

COTTON RESEARCH & DEVELOPMENT CORPORATION



Spotlight

SPRING 2014

on Cotton R&D

SCHEDULING FOR PRECISION IRRIGATION

'BEST EVER' COTTON CONFERENCE

Best Practice





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IMAGE MELANIE JENSON



Irrigation manager Nathaniel Phillis checks the lateral move system at "Keytah" which was used in a commercial comparative trial of irrigation methods.

IN THE SPOTLIGHT



The beginning of a new season is always a critical time for growers. Many decisions need to be made around the availability of resources and risks involved. After what was

an incredibly testing previous season, water availability and efficient use will be at forefront of most this year.

Encouragingly for the industry, a recent benchmarking study outlined in our Irrigation Special shows that growers have been as efficient in small production years as in large years. There is no doubt that irrigation R&D has supported grower's concerted efforts to improve water use efficiency. Scheduling is an integral factor in achieving the best water use efficiency and yield, and as such in our Irrigation Special we have outlined the newest world-leading research funded by CRDC in this area. This research, in particular canopy measurement which has been adapted to Australian growing conditions, is pointing to real improvements in the ease of scheduling.

On-farm, commercial scale irrigation research can also play a key role in continuing to offer growers irrigation options. A three-year grower-led trial at "Keytah" Moree compared four alternative systems which were made accessible to other growers. The ability to see how furrow, overhead, drip and bankless channel irrigation systems compare in 'real world' situations has provided irrigators from right across the industry an insight into the advantages and disadvantages of each system. This has allowed them to assess the suitability of a particular system prior to making decisions on investment in the redevelopment or new irrigation systems.

We are proud to highlight three of our recent publications that demonstrate the outcomes of cotton industry RD&E. The CRDC five-year report examines the impact of R&D during the last Strategic Plan and the achievements, which have been briefly outlined in this edition. The *Crop* and

Pasture Science journals released earlier this year, bring together the results of 18 years of collaborative research developed by the partners in the Cotton Co-operative Research Centre. Importantly the newly released *2014 Cotton Production Manual* brings together the latest RD&E to growers and consultants, keep an eye for it in the mailbox, or contact us for a copy.

Herbicide resistance is a key risk for Australian agriculture and we have included the first ever cotton industry Herbicide Resistance Management Strategy (HRMS) as special lift-out. We hope that the HRMS will be a valuable tool in industry-wide efforts to control herbicide resistance in Australian cotton farming systems. The HRMS is also detailed in the *2014 Cotton Production Manual*.

We are pleased to include a feature on the Australian Cotton Conference as it is much more than a remarkable showcase of the industry and its people. For more than 30 years it has been the key industry event for bringing every organisation, business, region, occupation and person "together". In doing so we collectively enjoy a sense of rejuvenation and comradery as new participants equally become immersed in cotton.

The CRDC invests in the Conference as an important way of extending the results of industry research and promoting a cohesive and forward looking industry. These characteristics strongly align with enabling the industry to achieve its vision for the future, Vision 2029. Vision 2029 aims to position the industry in the global marketplace and help achieve superior industry performance which is underpinned by collaborative science, technology and the passion and innovative nature of people within the Australian cotton industry.

Wishing you all a safe and prosperous season.

Bruce Finney



Australian Government
Cotton Research and Development Corporation

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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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WORLD LEADERS IN COTTON

CRDC'S FIVE-YEAR REPORT SHOWCASES ACHIEVEMENTS IN RD&E

A REPORT ON CRDC INVESTMENTS FROM 2008 TO 2013 HAS FOUND THAT \$49.8 MILLION INVESTED INTO COTTON RESEARCH, DEVELOPMENT AND EXTENSION (RD&E) BY COTTON GROWERS AND THE AUSTRALIAN GOVERNMENT RETURNED A BENEFIT TO GROWERS OF \$348 MILLION OVER THE FIVE-YEAR PERIOD.

The *World leaders in cotton – Achievements in Australian cotton research, development and extension 2008-2013* report outlines the major benefits to the industry from the 468 projects CRDC invested in during this time across three program areas – farming systems, value chain and human capacity.

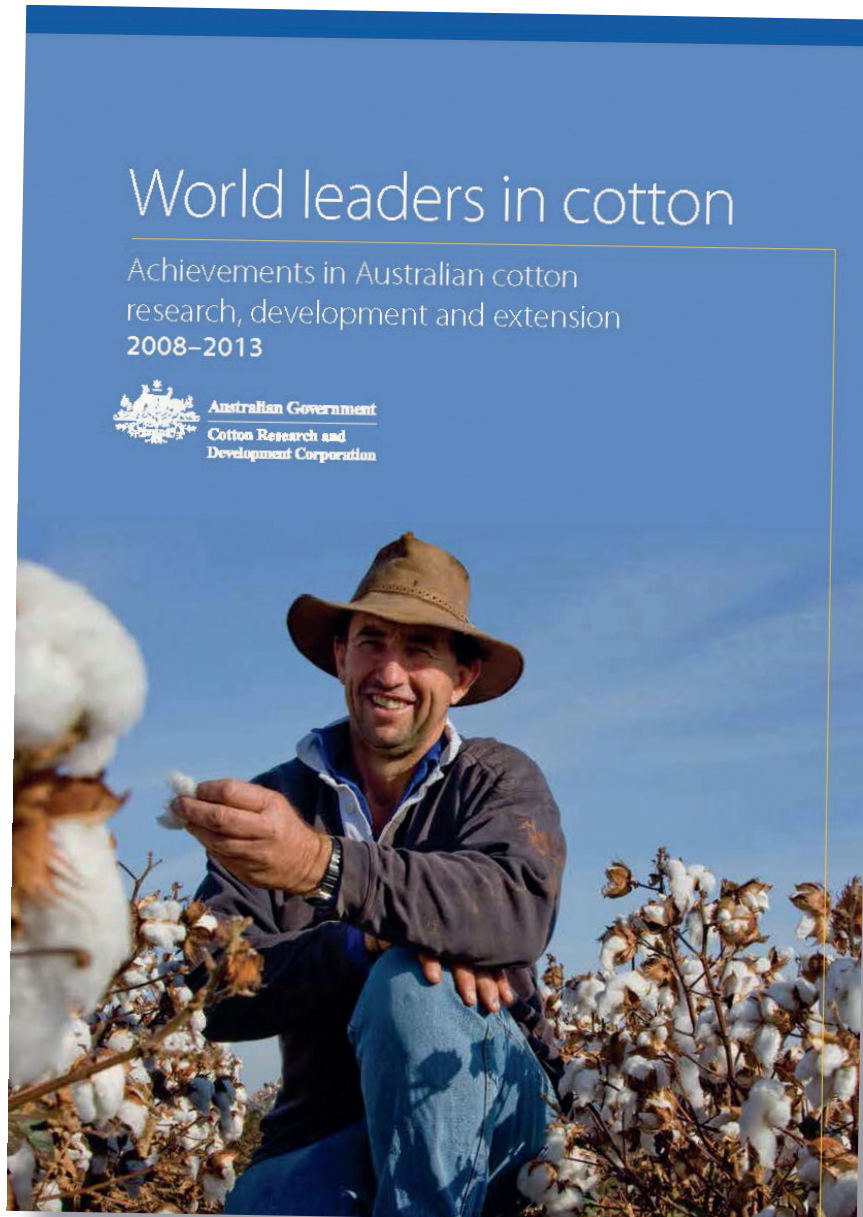
Three of the major outcomes for growers during this time included ensuring the continuation of the industry by preserving the efficacy of Bt cotton (under the farming systems program); ensuring market access for Australian cotton by supporting the development of a cotton to market strategy (value chain); and developing the industry's joint extension program, CottonInfo (human capacity).

Leading the world in managing Bt resistance

Managing resistance to Bt cotton is vital to the survival of the Australian cotton industry and has been a priority for CRDC since Bt cotton was first introduced in 1996, remaining a core part of the RD&E investment during 2008-13. Australia is now recognised as having the most rigorous and successful stewardship program for Bt cotton in the world. An independent review has shown that Australia's efforts to manage resistance pre-emptively appear to be more effective than efforts elsewhere in the world, with Brazilian growers and scientists seeking advice from Australia's world-leading researchers.

Research underpinning the Cotton to Market strategy

Working with industry partners to improve cotton's market access has been a major achievement for CRDC during 2008-13. CRDC's investment in understanding the current markets and potential opportunities for the Australian cotton industry provided sophisticated market intelligence, which in turn underpinned the development of a new industry marketing strategy by Cotton Australia with the assistance of the Australian



An independent review has shown that Australia's efforts to manage resistance pre-emptively appear to be more effective than efforts elsewhere in the world, with Brazilian growers and scientists seeking advice from Australia's world-leading researchers.

Cotton Shippers Association and CRDC. The resulting Cotton to Market international program was launched in 2014, incorporating CottonLEADS and the Better Cotton Initiative.

Ensuring research outcomes reach growers: CottonInfo

One of the key outcomes under the human capacity program was the development of the CottonInfo joint venture in 2012 – a five-year commitment from CRDC, Cotton Australia and CSD to provide extension services to cotton growers. The 25-strong team consists of regional

development officers from Emerald to Hillston, technical specialists and myBMP staff members who work together to deliver the latest research outcomes and best management practices to growers.

These are just three of the many major outcomes achieved by CRDC and its research partners on behalf of growers that are outlined in the report. You can read the full report online at CRDC's website: www.crdc.com.au/publications or request a hard copy (for a limited time) by calling CRDC on 02 6792 4088.





CRDC SCHOLARSHIP PROVIDES OPPORTUNITIES FOR YOUNG SCIENTISTS

UP AND COMING COTTON SCIENTISTS ARE BEING ENCOURAGED TO APPLY FOR CRDC'S SUMMER SCHOLARSHIP PROGRAM.

The summer scholarship program provides students with the opportunity to work on a real project in a working environment as part of their professional development.

All CRDC research partners, researchers or extension officers may apply for summer scholarship funds, and the scholarships are open to all university students of a high standard who are completing their senior years of an undergraduate degree or enrolled in an honours program. Students can conduct short research, extension or industry projects under the direct supervision of a researcher or extension officer from the public or private sectors.

Applications for CRDC summer scholarships close October 31.

For more information or to apply for a CRDC summer scholarship, contact CRDC on 02 6792 4088 or visit our website www.crdc.com.au

see our website



CREATE CHANGE IN YOUR INDUSTRY

CRDC'S GRASSROOTS GRANTS PROGRAM IS OPEN FOR APPLICATIONS FROM COTTON GROWER ASSOCIATIONS.

This impressive grant system offers support of up to \$10,000 for capacity building projects undertaken in the cotton industry, particularly initiatives which can be extended to benefit the industry more broadly or in differing regions.

Sally Hunter oversees the program on behalf of CRDC and has encouraged growers and industry organisations to work with CGAs to get projects up and running.

"You can use it to help solve the issues or challenges in your cotton valley," Sally said.

"Collaborative projects work the best, so my advice is to discuss with others about what the needs are and how you might fulfil them.

"A range of applications are encouraged, and past initiatives have included projects with schools/teachers, mental health awareness days, bus tours or other growers-teaching-growers tours, researchers connections with growers, weather stations and using weather tools for planning, soil and plant nutrition workshops, subsidising school teachers to Field to Fabric course – just to name a few.

"Applications close in December, but the

ABOVE: The diversity of projects under the Grassroots Grants program has been diverse – from bringing cotton into the classroom at Dalby High (above) to on-the-ground initiatives which directly benefit growers in daily practice.

popularity of the program and the calibre of applications already received and approved means potential applicants should begin discussing projects with me as soon as possible so as not to miss out on this wonderful opportunity.

"Projects can usually begin within a few weeks of submitting an application."

Applicants are urged to contact Sally to be sure they have the latest information and to discuss the project.

Guidelines and application forms are available from Sally or at www.crdc.com.au/growers-0 and click on the 'community and growers support' tab.

Sally Hunter, 0459 944 778
sally@fundbase.com.au

see our website

email us

YOUR 2015 COTTON CALENDAR

The cotton industry's joint extension program, CottonInfo, has partnered with Wincott to bring you the 2015 cotton calendar, which you will find enclosed with this edition of *Spotlight*.

The *Healthy cotton farms and families* calendar focuses on key topics for growers throughout the year - from improving energy use efficiency to keeping our families safe on our farms.

With photography from the Cotton Australia Click! photo competition and other talented photographers from within the industry, you might just recognise a place (or face!) or two.

On behalf of CottonInfo partners, Cotton Australia, CSD and CRDC, and calendar partner Wincott, we hope you enjoy the 2015 cotton calendar. To request additional copies please contact CRDC on 02 6792 4088.





THE AUSTRALIAN COTTON PRODUCTION MANUAL IS A ONE-STOP-SHOP FOR GROWERS, PROVIDING INFORMATION ON THE MANY DECISIONS AROUND PREPARATION FOR, AND DURING COTTON PRODUCTION.

NEW COTTON MANUAL OUT NOW

This critical reference tool for the industry has just been updated and released.

The new manual focuses on four key areas.

Cotton for profit

With the ever increasing cost of farming, growers are faced with the challenge of needing to improve yield while managing input costs. This section outlines key production issues for the coming crop with a particular focus on increasing input efficiencies, and provides key look-up tables, particularly in the nutrition chapter to help growers make more informed decisions.

Better farming futures

The cotton industry has a strong reputation for its proactive approach to the many issues facing the long term viability of production. The manual outlines the principles behind managing these production issues faced by growers. In this year's edition, the weed

section has been focused more on tactics for integrated weed management, while the natural resource management section has undergone an in-depth rewrite.

Cotton for the customer

Australian cotton is viewed worldwide as an excellent fibre, and as growers know, cotton quality is something that can be influenced throughout the season. This section covers management issues relating to quality, as well as chapters explaining post farm-gate issues.

The business of cotton

The business of cotton can be complex. The manual identifies issues across a range of



topics including economics, marketing, finance, insurance, as well as the safety and management of the human resources involved in the industry. Key points from the Boyce Accountants and CRDC annual *Cotton Comparative Analysis* report are new to this edition.

The Australian Cotton Production Manual is published by the industry's joint CottonInfo team and is updated each year to incorporate consistent improvements in industry best practice.

Electronic versions of the 2014 manual can be downloaded from www.crdc.com.au/publications or to request a hard copy contact the CRDC on 02 6792 4088 or your local CottonInfo regional development officer.



JOURNAL HIGHLIGHTS ROLE OF RESEARCH IN INDUSTRY SUCCESS

A RECENT RESEARCH JOURNAL LAUNCH GAVE THE OPPORTUNITY TO FOCUS ON THE BROADER IMPACT OF COTTON R&D.

The Federal Minister for Agriculture Barnaby Joyce and CRDC recently launched the cotton special editions of the *Crop and Pasture Science* journal at The University of New England (UNE).

The journals bring together 18 years of previously unpublished work from the cotton co-operative research centres and focus on some of the major outcomes from cotton R&D, from yield improvements to integrated pest management. It provides 24 peer-reviewed papers from 91 contributing authors.

The journals were guest edited by former CRC staffers Jane Trindall (now CRDC), former CRC CEO Guy Roth (now Roth Rural and Regional) and former CRC Chief Scientist Peter Gregg (now UNE), who were at the launch along with CRDC Chair Mary Corbett, Executive Director Bruce Finney, former CRC CEO Phil Armytage (now CSD), Cotton Australia Chairman Lyndon Mulligan and UNE's School of Environmental and Rural Sciences Head Professor Iain Young.

"The journals ensure this previously unpublished and important research is in the public domain," Bruce Finney said.

"Over the past 24 years, CRDC has invested \$200 million in RD&E on behalf of Australian



Federal Minister for Agriculture Barnaby Joyce (centre) launched the *Crop and Pasture Science Journals* at The University of New England, with CRDC NRM R&D Manager Jane Trindall, former CRC CEO Guy Roth, former CRC CEO Phil Armytage and former CRC Chief Scientist Peter Gregg.

cotton growers and the Australian Government, delivering an estimated minimum \$1.4 billion benefit back to growers on their farms, and twice that value to the wider community.

"This investment has included support of many research partners over the past three decades – including the three cotton CRC's over their 18-year tenure, which feature in the journals.

"CRDC's focus is on improving productivity and just as importantly the profitability of our growers, ensuring the industry is sustainable into the future.

"Our investments focus on all aspects of the supply chain: from growers to the wider industry to our customers, as well as our people and our performance.

"Thanks to R&D, Australian cotton growers are world leaders in resource efficiency, while reducing their environmental footprint. It's a

triple bottom line approach.

"Importantly, much of the work of the CRC continues under the CRDC and its researcher partners, like UNE.

"As a result the minister also announced the formation of the UNE Cotton Hub, which will coordinate all UNE staff who work in cotton to provide advice to the cotton industry, and the new UNE-CRDC jointly funded position 'Soil System Biology for cotton production' held by Dr Oliver Knox, who has recently started work at UNE."

Available online, the journals are a source of valuable technical information for growers and agronomists who want to delve into the detail.

The *Crop and Pasture Science* journal special editions, published by CSIRO, are available online from the CSIRO Publishing website www.publish.csiro.au.



GET MAPPING

PHENOXY HERBICIDE DRIFT COSTS THE COTTON INDUSTRY AROUND \$6 MILLION A YEAR IN LOST PRODUCTION.

Over the last six seasons, an average of nearly four percent of cotton crop area has been damaged by the drift of phenoxy herbicides (such as 2,4-D).

The industry's CottonMap program is a critical part of the campaign to halt drift. CottonMap is a website where cotton fields are mapped on-line so potential users of Group I products are alerted to the proximity of cotton fields to any area requiring weed control over summer. It was developed and now improved through a joint effort between CRDC, Cotton Australia, Grains Research Development Corporation and Nufarm.

Growers are urged to get on-line to map cotton fields at as soon as possible.

"Young cotton is particularly susceptible and this period often coincides with an increased use of phenoxy for weed control in summer fallow programs," says Cotton Australia's Greg Kauter.

"The problem is further exacerbated following summer rainfall that causes rapid weed germination and growth, needing timely control.

"By logging fields with CottonMap, people in your area will know you've got susceptible crops in the ground.

"The 2013-14 season saw 420,237 paddock hectares mapped (98 percent of the total crop) by 207 registered users and we hope to maintain that this year."

Cotton Australia runs an annual campaign in an effort to reduce drift incidents and has just released a new resource, Background Briefing – Phenoxy Herbicides, full of technical information, photographs and practical advice for cotton growers on how to manage this issue and report incidents

There is also an entire section devoted to on its website. "A really important message for growers is to report any incident as soon as it occurs, starting with your local Cotton Australia regional manager," Greg said.

WHAT'S NEW?

CottonMap is now accessible on smart phones and tablets and there have also been some improvements.

- Mobile devices will be redirected to www.cottonmap.com.au/mobile, the smart-phone version of the site.
- Field submission updates have been added to better inform users of the status of mapped fields.
- A 'news' item area has been added to the home page that will host CottonMap updates.
- An e-mail system has been added that allows all users to receive e-mail updates (opt-out option available).
- Last season's fields will be in the accounts of registered users, so simply delete the non-cotton fields for this season then add any new ones and resubmit at the bottom of the my-fields column.
- We know CottonMap passwords are not top-of-mind! Just remember your user name is your e-mail address and you can force a system e-mail containing your password as you log back in. Look for the "Forgot Password?" link.
- Current users with new e-mail addresses are now able to change their user names if desired.
- New users will be prompted to register after they submit a new field(s).

To find out more and to map your fields go to www.cottonmap.com.au

see our website



Luz Angelica Suarez is calling for grower support for her new project into monitoring and assessing phenoxy drift damage.

REMOTE SENSING TO ASSESS DRIFT DAMAGE

In 2012-13, despite work by the industry to reduce spray drift, more than 12,000 hectares of cotton was damaged by 2,4-D phenoxy herbicide drift, which impacted growers to the tune of \$8.8 million.

In addition to the proactive work the industry is doing through CottonMap to prevent spray drift damage occurring, quantifying and mapping the impacts of previous drift is also important for crop management, scientific understanding, documenting the damage for loss compensation and environmental management.

That's why CRDC is investing in a project being conducted by PhD candidate Luz Angelica Suarez at the University of Southern Queensland, which looks to understand how remote sensing techniques can detect damage to a cotton crop and how multispectral imagery can detect damage against yield records.

The project involves remote sensing techniques including hyperspectral and LiDAR radars to allow enhanced detection and mapping of damaged cotton. Hyperspectral sensors can detect changes in plant pigment, moisture content and internal leaf structure, while LiDAR scanners

As part of this study the team of USQ scientists are seeking to contact growers who were seriously affected by drift on their crops: specifically, those affected by 2,4-D drift since 2009. Information about the condition of the crop and yield records is necessary to compare results and confidentiality and anonymity is guaranteed.

FURTHER INFORMATION

For more information or to participate, contact Luz Angelica Suarez at USQ on 07 4631 5453 or luz.suarezcadavid@usq.edu.au

have the ability to quantify changes in the canopy, such as height, cover and density.

The study will benefit the industry by providing scientific knowledge and procedures that will allow sensing technology to help assess and monitor herbicide drift damage.



TACKLING GLYPHOSATE RESISTANCE TOGETHER

THE COTTON INDUSTRY'S FIRST HERBICIDE RESISTANCE MANAGEMENT STRATEGY (HRMS) HAS BEEN RELEASED.

The HRMS is a tool for managing the risk of herbicide resistance in irrigated and dryland farming systems incorporating herbicide-tolerant cotton.

The strategy has been developed in response to the escalating problem of group M herbicide resistance. Resistance to glyphosate has been confirmed in a number of species in cotton farming systems including awnless barnyard grass, fleabane, sowthistle, windmill grass, ryegrass and most recently, sweet summer grass (*Brachiaria eruciformis*).

CRDC instigated the HRMS project to provide growers and agronomists with more support in making changes to weed control practices through the development of an industry-wide herbicide resistance management strategy.

CRDC's Dr Ian Taylor says we must fully understand that glyphosate resistance is real in cotton and impacts to cotton farming systems may be significant.

"You can't spray your way out of herbicide resistance, as this inevitably selects for resistance; and since there have been no new modes of action since 1982 we would very quickly cycle through the existing modes of action for weed control," he said.

"There are no silver bullets, but if we work together as an industry we can select key tactics that will maximise the longevity of the farming system.

"Diversity in management approaches is key, as is controlling survivors and managing the seed bank.

"Good farm hygiene underpins weed management."

Cotton Australia's TIMS Committee endorsed the HRMS after consultant Annabelle Guest worked with cotton industry weeds researchers, TIMS Committee Herbicide Technical Panel and other industry stakeholders to refine the strategy and test its universal relevance in the industry.

At present the HRMS models two systems:

- Continuous back to back irrigated glyphosate-tolerant cotton with no summer fallow
- Dryland glyphosate-tolerant cotton grown every second year, alternating with long summer fallows

The strategy predicts the increased number of years of sustainable glyphosate use that can be achieved using glyphosate plus other tactics both in-crop and in summer fallow compared to a glyphosate-only system. It also predicts the effects these tactics will have on the weed seed bank. This information should form the basis of decision making when developing a plan to reduce the risk of herbicide resistance and also managing already existing resistant populations.

This first version focuses on a glyphosate-tolerant cotton system; however the availability of other herbicide tolerant traits and the future availability of stacked multi-trait herbicide tolerant varieties have also been considered in the design of the strategy, and may require a more sophisticated strategy into the future.

"Research indicates glyphosate resistance develops in grass weeds in 13 years (dryland) and 19 years (irrigated) in a glyphosate-only system," Annabelle Guest said.

"Resistance in broadleaf weeds is slower to develop and takes around 18 years in both irrigated and dryland systems with a summer fallow.

"Glyphosate resistance may be delayed by four to six years if residual and double knock tactics are already used in summer fallow."



You can't spray your way out of herbicide resistance, as this inevitably selects for resistance. Diversity in management approaches is key.

The formula to manage/delay glyphosate resistance

Extensive modelling of potential glyphosate resistance development has found that irrespective of whether a farm is irrigated or dryland, or the weed species present, or the amount of glyphosate used, the most effective way to delay resistance is to use the 2+2+0 Strategy, which is explained in detail in the accompanying liftout.

The HRMS will be reviewed annually to remain highly relevant to the field management of weeds in cotton and reflective of current weeds research.

annabelle_guest@bigpond.com
www.glyphosateresistance.org.au

email us

WEEDpak - www.cottoncrc.org.au/industry/Publications/Weeds

Weed Smart - www.weedsmart.org.au/

see our website

A SUCCESSFUL STRATEGY RELIES ON:

- Use of a variety of tactics, implemented at the right time.
- Rotate herbicide mode of action groups.
- Ensure survivors are controlled by another herbicide group or tactic and not allowed to set seed.
- Do not rely on glyphosate to manage weeds in non-crop areas (channels, tail drains, head ditches). Manage adjacent areas as fallows and rotate with non-glyphosate tactics to control weeds and cotton volunteers.
- COME CLEAN. GO CLEAN to prevent introduction and transport of resistant seeds. Monitor high risk entry areas and patch manage introduced weed seeds.
- Monitor and follow up to ensure survivors are controlled by another tactic before they are able to set seed. Have suspect weed survivors tested for resistance
- Conduct regular scouting and correct weed identification.
- Keep good records.
- Ensure timely implementation of tactics.
- Always follow label recommendations.

Refer to the explanatory notes flyer in this edition of *Spotlight* and *Cotton Pest Management Guide* and the for additional tips on IWM and use of tactics.



IMPROVING NITROGEN USE EFFICIENCY IN COTTON

DR CHRIS DOWLING HAS UNDERTAKEN A COMPREHENSIVE STUDY OF THE INTRICACIES OF NITROGEN USE IN COTTON CROPS, AND HAS RESEARCHED METHODS TO IMPROVE EFFICIENCY.

Nitrogen (N) nutrition of high yielding cotton crops remains one of the biggest production costs with improvement of nitrogen use efficiency (NUE) being somewhat of an enigma when trying to ensure that profitability and efficiency are both optimised.

When attempts to improve NUE are centred on tweaking N rates, application timing and products only, the outcomes are frequently fruitless, confusing and seasonally contradictory. This is generally because they are made in the absence of close consideration of the other major factors that control NUE.

NUE is not just related to N fertiliser practices but is intimately related to soil characteristics and condition, their reaction to irrigation practices, and weather conditions (Figure 1).

Measuring NUE

In scientific literature there are numerous methods used to describe NUE. The easiest to calculate is generally fertiliser nitrogen use efficiency (NUEf) which is the lint yield (kg/ha) divided by the total amount of fertiliser N applied.

CSIRO's Dr Ian Rochester has suggested that NUEf between 13 and 18kg lint/kg N denotes efficient N use. NUEf above 18 kg lint/kg applied N may indicate insufficient N was available to the crop and yield would most likely have been increased by extra N. NUEf below 13kg lint/kg applied N suggests that N applied was inefficiently used or in some circumstances, may indicate extra N was applied.

The trade-off between NUEf and net fertiliser margin remains one of the biggest challenges in improving NUEf. This was clearly demonstrated in N demonstration strips at "Yambocully" Goondiwindi, QLD, in 2014 (Figure 2). These results (NUEf < 13 at economic best N rate) suggest that an underlying soil or water factor may be adversely affecting NUEf. Addition of extra N at rates above 303 kg/ha to overcome system inefficiency not related to N application was not profitable.

There was however a severe economic penalty for under fertilising. Soil sampling for N post-harvest showed increasing soil residual N with higher N application rates but there was also a parallel increase in N that was not able to be accounted for presumably lost as gaseous emissions or leaching.

Improving NUE

Improvement in NUE requires a good understanding of the causes of inefficiency to make consistent improvement without sacri-

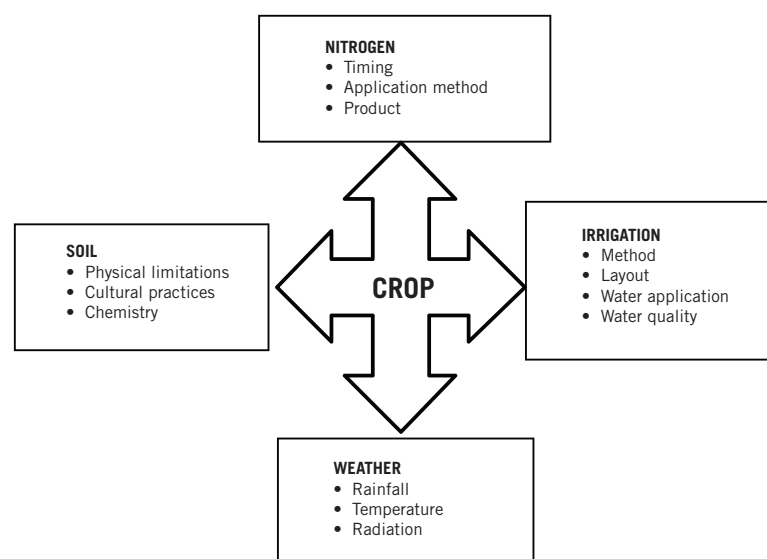


Figure 1 - Factors controlling nitrogen use efficiency in cotton

ficing profitability. In some cases there may be more gain in NUE from making changes to soil and /or irrigation practices than attacking N management directly.

Inefficiency can arise from a range of factors related to soil, irrigation, weather and nitrogen tactics and they can be classified into some broad categories. These categories provide some insight into loss pathways and practice change that leads to higher NUE.

Identification of the likely causes of N use inefficiency through an audit of current FNUE and practices can help define the strategies and tactics that are most relevant in addressing improvement in NUE in a particular situation.

Sources of N use inefficiency

Low NUE has its origins in both the soil environment and within the plant. In both cases the interaction with growing season conditions make single season measurements of NUE unreliable; measurements should always

be contrasted across different management practices in the same season or assessed as part of a longer term trend.

The need for fertiliser N stems from a lack of contribution from mineralising soil organic pools of fresh labile (low legume frequency and duration in rotations), older labile and humic fractions (being rundown). Where oversupply occurs there is a high probability of increased denitrification losses and decreased NUE (Figure 3).

Supply greater than demand - chronic oversupply

Oversupply occurs where N availability is greater than crop demand. This does not mean that high N rates are not seasonally justifiable, for example where there has been unseasonably wet weather and despite best efforts to avoid loss, extra N is added to maintain crop profitability.

When NUEf is assessed from an annual

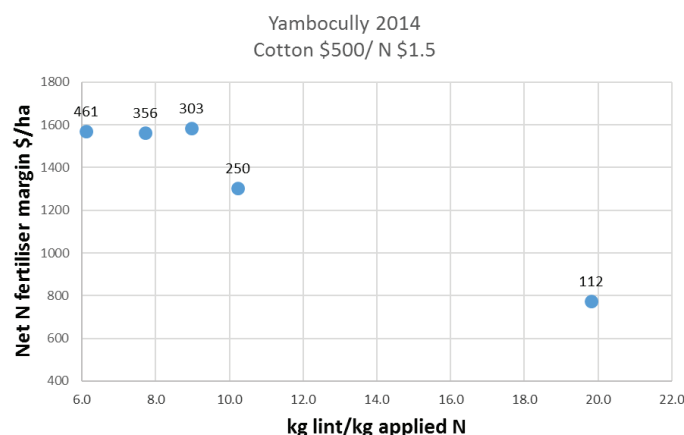


Figure 2- NUEf and fertiliser margin trade-off "Yambocully" 2014 (number above the dot is the total rate of N applied in kg/ha).

Acknowledgements
Thanks to Nigel Corish and Sally Dickinson for kindly making available the results of the "Yambocully" trial.



COMMON FACTORS CONTRIBUTING TO LOW NUE

perspective, if residual N from an “over-application” is subsequently lost, low NUEf is likely but where N loss of residual N is negligible (such as in dryland production), annual NUEf is low but rotational NUEf may still be acceptable.

Oversupply frequently occurs as a result of factors such as:

- over-estimation of yield potential
- lack of consideration of soil N that will become available (mineralisation potential)
- under-estimation of residual soil mineral N
- overcompensation for less than optimal soil condition (compaction) and irrigation practices
- poor calibration of application equipment

Indications that N supply may have been higher than yield requirements include:

- high late season plant tissue and petiole nitrogen concentrations (Figure 4)
- late season vigour leading to difficulty with defoliation
- high seed N percentage kg lint/kg fertiliser N in the low range (<13)
- kg lint / kg crop available N (soil + fertiliser) in the low range (<10)
- high residual soil mineral N immediately post picking (>80 kg/ha, 0-80 cm)

Management options

Use of objective measurement of nitrogen supply such as soil testing can at the minimum help rank paddocks with respect to their mineral-N content and plant tissue analysis around first flower provide the plants view of how much N it can see with its roots approaching maximum depth for the season. Adherence to a well-designed sampling protocol is key to getting these tools to provide

interpretability and consistency. (Nutrient Sampling Guidelines for cotton - www.cottoncra.org.au/files/0b13f3af-7ac6-4c68-910f.../SamGL06.pdf)

Causes of inefficient nitrogen uptake

Poor NUE from both pre and in-crop N application is a result of loss mechanisms such as volatilisation, denitrification and leaching, or temporary unavailability due to soil processes such as immobilisation. In-crop applications of N (particularly those between squaring and peak bloom) reduce the time that applied N is subject to loss processes and increases the chance of interception, being applied when a significant root structure is present and aboveground biomass demand is increasing rapidly (Figure 5, see over page).

Fertiliser N efficiency is also affected by the amount of soil available N at sowing (residual applied N from the previous season and mineralised N). High fertiliser efficiency is most common where soil residual N and the contribution from in crop mineralisation is low, losses are minimal and other management factors such as weeds, disease, sowing date, rate and cultivar optimised.

There is no doubt that inappropriately high biomass production early in the season due to high N availability may create poor NUEf but having the crop too low in N as it enters the reproductive stage (squaring to flowering) poses a production risk if N supply cannot be effectively made adequate by early flowering. Strategies for split application of N therefore need to consider both the amount and location of residual soil N to ensure adequacy pre-flowering and product supply and multiple application options for in-crop applications.

KEY THINGS YOU SHOULD KNOW

- Four broad factors influence nitrogen use efficiency (NUE): soil type, irrigation practices, weather conditions and N application management.
- Improvements to NUE should not centre on tweaking N rates, timings and products only.
- Major factors that control NUE in any cotton production setting include management decisions that affect the loss mechanisms arising from interactions between nitrogen application, soil, irrigation and weather.
- Long term measurement and monitoring strategies are important to distinguish between seasonally unavoidable low NUE and chronic production system related causes.
- High NUE, high yield and high profitability can co-exist.

Applied but temporarily unavailable

Immobilisation of soil N occurs when there is competition between soil microbes and the crop for soil mineral-N. It is likely to occur where large quantities of cereal stubbles (wheat, maize) are incorporated close to sowing, for example in dryland or where irrigated crops are sown into standing sprayed out wheat crops. Net immobilisation reduces available N to the growing crop in the incorporation layer. In the short term up to 18kg N/tonne of cereal stubble soil incorporated can be consumed in the immobilisation process.

Applied or mineralised, but lost from soil

Leached (summer mineralised N and residual mineral N) is more of a risk in lighter textured soils.

Ammonia volatilisation is generally a loss of N associated with applied N, particularly products that at some stage create ammonium-N after application (eg urea, DAP, chicken manure or fresh animal manure with high N content).

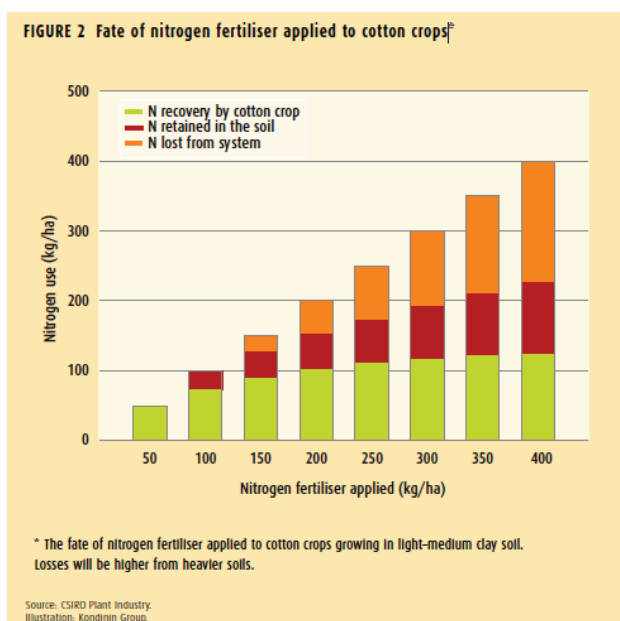


Figure 3 - NUE declines rapidly as N rate exceed that required by the crop. Source: Dr Ian Rochester, CSIRO.

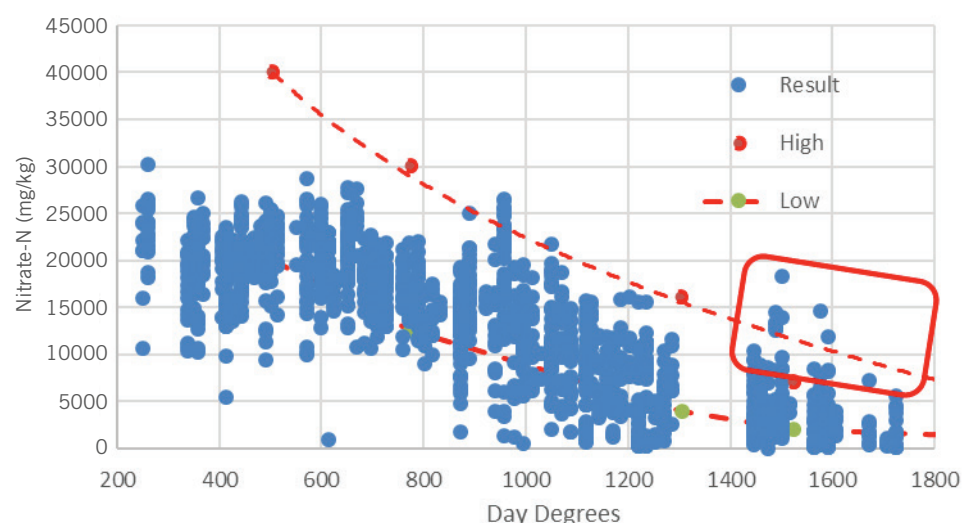


Figure 4 - High levels of N in petioles indicating high availability of soil N in late season (source Back Paddock Company)

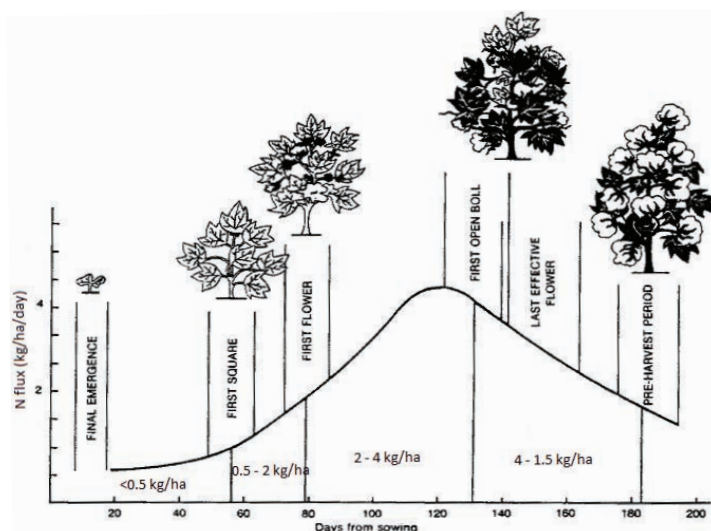


Figure 5 Seasonal nitrogen fluxes in cotton

Under favourable loss conditions, 10 to 20 percent of applied N may be lost in a four-day period (after application) but the effect on yield of this loss is not always proportional.

Management options

Recent research has indicated that urease inhibitors such as those containing the active ingredient NBPT are able to reduce the rate of urea hydrolysis and potentially reduce volatilisation losses. To be useful in increasing NUE this method needs to reliably produce higher yield or improved profitability to cover the extra cost.

Incorporation of manure (as for urea) is the most effective means of reducing N losses.

Denitrification

Significant denitrification losses are mostly related to conditions of high soil moisture. Research in recent years suggests that:

- Dry seasons create minimal waterlogging in dryland production so most denitrification losses are due to nitrification of urea and anhydrous ammonia in the fertiliser bands. In irrigated crops, losses can be significant where soil structure, irrigation practices and N fertiliser management are less than optimal.
- Wet periods producing water-filled soil porosity (WFSP) greater than 60 percent results in higher rates of denitrification. The intensity of loss is related to the quantity of nitrate and labile carbon co-located in soil layers, high soil temperature and duration of WFSP greater than 60 percent.
- Some nitrification-inhibitor treated and polymer-coated products have shown potential for reducing losses but the effect of factors such as soil temperature on application timing and persistence need to be further investigated to increase their reliability and profitability.

Management options

Changes to N fertiliser application tactics that are central to reducing denitrification losses:

- keep the N in the ammonium form for longer e.g. use of nitrification inhibitors
- minimise the amount of nitrate-N exposed to each irrigation (split application)
- minimise the duration of inundation and area of fields where soil moisture is above 60 percent WFSP.

Horizontal Movement

N movement from the soil into irrigation water as it flows down the field is a feature of flood irrigation systems. Losses occur from horizontal movement of nitrate-N carried down field and into table-drains and channels, and directly from the water (denitrification).

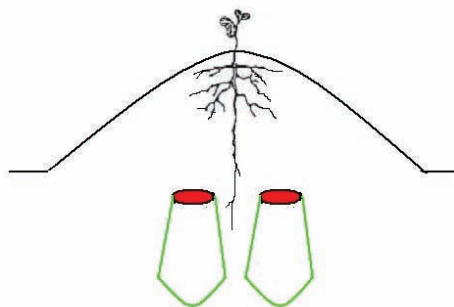


Figure 6. Preferred placement of pre-plant N

Management options

Ensuring fertiliser nitrogen is applied in a manner that creates downward movement rather than toward the surface of beds is recommended (Figure 6). This is particularly important where a high proportion of the N is applied pre-plant in hot production areas where irrigation and evaporation during the season can bring soluble salts such as nitrate to the surface from considerable soil depth via a soil process called hydraulic lift.

Available in soil but not taken up

Positional unavailability occurs when the active root mass is at distance from mineral N sources for a significant period of crop growth. This has occurred in low in-crop rainfall seasons where a significant N application is surface broadcast and then furrow irrigated. The upward movement of the wetting front carries urea and nitrate to the dry surface of the bed rendering some of it unavailable until rain falls or is lost via horizontal movement down the furrow when irrigated.

When the timing of release or transformation of the applied product (organic matter, enhanced efficiency N fertiliser) to a plant-available mineral N form does not match crop demand, it is more exposed to losses and low NUEf.

Factors that create a limitation to root mass, root depth and density such as by chemical (eg phosphorus deficiency), physical (eg compaction) or biological (root disease) can reduce NUEf.

Taken up to biomass but not transferred to harvestable parts

The relationship between N supply and that in the harvested material is more complex in cotton than in cereal crops. This complexity arises from cotton's indeterminate growth habit (vegetative and reproductive development occurring together) and the indirect relationship between the major saleable commodity, the lint, and the location of nitrogen that is removed at harvest, the seed.

Nitrogen use efficiency is reduced as a result of the indeterminate growth where loss of fruiting structures is related to an increase in vegetative growth, hence maintenance of a sustainable fruit load is key to high NUE.

Some of the factors that can influence NUE in relation to indeterminate growth include varietal selection, climatic conditions and agronomic management.

THE LINT-SEED RELATIONSHIP

Cotton lint contains no appreciable quantity of N, it is in the seed. This means gin turnout (GTO) is also a factor in manipulation of NUE. The N concentration in the harvested seed of some of the new smaller seeded varieties is frequently in the range 3.5 to 4.5 percent as compared to 3.2 to 3.9 percent for older varieties. At first glance this would logically suggest that it was taking more N to produce a bale of lint.

However a parallel increase in GTO has maintained a relatively stable position of N removal per bale (Table 1). With some of the newer small seeded varieties optimised NUE appears to be indicated when when seed N is around 3.9 percent (Rochester 2014) suggesting removal of 11 to 12 kg N /bale for GTO round 42 to 44 percent as compared to a similar range for seed N of 3.5 percent and GTO around 38 percent.

Seed N %	GTO %			
	38	40	42	44
3	11	10.1	9.3	8.5
3.5	12.7	11.7	10.8	9.9
4	14.5	13.4	12.3	11.3
4.5	16.2	15	13.8	12.7

Table 1 Effect of seed N content and gin turnout (GTO %) on nitrogen removed per bale of lint (kg N/227 kg lint).

Nutrient Sampling Guidelines for cotton - www.cottoncra.org.au/files/0b13f3af-7ac6-4c68-910f.../SamGL06.pdf

Rochester I, 2014. Growing high-yielding nitrogen-efficient cotton. www.australian-cottonconference.com.au/2014_Proceedings.htm





THE NEW VERSION OF NUTRILAGIC IS READY TO USE

THE WEB BASED NUTRILAGIC PROGRAM HAS UNDERGONE IMPROVEMENTS, BASED ON REQUESTS FROM GROWERS AND CONSULTANTS FOR A MORE COMPREHENSIVE PROGRAM TO CALCULATE NITROGEN FERTILISER RATES.

“From user feedback we have made it our priority to transform NutriLOGIC to better assist with your nitrogen fertiliser management decisions,” says website developer Loretta Clancy.

“We may not have changed the way NutriLOGIC looks, but we have changed the way NutriLOGIC recommends nitrogen fertiliser rates from a soil analyses.

“Using recent results from nutrition research, we can now recommend a nitrogen fertiliser rate for an expected yield.”

Other considerations used in estimating requirements for N fertiliser

include:

- Fertiliser recovery
- Cropping history (eg cereal or legume rotation)
- When the sample was taken (eg July/August)
- Soil type and level of compaction
- Region

“The new NutriLOGIC also gives users the choice to update their old soil analyses to include an expected yield or maintaining these analyses in the original version of NutriLOGIC,” says CSIRO’s Dr Ian Rochester

“These options give users an opportunity to compare old and new recommendations.”

For further information contact the CottASSIST team by phone, e-mail, or use ‘Contact Us’ in the CottASSIST main menu.

www.cottassist.com.au

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02 6799 1500

Loretta.Clancy@csiro.au

Sandra.Williams@csiro.au

SAFETY INDUCTION APP NOW AVAILABLE ON-LINE

THE FARMSAFE AUSTRALIA APP IS FREE AND SEEKS TO FURTHER IMPROVE THE SAFETY AND EFFICIENCY IN THE INDUCTION OF NEW WORKERS.

Workers complete the app in discussion with the employer during the induction process and then a record of the induction and issues it has covered are e-mailed directly to the worker and the employer, helping to simplify the record keeping process.

myBMP offers support

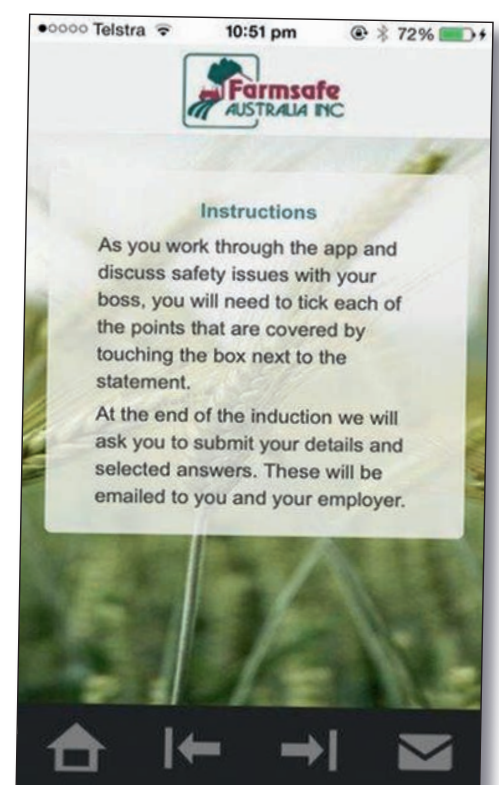
Finding good staff, managing them well and keeping them safe is a major priority for Australian cotton growers. myBMP is an invaluable resource to manage farm safety, offering employee induction plans, safety training information and assessments, recom-

mendations and ideas on managing staff and farm safety.

The myBMP program is free to all growers and getting access is as simple as registering at www.mybmp.com.au or call toll free on 1800 268 866 for more information. The myBMP HR & WHS module covers the areas of industrial relations and worker safety to assist in managing one of the most valuable assets of a farm business - the people.

The module focuses on all aspects of recruitment, whether it be family members, employees or contractors. From legal obligations around employing staff to putting in place procedures to help optimise employee productivity in a safe environment it offers practical ways to improve a farm's ability to attract, retain, manage and protect staff.

For assistance contact Nicole Scott 07 4639 4807/0418 775 726, 1800COTTON (1800 268 866) or nicoles@cotton.org.au



TO DOWNLOAD THE FARMSAFE INDUCTION APP FOR IPHONE / IPAD

- <https://itunes.apple.com/us/app/farmsafe-safety-induction/id895754573?ls=1&mt=8>

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STUDIES HAVE SHOWN THAT UP TO 75 PERCENT OF ENERGY CONSUMED ON IRRIGATED COTTON FARMS IS THROUGH PUMP STATIONS.

TRENDS EMERGE IN IRRIGATION PUMP TESTING

A poorly functioning pump station can be costly. However the good news for irrigators is that pump energy assessments are identifying issues as well as steps to improve efficiency.

The National Centre for Engineering in Agriculture (NCEA) at the University of Southern Queensland is undertaking on-farm energy assessments to help growers identify inefficiencies and cope with rising energy costs while also reducing greenhouse gas (GHG) emissions.

The on-farm assessments calculate energy use, efficiency measures, potential cost savings and also provide industry benchmarking data. The data collected will enable the development of best practices and tailored information for cotton growers to use to improve energy efficiency and reduce costs.

The NCEA's Phil Szabo is using a custom made pump efficiency monitor to collect and analyse data from pumping events to determine the efficiency and operating cost for the pump station and identify management and infrastructure improvements.

Most assessments have been on large, mixed flow irrigation pumps made in China for agricultural drainage purposes. There are already trends emerging, such as incorrect elevation of pumps, mismatched pump and engine combinations, and incorrect pipe sizes.

"The main issues I'm seeing relate to the positioning of large, mixed flow pumps in particular," Phil said.

"Many are located too high up from the river or tail water levels causing the pump to cavitate and run inefficiently.

"Cavitation is a serious issue that occurs when a pump has been incorrectly set up and is running outside its suction specifications. It causes premature wear on the pump centre costing thousands of dollars for replacement and when left unchecked significantly reduces the pump flow rate, therefore increasing energy costs per megalitre of water delivered.

"By positioning the pump closer to the water level, these inefficiencies may be overcome."

Another issue has been mismatched engines and pumps. Phil said in most circumstances the engine is overrated for the work required and often running below 50 percent load. He said engines should optimally run at 70 to 80 percent load, as running below 50 percent generally uses more diesel per mega litre of water pumped."

In some of the assessments, incorrect pipe size has been an issue. As in the normal design of pump stations, suction pipes should have larger diameters than the discharge pipes, however the opposite is being found. For example, at one site the suction pipe diameter was 650mm while the discharge was 700mm.

NCEA researchers are also reviewing tariffs and electricity charges on farms to identify where additional savings may be realised.

"Sometimes electrical pumping costs are noted as being overly high due to the high network connection charges and low usage charges, therefore increasing the cost of pumping significantly," Phil said.

Importantly, the NCEA team recommend that to have a true indication of efficiency, a pump test is needed.

"All pump stations require a test to identify the best



Irrigated cotton growers have been taking advantage of pump efficiency testing being undertaken by the National Centre for Engineering's Phil Szabo.

LEARN MORE

For growers and consultants keen to learn more about pump stations and pump tests, a training course will be held at "Keytah" Moree on October 29 by NCEA and NSW DPI. Furthermore, to get a clearer view of what pumps are installed across cotton farms, Phil Szabo is undertaking a survey and review of large, low-pressure flood lift and tail-water pumping systems. Gathering this information will mean more targeted and relevant advice and information will be available back to growers to help improve pump efficiency. The survey only takes a few minutes to complete, and will be coming to growers through the CottonInfo team.

Growers with an interest in improving energy efficiency of a pump station should contact Phil Szabo at NCEA.

operating point for efficiency and the operating point for maximum water flow with the minimum cost," Phil said.

"This alone will give the grower a management tool for running the pump station most efficiently for the particular pumping requirements.

"From here if there are issues, solutions could be simple or more complex, from changing pipe sizes, to lowering the pump to redesigning the system using a qualified hydraulic engineer."

The *Improving Energy Efficiency on Irrigated Australian Cotton Farms* project is supported by the Commonwealth Department of Industry as part of the

Energy Efficiency Information Grants Program.

There are a number of energy efficiency initiatives underway with cotton irrigators and to discuss the broad initiatives underway please contact Leah Ross at Cotton Australia on 02 9669 5222 or Jane Trindall at CRDC on 02 6792 4088.

Phil Szabo
Phillip.Szabo@usq.edu.au
07 4631 2814





ON CARBON NEUTRAL COTTON FARMS, RIVER RED GUMS DO THE HEAVY LIFTING

A STUDY IN THE NAMOI VALLEY SHOWS CARBON EMISSIONS FROM COTTON FARMS CAN BE OFFSET BY NATIVE VEGETATION.

Research by Dr Rhiannon Smith from The University of New England has found that river red gum woodlands in the lower Namoi Valley sequester and store much more carbon than any other vegetation type. As much as 300 tonnes of carbon per hectare is stored in the trees, logs, soil and herbaceous vegetation in river red gum ecosystems.

River red gums are found within riparian areas along rivers and these ecosystems are among the most productive in the world, with abundant water and nutrients available for plant growth. Irrigated cotton farms are known for the amount of riparian vegetation they contain.

Recent surveys show 70 percent of cotton farms have river frontage and 75 percent of growers actively manage these areas. Around 40 percent of cotton farms are dedicated to native vegetation, with 63 percent having a riparian zone between two and 15 kilometres (average seven kilometres).

"River red gum ecosystems are highly productive, and therefore sequester and store large amounts of carbon, allowing cotton farmers to achieve carbon neutrality," Rhiannon said.

"Scientists have indicated that river red gums could live up to 1000 years.

"During this time, they sequester large amounts of carbon both in the trees themselves and in the soil beneath them as their litter is incorporated into the soil.

"This litter and the organisms that feed on it promote soil health and arrest river bank erosion, which is of added benefit to cotton growers who have these trees on their farms."

Carbon neutral farming

Most cotton farms are a matrix of different types of land use, providing opportunities for growers to offset their carbon emissions, Rhiannon said.



To remain competitive in a global market with increasingly carbon-conscious consumers, the Australian cotton industry needs to continue to demonstrate its environmental sustainability and how it is working to reduce its carbon footprint.

As part of this aim, CRDC has funded research led by Dr Francois Visser at the University of Queensland to develop a whole-of-farm carbon footprint calculator.

This work builds on the existing Cotton Carbon Management Tool (CCMT) to include emissions and carbon sequestration from winter cropping and native vegetation. The CCMT already gives cotton growers an easy way to calculate and manage GHG emissions of each cotton crop. The only data

required is production area and whether irrigated or dryland. Results are shown as carbon emissions per bale of cotton produced to comply with the market place, with the total result shown as carbon emissions per hectare as well.

CottonInfo Carbon Technical Specialist Jon Welsh says the new whole of farm carbon calculator reflects the fact that most cotton farms are mixed farming enterprises, therefore growers need to be able to calculate whole farm emissions, rather than just the cotton component.

"It also gives the cotton industry and agriculture in general an idea of the environmental cost or benefit of land use," he said.

A case study illustrating the carbon footprint of a cotton farm was developed for the Kahl family's "Redbank", a 1200 hectare irrigated cropping and grazing property near Wee Waa, which showed the it was carbon positive, sequestering more carbon annually (1185kg/ha CO₂ equivalent) than it is emitting. In terms of carbon sequestration, riparian vegetation was found to be the most valuable of the three vegetation types (riparian dominated by river red gums/floodplain woodlands/perennial grasslands).

The property's annual carbon dioxide emissions were calculated to be 2742 kg/ha for cropping and 280kg/ha for grazing.

"The rate of sequestration in existing vegetation communities is highly variable depending on a variety of environmental and management factors," Rhiannon said.

"Further research will quantify car-

bon sequestration rates and gas fluxes under native vegetation to further quantify its benefits."

This research was supported by CRDC and the Australian Government.

Stacey Vogel – CottonInfo NRM Technical Specialist
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Rhiannon Smith - UNE
rsmith66@une.edu.au

The Cotton Carbon Management Tool can be found at
www.coolercarbon.com.au/#/cottonC





IT'S ALL ABOUT HOW MOTHS MOVE...

WHAT IS THE TWO-KILOMETRE REFUGE RULE FOR BT COTTON, AND WHY DO WE HAVE IT? SPOTLIGHT SPOKE TO PROFESSOR PETER GREGG AND COTTONINFO BT AND INSECTICIDE STEWARDSHIP TECHNICAL SPECIALIST SALLY CEENEY.

Under the Bollgard II Resistance Management Plan (RMP) refuges must be located within two kilometres of the corresponding Bt cotton crop.

Professor Peter Gregg from The University of New England has undertaken the most comprehensive industry review into the movement of *Helicoverpa spp.* across our landscapes.

He says both sexes and species of *Helicoverpa* (*H. punctigera* and *H. armigera*) are highly mobile and capable of moving extremely long distances. The type of movement can be described as either long or short range.

Long-range movement

"Long-range movement - or migration - is common and ensures a high

degree of genetic similarity in populations from widely separated areas," Peter said.

"It involves prolonged flight in strong winds at high altitude when moths are carried in the wind stream, so their direction and distance of travel depends on the strength and direction of the wind, meaning they may cover hundreds or even over thousands of kilometres in just one or a few nights of flight."

A well-known example of this in the cotton industry is the migration of *H. punctigera* from inland areas of Australia (such as the Channel Country in Qld) to cotton growing areas in eastern Australia. This migration occurs in spring as the vegetation in inland Australia begins to dry off and the population moves east in search of more suitable host crops.

"Movement is very significant for resistance management, as long-range movement is an extremely effective way of spreading resistance between widely separated areas," Peter said.

"Individuals that potentially carry resistance genes may move long distances and carry those resistant genes with them.

"Conversely, it is also an extremely effective way of diluting resistance through large influxes of moths that may not have had any exposure to Bt toxins.

"The long-range movement of *Helicoverpa* illustrates the importance of consistency in resistance management strategies between regions, as no cotton growing region in Australia has an isolated population of *Helicoverpa*.

"However a strong focus on regions where selection pressure is high is equally important, as an increase in the resistance frequency in one area can lead to an increase in resistance frequencies in the wider population."

Short-range movement

Short-range movement occurs within fields or between farms. Searching for a suitable mate or host crops are thought to be the primary drivers for short-range movement, however wind movement is also likely to influence this.

"A number of studies of *Helicoverpa* movement using different methods have suggested that moths are quite mobile both between and within farms, but distances are variable," Peter says.

"If a moth leaves its area of emergence, it is just as likely to move at least 10 kilometres as it is to move one kilometre or less.

"So the best answer to the question 'how far does a moth move?' is that it will move as far as it needs to in order

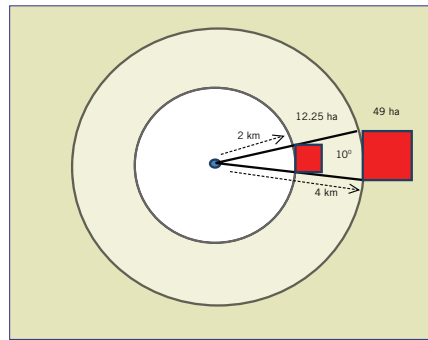


Figure 1. The minimum dimensions of a refuge required to intercept directional flight at varying distances from a source.

order for the moth to intercept it.

The same logic applies in reverse. If moths are leaving a refuge to find mates in a cotton crop, the further the refuge is from the crop, the less the chance that their flight path will take them over the crop.

Bollgard 3 and refuge distance

With the advent of Bollgard 3, RMPs are being revised. Refuges will remain an important component of the new RMPs, but there may be scope for altering some aspects of their deployment, including the two-kilometre rule, according to Sally.

“There may be scope for some flexibility in the two kilometres rule particularly if that flexibility results in a refuge which is better managed agro-nomically, and therefore more attractive,” Sally Ceeney says.

“To maintain maximum efficacy, any flexibility will still require refuges to be planted within the same farm unit and as close to the associated Bollgard 3 as possible.

“Additionally, if refuges are much more than two kilometres from the cotton crops they would quickly become too large and economically unviable, as the size of a refuge needed to intercept a moth’s flight path increases in accordance with its distance from the Bollgard II crop.”

For the time being however, Sally says best management of Bollgard II refuges is as vital as ever.

“This includes choosing a location where the refuge receives adequate water and nutrition, has a low weed burden and is free of Bt cotton volunteers from the previous seasons,” Sally said.

“It is important to maintain best practices and comply with the Bollgard II RMP so that the industry can realise the benefits of Bt technology into the future.”

More information

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WHEN BEING ATTRACTIVE COUNTS

Well managed refuges are the best performers for resistance management. Establishing and growing an attractive refuge is a critical and mandatory component in the Bollgard II Resistance Management Plan (RMP).

The aim of a refuge crop is to generate significant numbers of susceptible moths that have not been exposed to the Bt proteins in Bollgard II.

Attractive, fully irrigated unsprayed pigeon pea, will on average, produce twice as many *Helicoverpa* moths as the same area of unsprayed cotton. As well as producing high numbers of moths, it is also critical that the timing of production of moths from refuges matches that of Bollgard II crops.

Research by Geoff Baker and Colin Tann of CSIRO has shown that the productivity of pigeon pea refuges can vary considerably both between and within individual crops and also seasons. Not every dedicated refuge will produce large numbers of susceptible moths, however they need to have the capacity to potentially do so. The RMP requires growers to ensure that their refuge crops receive adequate nutrition, irrigation (for irrigated refuges) and weed and pest management (excluding *Helicoverpa* sprays) so that they remain attractive while Bollgard II is grown.

Dominic Cross (CSIRO) investigated how varying the rates of nitrogen and applied irrigation water impacts the survival of *Helicoverpa armigera* larvae in the refuge.

The amount of applied water has the biggest impact on survival rates of *H. armigera* in pigeon pea. The treatments that received moderate, or high water rates had much higher survival of *H. armigera* larvae than the treatments that received low water. The amount of applied nitrogen had less of an impact on larvae survival rates, although in treatments that received high water, those that also received moderate to high nitrogen had higher survival rates than those treatments with no applied nitrogen.

If the aim of a good refuge is to produce large numbers of moths that haven’t been exposed to the toxins contained in Bollgard II, then refuge crops that are given adequate water and nitrogen are more likely to be performing as productive refuges.

More information on best practice refuge management can be found in the *Australian Cotton Production Manual*, at myBMP or by contacting:

Sally Ceeney - sal@ceenag.com.au

Colin Tann - colin.tann@csiro.au

Dominic Cross - dominic.cross@csiro.au



to locate food sources, a mate, or an oviposition site.

“However, ‘as far as it needs to’ might mean 1000 kilometres or more, as for example in *H. punctigera* emerging in Western Queensland in spring, when native host plants are rapidly senescing.

“Alternatively, it may mean a matter of metres, in the case of a female which has emerged in or already located a flowering crop.”

Given that moths are highly mobile, why do we use ‘within two kilometres’ as the guiding rule when determining placement of refuges on farm?

“Certainly, ‘as far as it needs to’ can frequently exceed two kilometres by a considerable margin, however, if a refuge is to be productive, moths must first find it and lay eggs in it,” Peter explains.

Simple modelling can show the likelihood of a moth finding a refuge depending on the distance it has to travel (Fig 1).

This simple model illustrates that if a moth leaves a source area and travels more or less downwind, within an arc of 10 degrees, after travelling two kilometres the refuge will need to be 12.25ha for the moth to intercept it. However, if the distance travelled is doubled to four kilometres, the refuge size then needs to increase to 45ha in

IRRIGATION RESEARCH SHOWS A CONSISTENT INDUSTRY

AUSTRALIAN COTTON GROWERS USE WATER AS EFFICIENTLY IN TIMES OF FULL PRODUCTION AS IN TIMES OF SHORTAGE, YET LARGE VARIATIONS BETWEEN FARMS MEAN THERE'S ROOM FOR FURTHER GAINS.

The Australian cotton industry gauges its water use efficiency (WUE) performance using irrigation benchmarks. Specifically, water use indices which measure performance in bales per megalitre of water the crop receives through irrigation water, effective rainfall and soil moisture.

In 2006-07 NSW DPI conducted the first WUE benchmarking study for the Australian cotton industry. Performance has since been monitored with studies in 2008-09 and 2012-13.

Over the three studies around 40 irrigators from Central Queensland to Southern NSW provided information to benchmark irrigation water use. The web-based benchmarking program WaterTrack Rapid was used each season to provide consistent benchmark calculations across the years.

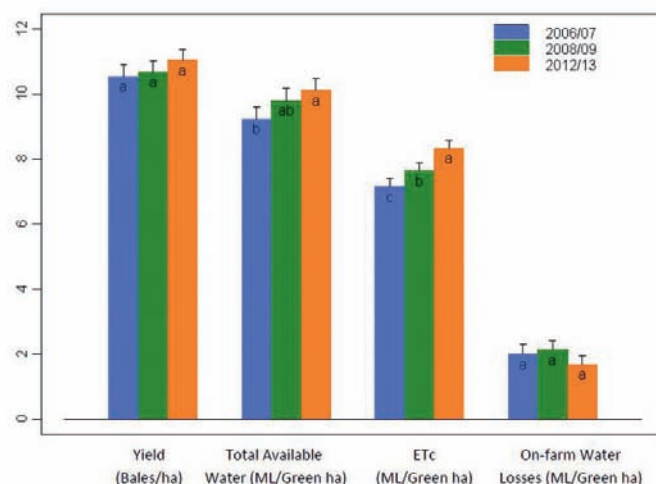


Figure 1. Variation in industry average yield, total available water, ETc and on-farm water losses over three seasons. On-farm water losses were no greater in 2012-13 despite managing much larger volumes of water compared to the other seasons. Bars labelled with the same letter are statistically similar. I.e Yields between the three seasons were similar, however the crop water use (ETc) was higher in 2013/14 compared to 2007-07 and 2008-09 due to the warmer seasonal conditions.

“What’s interesting in terms of the results is that these studies were conducted in seasons with varying seasonal

conditions and production, yet the efficiencies are all very similar, however there is also an obvious variation in effi-

ciencies between individual farms,” says CottonInfo WUE Technical Specialist (NSW) Janelle Montgomery, who has been involved in all three studies.

“The 2006-07 and 2008-09 seasons had low rainfall, water availability was low and coupled with relatively low cotton prices the Australian irrigated cotton planting was small, at around 140,000 hectares.

“In comparison, 2012-13 saw full storages, high allocations and a record planting of 365,268 hectares. The irrigation benchmarks measured in this record planting show Australian cotton irrigators manage water just as efficiently when their farms are close to full production.”

Meaningful indicators

Janelle says the most meaningful water use index for comparing water use efficiency between seasons is Gross Production Water Use Index (GPWUI_{farm}) which relates total production to total available water (irrigation water + effective rainfall + soil moisture). The GPWUI_{farm} for the 2012-13 study was 1.12 bales/ML (range 0.73 -0.43 bales/ML).

“There was no significant difference in GPWUI_{farm} between the seasons (Figure 2),” Janelle said.

“While this suggests little change in

GPWUI_{farm} over this time, importantly, cotton irrigators in 2012-13 were managing larger cotton areas and handling larger volumes of water.

“This shows that the cotton industry uses water as efficiently in times of full availability and production as in times of water shortage.”

However the data (Figure 3) also shows the spread of values of GPWUI_{farm} over the three seasons and significant variation between individual farms.

“While the study demonstrates the achievements of irrigators, this variation highlighted between individual farms shows there is scope for even further efficiency gains, Janelle said.

“A striking feature of the data is the variability.

“There is a large range in yield, water used, crop evapotranspiration and water use indices between the farms in all three irrigation seasons (Table 1). This variability shows there is room for further improvements in crop water management.”

More information

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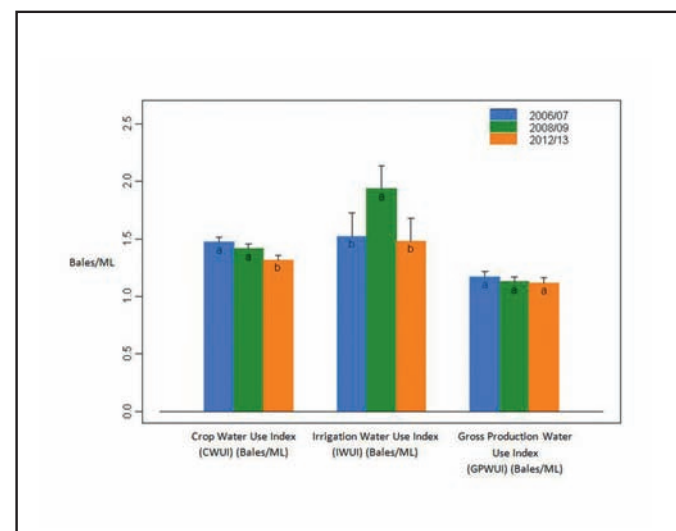


Figure 2: Variation in water use indices (bales/ML) over three very different seasons. Bars labelled with the same letter are statistically similar. The GPWUI is similar across all three seasons, therefore in 2012/13 when the industry was in full production, growers produced a similar amount of bales per ML (irrigation water + rainfall + soil moisture) as in years of water shortage (2006-07).

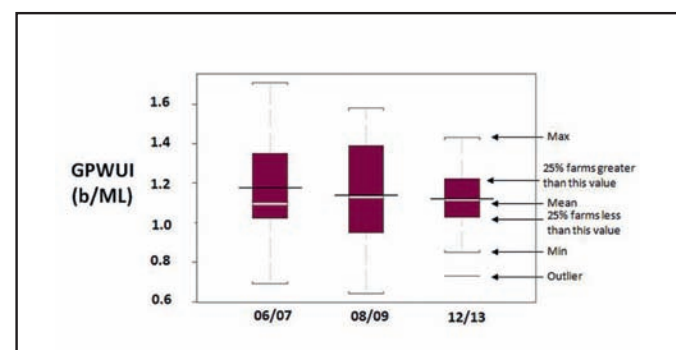


Figure 3: Variation Gross Production Water Use Index (total production/total available water, ie irrigation water + effective rainfall + soil moisture) showing minimum, maximum, median and mean values. This shows the spread of values of GPWUI_{farm} over the three seasons between individual farms. The range in GPWUI_{farm} shows scope for further efficiency gains.

IRRIGATION WATER USE INDEX

Irrigation Water Use Index (IWUI_{farm}) relates relates total production to the irrigation water used. It does not include rainfall or soil moisture. The variation in IWUI_{farm} between the seasons (Figure 2) is due to the variation in rainfall. Both 2006-07 and 2012-13 were very dry with little in-crop rainfall, irrigation water made up 89 and 83 per cent respectively of the total available water. Whereas in 2008-09 the average irrigation water supplied was only 65 percent of total available water. The difference in the IWUI_{farm} between the seasons illustrates the influence that rainfall has on this index.

CROP WATER INDEX

Crop Water Use Index (CWUI_{farm}) relates total production to the amount of water consumed by the crop, ie crop evapotranspiration. The CWUI depends mostly on agronomic factors rather than irrigation efficiencies and is useful for estimating potential crop water use and for examining crop productivity. While yields in 2012-13 were comparable to the 2006-07 and 2008-09 season (Figure 1), ETc (crop evapotranspiration = crop water use) was significantly higher resulting in a significantly lower CWUI in 2012-13 (1.31 bales/ML) (Figure 2).

Table 1: Yield, water used, crop evapotranspiration and water use indices established for 2006-07^a, 2008-09 and 2012-13 cotton seasons.

	2006-07 ^a		2008-09		2012-13	
	Mean (SD)	Min Max	Mean (SD)	Min Max	Mean (SD)	Min Max
Yield (Bales/ha)	10.69 (1.91)	4.07 13.19	10.63 (1.49)	8.00 13.57	11.14 (1.55)	7.18 14.37
Total available water (ML/ha)	9.31 (1.88)	5.12 12.79	9.66 (1.75)	5.88 13.31	10.16 (1.75)	6.61 15.47
Crop evapotranspiration (ML/ha)	7.36 (0.88)	5.42 9.13	7.59 (0.74)	5.60 8.61	8.48 (0.81)	6.55 9.83
CWUI _{farm} (bales/ML)	1.46 (0.26)	0.58 1.90	1.41 (0.21)	1.01 1.92	1.31 (0.16)	0.94 1.70
IWUI _{farm} (bales/ML)	1.4 (0.45)	0.80 2.78	1.99 (0.96)	0.82 5.75	1.41 (0.39)	0.76 3.01
GPWUI _{farm} (bales/ML)	1.17 (0.25)	0.69 1.71	1.14 (0.27)	0.64 1.58	1.12 (0.17)	0.73 1.43

HELP IS AT HAND

When considering changes in management to improve WUE, you need to look right across your farm – field, channels and drains and on-farm storages. Janelle says there are still a lot of low cost, small management changes that can be implemented to improve on-farm WUE. To start, the *myBMP* Water Module lists a range of practices to assist in the efficient management of water on-farm. *WATERpak* is the other invaluable industry resource and is being continually updated with the latest in irrigation research. The *2014 Australian Cotton Production Manual* also provides up-to-date info on irrigation management.

CSIRO Agriculture Flagship's Dr Onoride Coast has been working on a CRDC-funded project that is producing world-first technology for irrigation scheduling.

CANOPY SENSORS TO SUIT AUSTRALIAN CONDITIONS

AUSTRALIAN SCIENTISTS HAVE SUCCESSFULLY TAKEN UP THE CHALLENGE TO ADAPT THE USE OF CANOPY TEMPERATURE TECHNOLOGY TO AUSTRALIAN COTTON'S GROWING CONDITIONS.

CSIRO Agriculture Flagship scientists have developed a modified stress-time temperature threshold using crop canopy sensors for irrigated cotton to suite Australian conditions. The team has adapted a temperature stress threshold (BIOTIC) originally developed by the United States Department of Agriculture.

BIOTIC (Biologically Identified Optimal Temperature Interactive Console) is based on a biological optimum for plant physiological functions. The method was developed to trigger irrigation by minimising the time a crop is exposed to temperatures exceeding its biological optimum to a pre-determined temperature-time threshold.

While this approach is well suited to drip or overhead irrigation systems, it could not be used for scheduling furrow irrigation in Australian cotton systems, until CSIRO's Dr Rose Brodrick and Dr Onoride Coast adapted the concept as part of the *Applying plant-based measurements for irrigation in water-limited environments* project, supported by CRDC.

Their work followed on from 2010 trial work by Dr Warren Conaty which determined the optimal temperature for Australian cotton cultivars was 28-29 °C. Warren established that canopy temperature could be used as a measure of stress in deficit irrigation and concluded that it may be possible to adapt the BIOTIC system to Australian cotton production systems.

In 2013 Rose, Onoride and Dr Michael Bange subsequently took up the challenge to adapt the BIOTIC system to enable the use of canopy temperature to improve irrigation schedule irrigations using a stress-time threshold.

Onoride began by analysing years of data from previous

KEY CONSIDERATIONS IF PLANNING TO USE CANOPY SENSORS

While using canopy sensors is relatively simple, there are many factors to consider in order to interpret the data correctly. Growers and consultants planning to use crop canopy sensors should contact the researchers directly for guidance on correct set up and use.

"To schedule irrigations successfully, you need raw canopy temperature values, weather data and your regionally-specific stress-time threshold, which we can help with," Rose Brodrick says.

"Any growers interested in using canopy sensors this year should contact us for help in interpreting this data and making any adjustments.

"We are also keen to monitor as many crops as possible this year with canopy sensors to help us further refine our regional data, so if you intend using the sensors this season we would love to hear from you."

Contact: Rose Brodrick: rose.brodrick@csiro.au 02 6799 1500

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cotton experiments to determine the relationship between plant stress and canopy temperature was established. This was followed by more intensive data analyses that enabled calculation of region-specific stress-time threshold.

"As part of the canopy temperature scheduling approach, we developed algorithms and an associated software program that determines how much exposure to stress the crop can tolerate without losing yield before it needs to be irrigated," Onoride said.

"We tested the stress-time threshold in Narrabri and Emerald this year and these trials confirmed that we can use canopy sensors and the stress-time threshold to manage irrigation as successfully as an experienced irrigator."

While canopy temperature is a key component of the approach developed

by the crop physiology and agronomy team of CSIRO scientists, other factors, such as meteorological data, soil characteristics, and the crop's stage of development have been considered. These allow for subtle adjustments to accommodate changes such as cloudy skies, heat waves and humid weather, which vary the rate of evapotranspiration. Rain forecast is also taken into account when analysing the rate of accumulation of stress units to determine whether to irrigate or not.

"Our ultimate aim is to improve yield, quality and water use efficiency through improved irrigation scheduling under deficit conditions, especially where the intervals are much longer than a couple of days."

WITHOUT EVER SEEING THE CROP, A CSIRO RESEARCHER SCHEDULED IRRIGATIONS THAT PRODUCED HIGH YIELDING COTTON CROPS, MAKING DECISIONS BASED EXCLUSIVELY ON INFORMATION FROM CROP CANOPY TEMPERATURE SENSORS AND STRESS-TIME TEMPERATURE THRESHOLDS.

AUSTRALIAN COTTON INDUSTRY'S WORLD-LEADING IRRIGATION RESEARCH

CSIRO Agriculture Flagship's Dr Onoride Coast, based at the Australian Cotton Research Institute near Narrabri, scheduled irrigations for a crop near Emerald exclusively using data from crop canopy sensors placed in the crop. Yield figures revealed no significant difference between the crop irrigated using canopy temperature and that produced by the grower (10.1 bales ha⁻¹ and 10.5 bales ha⁻¹ respectively). The crop was grown beside cotton irrigated using the grower's normal scheduling, based on soil-moisture probe data and his many years' experience.

"The results were very encouraging," Coast said.

"The Emerald trial shows the feasibility of the technology and protocol in irrigation scheduling, as well as the reliability of the technology.

"Some Australian cotton farmers are very good at scheduling irrigation, however, sometimes at the point of making irrigation decisions doubts can still arise.

"Irrigation by canopy temperature will help eliminate the doubts by providing a sound basis in science for irrigation."

Grower impressed

Coast worked with CottonInfo Water Use Efficiency Technical Specialist (QLD) Dr Lance Pendergast (DAFF QLD) who is based in Emerald and said in this first season of in-crop trials that canopy temperature scheduling approach using the in-crop infrared sensors worked brilliantly.

"The grower is a very experienced and successful irrigated cotton producer and he was very pleased with the outcome and felt confident that, based on this first year's result, he would consider using this method to assist with making scheduling decisions," Lance said.

"This technology is very reliable and



in Australia it very closely mimicked the grower's scheduling for the season, which is remarkable," Lance said.

"This was an interesting experience for us all.

"There was an element of cat-and-mouse play leading up to potential irrigations, as neither the grower nor the researchers wanted the canopy temperature calculations to influence the grower's decision making."

Valuable tool for old and new

With Central Queensland's notoriously variable summer climate, the region's growers were very keen to see the technology trialled in their area.

"It is hoped that the canopy temperature approach would not only give experienced growers greater confidence in making irrigation scheduling decisions, but also provide new and less experienced growers with a sound

method to base their irrigation scheduling on," Lance said.

A collaborative framework was a key aspect considered when developing the Central Queensland project. A number of exciting research projects are underway in the region, so working together offered a range of advantages.

"Aside from the obvious potential for cost savings, the opportunity to evaluate research on a farm scale and under different conditions (as per different growing regions) increases the validity of any conclusions reached," Lance said.

With ongoing assistance from its collaborative partners, the *Optimising Water and Energy Use in the CQ Sector* project will continue the evaluation of both dynamic deficit and canopy temperature scheduling.

"The results achieved last season were very encouraging," Lance says.

"The two approaches complement each other and show considerable promise as scheduling methodologies that will assist growers to achieve improved production capacity."

Dr Onoride Coast grew this crop using only in-crop canopy temperature sensors and stress-time temperature thresholds to schedule the irrigations.

**"THIS TECHNOLOGY IS VERY RELIABLE
AND VERY CLOSELY MIMICKED THE
GROWER'S SCHEDULING"**

For more information:

Onoride Coast, 02 6799 1500

IRRISAT IS BACK AND YOU CAN GET ON BOARD

IRRISAT IS A WEATHER BASED IRRIGATION SCHEDULING TOOL THAT USES REMOTE SENSING TO PROVIDE SITE-SPECIFIC CROP WATER MANAGEMENT INFORMATION ACROSS LARGE SCALES AT RELATIVELY LOW COST.

The IrriSAT team of CSIRO's John Hornbuckle, NSW DPI's Robert Hoogers, Janelle Montgomery and Edward Joshua are looking forward to working with growers interested in using the IrriSAT technology this season.

The crop water use information is mapped across paddocks, farms and regions at various time scales including a seven-day forecast. This can be used to increase productivity and maximise returns through improved irrigation scheduling.

The technology can be applied across a large area allowing crop productivity to be benchmarked within and between regions. Importantly, this will provide insights into the drivers of productivity to better understand the variations in crop productivity.

During the 2014/15 season researchers will be concentrating on the benchmarking aspects of IrriSAT and running some intense field trials to further refine and improve the technology.

Based on the success trials of Irrisat in cotton crops in Northern NSW, the researchers will be running evapotranspiration (ET)/IrriSAT master-classes to improve consultants and irrigators skill on weather based



scheduling methods, including the IrriSAT technology. The classes will provide detailed explanation of how to download satellite imagery and apply the IrriSAT technology to produce crop productivity and seasonal crop water use maps.

CRDC is funding a collaborative project between NSW DPI and CSIRO which follows on from the initial trials. This project will build on two areas of the IrriSAT technology identified by cotton growers and consultants as beneficial to the industry and useful to growers; regional crop water use pro-

ductivity benchmarking and irrigation scheduling using real time and forecast crop water use estimation.

Growers interested in overlaying this technology across their fields, for further information or to attend workshops, please contact:
Janelle Montgomery, Cottoninfo/ NSW DPI (Northern NSW & QLD) 0428 640 990

Edward Joshua, NSW DPI (Central and Southern NSW) 0428 285 987
Robert Hoogers, NSW DPI (Central and Southern NSW) 0427 208 613

DELVING DEEPER INTO DYNAMIC DEFICITS

DYNAMIC DEFICIT SCHEDULING WILL CONTINUE TO BE EVALUATED OVER THE NEXT TWO SEASONS.

The dynamic deficit scheduling approach, under development by Dr Rose Brodrick, CSIRO Agriculture Flagship, as part of the CRDC project *Irrigation strategies in a limited water environment* is a refinement of the extensively used deficit-triggered scheduling method, wherein growers approximate soil moisture status (typically using soil moisture probe data), consider estimated plant water requirements for different physiological stages of development, and irrigate when soil moisture has depleted to a predetermined level.

"Irrigation deficit trigger points are typically based on soil moisture probe measurements and weather forecasts," Rose said.

"The irrigation point is based on average climatic conditions and soil water status to

prevent plant stress and does not take into account the actual or future level of plant stress in response to variable climatic conditions.

"The dynamic deficit approach takes into account extreme weather conditions, which we often experience here."

The researchers say dynamic deficit scheduling may be necessary to effectively match irrigations with potential crop stress and short-term forecasted climatic conditions. Soil moisture deficits are varied in response to the short-term forecast (up to seven days), so the trigger point is dynamic; for example, using this method a grower can determine whether they can safely delay irrigation when rain is forecast even if the rainfall doesn't eventuate.

"Yield is directly associated with the accuracy of maintaining soil moisture availability at ideal levels to meet plant demand throughout its development," Rose said.

"Varying the deficit based on current and



predicted climatic conditions (and the forecasted evapotranspiration rates) enables a better match between moisture availability and plant water use.

"Depending on the weather, irrigations can be brought forward (reduced deficit) or delayed (larger deficit) from when normally applied minimising crop stress, maintaining yields and optimising

water use efficiency.

"Experiments in Narrabri over the past five seasons have shown that when the weather forecast is taken into account that you can safely delay irrigations without any impact on yield even if rainfall doesn't eventuate - but if it does, there are big savings in irrigation water and improved water use efficiency."

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ABOUT 90 PERCENT OF IRRIGATED COTTON CROPS IN AUSTRALIA ARE WATERED USING FURROW IRRIGATION, AND RESEARCHERS ARE WORKING TO IMPROVE THE EFFICIENCY OF THIS SYSTEM.

REFINING FURROW IRRIGATION WITH AUTOMATION

Furrow irrigation comes with some inherent drawbacks. Due to the use of siphons which need to be manually started and stopped, it is labour intensive and can result in inflexibility with regard to timing.

As part of the *Commercial prototype smart automation system for furrow irrigation* supported by CRDC, the National Centre for Engineering in Agriculture (NCEA) researchers Dr Jasim Uddin, Professor Rod Smith and Dr Malcom Gillies are evaluating the potential for automation of furrow irrigation in partnership with Rubicon.

"A commercial adaptive real-time furrow irrigation system would compete with the pressurised alternative of centre pivot or lateral move machines on capital cost, water and labour savings but without the massive energy costs," Rod Smith said.

"Our research has demonstrated that the issues associated with traditional furrow irrigation disappear with adoption of real-time optimisation and automation."

Findings

The automated furrow irrigation system (Figure 1) was installed at four sites across major growing areas in NSW and evaluated over the 2013-14 cotton season. The system functioned reliably without manual intervention. The preliminary results indicate that higher irrigation application efficiency (up to 90 percent) is achievable along with significant labour saving. Researchers will make further refinements to the system this season.

"Cut-off time is vital in furrow irrigation as it significantly affects the efficiency of irrigation," Rod said.

"A simple method to determine cut-off time based on a single, in-field sensor was evaluated and found to give cut-off times similar to the optimum time suggested by more rigorous measurement and modelling.

"An analysis of historical data suggests that knowledge of the rate of advance of the irrigation flow down the furrow can be used to calculate the cut-off time on cracking soils.

"This technique could be used now by irrigators to optimise furrow irrigations whether the field is automated or not."



"In many situations the inflexibility of furrow systems constitutes a glass ceiling to production that we would like to be able to remove," says CottonInfo Water Use Efficiency Technical Specialist Lance Pendergast, who has been working with the NCEA researchers.

"We are doing all this work on methods of deciding when best to irrigate and how much to apply, but in reality it is often difficult to implement these strategies.

"One of the main issues to be addressed with automated furrow irrigation is to achieve uniformity in supply to individual furrows, as we know that uniformity is critical to achieving those incremental improvements in yield."

One alternative tested in the 2013-2014 season was the use of a prototype high-flow, lay-flat fluming and other alternatives are being tested this season.

The researchers say that ultimately they are working towards a system which monitors and controls the irrigation with limited need for the grower to intervene.

Commercial prototypes of an automated furrow irrigation system that enables automation of delivery from the head-ditch will be demon-

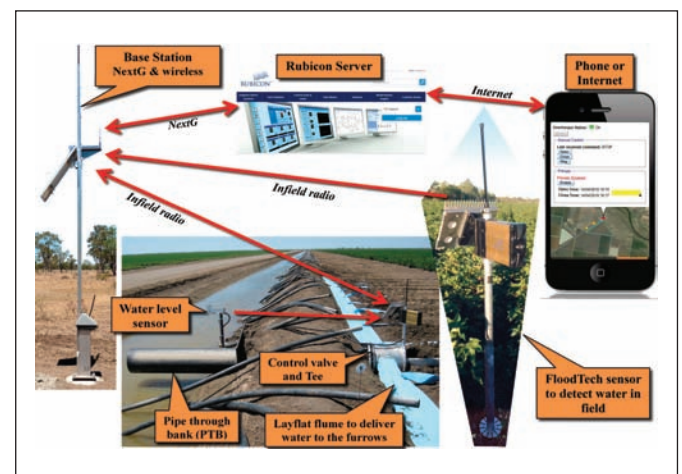
strated this season with the installation of equipment supplied by NCEA and its industry partner Rubicon. Demonstration sites at Emerald in QLD and Moree in Northern NSW will provide local growers, and the industry as a whole, the opportunity to consider an option that may fit their individual efforts towards improving production capacity.

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Using a control valve and fluming is one of the alternative systems to siphons tested by NCEA researchers.

Overview of the in-field furrow irrigation automation system.



FIELD TEST: WHICH WAY TO WATER?

AS THE ONLY TRIAL OF ITS KIND IN AUSTRALIA, A LOCAL IRRIGATION ASSOCIATION IS LEADING THE WAY TO BETTER UNDERSTANDING DIFFERING IRRIGATION METHODS.

The trial is unique in that it compares four irrigated cotton crops being grown side by side under lateral move, drip, bankless channel and traditional siphon irrigation methods.

The project investigated the relative water use efficiencies of these four irrigation systems on a fully commercial basis. The crops were grown in fields adjacent to each other at “Keytah” west of Moree. The three-year trial has been an initiative of Gwydir Valley Irrigator’s Association (GVIA) with support from CRDC, the National Water Commission – Raising National Water Standards Program and “Keytah” owners Sundown Pastoral Company and staff.

GVIA Chairman Joe Robinson “Tellerega” Moree said the trials had successfully demonstrated the value of a grower-led, industry-driven trial program with relevant and practical information for growers leading to improvements in on-farm water-use efficiency.

“This trial gives anyone who is interested in improving the efficiency and sustainability of their operation the chance to experience and hear what is involved with each system first-hand from the “Keytah” farm and irrigation managers, Nick Gillingham and Nathaniel Phillis,” Joe said.

“It has given us a lot to think about in terms of how to better manage our own systems, without physically having to undertake expensive changes to our irrigation systems which may or may not work.

“It highlights the pros and cons arising from each system.”

The information collected from the trials is designed to help growers make more informed decisions on their irriga-

tion practices and in turn to maximise their productivity per mega litre of water used.

The system comparison research has been run over three very different seasons, giving growers greater insight into the requirements and resource implications of the different systems.

Furrow irrigation is the most common method used in cotton growing. And while drip and overhead irrigation systems are relatively well understood in the irrigation industry, it is the bankless channel system that generated the most interest among other growers.

“The main advantages we have found in the bankless system are savings in labour and energy use,” “Keytah” farm manager Nick Gillingham said.

“Much less manpower and energy are needed to run this system, coupled with comparative water use efficiency to the other systems.

“This is what most people want to know about as costs in these areas are continually rising and we aim for better resource efficiency in all aspects of our farming.

“The project has been able to demonstrate that the typical siphon and the bankless channel systems are efficient from a yield and a water use perspective.

“A number of growers are looking at making changes to their irrigation systems, many of these growers have visited the site and discussed the management and results with us.

“There are many factors affecting irrigation system decisions, the main



ABOVE: “Keytah” Irrigation manager Nathaniel Phillis flushes the drip irrigation system.

being soil type, topography, water reliability, crop type and financial outlay.”

Taking a whole-of-farm view

As part of the trial Nick analysed the implications of irrigation systems for whole farm management.

He quantified the irrigation water applied (ML/Ha), operating labour time, operating energy cost (fuel usage in L/ML/Ha) the costs of operation and the total cost of the system (including maintenance, installation etc).

In terms of total capital outlay, the siphon channel system came up trumps, being the overall most cost effective, followed by bankless, lateral and drip as the most expensive. The



LEFT: If considering mechanised systems you have to be wary due to rising energy costs and lack of water in dry years, meaning you may have a large capital outlay in infrastructure sitting idle in those times.

bankless channel system appears to be the most efficient in terms of energy use, followed again by siphon, lateral and drip. Labour wise, the bankless system was only slightly less efficient than the drip system, with siphons by far the most labour intensive.

However, before making the decision to change to a system such as bankless channel from the traditional siphon method, Nick said any changes to an irrigation system has implications for farm management.

"Siphon irrigation is still giving the best dollar return," he said.

"So the question is, can you cost-effectively convert your siphon system, as you still need increased yield and increased water savings going forward.

"Each grower must look at their own individual system to calculate this, as they all have different management issues, for example all our water is gravity fed to this site here at Keytah, so that affects the energy use when comparing other systems such as laterals.

"For example if you are pumping from bores or need to lift a lot of water the numbers would be different.

"If considering mechanised systems you have to be wary due to rising energy costs and lack of water in dry years, meaning you may have a large capital outlay in infrastructure sitting idle in those times."

With trial data for the three years in (Figure 1), showing the lateral move system had the highest average yield, in terms of overall yield advantages and water use efficiency, the overall winner is harder to pin point, as seasonal and field conditions need to be taken into account, Nick says.

He also pointed out that in the 2013-14 trial, while the lateral yielded the most bales per hectare, the bankless channel and furrow irrigated fields had the highest Gross Production Water Index – or bales per megalitre water used.

"For example in the first year of the trial, the bankless channel crop was planted into newly lasered country,

which had undergone significant cutting, which caused some issues and affected yield," he said.

"It was also a very wet year, which can alter results, as the water applied will be different for each system depending on the season, some perform better under different conditions. "This year, being hot and dry, there were some savings with WUE in the drip and lateral, but the actual yield advantage wasn't there at the end."

The 2013-2014 season was climatically well suited - not for growers - but put the trials to the test, as there was almost no effective in-crop rainfall.

"The results showed that both the surface irrigation systems (furrow and bankless channel) were the most efficient producing the highest Gross Production Water Use Index (GPWUI)," project manager Lou Gall said.

"The lateral has consistently produced good yields and high GPWUI in previous years, but in 2013-2014 a season with no rainfall, the GPWUI was much lower and it was overtaken by these surface systems.

Nick said the lateral worked well in terms of crop establishment, as they were able to apply five millilitres every second day which got the stand going better than the other systems.

"There were some establishment issues in the siphon and bankless systems, however as the season drew on, those crops surpassed the lateral and drip in terms of vigour, as we were able to get the water on to the crops quicker," Nick said.

The trials demonstrated that the grower led, industry driven trial program was able to produce relevant information for growers.

A survey conducted during 2012 established that not only did growers see irrigation efficiency as critical to their long term viability; but that the commercial grower-led focus was seen as a practical way to provide useful insight into the various systems. Importantly many growers cannot

FIELD WALK SUCCESS

"As the turn out to our field day early in the year showed, for growers to be able to walk in the field and compare how a crop has performed under four different systems growing side-by-side is really popular," GVIA Chairman Joe Robinson says.

"The turnout of irrigators from areas such as Condamine in Queensland to Narromine and Bourke in NSW, along with those from the Namoi, Gwydir and Macintyre Valleys, shows this trial is creating broad interest and having the desired impact.

"The trial site has provided a visual learning experience not only for irrigators, but for agriculture and cotton students from The University of New England and Sydney University, including many international students from as far away as Brazil.

"This is another satisfying aspect to this project, to assist and encourage university students to pursue careers in the cotton industry by giving them first hand, positive experiences and the chance to meet and talk with growers and consultants, along with others in the industry who have attended our field days here."

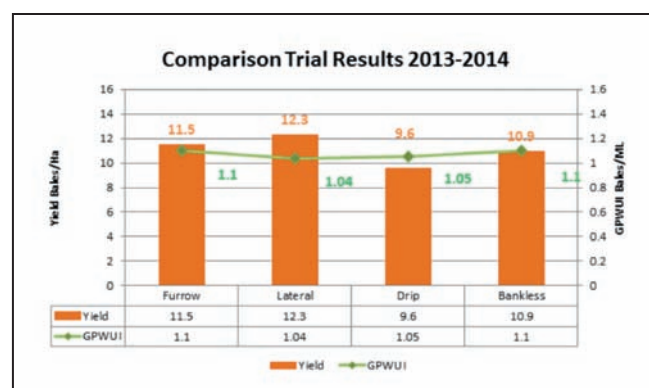


Figure 1. Yield comparison of the four systems over three years shows the lateral system ahead. Calculating overall yield advantages and water use efficiency can be difficult as seasonal and field conditions need to be taken into account.

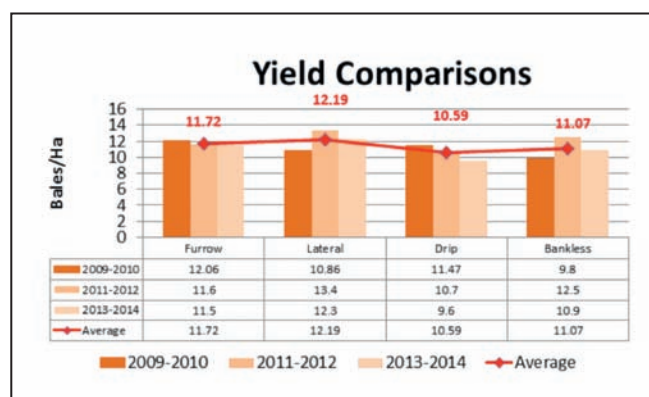


Figure 2. Last season while the lateral system produced the highest yield, it was not the most water use efficient. The water use efficiency performance of the lateral system is consistently high between seasons although these gains come at a larger operational and maintenance cost that must be considered.

afford to conduct trials of this nature themselves which makes this series of trials an incredibly valuable contribution to industry data.

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POLYESTER GOES GREEN: WHAT DOES THIS MEAN FOR COTTON?

POLYESTER IS NOW BEING MADE FROM BIO-DERIVED SOURCES AND SOON WILL ALSO BE RECYCLABLE.

THE ECONOMICS OF DEMAND

While polyester has taken over from cotton as the dominant fibre, cost and availability still play a significant role in inter-fibre competition. High oil prices and abundant cotton reduced demand for synthetic fibres during 2006-7, and cotton prices and demand benefitted. However, high cotton prices have underpinned a strong recovery in synthetic fibre markets, especially polyester, since mid-2009.

Polyester fibre, filament, yarn and fabrics have already replaced cotton in sportswear, hiking, camping gear and many other segments of the textile market. Man-made fibre production has increased at the expense of natural fibres (cotton, wool, silk and baste fibres) in both textile and industrial markets. Cotton's percentage of the world fibre market in 1991 was 49 percent. In 2013 it was estimated to be 31 percent.

Polyester is often substituted for, or combined silk or fine cotton in ladies underwear, body wear, yoga and sportswear, bathrobes and towels. This increasing share of polyester in world fibre production can be clearly seen in Figure 1 (polyester is the major non-cellulosic fibre).

New claims of being bio-derived and recyclable increase polyester's competitive advantage over cotton. Recyclability may also alleviate barriers

to polyester production during times of high crude oil prices, which is when cotton often gains its competitive advantage back. The use of bio-derived materials for polyester production also poses the question of whether polyester and cotton may eventually compete for scarce agricultural land in the future.

Polyester was invented in the 1940s by British chemists and bought to market by DuPont in the 1950s. Widespread uptake of polyester started in the 1960s and since that time annual world demand for polyester has grown from less than 500,000 tonnes to nearly 50 million tonnes in 2014.

Typically, polyester is made from precursor chemicals derived from crude oil. However with the development by the Japanese company Toray of polyester derived completely from bio-based material, the way we look at man-made fibres (MMF) is chang-

ing. Toray's polyester is created using molasses, giving the new fibre the 'sustainable' tag and greatly improving its environmental and sustainable credentials.

Another Japanese company is working on the development of technology for bioplastics, with the aim to create automobile interior components completely from plant-derived materials. Large brand owners like PepsiCo, Coca-Cola Amatil and Heinz are leading research in the formulation of bio-sourced feedstocks for polyester films and fibres, with the technology likely to be applied in the textile sector.

Desirable traits

Not only will these new polyesters now carry an eco-friendly tag, these materials are also marketed as having superior traits in functionality and wearability to cotton products.

		Feedstock	Textile	Industrial	Substitutes for...	Trade names (XYZ™)
Synthetic man-made fibres	Polyester	Terephthalic acid and ethylene glycol - Petrochemical	•	•	Cotton, Wool, Silk, Jute	Thermocool, CoolMax, Dacron, Holofil, Suprelle, Thermolite, Trevira
	Polyamide	Polyamide - Petrochemical	•	•	Silk, Wool, Leather	Nylon (var. names), Nomex, Kevlar
	Acrylic	Polyacrylonitrile from propylene - Petrochemical	•	•	Wool, Cashmere	Dralon, Orlon
	Elastane	Polyurethane-polyurea copolymer - Petrochemical	•		Rubber (latex)	Lycra, Roica, Invista, Elasthan, Acepora, Creora, INVIYA
	Polypropylene	Propylene - Petrochemical		•	Jute, Cotton	Carlona P, Herkulon, Moplen, Napryl, Profax, Propathene
	Polylactic acid	Starch – Corn/Sugar	•	•	Cotton	NatureWorks, Trevira INGEO
Cellulosic man-made fibres	Viscose	Cellulose - Wood	•	•	Cotton, Silk	Viscose (var. names)
	Modal	Cellulose - Wood	•	•	Cotton, Silk	Modal (var. names)
	Lyocell	Cellulose - Wood	•	•	Cotton, Silk	Tencel (var. names)
	Acetate	Cellulose - Wood		•		Rodia Filter Tow

Man-made fibres can be produced as a filament or staple fibre. Fibre refers to short finite or staple lengths (eg 20 – 65 mm) that ordinarily need to be twisted together in spinning for use in textiles, while filament refers to continuous lengths that can be converted directly into knit or woven fabric. Both forms are used in textile (apparel and home furnishing) and industrial applications (composite, non-woven, packaging, canvas, film and rope).



AT A GLANCE

- Global cotton production is approaching its physical maximum (ICAC).
- Per capita demand for fibres continues to grow with rising GDP.
- Global population continues to increase.
- Synthetic fibre production is already greater than cotton production and will continue increasing to satisfy growing demand.
- By 2020, polyester production will be 2.5 times greater than cotton production.
- The cotton market is more vulnerable to competition from polyester than vice versa.

Polyester has always been stronger, lighter and tougher than cotton, although it still remains much poorer in terms of moisture uptake, odour retention and comfort. Nevertheless new polyesters claim traits such as non-sticking on body, rapid moisture absorption, sweat permeability, subjective de-odourising, rapid warming and high insulation.

How quickly polyester producers will move towards plant-based feedstocks is unknown; regardless, the cotton industry both domestically and globally has been actively taking steps via research and global alliances to maintain our competitive and sustainable edge.

Leveraging cotton's position

Dr Stuart Gordon from CSIROs has been working with the Australian cotton industry for over 20 years now and has been looking at ways the Australian industry can leverage its positive traits and sustainable tag.

"Polyester is reinventing itself very quickly these days; it now comes in lots of different shapes, chemical finishes and names, together with marketing," Stuart said.

"Being a natural fibre has been a major attraction of cotton with consumers, however the development of technology to manufacture bio-derived polyesters heavily impacts our competitive advantage in this regard.

"An attractive fibre for spinners is one that is inexpensive and that has consistent fibre quality characteristics.

"The key for Australia is to focus on our yield, sustainable production system and quality - the focus needs to be on all these areas."

CRDC R&D Manager Allan Williams says research also needs to focus on the science of improving cotton's elasticity, moisture absorption and dyeing ability using GM or chemical modifications. He says significant advancement in one of

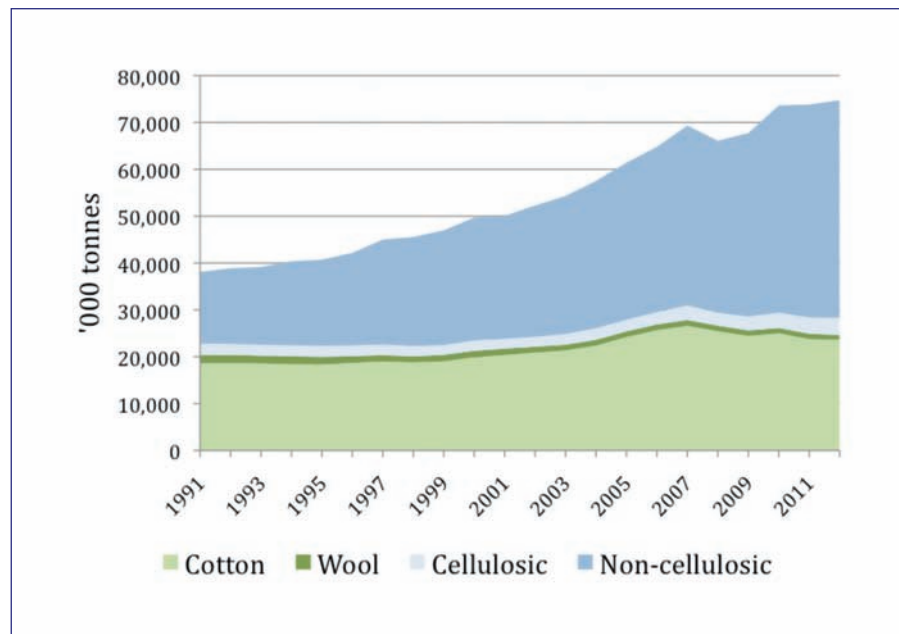


Figure 1. World fibre production by type, 1991-2013 (Source: OECD-FAO 2013).

This figure shows world fibre and filament production since the early 1990s. Cellulosic production refers to fibres such as viscose, modal, acetate and lyocell that use wood pulp as the main feedstock in their production. The bulk of the non-cellulosic production is largely polyester (terephthalic acid and ethylene glycol) although the number also includes acrylic and nylon fibres. The yearly growth in polyester filament production is predicted to be seven percent over the next three years to 2016 and 4.1 percent for staple fibre production.

THE GROWTH OF POLYESTER

- World production of polyester staple (fibre of a set length) has grown at an average rate of 6.5 percent per year during the past decade.
- Global production of polyester staple is forecast to rise by an average of 5.4 percent per year through 2025, compared with 4.1 percent for all fibres.
- The use of recycled raw materials for the production of polyester staple is growing and accounts for almost 50 percent in some regions.
- World production of polyester filament has increased by an average of 8.2 percent per year during the past decade.
- Global filament (continuous strand of spun fibre) production is expected to grow at an average annual rate of 7.2 percent through 2025, driven by China and to a lesser extent India.
- Use of recycled raw materials in filament is not as extensive as in staple but continues to grow rapidly from a small base.

these characteristics changes the game for cotton and its competitors.

Dyeing in particular is an area where cotton is at a disadvantage, with traditional dyeing techniques being wasteful in dyestuff, ie the amount of dye in the dye bath that actually attaches to the cotton, and salt, large amounts of which are used to drive the dye molecule into the fibre structure. Improvements in dyeing cotton that reduce the energy costs and/or the environmental impact are required for cotton to compete with man-made fibres.

"Innovative fabric finishes for cotton offer another way to enhance the competitiveness of cotton against polyester," Allan said.

"Concepts being investigated through CRDC-funded research include self-sterilising cotton fabrics, and cotton with improved moisture - handling characteristics, that stay drier for longer."

As well as improving the characteristics of cotton as a means of addressing

the MMF threat, CRDC has been working with industry partners to improve cotton's market access.

CRDC's investment in understanding the current markets and potential opportunities for the Australian cotton industry provided sophisticated market intelligence, which in turn underpinned the development of a new industry marketing strategy by Cotton Australia with the assistance of the Australian Cotton Shippers Association and CRDC. The resulting Cotton to Market international program was launched in 2014, incorporating Cotton LEADS and the Better Cotton Initiative. (See articles following pages).





TECHNOLOGY NOW SUSTAINABLY SEPARATES COTTON-POLYESTER BLENDS

WHILE IT IS EASY TO RECYCLE COTTON AND POLYESTER INDIVIDUALLY, IT IS NOT POSSIBLE TO MECHANICALLY SEPARATE COTTON/POLYESTER BLENDS AS THE FIBRES ARE CLOSELY BONDED TOGETHER.

Chemical solutions attempting to separate cotton and polyester blends have, until now, been unviable both economically and environmentally. However using an ionic liquid (a salt in a liquid state) researchers at Deakin's Institute for Frontier Materials have developed a simple process to separate polyester/cotton blends into their individual components.

"A significant hurdle to recycling waste clothing and other textiles back into their original fibres is that most of this material is composed of blended fibres – the most common being polyester/cotton blends," says PhD student Rasike De Silva who is working with Professor Xungai Wang and Dr Nolene Byrne at Deakin.

"Unlike harsh solvents which have previously been used to dissolve polyester, the ionic liquids we are using provide an environmentally friendly alternative; another benefit of using ionic liquids is the ease with which the polyester and cotton can be separated.

"The ionic liquid selectively dissolves the cotton component, with the added advantage that the liquid can then be recycled and reused.

"This cotton can then be regenerated into various forms, such as spun into fibres or cast as cellulose films, like cellophane."

Regenerated cotton is also increasingly being used as a low-cost precursor in the carbon fibre industry and as the starting material for bioethanol production.

The recovered polyester can also be recycled by melting and reshaping it into other forms, such as plastic bottles or fibres. The researchers say the new process is not limited to textile recycling but can also be applied to recycling any type of bio-composite material, including those used in the automotive industry. Regenerated cellulose fibres such as viscose, rayon



PhD student Rasike De Silva and his colleagues at Deakin University have made a breakthrough allowing waste cotton found in blended materials to be separated and thus regenerated into a range of products.

and lyocell have a considerable market share and are growing in popularity.

Environmental credibility

The environmental credibility of this new research lies in the development of a complete recycling solution for textile waste materials. Currently, solvents used are considerably more toxic and harmful than the solvents in this method. The environmental impact is also lessened by reduced water and energy use compared to current recycling methods.

"As significant amounts of textiles are discarded to landfill each year, our proposed recycling process will alleviate this problem. While we have not undertaken a detailed study, we also think this will have a positive impact on the life cycle assessment of cotton and cotton blended textiles and this is important for consumer satisfaction," Rasike said.

A textile engineer from Sri Lanka,

Rasike is working at the Institute for Frontier Materials with Dr Nolene Byrne and Professor Xungai Wang. He carried out the project as part of his PhD research into separation and utilisation of polymer fibre blends using environmentally friendly approaches.

WHAT A WASTE

Each year, masses of material from unwanted clothing and other sources are deposited in landfill.

By example, the United States generates more than 11 billion kilograms of textile waste each year with only 15 percent recycled and an estimated more than nine billion kilograms being sent to landfill, according to the US Council for Textile Recycling.

The US EPA estimates that textile waste occupies five per cent of landfill mass.



ENVIRONMENTAL CREDENTIALS ON THE WORLD STAGE

THE AUSTRALIAN COTTON INDUSTRY'S SUSTAINABLY-GROWN FIBRE STORY WAS HEARD ON THE GLOBAL STAGE EARLIER THIS YEAR WHEN A DELEGATION TRAVELLED TO HONG KONG FOR THE GREAT IDEAS IN COTTON CONFERENCE.



Cotton Australia led the delegation and CEO Adam Kay said the trip was “of enormous value to Australia’s cotton industry”. The Great Ideas in Cotton Conference focused on innovation with cotton textile technologies and concepts.

“We spoke to more than 300 attendees of the Conference and also engaged directly with our major partner organisations and participants in the export markets and supply chains, to take the positive story about Australia’s cotton industry to the world,” Adam said.

“We met with sourcing and manufacturing partners and brand owners, which has enormous importance to securing Australian cotton’s position in

the global fibre market.”

The delegation was also able to highlight and discuss Australia’s participation in the Cotton LEADS program, which is dedicated to the supply of responsibly produced cotton. Cotton LEADS emphasises the environmental gains, traceability and national capabilities achieved at a national level within the two current member nations, Australia and the United States. Combined, Cotton LEADS cotton accounts for approximately 17 percent of global production.

“This trip has paid enormous dividends for Australian growers by promoting our programs to critical players in the supply chain, future-proofing

Australia’s cotton crop, encouraging cotton as a fibre of choice for manufacturers, and ensuring Australian cotton is on the list of preferred suppliers for brand owners, retailers and manufacturers,” Adam said.

“Since its launch in October 2013, more than 170 textile companies from 17 countries have formally acknowledged the merits of Cotton LEADS cotton by signing on as partners.

“A number of major companies have signed a ‘Commitment to Cotton’ including retail giant Brooks Brothers, Fruit of the Loom, Central Textiles, Tuscarora Yarns, Mount Vernon Mills and the Esquel Group.”

Adam Kay puts Australia’s environmental credentials and sustainability on the table at the Great Ideas in Cotton Conference held in Hong Kong this year.

myBMP FARMERS LEADING THE WORLD BY EXAMPLE

THE AUSTRALIAN COTTON INDUSTRY IS NOW A SIGNATORY TO A LANDMARK AGREEMENT WITH THE BETTER COTTON INITIATIVE (BCI).

Better Cotton Initiative CEO Patrick Laine says Australian producers have made remarkable progress far beyond legal compliance in growing cotton for the benefit of people and planet.

“BCI is delighted to recognise myBMP as providing a credible, verified framework for documenting this continuous improvement,” he said.

“myBMP farmers are leading by example.”

The agreement, signed by Cotton Australia on behalf of the industry, transfers a BCI licence to Australian cotton produced under myBMP certification.

BCI is an international not-for-profit organisation dedicated to promoting the responsible and sustainable production of cotton globally. While Cotton Australia is already a member organisation of the BCI, this

agreement represents the first time Australian myBMP-certified cotton can be sold into the global market under the BCI banner.

Cotton Australia CEO Adam Kay says the agreement is being welcomed by Australian cotton growers and the wider industry.

“This agreement recognises Australia’s leading role in the production and promotion of responsibly grown cotton,” Adam said.

“Access to future growth markets is of tremendous importance to Australian cotton growers, particularly as they contend with competition from synthetic fibres.

“Within the global natural fibre market, demand for responsibly grown cotton is growing, and this agreement allows Australian cotton growers to participate more easily in that expanding market.

“I am confident this agreement and its promise of enhanced market access will encourage more Australian growers to achieve full myBMP certification.”

myBMP is the Australian cotton industry’s best management practice certification system and growers are

able to participate at varying levels of practice recognition. Certification within the myBMP system involves independent auditing and recognises that the cotton-growing enterprise has met all best management practice requirements and is operating at the pinnacle of cotton-growing practice.

Cotton Australia has been working towards the agreement with BCI for the past year.

“There are many similarities between the myBMP system and BCI’s systems, so harmonising the two was reasonably straightforward,” Adam said.

“Australian cotton growers will appreciate the ability to use one system to produce cotton under both the myBMP and BCI banners.”

Cotton Australia will manage the ongoing relationship with BCI on behalf of the Australian cotton industry, and will also work to ensure the myBMP system remains harmonised with any future changes to BCI systems.

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COTTONINFO MARKS SECOND ANNIVERSARY

THE COTTON INDUSTRY'S JOINT EXTENSION PROGRAM, COTTONINFO, MARKED ITS SECOND ANNIVERSARY AT THIS YEAR'S COTTON CONFERENCE WITH A SPECIAL EVENT TO ACKNOWLEDGE THE COTTONINFO TEAM.

The joint venture was officially launched at the 2012 Cotton Conference, with the three key partners, CRDC, Cotton Australia and Cotton Seed Distributors signing the historic agreement at the event.

Two years later, and the 25-strong CottonInfo team of regional development officers, technical specialists and myBMP experts have made great strides forward in the industry, delivering best practice information to growers across a wide range of important topics - from nutrition, water management, energy efficiency and carbon farming to biosecurity, disease, weed and insect management and natural resource management and stewardship.

The CottonInfo team are charged with three things: improving industry practices, improving responsiveness to issues and improving the communication of research outcomes by connecting growers with research. The Cotton Conference event brought together the CottonInfo team, along with the joint venture partners, to acknowledge the team's early successes and to note the work planned ahead.

To learn more about CottonInfo and how the team can help you improve your farm's productivity and profitability, contact your local regional development officer today!

FOR MORE INFORMATION, CONTACT YOUR LOCAL REGIONAL DEVELOPMENT OFFICER:

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Macquarie - Amanda Thomas:
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CottonInfo management committee at this year's conference - CSD GM Development and Communications Philip Armytage, CRDC GM Investment Ian Taylor, CottonInfo GM Warwick Waters, Cotton Australia CEO Adam Kay, CSD Chairman Peter Graham, CRDC Executive Director Bruce Finney and Cotton Australia Policy Officer Greg Kauter.



High Achiever Brendon Warnock, Narrabri, NSW, Growers of the Year Tim and Sally Watson, Sunland Ag Hillston, NSW, Young Achiever Zara Lowien Gwydir Valley Irrigators, Moree, NSW, Researcher of the Year Dr Stuart Gordon CSIRO Geelong and Service to Industry awardee Andrew Parkes, Customised Farm Management, Moree.

THE INNOVATION AWARDS

More than 1000 people gathered to celebrate and recognise the innovation, excellence and achievement at The Australian Cotton Industry Awards on August 7 at the Gold Coast Exhibition Centre.

The Awards involve all people throughout the supply chain, from growers and ginners to product suppliers, consultants, agronomists and researchers. They are an opportunity to showcase the innovative thinking of individuals or groups and share their stories.

"The Awards are not about being 'the best', they are about broadly sharing the positive stories of the cotton industry," co-organiser Sally Hunter said.

"If you would like to be inspired, go to the Awards' website and read the case studies, there is something we can learn, whether a farmer or researcher, by reading about these people.

"These Awards could be called the 'innovation awards' as innovation seems to be what is driving our industry if these people are anything to go by.

"By bringing these people's 'daily work' and the results of it into clear view others can benefit from their thinking and innovation.

"Many people in the industry may not think they are doing anything unusual, but to others it could be seen differently and they may be able to learn from them; we hope to bring these stories out through the Awards."

A case in point is the 2014 Grower of the Year, Sunland Ag Pty Ltd, spearheaded by the innovative thinking of Tim Watson who has been growing cotton near Hillston in the Riverina for 14 years.

"This enterprise is not confined by conventional thinking and as a result it is achieving outstanding results," Sally said.

Sunland Ag grows 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 putting it at better than the top 20 percent of farms participating in a benchmarking. Tim's philosophy is to always be the least cost producer of the highest quality fibre.

"Every year the Australian Cotton Industry Awards celebrate not just the great work and personal commitment of the recipients and finalists, but also the commitment of everyone throughout the cotton supply chain," Cotton Australia CEO Adam Kay said.

"Unfortunately, there can be only one recipient in each category. All of the successful candidates this year have achieved great things within Australian cotton, and they are all tremendous ambassadors for the industry." www.australiancottonawards.com

Monsanto Cotton Grower of the Year, Tim and Sally Watson, Sunland Ag (Hillston, NSW).

AgriRisk High Achiever of the Year, Brendon Jack & Jacqui Warnock. Warnock, Warnock Agronomics (Narrabri, NSW).

Chris Lehmann Trust Young Achiever of the Year, sponsored by Bayer CropScience, Zara Lowien Gwydir Valley Irrigator's Association, (Moree, NSW).

Cotton Seed Distributors Researcher of the Year, Dr Stuart Gordon CSIRO (Geelong, Vic).

Pivot Fertilisers Service to Industry Award, Andrew Parkes, Customised Farm Management, Moree.



CONFERENCE ATTENDANCE AT ALL TIME HIGH

OUR INDUSTRY HAS HAILED THE SUCCESS OF THE AUSTRALIAN COTTON CONFERENCE AND COTTON INDUSTRY AWARDS, HELD CONCURRENTLY IN EARLY AUGUST AT THE GOLD COAST CONFERENCE AND EXHIBITION CENTRE.

The conference is a joint initiative of Cotton Australia and the Australian Cotton Shippers Association, with support from CRDC and CSD.

"The Australian Cotton Conference was an enormous success and attracted more than 1800 delegates, the biggest attendance on record in the event's 34-year history," says Cotton Australia CEO Adam Kay.

"The success of the Conference demonstrates the resilience and positive attitude amongst those in our great industry.

"More than a third of the delegates were cotton growers, who attended despite some tough breaks in the past season for farmers in many cotton-growing regions."

This year's comprehensive speaker line-up and substantial program contributed to the excellent turn-out to the event.

Drawcard presenters included Victoria Cross recipient Corporal Benjamin Roberts-Smith VC MG, who opened proceedings, along with Olam Group Managing Director and CEO Sunny Verghese, Tracy Bevan from the McGrath Foundation and Federal Minister for Agriculture Barnaby Joyce.

Adam Kay says the conference organising committee had originally hoped for 1200 delegates, but was overjoyed when 1800 made the trip to the Gold Coast to participate.

"It also fantastic to see growers from all cotton-growing areas in Australia; from Emerald in Central Queensland to the expanding regions in Southern NSW and Northern Victoria attend the conference and contribute their ideas.

"It is testament to their faith in the cotton industry that so many people participated.



"Every two years the Conference draws together Australia's cotton community, from growers and suppliers to researchers and agronomists; this year we attracted a significant contingent from the cotton industries from other countries."

The organising committee, led by Mungindi grower and Cotton Australia Board member Barb Grey, and many volunteers contribute much time in preparation for this impressive event.

Barb thanked the 29 sponsors and 66 exhibitors of the Conference, and said the community and youth programs were particular highlights.

"This conference was the first to adopt a charity, and threw support behind the McGrath Foundation's mission to raise money to fund breast care nurses in communities right across Australia," Barb said.

"Conference delegates were invited to get involved by making a donation and wearing pink to the conference on the last day, which featured a speech by Tracey Bevan during the Wellbeing session."

Barb says the Conference also supported youth in the industry through its Next Gen in Cotton program, designed for those under 35.

"Australia's cotton industry has always been ahead of the curve when it comes to taking up new technologies and developing more sustainable and economical ways of operating," she said.

"The business environment for growers and those who supply and service our industry is moving fast and changing rapidly.

"It's essential the next generation of industry players are involved in the future development of our industry and even more essential that the next generation take some ownership of the future direction of the industry."

"The Next Gen in Cotton forum aimed to ensure the voices of up and coming leaders and industry participants are heard. It also updated them on the industry's Vision 2029 program, provided tools for better communication and allowed them to network with others their age in the industry."

The extensive Conference program covered topics including:

- global cotton markets, contracts and brand marketing
- forecasting the future for Australia's cotton industry
- tools for integrated pest management
- master-classes and workshops on nutrition and nitrogen management, dryland cotton farming, crop establishment and managing energy costs
- irrigation and resistance management
- cotton physiology
- social media.

Olam Group Managing Director and CEO Sunny Verghese was a popular speaker who stimulated much conversation among attendees about the future of agriculture and cotton in a global context. His presence was in great demand, with no time to spare between his presentation and filming a segment for ABC's Landline in the conference media room.



