Cotton Research & Development Corporation

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Spotlight on Cotton R&D

Winter 2009

Finding new value in the value chain

Australian Government
Cotton Research and Development Corporation

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

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

Cotton Research and Development Corporation

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

Corporate background

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

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

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Spotlight

Bruce Finney Executive Director, CRDC

The Australian cotton industry has a well deserved reputation for tackling challenges. Insects, disease, pesticide use, soil compaction … water. The industry response to drought and by effect climate change has been phenomenal. Yield improvements of 25 percent over the last six years have been critical in assisting the short term survival of farm businesses and equally building the capacity of the cotton industry to address climate change into the long term. Credit is due to our growers, consultants and researchers. These gains stem from grower innovation and adoption of the products of industry R&D including improved varieties, new technologies, information and practices. All of which evidence the benefits of the long term partnership between the Australian Government and cotton growers in R&D.

This edition of Spotlight highlights much of the current research and innovation underway to support improved productivity, input efficiency and the quality of Australian cotton. Starting with a feature on Sundown Pastoral Company's "Keytah", where the CRDC's Big Day Out was held in February. Farm Manager Andrew Parkes is the industry's most recent recipient of the innovator of the year award, and the industry was invited to "Keytah" to see first-hand what Andrew and his team have underway in farming practices, water use efficiency and involvement with trials and research. The farm's move to reduced tillage for cotton has produced tangible results in terms of energy use, soil health and improved water use efficiency. Importantly the difficulties and questions that arise were also tabled in an open and productive manner.

Grower interest in these issues is highly evident with the turnout on the day – around 180 people from southern NSW to Central Queensland. It was a unique opportunity for growers to compare Keytah's farming practice to their own, share experiences about how to improve or test the merit of the practices they already have in place.

About a zillion miles away from farming systems R&D - but equally connected - is the CRDC/ACSA led Premium Cotton Fibre Initiative. Under the Initiative, commercial spinning mill trials in India have shown the potential for Australian producers to develop a 'niche' product. Australia's first commercial long staple upland variety Sicala 350B, has exhibited qualities consistent with, or better than, other premium cotton fibres. The Initiative in bringing together our growers, agribusiness, merchants and researchers with overseas spinners is equipping the industry with improved understanding of the opportunities and risks for creating sustainable competitive advantage through differentiation of our product. The Initiative is seeking to realise the full benefits of the products of R&D as they become available. Already there are better varieties in the pipeline, best practices being developed and adopted for quality from farm to warehouse and new technologies for fibre measurement that may assist prediction of textile quality and efficiency of textile production.

More directly connected was CRDC's recent forum "We're Aussie, Wear Aussie", held in support of the domestic market approach being developed by ACSA and Cotton Australia. This approach goes beyond building relationships with spinning mills to seek opportunities through the retail sector. The take home message was that the local brand owners who participated were enthusiastic for an Australian cotton product – and believed that there was a strong fit for their marketing and branding efforts. The forum gave the retail brand owners a greater understanding of the 'story' we are trying to tell – and also gave us a better understanding of how we need to tell it in order to appeal to them and their customers.

The facilitation of communication along our textile supply chain can only assist the development of the concepts required to develop demand pull for Australian cotton fibre. CRDC sees strong strategic importance in developing contemporary knowledge and intelligence about products, markets and supply chains by facilitating new engagement mechanisms for industry and end users.

In closing I hope you enjoy and value the information provided in this Spotlight. We welcome any questions, comments or suggestions you may have on how we can improve our communication and connect you with your industry R&D.

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E-learning pilot to assess online skills value for cotton

Industry stakeholders and E-learning specialists met in Sydney in May to discuss how the industry could go about introducing and supporting E-learning and online training for industry-wide skills development.

Already well-proven in other industries, cotton will soon have a pilot program to test if E-learning using internet links from specially-developed training courses may become an efficient and responsive system to meet many of industry's future skills and training needs. CRDC has scoped this new approach and has recently secured new partnerships with experienced registered training organisations (RTOs) coupled with direct support from the well-regarded national E-learning initiative of the Australian Government – the Australian Flexible Learning Framework, and it's Queensland and New South Wales offices.

The Sydney meeting explored how E-learning as a technique and technology may provide future answers to allow online access to a vast array of future educational courses that could be specially developed to appeal to all sectors of the cotton industry. Representatives from CRDC, Cotton CRC, Cotton Australia, E-Learning Australia and RTOs, NSW DPI, Australian Agricultural Colleges Corporation (ACCC), and Tocal College attended.

The meeting heard from National Training Coordinator, Mark Hickman how increasingly complex farming systems together with changes imminent in cotton's value chain pointed to new levels of management and production skills that are urgently required at all levels of industry.

He said high-level business and production skills in management, together with a multi-skilled and competent workforce were the vital ingredients to a resilient cotton production sector.

"Even if you do have the skills today, you need to maintain and enhance these skills to remain competitive, and industry's systems for delivery of skills and knowledge had to change to keep pace," he said.

"Effectively applied, E-learning can impact on every sector of our industry and its reach would equally include researchers, extension services, farmers, consultants and agribusiness, plus all sectors of the post-farm-gate sector of industry. It is a technology where we can all benefit," he said.

"We see that professional development for cotton producers and their staff is often a very hard fit for day to day operations. With some businesses, resorting to professional development on rainy days, or when there is significant quite time in the business is the full focus of up-skilling, and this is clearly not going to be enough in the future.

"This is completely understandable given the significant labour shortages businesses face. Increased demands on owners and managers to work within their business, rather than to work on the business is a constant challenge and we're now seeking ways to bridge the gaps with flexible delivery of skills, training and knowledge delivery.

"Until now, the cotton industry did not have any inbuilt capability or a web based platform that could be used to deliver professional development in an online environment. But that is about to all change with the E-learning pilot."

Mark said the E-learning projects would be lead by AACC and Tocal College. Their involvement has a dual focus on recognition of skilling needs in human resources management coupled with creation and delivery of online studies. "These first projects are short – we are looking to six months of testing so we can focus on developing a pilot system that industry can build on."

? For more information contact Mark Hickman, National Cotton Training Coordinator mark.hickman@dpi.qld.gov.au.

The new on line BMP (myBMP) program is the perfect platform to develop an e-learning system for the industry.

The Australian Flexible Learning Framework (Framework) is the e-learning strategy for the vocational education and training (VET) sector. It provides the VET system with the essential e-learning infrastructure and expertise needed to respond to the challenges of a modern economy and the training needs of Australian businesses and workers.

Above: E-learning stakeholders in Sydney recently; Mark Hickman (DEEDI-QPIF/ Cotton CRC), Darren Bayley (Tocal College), Jamy Somerville (NSW DPI), Ross Murray (AACC), Joanne Hathway (Tocal College), Melanie Doriean (NSW DET), Michael Beeston, Stuart Higgins and Ben Stephens Cotton Australia.

A multi-skilled and competent workforce are vital ingredients for a resilient cotton production sector: Mark Hickman, National Training Coordinator

Ready to E-learn?

The first pilot project involves assessment of needs in on-farm human resources management. This is to be backed up by a specially developed E-learning training course delivered online.

Interested?

Email Mark Hickman, National Training Coordinator - mark.hickman@deedi.qld.gov.au

INNOVATION

Cotton's Big Day Out

ANDREW PARKES

More than 180 people from all cotton growing regions of Australia attended the cotton industry's 'Big Day Out' at Sundown Pastoral's "Keytah" 35km west of Moree on February 26 to learn more about the "no till" road to cotton and overall management strategies to optimise farming operations.

The day was an initiative of CRDC under the farming systems research program and was partnered by the Cotton CRC and offered a first hand look at the inner workings of a leading farming enterprise.

"CRDC recognises that there are three very important factors which have contributed much to the success of the cotton industry in Australia over the years," said CRDC Program Manager Bruce Pyke.

"These are:

- capacity of growers to rapidly adoption high quality R and D;
- progressive growers who believe in on- farm trials and innovation; and
- a wiliness to share information (successes and failures).

"The BDO enabled all three of these factors to be integrated in a single event which attracted a high level of interest from growers from at least six cotton growing valleys.

"CRDC's aim was to generate interest in alternative ways of thinking about and challenge conventional ways of managing their farming systems.

"We believe the BDO succeeded in meeting these aims and will seek to repeat an event like it in 2010."

Cotton's Big Day Out host, farm manager Andrew Parkes, followed up his Australian Cotton Industry Innovator of the Year Award by detailing the changes to their system of producing irrigated cotton on "Keytah", implemented in recent years to combat low water availability and rising input costs.

Central to the changes at Keytah has been the steady reduction in tillage since 2000. The audience heard how diesel use has been reduced by 18 percent/ha across the farm and further moves towards no-till currently being trialled will deliver another 13 percent energy use saving. Overhead costs have also been cut, the farm's tractor fleet now stands at eleven, down from 26 just eight years ago.

The huge crowd was bussed around the farm for the in-field presentations from Andrew, researchers Steve Yeates and Dr Nilantha Hulugalle and weeds PhD student Todd Green.

Before the tour, National Centre for Engineering in Agriculture's Craig Baillie spoke about energy use and ways to reduce it and spray expert Bill Gordon spoke about drift and ways to mitigate it.

CRDC's farming systems investment manager Tracey Farrell convened the day and said the Australian cotton industry has demonstrated its strong interest in applying outcomes of the latest research to meet its challenges. She said research presented at the field day proved how changing farm practice can lead to significant energy savings and the potential for improving nitrogen fertiliser use efficiency. These factors contribute to both increased farm profitability and a lightening of farms' carbon footprints.

On-farm research is part of Andrew Parkes' management philosophy. Years of on-farm trial work has built the farm's confidence to adopt a dual row spacing system comprising both narrow row (73.5cm, 30 inch) and wide row (147cm, 60 inch).

On-farm trial work continues this season with more detailed investigation of the comparative water use efficiencies of Bollgard II and conventional cotton varieties under full and supplementary irrigation regimes.

The day showcased many other topics and speakers linking research and farm practice on important issues such as managing difficult weeds, strategies for preventing glyphosate resistance and good stewardship for the application of fallow herbicides.

? For further information, contact Tracey Farrell, Manager – Farming Systems Investment. CRDC 2 Lloyd Street Narrabri NSW 2390. Tel 02 6792 4088.

CRDC Manager Farming Systems Investments Tracey Farrell (second from left) with cotton CRC extension specialists Sally Ceeny, James Hill, Dave Larsen and Letitia Cross.

On-farm research a win-win

PhD student Todd Green has investigated the dreaded weed Flaxleaf fleabane, which became an issue in some fields at Cudgildool.

There is reasoning behind all the trial work done on "Keytah". Decisions to trial a new management system are not made off the cuff, Andrew Parkes said in introducing the group to the Bollgard versus Conventional irrigation trial on "Cudgildool".

"We, as individuals and as an industry need to stay ahead of the group in terms of research and on-farm trials help achieve this – we are interested in whatever is an issue at the time – in the future it is likely to be for example carbon.

Andrew said the farm's management had been involved in many different types of trials, some incorporating a number of different sciences.

"Trials often are not a hard thing to do – there is a lot of support from CRDC, Cotton CRC and other bodies and CRCs," he said.

Getting the support of both independent researchers and agribusinesses had allowed them to undertake on-farm research with gusto.

"Also get the companies involved," he says.

"Whether it is a new nitrogen product, water saving device or plant variety, there are researchers, government departments and companies that have the resources to support your trial."

"If you are not sure how to connect with the research community or the available funding, then go through the CRDC, Cotton CRC, or Cotton Australia.

"If you have an idea that's been on your mind for a while, then take the time to tell your local grower organisation.

"It would be great to see growers having more input into where the research dollar gets spent."

Water use efficiency, in relation to varieties, timing and methodology has been trialled with researchers, new varieties with CSD, row spacings, fertigation, and the list goes on.

Andrew says some trials are more labour intensive for his staff than others, but this is of little consequence when weighing up the benefits, access to more up to date research is an immediate benefit.

"We can be the first to see what is working and what isn't," Andrew said.

"You have to approach research believing that it's going to give you a result one way or the other. But, if you are approached to run a trial and you don't think it's going to give you a result that's of value, then just don't go there.

"Being a part of on-farm trials helps give answers to questions about better ways to approach farming systems.

"With varietal trial work, we get to see new varieties coming along first, CSD do all the technical work, while we have the opportunity to compare the crops side by side to varieties we are already working with.

"One of the most beneficial research projects has been the investment made by the cotton industry into plant breeding industry.

"However when we do have a new variety trialed here and it is better, we don't completely switch over, for the next year it takes a while and we have to feel our way."

Some trials are more complex than others.

Water use efficiency can be one of those, when we have used all sorts of measures - C-probes, EM surveys, maps from tractors for field height and Sirmod.

Andrew says the path to growers conducting their own on-farm research, starts with a question.

He gave the farms' shift to 15 then 30 and 60 inch row spacings as an example.

"We had a question in our own minds, there was a lot of empty space in the one metre rows with

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On-farm research a win-win

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Bollgard and we wanted to work out the best way to utilise this space.

"There was a lot of pain in this – but we kept going and are now we are at 30 inch spacing, which we now know to be the most efficient so far."

Steve Yeates has been working with Andrew and his team for many years, looking at water use between Bollgard II and conventional varieties

He said of the journey "It's been incredible, if you wind back the clock four years to when Bollgard first came out there was a lot of discussion about what might and may not be different.

"There were a lot of theories around root growth and boll load.

"Bigger questions about how am I going to go with watering – how is it going to match up in terms of WUE.

"We set about answering those questions."

The main thing is understanding the plant and what happens to it is really the key to understanding its performance and how it uses water.

"It has been invaluable to do the work here."

Growers Henry Taylor, Alan Redfern and Mat Norrie

NSW DPI Water Use Efficiency Officer Janelle Montgomery and Monsanto's Bob Ford

Tim Whan, Harley Sheridan, consultant Steve Madden and Rod Smith found time to catch up before boarding the buses for what was a big day out looking over the many forms of innovation on the Sundown Pastoral properties.

Making the most of water

Water use efficiency (WUE) has been a large focus for all growers in situations of limited water availability, but for Sundown Pastoral, long term investigation in better ways to use their water has resulted in a 58 percent increase in WUE.

How did they improve so dramatically from 1.0 bales/ML to 1.58 bales/ML in one season?

Managing water better has come through a multi-faceted approach, by measuring the amount of water used more closely and investigating soil moisture and its water-holding capacity.

"There are some great tools available now to help improve water use efficiency," Andrew said.

"We have made real improvements in water use by allowing us to more accurately time irrigations and put the water on and off the field in the most efficient way.

"These tools are now allowing us to change things as we are irrigating in real time or for the long term to get the most value for our water."

Irrigation scheduling

Poor irrigation scheduling can lead to reduced yield and fibre quality and poor water use efficiency. Deciding when and in what order to irrigate no longer needs to be a headache for growers.

The progression to better scheduling has incorporated a variety of measurement tools, including C-probes, EM surveys, maps, field height maps from tractors and Sirmod software – on top of close physical monitoring of crops.

EM38 surveys were used to determine C probe positioning to determine the average water holding potential of the whole field.

"A C probe is only as good as the soil you are putting it in," Andrew said.

"We wanted to ensure we positioned the probe to ascertain the average water holding capacity for each individual field.

"Through constantly ground truthing what the C probes were indicating and by closely monitoring the crop we have been able to steadily increase the refill point for the crop between each irrigation".

"Rather than setting a refill point we tried to push the refill point a little deeper in between each irrigation, but it is still vital for growers to looking at the crop and there are other factors like variety and configuration to be taken into account. Through this approach the actual physical number of irrigations during a season has been decreased. This has numerous benefits including reduced labour and costs, increased opportunity to utilize rainfall in crop as well as a number of agronomic positives."

In an attempt to continue to increase WUE Andrew is now measuring variables on a larger scale. How much irrigation water is being applied, how much tail water is being returned, how much rain is being utilized by the crop and how much is running off are measurements that "Keytah" is starting to capture on a field by field basis.

Before deciding on the size and number of siphons to be used to improve water use efficiency, the Sundown Pastoral experience has shown it is first necessary to understand the hydrology of irrigation fields.

"By understand the hydrology of our fields, we have found up to a 50 percent difference is regularly seen in flow rates within a field and between fields.

"Where the water in the head ditch provides "less head" over the field to be irrigated , the larger the size and higher the number of siphons is needed to ensure an even irrigation within a field.

"By increasing the size and number of siphons the flow rate is also increased which ensures water is applied and removed from the field as quickly as possible which reduces the risk and impact on the crop from water logging.

"By putting into practice what we know about the hydraulic factors, the irrigation "set" is then finished more evenly which allows for more efficient use of irrigation labour and ensures a higher irrigation efficiency."

Row configuration

All cotton is grown on 1.5m beds and from an irrigation perspective there is less distance for the water to get to the seed in a "water up" situation when cotton is being grown on the 30-inch configuration.

"We are not waiting for moisture to work up and through the hill, as was the case in the traditional hills," Andrew said.

The decision of how much cotton will be planted in 30 and 60-inch rows depends on the water allocation for the season with the 30 inch having priority.

The 60-inch farming system is akin to growing dryland cotton in irrigated paddocks but with the ability to irrigate at any point during the season if and when additional water becomes available.

"We plant as much 30-inch cotton we can grow with the available water and everything else goes into 60-inch spacings," Andrew says.

"The 60-inch cotton is a buffer for us, if we have the water available, it will be irrigated, otherwise it relies on in-crop rain.

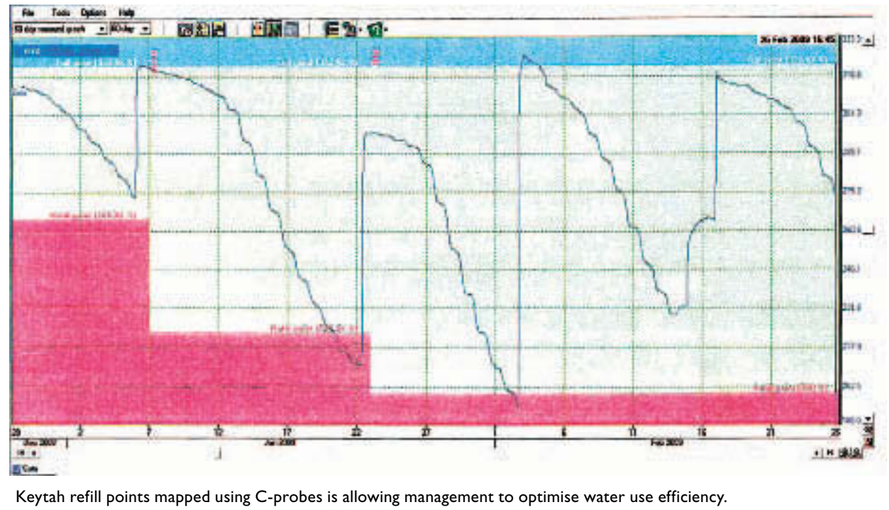
"This has allowed us to move to a lower number of irrigations in a 60-inch program – especially in limited water scenarios. The crop production potential is still high and if water becomes available we see no reason why yields of between eight to 10 bales per hectare can't be achieved".

Storages and deep drainage

One of the storages on "Keytah" which was previously thought to be one of the most efficient because of size and depth may actually not be performing so well at all, with concerns about sepage being the cause.

Through monitoring to ascertain seepage losses, the storage was found to potentially be losing up to 7.5mm per day through deep drainage– which would equate to a yearly seepage loss of 1062 megalitres or $424,800 of water value per year.

This assumption that the storage was efficient was particularly concerning to Andrew, as "at the end of the season all the water on farm was being directed to that one because we thought it was most efficient. We are re checking the measurements to ensure the results are correct before looking at mitigation efforts".



Keytah refill points mapped using C-probes is allowing management to optimise water use efficiency.

INNOVATION

Nilatha Hulugalle has made in-roads into understanding the benefits of rotation crops in cotton systems and the value of stubble in aiding soil health and improving soil moisture holding capacity.

PJ Gileppa of Auscott Narrabri and Wee Waa grower Charlie Arnott have a closer look at the planter which has been modified to plant cotton between rows of standing cereal stubble.

Fallow management and no-till cotton in action

The words no-till and cotton have rarely been used in the same sentence – but that is changing with the 'can do' attitude of cotton growers, including Andrew Parkes and the team at "Keytah".

Similar to the evolution that has taken place in dryland farming over recent decades, key drivers for no-till in irrigated cotton relate to water availability, rising costs and achieving sustainable year in, year out productivity to support the overhead costs of the farm business.

While every cotton grower is likely to approach the no-till evolution with innovations that are designed for their own particular circumstances, a strong theme that is emerging is the important role of cereals in the crop rotation.

So important are the benefits of cereal stubble in relation to moisture retention, at "Keytah" wheat is now planted in the cotton system whether it is likely a crop will harvested or not.

At the big day out the crowd heard how wheat is planted behind the cotton crop, straight after harvest and pupae busting, irrespective of the soil moisture profile. It is grown for the express purpose of providing stubble cover for the following summer.

Andrew Parkes commented that "It is nice to be able to harvest some grain if the season allows, but if not then the stubble is still in enough quantity to serve its purpose of increasing fallow efficiency".

The cotton-wheat-fallow rotation follows on from more than 16 years of research in this field by Dr Nilantha Hulugalle of NSW DPI, who says standing stubble's major benefit is in soil water conservation, especially from summer storm rain. Infiltration is improved and run-off reduced, while soil health can also be improved.

"Improved soil moisture can result in a wider planting window," Dr Hulugalle said.

"Standing stubble also has a modifying affect on soil temperatures in spring. Less temperature variation assists in achieving better plant stands and establishment.

"Reducing tillage results in a more sustainable and consistent system."

At "Keytah" all machinery is on three-metre centres. The wheat is planted on 15 inch rows, fitting neatly into the cotton system. The decision of whether to plant 30 inch or 60 inch cotton depends on water allocation and in-field soil moisture. Andrew Parkes says the advantages of these spacings include the ability to "off-set" the planting rows to the stubble rows, leading to increased yields and better utilization of tractors across all enterprises."

Results from the 2008/09 season at "Keytah" are testament that the reality of no-till cotton is getting closer. Only a single field of 'towards not-till' cotton was grown in 2008/09. The yield achieved was 3.17 bales/ha, equivalent to the yield achieved for the same variety grown using the farm's standard practices, 3.15 bales/ha. Despite the lack of clear yield or WUE advantages recorded in 2008/09, the team at "Keytah" will continue to work on the 'towards no-till' system.

"I think that the principles are right, we just need to get better at applying them! We can fine tune this system a whole heap more yet – this was our first go. The improvements will come in areas like irrigation scheduling, fertiliser application and management, variety selection, crop management (Pix use) as well as planting equipment and techniques," Andrew Parkes said recently.

There will be plenty of opportunities for fine tuning to occur in 2009/10. Fallow management since wheat harvest in 2008 has relied on chemical weed control and stubble has been left standing.

"We are intending to sow 400ha of irrigated 60-inch cotton which has been allocated four ML/ha in the new system. There will also be an additional 800ha that currently has no water allocated but will be supplementary irrigated through the season, if water turns up!

"We will trial the towards no-till system for the first time this coming season on a 30-inch configuration as well – I am sure it will most definitely have a place."

Pupae busting remains a very important tool for preventing insecticide resistance, particularly for Bt resistance in Bollgard II cotton. Researchers are yet to identify an alternative stand alone practice that could replace pupae busting, so at least for the time being pupae busting will continue to stand in the way of a purist no-till system developing for cotton.

St George grower Glenn Rogan is involved in on-farm research, having been involved in Sicala 350B trials for several years, and he caught up with Stephen Yeates, Research Agronomist CSIRO and Sub Program Leader Resilient Farming Systems, Cotton Catchment Communities CRC. Stephen has worked closely with the Keytah management in on-farm trials.

Bollgard vs Conventional:
understanding performance

Since the introduction of Bollgard II into the cotton landscape four years ago, researchers at ACRI have been investigating and comparing water use and irrigation scheduling between it and conventional cotton varieties.

Much of this work has been carried out with the help of the "Keytah" team and CSIRO's Stephen Yeates who heads the research, says that the field work carried out there has been invaluable.

"It's been incredible, if you wind back the clock four years to when Bollgard first came out there was a lot of discussion about what might and may not be different," he said at the field day.

"There were a lot of theories around about root growth and boll load.

"There were the bigger questions about 'how am I going to go with watering – how is it going to match up in terms of WUE?'.

"We set about answering those questions."

Mr Yeates said understanding the plant and what happens to it in physiological sense is really the key to understanding its performance and how it uses water.

"Whether Bollgard II is better than conventional water wise comes down to how insects affect the crop and what happens to the plant with some insect damage," he said.

> "Understanding the plant and what happens to it in physiological sense is really the key to understanding its performance and how it uses water"

"The way the crops mature makes quite a bit of difference to the yield potential and the amount of water you require.

"What we found here (at Keytah) was that because the system for growing conventional was already very good, that nearly 100 percent tipping out created a plant that has a higher yield potential.

"Combining that with a very high capacity to manage insects after tipping out saw good yields and high water use efficiency.

"In the case of Bollgard II we found that the plant is incredibly sensitive to stress as the boll load comes up near cut out, far more so than conventional.

"This is because during photo-synthesis, the bolls need a certain amount of water, and if the plant can't meet the demand it stops growing fruit at the top and you have premature cut out."

Both Andrew and Stephen say their trials are a work in progress, trying to figure frequencies of irrigation into seasonal conditions.

Andrew said measuring the amount of water going onto and coming off fields to determine WUE of conventional and Bollgard was also allowing them to move to trial lower numbers of irrigations in a 60 inch program – especially important in limited water scenarios.

For example, they have found that hot dry weather may warrant five irrigations with smaller deficits, provided a grower has the capacity to do it, but it is important to watch the weather for rain events to avoid waterlogging on paddocks after irrigation.

"The other side is what we saw last season, with a lot of in-crop rain and milder weather, where we could run irrigations on much greater deficits," Stephen said.

"Most of the water passing through the plant is used to keep the leaves cool. This is because cotton likes its leaves to be about 30°C.

"It does this by pumping water through them and if you get conditions where temperature is lower and the air not as dry, you shouldn't have to irrigate as frequently, in other words, you could irrigate at a bigger deficit without damaging the plant.

"In a situation like that, the plant it is telling you what is happening, not the deficit measured by a C probe or similar device."

In 2007/08 trials at ACRI, some incredibly high water use efficiencies were achieved in the milder weather by "stretching" irrigation frequencies.

In one treatment with only two in-crop irrigations the yield was 12 bales/ha which was more than 4.6 bales per megalitre of irrigation water!

However some questions remain says Stephen, how do we know when to stretch and how far to go in milder conditions?

"We need to be able to measure the plants' stress a lot more accurately and know that it is safe to do that and the plant is staying cool.

"That is where we should be looking to more research as there are big savings to be made in terms of water use.

"We also need to know how can we keep the plant growing and extend the flowering period? Is it more the frequencies of irrigation we need?

"Deficits are good for knowing how much water to put on, but how do we monitor when to irrigate?"

INNOVATION

Dr Guangnan Chen of USQ, Craig Baillie, NCEA and Andrew Parkes worked together to calculate energy usage in the farming systems at "Keytah".

Energy use in decline

A CRDC-funded study conducted to quantify direct energy usage and green house gas (GHG) emissions at "Keytah" has found that reduced tillage has had a significant impact.

The study, by Craig Baillie of the National Centre for Engineering in Agriculture (NCEA) in Toowoomba, analysed energy consumption, energy costs and greenhouse gas emissions stemming from changing farming practices on "Keytah".

Importantly, it was the aim of both Andrew Parkes and Craig Baillie to identify benefits captured by changes to the farming system and opportunities for ongoing improvement in energy efficiency.

The cotton industry is highly mechanised, resulting in an estimated 40 to 50 percent of farm input costs relating to machinery, while GHGs from the use of fossil fuels is in the order of 20 percent.

Previous research by NCEA shows the highest energy uses are irrigation (40 – 60 percent) where pumping occurs on farm. Harvesting also uses a significant amount of energy at around 20 percent. Traditionally tillage inputs have required a significant amount of energy however broader adoption of reduced tillage has seen a dramatic reduction in the farming system.

Mr Baillie said it was already known that minimum till systems equate to an estimated 10 percent saving as a rule of thumb (in relation to conventional systems).

Much of this information came from CRDC-funded research by Mr Baillie into on-farm energy use from seven case study farms.

It identified a 10 to 20 percent energy saving could be made by moving toward a minimum tillage farming system. Irrigation accounted for an average 57 percent of total farm energy use across the seven cotton farms studied.

He said opportunities for improvement in energy use in farming systems comes from changing and refining practices, which has been the case at Keytah. Fertigation is also being investigated as an alternative to mechanised fertiliser application.

As outlined in the previous articles in this feature, major changes in farming systems at Keytah include reduced tillage, row spacing (30 and 60 inch), cotton in a cotton/wheat / fallow / cotton rotation, a reduction in tractors (and hence staff) and conversion of diesel motors on irrigation pumps to gas.

The reduction in tillage operations has seen the farm cut its tractor fleet from 26 to 11, with further reductions likely.

Mr Baillie's assessment developed case studies on actual crop history data from a field (K8) which formed the 2000 benchmark, two reduced till (K8 & C16) and two fields moving toward zero till (K13 & C17).

Table 1 Energy use comparison in three farming systems (breakdown of results)

BREAKDOWN OF RESULTS	Preparation	Planting	In Season	Irrigation	Harvest	Post Harvest
2000 Benchmark	34%	2%	5%	45%	12%	2%
Reduced Till	19%	2%	6%	52%	13%	8%
Towards Zero Till	7%	2%	6%	60%	16%	9%

Machinery and specific farm practices were linked to determine fuel (energy) use. This was based on a combination of machinery specifications, workrates, loads, and data obtained from previous work conducted by the NCEA. Results were qualified with general farm records and observations Energy Assessments were made using the on-line EnergyCalc technology, which is a tool for on farm assessments being developed for growers and advisors.

According to the farm's own data and calculations by Mr Baillie, a dollar per hectare saving under a reduced till system of $77/ha has occurred since 2000 (from $430/ha to $353/ha), representing an 18 percent reduction in energy use. Carbon Dioxide emissions have fallen from 1313kg/ha to 1076kg/ha.

Table 2 Cost differentiation between three systems

RESULTS	Total Energy (GJ/ha)	# EnergyCosts ($/ha)	GHG Emissions (kg of CO_2)	Since 2000
2000 Benchmark	16.32	402	6377634 (1226 kg/ha)	
Reduced Till	14.33	353	5599958 (1076 kg/ha)	-12%
Towards Zero Till	12.44	306	4861566 (935 kg/ha)	-24% *(-13%)
# Assumed diesel cost: $0.95/L ($1.25/L not including excise)				
* Reduced Till – Towards Zero Till				

There is even greater scope for savings in looking toward a zero-till situation, with energy costs per hectare falling from $353 to $306/ha or a further energy saving of 13 percent.

In relation to the 2000 benchmark this equates to a total reduction in energy (diesel) of 24 percent and an estimated cost saving of $496, 643 across Keytah (assuming fuel price of $0.95/L; cropped area of 5200ha).

To facilitate the adoption of zero till at Keytah, surface irrigation fertigation is currently being explored to eliminate heavy primary tillage operations which in the past have been used to drill/deep rip fertiliser into the soil profile.

The fertigation system consists of a large tank containing liquid nitrogen based fertiliser (ie N26) that is applied into the head ditch at a constant flow rate (via a constant head device) where water is then applied to the field via siphon fed furrows during irrigation.

Andrew says the efficiency of this form of fertiliser application also requires some additional research and development as a comparison to traditional methods.

"There is some anecdotal evidence that suggests this application technique may provide benefits of greater N efficiency, which could lead to a reduction in the total N applied each year," he said.

"It also allows for the use and cost of N to be applied at the point when the crop needs it rather than 'up front' which has additional cash flow benefits."

Going gas greener?

Keytah has 26 pumps, running 26,000 hours a year, so energy use and associated running costs can reach staggering amounts.

Alternatives like gas substitution are being explored, with figures from recent testing of a converted engine showing a potential 30 percent reduction in diesel usage.

However it pays for all irrigators, regardless of pump numbers, to look for ways to monitor and make savings, as irrigation makes up an average 57 percent of total on-farm energy inputs.

Diesel substitution is becoming a popular alternative, achieved by mixing small amounts of LP gas with the diesel and recent testing has shown real reductions in fuel use and emissions.

Andrew has converted two motors and said it was only early days yet for comparisons, but at current diesel prices it is envisaged that the capital cost of the infrastructure would be covered in the first year of operation, but plans to continue with conversions as seasons return to normal, he said.

Recently, testing was undertaken by Diesel Gas Technologies/Gastek Global, on a converted Caterpillar C10, 335hp motor running a 26 inch lift pump lifting water from tail drains back into a storage dam. showed nearly 30 percent reduction in diesel usage.

Tests were run with the engine at 1400-1500rpm and 1700rpm. There was a 29 percent reduction in diesel use at 1680rpm, with the engine running at 80 percent load.

	Diesel Only	**DieselGas**		**% Diesel Reduction**
		Diesel	LPG	
1420rpm	30.4l/h	21.4l/h	8.8l/h	-29.6%
1680rpm	46.0l/h	32.9l/h	12.8l/h	-29%

Emissions were also measured with the engine running at 1420rpm, the speed at which it does most of its work.

There was a 26.7 percent reduction in nitrous oxide emissions and 3.9 percent reduction in carbon dioxide.

	Diesel Only	**DieselGas**	**% Reduction**
CO2	7.9%	7.59%	-3.9%
NoX	610ppm	453ppm	-26.7%

Matt Derrig of Diesel Gas Technologies said the reduction in both of these emissions is also an indication of increased engine efficiency and that particulate matter is also reduced.

Irrigation pumps and motors have the ability to use generous amounts of power or diesel – but there are ways to improve their efficiency.

Craig Baillie from NCEA has made some interesting assessments of on-farm energy use.

"In addition to these emission figures, exhaust gas exit temperatures were dropped about five percent, showing an increase in engine efficiency," he said.

"If the motor runs more efficiently, it runs better, needing less diesel to maintain its load, extending engine life thus making it more cost effective and also reducing the carbon footprint.

Even before considering a move to LPG supplementation, there are some key factors to making sure existing pumps and engines are working efficiently. Peter Smith, the NSW DPI Irrigation Officer for the North West, says he commonly sees repairs paid for in one season.

"In some cases, potential savings of $20,000 to $30,000 can be made per season for fairly cheap improvements. Before spending money on the engine, check that the pump is operating as efficiently as possible," he said.

"It is fairly simple to work out whether it is cost effective to repair or replace a pump.

"When the pump is right, there could be more big savings achieved by checking the engine. Having poorly performing pumps or prime movers is a waste of money and a waste of energy.

"We could make big improvements toward reducing greenhouse gas emissions and energy use if we got all pump stations running at their optimum efficiency."

Short workshops on irrigation pumps available through NSW DPI or the Cotton Water Team give an understanding of the basic principles and show you how to work out your running costs and efficiencies. In NSW, it is through NSW DPI PROfarm, with details at www.dpi.nsw.gov.au/agriculture/profarm or contact Peter Smith on 02 6763 1262. In Qld the workshops are available through the Cotton Water Team, contact Graham Harris, QDPI, Toowoomba, 07 4688 1559.

? ContacCraig Baillie, NCEA, 07 4631 2071, 0428 750 060, bailliec@usq.edu.au

Industry services: there for your protection

The crop protection team has been involved in facilitating IPM workshops in locations where an increase in capacity was required including Emerald, Hillston and the Burdekin.

The Crop Protection National Priority team is a group of extension staff prioritising the extension of disease, pest and weed related research information. The team is made up of Cotton CRC regional extension officers and partner staff including NSW Department of Primary Industries and Qld Primary Industries and Fisheries, CRDC, Namoi CMA and Cotton Australia.

How does the team help industry?

- Assists with the development of extension plans to deliver research findings to industry
- Develops extension resources to support extension officers
- Assist with development and planning of trials and benchmarking processes in regional areas
- Promote crop protection research work and issues through cotton pest management guide, Cotton Tales, fact sheets, media releases and other publications
- Faciliate workshops, field days and farm works to promote research and current industry best practice.
- Provide feedback to researchers and industry on current industry issues.

Integrated Disease Management Extension

The Crop Protection Team has worked with a range of pathologists to ensure that industry publications are up to date and that disease information is readily available. This has included facilitating a review of the *Integrated Disease Management Manual*, and updating *Cotton Pest Management Guide* to reflect latest research, best practice and emerging issues such as Tobacco Streak Virus and potential biosecurity threats. The Annual Disease Surveys dating back to 2004 have recently been added to the Cotton CRC website and an annual section has been added to the cotton pest management guide.

Integrated Weed Management Extension

With continued reliance on glyphosate, there is a risk of a shift in weed spectrum to weeds not controllable by glyphosate or herbicide resistance. In addition, barnyard grass which has been confirmed as glyphosate resistant, is a weed of some cotton systems.

The team has worked closely with weed agronomists on a number of projects to promote herbicide resistance risks. The team is working with the QPIF weed agronomy team to develop a herbicide resistance risk assessment tool and action learning workshop. These workshops are scheduled to be rolled out in December and are aimed to increase understanding of integrated weed principles. The team has also worked with researchers on weed thresholds to optimise the use of herbicides.

Integrated Pest Extension

The Crop Protection team work closely with researchers to help respond to emerging issues as well as assisting in the development and extension of new research. The team has delivered IPM courses in locations where increases in capacity were required.

Given the issues during the season, there has been a large amount of Silverleaf whitefly extension material produced, including a fact sheet available on the CRC website, update in the *Cotton Pest Management Guide*, presentations and cotton tales articles during the season and development of Silverleaf whitefly DVD and poster for the Australian Cotton Trade Show.

The development of the aphid tool has been completed by the team in conjunction with researchers. The team has supported the promotion of this new tool. The management of non-crop areas to promote beneficial insects has also been addressed in the extension programs.

Cotton Pest Management Guide

The *Cotton Pest Management Guide* is the cornerstone publication for all crop protection issues. The Crop Protection Team have contributed to it's annual update.

"We work with research and industry to minimise and manage the risks to the productivity and sustainability of the crop." Susan Maas, Crop Protection NPT leader

? To talk to a team member, contact:
Susan Maas, QPIF, 07 49 837403
Ingrid Rencken, QPIF, 07 4688 1610
Mark Hickman, QPIF, 07 46 881 206
David Larsen, NSW DPI, 02 67991534
Jane MacFarlane NSW DPI, 02 67991500
Tracey Farrell CRDC, 02 6792 4088
Cotton Australia www.cotton.org.au

Look out for new whitefly

Q

Growers are asked to be alert to any signs of whiteflies being able to withstand control treatments and report them to Queensland Primary Industries and Fisheries (QPIF) after the discovery of the Q biotype whitefly in Australia.

The first sign of the incursion was late last year in the Bowen-Burdekin when farmers noticed that usual insecticide treatments for silverleaf whitefly (SLW) were not as effective.

After testing, this new insect pest was confirmed and later also confirmed around Goondiwindi and Wee Waa, however, it is likely to be more widely distributed according to QPIF.

The Q biotype and SLW (B biotype) can only be separated using biochemical or molecular techniques. They have a similar life cycle and range of host plants.

Practicing good integrated pest management principles can discourage Q biotype numbers from building up.

"Q biotype has the ability to develop resistance quickly to some insecticide groups, particularly if they are used repeatedly," QPIF entomologist Dr Siva Subramaniam explains.

"Overseas, Q biotype has developed high level resistance to insect growth regulators and neonicotinoids.

"However, there are other chemicals and an effective biological control agent to keep the pest under manageable levels.

"The main issue is that any new incursions of Q or B could bring in viruses from overseas that aren't now in Australia."

No exotic whitefly-vectored viruses have been reported at this stage.

Growers are asked to be alert to any signs of whiteflies being able to withstand control treatments and report them to QPIF.

To find out more about Q biotype including its host species, and report suspected incursions, call QPIF Business Information Centre on 13 25 23 or visit www.dpi.qld.gov.au

Watch whitefly this winter

By Tracey Farrell, CRDC and Lewis Wilson, CSIRO and Cotton CRC.

Planning for pest management in cotton in NSW now needs to include SLW. In developing management strategies it is important to consider why the outbreaks occurred and what can be done to reduce their likelihood in the 2009/10 season.

SLW were first detected across northern NSW during the 1994/95 season and have been seen in cotton fields ever since. Researchers surmise that for 13 years SLW has gradually replaced the native whitefly populations. Differences in mating behaviour, SLW's stronger rates of reproduction on cotton and the use of broad spectrum insecticides in cropping programs have favoured this transition.

When average daily temperature data is analysed, northern NSW does meet the criteria for supporting the seven whitefly generations /year needed to produce an outbreak.

Once SLW is established in a region, the factors that drive subsequent SLW outbreaks are, in order of importance, climate, regional farming system, within crop management.

This means that in seasons with climatic conditions favouring SLW outbreaks, the cropping strategies employed across the region and the individual grower's consideration of SLW in crop management decisions will have much greater impacts on the eventuation of SLW outbreaks than in seasons where the climate is working against the pest. For real success, SLW management needs to be implemented all year round.

Climate

SLW does not have an over-wintering diapause stage. During winter their growth rate decreases in response to the lower temperatures causing generation time to increase. Colder than average winters coupled with cooler than average spring and summer conditions delay population expansion, helping to avoid outbreaks. However it is a misconception that frosts act as strong regulators of the population.

How do frosts influence the survival of SLW in winter?

Light frosts common to winters in northern NSW cannot be relied upon to stop SLW dead in their tracks. Nymphs are highly cold tolerant, having something akin to antifreeze in their system. Adults are mobile and able to withstand frosts by sheltering in the warmest part of the plant canopy or moving to hosts in protected locations. Sustained heavy frosts have a greater impact on population survival, and do occur in northern NSW in some winters. The impact is partly by causing death of the whiteflies and partly by causing death of the plant hosts.

Location	SLW generations/year (average)	Estimated generations from first identification until first outbreak
Emerald	9 – 12 (10)	70
St George	7 – 11 (9)	90
Goondiwindi	7 – 10 (8)	unknown
Narrabri	6 – 9 (8)	112
Warren	6 – 8 (7)	unknown

The time from when SLW was first detected in the cotton regions when the first outbreaks have occurred is shorter in the warmer regions where there are more generations and SLW displaces the Eastern Australian Native species faster.

A medley of cucurbit crop volunteers and preferred weed hosts – sow thistle, vines and turnip weed – growing unchecked during autumn. The abandonment of this field increases the risk of large SLW populations carrying over to the following summer. Farm hygiene and diligent control of broadleaf weeds are critical to the area wide management of SLW in cotton regions.

Regional farming system

In order for a SLW outbreak to occur a long period of continual hosts is required.

It is important for growers across a region to maintain very good farm hygiene to reduce the risk of outbreaks. Very good hygiene will limit access to preferred alternative hosts. Remove cotton volunteers from all around the farm – fields, roadways, irrigation channels. Many broadleaf weeds are also excellent hosts for SLW. In autumn and winter pay particular attention to control of sowthistle, turnip weed, marshmallow, wireweed and volunteer sunflowers. In spring look out for bladder ketmia, cow vine and bell vine.

Where possible work with neighbours to create a host-free period within the cropping rotation. Non-host crops include sorghum, maize, winter cereals and chickpeas. The co-ordination of tight planting windows maybe all that is required to achieve this. Host-free periods are most effective when conducted across large areas.

Within crop management

As many growers discovered first hand in 2008/09, whitefly can add considerably to the cost of an insect management program for cotton. Given the potentially high cost and the high risk of them developing resistance.

Industry researchers stress that the best strategy is to be prepared to control them but aim not to by implementing a range of IPM tactics. SLW can be a huge problem, but, the experiences from Emerald, the Darling Downs and St George show that with careful management they need not be particularly difficult or expensive to manage.

The September edition of *Spotlight* will feature an article on IPM tactics for SLW management in Bollgard II and conventional cotton systems.

Acknowledgements: Paul De Barro (CSIRO) and Richard Sequeira, David Murray, Zara Ludgate and Paul Grundy (DEEDI QPI&F) for their valuable input.

Future cotton researchers step this way

Camps, industry placements, scholarships, professional development and life experience are all part of the new $8 million national PICSE program which is showcasing careers and opportunities in Australia's primary industries sector.

The 'Primary Industries Centre for Science Education' (or PICSE) is a hands on program being delivered in regional and metropolitan centres and universities throughout Australia. PICSE is being supported for the first time through a three-year CRDC investment beginning in 2009-10. The CRDC initiative also dovetails into an existing Cotton CRC schools initiative in its Communities Program, and the work of education officer Trudy Staines, and Catchments Communities Program Manager, Dr Paula Jones.

Cotton CRC education officer, Trudy Staines

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

"By linking teachers and students with scientists, through careers camps, lab and site visits or industry placements, they soon realised that agriculture is more than just gumboots and tractors. Teachers are often surprised at how many avenues the primary industry sector provides for teaching mainstream biology and chemistry in context," Dr Russell said.

"The growth of PICSE is supported by the Commonwealth Government who in January 2009 allocated $3.6million to the program for a three year period.

"This amount is being matched by supporting partners in each State. Six Universities are also PICSE participants and these include Flinders University, University of Tasmania, University of Western Australia, University of New England, University of Sunshine Coast and University of Southern Queensland. The CRDC investment plan centres on the University of New England and supports the existing cotton courses under the tutelage of John Stanley.

"We have presented talks nationally on primary industries science to over 30,000 students, taken over 500 students on primary industry science camps and delivered professional development programs to over 700 teachers."

The PICSE program contains all types of activities which enable students and teachers to investigate science in the primary industries sector - gene technology, precision agriculture, climate, environment, wine, aquaculture, genetics and horticulture in a very long list of opportunity for science careers embracing agricultural industries.

? www.picse.net.au or contact: Dr David Russell, National Director, PICSE 03 6430 4935 David.Russell@utas.edu.au

Be a part of Cotton Collective Week

The Cotton Collective Week 2009 is about R&D transfer, celebration of industry achievers and an opportunity for the industry to come together to network and share ideas.

Winners of the annual Cotton Industry Awards will be announced at the gala dinner at the Crossing Theatre in Narrabri on Wednesday August 12.

CRDC, Cotton CRC and Cotton Australia have collaborated to present two days of industry forums on August 12 and 13 to discuss trends in current and future R&D and policy initiatives for key industry issues.

The main session topics of the "Cotton Matters" Forums will be: water management; cotton and greenhouse gases; whitefly management; Bt resistance; premium quality cotton and developing (cotton growing) regions.

The Cotton Matters Forums will be held at the Crossing Theatre and commence at 10am on Wednesday August 12 with a "Water Matters" plenary session and continue from 9am on Thursday auditorium with key note speakers on "carbon matters". Additional afternoon sessions will be held concurrently.

All industry participants are welcome to attend the Cotton Matters Forums.

The 2009 Australian Cotton Industry Awards showcase and reward the significant achievements made by our industry's growers, researchers, young achievers, and other key individuals.

Tickets can be purchased through the Crossing Theatre: www.crossingtheatre.com.au or (02) 6792 4654.

2009 Cotton Industry Awards finalists

Monsanto Grower of the Year
– Andrew Pursehouse, "Breeza Station" Breeza NSW; John Norman, Toobeah Qld; Gary Coulton, "Federation Farm" Narrabri NSW.

AgriRisk Innovative Grower of the Year
– Jamie Grant, "Kielli" Jimbour Qld; Robert & Penny Blatchford, "Innesfail" Gurley NSW; Commins Partnership, Whitton NSW

Cotton Industry Young Achiever of the Year
– Sean Boland, Moree NSW; Ben Stephens, Narrabri NSW; Greg Hutchinson, Moura Qld.

Cotton Seed Distributors Researcher of the Year
– Dr Michael Bange, Narrabri NSW; Nilantha Hulugalle, Myall Vale NSW; Dr Robert Mensah, Narrabri NSW.

The Cotton Service to Industry Award winner will be announced at the dinner.

Cotton Collective Industry Forums

BT RESISTANCE
Sharon Downes, 15(mins), Resistance monitoring
Rod Mahon, 15, Resistance mechanisms
Geoff Baker, 20, Refuges, Models of H.p. forecasting
Peter Gregg, 20, Central Australia survey results
Helicoverpa spp. ecology
Magnet® for resistance management
Kirsten Knight, 15, Monsanto's resistance monitoring
TIMS (Chair), 15, Role, current activities
Facilitated Discussion, 20mins

CARBON/ENERGY/GREENHOUSE
Ian Rochester, 10, Nitrogen Use Efficiency
Nilantha Hulugalle, 15, Rotations
Peter Grace, 15, Life Cycle analysis
Mick Keogh, 15, Current Policy thoughts
Cotton Grower, 10, Implications
Louise Adcock, 15, BMP Program
Facilitated discussion, 20mins

PREMIUM COTTON
CSIRO Geelong Researchers, 15, Current projects
ACSA/CA, 15, BMP/Australian Cotton Branding
Mike Bange, 20mins
Pete Johnson, 15, Premium Cotton Institute
Facilitated discussion, 20mins

2009 Cotton Collective Week

Tuesday, 11/8/2009:

Morning	Auditorium	REFCOM [10am]
	Boardroom	CA Board meeting [10am – 3pm]
Afternoon		REFCOM [ends 3pm]
	Auditorium	TIMS [3pm – 5pm]
Evening	Other location	CRDC/CA Board dinner

Wednesday, 12/8/2009:

Morning	Auditorium	Cotton Industry Forum [10am]
	Bowling Club	Wincott AGM and lunch
Afternoon	Auditorium	Cotton Industry Awards bump-in
	Cinema 1 & 2	Cotton Industry Forums [1.30pm]
	Cinema 1	Cotton Australia AGM [4pm]
Evening	Cotton Industry Awards Dinner	

Thursday, 13/8/2009:

Morning	Auditorium	Cotton Industry Forums
Afternoon	Cinemas 1 & 2	Cotton Industry Forums
	Boardroom	ACIC AGM [tba]

WHITEFLY
Lewis Wilson, 20, Overview
Robert Mensah, 15, on topic Whitefly
Dave Parlato, 15, Consultants experience
CA Processor Member, 15, Import of Whitefly on final product
Bruce Pyke, 15, Product Whitefly R&D/ + option
Mary Whitehouse, 15, Risk of Mirid management flaring whitefly
Facilitated discussion, 20mins

DEVELOPING AREAS
Paul Grundy/Steve Yeates, 20mins
NORCOM Chair, 10mins
Queensland Cotton , 10mins
Ord/WA – by video, 10mins
Jeff Bidstrup, 10, GM Issues
Monsanto, 10, End Point Royalties
James Hill, 15, Southern Area Update

WATER
Colin Mews – Water Buy Backs
Robert Freeman – Basin Wide Plan
Steve Elliot – DPI Farm Efficiency Funding
Gill Hogendyk – Environmental water
John Clements/Mike Murray – Northern Alliance
QLD – Healthy Headwaters
Graham Harris – Overview water R & D
Steve Yeates – Research results and future work
Anthony Ringrose-Voase – Deep Drainage
Bryce Kelly – Drainage and groundwater

Industry is a key investor in a project to evaluate 135 storages at no cost to growers in a bid to improve water use efficiency by mitigating losses.

Image courtesy of Guy Roth.

Deep drainage and seepage storage losses identified

While the storage may look reliable on the surface, a true picture can only be formed by taking water measurements.

With industry research showing that irrigation storages can contribute to major water loss on farm, many growers would be curious as the extent of losses occurring.

Auscott "Midkin", a cotton farm northwest of Moree estimated that during a 'standard' year, the farm's dual cell reservoir was losing over 3570 megalitres per year, with 43 per cent of this due to deep drainage.

At Sundown Pastoral's "Keytah" west of Moree, manager Andrew Parkes said seepage losses from just one of its storages had the potential to cost the company an average of 1062 megalitres per year, or in dollar terms, $424,800 annually.

With potential losses so high, now is the time for growers to find out at no cost how their storage is performing. According to project manager David Wigginton working through the National Centre for Engineering in Agriculture (NCEA), in Toowoomba, the project offers a great opportunity for growers to improve their water management and efficiency through directly identifying where losses occur.

His project, 'Measurement to improve the water efficiency of on-farm storages in the cotton industry', will assess at least 135 storages across all cotton regions over three years.

The Cotton Catchment Communities CRC received funding from the National Water Commission "Raising National Water Standards" Program for the project, which got underway last year. The initial idea for the project came from the Central Downs Irrigators Limited who undertook a very successful storage management project with Total Agricultural Services and FSA Consulting on the Darling Downs in 2004-05, funded through Condamine Alliance.

Consultants from six consulting firms across the cotton industry are undertaking storage evaluations using the Irrimate Seepage and Evaporation meter. The first few analyses are completed.

These consultants have purchased the necessary equipment and received training to deliver this service and the project supports them by funding the cost of individual storage evaluations. Furthermore, the project integrates the data collected across the industry, developing a better understanding of storage losses and solutions.

"The project will enable individual growers to have the seepage and evaporation losses from their own storages measured with the project bearing the cost of these measurements. The whole industry benefits from testing and promotion of the cost-benefit of strategies to minimise significant losses that exist," he said.

"It will identify the characteristics of efficient and inefficient storages, and build capacity and skills within the industry for the effective measurement and amelioration of storage losses.

"This knowledge will lead to the development of best management practices for the management of water storages, further increasing whole farm water use efficiency. The project will also selectively cover follow up evaluations to assess how successful changed practices have been for the farm.

"Where losses are significant, and growers apply appropriate solutions to minimise them, the project will remeasure up to 70 storages in order to evaluate how effective the solutions are," David Wigginton said.

"In addition, the project has engaged industry consultants to undertake the measurements, helping to improve their ability to continue providing these evaluation services after the project is finished."

Expressions of interest from growers who would like to have their storages assessed will be called for during June and July with evaluations likely to begin in August or September.

? For further information on the project and the consultants providing the irrigation services, contact David Wigginton, at david.wigginton@optusnet.com.au 0438 667 835

STEWARDSHIP

Being prepared for future resistance

By Sharon Downs, Tracey Farrell, Rod Mahon and Greg Kauter.

Bollgard II cotton provides control of Helicoverpa through the production of two toxins, Cry1Ac and Cry2Ab. While resistance genes that allow larvae to survive Cry1Ac are still rare in Australian Helicoverpa populations, genes that allow larvae to survive the second toxin, Cry2Ab, have become more common in both H. armigera and H. punctigera.

Currently there is no evidence of resistance impacting on the efficacy of Bollgard II in the field. However as a precautionary measure, the industry through the Cotton Australia Transgenic and Insecticide Management Strategies (TIMS) Committee, is investigating what the potential impacts of the changing resistance situation could mean for Bollgard II in years to come.

Laboratory technician Su Young at CSIRO Canberra, pipettes toxin onto the trays used for resistance testing. Image courtesy Sharon Downes, CSIRO.

A short history

In both *H. armigera* and *H. puntigera* Cry2Ab resistance was first detected at unexpectedly high frequencies of around 0.001 (one in 1000 - 0.1 percent) through F_2 screens. As resistant Helicoverpa colonies have been established by the testing laboratories, F_1 screens have also become part of the resistance monitoring program. The detection of resistance through this screening process has also been unexpectedly high for both species.

F_1 screens for *H. armigera* began in 2004/05 recording a frequency of 0.013 (13 in 1000, 1.3 percent). F_1 screens for *H. puntigera* have only recently commenced with a relatively small sample in 2007/08 detecting a frequency of 0.010 (10 in 1000 - one percent). Researchers are confident that the frequencies identified through the F_1 screens most accurately reflect the field situation.

Researchers use two types of screens to detect resistance. Initially F_2 screens are used as this process looks at the grandchildren of two field collected individuals. Once a resistant individual is detected, this individual is used to establish a resistant colony in the laboratory. When a resistant colony is available F_1 screens can commence. These screens look at the progeny from mating a field collected insect with one from the resistant colony. F_2 screens continue as only F_2 screens will detect different forms of resistance.

Researchers use a population dynamics model to make predictions about the 'durability' of Bollgard II given the known resistance frequencies.

There are strengths and weaknesses in the model's setup that require consideration when interpreting its predictions. At the time of Bollgard II's introduction, the model predicted Bollgard II would have a life expectancy five to ten times longer than that of INGARD.

This prediction contributed to the decision to remove the 30 percent cap on the area of transgenic cotton when Bollgard II was introduced.

It was considered that with the support of refuges, planting windows, control of volunteers and pupae destruction, the two toxins in Bollgard II could withstand the selection pressure from use as a higher proportion of the total cotton crop.

The latest resistance monitoring data

In response to the shifts seen in resistance frequencies last year (2007/08 season), further resources were allocated to the resistance monitoring programs run by CSIRO and Monsanto so that the intensity and duration of sampling could be increased. The period of monitoring was extended from December-March to September-April to ensure sampling occurred across all Helicoverpa generations.

The aim of the expanded program was to increase throughput as well as the ability to identify which generation(s) appeared to respond to selection events, as being measured by the resistance frequencies.

Data across all laboratories (CSIRO Narrabri, CSIRO Canberra, and Monsanto Toowoomba) is generated through the use of a common screening protocol, developed by CSIRO. It is therefore considered appropriate to pool these sets of information. A summary of the results that are cause for industry to consider potential changes to the Resistance Management Plan in the future is provided below;

H. armigera

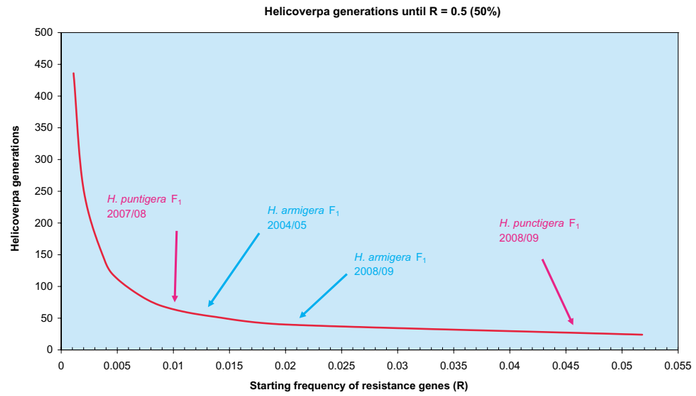
- At the end of the 2008/09 season, the frequency of Cry2Ab resistance genes in the field is 0.021 (21 in 1000, 2.1 percent), as measured by F_1 screens.
- This season the first individual carrying two copies of the Cry2Ab resistance gene was detected. This individual would be capable of surviving on Bollgard II towards the end of the season when Cry1Ac expression has declined.
- At the end of the 2008/09 season, the frequency of Cry1Ac resistance genes in the field remains at a very low level, as measured in F_1 screens.
- During the 2008/09 season there was no detection of Cry1Ac resistance in the F1 screens

H. punctigera

- At the end of May 2008/09, the frequency of Cry2Ab resistance genes in the field is 0.046 (46 in 1000, 4.6 percent), as measured by F_1 screens . Testing for this species is not yet complete for the season but the finalised frequency is likely to be very similar.
- This season, the first individual with a resistance gene for Cry1Ac was detected. The frequency of Cry1Ac resistance genes in the field has now been established at a very low level, as measured in the F_2 screens. (F_1 screens cannot be used until a resistant colony is established in the laboratory.)

Population modelling now predicts that the control provided by Cry2Ab, most relevant towards the end of each season, could be compromised in as few as six to seven seasons time. The graph shows that the current resistance frequencies are already past the point in the 'life expectancy' curve where small changes in the frequency will make large changes in the number of generations until resistance is endemic in Helicoverpa populations.

When Helicoverpa become resistant to Cry2Ab, Bollgard II will be as effective as INGARD. Insecticide sprays will be needed late in the season. Monsanto has announced intensions to make a third Bt technology commercially available in Australia. This is scheduled to occur around 2015.



The population dynamics model considers that there are four generations of Helicoverpa exposed to Bollgard II cotton each season. It considers that the mechanism of resistance to Cry2Ab is completely recessive, with no fitness costs, and is due to a single gene. The model is able to crudely account for the decline in Cry1Ac toxin after flowering by considering that when Cry1Ac levels are high, no larvae survive but that Cry1Ac is completely missing for the final generation late in the season. It accommodates for the contribution of refuges by assuming that 10% of the eggs are laid on non-transgenic crops. However it is unable to consider the impacts of extra 'non-mandated' refuge in the environment such as weeds, remnant vegetation and neighbouring crops that are attractive to Helicoverpa. The weaknesses in the model make it difficult for researchers to predict exactly how rapidly resistance frequencies will increase into the future.

The provision of extra resources to the monitoring program has seen a much larger sample size obtained in the 2008/09 season than in years previous. As screens from the fourth generation are only just drawing to a conclusion, analysis by region, host and by generation is still underway.

Because the initial frequencies of Cry2Ab resistance were much higher than expected even before widespread adoption of Bollgard II, researchers are also considering the possibility that something else in the Australian environment provides additional positive selection for individuals carrying a copy of the resistance gene.

To test this theory collections of Helicoverpa are being made in areas where little to no cotton is grown, such as the Cooper and Diamantina floods plains, the Bowen Basin and Bundaberg horticultural areas, the Mallee and possibly Kununurra. Resistance frequencies from these locations will be compared with the original baseline frequency from cotton areas. If indeed there is something other than cotton that selects for Cry2Ab resistance, the presence of the Cry2Ab in Bollgard II would supplement that selection.

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Left to Right; Glenn Fresser CRDC Board Director, Jodie Pedrana Monsanto and Andrew Parkes chair of Cotton Australia's TIMS Committee at the cotton industry's REFCOM forum in February. Photo: Greg Kauter, Cotton Australia.

Important facts for understanding the resistance risk

FACT 1: The Cry2Ab gene present in Australian populations of Helicoverpa is recessive. This means that larvae must carry two copies of the gene to survive the toxin. This makes Bt resistance different from resistance to conventional insecticides which usually only require an individual to carry one copy of the gene to survive the insecticide. The main aim of the Bt monitoring program is to detect increases in the frequencies of individuals that carry one copy of the gene so that we can modify the RMP before individuals with two copies of the gene become common.

FACT 2: In both Helicoverpa species, Cry2Ab resistance shows no cross resistance to Cry1Ac. When Bollgard II expresses both Cry1Ac and Cry2Ab optimally, Cry2Ab-resistant insects will still be controlled. The greatest risk of selecting for resistance and potentially seeing the consequences of Cry2Ab resistance in the field occurs at the end of the season. At the end of the season expression of Cry1Ac is known to decline, meaning there is greater reliance on the Cry2Ab toxin to defend the crop.

FACT 3: Cry2Ab-resistant insects are not dose responsive. Cry2Ab resistant H. armigera and H. punctigera tolerate very high doses of Cry2Ab toxin. Indeed, the most concentrated toxin that can be produced in the laboratory does not affect the survival or growth of the resistant insects. This has consequences for the development of future Bt technologies for the industry.

FACT 4: The rate of evolution of resistance can be influenced by the presence of fitness costs. CSIRO has investigated fitness costs of individual components of the lifecycle for the resistant H. armigera have and found no evidence of fitness costs. Monsanto has examined the mating propensity of a Cry2Ab-resistant colony. Resistant genotypes were found to mate less than susceptible insects indicating a fitness cost is associated with resistance.

STEWARDSHIP

Tracey Parker and Sharon Thomas, CSIRO, collecting H. puntigera larvae on the Eyre Creek floodplain, approximately 60 km west of Birdsville, where it enters the Simpson Desert. Larvae were plentiful at >5 /square metre. These larvae are now progressing through the resistance monitoring program to assist in indentifying whether something in the environment other than Bollgard II cotton is selecting for Cry2Ab resistance.
Image courtesy Peter Gregg, Cotton CRC and UNE.

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Being prepared for future resistance

Industry Response

In February, REFCOM (Research and extension in Bt resistance forum) brought together researchers, growers, consultants, and representatives from the Cotton CRC's extension team and Monsanto to discuss research progress and communication on Bt resistance.

As an outcome of this forum, the precautionary measure of developing a Cry2Ab resistance contingency plan is being undertaken.

The Bt Technical Panel of Cotton Australia's TIMS Committee are working with Monsanto to develop the plan. The plan will help the Cotton Australia TIMS Committee and Monsanto to respond when 'trigger points' are reached in the resistance frequencies.

Under the plan it is proposed to match potential mitigation strategies with the resistance risk to current and future Bt cotton technologies.

These responses will then be available to Monsanto and the industry to modify the Bollgard II Resistance Management Plan for future seasons.

What should growers do?

It is essential that Bt resistance management measures, as required by the RMP are followed. As a priority, growers should ensure that pupae busting of 2008/09 Bollgard II fields occurs before August 30. As the 2009/10 season approaches, plan for planting Bollgard II and the associated refuge at the right time and ensure that cotton volunteers that emerge in early spring are controlled.

During the season, manage refuges to be attractive for as long as possible through the season, and continue to control cotton volunteers in fallow fields.

All growers are encouraged to participate in industry discussions about possible changes that could be implemented to the Bollgard II RMP in future seasons. Contributions can be made;

- through your local CGA (Cotton Growers' Association),
- by directly contacting the TIMS Committee representative in your region,
- when attending the Bt Resistance information forum at the Cotton Collective in Narrabri, August 11-13,
- when attending a Resistance and IPM information forum being held in nine locations across the industry in late August.

The RMP for 2009/10

Minor changes are proposed for the 2009/10 season RMP and include clarification and tightening of a number of practices. Some of these proposed changes include the:

- Planting window in Central Queensland being shortened from 46 days to 42 days, as it currently exists for other areas.
- Criteria for planting the pigeon pea trap crop in Central Queensland being modified to ensure that it is a separate one percent planting additional to any pigeon pea refuge.
- Refuge planting window being tightened across all regions and will be relative to the first date of planting Bollgard II.
- The last date for pupae destruction will be bought forward one month to July 31 from 2010.

The RMP is subject to approval by APVMA. As the registrant, Monsanto submits the proposed RMP to the regulator. More details will be available once APVMA approval is finalised.

? Resistance monitoring results - Sharon Downes, CSIRO: sharon.downes@csiro.au
Contacting your local CGA and/or TIMS representative - Greg Kauter, Cotton Australia: gregk@cotton.org.au
Resistance research and extension - Tracey Farrell, CRDC: tracey.farrell@crdc.com.au

VALUE CHAIN

Australian Cotton – delivering what the mills want

To ensure that Australian cotton remains competitive internationally it is vital that growers in Australia develop a better understanding the key opportunities that exist for strengthening our market advantage.

A study commissioned by CRDC and ACSA in 2007 surveyed 34 companies in eight countries to understand the demand for Australian cotton and map the future course for high quality cotton in order to determine research priorities.

Dallas Gibb, Manager of the Value Chain Investment Program for CRDC says "We know that production from countries such as India, China and South America is increasing in both yield and quality. We need to continue to assess the changing demands placed on mills for fibre quality and how Australia cotton compares with other international cotton types in meeting these demands".

Through the survey Australian cotton was acknowledged as a superior fibre by almost all the companies in the study, with (comparatively) low contamination level, better uniformity and less color variation. However there was also found to be a need for more uniform micronaire, less neps and short fibre content, according to some companies, especially those surveyed in Thailand.

The study, carried out by independent company Technopak, found that increased global production poses a significant threat to Australian cotton growers.

Even though Australia emerged as the second most favoured country for cotton after the US among the surveyed companies, they do choose cotton suppliers (countries) depending on fibre price, required yarn parameters and buyer demand.

Based on the findings, Technopak made following recommendations:

- Create Demand/Pull for Australian Cotton through Supply Chain Marketing
- Generate Brand Awareness
- Focus on ELS Cotton markets.

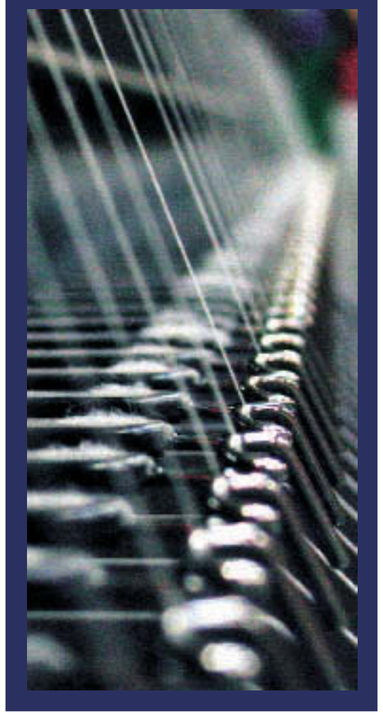
Since the Technopak report, "The Australian cotton industry has been collaborating to focus on investigating these opportunities to look at methods by which we can enhance the quality of Australian cotton and its reputation as a producer of the highest quality cotton," said Mr Gibb.

"From a premium quality perspective, Australia may not become a major Pima (ELS cotton) producer, however we can focus on meeting the demands that will develop as ELS cotton declines world-wide," he said.

"We know that new cotton varieties like CSIRO's Sicala 350B are being developed that have superior properties to the current varieties and through investments in projects that optimise the value of these varieties we may create a significant competitive advantage for our cotton and growers."

The CRDC is working with industry partners in a range of project including the Premium Fibre Project, Premium Blends Initiative, and Nep surveys. CRDC hopes to add value to our industry through research into premium products and developing improved routes to market.

The Australian cotton industry has been collaborating to focus on investigating opportunities to look at methods to enhance the quality of Australian cotton.



Detailed in this edition of *Spotlight* are some of the initiatives being taken to achieve these goals, including a recent value chain forum, Sicala 350B commercial mill trials, and the advancements in technology to give fibre-quality assurances.

Dallas Gibb says the "We're Aussie – Wear Aussie" value chain forum in Sydney last month allowed open dialogue about the perception of Australian cotton between growers, marketers, researchers, manufacturers and brand owners.

"The take home message was these local brand owners are enthusiastic for an Australian cotton product and believed there was a strong fit for their marketing and branding efforts," Mr Gibb said.

"The forum gave participants greater understanding of the 'story' we are trying to tell about how the quality of our cotton together with our BMP program may provide a competitive advantage for local and international brand owners.

"In return brand owners gave us a better understanding of how we need to tell our story in order to appeal to the consumer.

"Ultimately, the facilitation of greater two-way communication assists the development of concepts required to develop demand pull for Australian cotton fibre."

Collaborative discussions have occurred with a number of brand owners since the forum through the efforts of Australian Cotton Shippers Association and Cotton Australia.

While efforts are underway to create demand pull domestically, the same scenario is evolving internationally, on the other side of the globe, with commercial mill trials in India of Sicala 350B returning excellent results.

As part of the Premium Cotton Initiative, CSIRO textile specialist Rene van der Sluijs was on-site to observe and offer advice during the trials, which found that unblended 350B could be spun successfully in high quality fine count yarns.

"It was mentioned by the mill that it could easily replace one other premium cotton being used," Rene said.

"The results showed that quality combed yarns for the weaving and knitting sector in the count range 50 to 70 Ne can be produced on traditional ring spinning and compact spinning machines and furthermore, if blended with ELS cottons it could get down to 80 Ne – which is in the niche quality market."

CRDC's role is to understand customers' needs and to provide sound research support to the industry's marketing efforts focused on increasing our competitive advantage and premiums.

VALUE CHAIN

Sicala 350B impresses in commercial India trials

Manky Point in Kasauli at the foot of the Himalayas, is where industrialisation meets one of the world's natural wonders. The area is home to many mills and where Rene van der Sluijs travelled to oversee mill trials of Sicala 350B.

Initial trials conducted in 2004 showed that Sicala 350B fibre produced superior Ne 42 and Ne 35 ring-spun carded and combed yarn, and subsequently fabric (single jersey) knitted from it. Performance was measured in terms of process efficiency and quality relative to yarn and fabric produced from standard Upland cotton. Subsequent spin limit trials conducted in 2005 showed that Sicala 350 B could be used to process high quality fine count carded and combed ring-spun yarns in the range of Ne 60 to 70. The Premium Blends project in 2007 further highlighted the fact that a 70/30 blend of Pima/Sicala 350 B did not cause a practical deterioration in yarn quality and processing efficiency when compared with yarn spun from 100 percent Pima.

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

CSIRO Materials Science and Engineering (CMSE) researcher René van der Sluijs travelled to a Vardhman Textiles Limited owned mill in Northern India in early March as part of the Premium Cotton Initiative supported by ASCA and CRDC.

"The results from this commercial trial showed that Sicala 350 B can indeed be spun successfully in high quality fine count ringspun yarns. It was mentioned by the mill that it is comparable to other high quality cottons and could be blended with Extra Long Staple cottons to produce fine 80 Ne yarns," René said.

"This is getting into the niche market area."

A key aim of the Premium Cotton Initiative has been to link industry textile experts with the mills during the spinning process to determine whether Sicala 350 B results obtained at the CSIRO MS&E Cotton Mill in Geelong could be duplicated in a commercial spinning trial.

A further issue as to whether there are advantages or disadvantages of using Sicala 350B, or other varieties with similar fibre quality attributes, in terms of fabric formation are still being investigated.

Premium Fibre Initiative chair Pete Johnson said the project is about laying the groundwork to learn as much as possible about the fibre's capabilities so that when subsequent generations of higher yielding long staple upland varieties come on stream – and production increases - our shippers have as much technical information as possible to help market the crop.

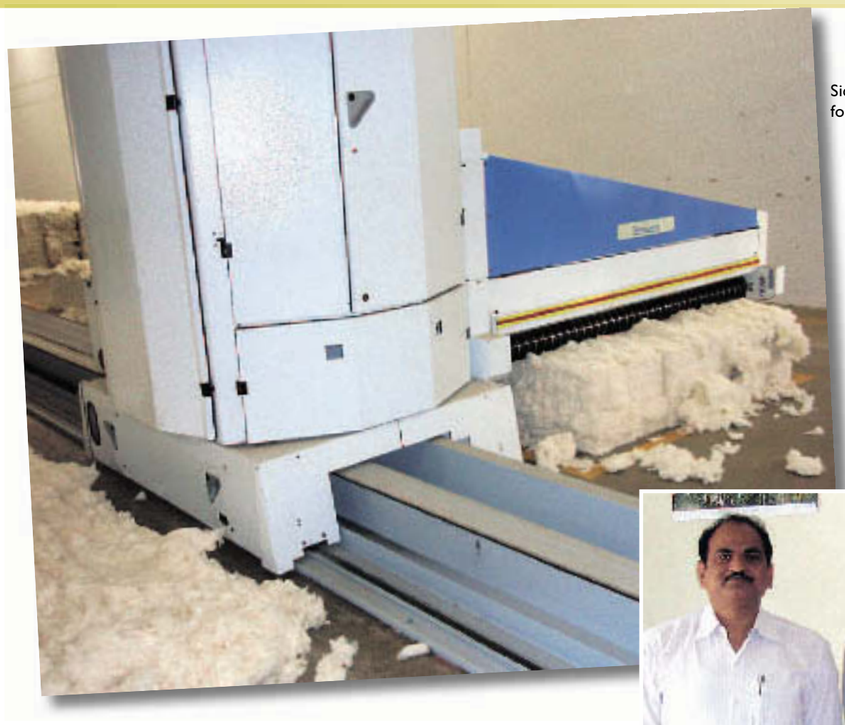
"Information on both yarn and textile performance will be an essential tool if we hope to effectively market this high quality crop into the very upper end and niche product categories," he said.

"At the moment, it is extremely difficult to extract a premium for the very limited supplies of Sicala 350B produced – but if we can combine increased yields in subsequent varieties, and go to the market with the knowledge to extract as much premium as possible, then we hope to have a formula to really generate some value for the industry."

Two 40-foot containers of Sicala 350B cotton were shipped to the Indian mill for the trials.

"It was initially planned to blend Sicala 350B with Extra Long Staple Upland varieties, however after discussions with Vardhman it was agreed that before Sicala 350 B is considered for any blends it needs to be evaluated on its own merits," Rene van der Sluijs explains.

"It was thus decided that 100 percent Sicala 350B would be processed and we are very pleased with the yarn quality and processing performance.



Sicala 350B bales being fed into the mill for its first commercial trials.

Industry researcher Rene van der Sluijs (centre) of CSIRO Materials, Science and Engineering in India with Mr Gupta and Mr Singal of Vardhman

"The results showed that quality combed yarns for the weaving and knitting sector in the count range 50 to 70 Ne can be produced on traditional ring spinning and compact spinning machines and furthermore, if blended with ELS cottons it could get down to 80 Ne – which is in the niche quality market."

Australian growers have access to the niche variety and the primary advantage for the spinner in using Sicala 350B or similar variety type fibre is a substantial savings in raw material costs compared with other premium varieties.

The results are a win-win situation for growers and spinners

However, while the results have been encouraging, there were some factors which will need to be considered.

"There were some issues with neps and short fibre content," René said.

"Yarn strength was also a little lower than desired."

These high quality fine count yarns are used mainly for the production of high quality woven and knitted shirting material where the incidence of neps can adversely affect the appearance of the fabric, especially on fabrics dyed to dark shades, such as black, navy, brown and green. The appearance of dyed or printed fabrics is negatively influenced by the presence of neps which appear as white spots on finished fabrics. This causes fabrics to be down graded or rejected as there are no cost effective means of covering or removing the imperfections once they are present in the fabric.

It is hoped that the current nep survey project funded by CRDC will give the industry an indication of the nep content in Australian cotton and allow the industry to benchmark the type and level of neps in Australian cotton to other growths and assist the industry in implementing measures to reduce the nep content in Australian cotton.

René was impressed with the mill, especially the Quality Assurance Department with many staff, who conduct routine tests according to a laid down schedule. "The laboratory is equipped with all the standard instruments one would expect to find in a modern high quality spinning mill, the mills are very clean and the spinning machinery was well maintained and in good running order," he said.

The next step in the project is to assess the product as a fabric.

Yarn for knitting has been sent for knitting trials and yarns for weaving trials to weaving mills. Sliver from the lots will also be used in dyeability trials to determine dye uptake and also to determine suitability of blending with other cottons.

Vardhman will now conduct further trials on Sicala350B on a larger scale both in 100 percent and in blends with ELS type cottons

Collaborating with the Vardhman Textile group

Vardhman's is one of the largest textile groups in India with numerous processing mills in different parts of India. They have close to 1million spindles and are currently installing a further plant with further expansion plans for the future.

Vardhman produce a large range of staple fibres with cotton accounting for 85 percent of their production in 100 percent and in blends.

The commercial trials were conducted in the province of Himachal Pradesh in Northern India which is nestled at the foot of the Himalayas.

VALUE CHAIN

Preparing cotton samples for testing with Cottonscan at CSIRO Textile and Fibre Technology. Image courtesy CSIRO.

Cottonscan development moves up a gear

Cottonscan technology is bringing the Australian and international cotton industry significantly closer to meeting a longstanding commercial challenge.

Fine fibres are needed to make premium lightweight yarns and fabrics but prior to Cottonscan, the industry's ability to accurately grade fibre on the basis of its fineness (also known as linear density) had presented a major problem.

Cottonscan can benefit both cotton growers and the textile industry, by enabling high quality, fine, Australian cotton to be correctly graded and valued by the market. Additionally, an accurate knowledge of the fineness of cotton is expected to increase the productivity and profitability of the spinning sector of the world's textile industry.

CSIRO Materials Science and Engineering (CMSE) scientists, headed by Dr Geoff Naylor developed Cottonscan with CRDC and are continuing to make groundbreaking improvements to the instrument opening the way for broader use of the technology in research and commercial facilities.

While the only instrument of its kind world-wide, its introduction to the market had been held up by its slower test times, which needed to be brought closer to the speed of the High Volume Instrument (HVI) machines currently used in classing houses and spinning mills.

Recently the machines were updated, or 'sped up' to perform testing in one minute, which is in the realms of testing time for HVI machines.

Dr Stuart Gordon, Project Leader - Post-Harvest Cotton at CMSE explains that commercial fibre testing technology uses a 'suite of instruments' and now, with Cottonscan's reduced testing time, it may soon be able to be added to this suite.

"When we are getting close to the HVI rate in terms of throughput, then it can be included in the suite of high volume test instruments used to class cotton," Dr Gordon said.

"The addition of Cottonscan will give a more complete testing system, the results from which can be used to give more accurate quality spinning predictions, a major objective of the development of this technology."

Cottonscan was used by CMSE in the Premium Blends Initiative, testing Sicala 350B cotton before it was sent to India for trials (see article "350B impresses" page 20-21)

CMSE has manufactured five of the faster machines, two are in the US with the others here at the CMSE site in Geelong, and all are currently undergoing inter-laboratory trials, to ensure the modifications are consistent among all five.

These inter-laboratory trials are a pre-cursor to Cottonscan's use in large scale trials at spinning mills in China – which Dr Gordon will oversee.

Like Cottonscan, SiroMat - the other CSIRO/CRDC-developed instrument for predicting fibre quality by measuring maturity will also be used in the Chinese trials, on Australian cotton.

SiroMat was launched at last year's Australian Cotton Conference and is currently in the process of commercialisation.

"Data from the two instruments gives more information on the cross-sectional properties, i.e. its linear density and maturity than the Micronaire value, which is an indeterminate combination of fibre maturity (SiroMat) and fineness (or linear density) with Cottonscan," Dr Gordon said.

"The cotton going to China will have been 'described' in terms of Cottonscan and SiroMat and the aim is to see how the additional fibre property data from these test instruments enhances the performance of yarn quality prediction equations used in spinning mills.

"The China trial is associated with the Cotton CRC's Cottonspec trial – which aims to produce a yarn quality prediction program based on measurements from HVI, and the Cottonscan and SiroMat instruments.

"These technologies will have uses in both classing houses and spinning mills, allowing Australia to provide a quality assurance in terms of fibre linear density and maturity.

"More broadly for the industry, cotton is performing on a multi-fibre stage and to be able to predict fibre quality gives assurance to potential spinning customers."

Dr Gordon hopes the other benefit for Australian growers will be the use of the HVI data, along with Cottonscan and SiroMat data to manage our cultivars.

"Cultivar selection, agronomy and field management affect the end product in terms of quality, which is translated as fineness and maturity.

"With such specific measurements from Cottonscan and SiroMat we can define areas where improvements can be made and then link them back to farming practices."

Talking the consumer's talk

New thinking adds value to cotton

At an innovation forum convened by CRDC to focus on competitive opportunities for Australian cotton, the industry heard that owners of some iconic Australian fashion and clothing brands were quite unfamiliar with qualities of locally-grown cotton.

"Cotton is cotton", was the widely held view of invited trade guests. However, it became proven that such misconceptions can and should be directly addressed through improving communications with consumers and brand owners. Such conversations, it was agreed, would lead to better understanding of the true needs of brand owners and apparel.

The forum heard that terms such as world-leading fibre quality, best environmental performance, top yields, greatest water efficiency and the adoption of quality assurance were not the qualities brand owners of apparel would pin on Australian cotton garments. The reason they would not link these qualities with local cotton is that they were unaware of the qualities because the conversations had not been held, it was found.

The Sydney forum held in May attracted wide support from brand owners such as Bonds and Gloucester and was designed to address the lack of conversation between industry and brand owners. Over 50 people attended the forum.

Industry and growers were well represented. The forum heard how vital it was that all sectors of the industry should redouble their efforts to tune-in to the conversations brand owners had with their customers and retailers. It was these 'conversations', the brand owners in attendance revealed, that held the key to understanding the real opportunities for adding value to the Australian crop. The disconnect between consumers and the fibre producers had long been a deficiency in Australia's efforts in gaining greater access to premiums and any conversations of any value went as far as the spinner in the value chain, it was revealed.

Brett Duczmal, Ecom Commodities; Vicki Frost, R&D Product Innovator, Bonds; Amanda Barton, Raw Materials Developer, Bonds.

Dallas Gibb, Program Manager, CRDC; Bob D'Alba, Qld Cotton, Jimmy Jackson, AWI, Mike Logan, Chair, CRDC.

Adam Kay, Harvey Gaynor, Pete Johnson and Aurthur Spellson successfully argued how Australia's cotton industry could be regarded as the national agricultural leaders in technology and performance that was backed by world-leading investments in R&D. The meeting also heard from CSIRO Materials Science and Engineering textile specialist Rene van der Sluijs plus two well-regarded wool-industry marketers, Georgina Carter of The Wool Company, and Jimmy Jackson at AWI.

Georgina and Jimmy demonstrated the importance of strategic marketing execution that involved careful planning, the best market research coupled with maintenance of very close links with influential players. Jimmy Jackson reminded us that we have to think about the real business we are in.

"We are more in the apparel business than the cotton business", he suggested.

Goondiwindi Cotton principal Sam Coulton, and Queensland Cotton marketer Bob Dall'Alba spoke of the challenges in communicating clear messages in the crowded commodity-focused markets.

The forum was devised by CRDC Value Chain Investment Manager, Dallas Gibb. Dallas said the Sydney meeting was the first one he was planning what would become a series that would test how brand owners and apparel developers viewed the Australian industry's BMP branded fibre, and to devise new strategies so Australian producers could achieve their 'quest of a sustainable competitive advantage'.

"We're beginning those conversations now," Dallas said, "and so far, it's working!"

According to feedback during the meeting, BMP certification meant significantly more as an internal industry-driven branding tool than it meant to the trade.

Glenn Rogan, producer, St George Qld; Kate McKenzie, Design Studio Manager, Bonds.

One brand owner asserted there is no consumer demand for a BMP-branded garment. He said an industry brand such as BMP would not easily translate into brand value at the retail end – "it is up to the brand owners to create their own brands and conversations with customers of apparel – and if we add values that BMP appears to offer, then we may do that if the consumer demands it."

Sam Coulton said the message of BMP works fine in industry but 'it won't work outside industry', a sentiment supported by Bob Dall'Alba who agreed that the Australian industry 'will find it hard to compete with the big dollars that brands and national industries have'.

Australian Farm Institute's Mick Keough, and branding consultant Kelly Tall, revealed numerous examples to the forum on how industries can have valuable conversations with consumers. Mick Keough suggested the food producing industries already had shown cotton the way; "it all starts with the consumer," he said.

Kelly Tall concluded a day of presentations by convincing industry that branding was achievable for Australian cotton, 'but consumer insights are the key', she said.

"For consumers, their insights are real and not generalisations, and these insights should unlock the potential for growth."

? For further information, copies of presentations and details of future innovation forums, contact Dallas Gibb, dallas@techmac.com.au 0458 385 278

Robert Davies, Gloucester Shirts; Arthur Spellson, Auscott marketing.

RESEARCH

Ultra-Narrow configurations: is it a better alternative?

Dr Rose Brodrick.

Ultra-narrow row cotton (rows spaced less than 40cm apart) has long been seen as a potential alternative system for Australian cotton, especially in regions with shorter growing seasons.

The aim of these systems with narrow rows has been to reduce harvest costs and achieve earlier maturity without sacrificing yield.

Advances in technology and positive commercial experience in shorter season production areas as well as access to transgenic technologies renewed interest in narrow row production across the industry.

Further interest was generated by advances in harvesting technology from John Deere that allowed spindle picking of narrow row cotton crops (38cm rows), avoiding the risk of discounts for fibre quality associated with harvest that were associated with previous narrow row picking systems.

Detailed studies to improve our understanding of differences in the growth and development of cotton in conventionally spaced (one metre) and ultra-narrow row (UNR – 25cm row spacing) production systems were conducted as part of postgraduate studies by Rose Brodrick (nee Roche), now a research scientist with CSIRO Plant Industry.

Following on from this research additional comparisons have been conducted in 38cm configurations in the warmer areas of the industry.

"Conceptually, in high-input systems, the high density planting of narrow row systems reduces the time to crop maturity, as fewer bolls per plant need to be produced to achieve yields comparable to conventionally spaced cotton crops," Dr Brodrick said.

"In practice, this earliness has been difficult to achieve consistently in UNR trials in both Australia and the US despite the level of crop inputs."

Dr Brodrick has also investigated many other variations of row configuration with different within-row spacing so that opportunities to achieve earlier maturity or higher yields can be exploited, and management strategies to allow this developed.

"This will fill a significant gap in our current knowledge of crop agronomy and management in cotton plant population issues" she said.

"During the course of the project a total of 13 field experiments were conducted that investigated: growth of cotton in different row configurations; growth of cotton grown in different row configurations and populations; Bollgard II versus conventional (non-Bollgard II) in different plant populations; and agronomy of narrow row systems."

In summary the outcomes of this project that were tangible and tested included the following:

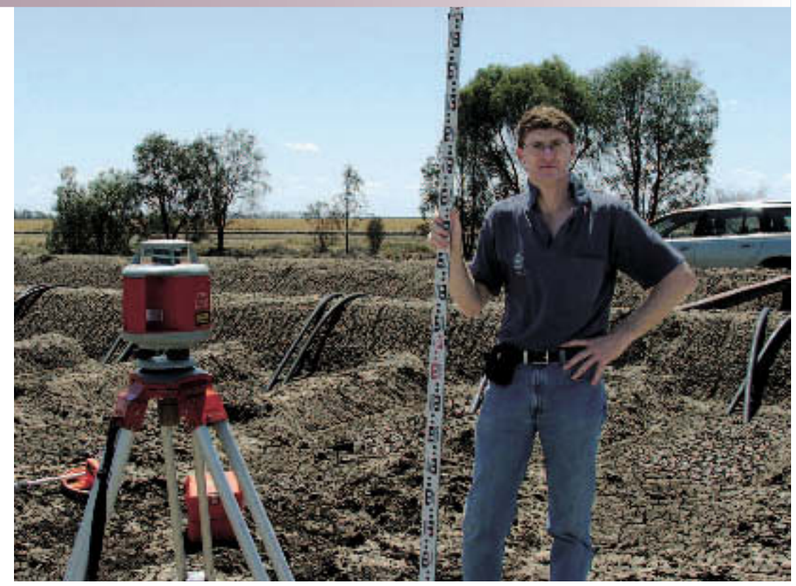
- Plant population differences from both changes in inter and intra row spacing had little or no consistent response on yield, quality or maturity. Narrow row systems (38cm) did not improve yield or cause earlier maturity.
- The addition of earlier and higher inputs of water and nitrogen did not overcome plant competition effects leading to improvements in yield in 38cm row spacings.
- No differences in management were identified between one metre and 38cm row spacings. Pix management was not different, re-confirming results of previous studies.
- No differences were identified in the response of non-Bollgard II and Bollgard II varieties to changes in plant population (including row spacing).
- Uniform plant population were vital for achieving optimum yield.

"Importantly in working with growers on experiments undertaken in this project I was able to identify a number of intangibles outcomes," Dr Brodrick explains.

"This resulted in a number of crop management recommendations from this work."

Dr Brodrick said that overall this research did not indicate that there were clear benefits of 38cm narrow row cotton systems for improving yield, quality and earlier maturity in Australian high input cotton systems on the majority of soil types on which cotton is grown. Results of research will be compiled into a research review to be provided to industry.

Technology and best practice drives improved efficiency



Rod Jackson preparing to undertake Irrimate on-farm demonstration trials in the Lower Namoi.

In 2006 NSW Department of Primary Industries and its team of experienced cotton irrigation extension officers received funds from the Cotton Research Development Corporation, Cotton Catchment Communities Cooperative Research Centre, and both the Namoi and Border Rivers Gwydir Catchment Management Authorities to undertake intensive water use efficiency (WUE) extension in NSW cotton growing valleys.

The project *Advancing Water Management* in NSW was initiated by industry and government in recognition of the importance of investing in a highly effective extension team to assist the cotton industry improve WUE.

NSW DPI Irrigation Officer and project leader Rod Jackson says the adoption of water management technology and irrigation best management practices are key drivers in generating greater water use efficiency.

In order to stimulate adoption and initiate practice change a multitude of extension techniques were utilised, including irrigation training, technology demonstration, dissemination of fact sheets, case studies and cost benefit analyses, consultant support and water use efficiency benchmarking

Henceforth, the Irrigated Cotton and Grains Workshop Series and the Centre Pivot Lateral Move training courses were delivered to 250 cotton and grains growers, with positive results.

"Documented evidence demonstrates the training resulted in growers having a greater knowledge and understanding of irrigation best practice and has lead to genuine practice change," Mr Jackson says. "Increased adoption of technology, better water management techniques and investment in new infrastructure has improved whole farm water use efficiencies.

"The increased knowledge, awareness, skills and attitudes acquired at the training workshops allowed growers to recognise strengths and weaknesses in their water management practices.

"It also helped them identify where investment will lead to the greatest increase in whole farm water use efficiency."

Many growers are now applying for WUE incentives available from Catchment Management Authorities (CMA).

Border Rivers Gwydir CMA assessed about 80 WUE incentive applications, with 66 securing funding for a variety of on-farm WUE activities, including purchase and/or upgrade of soil moisture probes, storage surveys, field and storage EM surveys, storage deepening or reconfiguration, supply and tail water system upgrades.

Similarly the Namoi CMA and Cotton CRC granted funds to nine applicants resulting in excess of 5111Ha coming under best practice water management.

Another major outcome of the training has been an increase in awareness of the Cotton BMP program, with the project contributing to an additional 13,614 Ha in the Namoi Valley now being managed and irrigated according to best practice.

"Each of the Irrigated Cotton and Grains workshops has specific linkages to the Cotton BMP Land and Water Module," Mr Jackson said.

"Growers were encouraged to consider the advantages of obtaining formal recognition of their best practice."

Decision support tools could assist growers to manage and measure water more efficiently.

Some of these tools, Irrimate and WaterTrack were demonstrated to growers, with knowledge and awareness of surface irrigation performance evaluation particularly has increased and practice change is now being documented, according to Mr Jackson.

"Many growers have begun to reconfigure fields to minimise loss, shorten irrigation times and optimise field application efficiencies," he said.

"The demonstration of the software and storage seepage/evaporation meters also increased awareness of the magnitude of storage losses on irrigation farms.

"A growing number of irrigators are now either raising storage bank heights or consolidating water storage to minimise evaporative losses."

In an effort to stimulate adoption of current industry standards for recording WUE, project staff conducted personal interviews on 42 farms from Emerald in central Queensland to Hillston in southern NSW to establish current WUE benchmarks for the cotton industry.

Benchmarking facilitates continuous improvement in management and water use. The results revealed that the average WUE for the 2006-07 season was 1.31 bales/ML (water pumped) or 1.13bales/ML (including stored soil moisture and effective rainfall). The results also highlighted that the top 20 percent of growers achieved a WUE around 1.5bales/ML. (See *Spotlight*, Summer 2008, pp3-5.)

In 2003 the CRDC-funded project *Whole Farm Salinity Management Strategies for Cotton Production in the Macquarie Valley*, established five long term monitoring sites in the Lower Macquarie Valley measuring deep drainage and changes to the salt store in the major irrigated cotton growing soils.

In 2006 and 2007 members of the Advancing Water Management Project team collected and tested soil samples at these sites to build a long term picture of potential soil degradation and productivity decline due to poor water quality and irrigation management.

"An examination of the 2007 soil and water analyses suggest that sodium and chloride concentrations increase during the irrigation season but decrease during the winter (non-irrigation season)," Mr Jackson said.

"Presumably this is due to leaching of the salts out of the crop root zone with winter rainfall.

"In time, it is likely that they will move into groundwater reserves, however there is considerable variation among locations due to variation in soils (texture, ESP etc) and cropping systems."

A technical paper on this monitoring will be published and presented at an industry forum this year.

RESEARCH

Dr Angus Crossan's project investigated the environmental impact pesticide and herbicide use has had with the introductions of GM technologies.

Climate a pest predictor

A project undertaken by Research Fellow Angus Crossan from The University of Sydney's Faculty of Agriculture, Food and Natural Resources, has provided a valuable review of environmental impact and development of risk assessment strategies within the Australian cotton industry.

The results of the analyses conducted within this CRDC-funded project were used to direct industry goals with respect to environmental custodianship.

It was found that GM technologies can reduce potential environmental impact by reducing or changing pesticide use practice.

Further, analysis of environmental impact of herbicide use did not show a significant reduction associated with the introduction of Roundup Ready (RR) cotton.

Dr Crossan said although the benefits of Bt cotton varieties and reduced endosulfan use are well documented, a strong correlation between pesticide use (per ha) and average rainfall was observed.

"This indicates that climatic conditions offer a potential predictor of environmental impact," he said.

"These results are based on the assumption that insect pressure is greater during wetter periods, thus requiring more insecticide use.

"We would therefore expect to observe an increase in pesticide use and potential environmental impact when growing conditions improve because of increased pest pressure."

Dr Crossan said these increases were unlikely to reach the levels observed when conventional cotton only was grown.

"It was difficult to determine the extent of benefits of Bollgard in reduced pesticide use because of strong climatic influences from the industry averages within Cotton Consultants Australia data sets," he said.

"However it is critical to continue collection of such environmental data to benchmark the industry's environmental performance and the value of new GM varieties to the industry."

Dr Crossan said although the benefits of Bt cotton varieties and reduced endosulfan use are well documented, a strong correlation between pesticide use (per ha) and average rainfall was observed.

In regard to another GM variety, Roundup Ready, analysis showed no significant reduction in the environmental impact of associated with its introduction, however there is potential for the newer Flex variety.

Dr Crossan said these results indicate that improvements in herbicide use scenarios could potentially be made by reducing the use of "high impact" residual herbicides with introduction of Roundup Ready cotton, but this has not appeared to occur.

"However, the use of Roundup Ready Flex and Liberty Link cotton should improve the potential environmental impact of herbicide use if such reduction in use of residuals is achieved," he said.

A slight negative trend between herbicide application and precipitation was also identified, indicating that if climates become drier then an increase in herbicide use (g/ha) will be observed.

"We expect this was either a response of growers aiming for a higher level of crop protection for improved yields and reducing the risk of crop failure, or a more virulent response by weeds during dry periods," Dr Crossan said.

An experiment conducted within this project showed that pesticide residues dissipate faster in actively composted cotton gin trash than in passively composted trash.

The experiment evolved from a previous study concerning potential environmental exposure and the regulation of gin trash wastes.

"Whilst composting of gin trash is recommended to reduce the concentration of pesticide residues, the resources required may be too large for an effective BMP," it was found.

Further studies with respect to re-use of gin trash are more likely to identify a more suitable industry-wide management practices, Dr Crossan believes.

Dr Angus Crossan demonstrates water quality tests to Alison Young of Burren Junction,. These provide the cotton and irrigation industry with a simple tool to seek, measure and record economic and environmental improvement.

Tailwater takes the test

A project which initially set out to advance the industry's capacity to manage tailwater quality through the development of constructed wetlands has instead yielded to irrigators' interest in finding a way to first measure tailwater quality.

Background knowledge for the project, overseen Dr Angus Crossan, included positive results regarding increases in biodiversity and improvement in water quality from pilot-scale wetlands.

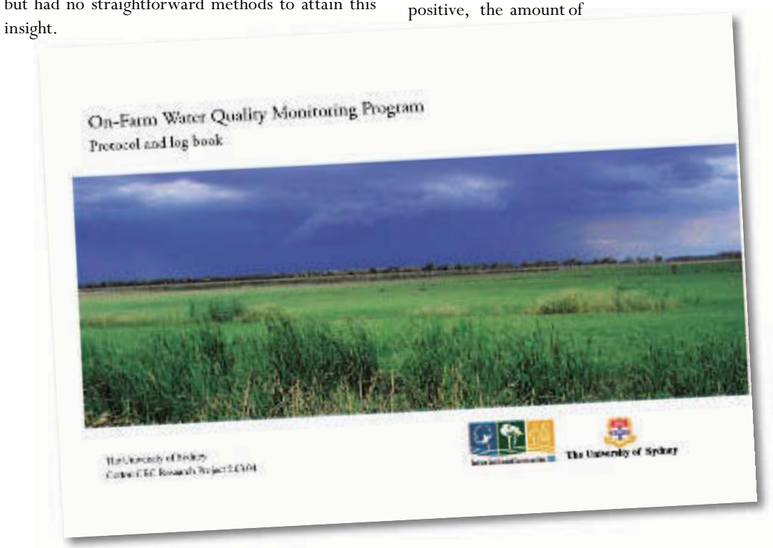
However, it was identified that the predominant concern of the industry was water availability because of drier than average climates and additionally, it was established that irrigators were more interested in whether or not the quality of their tailwater actually required improvement, but had no straightforward methods to attain this insight.

As a result Dr Crossan developed a simple water quality test kit to analyse irrigation water to provide the cotton and irrigation industry with a simple tool to seek, measure and record economic and environmental improvement.

In a pilot study, 20 water quality test kits and protocols were distributed within the industry, including some properties growing crops other than cotton.

Key water quality parameters including, turbidity, temperature, EC, pH, carbonate hardness, total hardness and nitrite, nitrate, ammonium, phosphate and chloride ion concentrations were recorded during irrigations.

"Although the feedback from participants was positive, the amount of data returned was not sufficient to enable a full analysis of water quality," Dr Crossan said.



"We expect that reduced on-farm staffing levels, as a consequence of very limited water availability, were too restrictive to allow sufficient resources to be made available for the trial."

However analysis of preliminary results indicated that at least 15 to 30 percent of nitrogen was lost to the tailwater systems as nitrate. This indicates that significant economic gain can be made through improving the efficiency of nutrient use.

"The main benefit of the water quality kits was that they provided a quantitative approach for environmental management," Dr Crossan said.

"Site-specific water quality measurements could be collected that were directly related to local practice.

"Any change in practice, that affects nutrient use efficiency, could be assessed, thereby informing and quantifying environmental management systems such as BMP.

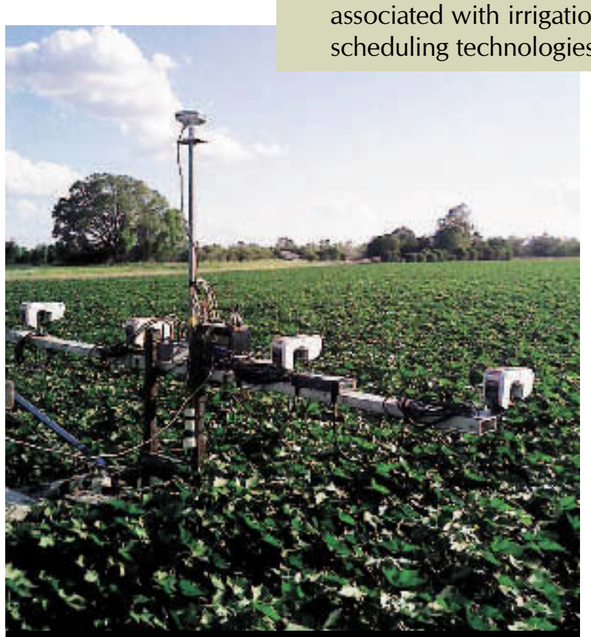
"Economic value of improvement in practice can be readily determined from the water quality data thereby providing further impetus for improvements.

"The water quality tests provide the cotton and irrigation industry with a simple tool to seek, measure and record economic and environmental improvement.

"That is why now, under another Cotton CRC/CRDC co-funded project we're currently developing simple tests for herbicides and pesticides that will add to the suite of water quality indicators within the kits," he concluded.

RESEARCH

Stem diameter sensors can be used to identify plant stress responses associated with irrigation however their benefits over traditional irrigation scheduling technologies appear to be marginal.



NDVI sensor platform measuring spatial variability of crop vigour in the Dawson Valley and Darling Downs.

Dr Simon White assesses leaf water potential of cotton plants on the Darling Downs with visiting Chinese academic Dr Jing Feng Huang looking on.

Dr Jochen Eberhard measuring cotton plant water status using a pressure bomb at Cecil Plains, west of Toowoomba.

Potential for plant based measurement investigated

Increases in crop water use efficiency have been achieved through greater precision in irrigation scheduling and the use of dynamic irrigated crop management strategies such as regulated deficit and deficit irrigation, a R&D report has found.

However, limitations exist in the use of soil moisture sensors and/or the water balance approach method for irrigation scheduling. The report says a key limitation with using either of these approaches for irrigation scheduling is that they do not provide a measure of actual plant water status.

Crop growth and response to irrigation is a function of plant water status and depends on soil water status, evaporative demand, the rate of water flow through the plant and the corresponding hydraulic flow resistance between the bulk soil and the appropriate plant tissue.

In response to this, the CRDC-funded project was undertaken by research officer Dr Simon White and senior research officer Dr Jack McHugh at the National Centre for Engineering in Agriculture. The project investigated the potential to use plant-based measurements for commercial irrigation scheduling of cotton.

The first year of the project evaluated the potential to use stem diameter sensors for irrigation scheduling in cotton under a lateral move machine. While the results were encouraging, the second season (2006/07) conducted on furrow irrigation across a range of irrigation schedules and three crop varieties were not as positive, generally because there was significant plant to plant variation in sensor responses.

The key recommendation from this work is that stem diameter sensors can be used to identify plant stress responses associated with irrigation, however, their benefits over traditional irrigation scheduling technologies appear to be marginal.

"These sensors will continue to have limited application as an irrigation scheduling and assessment tool in cotton unless appropriate threshold levels can be identified which take into account varietal differences and crop conditioning," Dr McHugh said.

During 2006/07, the project evaluated published relationships between canopy reflected energy (near infrared) data and that of plant water status and identified band widths correlated to plant water status when measured during a normal commercial irrigation cycle.

The 2007/08 trial continued to evaluate remote methods of plant based sensing to test the robustness of the published relationships between hyperspectral bandwidth (near and mid infra red) and normalised difference infrared index (NDVI) to changes in crop water status.

"The active sensor technology (NDVI) was unable to identify variability in crop water status, but did identify varietal differences and varying yield responses under all climatic conditions encountered" Dr McHugh said.

"The passive sensors (satellite or handheld hyperspectral instruments) were hampered by poor atmospheric conditions and high variability in localised sunlight intensity, therefore no significant relationships were identified between any band widths and crop water status".

? A grower guide to plant based sensing for irrigation scheduling has also been produced as a result of this project, to obtain a copy, contact Professor Steven Raine, 07 4631 1691 or raine@usq.edu.au or Dr Jack McHugh mchugha@usq.edu.au

Storages tell nature's story

PhD student Susan Lutton of Griffith University/ Cotton CRC has completed her project to investigate the diversity of farm storages and the structure and function of the aquatic life they support when compared with nearby natural wetlands.

The work was undertaken in the context reflecting how natural wetlands are under threat globally as water resources become directed to support growing populations and demand from agriculture.

In the Border Rivers Catchment in Queensland, a large irrigation industry coupled with a highly variable flow regime has necessitated the building of large on-farm water storages and often associated destruction or isolation of their natural counterparts. Her research was done with R&D investment support from CRDC and the results may be used to apply to future best management practice adopting optimised diversity and ecosystem function in storages.

Susan said with the decline in abundance of natural wetlands, the presence of irrigation storages on the floodplain has raised the question of their suitability as alternative aquatic habitat.

"To better understand the issue, initially the physical variety of water storages in the Border Rivers Catchment was described and their morphology and hydrology compared to that of natural wetlands," she said.

"Storages tended to be large, deep structures with a more regular shape, while natural wetlands were irregular and shallow with large perimeters.

"Although there was a degree of variability among storages, most fell into one group and were considered to be 'typical' in this region.

"Storages primarily function as water supplies and their associated management makes them mostly unsuitable as 'replacement' wetlands.

"However, given the large numbers of storages across the catchment, if managed effectively, they may provide an additional source of aquatic habitat and help maintain regional biodiversity.

"To maximise the biodiversity of storages it will be essential to increase habitat diversity within storages.

"In the future, improved design of new storages and alterations to existing storages and their management could help overcome this problem of low diversity of habitat, and help promote the spatial and temporal variation in habitat evident in natural wetlands."

Biodiversity, spatial and temporal, of two storage groups made up of typical storages with tailwater and without tailwater, was compared with natural wetlands.

Nine fish species were collected. These comprised seven native species and two exotic species. Only one species, the eel-tailed catfish, *Tandanus tandanus*, was specific to natural wetlands.

Given the large numbers of storages across catchments, managed effectively, they may provide an additional source of aquatic habitat and help maintain regional biodiversity.

Although fish species diversity was similar between the two storage types and natural wetlands, there was significant variation in total numbers, with typical storages having 10 times the average catch size of that found in natural wetlands.

In both storage types, catches were dominated by bony bream, *Nematalosa erebi*, while in natural wetlands, there was a more even distribution of species.

The percentage of exotic species was much lower in both storage types at less than eight percent compared with natural wetlands with greater than 40 percent.

There were also significant differences in macroinvertebrates, as 24 samples from natural wetlands revealed more than 14,500 individuals across 84 taxa (category or group of organisms). In comparison, 15 samples from typical storage sites and 12 samples from 'no tailwater' sites respectively, only 34 taxa from 2142 individuals and 34 taxa from 7611 individuals were collected.

Seventeen taxa were common to all three waterbody types while 45 taxa were specific to natural wetlands. None of the measured environmental variables explained the observed variation in macroinvertebrate life between waterbody types. Temporal patterns in macroinvertebrate and zooplankton were also investigated with the results showing typical storages' populations were less diverse than in natural wetlands.

To further investigate the variation observed in aquatic life, two sources of colonisation of storages were examined, namely those found in extracted river water and those hatching from the egg bank.

Eight fish species including three exotics were collected during sampling of eight samples of pumped river water. As in storages, the catch was dominated by *N. erebi* and exotic species were extremely low and less than one percent. Fish with a standard length of over 200 mm survived the extraction process, with 22 macroinvertebrate taxa and 332 individuals. This was a reduced diversity than collected from typical storages (34 taxa).

In comparison, zooplankton assemblages had similar diversity to those observed in the typical storages, 25 taxa compared with 22 taxa. Sediment samples collected from the floodplain had a more diverse but less abundant egg bank (46,463 individuals from 20 taxa) than those collected from dry typical storages (70,600 individuals from 16 taxa).

The differences observed in the three storage types suggested there may also have been variations in aquatic processes between waterbody types, therefore stable isotope analyses were used to investigate the major sources of energy fuelling the aquatic food webs. In general all components of the food web in typical storages were 13C and 15N-enriched in comparison with natural wetlands.

? Industry is investing in ongoing development of best practices in storages management on the basis of this and other ongoing work. Greater detail concerning this project is contained in the finished research paper, or by contacting Susan Lutton Susan.Lutton@student.griffith.edu.au

PhD student Susan Lutton hopes her study can help maximise future biodiversity in storages.

fashion and futures

Quality fibre and fashion gives food for thought

Careers, fashion and quality cotton headlined a unique day out at Georgie and Andy Carrigan's "Milchengowrie Homestead" at Boggabri in March.

Organised by Wincott, the day offered information about the many and varied aspects of the cotton industry, from employment opportunities in all sectors of the supply chain to end products from some of the industry's well respected figures in their fields.

Around 110 visitors enjoyed the day where 'cotton meets art and employment opportunity' with secondary school students and other visitors enjoying a fashion parade, art and sculpture exhibition and weaving display, and presentations from a variety of industry experts.

Award-winning researcher Rene van der Sluijs of CSIRO Materials Science and Engineering, Cotton Australia Chair Joanne Grainger, and John Hamparsum gave presentations

Rene's research has aided the industry in maintaining and improving fibre quality right through the production chain. His presentation outlined the production line post farm gate – describing the reasons behind the quest for a high quality product from a spinner's perspective.

Each speaker, while outlining their role in the production chain, also defined different roles for people in the industry.

Joanne Grainger's thought provoking address outlined the two aspects vital to the industry, people and product. Importantly, in order to advance both, she said, it was important for people to understand the difference between perceptions and realities surrounding the industry

"We have to present the true world and back it up with research and data," Ms Grainger said.

"We must educate and inform to achieve awareness.

"For example there is a perception that working in the cotton industry involves just hard (outdoor) work, isolation and long hours.

"However there are many different, meaningful jobs available.

"The reality is it's good to live in the country, and our industry is high tech and progressive.

Designer, Tia Carrigan, centre, with some of her creations in cotton and other natural fibres.

"There are perceptions regarding the sustainability of cotton production and that this can't be achieved – yet in reality our growers are the most efficient in the world."

Scott Davies of Carroll Cotton Gin explained the importance of the ginning process in maintaining fibre quality, while consultant Anna Madden offered insight into the role of agronomy and careers in the industry.

Breeza grower John Hamparsum decribed successful methods to attract and maintain quality staff and shared his experiences with the crowd.

Consultant Anna Madden spoke about her career as an agronomist

The quality cotton/careers theme continued with award winning designer in natural fibres, Tia Carrigan from Boomi in Northern NSW, showcasing what can be achieved with our high quality fibre in her fashion parade. Tia also met with textile students from St Mary's secondary school in Gunnedah who found out first-hand what it means to be involved in the textile and fashion industry.

"The cotton industry and agriculture in general are screaming out for staff, from farm workers and agronomists to scientists," says Helen Dugdale, who has been a supporter of Wincott since its inception.

"With this varied program we aimed to address the hot topics of fibre quality and careers in the industry – all in an enjoyable environment.

"As Australia has a reputation for high quality cotton we need high quality people to keep us ahead and to get a premium for our cotton.

"We need people in all sorts of careers in the industry – farm staff, irrigators, mechanics, agronomists, extension people, office people, finance, economists, designers, engineers, plant breeders, environmentalists, shippers, marketing, all sorts of researchers, and business people – all with the aim of producing a high quality end product.

"That is the linkage between the two main themes of the day - career options and quality cotton."

CSIRO's Rene van der Sluijs and Cotton Australia chair Joanne Grainger caught up at Wincott's day out at "Milchengowrie Homestead"

Fashion designer Tia Carrigan is no stranger to cotton, having grown up near Boomi in northern NSW, and still carries on her business from there. She spoke with textiles and design students from local high schools

The Carrigans, hosts for the day – Zac, Kate, Georgie and Andy Carrigan.

Wincott treasurer Anna Humphreys of Moree made guests feel welcome.

Scott Davies of the family-owned Carroll cotton gin after his presentation.

Calrossy Year 12 Ag students Steph McMahon from Tamworth and Jordon Hogg from Werris Creek.

Sally Boyle "Waiwera" Wee Waa and Millie Smith, Milchengowrie, Boggabri.

Rhonda Harris and Shona Hight "Windy Station" Quirindi.

Speaker Anna Madden and student Lauren Berecry, from Inverell.

Breeza farmer John Hamparsum spoke on the day, and also caught up with Rod Smith, "Milchengowrie".

The UN International Year of Natural Fibres – highlighting the role wool and cotton industries have played in shaping communities in regional Australia

Discover natural fibres 2009

Cotton and wool together in year of natural fibres celebration

Around the world, farmers harvest 35 million tonnes of natural fibres each year. This backdrop proved to be ideal for Australia's cotton and wool producers and their organisations to meet in Sydney on May 20 to share the official launch of the International Year of Natural Fibres (IYNF) in Australia.

On the podium to commemorate this important event were Tony Burke MP, Minister for Agriculture Fisheries and Forestry, and Dr Jacques Diouf, Director General of the Food and Agriculture Organisation (FAO) of the United Nations. The function by the water's edge in Sydney harbour and at the National Maritime Museum, was a location recognised for its symbolic trade link for both cotton and wool. At the ceremony, a commemorative Australia Post pre-stamped envelope also marked the occasion and symbolised IYNF in Australia.

In launching IYNF in Australia, Mr Burke highlighted the role the wool and cotton industries had played in shaping communities in regional Australia while being significant long-term players in underpinning the growth of the national economy. He heralded the input of both industries in achieving international leadership and contributing to the prosperity of the country through support of the regional and national economies. Both industries had also excelled in investing in R&D to drive productivity growth, Mr Burke said.

Recognising the uniqueness and importance of natural fibres the Minister noted that he was "confident there would never be an International Year of Synthetics".

FAO has taken up the gauntlet of supporting natural fibre production world-wide. The prominent UN body seeks to address the dual challenges of relentless competition from synthetics and impacts for natural fibre producers resulting from the global economic downturn. FAO say these factors impact upon the livelihoods of millions of people who depend on natural fibre production and processing. IYNF 2009 aims to raise global awareness of the importance of natural fibres, not only to producers and industry, but also to consumers.

In closing the launch Cotton Australia CEO Adam Kay thanked the Director General and Minister and spoke strongly of the sustainability and socio-economic importance of the cotton and wool industries working together in Australia's regional development and global trade in natural fibres.

Dr Jacques Diouf, Director General of the United Nations Food and Agriculture Organisation (FAO) and Tony Burke MP, Minister for Agriculture Fisheries and Forestry with the commemorative Australia Post pre-stamped envelope that marked also the occasion of the launch of IYNF in Australia.

Leaders of Australia's wool and cotton organisations, Brenda McGahan, Chief Executive Officer, AWI with Adam Kay, Chief Executive Officer, Cotton Australia by the water's edge in Sydney harbour and at the National Maritime Museum at the launch of IYNF in Australia.