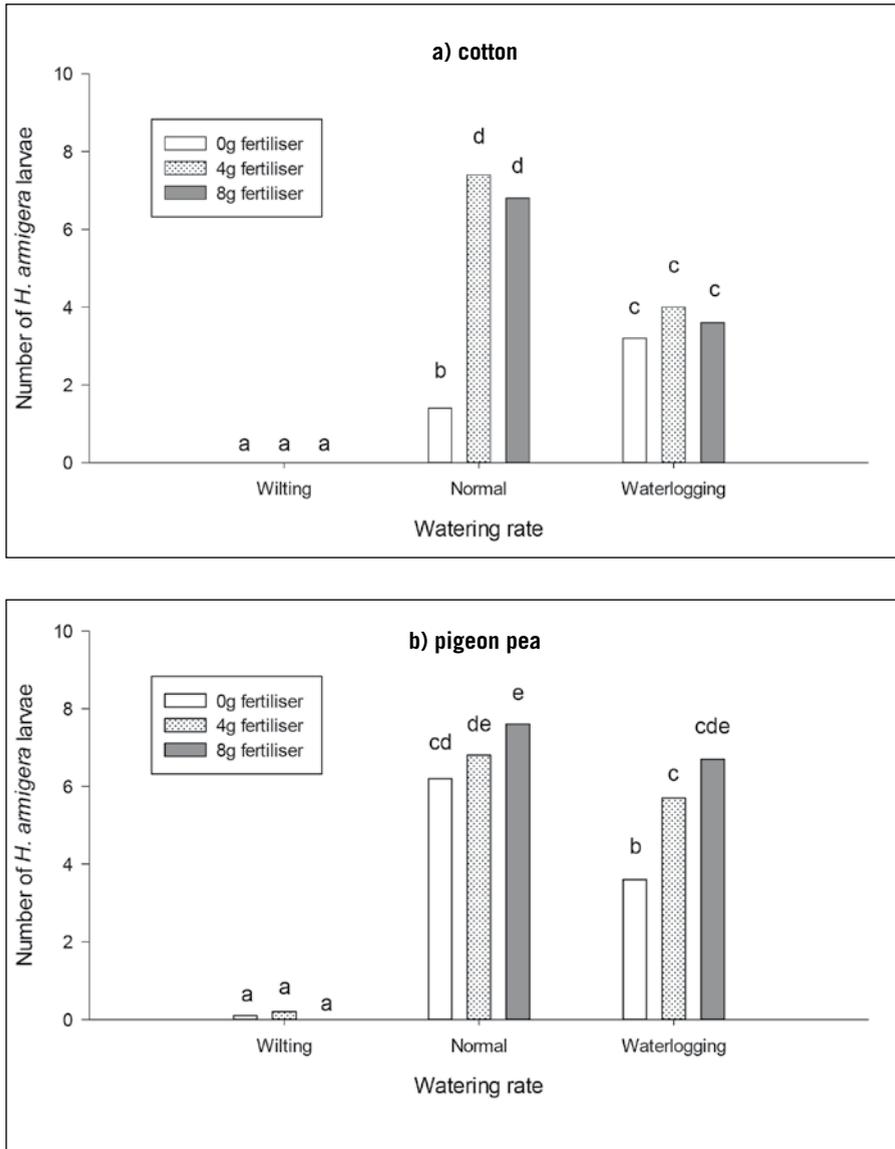
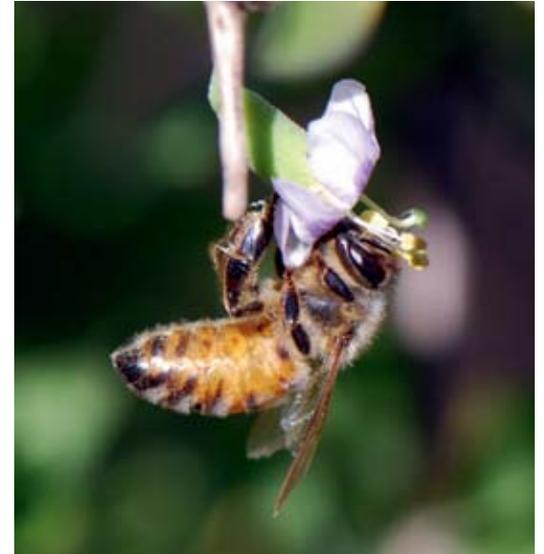


Fig. 1. Survival of *H. armigera* on cotton and pigeon pea plants grown under wilting, normal and waterlogging watering treatments in combination with 0g, 4g and 8g of fertiliser (N).

ment and survival of larvae.

Under field conditions, pigeon pea produced up to five times more pupae than cotton, even when using the same crop management techniques.

These results support the current RMP requirements that pigeon pea refuges need to be only half the area of non-Bt cotton refuge to produce the amount of moths. However the key finding was that the effectiveness of pigeon pea was dependant on the presence of reproductive plant parts (buds, flowers and pods) - if only foliage was present, then cotton was a better refuge than pigeon pea.

If pigeon pea refuges are to be effective at producing *Helicoverpa* spp. moths, they need to be managed in such a way that they bear flowers and fruits. A poorly managed pigeon pea crop that is water stressed and produces few flowers will not be able to support larvae and will act as poor refuge. In these conditions, it is likely that a non-Bt cotton crop with adequate management would outperform a poorly managed pigeon pea refuge.

Sally has encouraged growers to focus on how the refuge crop is managed to maximise production of susceptible moths.

“In dry seasons, the decision to apply scarce irrigation water to a refuge is difficult, but it is important to remember that this is when refuges are most critical, and that poor management of refuges, in particular, insufficient irrigation, is the greatest barrier to producing more Bt-susceptible moths and potentially compromises resistance management,” she said.

More information

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Did you know cotton farms can be a high risk environment for bees, particularly during long periods of dry weather? As pollen in native vegetation becomes increasingly scarce, cotton becomes one of the most attractive sources of pollen and nectar – and honey bees will travel for up to seven kilometres to find good sources of it.

The honey bee industry has recognised that cotton can be a potentially useful feed source, and so hives may be placed in close proximity to cotton. However bees are particularly susceptible to many of the insecticides still used in cotton production (such as fipronil, clothianidin, abamectin, indoxacarb and pyrethroids) which is why communication between growers and beekeepers is important.

To help growers be aware of hives near their farms, CropLife Australia and the Australian Honey Bee Industry Council have launched [BeeConnected - a website and mobile app](#) to allow all farmers, including cotton growers, and beekeepers to notify each other of their crop protection activities and hive locations.

Beekeepers can log the location of bee hives, while farmers and spray contractors can log the location of activities involving the use of crop protection products.

More information

To download BeeConnected visit www.croplife.org.au/beeconnected.

BeeConnected is available at no cost on iPhone, Android and desktop computers, and replaces BeeAlert, the original cotton industry bee protection program.

The cotton industry's 2014-15 *Cotton Pest Management Guide* is also available as a complete information source to implement successful Integrated Pest Management Practices on-farm.

Visit www.cottoninfo.net.au for your copy.





RESISTANCE MANAGEMENT OF COTTON APHID AND TWO-SPOTTED MITE

RESEARCHERS HAVE DISCOVERED A TURN AROUND IN THE NUMBERS OF TWO KEY COTTON PESTS.

Resistance testing on sucking insects as part of the cotton industry's ongoing resistance monitoring program found that the numbers of two spotted mite (TSM) had significantly increased and cotton aphid was almost absent in the 2013-14 season. This is the opposite of the findings from the previous season's survey.

While the turnaround in mite numbers was due to environmental factors such as weather and in some cases coupled with use of products against other pests such as mirids that tend to reduce predator abundance, insecticide resistance testing on these cotton pests has also showed a number of changes to previous seasons.

Dr Grant Herron leads the NSW DPI Entomology Insecticide Resistance Team and says TSM and cotton aphid samples were collected for resistance testing from across cotton growing regions by researchers, consultants and growers. The insect samples were then exposed to a range of doses of applicable insecticides in the laboratory to determine the occurrence and extent of resistance within different strains of the insect.

"Insecticide resistance develops when an insecticide is used to control a pest," Grant says. "Inevitably some insects carry a gene for resistance to that chemical and can survive the chemical treatment. When these individuals reproduce, subsequent offspring survive and multiply with that resistant gene.

"The problem is exacerbated when broad-spectrum insecticides are used on a target pest that also depletes beneficial insect populations which would otherwise assist with killing off surviving resistant pests."

Insecticide resistance monitoring is an essential component of the cotton industry's Insect Resistance Management Strategy (IRMS) with results of the monitoring program used to ensure the IRMS remains effective and relevant to the country's dynamic insect populations.

Two-spotted mite resistance levels

"Our testing of TSM showed survivorship against discriminating doses of bifenthrin (Talstar), abamectin (Agrimec), propargite (Comite) and diafenthiuron (Pegasus (CGA-140408))," Grant says.

"Testing revealed that more than 50 percent of the TSM strains were bifenthrin (Talstar) resistant, with one strain 72 percent resistant and another virtually 100 percent resistant, and the reason for such an increase is not clear.

"Similarly, abamectin (Agrimec) resistance was detected in six out of the 11 TSM strains and worryingly one of those strains was 79 percent resistant.

"This possibly relates to abamectin being applied as a prophylactic (preventative) treatment in combination with mirid sprays."

Although three TSM strains showed some survivorship to diafenthiuron (Pegasus (CGA-140408)), Grant considers this was likely a result of a natural vigour tolerance in the strains to diafenthiuron rather than actual resistant genes. To allow for this he will adjust his testing method by increasing the laboratory discriminating dose to avoid those false positives next season.



Good aphid management involves effective sample through correct identification as not all aphid species found in cotton crops will breed and do not need spraying.

KEY POINTS FOR APHID CONTROL

- When applying aphicides as foliar sprays, rotate subsequent sprays between chemical groups.
- When using at-planting treatments, consider potential resistance implications for subsequent foliar sprays ie: if foliar sprays are required for aphid control and neonicotinoid seed treatments have been used, the first foliar spray, targeting aphids, must be from a different chemical group.
- Don't follow a control failure with another product from the same group.
- Maintain beneficial insects by using the most selective chemical option (rather than a broad spectrum chemical), if aphids or other pests need to be controlled.
- Reduce on-farm overwintering hosts for aphids, so there is a host free period during the year. This will help reduce abundance of cotton aphids and plants that might carry CBT disease through winter (such as marshmallow and volunteer/ratoon cotton)
- Sample effectively for aphids and check species. Not all aphid species that land on cotton will breed and require spraying.
- Observe the control thresholds for aphids before spraying.



Cotton aphid resistance

In 2010-2011, 96 percent of cotton aphid strains tested showed some level of neonicotinoid resistance (ie Actara-Cruiser or Shield). However that figure had fallen to 29 percent in 2011-2012 and the 2012-13 season was similar with 33 percent neonicotinoid resistance.

“I speculated in 2013 that neonicotinoid resistance may plateau at approximately 30 percent of populations tested, however, in season 2013-2014 neonicotinoid resistance was not detected in any strain that originated from cotton,” Grant said.

“However, before I consider that neonicotinoid resistance in cotton aphid is under control (as it is now for pirimicarb - Pirimor) aphid abundance will need to return to more usual levels.”

Grant said that, pirimicarb (Pirimor) and OP-specific resistance was not detected in any cotton aphid strains collected from cotton, but was detected in strains from a watermelon crop. This indicates the potential to reselect this form of resistance in cotton aphids if there is overuse of these products.

Resistance Management

Integrated Pest Management is the key to successful insect control because it includes all available control tools to achieve economic control.

“If you suspect resistance has developed in your farming system remember you will usually not spray your way out of a resistance problem - just further into one,” Grant said.

“If resistance is suspected stop using the product immediately - check the crop and assess aphid numbers to determine if a follow up treatment is still necessary. If further control is required select an insecticide from a different chemical group to that just used.

“When selecting an alternative product be mindful there is some cross resistance between the 1A carbamate and the 1B organophosphate groups. For aphid control this means cross resistance between group 1A pirimicarb (Pirimor) and the group 1Bs omethoate (Folimat) and dimethoate (Rogor).”

More information

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2014-15 Australian Cotton Pest Management Guide
Available on-line at
www.cottoninfo.net.au



KEY POINTS FOR TWO-SPOTTED MITE CONTROL

- When applying foliar sprays, rotate subsequent sprays between chemical groups and do not follow a failure with another product from the same group.
- Be mindful that prophylactic use of treatments such as abamectin being applied in combination with mirids sprays will select resistance in co incident mites.
- Maintain beneficial insects by using the most selective chemical option.
- Sample effectively before spraying and note the species because strawberry mite and two-spotted mite especially look very similar but only the latter cause severe crop damage.



Sample effectively before spraying for two-spotted mite and take careful note for correct identification, as strawberry mite and two-spotted mite look very similar, however only the latter causes severe crop damage.

ABAMECTIN RESISTANCE ON THE RISE

Results from the 2013-14 resistance monitoring program show a concerning increase in the incidence of abamectin (Agrimec) resistance in two spotted mite (TSM).

Positive resistance to abamectin in TSM was rarely detected until 2010-2011, when resistance was found in three out of the four TSM strains tested.

Since then abamectin resistance has been regularly detected and last season showed abamectin resistance in six out of the 11 strains tested. Worryingly one of those strains comprised 79 percent resistant TSM.

“These results for abamectin suggest restraint in usage is now required,” CottonInfo IPM Technical Specialist Sally Ceeney said.

“A common use pattern for abamectin has been to apply in combination with mirid sprays as an ‘insurance spray’ against mites.

“Mirid sprays can be disruptive of beneficials so the inclusion of abamectin reduces the risk of subsequent mite outbreaks. However, this practice may ultimately lead to abamectin failure against mites as it is still selecting for resistance in the mites even when they are at low levels.

“A wide range of beneficials will attack mites as food. In the low spray Bollgard II environment beneficial abundance has broadly increased and this has meant that over the past 10 years mites have gradually declined in frequency as a problem.”

“This would suggest that insurance sprays against mite outbreaks in most situations may be unnecessary, and may be having a negative impact by increasing the levels of abamectin resistance.”

“Instead a valuable strategy is to monitor the mite population closely and the presence of predators in mite colonies – including thrips.”

Tracking the mites over several samples will indicate if they are decreasing (effective predation), static (possible effective predation) or increasing (insufficient predation).

This can help in deciding if addition of a mite spray to a mirid spray is justified. Only if the mites are in reasonable numbers and increasing quickly would addition of a prophylactic mite spray be justified – and the selection of miticides should be in line with the IRMS. Further, selection of mirid control options that have less negative effect on beneficials and less risk of flaring mites will further reduce the risk of mite outbreaks.

ISSUES TO CONSIDER

- Spraying mirids below threshold may increase the chances of flaring other pests, such as mites and SLW
- The use of an ‘insurance’ spray against mites at below threshold values may increase the risk of resistance

KEY POINTS

- Sample effectively for mites and observe if there are beneficials in colonies. Track trends - are mites increasing, decreasing, static?
- Control pests at or above industry recommended thresholds
- When making spray decisions and insecticide choices, consider the impact on beneficials and risk of flaring non-target pests
- More information on insect thresholds, control options and impact on beneficials can be found in the 2015 Cotton Pest Management Guide www.cottoninfo.net.au

INVESTING IN WORLD-LEADING RD&E.

OUR INVESTMENT in cotton RD&E over the past 24 years has delivered - and continues to deliver - outcomes for growers, the industry, and cotton communities.

In 2013-14, we invested \$22 million in more than 200 RD&E projects on behalf of growers and the Government, working with many core research partners across our five key investment areas: farmers, industry, customers, people and performance.

In this special *Spotlight* feature, we're outlining some of the critical areas that we are currently investing in.

You can find more detail on all of the topics mentioned in our 2013-14 Annual Report, which is available from the publications section of our site www.crdc.com.au/publications.

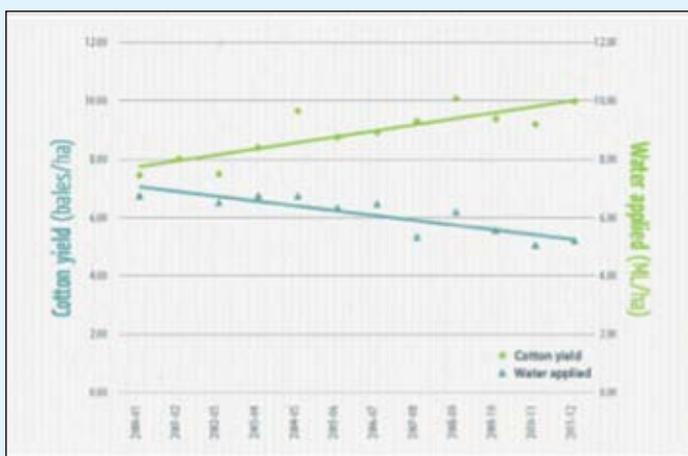
You can also find a full list of CRDC's current research projects (more than 200 of them!) online at www.crdc.com.au/research-development.

OUR MAJOR FOCUSES DURING 2013-14: FOR OUR FARMERS

Continued improvements in water use efficiency

One of the greatest success stories for Australian cotton, with significant gains made over time. Importantly, this work has continued in 2013-14, with investments into optimising crop water use and promoting water smart infrastructure, ensuring our industry's gains continue their upward trend.

Irrigated cotton yields and irrigation water applied in Australia 2001-12.



Source: Roth 2013

Monitoring and managing for disease threats

New and existing disease threats continue to challenge the industry – so our investment focuses on better understanding those threats and developing strategies and management tactics to address them. Disease surveys on farms across NSW and QLD, combined with data from experiments and observations provide strategies for Integrated Disease Management: aimed at decreasing the spread and severity of diseases.

Reducing reliance on insecticides

While total insecticide use in cotton has reduced by more than 90 percent in the last decade, within Integrated Pest Management (IPM) programs there is still very strong reliance on a few key products when a pest issues arises. Our future challenge will be to maintain low total insecticide use as pest threats and product availabilities continue to change. As a result, our investment is looking at refining pest damage thresholds and developing management tactics, to help growers continuously use less insecticide.

Making the most of nitrogen

The yields of Australian growers are the highest in the world. But high yields result in high rates of nutrients being removed from the soil, and



CRDC's investment in cotton RD&E over the past 24 years has delivered - and continues to deliver - outcomes for growers, the industry, and cotton communities.

the need for fertiliser to replace those nutrients. And, at the same time, fertiliser costs (particularly nitrogen (N)), continue to increase. So, we continue to invest in research aimed at better understanding how N can be optimised - to reduce overall N use and improve its efficiency. That's not only good for your bottom line, but also good for the environment.

Measuring soil carbon in cotton

Measuring soil carbon can be time-consuming and costly, so we are investing in a project to develop a relationship between soil carbon levels, the management practices being used on the farm, and temperature and rainfall conditions. Under this project, irrigated corn was identified as a potential crop to help increase soil carbon levels in a cotton-based farming system, and the preliminary results have been impressive, with a range of benefits being seen in the corn rotation. These have included increased yield of cotton in the crop following corn, higher levels of soil carbon (especially at depth; ie 60-120cm), increased cotton root densities and rooting depth, and a decrease in black root rot infestation.

Smart automation system for furrow irrigation

Cotton growers are under constant pressure to produce more cotton with less, including less water and less labour. Smart automated furrow irrigation potentially provides a solution for these very real constraints. This CRDC-funded project will develop a commercial prototype system which sees the integration of real-time optimisation software with a surface irrigation automation system. The output from this project will

.. FOR YOU, OUR COTTON GROWERS



MELANIE JENSON



MELANIE JENSON

Looking after our precious natural resources - one of CRDC's research projects has found that old growth river red gums can store almost 400 tonnes of carbon per hectare per year which is equivalent to the carbon emitted by 290 Holden Commodores in a year.

Managing our herbicide resistance risk

Herbicide resistance in cotton is a serious industry issue – particularly for glyphosate. Seven weed species have been confirmed as glyphosate resistant, and this issue is costing growers up to \$60 per hectare per season in increased weed control. As a result, CRDC commissioned the development of a Herbicide Resistance Management Strategy (HRMS) for cotton. You can download it in full from our website: www.crdc.com.au/publications.

Protecting our industry from a biosecurity threat

We are investing in a number of projects to help the industry deal with biosecurity threats: be it through surveillance or the development of diagnostic protocols and contingency plans. Our surveillance for exotic cotton viruses project helped identify cotton blue disease - the second most damaging virus disease to commercial cotton and a significant threat to Australian cotton - in Timor Leste in 2013. This disease is a Plant Health Australia priority pest, and a national diagnostic protocol is currently being developed as part of the CRDC-funded project.

Looking after our precious natural resources

Research is underway in a number of natural resource management areas – including understanding what role trees play in addressing the lateral flow of groundwater in salty areas; the connectivity of groundwater aquifers; and the value of the services provided by natural vegetated areas, like erosion control, carbon storage and keeping pest thresholds lower for longer. One of the research projects has found that old growth river red gums can store almost 400 tonnes of carbon per hectare per year (equivalent to the carbon emitted by 290 Holden Commodores in a year).

Managing climate change

Medium term climate change models forecast an increase in average daily temperature, the concentration of carbon dioxide and the frequency of extreme weather events (especially periods of drought), as well as an increase in the intensity of rainfall events – all of which could significantly affect cotton. CRDC is investing in a number of projects to better understand the implications and the appropriate management responses (adaptation), with a particular focus on temperature (extent of extremes and seasonal averages), carbon dioxide concentration and waterlogging/flooding.

be a fully tested, commercial prototype adaptive real-time system for the automation and control of furrow irrigation. Watch this space!

Growing better fibre and textile quality.

What happens in the field can impact the quality of cotton as a fabric, so we are investing in a project to assess the impact of different management strategies and practices (like cotton picking and ginning) on cotton's end fibre quality. It will help growers refine their on-farm activities to optimise both quality and yield.

OUR MAJOR FOCUSES DURING 2013-14: FOR OUR INDUSTRY

Research underpinning the Cotton to Market strategy

The industry marketing strategy by Cotton Australia with the assistance of the Australian Cotton Shippers Association (ASCA) and CRDC, Cotton to Market, is underpinned by sophisticated market intelligence about current markets and potential opportunities for Australian cotton – provided through CRDC's investment. We're proud to work with our industry partners to improve cotton's market access.

Development of the Bollgard 3 resistance management plan

Preserving the efficacy of Bt cotton to control insect pests is vital to the industry – and CRDC has been playing a leading role since Bt cotton was first introduced in 1996. With Bollgard 3 set to be released next year, the development of the resistance management plan (RMP) for Bollgard 3 has been a major focus in 2013-14.

OUR MAJOR FOCUSES DURING 2013-14: FOR OUR CUSTOMERS

Novel spinning software to predict final yarn quality

CRDC invested in the development of Cottonspec by CSIRO – in collaboration with a range of mills in China. Cottonspec is a novel spinning software technology designed to improve mill efficiency by offering accurate prediction of final yarn quality, based on raw fibre inputs and spinning techniques. Preliminary results have shown that, used within a modern spinning mill, Cottonspec can accurately predict key properties such as yarn tenacity and evenness. Commercial-scale use of the software has shown its capacity to reduce raw material costs by enabling the replacement of higher-Ne Pima cotton with premium upland cotton for premium yarn production, and its capacity to improve mill efficiency. Discussions are continuing about commercialisation plans for the technology.

Sensors to prevent cotton contamination

Australian cotton is able to command premiums on the fact that it has very low levels of contamination – however, the plastic that encases the new round modules may present a contamination risk that could threaten our reputation with the mills. As a result, CRDC has invested in a project with CSIRO to develop low-cost camera base sensors in gins, which provide gin operators with a view of the feed rollers or beaters to determine if they become contaminated with plastic wrap. Commercial interest in the system is high.

Understanding what impacts cotton dye uptake

Dyeing of cotton is a major cost in garment production. It may be influenced by the quality of cotton; however limited information is known of the key factors of the cotton fibre that may affect dye uptake and dyeing efficacy. As a result, we are funding a project to assess the physical and chemical properties of cotton fibre and their influence on dye uptake.

Design of thermal cotton and wool blend fabrics

Cotton and wool blends provide a number of thermal advantages in finished garments, and as the majority of cotton/wool blends are knitted garments, there's a market opportunity for a new range of woven garments.

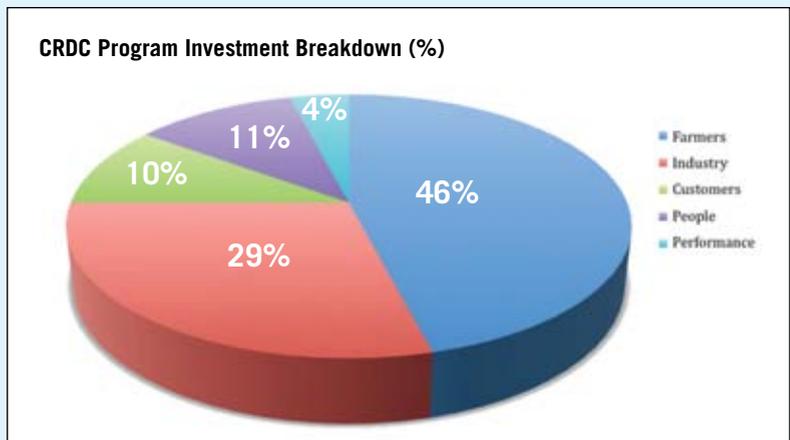
CRDC is investing in a project to develop a new range of thermal woven fabrics made from cotton and wool, designed with different thermal ratings for wear as dress and casual shirts across different seasons.

Scoping a new future for cotton fibre

Cotton is losing market share in all sectors of apparel and as such CRDC has commissioned a project to assess future trends for fibre use and identify key opportunities for cotton. The project has identified a number of short and long-term opportunities, including reducing the environmental impacts associated with making denim (denim, an iconic cotton fabric, is increasingly being produced with other fibres that have a claimed lower environmental impact) and improving the functionality of cotton fabrics to enable them to better compete with man-made fibres (for example, heat and moisture management, anti-bacterial properties and stain repellency).

Converting cotton gin trash to bioethanol

Cotton gin trash has long been considered a waste product, with limited use as compost at best. CRDC has invested in a project aimed at adding value to this trash by looking at alternative uses: providing gins with alternative sources of income and improving the sustainability of the industry. The project has particularly focused on processing cotton gin trash to produce bio-fuels and other bioproducts – and the results show that trash could be an ideal feedstock for bioprocessing into sugars and subsequently ethanol.



CRDC has invested in the development of the Cottonspec technology with CSIRO, which can accurately predict key properties such as yarn tenacity and evenness.



MELANIE JENSON

OUR MAJOR FOCUSES DURING 2013-14: FOR OUR PEOPLE

Attracting, developing and retaining cotton's people

The issues of attracting, retaining and developing people in the cotton sector require effective workforce development right across the supply chain. What's missing currently is a comprehensive understanding of the workforce development system; an analysis of what's working well and what needs to be improved; and a framework to link it all together. We believe that without these elements, there is often limited impact from project investments - training may be delivered but people do not have positions to go to; or the impacts are very short-term and people are attracted into the sector but do not stay in the long-term. As a result, we are currently investing in this area.

Keeping people safe on our farms

Health and safety continues to be a major concern for cotton growers and employees within the cotton industry. While there is compelling evidence that the cotton sector is a leading performer in terms of health and safety, there is a requirement to continue to improve to meet the aspirational levels articulated within *myBMP*. The cotton industry has also recognised that its health and safety data, relied upon for decision-making, is not entirely accurate or current. As a result, CRDC invests in projects in this area, ensuring the industry can continue to meet its targets, and the data used for decision-making is up to date.

Building our future talent

CRDC proudly invests in a number of initiatives focused at the school, undergraduate and post-graduate levels to help ensure the industry is able to attract talented young people. These programs include the Primary Industries Centre for Science Education (PICSE) program, the Primary Industries Education Foundation (PIEF), the Rural Industries Research and Development Corporation (RIRDC) Horizon Scholarship program and CRDC's own summer, honours and PhD student scholarship programs. CRDC also supports a part-time education officer, based at the Australian Cotton Research Institute, to implement a range of activities in schools to boost knowledge of the industry and its career options.

Developing our current leaders

We are also proud to help support the development of leadership skills among the existing cotton industry. Our industry requires leaders who are able to develop and broker solutions, as well as advocate for the industry in the public arena and in boardrooms. CRDC supports a number of leadership development opportunities, including the Cotton Australia and CRDC Future Cotton Leaders program, Nuffield Scholarships, the Australian Rural Leadership Program and the Peter Cullen Trust Science to Policy leadership program.

OUR MAJOR FOCUSES DURING 2013-14: FOR OUR PERFORMANCE

Linking research with extension and best practice

CRDC's work in research and development also extends to the critical functions of extension, through the joint CottonInfo program, and best practice, through *myBMP*. CottonInfo is designed to deliver research and development outcomes and best practice information to growers and the wider industry, while *myBMP* sets the industry's best practice performance criteria and provides the framework for growers to participate and be accredited in best practice. CRDC plays an important role in both programs: supporting CottonInfo's management, communications and technical specialists, and providing the research to underpin the best management practices within *myBMP*. CRDC is proud to support both programs along with joint partners Cotton Australia (CottonInfo and *myBMP*) and CSD (CottonInfo).

Understanding our growers through the Grower Practices Survey



MELANIE JENSON

CRDC proudly invests in a number of initiatives focused at the school, undergraduate and post-graduate levels to help ensure the industry is able to attract talented young people.

Our survey of growers gathers invaluable information about cotton farming practices – helping us monitor trends over time, evaluate research outcomes, plan new projects, identify priority issues and tell the industry's story. The 2013 Grower Practices Survey found that 91 percent of growers consider research and development to drive continuous improvements in the Australian cotton industry, while 86 percent believe that cotton is profitable and consistently their crop of choice.

The full report is available from the publications section of our site www.crdc.com.au/publications.

see our website

For a full list of current 2014 research projects go to www.crdc.com.au/research-development.

see our website





COTTON'S GLOBAL FOCUS ON THE INTER-FIBRE CHALLENGE

THE FOCUS OF THIS YEAR'S INTERNATIONAL COTTON ADVISORY COMMITTEE (ICAC) WAS "FROM LAND TO BRAND", AND SOUGHT TO IDENTIFY HOW THE GLOBAL COTTON INDUSTRY COULD BEST PROMOTE COTTON AGAINST THE ON-GOING CHALLENGE OF THE INCREASING SHARE OF MAN-MADE FIBRES IN THE GLOBAL TEXTILES MARKET.

CRDC Chair Mary Corbett, Executive Director Bruce Finney and R&D Manager Allan Williams attended this year's ICAC meeting held in Thessaloniki, Greece in December. Cotton Australia's Michael Murray was also part of the Australian delegation, which was both led and ably assisted by Christopher Parker and Russell Phillips from the Commonwealth Department of Agriculture.

While there is a vast range of cotton farming systems, trade policies and socio-economic conditions among the member countries of ICAC, the meetings provide the opportunity for identifying and progressing the shared interests of cotton-producing nations, both developed and developing. These include addressing the sustainability of cotton growing, the classification of cotton, and the promotion of cotton in the global textile market-place. While there is competition between countries in the market for raw cotton, there is nevertheless an imperative for the cotton sector as a whole to work together to counter the threat from man-made fibres (MMF). The ICAC meetings provide an annual forum for members to share their experiences and identify opportunities for greater collaboration. ICAC is also the host organisation for the World Cotton Research Conference, which will next be held in Brazil in 2016.

The Australian cotton industry is helping to lead the way in addressing the global opportunities for cotton. At the conference, the recently produced *Australian Grown Cotton Sustainability Report* was used by Allan Williams in his report as Chair of the Expert Panel on the Social, Economic

and Environmental Performance of Cotton (SEEP) to highlight the importance of collecting and reporting information on the sustainability performance of cotton. The report was used to demonstrate how a global effort to agree on a core set of indicators, as undertaken by SEEP, can be used by a national industry to promote the performance of cotton nationally and internationally.

Michael Murray also made a presentation "Highlighting the Australian Cotton Story: Strengthening our Brand" in which he provided an overview of the *myBMP* Program. Michael highlighted the Australian cotton industry's responsible production methods, high yields, consistent quality, water and pesticide usage efficiency gains, and how the industry's participation in the Better Cotton Initiative (BCI) and Cotton LEADS provided forums for the industry to 'tell its story', and to promote to the international marketplace Australia's track record of supplying high quality, responsibly produced cotton.

Through both the cotton classers association and CSIRO, Australia participates in the Committee for the Standardised Instrument Testing of Cotton (CSITC). Since the establishment of CSITC under the auspices of ICAC, 31 international 'round trials' have been conducted. These trials assess the performance of classing houses in their classing of a reference cotton sample, and are designed to improve the global consistency of cotton classing. The performance of Australian classing houses has continued to improve, and all Australian

ABOVE: The Australian cotton industry is leading the way in addressing global opportunities for cotton, evidenced by the release of the *Australian Grown Cotton Sustainability Report*. The report was presented at the recent ICAC meeting in Greece by CRDC R&D Manager Allan Williams to illustrate the importance of collecting and reporting information on the sustainability performance of cotton.

instruments perform better than the worldwide average.

Despite the in-roads of MMF, there were some positive trends reported to the meeting. Population growth, together with urbanisation and rising living standards is giving consumers (especially in developing countries) more discretionary spending power, which supported a five percent year-on-year increase in global apparel sales over the past 15 years. Cotton remains one of the most important and widely produced agricultural and industrial crops in the world. It is grown in more than 80 countries on about two percent of the world's arable land, making it one of the most significant in terms of land use after food grains and soybeans. In some African countries cotton accounts for more than 80 percent of the GDP. World raw cotton production in 2013-14 involved more than 350 million people and was worth approximately \$50 billion.

More information
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www.icac.org

email us

see our website