Cotton Research & Development Corporation

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Spotlight on Cotton R&D

- ***Protecting the crop***
- ***Value chain opportunities***
- *Also inside this issue:*
  Objective measurement breakthrough
  New value in soils knowledge
  Water; Save 35pc with furrow optimisation

Australian Government

Cotton Research and Development Corporation

Spring: September 2007

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

Cotton Research and Development Corporation
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Our vision: A globally competitive and responsible cotton industry

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

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

Corporate background
CRDC was established in 1990 under the Primary Industries and Energy Research and Development Act 1989 (PIERD Act.) which outlines its accountability to the Australian Government and to the cotton industry through the Cotton Growers' Research Association (ACGRA). CRDC is responsible to the Australian Government through the Minister for Agriculture, Fisheries and Forestry, the Hon. Peter McGauran MP and the Parliamentary Secretary to the Minister the Hon. Sussan Ley MP. CRDC is committed to fulfil its legislated charter to: Invest in and manage an extensive portfolio of research, development and extension projects to enhance the ecological, social and economic values associated with cotton production systems and to benefit cotton industry participants, regional communities and the Australian community.

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Spotlight

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OUTLOOK SLIGHTLY IMPROVED

Rainfall events in August have improved the cropping outlook for many, but not all, cotton growing regions. Some positivism can also be drawn from recent improvement in cotton prices and the excellent yields and quality achieved last season. The reality, however, is that much more rain will be required if a significant area of cotton is to be planted in 2007. Under these circumstances of uncertainty for all, the CRDC Board is continuing to closely monitor the outlook and consider scenarios for research funding.
Of importance is CRDC's 2007/08 Annual Operating Plan which details how we shall respond to needs to consolidate activities and R&D investment. This is the fifth and final AOP prepared under the strategic R&D Plan 2003-2008. Consequently evaluation of the achievement of R&D Plan outcomes and the impact of R&D investments will be of importance. We look forward to sharing the outcomes of those evaluations in future editions of Spotlight. In this edition we focus on the important research addressing crop protection threats and creating extra value in the value chain.
Concurrently, the CRDC is preparing its successive strategic R&D Plan 2008-13 for implementation over five years from 1 July 2008. CRDC has already had opportunity to provide overviews and discuss the draft high level strategies with a number of grower, industry and government organisations.
The CRDC highly values this interaction and we will be continuing to broadly consult in forming the draft Plan. Building on this input will be invited expert papers which critique the draft Plan and propose research initiatives that will be work shopped at a forum later this year.

NEW CRDC CHAIR ANNOUNCED

Parliamentary Secretary to the Minister for Agriculture, Fisheries and Forestry, Sussan Ley, announced on August 24 that Narrabri cotton farmer, Mr Mike Logan is the newly appointed Chairman of the Cotton Research and Development Corporation (CRDC).
Ms Ley said that Mr Logan would bring a wealth of practical industry experience and a strong vision to the position for the three years of his appointment.
Mr Logan has long been a strong advocate of best practice use of natural resources in the Australian cotton industry. His cotton farm was the first in the world to gain ISO certification for compliance with world's best practice principles for environmental management. Mr Logan also spent six years on the board of Land and Water Australia where he played a leadership role in a number of key programs dealing with irrigation and climate variability. He is also a past director of Cotton Australia.
"Mr Logan's extensive knowledge and long standing involvement in the cotton industry will be of immense benefit to the CRDC, and will be invaluable as the cotton industry responds to its challenges. Increasing the efficiency of water use in an environment of strong competition for natural resources will be one of the most important of these," Ms Ley said.
"Mr Logan's appointment comes at an opportune time, as the CRDC develops its five-year R&D plan to ensure the cotton industry remains sustainable and profitable into the future."
Ms Ley thanked Ms Bridget Jackson who retired after seven years service as the CRDC Chairman.
Ms Ley also thanked Mr Richard Browne, Deputy Chairman of the CRDC, for his effective leadership of CRDC while the new appointment was finalised.
The Board and management of CRDC welcome this news and look forward to working under Mike's guidance at a particularly challenging and critical period for the future of the industry.

Contributors: Editorial and photographic contributions to Spotlight are welcomed. All intending contributors should in the first instance contact the Editor.

Cover Photo: A study by Judy Nobilo of the plain brown lyunx spider Oxyopes molarius eating a green mirid Creontiades dilutus.

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

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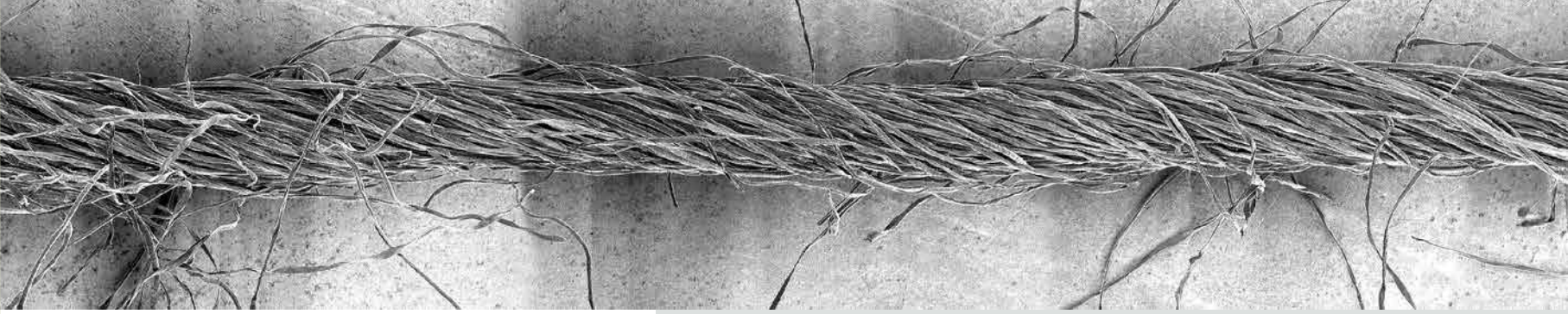
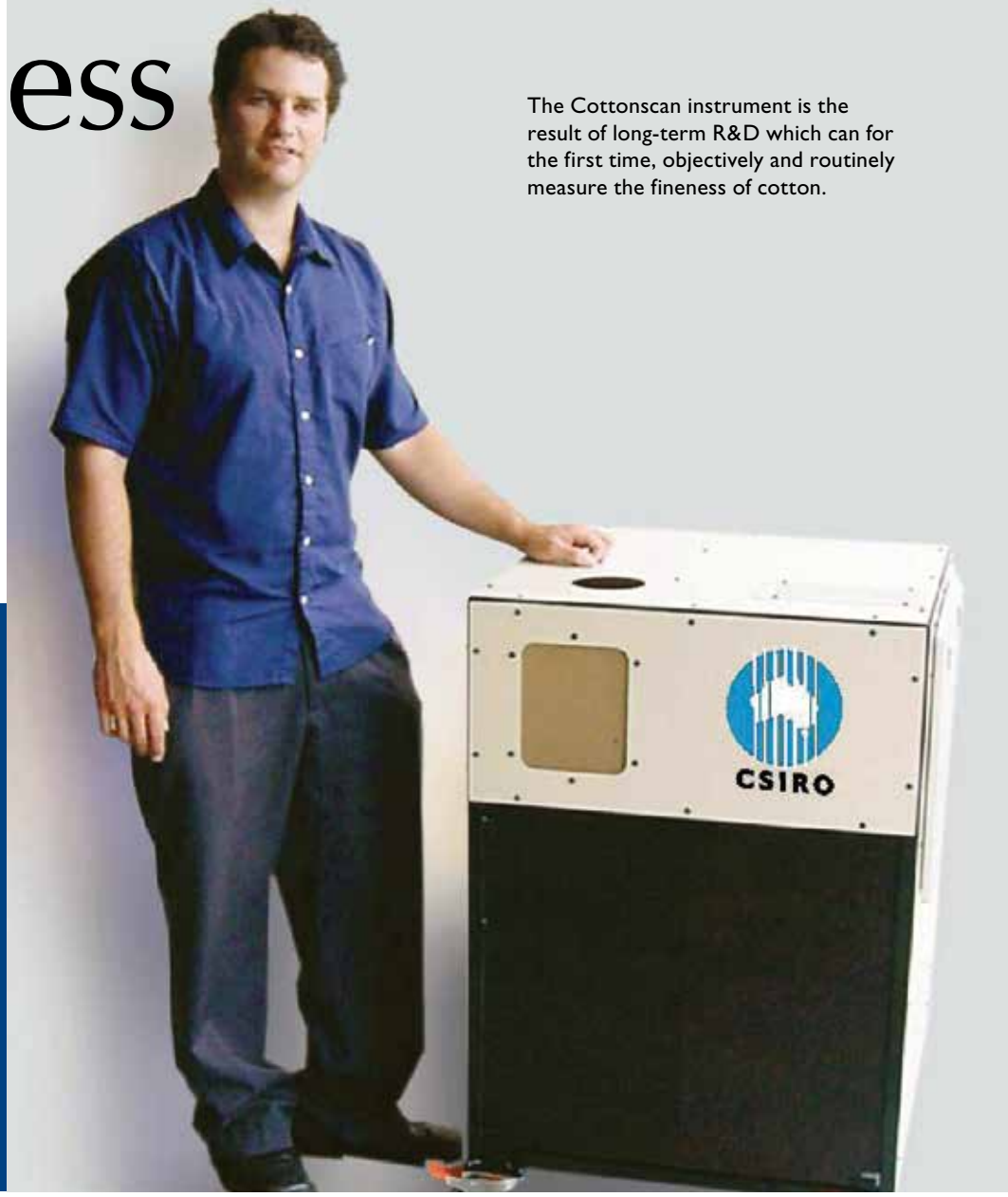


Fibre fineness made to measure



The Cottonscan instrument is the result of long-term R&D which can for the first time, objectively and routinely measure the fineness of cotton.

The link between micronaire and fibre fineness is ambiguous. The fibre fineness of a ginned lint sample can now for the first time be measured routinely. In a matter of minutes the Cottonscan was able to duplicate several years of work undertaken by the American researchers.

A long-term research project at CSIRO Textile and Fibre Technology, with funding support from the Australian cotton industry through CRDC has been seeking novel instrumentation for measuring cotton fibre mass per unit length.

A recent breakthrough at CSIRO in novel instrumentation has demonstrated that for the first time the fibre fineness of a ginned lint sample can now be measured routinely using the patented Cottonscan technology developed at CSIRO. In the absence of actual fibre fineness information the market has relied on micronaire, as a proxy for fibre fineness.

Fibre fineness is a key fibre quality parameter, and the scientific paper to be presented at the World Cotton Research Conference in Texas in September by CSIRO's Geoff Naylor, will announce the breakthrough to the world's cotton industry. Geoff is research leader and manager of the cotton textile research unit of CSIRO at Geelong, Victoria.

In testing and validating the technology, Geoff Naylor said CSIRO scientists authenticated the Cottonscan system by measuring a set of calibration cottons obtained from America. The cross-sectional area of these 'calibration' cottons had previously been measured by US scientists by careful detailed analysis of a large number of individual fibre cross-sections for each sample. In a matter of minutes the Cottonscan was able to duplicate several years of work undertaken by the American researchers.

For example in recent years, the discounts for high micronaire relate to the spinner perceiving that the mass per unit length of the fibre will be too high to enable him to spin the high quality fine yarns required by his customer, the fabric manufacturer. However the link between micronaire and fibre fineness is indeed ambiguous.

The scientific paper to be presented at the world conference describes an inter-laboratory trial used to assess the precision of the Cottonscan instrument. Three instruments (at CSIRO in Geelong, ACRI in Narrabri and at a commercial cotton classing office) were used to confirm the robustness of the complete Cottonscan technology. No significant difference between laboratories/instruments was observed.

'Weight' is an important fabric property. As consumers we know instinctively that it would be inappropriate to manufacture a summer shirt from a 'heavy weight' fabric. In the textile industry, whenever a fabric is analysed its weight is determined. For example, denim fabrics are typically about 500 grams per square metre (g/m2), while summer-weight cotton shirting fabric is typically in the region of only 100 g/m2.

In general, lighter weight fabrics require lighter weight yarns. Yarn mass per unit length is always specified by the fabric manufacturer to their supplier, the spinner. For example Denim fabric is typically manufactured from yarns that weigh between 60 and 100 grams per kilometre (this unit is called tex) whereas a summer shirting fabric requires a yarn as fine as 15 tex.

In a similar way, the spinner needs finer fibres to manufacture lighter weight yarns. As fibres are considerably finer than yarns their mass per unit length is generally measured in milligrams per kilometre (mtex). For virtually all other fibres except cotton, the weight per unit length of the fibre is measured and specified by the fibre supplier for the spinner. However to date this has not been possible for cotton.

High quality fine yarns destined for light weight fabrics is the key segment of the cotton yarn market that uses Australian cotton. Lighter weight fabrics generally demand a premium in the fabric market and the premium flows through the value chain as a premium for finer fibres.

The Cotton "Pathway"

What is BMP?

Best Management Practices is the Australian cotton industry's commitment to continuous improvement focussed on reducing the impacts of cotton farming on the natural environment, neighbours, workers and the community; in other words, its environmental management system (EMS).

The BMP program is a coordinated industry effort, with CRDC managing the development and Cotton Australia managing implementation and auditing.

The Australian cotton BMP sets an example for the rest of the rural sector, by combining sound science and practical farm management.

BMP helps cotton growers:

- Identify and manage environmental risk;
- Create a safe workplace for staff
- Design cotton farms that minimise environmental impact
- Use pesticides in a safe and responsible manner
- Use all available options to control pests
- Minimise use of and recycle water
- Store and handle chemicals safely
- Contribute to catchment targets through individual on-farm improvements;
- and now - preserve and protect optimal fibre quality characteristics.

BMP Program
On-farm adoption

EMS PATHWAYS

The concept is that agricultural industry's received funding to help them build a pathway to three outcomes:

- Adoption of profitable and sustainable farming practices;
- Improved natural resource management and environmental outcomes; and
- an ability to demonstrate environmental stewardship to domestic and international markets

Allan said that although the formal title of the project was Enhancing the cotton industry's BMP Program (EMS pathway) to improve adoption you could be forgiven for thinking that the project was only concerned with looking at fibre quality and branding issues; but "it was always accepted that an environmental brand that did not include quality considerations wasn't going to cut it".

Meeting spinner & fashion requirements

Australian cotton is often purchased for a premium because it meets spinners' requirements on the basis of quality and consistency. However, coarse (high micronaire) fibre, high nep counts and excessive short fibre content are aspects of Australian cotton spinners would like to see improved.

Fibre quality is affected by a large number of interacting factors – variety, seasonal conditions, crop and harvest management, ginning and storage can all shape whether or not the spinner's requirements are met. While some of these factors cannot be controlled, there are many that can be influenced.

Better varieties, management for each region's climate and processing and handling to minimise damage to fibre are opportunities to improve fibre quality.

The industry is currently researching and investigating extension of BMPs throughout the value chain: this would include warehousing, picking and carting.

Spotlight will continue to report on developments within the value chain and the degree to which participants can extract greater value along the supply chain.

"Cooperation along the production supply chain – from seed breeders, growers, ginners, warehousers and shippers – is the key to success in increasing the quality of cotton," says Andy Weil III.

According to the EMS Pathways project author Allan Williams, these words summarise very neatly one of the major aims of the EMS Pathways project – focussing on the whole supply chain to extend the BMP concept both in scope – to fibre quality – and in extent, to all sectors of the supply chain.

Increased Retail Demand

EMS PATHWAYS – the theoretical road map - looking at testing the hypothesis that by: extending the BMP concept to cover environmental and quality considerations, and by branding that combined concept, the industry would be able to gain a market advantage that would provide incentive for the uptake of BMP.

Environmental Outcomes

A BMP stakeholder workshop, convened by CRDC and supported by industry bodies held in June 2006, recommended a greater BMP focus on industry-wide practices leading to improvements that would increase BMP's value to growers.

The EMS Pathways Project aims to extend the cotton industry's BMP program through the entire value chain to create a complete environmental and quality assurance supply chain program – which in turns helps to brand Australian cotton and attract premiums.

Studies show that one in five European consumers say they would be willing to pay for products that are socially and environmentally responsible.

The industry's BMP program has the opportunity to develop an Australian cotton crop that can be promoted as environmentally responsible.

For example, in progressing opportunities to link BMP with retailers and consumers, branded garments made from Australian BMP cotton have gone on sale in Japan under an in-house brand, and the success of the trial resulted in a second shipment of BMP cotton for use in the campaign (see 'headline' page….

The EMS Pathways project aims to foster good natural resource management outcomes through potential market-based incentives.

So far, the EMS Pathways partnership project has developed draft BMPs for defoliation, harvesting, module building and transport, which were trialled from the 2005-06 season.

BMP COTTON
BEST MANAGEMENT PRACTICES

Ability to demonstrate stewardship

Traceability of environmental performance

Cotton growers who follow BMP guidelines now also have economically viable options for gin trash re-use options following a research project by the CRDC which tested trash and found residues posed little risk to the environment, resulting in the classing of the trash as 'solid waste' rather than 'hazardous' and was planned by the EPA.

Quality must be kept through the ginning process to maintain and gain market premiums.

A ginning BMP to retain fibre quality is currently being tested through a pilot audit of 27 of the 40 gins in Australia. Further to this, a CRDC project is assessing moisture management and focussing on improving quality parameters during ginning. An EMS pathways project examined hessian bale coverings and resulting contamination.

Further down the supply chain – classing houses in Australia have undergone a voluntary audit on their classing BMPs.

To advance the quality assurance through the chain, traceability research - where Australian cotton is tracked from grower to spinner, is providing important information of the practicalities of demonstrating quality assurance through the supply chain, this report was handed down to CRDC in July 2007 and is being considered by all participants in the supply chain.

Where will the Pathways lead us?

By Megan James

There's been some twists and turns, some smooth stretches, and a few bumps along the way, but in June 2007, the Australian cotton industry, led by researcher Allan Williams completed the "EMS (Environmental Management Systems) Pathways Program Project: Enhancing the cotton industry's BMP (Best Management Practice) Program to improve adoption". Following is a glimpse into this three-year journey.

The CRDC project was funded through the Australian Government's Pathways to Industry EMS Program which was supported by the Natural Heritage Trust. It set out to investigate whether and how the cotton industry's adoption of environmental management systems (through BMP) could lead to increased awareness of the environmental credentials of Australian cotton, and ultimately increased market value.

Can the Australian cotton industry develop an environmentally-robust product that could be "branded" to attract a premium price in the worldwide marketplace? And, if so, would this provide an incentive for increased adoption of BMP and improved natural resource management (NRM)?

As with many research projects, the answers weren't as straight forward as many would have hoped. However, there is no doubting that the project made significant steps forward in setting the scene for future branding opportunities, increasing adoption of an EMS-approach across all sectors in the domestic cotton supply chain and, perhaps most importantly, in creating invaluable industry connections.

The Pathway: Testing pull-through potential

The project had two main points of focus. Firstly, investigating and testing the potential for market pull-through to provide an incentive for the on-farm adoption of better NRM practices.

This included investigating the market's (especially retailers') desire for 'sustainability' attributes and determining whether the existing BMP Program could meet those requirements by trialing a whole of chain BMP approach to producing 'Australian BMP cotton' (to be made into garments and sold overseas). Then developing fibre quality best management practices for each of the major sectors of the domestic cotton supply chain, and investigating ways to demonstrate environmental stewardship both in Australia and internationally.

Building farming systems

The second focal point was, as Allan puts it, "trying to come to grips with the existing milieu of NRM in Australia: the institutions, legislation, policies and current thinking regarding how best to build a pathway to sustainable farming systems. This involved reviewing the catchment planning process and relevant state and federal legislation".

The cotton industry's long and fragmented supply chain meant that the project needed to engage a large number of industry participants - including plant breeding and seed companies, cotton growers, cotton harvesters, cotton ginners, cotton shipping merchants, cotton classers – not to mention the research and industry bodies.

It was a mammoth effort: three years of investigation, reviewing and presenting more than 100 plans, papers, articles, and reports, conducting workshops, countless informal interviews and discussions, plus a number of separately funded sub-projects.

And the timing was tough. The later stages of the project were conducted when the industry was experiencing its lowest cotton production for over 20 years – not an ideal environment to be asking commercial entities to be introducing new concepts.

BMP beyond the farm-gate

Impressively, despite the low production levels, the project succeeded in extending the BMP concept beyond the farm-gate and incorporating more than just environmental considerations. BMPs have now been developed across the growing, classing, harvesting and ginning sectors. There has been an increased ownership of an EMS approach and levels of collaboration never seen before in some sectors.

However, it seems that the EMS Pathways project has uncovered that there is still skepticism in the industry (particularly from growers) about the benefit of undertaking BMP. As Allan reports, "History has shown that Australia has been able to sell its entire crop, even in years of record production, so the need for a brand to provide an additional marketing tool falls in the 'nice if we had it but don't really need it' category."

While BMP adoption amongst producers has increased (up from 20% of growers in 2002 to 37% in 2007), and growers who have taken part speak positively of the experience, there is still a level of lethargy about BMP when they see "no explicit benefit arising from undergoing the audit". Still Allan's report does note, that "lack of involvement in certification…does not equate to a lack of best practice adoption."

As CRDC Research and Extension General Manager Bruce Pyke says, "it will be important to continue to streamline the BMP accreditation process to assist the adoption rate. But it's a fine line. We can't erode the credibility by making it too easy."

Branded Aussie product: a strong potential

In terms of a market for branded Australian cotton, Allan Williams strongly believes the potential is there.

There was definite interest for a sustainable product in the Japanese market, he said. The project worked closely with Japanese department store Izumiya in developing and marketing more than 330,000 items in a clothing range produced from BMP certified Cotton.

There is also a strong trend towards environmental responsibility emerging in retailers and brand-owners around the world. For example, UK retail icon, Marks and Spencer have prioritised identifying sustainability of product right back to the primary production stage of their products. In the US, a globally-significant retailer, Wal Mart, has created a sustainable textiles network, and Tesco's (US) has announced plans to put a carbon impact rating on every product it sells.

Despite these key market signals, EMS Pathways researcher Allan Williams is the first to admit that environmental considerations are still not the main driver for consumer decision-making, and, when it comes to clothing, there is no direct health benefit and therefore no "selfish motivator" for consumers.

"Despite this lack of willingness of the average consumer to choose to pay for improved environmental performance, I have little doubt that this pressure and scrutiny is going to continue, at both the policy – and therefore farm level, as well as the marketing and retail level."

Next steps

In many ways, the EMS Pathways success was in its ability to identify new connections, sources and causes for weaker connections and the need to re-establish once-strong ones. The next step will be to further invest in the areas that "offer the best value," Allan Williams said.

"Overall, my feeling is that NRM is always going to be an expectation for farmers at the policy level, so the task is leveraging that requirement for marketing purposes. The challenge is to get the right balance between the appropriate level of investment to ensure that opportunities are taken, without spending too much."

Recommendations

1. Develop an agreed set of BMP marketing information
2. Undertake formal discussion regarding the development of a brand based on fibre quality (and whether this can be linked to BMP)
3. Develop further links between production practices and environmental outcomes
4. Streamline interaction with catchment authorities and industry

Actions

Various industry sectors are already taking on board the report's recommendations and taking the next steps along the pathway to an environmentally sustainable and profitable future. Allan Williams is hopeful these new journeys will continue to build on the project's goal to turn an "unmade and narrow path" into a wide, smooth road.

? **Contact** Allan Williams Phone 0419 935 301 or email: allanw@austarnet.com.au

Focus on quality

According to CRDC Research and Extension General Manager Bruce Pyke, the EMS Pathways project has helped the industry to concentrate on quality.

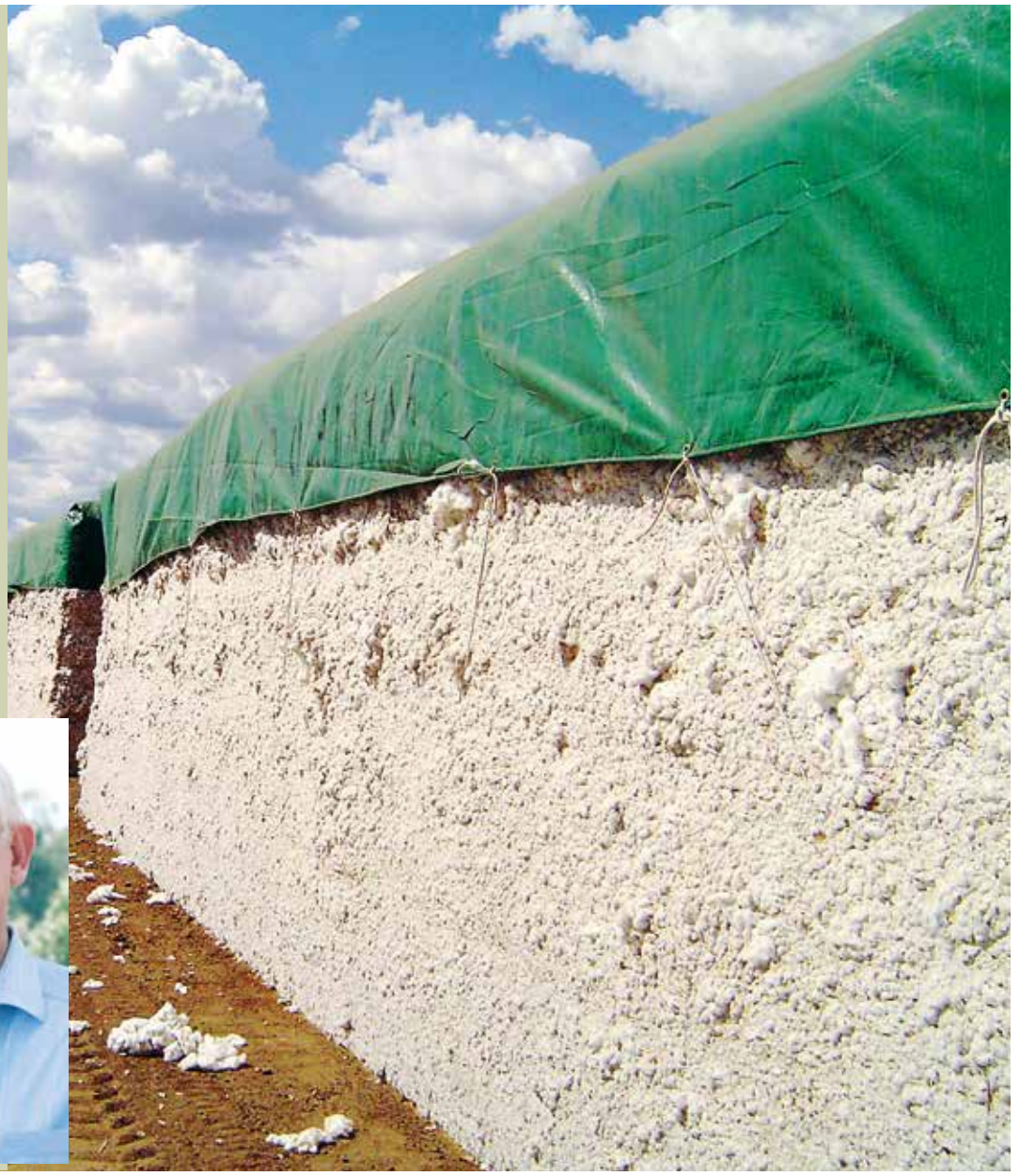
"In some ways, the project has uncovered that there is generally more interest in quality than in environmental stewardship."

However, he said that it's important to realise quality and environmental best practice will always go hand in hand.

"Industry adoption of BMP can assist in producing the right quality. It can help focus on efficiency and give farmers 'more strings to their bow'. In the end, I believe it will serve to keep us in certain markets and may help us get into higher value markets."

Bruce (pictured) encouraged growers to continue down the path of BMP accreditation.

"The key thing to remember is that this focus on environmental performance is not going to go away. The industries that are best-equipped to deal with the growing pressure on issues that affect our environmental footprint - like water, carbon emissions, nitrogen and energy efficiencies – are going to be the ones that succeed. Cotton is already well placed here because it has a BMP framework."



Shipper perspective: Keeping the branding dream alive

"Don't underestimate the potential demand for environmentally sustainable Australian BMP Cotton" is the message from Australian Cotton Shippers Association President and Paul Reinhart (Australia) Managing Director Tony Geitz.

Tony, who was part of a recent delegation visiting cotton end-users and retailers in Hong Kong and Japan, is confident that there is strong potential for a distinctly Australian Cotton brand to sure-up supply and attract premium prices in niche overseas markets.

ACSA had been very supportive throughout the life of the EMS Pathways project and even co-funded a parallel project to investigate branding issues.

"The idea of highlighting the differentiation point of environmentally sustainable Australian BMP Cotton has been bubbling away since the emergence of other international brands like 'Pure Brazil Cotton' and others, but ACSA's promotional efforts we really only directed at the spinning mill," Tony said

"The EMS Pathways project heightened the focus on branding and created the impetus for ACSA to look seriously at stimulating demand pull from the retail and brand-owner end of our supply chain."

In 2006, under the auspices of the EMS Pathway's project, 100% Australian 'BMP certified' cotton was used to create garments sold in the Japanese department store, Izumiya, under the store brand "Good – i". The promotion was based around the Australian and sustainability attributes of the cotton. The 2006 range sold out and Izumiya has plans to expand the volume of garments both this year and in 2008.

Tony admits there are hurdles to overcome in relation to creating an understanding of what BMP cotton is all about with retailers and ultimately consumers, and with the development and marketing of an appropriate brand name and logo. However, he said he'd been very encouraged by the response in the Japan and Hong Kong markets after ACSA's recent EMD (Export Market Development) visit.

At present, ACSA together with Cotton Australia, are investigating a number of other inquiries from Japan as well as interest from Hong Kong.

The product is being marketed under the brand name: "BMP Cotton" coupled with the Cotton Australia symbol.

"We recently visited two Hong Kong based vertically integrated textile companies supplying high end value garments to the US and European markets that are keen to work closely with ACSA and potentially develop their own specialised retail lines using Australian BMP Cotton."

He said the Australian cotton industry had the potential to capitalise on the high demand, but limited supply, of organic cotton and the rise in popularity of "eco-friendly".

"There is so much interest in organic cotton, we have an opportunity to get out there demonstrate our point of differentiation and offer these retailers and consumers the next best thing – Australian BMP Cotton."

However, he stressed it was vital that Australian BMP Cotton had credibility in its environmental claims.

"Traceability is also a fundamentally important issue and is even emerging in food products exported into the Japanese market."

Tony admits there are still many areas still being ironed out, including licensing arrangements, rules on blends, traceability and a BMP for warehousing, but with continued industry collaboration and support from growers, the future is looking promising.

? Contact ACSA 07 3879 339 or www.australiancottonshippers.com.au

Left: BMP clothing making its mark in Japan: ACSA representative Hilton Lobb and Cotton Australian CEO Adam Kay with Mr Nakamura of Daichibo – a large Japanese business house involved in a trial of BMP Cotton garments.

Pathways research strengthens new - BMP

Cotton Australia CEO Adam Kay says the EMS Pathways project has validated the importance of BMP (Best Management Practice). "Many growers probably don't realise just how important regulators and politicians consider BMP when it comes to maintaining our industry. It's now looked upon by outsiders as a social license to produce cotton."

He said governments were even beginning to recognise BMP as a credible alternative to statutory natural resource management (NRM) requirements.

"We are in negotiations with the Queensland Government to allow BMP accreditation to be used in place of the statutory Land and Water Management Plan. All going to plan, this could have a direct financial benefit, saving growers thousands in consultants' fees."

He said BMP was taking on a new direction.

"BMP was first introduced in 1995 in response to concern over industry pesticide use. These days the focus is more on NRM. For the last two years, growers have been heavily consulted. We are now ready to put all those ideas into the program, and review and modify it to make sure that it's a rigorous management system without being too onerous for growers."

One of the more exciting aspects is the introduction of an online system (e-BMP), making it easier for growers.

"This give us the opportunity to analyse data, measure change over time, and feed it to our extension teams. It will make our support and extension much more efficient.

He said the revised BMP may also include steps for reducing greenhouse gas emissions.

"Greenhouse is a real hot button politically and is becoming a key consideration in the cotton industry. Nitrous oxide from nitrogen fertilizer is actually the main culprit. If we can become more efficient with nitrogen use, we can achieve good environmental outcomes and improve the grower's bottom line."

"This was an important point highlighted in the EMS Pathways project - production and environmental benefits should not be addressed separately, they can go hand in hand."

To drive the BMP program revamp, Cotton Australia (with funding support from CRDC and Cotton CRC) has recently appointed a new BMP Manager, Louise Adcock. Louise has extensive background in agriculture including the cotton industry. Most recently she managed the Environmental Champions program for the Ricegrowers' Association of Australia.

As for premiums for BMP Cotton, Adam is optimistic.

"We only have to look at the high level of inquiry we receive for organic cotton. Many are realising that a truly organic product is a bit of a dream. Organic cotton uses the same amount of water to produce one-third of the yield – that's not sustainable. Our BMP is more eco-friendly. It's early days but it's very promising."

Cotton Australia - Phone (02) 9669 5222

www.cottonaustralia.com.au

BMP top of the classers

One of the success stories from the EMS Pathways Project was the adoption of the BMP Program in the cotton classing sector.

In close collaboration with the Cotton Classer Association of Australia, the project helped develop a set of BMPs for classers and guided them through the audit process, and according to CCAA president and Auscott Classing Manager Greg Parle, the EMS Pathways project was very worthwhile in creating stricter environment controls on classing and, importantly, in bringing the classing facilities closer together.

Classers have now put in place a sector-wide independently monitored check-test program where each facility checks the same sample of cotton to ensure uniformity and consistency, and a one module averaging system. Previously there have been three different systems, Greg Parle said.

All six of Australia's classing facilities are now accredited, and all pass their most recent annual audit in May this year. Classers will continue to undertake an annual BMP audit.

"We are really happy with the outcome, and see BMP as an ever-evolving process. We're looking forward to continuing to work in collaboration with each other, other industry sectors and the CSIRO to achieve the best outcomes," Greg said.

CRDC ED Bruce Finney said the CRDC was proud to have been involved in the development of an EMS approach for the classing sector.

"We want to congratulate classers for their achievement in adopting BMP and remain prepared to support them further in their commitment to continuous improvement."

? **Contact** Cotton Classer Association of Australia

Value chain opportunity: Growers tentative, but hopeful

When water is scarce, prices are low and production costs continue to soar, it's not surprising many growers are hesitant about anything that could be considered an added burden to their already-strained resources. However, according to Cleave Rogan, ACGRA member and St George farmer, many cotton growers are confident that the EMS Pathways Project has set the industry in the right direction.

"I can remember the very first meeting of the pathways project when we first started talking about how we could develop stronger connections between farming and the end product. I think we have definitely seen this come out of the project with better links between farmers, gins, spinners and merchants now established."

"I am hopeful that we are headed down the right path, but I do feel that it's going to take more than one driver before we'll see the majority of growers fully on board. As the pressure increases on issues like water and carbon trading, it's only a matter of time before growers see BMP adoption as a vital part of running their business.

"Ultimately, like all growers, I want to be able to sell my cotton into the premium market. With other countries catching up to our quality we need to be doing whatever we can to lift our game."

Cleave Rogan is a strong believer that, to be successful, producers should enhance their understanding of the supply chain and, to this end, he recently undertook the CSIRO Field to Fabric course. "I guess it's the old expression 'yield is king but quality is queen'. I was keen to learn why quality parameters are so important."

Cleave said the Field to Fabric course gave him a good overview of the processes involved in fibre manufacture, the competition with other fibres both natural and man made, and the complexities on a worldwide stage.

"The course had a very good atmosphere generated by the presentations, knowledge of the topics, combined with the practical demonstrations. A wide cross section of people from throughout the industry and from around the world, combined with good hospitality, made for an excellent training experience."

? **Contact** Cleave Rogan, RowAg Farming, Phone 0418 721564

We need to be ready.

Emerald grower and ACGRA President Hamish Millar said the EMS Pathways project reinforced the importance of exploring new ways to differentiate Australian cotton from the competition.

"I'm confident that there is strong merit in the EMS approach. We must keep moving forward and doing the hard yards in order to find new ways to leverage value."

"It's a hard message to sell when there may not be a direct financial windfall in the short-term, but I believe growers need to realise that participating in BMP is a win-win."

He said the industry needed to be at the forefront to meet the needs of the environmentally-astute consumer.

"We may not be seeing it right now but the signs are there, and when the pressure does come from consumers, we'll be ready."

? **Contact** Hamish Millar 0418 741 553

Japanese department store Izumiya developed and marketed more than 330,000 items in a clothing range branded as BMP-certified Cotton. ACSA representative Hilton Lobb and Cotton Australian CEO Adam Kay with Mr Nakamura of Daichibo – one prominent Japanese business house involved in a trial of BMP-branded cotton garments.

Right: EMS Pathways researcher, Allan Williams' three year journey through the labyrinth of global markets in search of the new edge for Australian cotton and its environmental record found substantial supporting evidence for new directions.

BUILDING ON THE PATHWAY

"Cotton, grains and beef: one farm, multiple enterprises, common indicators" is a new project which will be undertaken by CRDC, in collaboration with Cotton Australia and the Cotton, Catchment, Communities CRC (Cotton CRC), with funding from the Australian Government's EMS Pathways to Sustainable Agriculture Program.

According to CRDC Program Manager Dallas Gibb, this new pathways project has come about as a direct result from the industry's 2004-2007 EMS Pathways Project which highlighted the lack of agreed indicators for measuring environmental outcomes across industries and catchments.

"We believe the cotton industry is improving its natural resource management, but with the complexities of the catchment planning process and the fact that most cotton producers also run grain and/or cattle enterprises, in the past it's been too difficult to measure."

The new project will aim to develop a set of relevant environmental performance indicators (EPIs) for cotton farms, that are consistent and compatible with the grains and beef industries, and aligned with NRM catchment targets.

As researcher Allan Williams says, by identifying EPIs and measuring them, producers can be provided with information in a language they understand.

"By collecting real, meaningful data, producers can be more confident that the decisions they are making and the practices they are adopting are making positive contribution to both the sustainability of their farming operation and catchments," Allan said.

The project, which will feed into the BMP Program, will test indicators with both cotton growers and Catchment Management Authorities to ensure they are relevant and applicable.

? **Contact** Dallas Gibb, CRDC (02) 6792 4088

Ginners urged for unified BMP approach

Cotton ginners were hesitant about becoming involved in the BMP Program, admits Australian Cotton Ginners' Association President and Namoi Cotton Operations Manager Matt Berry.

"Once engaged, the ginners quickly realised that our contribution is valued and that the industry must move forward with a unified approach."

"Our original concerns were mostly relating to the need to avoid replication of current Quality Assurance systems, like ISO accreditations, which might undermine investment already made in this area. In other words, we did not want to reinvent the wheel."

He said those fears had now been allayed, with the ginning BMP currently being tested through a pilot audit at 27 of the 40 ginning facilities in Australia.

"We are keen to continue to work, in collaboration with industry, to ensure the BMP for our sector remains relevant and beneficial, while being mindful of the marginal economic returns that are currently being generated by Australian cotton gins."

? **Contact** Australian Cotton Ginners' Association President Matt Berry (02) 6790 3000

Crop Rotations in a Dryland Cotton Farming System

Crop rotations trials at Warra, Darling Downs revealed cotton double cropped with a winter cereal is the most profitable and beneficial way to improve soil health.

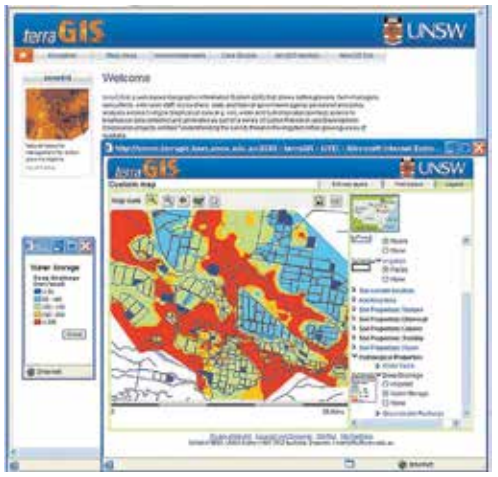
Results from many cotton-rotation system experiments conducted in New South Wales and Queensland show that cotton yield/per hectare was lowest or equal lowest with continuous cotton, particularly if intensive tillage was the management practice.

In 1992 Jeff and Marilyn Bidstrup became involved in a dryland on-farm experiment at Warra in South East Queensland in rotation crop management with the Cotton CRC. The objective of this study was to quantify the changes in physical and chemical properties of grey cracking clay due to sowing cereal and legum crops in rotation with dryland cotton.

The major contributing factor to changes in soil chemical properties from the rotations was the coarse soil organic matter. This is a more labile or mobile fraction of soil organic matter. An increase in organic matter has many benefits from improved structure, which corresponds to improved plant available water content through to improving the soils nutrient cycles and providing an energy source for the soil biology. Significant improvement in soil chemical properties can be expected to occur if crops which produce large amounts of dry matter such as forage sorgum were to be sown at regular intervals

Helen Squires Soil specialist with the Cotton CRC said the benefits of crop rotations for soil structure and health is unquestionable, it can be seen by the Bidstrup trails that opportunity cropping in a dryland rotation farming system is by far the most beneficial option.

? For further soils case studies, go to: http://web.cotton.crc.org.au/content/Industry/Publications/Soils.aspx or contact Helen Squires Soils Extension Specialist Cotton CRC 02 6799 1500.
Email helensquires@dpi.nsw.gov.au



The biophysical data shown in terraGIS includes maps of soil properties such as CEC, pH, ESP and available water content in the root zone and subsoil as well as the vadose zone. Hydrological data such as depth to water table, deep drainage and groundwater recharge rate are also shown. Detailed interpretation and explanatory notes are provided as part of the sister-webpages of terraGIS. It is envisaged that workshops will be organised in order to demonstrate the use and application of terraGIS in the future.

By Melanie Jenson

New value in soils

TerraGIS is a web-based geographic information System (GIS) that allows cotton growers, consultants, extension staff, researchers, Catchment Management Authorities, state and federal government agencies and policy analysts access to digital biophysical data (e.g. soil, water and hydrological properties).

The development of this tool will allow cotton consultants and cotton farmers to better understand the science of their soil. As a result they will be able to make more informed decisions about farm planning, which in turn will improve natural resource management (NRM) and overall farm efficiency, according to Dr John Triantafilis of UNSW, who for 16 years has been developing methods to collect and interpret soils and remotely sensed data for salinity hazard and risk assessment.

“In irrigated cotton growing areas, there is an increasing emphasis on generating natural resource management information,” John said.

“This is the case at the district level, where integrated soil and water management is desirable. “However, biophysical data (e.g. pH, salinity, sodicity) acquisition, required for scientific purposes and policy development, is labour intensive and time consuming.”

In collaboration with various community groups and successful funding applications to the Natural Heritage Trust (NHT), biophysical data is now available in seven irrigated cotton growing areas: Toobeah, Ashley, Wee Waa and Gunnedah, Trangie and Warren and Bourke located in five catchments including the Macintyre, Gwydir, Namoi, Macquarie and Darling.

This has been achieved with the use of remote-sensing technologies (e.g. gamma ray spectrometry and electromagnetic (EM) induction) which are revolutionising the way in which NRM information is being collected in order to generate biophysical data.

”Once developed biophysical data can be incorporated into Geographical Information Systems (GIS) which allow the various sources of information to be cross referenced spatially,” John said.

”In a digital format, the GIS framework can also greatly increase the ease with which soil, water and hydrological properties can be interpreted, assessed and applied to land use planning and NRM.

” This is because a GIS is capable of handling and solving complex modelling problems (e.g. salinity hazard and risk mapping) in spite of large data volumes and interrelated environmental issues.”

To facilitate access to biophysical data, collected as part of a series of Cotton Research and Development Corporation and NHT projects and carried out under the auspices of the Australian Cotton Cooperative Research Centre at the research laboratories of the Australian Cotton Research Institute, The University of Sydney and The University of New South Wales, the various soil, water and hydrological properties mapped have been put together into a simple-to-use web GIS platform called terraGIS.

terraGIS can be viewed at the following address: www.terraGIS.bees.unsw.edu.au

The ancillary biophysical data sets available in terraGIS include;

- Cadastral (i.e. water storage reservoirs, irrigation fields, roads and water courses),
- Ancillary (i.e. EM38, EM34, gamma ray spectrometry, DEM - elevation),
- Soil properties (i.e. soil texture, exchangeable cations, CEC, pH, ECe, ESP, Ca/Mg)
- Water properties (i.e. permanent wilting point, field capacity, available water content), and
- Hydrological properties (i.e. deep drainage, hydraulic conductivity, groundwater recharge).

The ancillary data and biophysical information shown in terraGIS was collected with funding investment from CRDC and industry research partners.

Source of water losses found

Terry Haynes, Water Resources Manager of Auscott 'Midkin' Moree says he wouldn't turn a sod to build a new reservoir without the help of Electromagnetic Maps as the technology has meant a potential saving of more than 2500 megalitres of water in a normal year from a recent reservoir constructed on the site.

Auscott Midkin, north-west of Moree estimated that the farm's existing dual-cell reservoir built in the early 80's was losing more than 3570 megalitres per year, with 43 per cent due to deep drainage.

The losses were caused by three main factors: the positioning of the dam over ancient water channels; the large surface area to volume ratio resulting in high evaporation and lastly, trees within the reservoir had died and decayed roots had left deep channels through the soil.

The original storage was a head-water only structure, so considerations for a new site included a "holistic approach" which included short-circuiting the tailwater return, according to Terry.

Unlike when the existing reservoir was built, Auscott now has the advantage of EM technology when considering options to increase efficiency and suitability of a given site for irrigation fields, supply channels and reservoirs.

Terry first learned about the technology and became interested in its potential when initial district scale maps of deep drainage were derived by calibration equations generated between EM survey data and a soil water balance modelling data across the Ashley district.

UNSW's Dr John Triantiafilis undertook the surveys and the results were made available to Terry and others in the district via these written texts and presentations given by John. The information is now included in the terraGIS website (see other story) and can be viewed by consultants and growers to improve their decision making.

"Get a very good EM survey and ground truth it before you turn a sod," says Terry.

"We needed a site with no deep drainage and a storage with less surface area.

"At this site with it extensive prior steam history, it would have been almost impossible not to make the same mistake again in regards to the positioning of the new storage if not for EM.

"We were able to pinpoint suspect areas and GPS them from the EM data. This allowed us to concentrate physical evaluations, understand and plan around potential problems. "Without this technology, it would have virtually taken years to collect the same data.

Terry Haynes, Water Resources Manager of Auscott 'Midkin' Moree

"The survey even dictated where to extract suitable material for the planned reservoir walls, which were self-funding, and we reduced the surface area from 180 ha to 60ha, and now it effectively mirrors its evaporation rate."

EM surveys were done at potential sites, then soil pits were dug to 'ground truth' the maps. Once all the parameters were assessed a final EM survey was done at the preferred location.

The reservoir would have been excavated to the same depth prior to the availability of EM technology, however the survey showed sites vulnerable to deep drainage and these were only minimally disturbed.

The walls are six metres above and two metres below the ground.

This 2500 megalitre saving (in a typical year) represents a huge financial and increase in water use efficiency, coupled with the proactive natural resource management.

"It would have been almost impossible not to make the same mistake again in regards to the positioning of the new storage if not for EM."

Terry Haynes.

Resistance is one of the most important issues facing Australian cotton growers and effective management is critical to the protection and success of future cotton crops.

The CRDC invests almost one third of its research and development budget in the crop protection program to improve integrated management of major pests, weeds and diseases and to reduce grower reliance on chemicals.

There are different types of resistance that pose a threat to the sustainability of cotton growing in Australia - the resistance of pests and weeds to chemicals and the resistance of pests to Bacillus thuringiensis (Bt) - the toxin contained in transgenic cotton plants.

Ongoing R&D investment helps to ensure that the development of resistance is minimised through the design and implementation of resistance management strategies for insecticides, herbicides and transgenic technologies.

Managing resistance

NSW Department of Primary Industries (DPI) researcher, Dr Louise Rossiter, is based at the Australian Cotton Research Institute in Narrabri and manages a CRDC-funded research project to monitor insecticide resistance in Helicoverpa armigera and Helicoverpa punctigera, also supported by the GRDC.

She explained that resistance is an evolutionary response to a selection pressure, such as an insecticide. Louise said that using an insecticide selects for individuals with a genetic mutation that allows them to survive a dose of insecticide that kills others without that mutation. Initially these individuals are rare, but with repeated selection their frequency within a population can increase to a point where control problems are observed in the field.

“The monitoring program provides the cotton industry with the first indication of any developing resistance in cotton bollworm,” Louise said.

“If we didn’t have that early indication system, we wouldn’t know until control began to fail out in the field. It is obviously a major cost to growers and the industry if it gets to that stage.”

Louise said that growers can control any resistance already present and minimise it from developing further by following the Insecticide Resistance Management Strategy (IRMS).

“To help manage resistance growers should follow the IRMS and work within an IPM system to maintain beneficials. As we know from experience, using broad spectrum or ‘hard’ chemicals early in the season can increase other pest populations by taking out the beneficial insects,” she said.

“If you have a high H. punctigera influx in early season, it’s tempting to control it with the cheaper broad spectrum chemicals but you have to think about the ramifications for other pests - including H. armigera - down the track.

“There have been incidences in the last couple of seasons where spraying for Helicoverpa has occurred on transgenic crops, so it’s also important for growers to remember to work within the IRMS when spraying Bollgard II® cotton.”

Resistance threat – always present

By Tristan Viscarra Rossel

Bt resistance monitoring

It is estimated that over 80 per cent of Australia’s 2007-8 cotton crop will be planted to transgenic Bollgard II varieties which are protected by proteins from Bt. Obviously it is critical that the industry invests in research to sustain that technology for as long as possible.

At the Australian Cotton Research Institute in Narrabri, Dr Sharon Downes from CSIRO Entomology monitors the resistance of Helicoverpa populations to the Bt toxins in Bollgard II cotton.

Sharon said that there are at least three main factors that could affect the evolution of Bt resistance in insect populations.

“Perhaps the most important thing is the dominance characteristics of the resistance gene - whether it’s dominant or recessive,” she said.

“The initial frequency of alleles in insect populations and the proportion of the population that is exposed to the toxin are also vital for determining how fast resistance might develop. (An allele - pronounced al-eel or al-e-ul) is any one of a number of viable DNA codings that occupies a given position (locus) on a chromosome.)

“It’s also critical to consider whether or not there are any fitness costs associated with being resistant. If you remove a resistant insect from an environment where it is exposed to the toxins, it sometimes exhibits huge fitness costs like reduced growth rates or lower rates of reproduction.”

The Resistance Management Plan (RMP) for Bollgard II cotton is based on a strategy where a non-transgenic crop is grown alongside the transgenic cotton, which administers an optimal dose of the Bt toxin. It is assumed that the moths from both crops mate randomly - and this is actually being tested by another CSIRO project.

“The susceptible moths from the non-transgenic crop should mate with any potentially resistant moths from the Bt crop to produce heterozygotes (individuals that carry one resistance gene and one susceptible gene),” Sharon explained.

“The form of dominance is important because this determines whether the heterozygotes will be killed by the transgenic cotton which should lead to a dilution of resistance in the population. If the resistance is recessive then an insect needs two copies of the resistance gene to survive the toxin.”

In the laboratory the resistance is recessive, which is favourable. However, based on the frequency of surviving (and functionally resistant) insects in the initial resistance screens, some dominance may be present. CSIRO are currently investigating this.

“While we have found an unexpectedly high baseline level of resistance to the Cry2Ab toxin there has been no increase in the frequency of resistant alleles,” Sharon said.

Results from this monitoring program and related research from across the industry are collated and the researchers and other stakeholders meet at the end of each season to assess whether the current RMP is adequate.

The program has been operating since 1994, before the first planting of transgenic Ingard® cotton, and remains a very important industry tool to protect the Australian cotton crop.

? For more information about the resistance monitoring programs, contact: Dr Louise Rossiter, NSW DPI 02 6799 2428 louise.rossiter@dpi.nsw.gov.au or Dr Sharon Downes, CSIRO Entomology on 02 6799 1576 sharon.downes@csiro.au

Glyphosate resistance

Researchers have been monitoring northern cropping regions for glyphosate resistance in weeds. Several populations of glyphosate resistant annual ryegrass Loliumn rigidium have been found across southern Australia and on the Liverpool Plains near Tamworth.

However, in early 2007 glyphosate resistant barnyard grass Echinochloa colona was confirmed on a property at Bellata, quite near to the cotton growing region. The paddock at Bellata allegedly had a long history of winter cropping and summer fallow weed control relying solely on glyphosate, with 15 to 20 applications over a five year period.

According to Dr Steve Walker, a Queensland Department of Primary Industries & Fisheries (DPI&F) weed scientist at Leslie Research Centre, glyphosate resistance is a potential threat to the cotton industry.

"We believe that grain growing systems have a higher risk of developing glyphosate resistance in the summer grasses, particularly for those systems that are predominantly winter cropping and zero till, as they rely totally on glyphosate. But there are definite risks to dryland and irrigated cotton systems too," he said.

"We will be looking at some modelling for cotton systems and researching the implications for the cotton industry as part of our research."

Steve said growers should follow recommended management practices to reduce the risk of developing glyphosate resistant weeds.

"If growers are using glyphosate tolerant cotton crops, they must take care to stop the seed set of any survivor weeds. This will prevent any potentially resistant weed seeds getting into the seed bank and causing a problem further down the track," he said.

Glyphosate resistant weed seeds may enter the farming system through dirty equipment such as headers, pickers and trucks, flooding, waterways, or purchased seed and grain.

Reduce the risk of glyphosate resistant weeds

Do not rely solely on glyphosate to control weeds.

- Follow the crop management guidelines using an integrated approach to weed control.
- Stop the seed set of any glyphosate survivor weeds.
- Look for new weeds in flood wash areas and along water channels.
- Prevent weed seed introductions.
- Wash down vehicles and machinery.
- Purchase grain or fodder from a reliable source - consider asking for a vendor declaration.

? Contact Dr Steve Walker, DPI&F Leslie Research Centre steve.r.walker@dpi.qld.gov.au or Mr Graham Charles ACRI 02 6799 1524 Graham.Charles@dpi.nsw.gov.au

Glyphosate resistance register

The spread of glyphosate resistance in the northern grain region will depend on the rate and intensity at which the glyphosate is applied.

The Glyphosate Resistance Register, which is managed by Dr Chris Preston at the University of Adelaide, contains information regarding all the known glyphosate-resistant weed populations present in Australia.

The register shows that all of the known populations have occurred in situations where there has been intensive use of glyphosate, few or no other effective herbicides used, and a few or no tillage operations.

? Locate the Australian Glyphosate Resistance Register at http://www.weeds.crc.org.au/glyphosate

Optimal levels of glyphosate

Research is underway at the Australian Cotton Research Institute in Narrabri to determine thresholds for spraying both Roundup Ready Flex® and Liberty Link® cotton in order to reduce or at least optimise the amount of spray used.

NSW DPI research agronomist with the ACRI, Graham Charles, has been developing a threshold system based on an approach first developed in 1968.

"We want to develop a system that alerts growers about when the crop needs to be sprayed to avoid yield loss and to ensure that glyphosate is not being overused," he said.

"The system will need a trigger that indicates when there is a build up of weed species that are tolerant to glyphosate so an alternate weed management strategy can be adopted."

The solution is complicated by the fact that there may be over a hundred different weed species to consider. To overcome this, the project is focussing on developing an on-the-go sensor to measure the leaf area of the weeds and the cotton, and using that to estimate the level of weed competition.

While some 'very preliminary' thresholds will be published soon Graham said that it will be a number of years before a complete system is available.

Roundup Ready Flex®

Roundup Ready Flex® was commercialised last season and had a reasonable uptake, comprising 11 per cent of the 2006-7 cotton crop.

Craig Farlow from Monsanto Australia explained that it gives a much wider window for application of glyphosate than its predecessor, Roundup Ready cotton.

"You're allowed two applications over-the-top of Roundup Ready cotton until the four true leaf stage and then you can use up to two shielded applications in crop," he said.

"With Roundup Ready Flex cotton you can apply up to three Roundup Ready® herbicide applications up to the 16 node stage and then you can do a further directed spray through to 22 nodes."

"It gives you much greater flexibility in applying Roundup Ready herbicide in the crop."

Being able to use glyphosate more frequently for weed control has implications for glyphosate resistance if growers are not using IWM principles. Craig said that Monsanto advocates the use of an integrated approach to weed control to ensure the sustained use of the technology.

"Relying on only one mode of action goes against any herbicide resistance strategy," he said.

"We believe that Roundup Ready Flex® technology is compatible with all alternative methods of weeds control and modes of action that are currently used in conventional systems. It comes down to individual fields - the types of weeds present and the extent of the weed infestation."

To further protect the sustainability of its technology, Monsanto provides accredited training for growers and industry service providers to ensure that they fully understand the Roundup Ready Flex® Crop Management Plan including all compliance, agronomic and application considerations associated with the technology.

This short course covers weed control in Roundup Ready Flex® crops, how the technology works, varietal development, integrated weed management, the Roundup Ready® herbicide label, and compliance with the Resistance Management Strategy.

? For information on Roundup Ready Flex, contact Craig Farlow, Monsanto Australia 0427 528 185 craig.m.farlow@monsanto.com for information on the Roundup Ready Flex® Cotton Stewardship Program.

$1m annually is invested in R&D that aims to control the threat of resistance in cotton pests and weeds.

Resistance program worth the investment

By Tristan Viscarra Rossel

The introduction of biotechnology in the mid-90s brought with it new opportunities and a whole raft of new production challenges for the cotton industry to address.

For the industry to remain competitive and sustainable considerable investment of producer levies and public contribution is made each year through CRDC to protect the Australian cotton crop.

The CRDC invests over $3 million a year in its crop protection program – of which $1 million is solely invested in programs that aim to control the threat of resistance in cotton pests and weeds. And the CRDC is just one of many organisations funding this key industry priority.

Dr Ian Taylor, the CRDC's crop protection research program manager, explained that cotton industry stakeholders collaborate closely to plan resistance research and programs.

"The CRDC invests $1.1 million annually into resistance research; with close to $1 million from Monsanto, around $500,000 from the CSIRO and $300,000 from the NSW DPI," he said.

"The CRDC liaises closely with key stakeholders such as ACGRA, and with scientists and consultants, to determine industry priorities and research areas. The CRDC and its research partners invest in these priority areas to ensure maximum benefit is derived from the new technologies, but more importantly that the sustainability of these valuable technologies is preserved."

The CRDC primarily supports the costs associated with the research while its research partners support projects through in-kind investment in scientists and infrastructure. Along with the ACGRA, the CRDC has the responsibility for reviewing project objectives and milestones to ensure that projects remain on track and to provide assistance wherever possible.

The main objective of the cotton industry's resistance program is to minimise the likelihood of resistance developing through improvements in integrated management of major pests, weeds and diseases. An integrated approach involves the use of a number of management options thus reducing the evolution of resistance.

An important outcome of the responsible use of transgenic technology together with an integrated management approach has been the significant and continued reductions in growers' chemical insecticide and residual herbicide use.

Monsanto Australia is a major stakeholder in the Australian cotton industry with a vested interest in managing resistance. Its business is focused on plant biotechnology – developing crops with in-built insect protection and crops that can tolerate the application of glyphosate, giving more flexibility for weed control.

Entomologist with Monsanto Australia, Kristen Knight, explained that the company invests in resistance research to protect the technology.

"Our R&D investment is important to the organisation and to the industry because we want to ensure that the Bollgard II® technology is sustainable for the long term and our research outcomes are shared with the industry," she said.

"Since the 2002-2003 season we've had two people working full time, monitoring Bt resistance," Kristen said.

"We follow exactly the same protocols as the CSIRO to ensure consistency. This means that more individual insects are sampled each season and results can be compared between the two labs. It gives the industry a more accurate baseline for the frequency of resistance.

"At the end of each season we work together to make sure that the resistance management plan (RMP) is sustainable."

Success for the resistance program is measured by continued reduced reliance on chemical inputs and more effective management strategies for pests and weeds.

In the last five years growers have readily adopted biotechnology with over 80 per cent of last season's crop planted to cotton varieties that contain Bollgard II and Roundup Ready® or Roundup Ready Flex® genes. Consequently, pesticide use has been reduced by over 85 per cent over the same time period.

It is critical that the industry continues to invest in resistance R&D to protect the cotton crop for the 2007-8 season and beyond, and continues to run programs that encourage growers to adopt new technologies and integrated management practices to manage resistance.

? Contact Dr Ian Taylor CRDC 02 6792 4088 ian.taylor@crdc.com.au or Kristen Knight Monsanto Australia 07 4634 8400 kristen.m.knight@monsanto.com

Bollgard II and Roundup Ready and Roundup Ready Flex are trademarks of Monsanto Australia.

Priority team helps industry maintain its edge

Innovative R&D has been the primary driver behind the Australian cotton industry's success and the uptake of this research at a practical level is the result of dynamic extension teams, working together on a regional and national level.

With the 2007-8 season fast approaching and with new challenges being faced, the Cotton Catchment Communities CRC (Cotton CRC) extension teams are busy planning and preparing for next season's activities.

The Cotton CRC currently has four national priority teams - one of which is the Insect and Weed Priority Team.

The Insect and Weed Priority Team encourages and promotes grower best practices that will reduce the likelihood of resistance though insecticide resistance management strategies (IRMS) and the uptake of emerging technologies.

IRMS and the adoption of an integrated pest management (IPM) strategy combined with integrated weed management (IWM) will help to prevent herbicide and pesticide resistance.

Rod Gordon, Macintyre regional extension officer with the Cotton CRC and Queensland DPI&F, is the team leader. Rod said that he believes the team is invaluable to the cotton industry, delivering the knowledge and resources for growers to implement best practice insect and weed management.

"The National Priority Team has aligned its aims with that of the Cotton CRC goal to reduce pesticide use by 50 per cent by encouraging adoption of best practice management strategies," he said.

Best practice pest guide due October

While limited water is foremost in the minds of growers and consultants, adopting industry best practices for pest management remains a key factor to protect yield and minimise production costs.

The Cotton Pest Management Guide is the universal pest control compendium for cotton growers, consultants and agribusiness. It is widely regarded as the most up-to-date information source and its recommendations for managing insect, weed and disease pests in cotton is considered best practice.

The Guide is compiled annually by NSW Department of Primary Industries for the industry with the input of experts, researchers and regulatory authorities and its content reflects years of valuable investment of producer levies managed by CRDC together with industry R&D organisations and specialists

Popular sections include the Insect Control Guide, Chemical Use, the IRMS charts and the Weed Control Guide. The new Guide will include new sections on pesticide application techniques and spray drift management.

The Cotton Pest Management Guide 2007/08 is due for release in October. NSW DPI distribute copies to producers, however industry Extension Team members (see box), CRDC and Cotton CRC retain copies for ongoing needs of producers and any persons needing a copy.

? Contact Tracey Farrell NSW DPI 02 6799 1548 or 0427 260 344 tracey.farrell@dpi.nsw.gov.au

Aphid threshold calculator

Reduced insecticide use against Helicoverpa has allowed other pests to survive and become more important. For example, cotton aphids are now occurring earlier in the season and mirids are occurring later in the season.

This coming season the team will focus on developing resources that highlight the most effective insect management strategies for cotton aphids and mirids.

The team is working closely with Dr Lewis Wilson, a research scientist with CSIRO Plant Industry and the Cotton Catchment Communities CRC, to design and implement an aphid threshold calculator for consultants and growers.

The aphid threshold calculator will facilitate sampling and monitoring of aphid populations, predict likely yield losses and help growers to decide if and when control strategies are required.

"With mirids playing an increasing role within the cotton pest spectrum an integrated pest management approach - and attitude - is important," Rod said.

In July the team held a mirid research review at Toowoomba DPI&F to identify key messages and research outcomes for extension, and to highlight priority areas for future research.

"The mirid review served to update the industry's research status and direction, identify extension messages and to highlight the importance of utilising the relationship with regional extension officers," Rod said.

"In conjunction with consultants and researchers, a number of fresh informative extension resources will be developed, capturing the decision processes involved to successfully manage a crop containing multiple pests and weeds.

"The implementation of IPM and IWM strategies will reduce the incidence of resistance and species shift, and ultimately reduce the impact on the environment."

? Growers, consultants and agribusiness suppliers are encouraged to contact the Weed and Insect Priority Team (see box) for further information.

The ages of cotton pest management

By Peter Gregg, Chief Scientist, Cotton CRC

In my Inaugural Lecture to the UNE earlier this year, I detailed the various "ages" of the cotton industry in Australia. These are illustrated by the popular approach to pest management and key research at the time.

1963-1980 The "Stone Age"

A time when DDT was widely used to control insects in cotton crops. Important research was conducted into the ecology of the Helicoverpa , but problems of insecticide resistance and environmental pollution were serious.

1980-1995 The "Age of Faith"

With DDT outlawed, the chemical companies developed synthetic pyrethroids. Growers had "faith" in the ability of companies to come up with solutions to problems. Resistance to them appeared too, but the world's first pro-active insecticide resistance management strategy was developed. However, the pyrethroids were "hard" insecticides which disrupted insect natural enemy populations and obstructed the development of Integrated Pest Management.

1993 The "Age of Reason"

Selective chemicals were developed to control pests while not affecting those bugs considered "beneficial". These chemicals included many with novel modes of action, but they were often expensive. Biopesticides were also developed. Peter's own research, which led to the development of a moth attractant technology known as Magnet®, being commercialised by the Australian company Ag Biotech, was cited as an example of this selective approach.

1996 The "Age of Biotechnology"

Transgenic or GM cotton was developed and cotton growers became less reliant on insecticide sprays. Extensive research was done showing minimal effects on the diversity of insect species in transgenic cotton, and developing strategies to manage potential resistance. Eighty per cent of Australian cotton is now transgenic.

1963 The "Age of (gradual) Enlightenment"

Integrated Pest Management (IPM) and Area Wide Management (AWM) methods to control pests. All tactics of pest management were combined and developed in a systematic approach. Better understanding of biological control, selective insecticides and transgenic crops have all been combined to produce sustainable and environmentally friendly pest management in cotton.

Company trial results have shown that coarse spray qualities, when produced by nozzles operated correctly, can produce equivalent or better efficacy than finer spray qualities, even with contact herbicides

Calibrate to succeed

By Bill Gordon

As nozzles are used they become worn. They then tend to increase flow rates, so the introduction of automatic rate controllers has led to a tendency "calibrate"spray nozzle less often because the equipment generally always apply the number of litres per hectare expected.

But obtaining the desired application volume does not guarantee the evenness of the amount of spray being delivered from different parts of the boom, so without checking individual nozzle outputs, the volumes delivered across the entire boom may not be uniform due to uneven wear of the nozzles.

To maintain the same overall flow rate, the pressure at the nozzle may be decreased in some nozzles and increased in others because they will receive an average flow rate. Reduced pressure impacts a nozzle's ability to operate effectively, particularly those with a pre-orifice, which most low drift and air induction nozzles are fitted with.

To get the best out of each spray job, the operator has to understand all of the factors which influence the outcome. This is what we try to cover in our spray workshops.

The whole process begins with product selection, carefully reading the label and understanding the mode of action of the product, which will give an indication of the spray quality (droplet sizes) that should be used.

The mode of action also needs to be considered in relation to the intended target for the spray. Different spray qualities and nozzle types can increase retention of the product on the target, or increase penetration into the canopy, while others can increase the amount of chemical absorbed into the plant or deposited onto the soil. It is important to understand how these factors interact to ensure the product ends up where it will produce the best results. Application volume can also influence the evenness of the application, typically contact products will require higher application volumes than fully translocated products.

Field research challenges droplet size

Recent results from trial work conducted by companies such as Nufarm and Syngenta are challenging long held beliefs about the kinds of droplets we need to be using, even when applying contact type products such as Sprayseed or Revolver and Bromoxynil.

Company trial results have shown that coarse spray qualities, when produced by nozzles operated correctly, can produce equivalent or better efficacy than finer spray qualities, even with contact herbicides.

The critical factor here is that by using a coarse spray quality the potential for drift to occur is greatly reduced (for a fine spray quality more than 40 % of the spray is in droplets less than 150 microns, for a medium spray quality that is around 20% of the spray in droplets under 150 microns, and for a coarse spray quality there is less than 10% of the spray in droplets under 150 microns).

Other research groups such as CPAS (University of Queensland, Gatton Campus) have also been evaluating the effects of spray quality on the efficacy of products used on some of our 'harder to kill' weeds, as well as assessing the impact of formulation and adjuvants on the amount of drift that can be expected when using various nozzle types.

There has been a lot happening in efficacy based application research over the past 3 years, perhaps more than that for the entire previous decade.

Our current project conducted a trial last year evaluating spray quality and volume effects, and we have 5 more planned for the next 12 months to look at the effects of spray quality, application volume and some adjuvants on the efficacy of common products and tank mixes.

We will be publishing our trial results in industry journals and will be presenting them in our workshops and public forums as we complete them.

? Further information: Bill Gordon leads a CRDC initiative to convey the best methods for pesticide application on cotton farms. He runs workshops across cotton producing regions. For details of the Workshops, contact your cotton extension officer, or Bill Gordon, 0429 976 565 or email bill.gordon@bigpond.com

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Avoid omethoate/dimethoate use on mirids early season due to resistance in aphids and also the potential to flare other pests such as silverleaf whitefly.

Resistance on the slide

The annual Cotton Pest Management Guide, produced by NSW DPI, and the Cotton CRC website contain useful information regarding pest control and resistance management. The Cotton CRC website also displays updated information on the resistance status of Helicoverpa to conventional insecticides and the Bt toxins in Bollgard II.

By Dr Louise Rossiter, NSWDPI Research Scientist

Good news for the industry is that resistance monitoring data from 2006/07 has showed a continuing trend of reduced resistance frequencies or a neutral trend to most of the conventional insecticides used against H. armigera,.

NSW DPI Research Scientist Dr Louise Rossiter said monitoring had concentrated on the IPM compatible chemistries of Steward®, Tracer® and Affirm®, with occasional survivors detected.

"These results represent no change for Steward and Affirm which have not presented a resistance risk since they became available for use, with the data for Tracer encouraging because this insecticide was an increasing resistance risk at the end of the century and the frequencies have declined significantly since 2001/02 when its use period was restricted within the IRMS", Louise said.

"Monitoring for the older chemistries was greatly limited in 2006/07 due to light Helicoverpa pressure, but generally frequencies were similar to, or reduced from previous years. Overall, the results suggest positive effects on the insecticide resistance status of H. armigera."

Louise said that this result may be due to various factors such as reduced and more strategic insecticide use, widespread uptake of Bollgard II® (a major factor contributing to reduced insecticide use), resistance management strategies, integrated pest management and at least during the 2006/07 cotton season, very light insect pressure – therefore requiring very few Helicoverpa sprays, which reduces the selection pressure for resistance development.

"Generally it is considered that the absence or reduction in sprays for Helicoverpa on Bollgard II allows beneficial insects to build up which can be very useful in managing other pests such as mites and aphids," Louise said.

"Other sucking pests however are emerging as a greater potential problem in Bollgard II as they are not co-incidentally controlled by Helicoverpa sprays, with mirids being probably the major new sucking pest to require chemical control."

Another CRDC supported project run by Dr Grant Herron, NSW DPI, has been initiated to develop techniques to evaluate and monitor resistance in mirids. At present however there is very little known about mirid resistance, the potential for resistance to develop, or the best approach to take in regard to chemical use to manage resistance development.

The only guideline the IRMS provides is to avoid omethoate/dimethoate use on mirids early season due to resistance in aphids and also the potential to flare other pests such as silverleaf whitefly because they are broadspectrum insecticides that disrupt a range of beneficials.

Egg collection imperative to program

An essential part of resistance management is the collection of material for monitoring.

In the 2007/08 season the CRDC will provide support for dedicated (Helitothis) egg and larval collectors in the Emerald, Darling Downs, St George, Macintyre and Lachlan valleys.

Dr Sharon Downes of the CSIRO said that egg and larval collection was critical to her work in monitoring resistance in Bollgard II.

"The egg material will be divided between the insecticide and Bt resistance monitoring programs, and there will be particular emphasis on improving collections of live larvae from Bollgard II for Bt resistance testing," she said.

Sharon is part of the TIMS Committee's Bt Technical panel, and her research into frequencies of resistance is used by the committee, along with ecological and genetic data from other researchers, to assess the Bollgard II RMP, which is evaluated annually.

Sharon said the industry's challenge for the future was to view the mandatory growing of non-Bt refuge crops under the Bollgard II RMP as an insurance policy for the future of the technology rather than as an unnecessary burden.

"The refuge strategy is the lynch pin of the RMP," she said.

"Our finding of a higher than expected baseline frequency of alleles that confer resistance to the Cry2Ab toxin in Bollgard II makes it all the more critical that refuges produce large numbers of Bt-susceptible moths at the right time to be effective in diluting resistance".

If a Bt-resistant moth mates with another Bt resistant moth, the resultant offspring will also be resistant to Bt, something we very much want to avoid.

Refuge crops keep resistant pests at bay

By Mary Ann Day

The introduction of transgenic (Bt) cotton in 1996 saw mandatory requirements for farmers to grow a refuge crop to prevent resistance to Bt building up among the target insect pests, Helicoverpa armigera and H. punctigera.

The rigor of this requirement has stood Australia's cotton producers in good stead. Planting another crop near the Bt cotton crop, such as pigeon pea, sorghum, maize or conventional cotton produces moths that have not been exposed to Bt toxins. Such moths then mate with any resistant moths from the Bt cotton crop, thus dampening the emergence of resistance overall.

Along with the GM technology itself, refuge cropping is the key to maintaining resistant-free populations of the main pest of cotton.

This use of Bt cotton has, as well as reducing Helicoverpa damage in cotton, also led to reduced and softer pesticide use, and more scope for management of beneficial predators and parasitoids.

Dr Geoff Baker, Program Leader at CSIRO Entomology, together with Dr Colin Tann from CSIRO has been carrying out extensive research into refuge management,.

"Since the introduction of Bt cotton, farmers have been compelled to set aside refuge areas. This is specifically to grow the pests that they have hitherto been plagued by, and to protect the industry from the advent of Bt resistance," Dr Baker explained.

"The theory of refuge management is that a moth which emerges from a Bt crop is likely to carry two copies of a "resistance gene".

"Ideally such moths should mate with a moth from a refuge crop carrying no copies of the resistant form of the gene and this mating combination leads to susceptible offspring because resistance genes (in this case with Helicoverpa) are recessive to susceptible genes.

"Of course, if a resistant moth mates with another resistant moth, the resultant offspring will be resistant – something we very much want to avoid."

Dr Baker said that one of the key areas of study focused on how well Helicoverpa, from different crop origins, inter-breed, or whether, for example, moths from pigeon pea crops are more likely to mate amongst themselves than with moths from other crops such as cotton, and vice versa.

The latter behaviours would work against the aspirations of refuge crop use.

"While we have found that Helicoverpa do in fact cross-breed, such is not without bias. We are continuing our research to verify the extent of such bias in the mating patterns of the moths."

Moth origins can be traced. Each moth has a particular chemical signature, depending on which type of crop it came from.

"We can, for example, identify the moths' origins as feeding larvae using carbon isotope signatures," Dr Baker said.

"This method enables us to separate moths that fed as larvae on maize or sorghum from those that fed on cotton or pigeon pea. So we can test for mating patterns amongst moths from such origins."

The scientists are also looking at how well moths from refuges visit the various extremities of the large Bt cotton crops that are grown. Do these refuge-derived moths cover such crops efficiently ?

"While it is too early in our research to give tips to farmers, it is useful for them to see that studies are being carried out into best management practices and into the effectiveness of refuges. When farmers are being told to grow pests, they can be reluctant about it. Refuge crops incur costs for the farmer.

"Our studies will help them to understand how well this strategy works in preventing pests from becoming resistant and through maximizing moth production from refuges will also help to minimize costs to growers."

Dr Baker said previous research had found that pigeon pea is the best crop for producing moths, and thus less of it is needed compared with other refuge crop options.

Guidelines are laid down on how much land needs to be set aside for refuge areas, depending on the area of the Bt cotton crop. For example, 40ha of Bt cotton currently requires the equivalent of 2ha of pigeon pea crop.

The scientists have also gathered data on the abundance of secondary cotton pests and beneficial invertebrates within refuge crops, and how these relate to observed densities of these same invertebrates in the associated Bt cotton crops.

The project has, in addition, continued monitoring long-term and seasonal changes in Helicoverpa, across the years from before Bt cotton was deployed.

"We have conducted the majority of our monitoring in northern NSW and southern Qld, especially in the Namoi and St George regions, using pheromone trapping to assess Helicoverpa numbers. We propose to continue such monitoring to provide on-going assessments for industry and researchers," Dr Baker said.

? References: Mating of Helicoverpa armigera (Lepidoptera : Noctuidae) moths in relation to their plant hosts as larvae within Australian cotton farming systems Geoff H. Baker1* and Colin R. Tann2

CSIRO Entomology and Cotton Catchment Communities CRC

By the same authors:

Ecology of Helicoverpa in relation to transgenic cotton and the efficiency of refuge crops

One pupa left per square metre can result in 10,000 moths emerging per hectare the following spring, so pupae busting is one of the main methods that can stop the resistance frequency to Cry2ab.

Bustin' for resistance control

By Melanie Jenson

Heliothis (Helicoverpa spp) pupae that overwinter (diapause) in the soil have a high risk of carrying resistance into the next season which is why pupae busting as soon as possible after picking is an integral part of resistance management for Heliothis.

Pupae busting by cultivation destroys the exit tunnels of the pupae and directly kills most pupae. The work is required to be completed before end of August.

Bollgard II® has averaged 80 per cent of all the area grown to cotton in the last three years, ranging from 100 percent in some areas, to 60 percent in others, representing the reliance of the industry on the crop and in turn the importance of successful resistance management strategies for it.

"Pupae busting is a critical element of the Resistance Management Plan, as cultivating the soil after a Bollgard II crop will destroy any surviving Helicoverpa spp. pupae," said Monsanto entomologist Kristen Knight.

"This reduces any population that may emerge the following spring, thereby also reducing the carry-over of resistance genes.

"It is possible that any survivors could have been selected for resistance to the Bt proteins and these individuals could carry resistance genes from one season to the next."

One pupa left per square metre could result in 10,000 moths emerging per hectare the following spring, seriously impacting resistance development.

"This being the case, pupae busting is one of the main methods that can stop the resistance frequency to Cry2ab increasing thus, maintaining the sustainability of Bollgard II," Kristen stressed.

TIMS chairman Andrew Parkes reiterated that pupae busting is one of the strongest weapons farmers have in managing helicoverpa resistance in Bollgard II crops.

According to Andrew, who also manages the Sundown Pastoral properties west of Moree, pupae busting forms one of the strongest legs on the 'three-legged stool' that is the Bollgard II RMP.

"There are three main components to the RMP which make up the majority of the requirements - planting window restrictions, refuge management and pupae busting. This can be likened to a three-legged stool – if one leg is weakened or removed it may fall over," Andrew said.

"The pupae busting component is the leg that is very robust as it is a "physical" interruption to any potential resistance development, so the importance of this operation cannot be underestimated.

Andrew said that growers need to ask themselves "what if resistance did develop?" when considering the importance of the operation.

"All the gains that Bollgard II has allowed us to make in our industry, on so many levels, farmers need to ask themselves 'how could we go back to the old days?'," he said.

"That is the greatest impetus for everyone to strictly adhere to the RMP."

Over the past 10 years pupae busting has been a not-negotiable aspect of growing transgenic cotton, according to the Australian Cotton Growers Research Association's Greg Kauter.

He said research had continued to support this.

"Over a long period of time we have come to understand from science and research that there is a great opportunity through pupae busting to manage resistance in a non-chemical way as the pest passes through this vulnerable physiological bottleneck," Mr Kauter said.

"We are compelled to use a range of means in integrated pest management, both chemical and cultural.

"Pupae busting presents an ideal strategy as it is harder to come up with cultural rather than chemical solutions in IPM."

Andrew Parkes said the main way to optimize the pupae busting operation was to cultivate fields immediately after picking, making sure Bollgard II RMP conditions are adhered to, which also opens up more management options for rotation crops while maximizing the impact on diapausing pupae.

"If pupae busting is undertaken immediately after picking, then in the event of rain our country is ready for a number of cropping options, which is, generally, to sow winter cereals and take advantage of moisture as soon as it is dry enough to plant.

"If it rains and the fields have not been pupae busted, often moisture will be lost by the time the operation is completed and the window of opportunity is gone.

"Timeliness also can minimize compaction, by not being forced onto 'wet' country."

Andrew said to economise the operation, some machines are tooled to accomplish two or three Further reading:

Research review: "Management of overwintering pupae"

Information sheet: "Heliothis pupae control – a key resistance management tactic"

Machine Pak: Chapter 3 describes appropriate tillage equipment for different situations.

All available by contacting the Cotton Catchment Communities CRC or email david.larsen@dpi.gov.au

operations in one pass, for example pupae busting, fertiliser application and hilling up.

Adoption of biotechnology in Australia is strong with farmers planting about 80 per cent of their crop to genetically modified (GM) varieties.
Nearly half of these biotech varieties offer traits for both insect protection (Bt) and improved weed control.
Australian farmers were among the first in the world to plant GM cotton in 1996, and have now gained an estimated US$70 million in net farm income. In addition, they've reduced agricultural pesticide 9.2 million kg and decreased the associated "environmental footprint" by 21 percent.

– Monsanto Australia

Key components of the Bollgard II RMP

- Refuge crops
- Planting window
- Pupae busting
- Control of volunteers and stub cotton
- Spray limitations

Pupae busting requirements for refuges

Soil disturbance of refuge crops should not be undertaken until after the pupae busting in Bollgard II fields on the farm is complete. In Central Queensland soil disturbance of refuge crops can only occur after all Bollgard II on the farm has been removed.

There are different requirements for different refuge types.

Unsprayed refuges (cotton or alternatives)

Can be left uncultivated until the following spring which allows emergence of moths that have not been selected by the Bt proteins.

Sprayed cotton refuges

The TIMS committee has changed the requirements for sprayed conventional cotton crops defoliated on or before 9th March.

Crops defoliated after March 9 are more likely to harbour insecticide resistant diapausing Helicoverpa armigera pupae and should be pupae busted as soon as possible after picking and no later than the end of August.

The variation to the IRMS statement is based on the expected date for the commencement of diapause in central cotton growing regions, and implies that the majority of pupae under crops defoliated on or prior to the 9th March will not be in diapause and are likely to emerge as moths before post harvest pupae destruction can take place.

? Further information on or to run the Diapause model for your location at; http://tools.cotton.crc.org.au/cl2/diapause/index.aspx

Sprayed or unsprayed cotton refuges in Central Qld

Many pupae under crops at the end of season will have completed development as adults and emerged before crops are harvested, therefore pupae busting after harvesting in Central Qld is not effective. Instead a summer trap crop is used to concentrate moths emerging from cotton crops late in the season.

– It is however still important to destroy Bollgard II crops as soon as possible after harvest, by cultivation or herbicide, to prevent larvae developing and being selected for resistance on regrowth.

What constitutes good pupae destruction?

By Nicole Griffin, Compliance and Stewardship Manager, Monsanto Australia

For pupae destruction to be effective the soil across the entire plant line and furrow needs to be disturbed to a depth of 10cm.

By disturbing the soil to a depth of 10cm it destroys the escape tunnel in the pupal chamber that would be used for emergence, so they would be effectively buried.

There are several ways in which growers can achieve soil disturbance to 10cm but it is important that they focus on the result rather than the method.

Generally operations that remove the roots and reforms the bed provides the best outcome for pupae destruction.

What does the research show?

Researchers consider pupae destruction to be the most effective way of managing the risk associated with the development of resistant Helicoverpa species.

This is due to the fact that, by mechanical means, we are able to prevent potentially resistant individuals from passing on inherent genes from one generation to the next.

However research does show that the effectiveness of pupae destruction can be varied depending on the soil type and the soil moisture at the time of the operation.

If conditions are either too wet or too dry the results using the same implement can vary greatly.

It is important to assess the soil conditions of each field before the commencement of pupae destruction.

Common pitfalls to be avoided

Two main pitfalls are associated with pupae destruction:

a) Attempting to do a one pass pupae and winter cereal sowing operation. These two operations are effectively trying to achieve two different outcomes. Pupae destruction is trying to achieve full soil disturbance to a depth of 10cm and sowing winter cereal is trying to conserve moisture and not plant seed too deep.

b) Assuming that what works in one field will work in all fields. Both soil type and soil moisture need to be taken into consideration when making decisions on what implements to use for pupae destruction.

What is Monsanto doing?

Monsanto appoints Technology Service Providers in each cotton growing valley to look after the day to day management of our technologies.

Monsanto takes stewardship of our products very seriously and this season will see the commencement of a comprehensive training and accreditation package for individuals who intend to conduct pupae destruction audits.

The training will provide auditors the necessary knowledge to help give advice to growers on what is expected when performing pupae destruction operations.

Growers and cotton consultants are more then welcome to attend these training sessions.

AWM was a crisis reaction - it got growers talking about new options for area-wide control, based around softer chemistry.

Transgenics demand area-wide focus

By Lee Jenson

According to eminent industry researchers and practitioners, Area Wide Management (AWM) remains strongly relevant despite widespread adoption of Bt cotton and the distractions owing to drought factors.

"Back in 1997-98, AWM was a response to crisis," says QDPI & F principal entomologist Dr Dave Murray. That was the industry's response to difficult management of high Helicoverpa pressure, and its impact on economic viability.

"With the way seasons are, AWM momentum is lacking, but still, what happens in one crop can impact on another," he said.

He said AWM has always been fuelled by extensive industry research, which has provided growers and consultants with an enhanced knowledge base with regard to both the ecology of Helicoverpa, and the identification and conservation of beneficial insects. More importantly, it got growers talking about new options for area-wide control, based around softer chemistry, trap crops and transgenic cotton varieties.

"There's been a lot of research on biological control and the impact of natural enemies and how soft approaches could avoid outbreaks of secondary pests like aphids and mites.

"A lot has changed in the past decade. One major shift has been the high adoption of transgenic cotton – Ingard®, initially, and then Bollgard II®.

"This removed a lot of general use of pesticides. The past few years have seen a decline in Helicoverpa, especially H. armigera.

"It used to require, commonly, up to eight sprays. Now it's more likely to be one to three sprays, and they're not for Helicoverpa.

"This means a lot more conservation of natural enemies.

"But Helicoverpa numbers may have been reduced due to the drought, and when it rains again and insect pressure returns we will have to get back to AWM. We need to make sure what has been learnt over the past decade is not lost," Dr Murray said.

Dr Peter Gregg, chief scientist, Cotton CRC said the early concept of AWM was driven by the need to separate farmers using "hard" chemicals such as synthetic pyrethroids and to mitigate the impact these chemicals had on beneficial insects. AWM groups were set up to avoid this.

He said that work done in the late 1990's looked a the economics of "soft" and "hard" chemistry approaches and this showed the soft approach didn't cost more and there could even be a dollar advantage.

Dr Geoff Baker, program leader, invasion biology and functional ecology, CSIRO Entomology, has been conducting research into resistance of Helicoverpa in Bt crops.

"My own research currently deals with Bt crop refuge management and its efficiency," Dr Baker said.

"The idea is to produce large numbers of Bt susceptible Helicoverpa, i.e. insects never exposed to Bt, in these refuge crops, which will them mate with any Bt resistant moths that emerge from Bt cotton crops, thus dampening the likelihood of the emergence of Bt resistance generally.

"It's mandatory that farmers must grow refuge crops in association with their Bt cotton, but of course the susceptible moths, and the resistant ones, are not obeying farm boundaries, so the system is also operating on an area-wide scale".

Looking to the future, CSIRO Entomology acting deputy chief Dr Gary Fitt says on-going work with AWM needs to be an extension of area wide IPM ideas.

"For example, work around re-vegetation, maintaining and maxmisation of beneficials around cropping areas. That is, managing whole landscapes rather than just fields. Resistance management of transgenics will be critical. When you look at the resistance management strategy for Bollgard II®, it needs to be considered on an area-wide basis," he said.

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TIMS: Transgenics communication attention required

Communication and co-operation between growers within a specific growing area continues to be essential in the age of transgenic agriculture, according to TIMS Committee Chairman Andrew Parkes. TIMS (Transgenic and Insect Management Strategies) is an ACGRA committee working closely with CRDC. TIMS is charged with management of resistance to insecticides and transgenic cotton.

"AWM groups will continue to be important. In terms of AWM of Helicoverpa, it's still an agenda item but the focus is more on controlling sucking pests and what impacts that may have on other pests," Andrew Parkes said.

"So, how will controlling mirids affect the control of other sucking pests and what are the risks to beneficials? Attacking mirids too early can cause a chain reaction in that it takes out predators of silver leaf whitefly.

"Silverleaf whitefly was introduced to Australia in 1993, but first caused serious problems in Central Queensland around four years ago. It has the potential to pose major problems if not managed effectively.

"Control requires expensive sprays because of resistance, but the problem is if you don't control whitefly there is the potential for sticky cotton and downgrading. Australia's cotton has always had a reputation for cleanliness so that's something we want to keep", says Dr Peter Gregg.

"The best way to do that is to avoid whitefly outbreaks by not overusing chemicals for other pests".

Herbicide resistance emerges as newest challenge

The cotton cropping zone has recorded its first confirmed existence of glyphosate resistant barnyard grass resulting in urgent need to establish both containment and avoidance measures, says TIMS committee chair Andrew Parkes

"We have now actually seen the first glyphosate resistance in barnyard grass. This may be an important point for the future, so we need to have discussions on how to rotate chemistry", says Andrew Parkes.

"The thing is neither insects nor weeds recognize boundary fences. They go where they want to go, so with our management choices we all impact on each other.

For this reason, AWM groups are very important and will continue to be.

"Bugs have found a way through all the chemistry we've thrown at them so it's only a matter of time before they find a way through Bt crops. Holding that resistance at bay will be very important."

Infested paddock at Bellata, NSW, in January 2007 - pre-emergents failed due to dry conditions
Photo Andrew Storrie , NSW DPI.

TIMS was a critical component in terms of correct management and good stewardship of technologies that come into the industry.

Realising the need to manage

By Melanie Jenson

The formation of the Transgenic and Insecticide Resistance Management Strategy (TIMS) committee in 1995 was a classic example of the Australian cotton community looking forward and rising to the challenges of an ever-evolving industry.

The committee was formed to more effectively manage the existing process of formulating the annual Insecticide Resistance Management Strategy (IRMS) and develop industry supported Resistance Management Plans for the then 'new' Bt cotton INGARD®.

"Before TIMS there was no one united industry body ultimately responsible for developing insect management strategies," said Moree cotton grower Peter Glennie, who drafted the intitial plan for the formation of such an entity.

"Various researchers and growers had ideas, but what we needed the industry to work to the same science-based and agreed plan.

"The orginal pyrethroid strategy that was developed by researchers worked well and was well adopted, especially as it was voluntary, but this led to many people wanting to have input and we (as an industry) became reactive rather than proactive.

"I felt we needed someone (a committee) within the industry to ultimately be in charge – with the authority to design insect management strategies and to deal with the day to day monitoring of the strategies.

"The fact that this was 1995 and Bt cotton was due for release in the following year also added to my concerns regarding the urgency and need for this committee to be established.

"I thought then and know now that it is extremely important that all cotton insect management strategies be dealt with by the same group, as one management practice could have a large effect on other insect management systems.

"By formally correlating all management practices, a base was formed from which management for all new technology (including the Bt gene) could flow from automatically."

As Peter suggested should happen, the Transgenic and Insecticide Resistance Management Strategy committee is now convened by ACGRA to guide the development of scientifically based strategies to manage resistance to pest management technologies that growers rely on to effectively manage insect and weed pests.

For more than 10 years the TIMS committee has supported the development and annual review of the Cotton IRMS, Bollgard II® Resistance Management Plan (RMP), Roundup Ready® Crop Management Plan (CMP) and has recently with the respective technology providers finalised the Roundup Ready FLEX® CMP and the Liberty Link® Cotton and Liberty® 200 Herbicide CMP.

The TIMS Committee has the key role of assisting providers of new pest management technologies in cotton to develop scientifically based resistance management plans for their products that meet the cotton industry's needs. This is an important process to ensure both short and long-term factors are considered.

CRDC Research Program manager Ian Taylor said TIMS was a critical component in terms of correct management and good stewardship of technologies that come into the industry.

"It is important that the industry owns responsibility for being good stewards," Ian said.

"We have always taken a strong position in managing resistance and it is our responsibility to do so.

"The technical panels that are part of TIMS provide a high and critical level of detail which is used by the broader committee to formulate appropriate resistance management strategies.

"CRDC supports both researchers and the TIMS committee with operational funding, which has resulted in much of the research that underpins the RMS and RMPs."

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TIMS Committee

Chairman; Andrew Parkes, ACGRA, Independent - from any region

Northern Area Representative; Damien Erbacher, ACGRA, Biloela, Central Highlands, & Dawson Valley CGA's.

Darling Downs Representative ; Neville Walton, ACGRA, Darling Downs CGA

Western Area Representative; Greg Morris, ACGRA, Bourke CGA, Dirranbandi CGA, Mungindi WU & CGA, St George CGA

Central North Area Representative; Joe Robinson, ACGRA, Gwydir Valley CGA, Macintyre Valley CGA, Walgett CGA

Central South Area Representative ; Andrew Greste, ACGRA, Lower Namoi CGA, Upper Namoi CGA

Southern Area Representative; Bill Tyrwhitt , ACGRA, Lachlan CGA, Macquarie CGA, Tandou

Herbicide Tech Panel Chairman; John Watson, ACGRA, Transfer of recommendations to and from Herbicide Tech Panel

Convenor/Secretary; Greg Kauter, ACGRA EO, Convenor and secretary for recording meeting minutes

Central CCA Representative; Steve Madden, CCA, Gwydir, Macintyre, Lower and Upper Namoi Valleys

Northern CCA Representative; Matt Holding, CCA, Central Highlands, Dawson & Callide Valleys plus Darling Downs

Southern CCA Representative; Chris McCormack, CCA, Macquarie, Lachlan, Murrumbidgee, Tandou

Western CCA Representative; Jamie Street, CCA, St George, Dirranbandi, Mungindi, Walgett and Bourke regions

NSW DPI Representative Robert Mensah, NSW DPI, Communication to and from all NSW DPI appropriate staff and branches

QDPI Representative; Geoff McIntyre, QDPI, Communication to and from all QDPI appropriate staff and branches

CSIRO Representative; Lewis Wilson, CSIRO, Communication to and from all CSIRO appropriate staff and branches

CRDC Representative; Ian Taylor, CRDC, Communication to and from all CRDC appropriate staff and branches

CRC Representative; Gary Fitt, CRC, Communication to and from all CRC appropriate staff and branches

GRDC Representative; Dave Murray, GRDC, Communication to and from all GRDC appropriate staff and branches

Pulse Australia Representative; Vacant , Pulse Australia , Communication to and from all Pulse Australia appropriate staff

To view details of contacts on TIMS committee, ACGRA TIMS technical panel and Herbicide Tolerant Crop Technical Panel and Insecticidal Transgenic Crops Technical Panel, see Spotlight online: www.cottonnews.com.au/spotlight

PRIORITY PESTS FOR THE COTTON INDUSTRY

Common name	Pest type	Scientific Name	Economic Impact
Cotton Leaf Curl Virus*	Virus	Gemini virus	Extreme
Fusarium wilt (exotic)*	Fungus	Fusarium oxysporum f. sp. vasinfectum	Extreme
Cotton Boll weevil*	Insect	Anthomonus grandis	High
Bacterial Blight*	Bacteria	Xanthomonas axonopodis pv mavacearum X. campestris pv mavacearum	High
Tarnished Plant Bug*	Insect	Lygus lineolaris	High
Blue Disease*	Virus	Luteovirus	Medium
White Fly	Insect	Bemisia tabaci (B Type; Q Type)	High
Melon (Cotton) Aphid (exotic strains)	Insect	Aphis gossypii	High
Green Jassid	Insect	Amrasca devastans	High
Texas Root Rot	Fungus	Phymatotrichopsis omnivore	High
Tetranychus mites	Mite	Tetranychus spp.	Medium

*Training modules will be developed for these six Priority Pests.

Training modules for Cotton bio-pests

The Cotton Industry Biosecurity Plan (IBP) released in November 2006, outlines mechanisms for the cotton industry and state and federal governments to actively determine pests not currently within Australia that pose greatest threat to the viability of the industry and to analyse risks and establish procedures to reduce the chance of pests entering Australia.

With the Cotton IBP, 11 key pest threats were identified. These were based on the economic risk they represent should they become established in Australia.

To increase awareness of Biosecurity within the Cotton Industry, training modules are being developed that will provide basic information on the identification and importance of 6 of these key pest threats and training will be offered to growers, agronomists, researchers and DPI personnel working in the cotton industry. This training will assist with surveillance for exotic pests, an important aspect of Biosecurity in the cotton industry as early detection of new pests can significantly reduce the cost and increase the chance of successful eradication or containment.

What's good and bad: Strategies for beating cotton pests

Research effort

Research into beneficial insects and ecological studies aim to provide increased understanding the balance between 'good' and 'bad' insects.

CSIRO Entomology, NSWDPI and QDPI&F are looking at the impact of both parasites and predators or collectively, beneficial insects, through their involvement with Cotton Catchment and Communities CRC and the CRDC. CRDC and Cotton CRC collaboratively maintain a strong commitment to helping the cotton industry improve the ways it manages insects, both pest and beneficial.

Research is also being conducted into the range of pests that attack cotton. The main enemy in traditional conventional cotton systems has always been Helicoverpa spp., but since the introduction of GM cotton and the current Bollgard II® technology, new cotton pests such as mirids, aphids and white fly have emerged.

Ian Taylor, of CRDC explains the emergence of new insect threats.

"Mirids are a significant pest of cotton. In the new Bollgard II GM cotton systems, growers may experience yield losses of up to 40% if mirids are not controlled. It is thought that Mirids may be nocturnal, and therefore some damage is occurring at night. Damage is therefore unlikely to be detected using conventional crop scouting techniques and may only become noticeable after scar tissues has formed. Mirids generally feed on squares and small bolls of cotton plants after flowering, leading to significant yield losses over time.

"Mirids have been a problem in Australian cotton for about four or five years and they remain a challenge for us. Growers have been spraying their crops with fipronil and/or dimethoate - chemicals which have been very effective in treating mirids," Ian says.

"Unfortunately the use of insecticide chemistries disrupt the beneficial insect complex and have tended to flare other insect pest species such as silver leaf whitefly and mites. This is the reason for a research focus on improved IPM systems in Bollgard II cotton.

Aphid threat

Dr Martin McLoon, Molecular Biologist with NSW DPI has been carrying out a study with Dr Grant Herron into aphids.

"The cotton aphid is a major pest of Australian cotton because it develops a resistance to the carbamate insecticide, Pirimor and organophosphates generally," Dr McLoon said.

"Until recently, these pesticides were very effective, but now resistance in the cotton aphid and is proving to be a major threat to Australian cotton production.

"We have been carrying out molecular tests to establish resistance in aphids, monitoring insecticide and making aphid collections from fields where failures or problems have been experienced.

These are tested against a range of the current control options allowing the early identification of emerging resistance problems, as well as keeping track of existing problems. We have an Insecticide Resistance Management Strategy for cotton and this information contributes to the development of the aphid component of this Strategy."

The research continues, but as the molecular assay can provide results in 48 hours compared to four to eight weeks for bioassay tests, such tests could be used prior to insecticide control. The test could be used to determine if resistance aphids were present, so eliminating the risk of expensive spray failures caused by resistance.

? Contact Drs Grant Herron and Martin McLoon, 0246406471; email: grant.herron@dpi.nsw.gov.au; martin.mcloon@dpi.nsw.gov.au)
Also see: 'Real time PCR detection of pirimicarb and organophosphate resistance in Australian field isolates of cotton aphid, Aphis gossypii' by Drs Martin McLoon and Grant A. Herron.

Mirid triggers

Mary Whitehouse, Research Scientist with CSIRO based at the ACRI, has been surveying growers and consultants to find out what triggers them to spray for mirids. "The current threshold for spraying is three mirids per metre using a 'beatsheet' in warm regions and half this measure in cool regions," Dr. Whitehouse explained. "When mirid numbers are above this figure and retention is less than 60%, it indicates that the crop is susceptible to mirid damage and growers may need to spray. What the surveys showed, however, was that many growers sprayed below this threshold, suggesting that many were spraying unnecessarily. There were also differences between regions in their tendency to spray. For example, in some regions growers were more likely to spray below threshold, while in others they were less likely to spray below threshold. This may reflect concern in some regions to retain all fruit in a drought season, and concern in other regions about white fly, which can be triggered by spraying for mirids."

"We need to address concerns that growers may have about the mirid thresholds, and provide growers with confidence to stick to these thresholds so that other pests are not flared. One way to give confidence to the thresholds is to highlight the predators in the crops that attack mirids. Our work suggests that plain brown lynx spiders and yellow night stalkers attack mirids; and that damsel bugs, red and blue beetles and ladybirds may also feed on mirids in the field. When managing mirid predators, an important point is that spider predators are different from insect predators in that they can't fly into a crop as adults and normally enter crops as small ballooning spiderlings, so that spiders need to grow up in the crop. The presence of mirid predators should give growers more confidence in the mirid threshold, but we are still trying to understand the exact relationship between the number of mirids and mirid predators (and mirid prey) on the amount of mirid damage.

What's good and bad: Strategies for beating cotton pests

Sticky cotton downgrades

"Of all the pests, white fly is the most likely to cause problems with stickiness in cotton," said Bob Dall'Alba, Chief Marketing Officer for Queensland Cotton,

"While fortunately sticky cotton is not a big problem in Australian cotton, clearly, anything that contaminates the cotton fibre is of concern to the spinners. So it is important for growers to pay attention to controlling white fly as a preventative measure. Stickiness in cotton leads to breakages in the yarn and poorer quality. We have been lucky so far and have had just isolated incidents, which have been contained.

"At present our Australian cotton is seen in the industry as the least contaminated cotton and many growers understand this and try to make sure our cotton stays problem-free."

? Contact: Bob Dall'Alba, 07 3250 3300; bdallalba@qcotton.com.au

New bio-pesticides

Dr. Taylor also revealed that the NSW DPI and CRDC have over the last few years developed a number of new bio-pesticide options to help with the management of mirids.

"We are currently entering into large-scale field trials with a commercial partner to assess the effectiveness of the bio-pesticides in a commercial situation.

"It is hoped that following successful testing of these bio-pesticides that we may be able to see them being implemented into Australian cotton systems, so we are looking ahead over the next couple of years- but this new development could allow us to be much more selective in our control of cotton pests."

? Contact: Ian Taylor CRDC 0267924088; email: ian.taylor@crdc.com.au

Emerald white fly knowledge ahead

Dave Parlato, a consultant in Emerald, said they had a good year in Emerald. "Because it was cooler, there were fewer problems with white fly," he said.

"But we still need to treat some areas for white fly every year as white fly can damage the quality of the cotton. When we first had an outbreak of white fly seven years ago, we went to the States to see how they managed it. With that knowledge and our own local research we have been very successful in containing the pest and managing it in an area wide perspective."

? Contact Dave Parlato, 0408 771848 or 0749822051; email:dhorcott@bigpond.net.au

White fly

Dr. Richard Sequeira, Principal Research Scientist with the Queensland Department of Primary Industries and Fisheries, has been researching the control of white fly in the Queensland area.

He has been developing a new management strategy for white fly control as these pests steadily are spreading south east.

During the last few years, silver-leaf whitefly *Bemesia tabaci* (SLW) has become more prevalent in St George and the Darling Downs areas because of the warmer temperatures experienced in these regions. The increased whitefly problems have cost some growers as much as $200 per hectare extra in control costs.

"White fly are sap suckers which feed on the under side of leaves. They feed off the sap and excrete a sugary secretion called honeydew, which damages the cotton (and causes lint quality deterioration).

"Once you get white fly it is very difficult to get rid of," added Dr Sequeira. "But Admiral is 95% effective and we are confident that here in the Emerald area, we are on top of the white fly problem."

? Contact Richard Sequeira, 07 49837410 or 0407 059066; email: richard.sequeira@dpi.qld.gov.au

C Qld awaits mirid menace

"Mirids have not been a serious problem in Central Queensland in the most recent season," said Doug Sands, Development Extension Officer with the DPI.

"We have been spraying with Regent and this year we only planted a very small area to cotton due to reduced water availability, but had very good yields. Yields jumped half a bale per acre over last year, due to a very mild season."

? Contact Doug Sands, 07 4983 7403; email: douglas.sands@dpi.qld.gov.au

Spray Triggers

The most important factor triggering a mirid spray in the 05/06 survey was the overall number of mirids (rather than the number of adults or juveniles.

Fruit retention and square damage were also considered important, while tip damage had little influence on the decision to spray. Interestingly, mirid numbers were viewed as important in the decision to spray for mirids even though the counts were well below threshold (irrespective of whether mirids were the primary or secondary target).

In the 2006/07 survey, different locations varied in their tendency to spray below threshold. Tropical regions, and to a lesser extent cool regions, were more likely to spray above threshold; while warm regions were more likely to spray below threshold. Middle regions were equally likely to spray above and below threshold.

There was no correlation between mirid numbers and fruit retention in either season indicating that respondents were not induced to spray on low mirid numbers because fruit retention was also low. Some pest managers in the 2006/07 season measured fruiting factor rather than percentage retention. There was also no correlation between fruiting factor and number of mirids. In the 2006/07 season, 12 spray events were reported as "insurance" sprays, where conditions would not suggest a mirid spray, but because of other management constraints (eg: last opportunity to use a ground rig, or spray plane going over anyway) a mirid spray was applied.

Not surprisingly most of these sprays occurred below threshold. The 2005/06 survey indicated that there was no correlation between the perceived importance of fruit retention and the actual fruit retention measured. Fruit retention at both high and low levels were considered to be equally important in forming a decision to spray.

Why? Perhaps the success of some very high yielding crops may have reduced the amount of fruit loss that some pest managers are prepared to accept, resulting in a variable view of the critical level of fruit retention among respondents. In the 2006/07 season, water restrictions meant that some people anticipated that they had insufficient water to provide the expected number of irrigation events required and so did not want to lose early fruit in order to mature the crop faster. Analysis is still underway in this area.

Fruit retention may not have been as important as mirid numbers, but it was measured more accurately than fruit damage. In the 2005/06 survey, only 54% of the spray events reported the percentage of fruit damage, 14% gave a qualitative assessment ("minor" or "increasing"), and 32% had no comment on damage. This is surprising, given that fruit damage, especially square damage, was seen as important. This finding may reflect the difficulty in accurately gauging mirid damage in a growing crop without cutting open large numbers of fruit, and indicates an area where mirid management tools could be improved.

Control Options

In the 2005/06 season, Helicoverpa and green vegetable bug (GVB) control was associated with mirid control. Not surprisingly, when mirids were not the first target, the insecticide applied differed. with both Indoxacarb and Spinosad only used when mirids were the secondary target (although in 2006/07, mirids were targeted with Spinosad).

In the 2006/07 season, no sprays targeted Helicoverpa (only Bollgard crops were monitored), fewer mirid sprays also targeted other pests (probably because it was a low pressure year), and mirid sprays were occasionally applied in conjunction with non-insecticide sprays (pix or plant growth hormone).

GVB was again the pest most commonly controlled in association with mirids.

Both salt and oil were used as additives in both surveys. In the 2006/07 survey, the amount of salt used with Fipronil increased, but this was largely confined to Emerald. Both salt and oil were used in conjunction with Fipronil and Dimethoate. Oil was used with Endosulfan in the 2005/06 season and it was used with Indoxacarb in the 2006/07 season.

In the 2005/06 survey, efficacy of the insecticide employed was reported to be the most important factor, however the choice was also strongly influenced by the desire to preserve beneficials suggesting that respondents valued the 'mopping-up services' of beneficials and their potential to inhibit other pests from flaring.

? Contact Mary Whitehouse, CSIRO Entomology, ACRI Narrabri, ph 02 6799 1538, fax 02 6799 1538, email mary.whitehouse@csiro.au

If fruit loss at squaring stage exceeds 40%, plants will suffer significant yield loss

Mirrids Qld threat

"There are two species of mirids in Australian cotton," explained Dr Moazzem Khan, Research Scientist with the Queensland Department of Primary Industries and Fisheries, and mirid research specialist.

The green mirid and the brown mirid are key sucking pests in Bollgard II. While green mirids cause damage from the seedling stage through to the late boll stage, brown mirids cause damage from boll setting to late boll stage.

Dr Khan carried out tests over the past season and found that in Bollgard II the early boll stage -defined as the period between 60% of plants having 1st flower to 60% of bolls reaching 25 days, is the most critical stage to suffer yield loss from mirid infestation. He also found that at squaring stage, from emergence to 60% plants having 1st flower, cotton plants usually recover or compensate from mirid damage without experiencing significant yield losses unless those plants are suffering from some other stress such as water stress. But if fruit loss at squaring stage exceeds 40% plants will suffer significant yield loss even with ideal growing conditions.

"Which means that in making a management decision that percentage fruit loss along with mirid number should be considered", he added.

"Small to medium sized squares shed due to mirid feeding; larger squares usually don't shed but still can suffer damage that may cause parrot beaked boll. Bolls, aged above 25 days old are unlikely to suffer any significant damage due to mirids feeding on them."

"All stages of mirids cause damage, but fourth and fifth stage nymphs and adults cause the most damage. Early mirid management intervention though sometimes disrupts natural enemies and results in outbreaks of whitefly, mites or aphids later in the season," Dr. Khan added.

"Most of the registered mirid chemicals are non-selective and are highly disruptive to a wide range of beneficial species," he said.

"We have been trialling the use of salt mixtures, which allows the reduction of the chemical rate by one third without reducing efficacy or residual effectiveness. Most importantly, the salt mixture has much less impact on beneficial insects in the system.

Dr. Khan has also been studying Stinkbugs, which have recently reemerged as an important late season sucking pest complex of cotton in Australia. He found that green vegetable bug (GVB) is the most damaging stinkbug and causes up to 50% yield loss if left unsprayed.

"We have developed an action threshold for GVB, 1/m when using a beat sheet and 0.5/m when using the visual count method. Since GVB distribution in the field is very patchy, a thorough inspection to assess GVB number is required", he added.

The salt mixture was also found to be quite effective against GVB, Dr. Khan said.

? Contact Dr. Moazzem Khan, 0741600705; email: moazzem.khan@dpi.qld.gov.au

The general reliance on Fipronil for mirid control is of concern as it may lead to the evolution of resistance to this insecticide.

More known on mirid spray triggers

'We need to enhance confidence in mirid thresholds, but included in the cost of spraying is the very real threat of flaring other pests'

By Mary Whitehouse

Recent surveys are beginning to shed greater light on the practical answers around the question of how pest managers should gauge when to spray for mirids.

A pilot survey conducted in the 2005/06 season with the help of 14 growers, consultants, agronomists and managers in the Namoi, Gwydir, and McIntyre valleys, together with preliminary results from a more extensive survey during the 2006/07 season, are beginning to answer the question of how pest managers should respond to mirids.

In practical pest control terms, spraying for mirids may be important to avoid yield loss, but included in the cost of spraying is the very real threat of flaring other pests.

The data from the 2005/06 survey indicates that respondents' decision to apply insecticides was largely based on mirid numbers, and to a lesser extent on fruit retention.

The survey found that respondents were not guided by mirid thresholds, while fruit damage was often estimated rather than measured. This indicates a need for an easier way to measure damage. Respondents were also concerned about preserving beneficials, and this influenced their choice of insecticide.

The data from the 2006/07 survey has not yet been fully analysed, but the results so far indicate that there is again no correlation between retention and mirid numbers, although the cotton growing valleys seem to vary in their response to the mirid threshold.

The 2006/07 survey included reports of a larger range of insecticides being used than in the 2005/06 survey. In addition, there were proportionally more Fipronil sprays in the 2006/07 survey (63%) compared to the 2005/06 survey (55%), although the 2006/07 survey included areas not included in the earlier survey.

The general reliance on Fipronil for mirid control is of concern as it may lead to the evolution of resistance to this insecticide. In addition, the widespread use of this product could stimulate outbreaks of secondary pests (such as mites) which are flared by Fipronil. The large number of sprays in crops with both low mirid numbers and high retention exacerbates the problem, and suggests that we need to enhance confidence in mirid thresholds.

Fruit loss – which strategy?

With Helicoverpa causing little damage in Bollgard II® cotton, there is an increased focus on fruit loss caused by sucking pests such as the green vegetable bug Nezara viridula and the green mirid Creontiades dilutus.

Mirids are a difficult pest to manage because there is no clear-cut relationship between yield loss and mirid numbers, which make it harder to know when, or indeed if, it is appropriate to apply insecticides. In addition, controlling mirids in Bollgard II® cotton may require broad spectrum insecticides which could disrupt the beneficial population and thereby increase the risk of secondary pest outbreaks such as mites, aphids and whitefly. During the 2005/06 season, mirid sprays were implicated in the flare-up of whitefly on the Darling Downs.

In order to manage this real risk, we need to benchmark how the industry is currently responding to the mirid threat.

Respondents to the 2005/06 pilot survey generously provided information on 38 spray events that either targeted mirids, or mirids were cited as being a secondary target.

The aim of the survey was to find out the factors that triggered an application of a spray for mirids, and the control options chosen.

The 2005/06 survey was a precursor for an industry-wide survey conducted in the 2006/07 season where 65 growers, managers, consultants and agronomists reported from Emerald, Theodore, St George, Darling Downs, McIntyre, Gwydir, Namoi Macquarie, and Lachlan/ Murrumbidgee growing regions. These respondents provided information on 250 mirid checks in 77 fields, and 92 spray events.

CSIRO's Dirk Richards probing to integrate cotton's inputs.

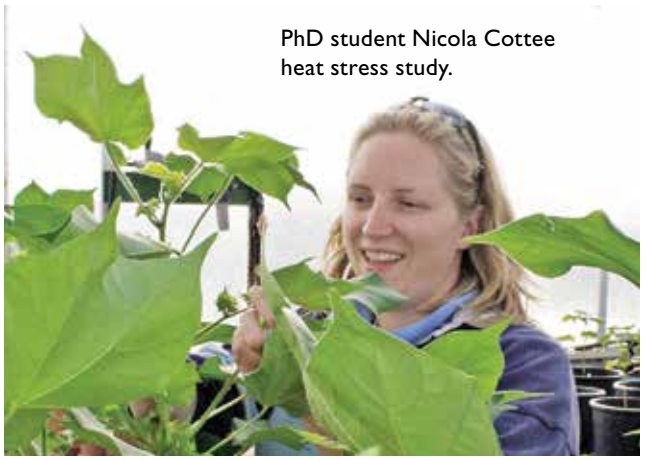
Integrating agronomic inputs

This new project focuses on the challenges of integrating agronomic decisions in the whole cotton farming system. A key component of this project will be a critical analysis of high yielding cotton systems against a range of risk, sustainability and profitability measures.

Research and industry innovation across a wide range of areas, such crop protection, nutrition/soil, irrigation, agronomy, weather, variety and trait need to be packaged into region and outcome specific management. Desired outcomes of this research are industry efficiency in water, nutrition and energy with best yield and fibre quality. The project officer, Mr Dirk Richards, and Technical Officer, Graeme Rapp, both have over 10 years experience in the cotton industry. This research will provide an objective assessment of existing industry practices, in addition to their interactions and efficiency of resource use.

The findings of this analysis will be extended to industry through guidelines for efficient, profitable, sustainable and climatically adaptable high yielding and high quality systems with the help of the Cotton CRC extension team.

Although the team will be based at Narrabri, research sites will cover many production regions. Mr Richards will also be collaborating with Cotton CRC/ GRDC 'High yielding irrigated grains in cotton production systems' project.



PhD student Nicola Cottee heat stress study.

Heating up

Conditions in cotton growing regions have the tendency to be extremely hot and humid resulting in detrimental effects to both the cotton plant growth and yield.

Nicola Cottee, PhD student at The University of Sydney is looking to develop new ways to measure heat stress in cotton and ultimately enable more effective selection of varieties for better growth and higher cotton production in warmer cotton regions.

Techniques that measure leaf function through photosynthesis and cell damage were developed in glasshouse experiments and subsequently evaluated under field conditions at the Australian Cotton Research Institute, Narrabri and Texas Agricultural Experiment Station, USA. Preliminary results have shown that Sicot 53 and an experimental line; CSX 376 demonstrated good heat tolerance, while Sicala 45 and Sicala V2 were relatively less tolerant to heat stress.

These findings may provide the basis for the selection of agronomically superior cotton cultivars for breeding programs targeting growth and production in the warmer cotton growing regions of New South Wales and Queensland.

Research collaborative involving researchers at The University of Sydney, CSIRO Plant Industry, Cotton Catchment Communities CRC and Texas A&M University.

? Contact nicola.cottee@csiro.au or 6799 7480

Using N fertilisers more efficiently

The increasing costs of nitrogen (N) fertiliser, combined with greater focus on greenhouse gas emissions has prompted greater attention to the efficient use of nitrogen fertilisers.

The 2006/07 season saw Nitrogen efficiency measured in 34 cotton crops at various sites in the Macquarie, Namoi, Gwydir, Macintyre and Central Queensland regions, to establish the crop N uptake, crop N use efficiency and N fertiliser recovery. The results established that on average an excess of 40 kg N/ha was being applied.

The results indicated that there is considerable scope to reduce N fertiliser application without reducing yields. With that in mind, the direction for the 2007/2008 season will focus on continued nitrogen use efficiency monitoring to obtain data for each region and to identify the best N management practices and extend this to the whole industry.

? On-farm experiments will continue in the coming season, if you are interested in this nitrogen use efficiency assessment program, please contact your local Regional Cotton Extension Officer.

Central Queensland aims higher

There is a wide-spread view among central Queensland cotton growers that their industry has lagged behind southern, more temperate cotton growing regions in terms of locally relevant, basic crop agronomy and management research.

Richard Sequeira, Douglas Sands, Andrew Moore and Lance Perdergast of QDPI&F are currently running a research project aimed at laying the foundations for integrated systems-research in the region by bringing together crop agronomy, pest and disease management into a unified framework. The research will deepen and widen the knowledge base developed from previous CRDC funded projects for management of heliothis and silverleaf whitefly within the context of Bollgard II® production systems. The interactions between agronomic variables (e.g. sowing date, nutrition, and crop management), seedling and other plant diseases and insect problems that are poorly understood in the region will be documented and characterised with a view towards developing locally relevant best practice production guidelines for central Queensland cotton growers.

The project will address the needs of the central Queensland region in terms of research that will help cotton growers fully utilise new biotechnology, the opportunities provided by the environment and develop effective pest management strategies, thereby optimising inputs, maximising production and profitability of their industry.

? Contact Richard Sequeira (07) 4983 7410

Stay aware in cool, wet starts

Although aphids and mites were not too prevalent last cotton season due to drought conditions, in a wetter winter with abundant weed growth, growers should monitor young cotton crops.

By Lewis Wilson and Chris Anderson

Growers and consultants should be aware that cool, wet starts to the season can increase the severity of black root rot, Fusarium wilt, and seedling diseases caused by Rhizoctonia and Pythium.

For example, in the southern regions of NSW, stand losses due to seedling diseases caused by Rhizoctonia and Pythium are much higher than losses in northern areas, due to the cool starts.

NSW DPI plant pathologist Chris Anderson said stunting caused by black root rot is usually more severe in cool seasons.

Fusarium wilt is usually visible in the crop much earlier compared to warmer seasons and symptoms may be much more severe.

Verticillium wilt is a slightly different story where a cool start can cause stunting in November, but plants will grow out of this as the weather warms up.

"Crop losses due to Verticillium wilt are increased by cool/wet periods in the middle of the season," Chris said.

"However, a cool snap at the end of an otherwise warmer season may flare Verticillium wilt, and thereby aide defoliation and the opening of bolls.

"We encourage growers to read and follow the IDM guidelines. In particular, if you suspect a cool start to the season, then delay sowing to avoid the impacts of seedling disease, black root rot and Fusarium wilt. If cool conditions persist throughout the season, then expect some losses due to disease. Wet conditions through winter and springing can also lead to higher pest pressure due to the increased availability of weed and crop hosts for them to feed on.

Dr Wilson and his Technical Officer, Tanya Smith, have extensively surveyed weeds, crops and native vegetation through winter, finding that aphids survive the cooler months on whatever weeds are available. They also found that aphids survive in farm gardens, especially hibiscus.

In spring aphids move from dying weed hosts and gardens and may colonise young cotton crops.

Mites similarly use a wide range of weed hosts, in or around cotton fields and will crawl or use wind currents to seek new hosts in spring. For this reason populations are often initially higher near the edges of fields.

"Although aphids and mites were not too prevalent last cotton season due to drought conditions, in a wetter winter with abundant weed growth growers should monitor young cotton crops for aphids and mites," Dr Wilson said.

"Good farm hygiene, especially weed control will help to reduce the numbers surviving through winter.

"Regular checking of seedling cotton will show if mite or aphid populations are increasing, indicating a potential problem, or static or decreasing indicating that predators and parasites are providing good control."

Dr Wilson said if mites or aphids are found but do not require control, it is also important to consider the control options used for other pests. "Broad-spectrum insecticides may dramatically reduce beneficial populations and thus allow mite and aphid populations to increase rapidly. If seasonal conditions are cooler, cotton growth will be slower and the effects of pest damage more obvious, causing concern," he said.

"This is especially the case for thrip damage. Growers concerned about thrips should consider a seed treatment or at planting soil applied insecticide to control them, as this will be more effective and less disruptive to beneficial populations than later spraying the crop with an insecticide.

"Be aware though that the choice of seed treatment or at-planting insecticide will influence options for later aphid control to avoid selecting twice with the same group of insecticides.

"Extensive research shows there are clear thresholds for early season pests. Careful monitoring of pest populations and their damage will allow good decisions based both on pest numbers and plant damage levels. Good information on insecticide effects of beneficials, pest sampling and pest and plant damage thresholds can be found in the Cotton Pest Management Guide."

? Contact: Chris Anderson, Plant Pathologist NSW DPI. 02 67992454; Dr Lewis Wilson, Program Leader 'The Farm', Cotton Catchment Communities CRC 02-67991500 E-mail lewis.wilson@csiro.au

Further reading: Cotton Integrated Disease Management Guidelines. CRC website at http://web.cotton.crc.org.au/content/Industry/Publications/DiseaseMicrobiology/CottonIDMGuidelines.aspx or in hard copy from the Cotton Catchment and Communities CRC.

Anderson CMT, Nehl DB (2006) Delayed sowing as a best-bet approach to minimize the impacts of Fusarium wilt. In 'Proceedings of the 13th Australian Cotton Conference'. Broadbeach, Australia. (Australian Cotton Growers Research Association. Nehl DB, Mondal A, Anderson CM (2006) Delayed sowing can decrease the severity of black root rot of cotton. In 'Proceedings of the 13th Australian Cotton Conference'. Broadbeach, Australia. (Australian Cotton Growers Research Association)

Priority Pests for the Cotton Industry

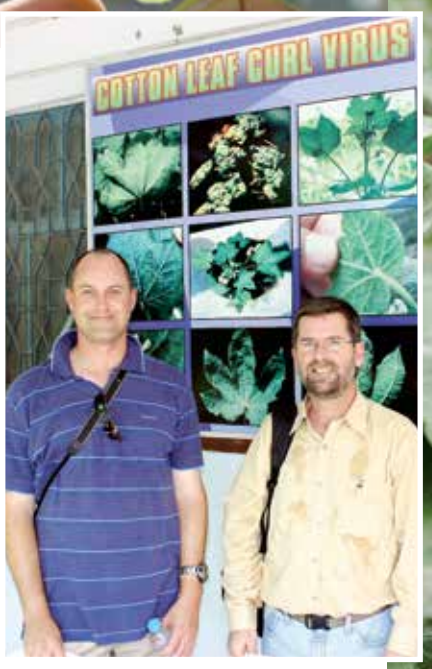
In developing the Australian Cotton Industry Biosecurity Plan (IBP), six economically-important pests of cotton were identified and where the industry will introduce training.

The IBP released in November 2006 by Plant Health Australia and ACGRA at Dalby outlines mechanisms for the cotton industry and state and federal governments to actively determine pests not currently within Australia that pose greatest threat to the viability of the industry and to analyse risks and establish procedures to reduce the chance of pests entering Australia.

With the Cotton IBP, 11 key pest threats were identified. These were based on the economic risk they represent should they become established in Australia.

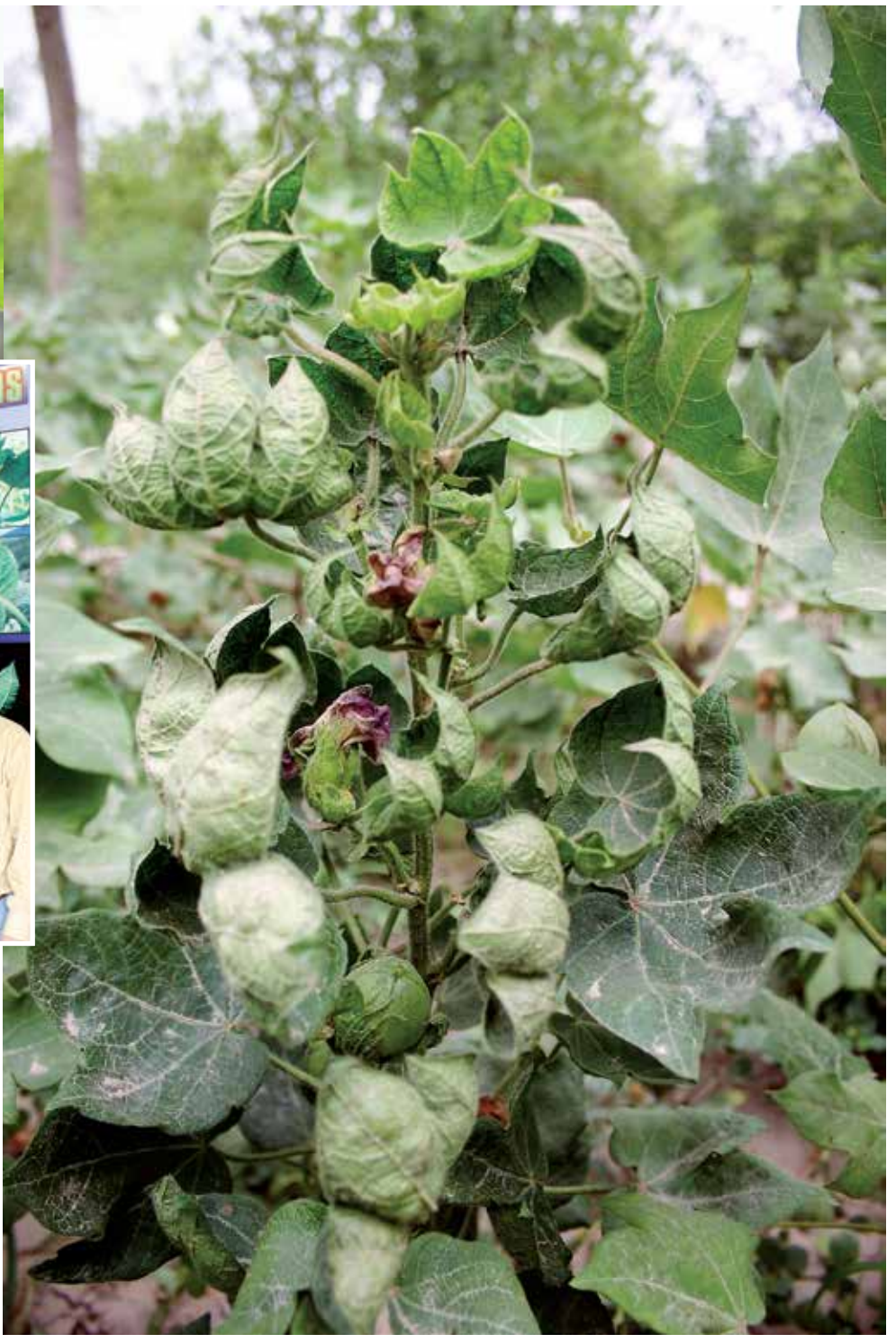
To increase awareness of Biosecurity within the Cotton Industry, training modules are being developed that will provide basic information on the identification and importance of 6 of these key pest threats and training will be offered to growers, agronomists, researchers and DPI personnel working in the cotton industry. This training will assist with surveillance for exotic pests, an important aspect of Biosecurity in the cotton industry as early detection of new pests can significantly reduce the cost and increase the chance of successful eradication or containment.

Biosecurity at work: Hamish Millar, chair of ACGRA, Andrew Ingliss AM, Chairman Plant Health Australia, and Chris Adriaansen, General Manager, Plant Health Biosecurity, Queensland Department of Primary Industries and Fisheries at the November 2006 Dalby launch of the Cotton Industry Biosecurity plan.



On their recent fact-finding mission to Pakistan, ACGRA's Damien Erbacher and Greg Kauter.

Our scientists on leaf curl virus mission



Cotton leaf curl virus is one of the major risks to the cotton industry dentified by the Industry's Biosecurity Plan.

A number of industry representatives including scientists, consultants and growers and including Greg Kauter, Executive Officer of Australian Cotton Growers' Research Association, have just returned from a fact finding visit to Pakistan.

The group visited Pakistan in July 2007 to gain a special insight into disease symptomology, understand vector interactions and to aid in enhancing Australia's diagnostic capacity for the potentially devastating disease. Cotton Leaf curl virus is endemic in Pakistan and not present in Australia.

"It is important to increase our knowledge about this virus," Mr Kauter explained.

"There is a similar virus in Australasia among capsicum and tomato crops, which is carried (vectored) by white fly, and we need to be vigilant to make sure that we keep the leaf curl virus out of Australia.

In Pakistani Punjab the virus escalated after they grew several susceptible varieties of cotton in the 1980s. Now they are dealing with it in different ways such as breeding resistant varieties and not planting too late. They also pursue novel sources of resistance through intra-specific crosses, biotechnology and mutagenisis.

"Clearly here in Australia, we need to watch out for breaches in quarantine to prevent this virus from entering. Farmers need to be on the look out for unusual crop symptoms and check their pest fact sheet."

? The Cotton Industry Biosecurity Plan can be found at www.acgra.net.au/biosecurity.htm
Contact Greg Kauter, ACGRA, tel 0429 700711.
Email:greg.kauter@acgra.net.au

Plant Health Australia watchful vigilance

Plant Health Australia's (PHA), role is to coordinate plant health on a national level including assisting with the management of outbreaks of exotic pests which could affect industries such as cotton.

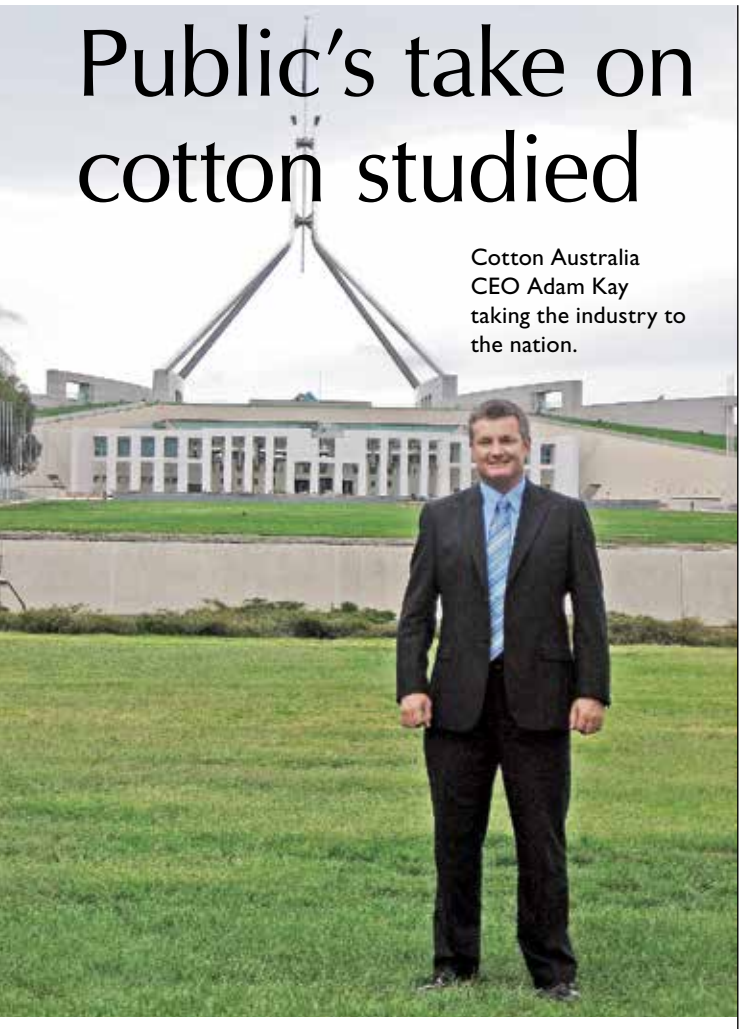
The cotton industry's own Industry Biosecurity Plan (IBP) released in November 2006, outlines mechanisms for the cotton industry and state and federal governments to actively determine pests not currently within Australia that pose greatest threat to the viability of the industry, and to analyse risks and establish procedures to reduce the chance of pests entering the country.

"We have a list of 11 key exotic pests of concern to the cotton industry which were identified based on the economic risk they represent should they become established in Australia," explained Dr. Sharyn Taylor, Program Manager with Plant Health Australia. "For six of these pests, Cotton Leaf Curl Virus, Cotton Boll Weevil, Tarnished Plant Bug, Blue Disease and exotic strains of Bacterial Blight and Fusarium Wilt, training modules are being developed to increase awareness of biosecurity and provide basic information on their identification and importance.

These training modules will be offered to growers, agronomists, researchers and DPI staff working in the cotton industry. This free training will help with surveillance for exotic pests, an important aspect of biosecurity in the cotton industry, as early detection of new pests can significantly reduce the cost and increase the chance of successful eradication or containment."

? For more information about the training courses and exotic pests, contact Sharyn Taylor at the PHA on 02 62604322 or visit the PHA website www.planthealthaustralia.com.au
Contact PHA Sharyn Taylor 0262604322 staylor@phau.com.au)

Public's take on cotton studied



Cotton Australia CEO Adam Kay taking the industry to the nation.

With water being a significant public policy issue in this country, a new project is studying public perceptions about the cotton industry's use of water for irrigation. Cotton Australia, together with various industry organisations has led a project to do this on behalf of the industry. CRDC has assisted with up-to-date research and water usage information together with funding to assist the public research phase.

The project has been running for six months, since Cotton Australia's new CEO, Adam Kay, pictured, came on board.

To establish what the community really thinks of cotton, the first phase of the study engaged Gavin Anderson & Co to measure the level of community awareness of cotton production in Australia and uncover generally-held perceptions concerning cotton's relationship with water for irrigation. Ten focus groups took in six metropolitan groups in Sydney, Adelaide and Brisbane. Four regional groups were selected from Tamworth and Toowoomba.

Findings from the research allowed Cotton Australia to undertake educative briefings with key stakeholders and decision makers, including Federal and State Governments and Oppositions, media and media commentators.

Mr Kay said the aim of the project has been to develop an industry strategy that was based on fact rather than assumptions. It also focused positively on the benefits offered by the Australian cotton industry, particularly the social impacts on regional communities and cotton's care for the environment, he said.

"The information from our market research has been extremely useful in developing the messages needed to address concerns. For example, it showed there was a perception that cotton was a 'waster' of water. This perception can be easily addressed using sound data available to the industry that is now more widely available and used.

"Funding for the research came in from many companies throughout the industry. Many larger growers also contributed. We have had meetings with these and other industry stakeholders to determine the way forward.

"We hope decision-makers can better understand the cotton industry and how we operate, as well as recognise our significant social, economic and environmental contribution to the nation," Adam said.

? If you would like more information on this project, please contact Cotton Australia CEO, Adam Kay on (02) 9669 5222 or (0437) 695 222. . Cotton Australia website: www.cottonaustralia.com.au

Thirty four participants took the July Field to Fabric course at CSIRO Textile and Fibre Technology facility at Geelong. We had:

5 Growers
2 Corporate Growers
2 Consultants
2 Extension
10 Processing
10 Overseas buying
1 Classing
1 Marketing
1 Communications

Cotton Field to Fabric Course

By Cleave Rogan

The Field to Fabric Course at CSIRO Fibre & Textiles at Geelong, Victoria in July gave me and 33 others a good understanding of the processes involved in cotton fibre manufacture from field to fabric. We now understand much more about competition faced by Australian cotton against other fibres, both natural and man made, and helped us understand the complexities of the World cotton market.

The course had a very good atmosphere generated by the presentations and the adjacent hi-tech textile mill. The knowledge of presenters combined with practical demonstrations, and the chance to talk with the people who understood and run operating machines in a modern textile manufacturing complex, was a highlight.

Presentations in the first day covered agronomy, picking, ginning, classing, marketing, fibre properties and the global textile market.

Day-one highlights for me were Australian cotton against the global perspective, followed closely by agronomy decisions related to fibre properties.

Day Two presentations covered processes cotton takes preparing it for spinning. Short walks over to the Yarn Manufacturing Building meant valuable theory and practical sessions in one. In the factory we where shown all machines working. This gave me an understanding of the uses for each machine and the merits of each.

The take home message for me on this day was how some machines can switch from one fibre to another fibre quickly and how description and quality of fibre are important for a spinner's lays so they can produce a yarn without faults at the high-end of the market.

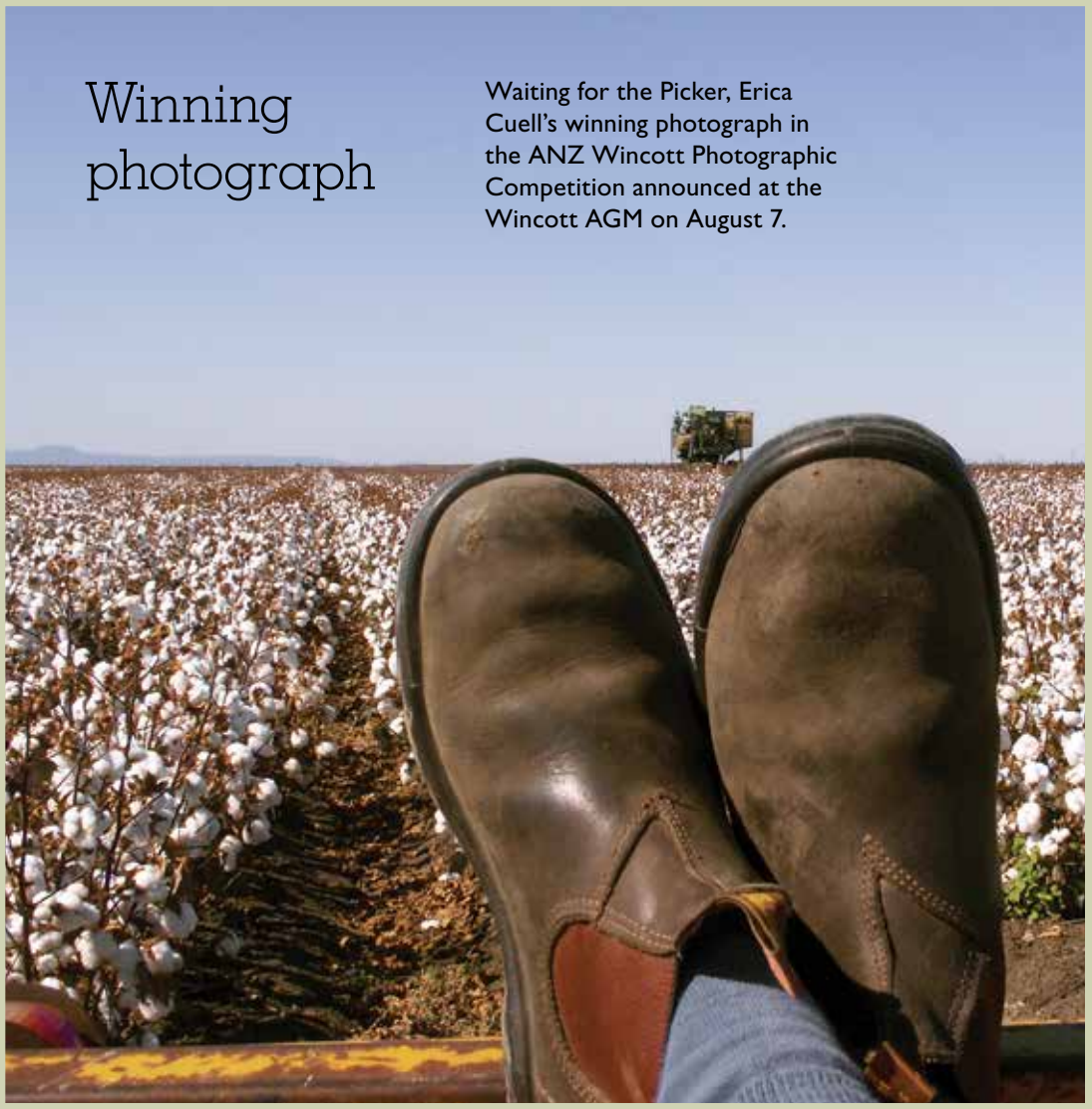
Day Three covered fabric formation, dyeing and quality assurance with both theory and practical sessions throughout the day. Again, combining theory and practice gave me a good understanding of the processes involved. The highlight was fabric formation on different processes and machines, and understanding importance of the speed that they must operate at based on the purpose the fabric being made. We where also shown the multitude of instruments that are used in the research, testing and development of fibres.

I thank Cotton Research Development Corporation for the valued financial support they offered myself to attend this course.

Cleave Rogan is a principal of RowAg Farming, "Bookamerrie", St.George.

CRDC funds places at the Field to Fabric course. The next Field to Fabric course at Geelong is scheduled for November 2007. For further information, contact Helen Dugdale, CRDC, 02 6792 4088, or Rene van der Sluijs, CSIRO Textile and Fibre Technology, 03 5246 4000.

Winning photograph



Waiting for the Picker, Erica Cuell's winning photograph in the ANZ Wincott Photographic Competition announced at the Wincott AGM on August 7.

Women of cotton reflect strength

As part of the Cotton Collective held in Narrabri on August 7, thirty women and a few men gathered to celebrate Wincott's 5th Annual General Meeting.

Following CRDC funding in the formative years of Wincott, the organisation in its representation of the interests of women involved in the cotton industry continues to gather strength.

Telstra's Gold Sponsorship announcement at the AGM, together with existing Gold Sponsorships which now boast Monsanto, ANZ, Grant Thornton and Cotton CRC is further proof of a valuable industry organisation. Telstra's Elise Munsie spoke of Next G, as well as her participation in the ARLP Course – a national rural leadership program of which many in the cotton industry have participated, at the AGM.

The Cotton Collective also meeting announced Erica Cuell of CSIRO, Narrabri, as winner of the ANZ Wincott photographic competition with her photograph entitled "Waiting for the Picker".

Outgoing Chair, CRDC's, Helen Dugdale reported on 2006-07 Wincott activities and announced the new committee with women from seven cotton production regions.

The Wincott committee is Chair, Jo Begbie, Hay; Vice Chair, Helen Dugdale, Narrabri; Treasurer, Anna Hillam, Moree; Secretary and Publicity Officer, Kate Schwager, Wee Waa; Assistant Publicity Officer, Meg Kummerow, Dalby; and committee members, Jennie Conachan, Theodore; Rose Roche, Narrabri; Anna Madden, Wee Waa; Sara Wilson, Goondiwindi, and Annabel Wiseman, Emerald.

The meeting conveyed congratulations to Wincott member Joanne Grainger following her election as Chair of Cotton Australia. She is the first woman to hold the position of Cotton Australia Chair. Joanne is very active as a contributor to industry and has held many positions of responsibility.

The address of guest speaker Barbara Newton of Tullamore surrounded her theme of 'the tapestry of my life'. In this, she touched on her varied personal experiences as a nurse, as an opera singer, and also dealing with depression.

"There are a lot of women with a story to tell, and the cotton industry would have plenty of inspiring stories," Barbara said.

"Women in the bush are different from those in the city because we tended to bond and help each other more," she said.

The meeting heard informative talks on cotton technology from Kristen Knight of Monsanto Technology Department who explained research with Bollgard cotton and how important it is to, "look after your refuge crop to safeguard against build up of resistant moths to Bollgard."

Sara Wilson of Bayer Crop Science, Goondiwindi followed up with a discussion on Bayer research into Liberty Link Cotton. Her message on safety with new crop protection chemicals proved to be of great interest to the meeting.

? Contact Kate Schwager, 02 67967243, email: wincott.news@ozcotton.net or visit the website: www.wincott.net.au

Workshops raise vegetation awareness

Two Natural Resource Management Field Days instigated by Wincott were held on 19th & 20th June 2007, at Goondiwindi and Mungindi.. The purpose of the Days was to raise the awareness of native vegetation issues in the Border River areas of Queensland and NSW and to help improve the understanding of local vegetation and its contribution to the landscape. Latest tools and techniques developed from research to better manage native vegetation and riparian areas was widely discussed.

Local indigenous people attended both Field Days and freely shared their knowledge. Wincott said the background to this small project was mainly that Wincott had identified a need for more information on these topics but were unable to readily find it.

Outcomes of the Field Days saw participants go away with new skills and backup fact sheets and resources which they could then take home and use in their own situations.

An enthusiastic team made up from representatives of Wincott, Qld DPI, Cotton Catchment Communities CRC, Qld Murray Darling Committee (QMDC), Border Rivers Gwydir CMA, Border Rivers Food & Fibre (BRF&F), Cotton Research & Development Corporation (CRDC), and Moree Shire Council were involved. The collaboration between these organisations was productive. In the process of developing these Field Days we (the organising team) also felt that we learnt a lot from each other and were able to share resources and ideas and contacts."

"It also meant a broader array of skills, knowledge and ideas were brought to the team and to the Field Days" Helen said

Examples of Hands-on Sessions in Program (where participants were divided in to 3 groups, then swapped over to a new session):

Walk & talk on Bird identification, trees, shrubs and groundlayer plants

Identification of weeds and pests and how to manage them

Assessment and monitoring techniques of water quality, biodiversity, riparian health (number and variety)

The field days generated a great deal of publicity as well as using the extensive email networks that the team had between them. As a result of the success of these field days many other regions have heard about them and have been inquiring when one can be held in their area.

? For enquiries, please contact: Coordinator Kate Schwager on 02 67967243 0407665357 or email bkschwager@bigpond.com

Sprayed conventional cotton crops defoliated after March 9 are more likely to harbour insecticide resistant diapausing Helicoverpa armigera pupae and should be pupae busted as soon as possible after picking and no later than the end of August.

Pupae decisions amended for 07/08 crop

The TIMS committee recently approved a change to the Post Harvest Pupae Destruction statement for the 2007/08 IRMS. The revised statement considers the likelihood that larvae will enter diapause before a certain date, which allows for removal of pupae busting operations in field specific situations.
The estimated commencement date of diapause is based on the Helicoverpa Diapause Induction and Emergence Tool developed by QDPI&F

What is the amendment?

Current Post Harvest Pupae Destruction statement

– Cultivate to destroy over-wintering pupae as soon as possible after picking and no later than the end of August.

New Post Harvest Pupae Destruction statement:

– Sprayed conventional cotton crops defoliated after the 9th March are more likely to harbour insecticide resistant diapausing Helicoverpa armigera pupae and should be pupae busted as soon as possible after picking and no later than the end of August.

The variation to the IRMS statement is based on a scientifically validated expected date for the commencement of diapause for Helicoverpa armigera in central cotton growing regions. It implies that the majority of pupae under crops that are defoliated on or prior to the 9th March will not be in diapause and therefore are likely to emerge as moths before post harvest pupae destruction can take place.

What impact will this change have on insecticide resistance management?

The diapause model predicts that a very low percentage of larvae (<2%) will potentially have entered diapause on or prior to the March 9 in central cotton growing regions. The risk posed to insecticide resistance management by this small proportion of larvae that may not get pupae busted is considered low because conventionally sprayed cotton currently represents less than 15 % of the total cotton growing area. The amended guidelines will only affect the small proportion of conventionally sprayed cotton that is defoliated on or prior to the March 9, and that total represents a small part of the overall industry.

Do I still have to pupae bust my Bollgard II crop if it is defoliated before this date?

It remains critical to pupae bust Bollgard II.

This mandatory requirement must be completed according to the guidelines in the RMP. The risk to insecticide resistance is considered low within the current cotton cropping system that is dominated by Bollgard II. The converse is true for Bt resistance management. With approximately 85% of cotton being Bollgard II, even allowing a small proportion of larvae to enter diapause and not be pupae busted is a high risk for Bt resistance management.

Will this change have implications for managing resistance to Bollgard II cotton?

The modification may allow for a greater emergence of Bt susceptible moths from conventionally sprayed areas that would otherwise have been killed by pupae busting. However, since this enhanced emergence is very low (<2%) the impact on resistance management for Bollgard II cotton will be minimal.

Is there potential for this statement to be modified in the future?

The new guidelines regarding pupae busting in conventionally sprayed cotton apply to a cotton system dominated by Bollgard II cotton. The TIMS Committee was able to consider a revised Post Harvest Pupae Destruction statement for inclusion in the 2007/08 IRMS because of information produced from the on-going Insecticide Resistance Monitoring Program for Helicoverpa funded by CRDC, GRDC and NSW DPI.

Continued monitoring of insecticide resistance frequencies and the ongoing assessment of the proportion of sprayed conventional cotton by region are important aspects of the IRMS change, and will be reviewed annually as part of assessing the impact and risk posed by this change.

December 2007 edition. Spotlight will publish an extensive feature in the December 2007 issue on the services provided to cotton production from natural and diverse landscapes. In the 'Farming for Nature'. feature, contributions are invited. Please contact the editor of Spotlight at CRDC. Phone 02 6792 4088 or email spotlight@crdc.com.au if you have an interesting on-farm experience or research which demonstrates the linkages.

Farming for nature:

cotton already leading the way

by Tristan Viscarra Rossel

The Australian cotton industry has invested in natural resource R&D for many years. This research is directly linked to both industry and Australian Government's national rural R&D priorities since 1994 and the outcomes are beginning to show that when it comes to sustainable farming practice.

Cotton growers are undertaking many positive practices which are known to enhance biodiversity, according to Dr Paula Jones from the Cotton Catchment Communities CRC. Enhancing biodiversity adds value to their farm and to production, Paula said.

"A recent survey showed that growers are already doing the right things – fencing off native vegetation and selectively grazing it or just leaving it altogether; controlling pests and weeds; and monitoring feral animals and insects," she said.

"A lot of the practices we suggest that they do, they already do as part of their day-to-day farm management – but without recognising it, in many cases.

Under the previous Australian Cotton CRC, Paula explained that the projects looked at the behaviour and management of beneficial insects on cotton farms, the impact of defoliants on native vegetation, the relationship between native vegetation and beneficial insects and whether insectivorous bats were predators of cotton pests.

The Cotton Catchment Communities CRC now has a number of R&D projects that focus on quantifying the value of greater biodiversity for cotton farming areas.

"A couple of projects are looking at ecosystem services – trying to put an economic value on services that the ecosystem provides to the catchment area," Paula said.

"For instance, native vegetation can provide a range of different cotton production benefits including harbouring beneficial insects. Some of our research is looking at the different services that are provided by areas of native vegetation including some pest control benefits."

The CRDC's Integrated NRM research project manager, Helen Dugdale, said that the current projects funded by the CRDC aimed to improve water use efficiency, assess the value of aquatic biodiversity in ring tanks, reduce the impact of sodic soils, assess environmental risks of gin trash, optimise sequestered carbon on cotton farms and reduce greenhouse gas emissions.

Earlier this year the Australian Government revised its national R&D priorities to include climate variability and climate change - to build resilience to climate variability and adapt to and mitigate the effects of climate change.

Helen Dugdale said that's in line with cotton industry's future research priorities too.

"There is a lot of interest in climate change R&D. We'll start to address it in terms of how we can help growers to handle major changes in the climate and hence how we can help the catchment areas," she said.

? Contact Dr Paula Jones, Cotton Catchment Communities CRC 02 6799 2440 paula.jones@cotton.crc.org.au or Helen Dugdale, CRDC 02 6792 4088 helen.dugdale@crdc.com.au

Trees reduce yield losses in high winds

A massive tree planting effort from James Thomas and his father Ian at 'Bloomfield', 12km east of St George, over the past 20 years is already delivering the goods.

The initiative started in 1988 when the Thomas' planted native trees along a main irrigation channel which bordered a paddock with recurrent salt problems.

"We were fighting the salt a fair way down the soil profile. We looked at engineering options but in the end the trees were the best long-term solution," James explained.

"We planted 550 trees on the edge of the channel and within a few years it lowered the water table significantly - you couldn't dig deep enough to find any signs of moisture."

Now the farm has close to 5000 trees and is reaping secondary benefits from the native vegetation.

In recent wind storms, when neighbouring cotton farms suffered significant crop damage from wind burn and ring barking, the tree lined paddocks at 'Bloomfield' faired much better. And James said the trees can also intercept spray drift.

They do not undertake insect monitoring but James believes that the native vegetation harbours beneficial insects - natural predators of cotton pests.

Eight bat nesting boxes have also been built and installed in the native vegetation areas, which adds another element of biological pest control to the mix.

"We hope to build some more boxes and get them out there – it's a wet weather job," James said.

? Contact James Thomas, 'Bloomfield' 07 4625 2128 thomasco1@bigpond.com

Practical steps to retain existing biodiversity

There are many things growers can do to promote biodiversity. Included on the list is maintain areas of native vegetation near cotton crops to create protected habitat for native animals, birds and beneficial insects.

- Design irrigation storages and water courses to aid the removal of sediment, nutrients and pesticides from irrigation water and enhance the habitat for native animals and plants.
- Plant native vegetation along waterways. This provides shelter and food for native animals and insects.
- Slope the edges of waterways to encourage greater plant diversity and improve pesticide breakdown by microbes.
- Develop practices and processes that help filter irrigation water for reuse on the farm, including farm wetlands, and in the environment generally.
- Implement the Land and Water Management module of Cotton Australia's Best Management Practices (BMP) program for a systematic approach to biodiversity management.

Read Design principles for healthy waterways on cotton farms available from the Cotton Catchment Communities CRC website.

Contacts: Dr Paula Jones, Cotton Catchment Community CRC 02 6799 2440: paula.jones@cotton.crc.org.au

Helen Dugdale, CRDC 02 6792 4088 helen.dugdale@crdc.com.au

James Thomas, 'Bloomfield', St George: 07 4625 2134: thomasco1@bigpond.com

Growers address NRM and biodiversity in different ways

By Veronica Chapman, Resource Management Officer Qld DPI&F, St George.

Other industries, such as grain and horticulture, are currently developing BMP-type programs and since the cotton industry BMP program has been in existence for some years these, industries are looking to the cotton industry for information and tips on how to get it right.

A number of cotton-growing properties in Queensland and NSW contain native vegetation, much of which is left relatively undisturbed or lightly grazed. This remnant vegetation provides habitat for wildlife and hopefully some connectivity of vegetation within the landscape.

If growers can meet the standards in relation to vegetation management within the Land and Water Management module of the Australian cotton industry Best Management Practices (BMP) program they are making a valuable contribution to catchment targets.

A number of growers in Queensland and NSW have undertaken 'Land and Water Management' workshops which have been conducted as a joint initiative of Cotton Australia, Cotton CRC extension staff and the local catchment body.

Individual growers address NRM and biodiversity issues in different ways. Some growers adopt the BMP program using it as the model for running their farm business, while others manage their production system in such a way that there are NRM benefits as well.

Then there are growers who are passionate about sustainable land use and management – and actively encourage their neighbours to do the same! Other industries, such as grain and horticulture, are currently developing BMP-type programs and since the cotton industry BMP program has been in existence for some years these, industries are looking to the cotton industry for information and tips on how to get it right.

Funding available to make a start

Many of the catchment bodies also have incentive funding available - and growers are encouraged to contact a representative from one of the above groups prior to undertaking any NRM-type work if they are seeking incentive dollars.

This will help to establish if the catchment body can get more value for their funding by not only working with an individual but perhaps with surrounding landholders and it also means people know the criteria which they need to meet to be eligible for funding and the amount of incentive funding that they are likely to get, as the contribution from the catchment body relative to what the landholder contributes is dependent on a number of factors - eg. the work they are proposing; issues they are addressing and the public/private benefit.

? For technical assistance, contact Cotton Australia Grower Services Managers (particularly in relation to elements of the BMP program), Cotton CRC extension staff (particularly those working on NRM-type projects) and local Catchment Management bodies.

Carbon accumulation under zero tillage cropping on cracking clays?

By Rick Young and Brian Wilson

Current knowledge strongly suggests that dryland farmers in north west NSW cannot expect to accumulate soil carbon in continuously cropped land within the short to medium term

Despite claims of significant carbon accumulation under zero tillage management of annual cropping (zero tillage, stubble retention, nutrient addition) both in Australia and North America, where the potential sequestration rates are claimed to be up to 400 kg C/ha.year, there is little scientific evidence for net carbon accumulation under improved management of annual cropping systems in Australia.

Most Australian studies, including a recent study on the Liverpool Plains, have indicated that a phase of perennial pasture is needed to make net additions to soil organic carbon while improved management of cropping systems will only reduce the rate of decline in soil organic matter.

The recent Liverpool Plains study by NSW DPI and NSW DECC, found that carbon levels in a Black Vertosol, low in soil carbon after twenty years' cultivation and cropping, remained at a constant level over six years under several zero tillage cropping systems (continuous winter cereal, continuous sorghum with opportunistic winter pulses, and long fallow wheat/sorghum rotations). Paradoxically, the most productive systems, with annual biomass yields of 10-12 t/ha, showed no evidence of soil carbon accumulation; accumulation was evident only under intensive response cropping and perennial pastures with lower annual biomass yields of 5-8 t/ha

Carbon was found to accumulate at 100-200 kg/ha annually only under zero tillage response cropping where nine crops were grown over six years. Under pastures of lucerne and mixed perennial grasses, soil carbon accumulated at greater annual rates of 200-500 kg/ha. However, the response cropping was considerably more intensive than in commercial practice which is usually around five crops in four years. The fact that plants were growing in almost all seasons was probably the reason behind the small but significant rate of carbon accumulation in this case.

In addition to these experimental observations, a survey of seven Liverpool Plains and Manilla district farm paddocks indicated that soil carbon under continuous cropping and perennial pasture, respectively, was ~55% and ~80% of that under adjacent grassy woodlands. Most often, the amount of carbon under grassy woodland was ~50 t/ha to a depth of 20 cm. The carbon under cropping was variable and did not appear to be associated with management, apart from an extreme case of a long term continuously cropped light textured red soil which had only 25% of the carbon of nearby woodland.

Overall, the average annual rate of loss of soil carbon under cropping was ~1.5% of the original stock. In the drier Walgett and Coonamble districts, the rate of loss was less at ~0.8% annually. However in these drier areas, the original carbon stock under woodland or grassland was also less: 12-25 t/ha.

Current knowledge strongly suggests that dryland farmers in northwestern NSW cannot expect to accumulate soil carbon in continuously cropped land within the short to medium term at least. The inclusion of healthy perennial, especially grass, pastures in rotation with crops may assist in a slow net accumulation of carbon, although this has not been demonstrated over the medium to long term. For carbon trading purposes, woodland systems are likely to sequester more carbon than improved management of cropping systems.

Although it has not been demonstrated that soil carbon accumulates under zero tillage cropping, the increased financial returns and soil and water conservation benefits from these much improved practices are now widely recognised.

? Contact Rick Young NSW DPI 02 6763 1117 rick.young@dpi.nsw.gov.au Dr Brian Wilson NSW DECC University of New England

Coolibah trees, Eucalyptus coolaba are an iconic part of the Namoi floodplain yet study of their environment may hold the clue to new ways to count their benefits as a service to whole-of-farm cotton production.

Native payback

The payback of native vegetation for cotton farmers and how vegetation management can maximise those benefits is the key focus of University of New England PhD student Rhiannon Smith.

In a new project funded by the Cotton Research and Development Corporation and the Cotton Catchment Communities CRC, Rhiannon's 'Ecosystem Service Benefits of Native Vegetation on Cotton Farms of the Namoi Floodplain', project is investigating how cotton producers could view native vegetation management as core thinking in day-to-day decision making for cotton production.

In the research, Rhiannon is concentrating on six benefits thought to come from improved vegetation management on cotton farms. Described as ecosystem services, the benefits are carbon sequestration, natural pest control, erosion mitigation, forage production, salinity mitigation and biodiversity conservation.

Rhiannon's project will measure each ecosystem service at a large number of sites across the Namoi floodplain. When combined with land management information from landholders, Rhiannon will formulate a list of best management practices for maximising the provision of ecosystem services from the main vegetation types found on cotton farms across the floodplain.

Recent work has concentrated on measurement of carbon sequestration by coolibah trees Eucalyptus coolaba.

"Once calculations from fieldwork are completed, we will develop an equation that will be able to estimate the total biomass of a coolibah tree and its carbon content using measurements of the diameter of the tree trunk, the height of the tree and the number of stems," Rhiannon told Spotlight.

"When combined with estimates of carbon sequestered by soils and other on-farm vegetation, this information can be used to calculate the amount of carbon sequestered on farm.

"Landholders will be able to compare their farm's carbon sequestration against the amount of carbon emitted to determine their farm's carbon footprint and guide efforts towards making their operations carbon neutral."

Rhiannon has always had an interest in the cotton industry, being a Narrabri local.

"The long term sustainability of the industry is of particular interest to me, as I recently completed a Bachelor of Natural Resources degree with Honours at The University of New England," she said.

Native vegetation management can be core thinking for day-to-day decision making in cotton production. Recent work has concentrated on measurement of carbon sequestration by coolibah trees Eucalyptus coolaba.

As part of her undergraduate degree, Rhiannon completed a project, also through the Cotton CRC, that investigated the diversity of plants, birds and invertebrates in tree plantings on cotton farms around Narrabri.

The results of that study can be found on the Cotton CRC website, www.cotton.crc.org.au

Aquatic communities flourish in on-farm water storages

By Susan Lutton

On-farm water storages may represent a significant and previously underrated aquatic habitat within cotton growing areas.

A number of sampling activities have been conducted to investigate the ecological value of storages in the Border Rivers catchment by collecting fish and macroinvertebrate samples. These were compared with samples taken from natural wetlands.

Both fish and macroinvertebrates were collected from water after it came through the pumps with surprisingly large fish (205 mm) surviving the pumping process.

A range of fish and macroinvertebrate species also went on to become established in the on-farm storages. Fish species diversity was similar in the natural wetlands and the storages but greater numbers of fish were found in the storages.

Bony bream dominated the fish populations of storages while European carp was the most common species in the natural wetlands. An unexpected result was that 40 per cent of all fish in the natural wetlands were exotic species compared with less than two per cent in the storages.

When it came to the macroinvertebrates, natural wetlands were significantly different from storages. Natural wetlands had increased abundance and species diversity (83 taxa) when compared with the storages (34 taxa).

Further analysis hopes to identify the relative influence of different management practices and habitat availability on storage communities.

However, it is believed that there are a number of options which will increase biodiversity such as establishing aquatic vegetation and removing pesticides from tailwater.

The benefits of implementing these will also increase habitat availability for mobile fauna, such as waterbirds, and boost the potential for aquaculture production.

? Susan Lutton is a CRDC-funded PhD student at Griffith University and her valuable work is conducted for the industry through Cotton CRC. For more information see http://web.cotton.crc.org.au/files/a7ac5460-cc7f-4a0e-8cad-994d00a5035e/BdWS0606.pdf or contact Susan, susan.lutton@student.griffith.edu.au

Why I love my science job

Researchers and scientists are the driving force behind the cotton industry – which is driven and continues to flourish with the aid of science.

Science is what management decisions are based on in the cotton growing industry – it is science which has allowed the industry to be a forerunner in agriculture and to stay ahead of potential problems – by being proactive.

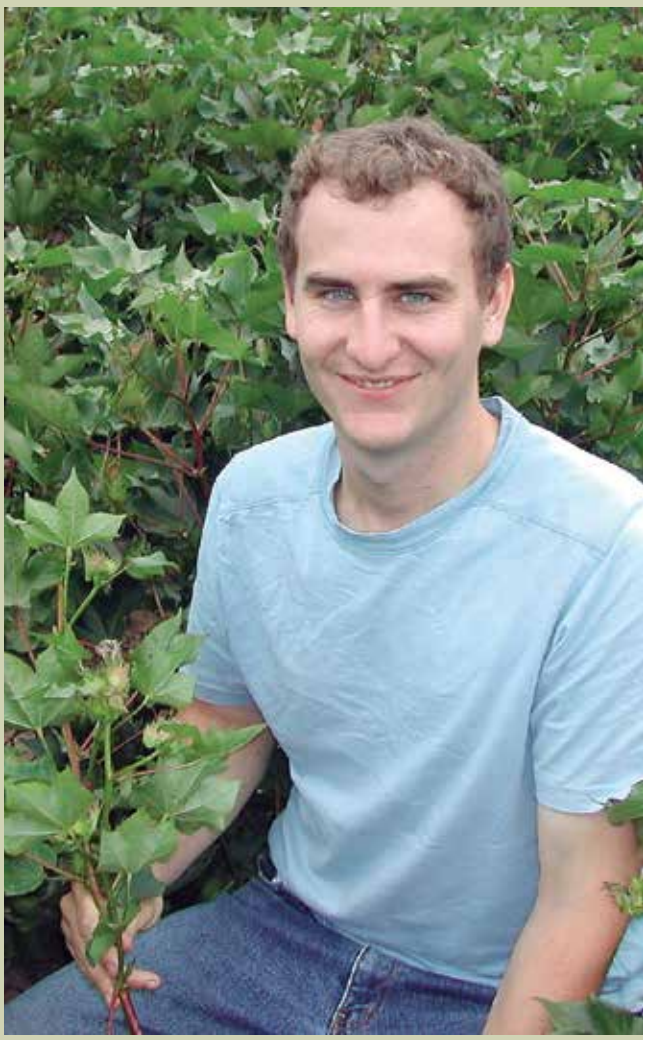
Scientists are on a perpetual voyage of discovery and can contribute to the fabric of society and the future of agriculture through their discoveries.

The opportunities for scientists to be a part of the industry are almost limitless, whether is microbiology or managing

What attracts people to the world of science and what do they find when they get there?

In this feature, Spotlight writer Rossina Gall catches up with five of the industry's young scientists and finds out what they love about their jobs.

Chris Anderson BA (Hons)



Chris Anderson grew up in Sydney listening to naturalists Densey Kline and John Dengate on the radio and dreaming of being a wildlife ranger.

As a child his love for science was fostered with gifts of ant farms, microscopes and books, hours spent collecting tadpoles and fish at a nearby creek and an enthusiastic biology teacher.

"I've loved science since I was in primary school," says 28 year old Chris, a professional officer in plant pathology at DPI, Narrabri.

"I did science at the University of Sydney. Before I did honors in biology I started a summer scholarship with CRDC looking at the potential biological control of aphids with a naturally occurring fungus.

"I'm currently doing my PhD and research plant diseases and pathogens like black root rot, particularly Fusarium and Verticillium wilt and foliar diseases like Alternaria leaf spot and general seedling disease.

"My job is great. I love working outside assessing experiments and surveying crops.

"In a couple of weeks I'll travel from Hillston to the Darling Downs collecting soil samples and preparing a culture collection for the lab.

"I'm lucky to work in such a progressive industry and growers enthusiasm in adopting disease management recommendations gives me great job satisfaction."

Chris's achievements include two Cotton CRC Scholarships, the GS Caird Scholarship for Botany and a prize in plant morphology at the University of Sydney.

He submitted a paper, The fungus Lecanicillium lecanii colonises the plant Gossypium hirsutum and the aphid Aphis gossypii to Australasian Mycologist recently and is working on another paper, "Delayed sowing as a best bet approach to reducing the severity of Fusarium wilt" for Australasian Plant Pathology.

"In five years time I'd like to have finished my PhD and extended my research to provide pathology research solutions for the whole farming system that benefit not just cotton but all rotation crops. Oh yeh! And go four wheel driving around Australia."

Oliver Knox BSc (Genetics), PhD (Soil Science)

"My Dad said I shouldn't follow in his footsteps and join the Navy, so I thought about medicine, started doing pharmacy, entered genetics, and now I'm a microbiologist, soil physicist and ecologist."

After years of researching plant and fungi genetics at the University of Aberdeen, Oliver Knox seized an opportunity and moved his wife and six week old baby 17000km from his home in Scotland, to join the CSIRO researchers in Narrabri.

"I love my work. It gives me the chance to ask questions then try and work out the pieces of the big puzzle," says the passionate 34 year old soil biologist.

"The soil remains a largely unexplored frontier, which opens up countless opportunities to discover new things and test many unanswered hypothesis.

The rewards of my work are at two levels – one is the science and the other is I can make a difference for the cotton industry where so many people from different disciplines work together; breeders, plant physiologists, pathologists, plant nutritionalists, soil chemists and growers of course. Everyone is very open about their research, so it's a great collaborative environment – from this stems good ideas and great science."

Oliver, with other researchers has a paper, "Genetic modification of cotton does not affect colonisation of roots by arbuscular mycorrhizal fungi", submitted to Australian Journal of Experimental Agriculture and is working on another about "Quantitative expression of Cry proteins throughout an Australian season in field and glasshouse grown Bt-cotton".

"In the future I'd like to have tenure and residency in Australia. I would also like a bigger research group continuing to explore how cotton varieties affect soil microbiology and the benefits to be derived from this. It sounds a bit ambitious, but I think it's realistic."

Dr Sharon Downes

Growing up on a hobby farm outside Melbourne, Sharon Downes loved animals and wanted to be a vet.

After studying science at the University of Melbourne she discovered a passion for biology and went on to complete a PhD on the evolution of predator-prey behaviour between snakes and lizards at the University of Sydney.

Today, the enthusiastic 35-year-old research scientist heads a team of CSIRO scientists monitoring Helicoverpa for resistance against the Bt toxins in Bollgard II cotton.

"I previously studied the behavioural ecology of reptiles but now I'm dedicated to working on the evolution of resistance in insects," Sharon said.

"I'm always amazed how animals adapt to suit their local environment.

"Because of this process the cotton industry is under constant threat of Bt toxins becoming obsolete."

Sharon said that resistance would affect the livelihood of many people and that her research addresses important issues.

"I feel my research is making a difference particularly because the cotton industry is very receptive," she said.

"People are proactive and always seeking more information to apply in the field."

Sharon's professional accomplishments speak for themselves;

At university she received the Graduate Women in Science Eloise Gerry Fellowship, University of Sydney Jabez King Haydon Memorial Prize in Biology for best PhD Thesis, University of Melbourne Howitt Natural History Scholarship in Science, and the American Society of Ichthyologists and Herpetologists Gaige Award – and last year won an Australian Government BRS Science and Innovation Award for Young People.

So what now?

"We have several papers recently published and in the pipeline. An article on the current status and future challenges of adaptive resistance management in Australia for Bt-cotton is published in the Journal of Invertebrate Pathology, and a recently submitted paper on the frequency of alleles conferring resistance to the Bt toxins Cry1Ac and Cry2Ab in Australian populations of Helicoverpa armigera received favorable reviews from the Journal of Economic Entomology," Sharon said.

When asked whether Sharon bought cotton in preference of synthetics, she replied "I try and make sure I buy recycled items first and then those that are cotton".

Sharon is happy to discuss her latest work and can be contacted on Dr Sharon Downes Ph 67991576 email: sharon.downes@csiro.au

Rose Roche BSc (UTS), BAppSc (Hons – QUT), PhD (UQ)

As a young girl, Rose Roche was torn between her love for science and music but now living and working in Narrabri as a Post Doctoral Fellow for CSIRO, the 29 year old says things couldn't be better.

"At school biology just made sense to me and I also had a very inspirational teacher. When I completed honors in biology, I applied for a CSIRO scholarship funded by CRDC for my PhD and now investigate cotton's response to different plant populations and the impact row configuration has on yield and fibre quality.

Having lived on a dairy farm, Rose understands and is passionate about good research to develop practical solutions.

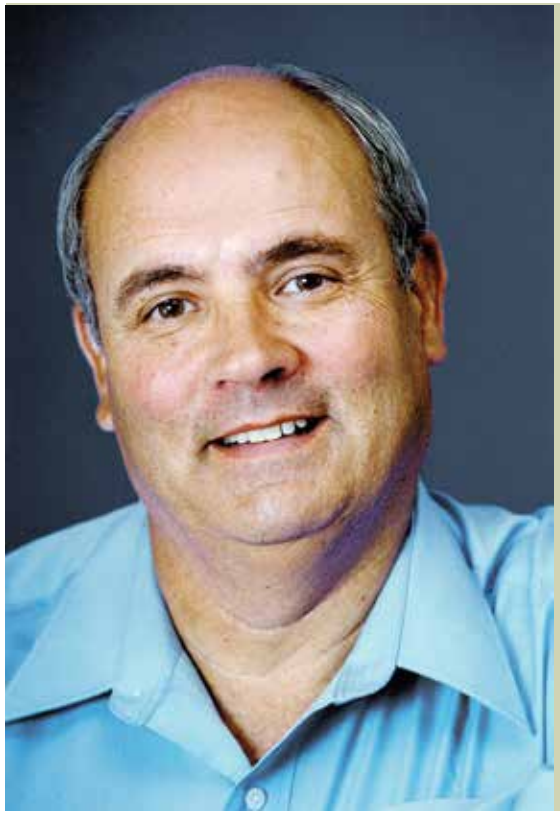
"It's exciting to present findings that show real benefits for growers. Recently we confirmed a 15.9% increase in yield when comparing ultra-narrow row (UNR) cotton and conventionally spaced cotton, which is planted one metre apart"

Rose loves working at ACRI (Australian Cotton Research Institute). "I grow my own cotton and decide when to irrigate, fertilise and spray. I also do experiments on the effects of nutrition, irrigation and growth regulators on my crops."

An Australian Cotton Industry Young Achiever finalist, Rose has presented scientific papers in the U.S and the Australian cotton conference and enjoys speaking with growers about her research at field days and research reviews.

A committee member of Wincott (Women's Industry Network – Cotton), Rose believes the cotton industry leads Australian agriculture in its commitment to achieving the best outcomes both economically and environmentally.

"In the future I hope to provide leadership within the industry and move into research to help cotton growers adapt to climate change - it's always important to keep moving forward in scientific research and keep your work challenging."



Eddie Parr

Eddie Parr wants to do things smarter so the cotton industry shines in the eyes of those who don't understand how it helps achieve vibrant rural communities.

"I'm not a hard core scientist", says the Leader for Irrigation Industry Development at NSW DPI in Orange.

"I look at the soft sciences around adoption of better irrigation methods. It's an important part of the research chain as it builds relationships enabling two- way communication between researchers and growers.

"We can then collectively find out how to do things better to achieve productivity and environmental outcomes."

Growing up on a citrus orchard outside Sydney, Eddie has a long association with agriculture.

"When I graduated from engineering I designed dams and on farm works then spent two years looking at irrigation and drainage issues for sugarcane and rice production in Fiji," he said.

On returning to Australia, Eddie worked on irrigation in the Murray Valley before joining DPI NSW where he was instrumental in introducing the Waterwise on the Farm initiative to NSW.

Today Eddie is dedicated to extension, education and training with his staff located in irrigation regions across NSW.

"There's a lot of irrigators who do things well and my challenge is promoting the benefits of adopting better practices to all growers," he explains,

"We try and send out messages that are applicable to individuals as its not just 'one size fits all'."

Eddie says that the industry offers great opportunities.

"One of our officers is pursuing a PhD looking at latest permanent bed irrigation methods used in the Murrumbidgee area where no syphons are used," he said.

Eddie advises though that the challenges are great trying to maintain Australia's position as a world leader in cotton production.

"We seek to deliver to the world quality and quantity fibre from our old soils, using our limited water resources. That's a challenge."

On track with water

Improved measurement is an essential forerunner to improved management. Two irrigation management products now commercialized and on the market following seeding R&D funding from CRDC are now proven as whole-of-farm irrigation management information systems and able to predict how much cotton an available water resource can safely sustain.

Prediction comes from measurement of water lost within the system, how much is used in crop and from this, the water savings generated.

Irrimate® and WaterTrack® are the two commercialised products now available which have been extensively further developed by the Narrabri-based AquaTech company.

The current WaterTrack range was developed in a joint-venture between Aquatech Consulting, Consulting Irrigation Engineers from Narrabri NSW, Sustainable Soils Management, of Warren NSW, Consulting Soils Specialists and Scolari Software, from Dubbo NSW.

Aquatech director Jim Purcell says water budgets in some respects are even more important than financial budgets. "Given it is very difficult to go to a "water bank" and get more water three quarters of the way through the season, in a 500 ha area grown where 20 percent of water can be saved, this could provide 100ha of extra area for crop and generate extra profits between $70,000 and $150,000," he said.

"Saving water and saving on costs are two essentials for good management and today, especially at a time of drought, it is essential for farmers and consultants to know how much water needs to be used and then be able to use that water with minimum losses."

Jim said WaterTrack consists of two water balance computer programs: WaterTrack Rapid and WaterTrack Optimiser, and these provide whole farm water balance information at different levels.

"WaterTrack Optimiser can tell you how much water is used, how much is lost, and ultimately, how much cotton you can grow with the water you have. This allows you to plan ahead and be aware of the limitations you have with the water available. With these tools, farmers can also plan to make changes to their infrastructure, such as storages, drains and channels, to improve water use and minimise water loss. WaterTrack Optimiser provides a comprehensive daily whole farm water balance, with a full break down of losses and the ability to predict water use and losses forward to optimise production per megalitre."

A 20pc water saving over a 500ha cotton crop is like adding 100ha of productive area. That can realise additional profits between $70,000 and $150,000. WaterTrack Optimiser can tell you how much water is used, how much is lost, and ultimately, how much cotton you can grow with the water you have.

Jim Purcell

WaterTrack - a new look

Furrow optimisation can save 35 percent

Gary Chesterfield out front with furrow optimisation techniques and delivering valuable water savings on the Darling Downs.

Water savings up to 35 percent can be achieved using furrow optimisation techniques, according to Toowoomba-based consultant Gary Chesterfield.

Gary says this often involves changing inflow rates to reduce infiltration opportunity time, either through addition of more syphons or increasing the hydraulic head in head ditch and stopping the irrigation when water first comes through to the tail drain. The key point is being able to model changes to determine the right solution.

"Splitting the field to further improve efficiency and improve crop performance is another option. Some of my growers have been using the IrrimateTM technology, to measure how much water is applied to individual fields and how evenly it is applied," Gary said. (See Spotlight Winter 2007)

"Successful Furrow optimisation can also include pre-crop planning, crop and field selection, layout and infrastructure, fertiliser strategies, weed and insect management strategies and irrigation strategies. In addition, resource assessment, including detailed elevation maps, soil maps and yield maps plus in-crop water scheduling and associated water-use monitoring have been applied in a pilot project in Queensland.

"One of the aims of this project is to encourage commercial consultants to provide these types of services and to increase the demand for these services by irrigators," Mr Chesterfield said.

A regional natural resource management group responsible for the Condamine River Catchment, the Condamine Alliance has been working with 12 growers in the Brookstead, Bowenville and Norwin areas.

The Alliance last year invested $25,500 on the project, as part of $458,000 in total commitments to Darling Downs water-use efficiency programs from its $10.7 million regional investment strategy, funded by the Australian and Queensland governments from the National Action Plan for Salinity and Water Quality.

The Condamine Alliance has also invested $140,000 through Cotton Australia to fund adoption of its Best Management Practice program, particularly the new Land and Water Management Module.

"When they are getting good yields- sometimes by simply reducing their area and concentrating on a single field- they don't think it is value for money to spend on this. Yet this is a very important asset in irrigation and could yield substantial savings for them. Farmers can get savings of as much as 20 per cent and more simply by making subtle changes such as changing their syphon size from 50 to 63 mm or raising the head of the water by 10 cm, so increasing the water flow rate.

"I have known farmers achieve 30 to 35 per cent gain on irrigation this way and have three full irrigations instead of two and a half. Essentially, there needs to be more awareness and farmers need more incentives."

David Wigginton, sub-program leader for Water within the Cotton CRC added that there were a number of producers across the industry who have adopted furrow optimization irrigation techniques but overall the uptake is still in its infancy, he said. He organised Cotton & Grains Irrigation workshops in all cotton regions. The workshops are aimed to both consultants and growers and presented by local Water Extension Officers. Irrigation workshops are free and available on request, by contacting your Water Extension Officer.

Irrigation engineer Jim Purcell said he first looked into water saving and measuring devices back in the mid 90s when a cap was put on extraction from the Murray Darling river.

"The cotton industry started looking at water use efficiency projects and we set up Aquatech in the late '90s to meet the demand for better and more efficient water management and water saving.

"We were looking not only at irrigation, but at improving water use overall on the farm- what happens to the water, how much is used, where it is lost and the magnitude of the losses.

"Development of WaterTrack began June 2003. We developed the Optimiser version first and released it in May 2005. WaterTrack Rapid followed with release in May 2007.

"Now WaterTrack Optimiser is being successfully used on 25 farms in the cotton industry throughout north west New South Wales and south west Queensland. Four consultants are providing WaterTrack consulting services and 16 are providing Irrimate consulting services.

"WaterTrack Rapid does not have prediction capabilities and is designed to provide a rapid and simple farm water balance with total losses for a selected period. It is a simple web based approach to calculating essential irrigation performance indicators and losses for any farm.

"This has been the worst ever drought and we have introduced WaterTrack during that drought," Jim Purcell continued. "Of course you can't save water if you haven't got any. So the biggest barrier to WaterTrack uptake is lack of water.

"The other drawback for some farmers is that they are actively reducing costs to survive the drought and don't want to address the once off costs until production increases. Some others worry about the work involved with setting up their farm on WaterTrack Optimiser.

"For this reason we offer an installation and set-up service to growers and once set up, the WaterTrack Optimiser system is easy to run. WaterTrack Rapid is only $675 per farm per year, so cost is not a big barrier. A single farm version of WaterTrack Optimiser is run on the farm computer and costs $8900. Alternatively some consultants are running a full WaterTrack water management service to growers who only have to supply irrigation records.

"As with all new products and services farmers are weighing up the cost and potential returns and talking to other farmers using the products," Jim said. We have done the sums and an extra $70,000 to $150,000 farm profit per year for a 500 ha farm is good value for a one-off cost of $8,900 plus support or a consulting fee of around $8000 per year."

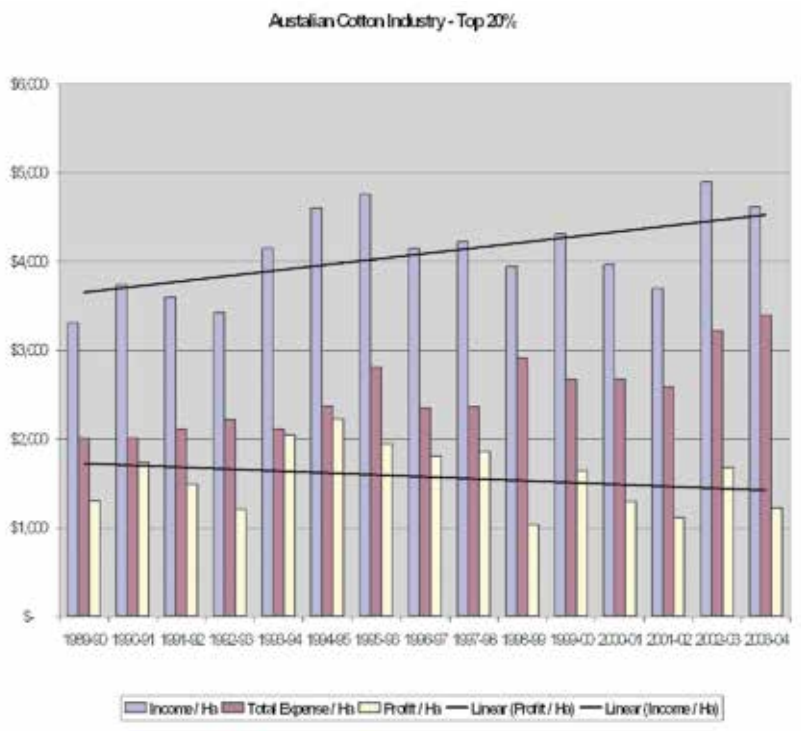
? Contact Aquatech, (02) 6792 1265, office@aquatechconsulting.com.au or view the product websites, www.watertrack.com.au or www.irrimate.com.au

The big questions

What R&D investments do we need to make in the next five years to underpin the long term future of the industry?

R&D could support transformational improvements in the value of Australian cotton through working more actively with our industry participants in the post farm gate sector.

Should we not ask "can we redefine, measure and value the qualities of our cotton in ways that would increase the value to our customers?"



Taken only from the top 20% of cotton producers, this graph highlights the ever-widening gap between costs and profits. The lower line shows declining profits per ha despite income increasing as a result of yield increases. Source: Boyce Report

Cotton's R&D challenge

Creating a preferred future for the Australian cotton industry

By Bruce Finney, Executive Director, CRDC

Proposed R&D Strategy for the Value Chain 2008 - 2013

To add value to the Australian cotton industry through evolved and new premium products in transformed supply chains.

Looking back, the Australian cotton industry has grown on the strength of our capacity to adapt in meeting challenges and turning many of them into opportunities. Internationally, Australian cotton growers are recognised as leaders in the sustainable production of high yielding and high quality cotton. This has been supported by Australia's leading research and excellent researchers.

As CRDC develops its next five-year strategic R&D Plan for the period 2008-13, the key changes and trends in the Australian cotton industry's operating environment are being considered. These include:

- The declining number of cotton growers and supporting service sector
- Rising costs for fuel, electricity, fertiliser, water and labour
- Increasing competition for scare resources including skilled people and water
- Ongoing and evolving public scrutiny on environmental performance
- Climate variability and climate change
- Globalisation and consolidation in the textile industry, biotech and germplasm sectors

A trend, as highlighted by analysis of even the best or our producers, which cannot be ignored is declining profitability – this is despite significant productivity gains. And whilst this has been exacerbated by prolonged drought years, it is worth considering our future practices. In considering the future, the question is begged; "will doing the same or the same better, lead us to the levels of profitability we aspire to?"

If the answer is no, then, "do we need to radically change what we are doing and how we are doing it to reposition the industry?" And if so, "what R&D investments do we need to make in the next five years to underpin the long term future of the industry?

Just as research has assisted growers on-farm, equally there are signals that R&D could support transformational improvements in the value of Australian cotton through working more actively with our industry participants in the post farm gate sector. The industry is already well served by capable businesses and personnel in this sector and this creates a valuable foundation for new opportunities. Already there are exciting prospects for differentiating the textile quality of our cotton, supporting improvement in ginning, classing and innovation in the marketing of the Australian cotton crop for the benefit of all participants in our supply chain. Should we not ask "can we redefine, measure and value the qualities of our cotton in ways that would increase there value to our customers?"

The return on research investment in these areas could be very high. This won't be simple or low risk necessarily. It will require strong collaboration between industry organisations, businesses and researchers. There are early signs that this commitment and shared thinking exists. In no small part this is due to what has already been achieved and learnt through the value chain research and EMS Pathways project outcomes reported in this edition of Spotlight.

> "The best way to predict the future is to create it"
> *Peter F. Drucker*

Recent changes to the Australian Government Rural Research and Development Priorities highlight the need to focus research on not only productivity, but profitability through better understanding supply chains and responding to market requirements.

Given the challenges and opportunities presented, it is now more important than ever that the industry has an R&D investment strategy which delivers transformational gains in the value of our cotton into the future. The CRDC is considering these matters in consultation with the Australian Cotton Growers Research Association, Australian Cotton Shippers Association and the Australian Government. Your views are also sought. The outcomes of these deliberations will be incorporated in our next strategic R&D Plan.

Creating A Vibrant Fibre Sector In The Australian Economy

A recent paper produced by CSIRO Textile and Fibre Technology, the Centre for Material and Fibre Innovation, Deakin University RMIT University: Creating A Vibrant Fibre Sector In The Australian Economy, discusses the future of fibres, (available online www.cottonnews.com.au/spotlight).

The report says Australia's textile industry has declined as a value-adding powerhouse, yet R&D can be called upon to bridge the gap by redesigning the future for fibres with new businesses, products, markets and processes.

It also reports, "the research community needs to take the lead in alerting all the relevant stakeholders on what prospects are emerging for the industry and what is possible in the future, thus identifying and creating the opportunities for business to exploit."