COTTON RESEARCH & DEVELOPMENT CORPORATION

Spotlight on Cotton R&D

WINTER 2013

GET MOBILE: Knowledge on the go

WAR ON WEEDS: Managing pests, diseases and biotechnology

Best Practice

CONTENTS WINTER 2013

IMAGE MELANIE JENSON

Boggabilla grower Graham Cook and Border Rivers Regional Development Officer Sally Dickinson at the Australian Cotton Trade Show at Moree where new mobile applications were launched.

IN THE SPOTLIGHT

In this edition of Spotlight we focus on carbon farming and the opportunities for the Australian cotton industry. CRDC welcomed the announcement of the industry's successful grant application for the project 'Carbon Farming in the Australian Cotton Industry' funded by the Federal Department of Agriculture Fisheries and Forestry. While growers are aware of the government's Carbon Farming Initiative (CFI), the challenge for growers is to understand how it all relates to their business, what they can do, and the effect on their business, which we aim to do through this project. CRDC and the collaborators in this project recognise the need to gather all of the research that has been done in the area of improving nitrogen use efficiency, reducing emissions and carbon farming to formulate Best Management Practices to allow for practice change on the ground.

We also focus on farm hygiene and its role in Integrated Pest Management. That the industry is in a relatively healthy position in terms of capacity to manage pests on our crops is due to best practice on behalf of growers and consultants, but we need vigilance. As demonstrated in the USA with boll weevil, the removal of weeds and rogue cotton from farms over winter can control insect pests. Industry is urging growers to help stop the spread of diseases, such as cotton bunchy top, and pests, such as silverleaf whitefly and aphids, into next season's crop.

The information provided by resistance monitoring of insects is an integral component of the industry's Insect Resistance Management Strategy. CRDC invests in the industry's resistance monitoring programs which cover Helicoverpa, mites, aphids, silverleaf whitefly and mirids. We have included reports in this edition from the respective researchers and the implications for growers in what has been a relatively low pressure year for insects.

The Warnock family from Northern NSW have ended this season without any insecticide sprays on their crop. IPM plays the major role in this outcome. Brendon and Jack Warnock share their experience with IPM and how they manage for minimal disruption to beneficial predators on their farm.

Meanwhile a group of growers at Mungindi in Northern NSW are exploring biodiversity and the promotion of beneficials on their farms through a native vegetation benchmarking study undertaken as part of the collaborative Cotton Growers for a Sustainable Landscape project.

The CRDC Grower Survey is coming to you soon. The value of the information gathered from these surveys is significant with the results providing a picture of our industry performance and grower needs from many angles. The article on nitrogen use across the industry is clear example of this. There are many other examples like this one which help us gain a clear picture of management practices which in turn helps us direct investment to research areas.

CRDC is pleased to be supporting industry researchers to share their work with each other at the forthcoming Researcher's Conference. In doing so we anticipate outcomes of even better research ideas, use of novel methodologies, integration of science, building of researchers skills and understanding of industry R&D needs. The Australian cotton industry is fortunate to have the support of such great researchers in their fields, investing in their capacity to make a difference for the industry makes lots of sense. CRDC wishes Australian cotton researchers all the best with their inaugural conference and meeting in September.

We report also on how industry has responded quickly to the discovery of reniform nematode at Theodore this season. This parasite has the potential to severely impact yield and management is costly or largely untested in this country, as this is only the second detection of the nematode in Australia.

The Cotton Industry Development and Delivery Team were fully engaged in the Australian Cotton Trade Show, providing the perfect opportunity to launch a new range of information products. Industry is working hard through the D&D Team to provide information to growers in useable ways, and the launch of several mobile applications is testament to this. The Australian Cotton Production Manual is also a signature publication of the industry and we hope growers and consultants make use of these extremely well researched tools.

Bruce Finney

Australian Government
Cotton Research and Development Corporation

Spotlight is brought to you by Australia's cotton producers and the Australian Government through the publisher Cotton Research & Development Corporation (CRDC).
CRDC is a research and development partnership between the Australian cotton industry and the Australian Government.
Cotton Research and Development Corporation
ABN: 71 054 238 316
Our vision: A globally competitive and responsible cotton industry
Our mission: 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, Joe Ludwig. 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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WITH INCREASING ATTENTION ON CARBON FARMING CONSIDERATIONS AND THE NEED TO REDUCE GREENHOUSE GAS EMISSIONS, THE COTTON INDUSTRY HAS SECURED FUNDING TO ENHANCE GROWER AND CONSULTANT UNDERSTANDING OF CARBON RESEARCH.

READY FOR A CARBON FARMING FUTURE?

The industry's project 'Carbon Farming in the Australian Cotton Industry' is funded by the Australian Government Department of Agriculture Fisheries and Forestry as part of its Carbon Farming Futures Extension and Outreach Program. Managed by CRDC, the project proposal was formulated through the industry's new framework for high level collaboration to deliver research outcomes – the Cotton Industry Development and Delivery Program. Key agencies collaborating on the project include Cotton Australia and Cotton Seed Distributors, as well as CSIRO, The University of New England, NSW Trade and Investment, Queensland University of Technology, Grains Research and Development Corporation, and the QLD Alliance for Agriculture and Food Innovation.

CRDC Climate, Carbon and Soils Research Manager Allan Williams says growers are aware of the governments Carbon Farming Initiative (CFI), and have been watching what is happening in carbon particularly over the last two to three years.

"The challenge for growers is to understand how it all relates to their business, what they can do, and what will happen if they do so," Allan said.

"We recognised a need to gather all of the research that has been done in the area of improving nitrogen use efficiency, reducing emissions and carbon farming to formulate Best Management Practices to allow for practice change on the ground.

"A change in farming practices to reduce emissions and sequester carbon also makes good economic sense for growers because an outcome of change is improved efficiency.

"This project aims to achieve positive emissions/carbon outcomes whilst also maintaining the focus on productivity goals."

A significant part of the project includes the appointment of a Carbon Technical Specialist into the Cotton Industry Development and Delivery (D&D) Team, as well as economic analysis and technical forums.

Federal Minister for Agriculture, Fisheries and Forestry Joe Ludwig MP met with industry and growers at Breeza in May for the announcement of the 'Carbon Farming in the Australian Cotton Industry' project funded by the department as part of its Carbon Farming Futures Extension and Outreach Program.

"Success of the new D&D Team depends on expertise across the full spectrum of issues for cotton production," explains Dr Ian Taylor, Cotton Industry D&D Program Manager.

"Until now, we have not had anyone focusing on carbon and associated government policies.

"This project allows us to fill that gap with a Carbon Technical Specialist. The D&D Team Specialists are the link between the researchers and the RDOs (Regional Development Officers).

"The RDOs then directly support growers to ensure on the ground understanding and uptake of research outcomes.

"We are working hard to ensure research outcomes follow through to improvements on the ground."

The project will integrate new and emerging carbon farming information into cotton industry extension, BMPs and adviser training.

Allan Williams says that up until now there has been a lot of work done looking at nutrition and nitrogen use efficiency in reducing nitrous oxide emissions from cotton and grain production.

"The challenge has been for maximising nitrogen use efficiency, where the line is between reducing nitrogen rates and increasing the risk of yield losses," he said.

"As part of the project, we are developing a list of practices that will assist growers improve nitrogen use efficiency, looking at not just rates but also timing and placement and other practices such as irrigation management.

"The project will bring together all relevant information and research outcomes relating to soil carbon sequestration and reducing emissions for delivery to growers and advisors.

"This will help growers to understand what practices they can change to meet their needs, ensure continuous improvements by the industry that can be demonstrated, and highlight opportunities that will be available under the Carbon Farming Initiative."

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A CRDC-FUNDED PROJECT INVESTIGATING THE USE OF COTTON GIN TRASH FOR BIOETHANOL PRODUCTION HAS THE POTENTIAL TO BOOST RETURNS AND STIMULATE REGIONAL INDUSTRIES.

TURNING TRASH INTO TREASURE

Ginning operations and farmers would directly benefit if cotton gin trash (CGT) is found to be suitable as a biofuel feedstock, literally generating a double income: cotton and biomass. If carbon credits were to be included, three income streams could be generated from the one crop, says NSW DPI senior research scientist Dr Tony Vancov who is leading the research at Wollongbar Agricultural Institute.

He said the environment and the agricultural industry could benefit more broadly, as the results of this work could facilitate the development of viable sustainable ethanol plants in regional areas without negative production to livestock and food industries for regional-based bio-refineries.

"Production of fuel from cotton gin trash feedstocks will also reduce net greenhouse gas (GHG) emissions by reducing consumption of fossil fuels," Tony says.

"This will be greater than the GHG reductions from crop-based ethanol as no or little inputs are used in generating the feedstocks.

NSW DPI's Tony Vancov is exploring making use of cotton gin trash for ethanol production, which could open up new opportunities for for growers, gins and regional industry.

"The establishment of a biofuels industry in regional Australia will lead to several social benefits and include diversification of business opportunities which brings with it additional infrastructure, skilled work base to smaller communities, employment and thereby ensuring income stability and continuance of the community's population base."

The researcher says the cotton ginning process generates about 60 kilograms of CGT per bale, which contains more than half cellulose and hemicellulose which could be used as a feedstock resource for biofuel production. He says the residues from the cotton 2009-10 harvest represented a renewable energy resource of more than 240,000 tonnes of CGT which equated to approximately 78 million litres of ethanol.

Producing ethanol from materials such as gin trash is attractive as producing ethanol from starch has drawbacks. Competition with the animal and human consumption markets for resources affects supply and there is little reduction in greenhouse gas emissions via this production method.

Tony said the progress on his research to date is very promising.

"We have subjected several CGT samples to detailed physical and chemical characterisation (moisture content, carbohydrate profiles, lignin, ash and other extractives)," he said.

"Samples with higher lint content were found to contain larger amounts of sugar (up to 80 percent) which is excellent because the higher the sugar content the higher the bioethanol yields.

"Preliminary fermentations indicate that the extracted sugar from the trash can be converted into ethanol, with further experiments planned."

The pilot project is expected to be completed at the end of next year and expands on previous NSW DPI work testing cheaper pre-treatment options for CGT conversion to sugar streams for fermentation to ethanol.

"Regardless of its detractors, bioethanol will always be a valuable commodity," Tony says.

"It is a highly versatile compound and is readily sought and used as a fuel supplement, additive and platform chemical. Its utility in wide ranging industries (chemical, food-beverage, medical, research etc) guarantees its 'place in the sun'.

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RESEARCH RESPONDS TO RISING CO_2 LEVELS

ONE OF AUSTRALIA'S INNOVATIVE YOUNG RESEARCHERS HAS BEEN WORKING WITH A SCIENTIST FROM THE UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) TO IMPROVE THE QUALITY OF RESEARCH INTO CLIMATE CHANGE'S EFFECTS ON COTTON IN AUSTRALIA.

PhD student Katie Broughton and USDA Cotton Physiologist Dr Paxton Payton were a familiar sight at Australian Cotton Research Institute (ACRI) earlier this year, setting up state-of-the-art technology from the US to measure how Australian cotton responds to water deficits, rising temperatures and CO_2 levels.

Last year Katie travelled to Lubbock, Texas in the US where she worked with USDA cotton physiologists to learn to use the specialised whole-plant field chambers, with the aim of using the technology here in Australia for climate change studies. Katie's travel to the US was funded by the CRDC Award for the 2012 Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry, which she has praised for giving her such an opportunity.

Now working with CSIRO and the Universities of Sydney and Western Sydney investigations into how projected climatic changes affect cotton physiology and production in Australia are underway. The new research at ACRI will use the whole plant chambers in the field to modify the environment of cotton during critical developmental stages with water stress treatments.

"Specifically this will enable investigations to be conducted under Australian field conditions, using our cotton varieties. This will provide improved insights into how future environments (eg high temperature, high atmospheric vapour pressure deficits, all with higher CO_2) will impact the Australian cotton industry so that appropriate adaptation strategies can be developed," Katie said.

"While work has been undertaken in the US, their cotton varieties and agricultural systems are different to Australian cotton production in terms of varieties, soil type, methods of irrigation and climate."

Katie will be working with CSIRO's Dr Mike Bange, Professor David Tissue from University of Western Sydney and the University of Sydney's Dr Daniel Tan, along with the unique opportunity to draw on the overseas expertise of Dr Paxton Payton.

Paxton said the collaboration between USDA Agricultural Research Service and CSIRO with support from Cotton Inc and CRDC represented a great opportunity for the cotton community.

"Working in both hemispheres gives us the unique advantage of doubling our research output in a single year," he said.

"Our interests and concerns in the US are identical to those in Australia: primarily, how predicted environmental change might impact cotton production and what management and breeding strategies can mitigate any negative effects of environmental change.

"Additionally, we are running these experiments in two very different environments, semi-arid, short-season production in Texas and in a long-season in Australia.

"That allows us to examine cotton's response to high temperature, elevated CO_2 and high vapour pressure deficit, under very different growing conditions."

Dr Mike Bange, CSIRO's Plant Industry Stream Leader (Industrial Fibres from Cotton) said Katie's research is the start of a larger effort to ensure that there is a clear understanding of the impacts of climate change.

"Katie will be especially looking at the effects of temperature and elevated CO_2, so that adaptation strategies if any can be developed," he said.

"It is already widely understood that much of the climate variability that the industry endures goes beyond some of the effects of climate change and some practices and knowledge exist to cope with this.

"However there are some aspects that need further understanding like the effects of elevated CO_2, for which little research has been undertaken in Australian field conditions for cotton production."

Katie is currently analysing the data from this season's experiment and Spotlight will bring her findings to readers in coming issues.

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MAIN IMAGE: While similar research has been undertaken in the US, Katie Broughton's research will enable investigations to be conducted under Australian field conditions, using our cotton varieties.

INSET: USDA Cotton Physiologist Dr Paxton Payton – "The collaboration represents a great opportunity for the cotton community – working in both hemispheres gives us the unique advantage of doubling our research output in a single year".

WORKFORCE RESEARCH HEADS SOUTH

CRDC HAS EXTENDED THE *INNOVATIVE WORK: COTTON WORKFORCE DEVELOPMENT FOR SUSTAINED COMPETITIVE ADVANTAGE* PROJECT TO INCLUDE A CASE STUDY IN SOUTHERN NSW.

Cotton Australia Education Coordinator Sophie Davidson, CRDC Human Capacity Program Manager Bruce Pyke, Cotton Australia Macintyre Regional Manager Bec Fing and Research Analyst Gail Power of the University of Sydney's Workplace Research Centre work through issues at the Cotton Workforce meeting in Moree in March.

Associate Prof Ruth Nettle of the University of Melbourne, said this will add to the existing data from case studies undertaken in the Emerald/Springsure and Gwydir production valleys last year which involved interviews with growers and stakeholders to understand what the issues were and why they were issues; and a grower survey – to establish what the labour demand was. The research team provided feedback to the Gwydir growers in March and to Emerald/Springsure growers in May this year.

The rationale for the project is that the cotton industry needs to have a workforce adequate in number and skill to drive industry competitiveness through time.

The third case study in the Southern NSW production valley will include Murrumbidgee and Lachlan grower groups.

"Sufficient interest in the idea to proceed was expressed by local growers when Dr Jennifer Moffatt, of University of Melbourne, recently attended a Griffith cotton industry meeting, to propose the case study," Ruth said.

"This area is rapidly expanding into cotton production, with unknown workforce needs."

The researchers anticipate they will be conducting interviews with growers and stakeholders in late June 2013, with a grower survey in June/July.

CRDC's *Innovative Work* project is one piece of research industry is undertaking to find a united way to address human capacity issues. A workforce development meeting in Moree in March brought together a group of individuals committed to unravelling steps to developing a sustainable workforce.

It was the third such meeting convened by CRDC's Human Capacity Investment Manager Bruce Pyke in the last 18 months. The aim of the gathering was to provide an opportunity for the researchers working in this space to communicate on their projects or their plans as results come to hand and provide an opportunity to discuss them.

Facilitated by Ruth Nettle and Jennifer Moffatt, it was attended by people including researchers to education providers, Cotton Australia's Angela Bradburn, Sophie Davidson and Human Capacity Panel Member and grower Barb Gray.

A further aim of the meeting, according to Bruce Pyke, was to allow and encourage CRDC and CA to be clearer about their role in supporting workforce development for the industry.

"While clearly CRDC and CA can't do everything, what we do needs to be strategic, well directed and get the best return on investment which to CRDC translates to improving the outlook for industry's current and future labour force," Bruce said.

"The problem is that workforce development is not our traditional space. So one of the best things we can do at present is to keep the discussion going and make steady progress together.

"One of the initial problems in addressing workforce issues was that CRDC and industry had no data."

Consequently CRDC commissioned Gordon Stone to work with agribusiness to identify needs and opportunities, and now the *Innovative Workforce* project which targets the on-farm workforce.

"The next step will be to convert the new found knowledge from these meetings into what could be termed a workforce development strategy for the industry that is jointly 'owned' and implemented by CRDC and CA. It is hoped this will be achieved after a further meeting later in the year," Bruce said.

The following reports documenting work done to date on the Innovative work project will be available from CRDC on request:

1. Review of current industry, regional and farm workforce development activities and human resource practices on farms (from the Emerald and Gwydir case studies).
2. The cotton workforce development system: identify opportunities for enhancing industry competitiveness (an overview report).
3. A searchable and updateable data base that presents relevant labour market analysis information for each cotton region (spreadsheet of workforce-related Census material from 2006 and 2011).

If anyone would like further information about the project or would like to be involved in the Southern New South Wales case study please contact Dr Jennifer Moffatt Jennifer.moffatt@unimelb.edu.au or 0422 183 011.

PETER LONERGAN NSW DPI

THE TIME TO PROTECT YOUR NEXT CROP IS NOW

BREAKING DOWN THE GREEN BRIDGE

REMOVING WEED HOSTS OVER WINTER IS A MAJOR SHARED PRINCIPLE OF THE INDUSTRY'S INTEGRATED PEST AND DISEASE MANAGEMENT STRATEGIES AND STEWARDSHIP PLANS. FAILURE TO BREAK THIS GREEN BRIDGE CAN IMPACT ON MORE THAN JUST ONE SEASON.

Winter management is just as critical for pest and disease control as when the crop is growing. Maintaining a farm free of cotton and weeds during winter breaks the green bridge needed for pests and diseases to survive through to the next season.

How growers manage their farms in terms of weeds, in particular volunteer/ratoon cotton is also a stewardship issue.

"Farm hygiene is important in managing the resistance risk to Bollgard II technology," D&D Team Stewardship Specialist Sally Ceeney said.

"The presence of volunteers and ratoons on farm increases the length of time (outside of the normal cropping season) and amount of exposure that Helicoverpa spp. have to the toxins contained in Bollgard II, increasing the risk of resistance.

"Looking ahead with the release of Bollgard III on the horizon, it is important for industry to remember that Bollgard III is built on the current platform of Bollgard II with the addition of a new toxin, Vip3a.

"The efficacy of Bollgard III is therefore heavily dependent on the status of resistance to the toxins currently contained in Bollgard II."

Breaking the green bridge through control of ratoon and volunteer cotton could also have a long term impact on pest management and the viability of the Australian industry. D&D Team Biosecurity and IPM Specialist Susan Maas explains.

"Many growers and consultants are aware that early infestations are more likely if lots of weed and cotton host plants are present over winter and into spring," she said.

"Aphids, mealybug and cotton bunchy top are perfect examples of problematic issues for industry, which both rely on a steady supply of weed hosts to survive on farms over winter.

"Breaking the green bridge over winter is a proven management tactic, as seen in the United States and the management of boll weevil where a key part of the eradication program included mandated control of volunteer and ratoon cotton."

Boll weevil is considered one of the most "important" pests in the US, and an eradication program has been ongoing since the late 70s with successful eradication from 10 states. In addition to yield gains of more than 10 percent, eradication has halved insecticide control costs.

The US boll weevil experience also has another lesson for Australian growers. In the event of an undetected incursion of such a pest, farms with weeds and rogue cotton could unknowingly harbour and spread this pest prior to detection.

CSIRO Entomologist Dr Lewis Wilson has seen the boll weevil issue first hand in Texas and says an incursion of boll weevil to Australia would be 'dire'.

"If boll weevil were to enter the country, volunteers and ratoons would provide a substantial summer and overwinter habitat for this pest and substantially undermine attempt at control or eradication," Lewis said.

"This pest would be absolutely devastating and its management expensive and very disruptive of our IPM systems.

"Boll weevil is a pest we don't have and don't want, however it is important we work together and proactively manage to break this green bridge and reduce the biosecurity risk that is posed."

CONSIDERATIONS

Managing volunteers/ratoon cotton is always challenging. In field, cultivation and herbicides can be effective in controlling volunteer cotton, however the following points should be considered:

- The effectiveness of registered herbicides is generally limited to volunteers no more than four to six leaf. The size of the volunteers needs to be assessed before a herbicide selection is made.
- Larger plants will be more difficult to control in a single pass.
- Using the recommended water volumes for application is imperative for effective control.
- Other weeds within the field should be taken into consideration when making a herbicide selection.
- It is important to read all labels to confirm the correct application timings and rates. Label directions must be followed.
- Control of volunteers growing outside fields (along channels, roads and fences) is even more challenging as herbicide control is not always possible.
- Manual chipping is sometimes the only effective option, particularly where volunteers are well established. While this is an intensive strategy, it is a good investment when taking into account the potential costs and losses caused by pests such as SLW, aphids and now mealybugs, diseases such as CBT, and the added risk of contributing to increasing resistance levels in Helicoverpa to the Bollgard technology, currently and in the future.

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Resources

Cotton Pest Management Guide
Australian Cotton Production Manual 2013
*my*BMP.com.au

see our website

WINTER WAR ON WEEDS: MANAGING ROGUE COTTON

AS ANYONE WHO HAS TRIED TO KILL UNWANTED COTTON PLANTS KNOWS, IT CAN GO FROM BEING DIFFICULT WITH SMALL PLANTS, TO ALMOST IMPOSSIBLE WITH LARGER PLANTS. HOWEVER IT IS KNOWLEDGE ALL COTTON GROWERS NEED TO HARNESS.

For the last three years, volunteers and ratoons were identified by respondents to the Crop Consultants Association (CCA) survey to have increased in prevalence year on year. More concerning is that volunteers and ratoons were recognised as the weed that is having the largest impact on their clients' profitability.

In 2010, the CCA were asked what are the most effective and reliable operations used by their clients to prevent cotton ratoons. While there was a range of different responses, it is interesting to note, that being successful appears to rely on a number of strategies implemented over time. Some examples include:

- "Effective stump removal when pupae busting, avoiding back to back and stringent controls in fallow"
- "Mulch/root cut/side bust/fallow over summer and spray group B and Group I herbicides to control before going back to cotton."
- "Post cotton discing of fields two to three times. Pre-water and then spray out with non-glyphosate or mixed herbicide"
- "Deep root cut and weed seeker"
- Full cultivation, slash and root cut, bean knife cut, spray volunteers with chemicals other than Roundup"
- "Root cut/cultivation followed by Group B in crop application in following wheat crop."
- Root cut, centre bust, discing and ripping.
- Furrow depth centre bust with winged tines and side tynes in the hill.
- Effective mulching and root cutting, middle busting or centre busting beds followed by chisel plough.
- Root cutting, side busting, fertiliser application to achieve 100% cultivation.
- Root cutting, followed by ripping, and sowing wheat straight behind the cotton.

Following post-harvest operations, management of volunteer and ratoon cotton is challenging. NSW DPI'S Graham Charles offers some insight.

"It is important to get on top of ratoons and volunteers early," he says.

"Lack of control increases resistance risks as well as serving as a reservoir for pests and diseases."

Volunteer cotton

Volunteer cotton plants occur wherever cotton trash is left following a crop

Graham suggests regularly monitoring areas where volunteers are likely,

"Cotton trash and volunteer plants are inevitable in-field following a crop, but also occur wherever bales or modules are placed, along the roads frequented by module trucks and in channels and drains where trash accumulates.

"As seedling volunteer cotton (less than six node) is much easier to control, areas on farm where trash has accumulated should be monitored to enable prompt and early control."

Volunteer seedlings which emerge over winter are likely to be killed by frosts, but seedlings emerging later in

the year are likely to establish and grow, whether they occur in a channel, in what is now a wheat paddock or a cotton field, or anywhere on the farm.

These unwanted seedlings are a major weed problem for the industry and need to be controlled before they become a host for pests and diseases, compete with other crops or cause stewardship issues.

"Like most cultivated crops, cotton has little hard-seededness, meaning that most volunteer cotton seedlings will emerge as soon as conditions become favourable in spring," Graham said.

"In wet winters, much of the seed may die before spring and relatively few volunteer seedlings are likely. Volunteer problems are most problematic following dry winters, with potentially very large numbers of seedlings emerging following spring rains or irrigation.

"Recognising when risks are higher, can allow the use of additional control tactics, such as strategic cultivations, and influence planting decisions such as whether to pre-irrigate."

Herbicide control

There are a number of herbicides registered for controlling volunteer cotton seedlings, as listed in the *Cotton Pest Management Guide 2012-13*,with most chemicals being effective in controlling four to six node seedlings. These registrations give growers a range of options that can be effective for controlling cotton seedlings in a range of situations.

However, the emphasis is on seedlings, with no registrations for seedlings beyond nine nodes of growth.

"Even within the label window, it is highly recommended that growers target smaller seedlings wherever possible, as 100 percent control is unlikely on larger seedlings under less than ideal conditions, such as moisture stress or cold stress," Graham said.

"For all these herbicides, best results will occur from using a double-knock strategy, such as using a registered herbicide to control volunteer seedlings prior to crop emergence followed up by an early inter-row cultiva

"IT IS IMPORTANT TO GET ON TOP OF RATOONS AND VOLUNTEERS EARLY. LACK OF CONTROL INCREASES RESISTANCE RISKS AS WELL AS SERVING AS A RESERVOIR FOR PESTS AND DISEASES."

NSW DPI's Graham Charles has been undertaking a CRDC-funded project investigating volunteer control using herbicides. He spoke about volunteer and ratoon control at a field day examining the issue at "Alice Downs" near Moree and is pictured with Pamela Benton of Cotton Grower Services Moree.

tion to remove any survivors.

"When volunteer plants get beyond this growth window, there are no registered herbicides for controlling these weeds and cultivation is the most cost-effective and efficient option."

Ratoon management

Ratoon cotton occurs when a plant survives over winter and then regrows from the old root stock.

Graham explains that this is not an unexpected outcome where plants are not disturbed, as cotton is a perennial plant, and has the potential to grow over many years, becoming progressively larger and more difficult to manage over time. Hence, cotton has to be managed post-harvest to prevent the problem of ratoon cotton.

"It is almost impossible to control a ratoon plant with herbicides in spring/summer, because of the relatively small leaf area on a ratoon plant compared to its very large root system," he said.

"In practical terms, it is rarely possible to get ratoon plants to take up enough chemical through their leaves to kill the roots. Even above-label rates of herbicide are very unlikely to be effective on ratoon cotton.

"When applied at high rates, a herbicide is more likely to kill the leaf material before much is translocated to the roots, so given the small amount of leaf material and large root system on ratoon plants, it is a given that a rate sufficiently high to kill the roots will almost certainly kill the leaves before it gets translocated, and so will not be effective at doing anything more than defoliating the plants.

"The simplest and most cost effective way of controlling ratoon cotton is to prevent it occurring by carrying out effective root cutting or root pulling after picking, in conjunction with an effective pupae-busting cultivation."

Cultivation

Where ratoon plants do occur, it is a sure sign that there is a problem in the system, and is best addressed by using a heavy cultivation to remove the plants.

A precisely placed tyne every one or two metres (depending on the row configuration) can eliminate ratoons with minimal soil disturbance and loss of moisture.

Dryland growers may be reluctant to use heavy cultivation to manage ratoon cotton, but it is the only cost-effective option, and the moisture lost through cultivation pass will be less than the moisture lost through the ratoon plants that can easily dry down the profile to a metre or more. A precisely placed tyne every one or two metres (depending on the row configuration) can eliminate this problem with minimal soil disturbance and loss of moisture.

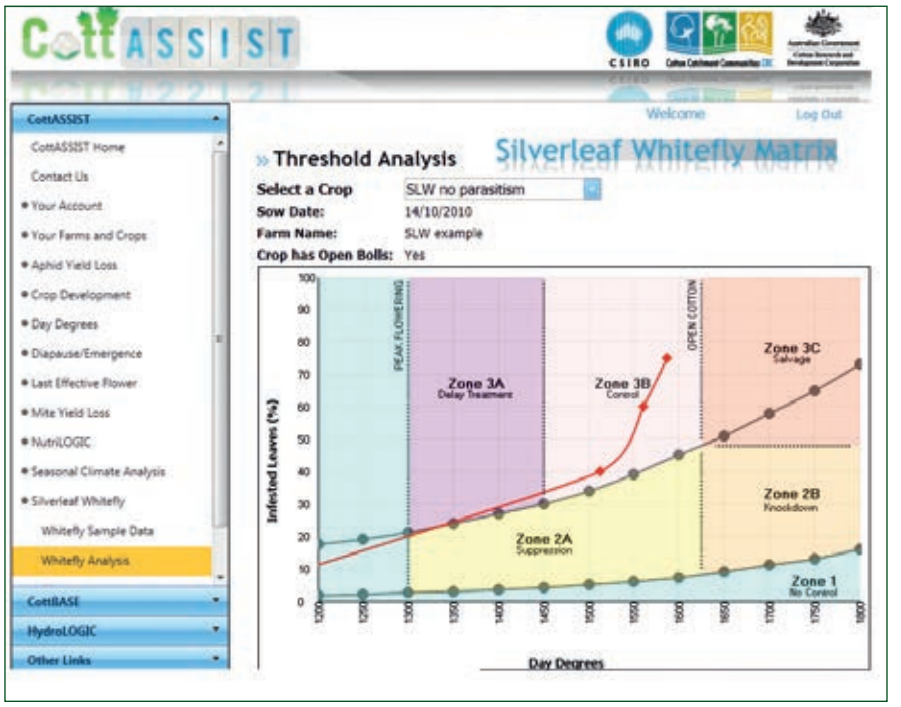
More information on herbicides and rates:

Cotton Pest Management Guide2012-13 – also available on the web at www.*my*BMP.com.au

see our website

INTEGRATED PEST MANAGEMENT: A WHOLE OF YEAR APPROACH

INSECT PESTS LIVE A LIFE OF CHANCE. THEIR SHORT LIFECYCLES AND IMPRESSIVE REPRODUCTIVE CAPACITIES ARE ESSENTIAL FOR THEM TO SURVIVE GIVEN THE EQUALLY IMPRESSIVE NUMBER OF WAYS THEY CAN MEET THEIR DEATH. IPM IDENTIFIES RESOURCES AND YEAR ROUND TACTICS THAT CAPITALISE ON THIS KNOWLEDGE, DISCOURAGING PESTS FROM COMING INTO THE CROP AS WELL AS MAKING PEST SURVIVAL IN THE CROP MORE DIFFICULT.



If whitefly populations start higher in the new season or if natural enemies are disrupted, then the population is more likely to rapidly increase into the control zone.

"Thinking about IPM in this way, spending money on insecticides during the season isn't the only way to get 'bang for your buck' in pest management," Development and Delivery Team IPM Specialist Susan Maas says.

"Insecticides have the advantage of being very targeted, but their influence is very short lived compared to investment in tactics that constantly suppress pests' capacity to thrive."

Susan encourages growers and consultant to develop an IPM plan for the whole farm utilising the full range of tactics across the entire year.

With no cotton in the ground, winter can become a time of complacency in relation to insect control, however as CSIRO's Dr Lewis Wilson highlights the importance of vigilance at this time of year.

"Volunteer and ratoon cotton plants, whether Bollgard II or conventional act as potential winter hosts for pests, especially mites, aphids and whitefly and as reservoirs for disease, such as cotton bunchy top," he said.

"This increases the risks of problems from these pests and diseases in the following cotton season."

Breaking the bridge

Looking at IPM as a year-round approach, growers and consultants are starting to consider next season's strategies as well address issues at hand such as removing weeds from fields and around farms. This is an integral part of any IPM strategy.

Breaking the green bridge over winter is an extremely effective tactic in IPM decreasing the risk of problems with these pests next season.

"Many growers and consultants are aware that early aphid infestations are more likely if lots of weed and cotton host plants are present over winter and into spring, and this can increase the risk of serious yield losses to cotton bunchy top," Susan said.

"However it is important to be aware that farm hygiene is a key component of management for all insect and mite pests."

Population size and temperature

Research has shown that the risk of population outbreaks in SLW is primarily driven by two factors; the size of the initial population in spring and the summer temperatures.

"Higher starting numbers give the whitefly the edge over their natural enemies and reduce the number of generation it takes to reach outbreak levels," she said.

"If you start with more pests in the spring, even with careful management and favourable climate (for population suppression) you are going to reach threshold quicker.

"For SLW this could be the difference between no control, suppression control or an insect growth regulator product or equivalent.

"This issue is further compounded by the likelihood that poor farm hygiene will result in other pests reaching threshold and requiring control.

"Any disruption to beneficial populations will increase the likelihood of pests such as SLW, mites and mealybug flaring late in the season.

"IPM is about using all the tools throughout the year to keep pests under control."

Role of resistance monitoring

Having a strong IPM system using a range of tactics including winter host control and strategic insecticide selection will also help manage resistance. Resistance has the potential to reduce the number of products available for pest control and impact any IPM strategy.

The Resistance Monitoring Program for Helicoverpa, aphid, two-spotted mite and silverleaf whitefly is conducted annually by the cotton industry and provides the foundation for the annual review and updating of the Insect Resistance Management Strategy (IRMS).

The IRMS is designed to both delay resistance development and to manage existing resistance.

All growers and consultants have access to this industry service to investigate suspected cases of resistance.

In this edition of *Spotlight* we have included reports from the managers of the resistance monitoring programs who offer sage advice to growers and consultants about the importance of IPM and resistance management.

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AN INTEGRATED PEST MANAGEMENT (IPM) PROGRAM AT THE WARNOCK FAMILY'S MAULES CREEK PROPERTY HAS RESULTED IN BIG CHANGES TO PEST MANAGEMENT OVER THE PAST 20 YEARS.

A SPRAY-FREE SEASON

Jack and Jacqui Warnock's "Warilea" is 25 kilometres east Narrabri in the Maules Creek area. The 1280ha property is managed by son Brendon.

Cotton represents 95 per cent of farm returns each year, with winter cereals (mostly wheat) and winter legumes (chickpeas, faba beans and field peas) as rotational crops.

The 2012-13 season was the first time insecticide wasn't used on the crop, apart from treatment on the seed at planting.

Brendon said the successful IPM plan at "Warilea" hinges on a number of factors: encouragement of beneficial insects through native re-vegetation/conservation and targeted sprays; maintaining healthy refuges; crop monitoring and careful use of thresholds before making any spray decisions.

The early days

Jack has been involved in the cotton industry since 1968 as an agronomist and cotton consultant before growing cotton in the Maules Creek area from 1984.

"When we started farming there had been very little development where groundwater was the predominant source of water for cotton," he said.

"Here we only use rainfall, groundwater and harvested storm water runoff. There is no access to river water for irrigation on our farm."

The Warnocks were among the pioneers in IPM in the Maules Creek area, and before making the change all those years ago, Jack travelled to cotton farms in the Goondiwindi and Border Rivers areas with consultant Jack Murray to examine the extent of insecticide usage and the success growers were having with IPM.

"We looked at how they were doing it, managing and monitoring the crops," Jack said.

"In those early years one of the main issues with IPM and encouraging beneficial insects was having neighbours do the same thing," he says.

"People were nervous in the early years after relying on insecticide for so long. Pyrethroids were still used for a while after we wanted to get away from those insecticides. We had to encourage our neighbours to change.

"Now no-one relies on insecticide in our part of the world."

A successful IPM program is dependent on managing a number of factors – which grower Brendon Warnock is acutely aware of.

Native re-vegetation

Brendon said spider, lady bug and predatory wasp numbers are well and truly on the rise and this proliferation is a major factor in their successful insect management plan. Tree planting is a factor in this and has been a long-term development goal for the property. Native trees and shrubs were planted about 20 years ago, including eucalypts, wattles, casurina, melaleuca and callistomens.

"Perennial native vegetation provides an alternative habitat for beneficials, especially over winter and when fields are fallow, thus maintaining their population in the nearby landscape," Brendon said.

"Complex vegetation, with different species and layers, is best for natural pest control.

"Re-vegetation here has incorporated a number of prolific flowering species such as eucalypts and melaleucas which are particularly attractive to a range of beneficial insects.

"In addition, over the 20 years the grassy understory has also added to this species complexity."

The trees created some problems with the competition for water where they adjoin irrigation fields, but their establishment was one of the family's long-term goals for the property.

Monitoring

Regular monitoring is one of the key upfront tactics of IPM, and the Warnocks have demonstrated that it takes a team approach to implement IPM. Consultant Steve Madden visits the farm two to three times a week to monitor crop development, insect pest and beneficial insects, nutrition and irrigation requirements.

"We wouldn't contemplate this program without using a consultant," Jack says.

"There was concern among consultants in the early days of what they were going to do when the new GM technology was introduced, but there's been no reduction in the demand.

"They're required all season, for all agronomic services.

"It appears that the issues with insect pests are changing from year to year. Perhaps it's due to the build-up of beneficial insects in local ecosystem, but we've had less and less worries with insect pests."

Being on target every time

Usually the Warnocks spray between one and two times a season, in recent seasons mainly for mirids and green vegetable bug with a possible need to control aphids by adding insecticide in the defoliation spray at the end of each season.

"We've got all these millions of little predators working for us now, and we aim to keep this balance, because if you lose it, it's hard to get it back," Brendon says.

"We are very conscious of spray thresholds are they are integral in the decision making process of whether to spray or not.

"That is why we monitor regularly, because for example mirids can be sporadic so there is a need to observe numbers over several checks.

"Then, if a decision is made to spray, it is very targeted toward the problem insect, so as to conserve beneficials and avoid flaring other pests."

The Warnocks run a mixed farming operation at Maules Creek near Narrabri in the Lower Namoi Valley and take a proactive and innovative view to farm management.

AN IPM PLAN

IPM is a year-round approach and is both pre-emptive and responsive. Up-front tactics work to reduce the incidence of insect pests on your farm. Active tactics enable you to supress populations in-crop at levels that protect its quality and yield.

Up-front Tactics

Whole farm weed management throughout the year to remove hosts.

Field selection that considers proximity to other host crops, sensitive areas eg watercourses, pastures and buildings – relative to the prevailing wind direction. Stubble loads and soil pest activity should be monitored in the lead up to planting.

Seed bed preparation and optimal planting time so that vigorous early growth enables crops to recover from damage from soil-dwelling pests such as wireworm, mealy bug and symphyla. Very late planted crops can be susceptible to pests such as whitefly.

Create a diversion using trap cropping to concentrate pests into a smaller less valuable area by providing the pest with a more preferred host crop for example lucerne can be used as an effective trap crop for mirid and aphids.

Plan and communicate your IPM strategy.

Monitoring the plant for pest and beneficials frequently provides the basis on which tactical decisions about pest management can be made in-crop.

Active Tactics

Build bigger populations of beneficials, (predatory insects, parasitic insects, spiders) through attraction and conservation. The abundance of beneficial insects in a cotton crop is affected by food resources, mating partners, proximity to other sources of habitat, climatic conditions and insecticide sprays.

Choose insecticides wisely – in addition to the efficacy against the target pest, it is very important to consider its selectivity and impact on beneficials, as well as the IRMS.

Be kind to bees. Insecticide use, particularly fipronil, abamectin, indoxacarb and pyrethroids, makes cotton crops a high risk environment for bees.

Communicate with neighbours as an area-wide approach is needed for pests that move quickly throughout the landscape.

Follow the IRMS and Resistance Management Plan.

Zero tolerance to ratoon and volunteer cotton (rogue cotton) is a host to all cotton pests as well as diseases. Control or removal should be given priority and should include in field as well as non-crop areas.

A healthy refuge

The importance of maintaining healthy refuges is clear at "Warilea" and is integral in the IPM plan.

A lot of time, effort and money are used to ensure it works to maximum efficacy.

This year the pigeon pea refuge was manually chipped twice, cultivated, and 'a lot of money' spent on herbicides to maintain it as a healthy, attractive crop to helicoverpa.

However the healthy refuge also played host to major beneficials insects, with spiders and lady beetle very prevalent. The crop will now be slashed and returned to the soil to make the most of its nitrogen-fixing qualities.

"We understand that by slowing the development of Heliothis resistance to Bt cotton we are lowering future control costs," Brendon says.

"With this mindset we see value in our refuge and take pride in doing a good job."

Weed control challenge

Weed management is perhaps the most undervalued tactic in IPM. Many cotton pests rely on volunteer cotton plants and weed hosts prior to migrating into cotton fields. Pests that gain the greatest advantage from weeds are those that can't hibernate elsewhere when conditions are unfavourable.

"Farm hygiene is very important," Brendon says.

"We try to keep the farm free of rogue cotton and weeds all year round and then in winter we focus on breaking the green bridge to avoid pests overwintering on our farm.

"IPM is a year-round approach because conditions change every year – and insects never give up, they are always evolving, as are our approaches to managing them."

EXPLORING THE BENEFITS OF BIODIVERSITY AT MUNGINDI

FIVE MUNGINDI COTTON GROWERS HAVE LAUNCHED INTO A NEW NATIVE VEGETATION BENCHMARKING PROJECT, TO EXPLORE THE BENEFITS BEING SUPPLIED AS FREE ECOSYSTEM SERVICES TO THEIR CROPPING SYSTEMS.

Ecological consultant Dave Carr and landholder Anthony Barlow taking part in a native vegetation assessment at Mungindi.

Species like native bats, birds and insects all play a critical role in pollination and predation on crop pests, but these animals need appropriate habitat if they're to survive in sufficient numbers to control pests like aphids, thrips, caterpillars and mirids.

The project was undertaken with support from the CRDC and the *Cotton Growers for a Sustainable Landscape* project.

"The Mungindi landholders wanted to better understand the natural environment on their properties and how natural ecosystems affect integrated pest management," explained Sally Dickinson, Regional Development Officer with the Cotton Development & Delivery Team, who oversaw the project.

The farmers involved in the benchmarking group manage almost 17,000 hectares of land in the Mungindi area.

Anthony Barlow is one of the five cotton growers in the group and is optimistic about the potential benefits of benchmarking native vegetation on farm.

"This project is important to highlight the great riparian native vegetation that most irrigators already have on their farms and this is an opportunity to get a baseline for these assets," he said.

"The idea of monitoring the relationship between insect management and native vegetation is really the next step for Integrated Pest Management."

Advantages of functioning ecosystems

"Through this project we're trying to better quantify the production advantages of maintaining and possibly even expanding these areas of natural habitat and biodiversity," Sally Dickinson says.

"Working with an ecologist like Dave Carr to benchmark on farm biodiversity, these landholders have been gaining a better understanding of the various components that make up a functioning ecosystem.

"They want to know what they are doing well in terms of managing their native vegetation, and what they can improve in order to get maximum advantage from the ecosystem services that areas of native vegetation can generate."

Biodiversity report positive

After visiting each of the properties, Dave said the biodiversity along creeks and riparian areas is in particularly good condition.

"Most of these areas are remnants of coolibah black box woodland," he said.

"There's a good mix of native plants making up the ecosystem, and a high diversity of tree species in a wide range of age groups, with lots of tree hollows and undisturbed fallen logs.

"We're trying to work out what's living in this bushland that can be beneficial to a cropping system, particularly the predatory insects, birds, and bats.

"Unfortunately, because the biodiversity is quite low in the crop paddocks on some of the properties we've assessed, there may not be enough movement of beneficial animals in the landscape to benefit the crops.

Increasing impact of beneficials

"One solution we may be able to investigate as part of this project, is whether it's possible to plant more native vegetation closer to the cropping areas, so the predatory beneficials can have a greater impact on crop pests.

"If the beneficials have better access to the cropping paddocks earlier in the season, they could stop pest numbers from building up to detrimental levels.

"If you can avoid just one or two early chemical pesticide sprays, by letting natural predators do the work for you, that's a significant reduction in your production costs.

"This can be a win-win scenario for farm production and for the public benefit of increased biodiversity.

"I think this project has made a particularly good start at identifying the benefits of managing and possibly even expand these areas of natural habitat as a tool to increase farm profitability."

The Mungindi Group project is administered and supported by the CRDC, with funding through the Commonwealth Government's Caring for our Country initiative and the Border Rivers Gwydir CMA.

PROTECTING THE FUTURE

NSW DPI'S DR LISA BIRD EXPLAINS THE ROLE OF RESISTANCE MONITORING AND THE IMPORTANCE OF THE IRMS IN MANAGING THE VIABILITY OF THE MODERN COTTON INDUSTRY.

NSW DPI Research Officer, Insecticide Resistance, Dr Lisa Bird oversees the annual Helicoverpa Resistance Testing program at ACRI.

The Resistance Monitoring Program is a part of the Australian cotton industry's pre-emptive insecticide resistance management strategy (IRMS) aimed at the early detection of field resistance. Resistance monitoring data are used to inform a wider consultation process for assessing the effectiveness of the IRMS and formulating countermeasures to reduce the risk of field failures and thereby minimise further spread of resistance in insect populations.

The IRMS is aimed at managing field-scale resistance risk directly in all cotton pests and includes all chemistries commercially available for use in cotton. In 2012 the IRMS was reformatted to reflect the increasing significance of non-Helicoverpa pests such as aphids, mites, mirids and silverleaf whitefly.

The strategy aims to address the risk of resistance associated with inadvertent selection of pests that are not the primary target of the insecticide, and to increase the relevance of insecticide use in Bollgard II cotton. Therefore the IRMS should be consulted for every insecticide or miticide application regardless of target pest and cotton variety.

Protecting technology

Since the introduction of Bollgard II, resistance to many insecticides has stabilised. This is particularly significant for the more selective products used to target Helicoverpa, such as indoxacarb (Steward®), emamectin benzoate (Affirm®), chlorantraniliprole (Altacor®) which are highly valuable in Integrated Pest Management (IPM) systems.

Hence in the interests of industry stewardship of these products there is an ongoing need for compliance with the IRMS to protect their long-term effectiveness for use in cotton production and other cropping systems that play host to Helicoverpa.

"THE IRMS SHOULD BE CONSULTED FOR EVERY INSECTICIDE OR MITICIDE APPLICATION REGARDLESS OF TARGET PEST AND COTTON VARIETY."

IRMS mitigates resistance risk

Resistance risk is managed through the IRMS by reducing selection pressure imposed on insect populations by any one chemical group. This is achieved by the use of a windows-based approach which restricts the timing and number of applications for any given product, and by encouraging rotation with other insecticide groups.

The IRMS is designed to fit with IPM principles and promotes the use of selective alternatives in favour of broad spectrum chemistries which are disruptive to beneficial insects and increase the risk of secondary pest outbreaks. More information can be sourced from the *Cotton Pest Management Guide 2013-14*.

The Australian cotton industry's Resistance Monitoring Program is a part of the industry's pre-emptive insecticide resistance management strategy (IRMS) aimed at the early detection of field resistance.

Resistance results

(Indoxacarb (Steward), emamectin benzoate (Affirm), chlorantraniliprole (Altacor))

Resistance to these IPM-compatible chemistries remains consistently low across all regions with very few survivors detected in 2012-13 (Figure 1). The change in the Steward window to provide an early season 'soft option' for Helicoverpa control has not led to detectable changes in resistance frequency.

Continued compliance with resistance management guidelines remains essential for minimising resistance risk associated with the use of Steward particularly because of the continuous window of use which extends from chickpeas into cotton.

It is not judicious to assume that resistance alleles selected by exposure to products used in non-cotton systems (chickpea for example) will be eliminated by exposure to Bollgard II in the subsequent generation. This is because the large majority of *H. armigera* will not preferentially establish on cotton but instead will favour alternative hosts present in a mixed cropping landscape such as maize and sorghum.

Low level detection of resistance to these products does not necessarily preclude the presence of resistance alleles in the Helicoverpa population. Overseas studies of indoxacarb and chlorantraniliprole resistance in *H. armigera* and several other species of Lepidoptera suggest that recessive alleles can confer resistance to these products.

We are currently calibrating new screening methods that will vastly improve our capability for detecting the presence of recessive resistance alleles for conventional products and therefore enable effective resistance management if overall product use increases.

Organophosphate & carbamate resistance

Resistance to organophosphates (chlorpyrifos) remains present in *H. armigera* populations since being detected again in 2001/02. However, resistance frequencies have declined to very low levels – less than three percent – which have been maintained over the last eight seasons. Results for 2012-13 indicate a continuing trend of low frequency organophosphate resistance.

Carbamate resistance has been present at moderate frequencies for over 10 years, with typical frequencies of 20 to 30 percent. Results from season 2012-13 show resistance to carbamate remains at moderate and stable levels, with regional frequencies ranging from 17 to 32 percent.

Synthetic pyrethroid (SP)

Synthetic pyrethroid (SP) resistance is well established in Australian populations of *H. armigera* at variable but generally high frequencies. Monitoring has historically involved the use of fenvalerate and, while not registered for use in Helicoverpa control, fenvalerate provides a good indicator of general SP resistance.

In 2011 the frequency of SP resistance increased by 30 percent. Results from this season show that general SP resistance remains fixed in the *H. armigera* population at 90 percent with regional frequencies ranging between 87 and 95 percent.

In 2011 resistance to the SP bifenthrin (Talstar®) also increased by 30 percent to an average frequency of 40 percent. The situation remains unchanged this season with regional frequencies ranging between 36 and 48 percent.

The implications of these results for management are that applications of SPs on *H. armigera* dominant populations will provide little or no control. Nevertheless, *H. punctigera* remains fully susceptible to SPs and will continue to provide effective management of this species. Therefore it is important to consider species composition before using SPs for Helicoverpa control.

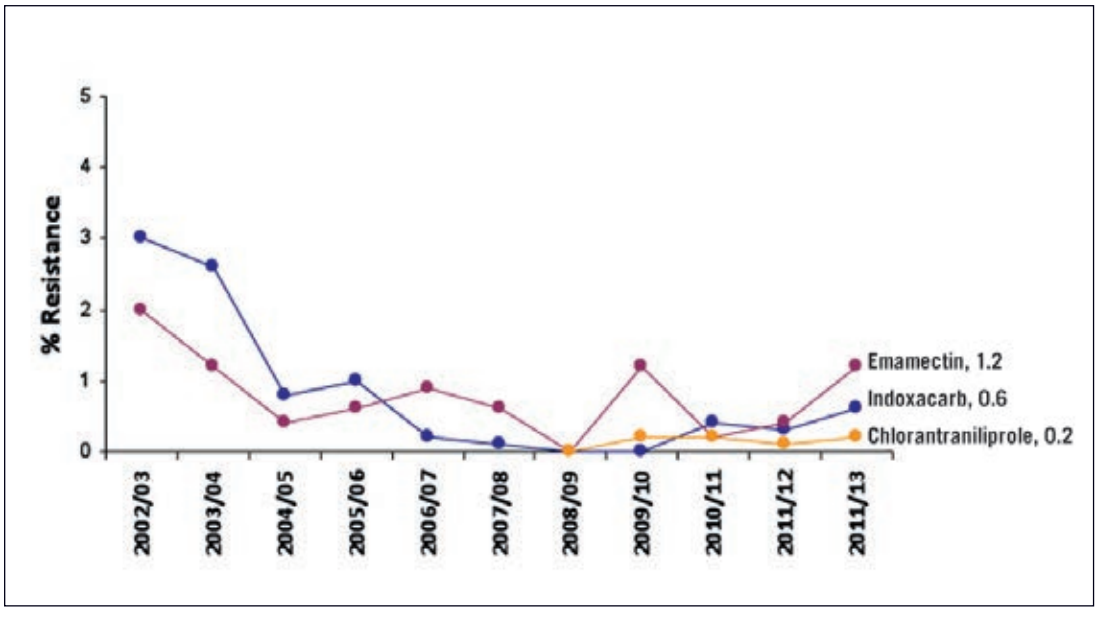


Figure 1. Annual indoxacarb, emamectin benzoate and chlorantraniliprole resistance monitoring results – average all regions (H. armigera)

RESISTANCE MONITORING RATES RISKS AMONG SUCKING PESTS

NSW DPI's Grant Herron and his Entomology Insecticide Resistance group monitor for resistance in key sucking pests of cotton with data underpinning the sustainable use of insecticides.

THE SUSTAINABLE USE OF INSECTICIDES TO CONTROL SUCKING PESTS RELIES HEAVILY ON THE WORK OF NSW DPI'S DR GRANT HERRON AND HIS RESISTANCE MONITORING TEAM.

The use of Bt cotton in Australia has resulted in a reduction in chemical insecticide usage to control Helicoverpa, however each season problem sucking insect pests such as bugs, mites and cotton aphid still threaten cotton yield and insecticides are the primary line of defence.

NSW DPI's Grant Herron and his Entomology Insecticide Resistance team monitor key sucking pests including aphids, mites and mirids. This data underpins the annual Insect Resistance Management Strategy recommendations for insecticides.

"Resistance monitoring is absolutely critical to successful Integrated Pest Management (IPM) because IPM-preferred chemicals are few and when lost to resistance IPM itself can fail," Grant says.

Using broad-spectrum insecticides depletes beneficial insect populations and often leads to further pest outbreaks. Inevitably there is selection for insecticide resistance.

Dealing with the resistance risks requires on-going monitoring for of pest susceptibility to key insecticides.

Cotton aphid

Cotton aphid is resistant to a range of insecticides in many crops and countries. The cotton aphid has the potential to do enormous damage by reducing yeild but more importantly Australia's reputation for producing high quality clean lint.

"The most useful IPM-preferred chemical for aphid control in cotton is pirimicarb and a decade ago it was all but lost to resistance," Grant says.

"Now pirimicarb-resistant cotton aphid continues to be infrequent, so the chemical remains a relaible IPM-preferred method of aphid control. However, there is likely cross-resistance between phorate (Thimet) and pirimicarb (Pirimor) and dimethoate/omethoate. If phorate (Thimet) is used as a side dressing for insect control, then neither pirimicarb (Pirimor) nor omethoate/dimethoate should be used as the first foliar spray for any subsequent insect control.

Continued control

In recent seasons resistance developed in aphids against the neonicotinoid chemicals including thiamethoxam (Cruiser) and clothianidin (Shield). Growers may not have been targeting aphids but if they were present in fields at low levels, resistance was still being selected. Resistance increased quickly and by season 2010-2011 it was detected in nearly every strain.

Then in 2011-12, Grant and his team found the frequency of neonicotinoid resistant cotton aphid markedy decreased from the 96 percent high to a moderate 22 percent tested. Data this season again suggests resistance is declining and for 2012-13 is likely to be about eight percent strains tested. Grant says the decrease in neonicotinoid resistant aphids is likely more related to a subtle change in the way foliar neonicotinoids are being used against pests other than aphids, rather than a reduction in neonicotinoid seed dressing consumption or an increase in seed dressing efficacy.

"There is now an increase in sprays specifically targeted against green mirids, with high reliance on Regent (fipronil), which accounts for about 70 percent of sprays and organophosphates (omethoate and dimethoate) accounting for about 20

Two-spotted mite is notorious world-wide for developing insecticide resistance and Australia is no exception.

percent of sprays," Grant said.

Mites

Grant said anecdotally, two-spotted mite is being displaced by bean spider mite or strawberry mite with sprays intended for two-spotted mite control now often targeting misidentified strawberry mite.

"Proper identification can help pest managers to save money as the strawberry mite seems to cause much less damage than TSM even when present in high numbers," he said.

"For that reason thresholds for strawberry mite control will likely be much higher than TSM and spraying may not be needed at all." Two-spotted mite (TSM) is notorious world-wide for developing insecticide resistance and Australia is no exception.

"Although TSM remains resistant to many of the chemicals used for its control it is becoming rare and appears to be being displaced by other mite species," Grant said.

"Once both bean spider mite and TSM were collected and tested for resistance but from about 1980 bean spider mite disappeared from Australian cotton.

"This is unusual because normally bean spider mite would displace TSM but for the past 30 years bean spider mite has been virtually absent from Australian cotton."

The reason most likely relates to TSM's ability to develop resistance.

For instance, Grant says, bean spider mite resistance to the OP monocrotophos never exceeded about 10 fold, yet TSM resistance to the same chemical was often hundreds of fold. Now TSM is rare and only seen in southern NSW. Although still resistant, absolute spray numbers may now be too low to give TSM the competitive advantage it once had.

"It would anecdotally appear some recent TSM sprays are actually controlling misidentified strawberry mite that causes significantly less damage than two-spotted mite although strawberry mite and TSM do look very similar."

Mirids – the next challenge

The development of insecticide resistance in mirids remains a possibility and methods are being developed to detect both neonicotinoid and fipronil resistance. Testing mirids against insecticides is not particularly difficult, however they are very fragile and easily damaged, creating logistical difficulties for establishing a program that monitors field resistance.

"Similarly, I have collected green mirid from unsprayed lucerne and tested them against the neonicotinoid clothianidin (Shield)," Grant said.

"The dose response for clothianidin (Shield) has been established to identify a discriminating dose for resistance monitoring.

"In the 2013 spring I will do the same for fipronil but my ultimate concern with mirids is the difficulty establishing green mirids suspected to have resistance into culture and maintaining them prior to resistance testing.

"Mirids do not travel well because they are very fragile and in my experience most will die in transit on their way to the laboratory for testing. Those that do establish into culture will be slow and time consuming to breed and resistance may revert before it can be diagnosed.

"It is a species that will benefit from molecular based testing methodology and to that end I am developing a molecular method for detecting fipronil resistance in green mirid."

For season 2012-2013, 12 strains of cotton aphid were collected and are currently being evaluated against pirimicarb (Pirimor) (*ACE*1), organophosphate specific (A302S), thiamethoxam (Cruiser), clothianidin (Shield) and diafenthiuron (Pegasus) resistance.

While testing is not yet complete, if similar to last year there will be no diafenthiuron (Pegasus) resistance, none or very little pirimicarb (Pirimor) or organophosphate specific resistance with moderate to low frequencies of thiamethoxam (Cruiser) and clothianidin (Shield) resistance. The likely decline in neonicotinoid resistance from a 96 percent high two seasons ago has happened despite the amount of thiamethoxam seed dressing used in Australian cotton increasing rather than decreasing and a higher rate 'Extreme' product also being available.

"I suspect any reduction in neonicotinoid resistance is due to the way foliar neonicotinoid sprays (eg clothianidin or acetamiprid) rather than seed treatments are being used," Grant said.

"Resistance issues in cotton aphid have often been thought linked to concurrent selection and I consider it likely that neonicotinoid use against pests such as green mirid and vegetable bug *Nezara viridula* has subtlty altered and this is coincidently changing the neonicotinoid resistance frequency in cotton aphid."

" DEALING WITH THE LIKELIHOOD OF RESISTANCE REQUIRES ON-GOING MONITORING FOR RESISTANCE TO KEY INSECTICIDES IF FUTURE CONTROL PROBLEMS ARE TO BE AVERTED."

Acknowledgments

Dr Idris Barchia, Dr Yizhou Chen, Daniel Bogema, Monica Suann, Kate Marshall, the many researchers, consultants and growers who collected aphids and mites are thanked.

SLW RESISTANCE: GOOD LUCK OR GOOD MANAGEMENT?

WHILE RESISTANCE LEVELS IN SLW REMAIN LOW, BEST PRACTICE MANAGEMENT IS CRITICAL TO ALLAY THE EVER PRESENT RISK OF THIS PEST'S ABILITY TO RAPIDLY BECOME RESISTANT TO INSECTICIDES.

IMAGE COURTESY C MARES CSIRO

The current IRMS is as relevant for SLW (pictured) as it is for Helicoverpa and aphid management all of which are underpinned by the successful stewardship and resistance management plans for Bt technologies.

As with the results for Helicoverpa spp. resistance levels to conventional insecticides (see Pages 14-15), data from 2012/13 testing has also confirmed that resistance levels remain low for the key insecticides used for silverleaf whitefly (SLW) management.

QLD DAFF's Paul Grundy currently heads the industry's SLW Resistance Monitoring Program and reports that testing of SLW collected from across each of the cotton growing regions has confirmed that resistance to Admiral® (Pyriproxyfen), Pegasus® (Diafenthiuron) and Talstar® (Bifenthrin) remains at very low levels and this is unchanged from last season.

"Growers can therefore expect these products will continue to be effective in 2013/14 when used within the parameters set by the Insect Resistance Management Strategy (IRMS) ," Paul said.

"SLW also remain fully susceptible to the newer insecticide Movento (Spirotetramat) which has seen limited use since its registration and therefore minimal selection pressure."

Technical Officer Dr Raechelle Grams conducts a bioassay for SLW resistance testing in the Toowoomba QLD DAFF laboratory.

Weather a major factor

Paul says a run of wetter than average seasons was a major factor in the reduced prevalence of SLW and consequent low frequency of spraying.

"The pattern of SLW outbreaks as this pest has advanced south over the past five to six years has followed a typical pattern seen with the initial outbreak in Central Queensland," Paul said.

"This has been above threshold SLW numbers in the majority of fields during the first and second seasons of outbreak, followed by a general dampening of populations due to responsive natural enemy populations and the efforts of people paying more attention to early season pest management to avoid all forms of disruptive chemistry.

"In areas such as Central Queensland that witnessed the industry's most severe outbreaks of SLW a decade ago it is now common place for only 10 to 30 percent of fields to be treated in any one season and when SLW is treated, products such as Pegasus or Movento are typically used to target several pests collectively.

The IRMS principles are much more difficult to adhere to when outbreaks occur readily and become widespread. Prevention is definitely the most secure approach.

Rapid resistance evidenced

It is well demonstrated in Queensland's coastal horticultural regions and in some of the United States' cotton production counties, that SLW can rapidly acquire resistance and become difficult to control when pesticides are used without effective stewardship.

"EFFECTIVE INTEGRATED PEST MANAGEMENT (IPM) IS THE CORNERSTONE FOR SUSTAINABLE PEST MANAGEMENT..."

"For the Australian cotton industry so far the biggest plus for SLW resistance management has not only has been the effective stewardship of insecticide use but the effective deployment of Bollgard cotton which has greatly reduced overall insecticide use and allowed natural enemies for SLW to establish in new regions and lower the reliance on pesticides for SLW management," Paul said.

Therefore the message from the SLW Resistance Testing Program is one that is consistent with all of the industry's resistance testing programs.

"Effective Integrated Pest Management (IPM) is the cornerstone for sustainable pest management and for cotton a significant part of IPM is the responsible stewardship of conventional and transgenic technologies all of which work in unison together," Paul said.

"The current IRMS is as relevant for SLW as it is for Helicoverpa and aphid management all of which are underpinned by the successful stewardship and resistance management plans for Bt technologies.

"The relative ease with which insects have been managed during the last decade compared to the 1990s is testament to this integrated approach."

THEODORE GROWERS CONFRONT NEMATODE CHALLENGE WITH SCIENCE

THEODORE COTTON GROWERS ARE FACING AN UNPRECEDENTED CHALLENGE TO THEIR PRODUCTION CAPACITY FOLLOWING THE RECENT DISCOVERY OF RENIFORM NEMATODES IN SEVERAL IRRIGATED COTTON PADDOCKS.

Controlling reniform nematode is a challenge these growers are determined to beat through participating in a collaborative region-wide soil sampling project between CRDC and Queensland Department of Agriculture, Fisheries and Forestry (QLD DAFF); by establishing trials to assess best management options; through on-going assessment of plants and by taking a rigorous approach to weed management and farm hygiene practices.

Reniform nematode (*Rotylenchulus reniformis*) is a plant parasitic nematode that feeds on the plant root using retractable, hollow, spear-like mouthparts causing plant stunting.

This is only the second time it has been found in Australian cotton crops and, unlike other soil nematodes, it is more suitable to the heavy clay soils.

Experience from countries like the United States where reniform nematode is prevalent in cotton suggests that not only can yield losses be severe in crops with high populations, it also has the ability to interact with certain fungal pathogens in disease complexes exacerbating the effect on plant productivity.

Whether this interaction is likely with Australian strains of disease and Australian varieties is unknown at this stage.

Intensive sampling undertaken

The detection of reniform nematode is a bitter pill for Theodore growers to swallow – many are still recovering from partial or complete loss of cotton crops in March and December 2010 following major floods in the Dawson River and can ill-afford potential yield losses in future crops.

In a bid to attain a comprehensive data set on the populations and spread of reniform nematode, a team headed

ABOVE:
Peter French, "Nandina" Theodore, says the important thing is to learn how best to manage the nematodes which is what he is working toward now.

by QLD DAFF plant pathologist Linda Smith has spent weeks in the Theodore area sampling every field in the irrigation area, taking 100 core samples of soil every 10 hectares from which a subsample is then extracted for testing.

"We need to get a handle on populations and then compare that to yield data. We also need to determine at what thresholds the reniform nematode is having an impact on plant growth," Linda said.

"At least we are now on our way to understanding the issue and that's a critical step in addressing the challenge."

JENNIFER COBON QLD DAFF

Reniform nematode are under the microscope from QLD DAFF.

Come Clean Go Clean essential

Linda said the Australian industry had sourced important and helpful information from the United States but stressed that it was vital to collect data sets under Australian conditions to understand how the parasite behaved in local soils and under local climatic conditions.

Soil sampling is being carried out across Theodore both post-harvest and pre-spring plant and once results are collated, targeted management strategies can be recommended.

In the meantime, the resounding message from industry in early management of the parasite centres on farm hygiene and strict enforcement of the `Come Clean Go Clean' procedure to minimise the spread of the nematode, monitoring crops for underperforming/stunted plants and liaising with QLD DAFF to discuss sampling, and vigilance on weed management to avoid the presence of host plants.

How long reniform nematode has been present in soils around Theodore is unknown and the effect of the parasite on plants may have been masked over several years by waterlogging or unknowingly attributed to damage by symphylans – white, soft bodied, centipede-like, soil inhabiting anthropods that affect a plant's root development leading to stunted crops – which were particularly prevalent in cotton crops around Theodore in the 2008/2009 season.

Estimating production risks

However unpalatable the results for growers, a baseline assessment of the reniform nematode presence will allow them to estimate production risks, make informed decisions on strategic crop management and seek chemical control options where appropriate.

There's little doubt that affected growers will be forced to carefully consider their cropping management options if they are to minimise the future impact of reniform nematode on plant performance and yield.

The challenge comes in considering

Theodore growers Peter and Diana French, "Nandina", are well-aware of the production threat posed by reniform nematode having experienced yield losses in areas of their 2012/13 cotton crop due to plant damage by the parasites.

In an effort to help generate as much data as possible surrounding reniform nematode behaviour under Australian soil types, conditions and crop varieties, the Frenchs are participating in a QLD DAFF trial to assess management options under high populations in country cropped to wheat compared to fallow cotton country.

"We are still learning about reniform nematode and we have no idea how we ended up with them in the first place – we'll probably never know," Peter said.

"Currently we are doing our utmost in terms of good farm hygiene and weed control to ensure we aren't inadvertently spreading the parasite or providing host crops.

"The important thing though is that we learn how to best manage them and that's what we are working towards now."

The Frenchs have grown cotton at Theodore for the past 50 years and these days grow around 350 hectares under irrigation.

Like other areas of central and southern Queensland, the Frenchs had a wetter than average summer and with a full profile of moisture, initially decided to direct drill wheat into around half of their cotton country in a bid to improve soil structure by providing a green manure crop.

At the outset there were suggestions that their decision to plant wheat could have a double benefit in managing reniform nematode populations as it is not a host plant and therefore does not enable the parasite to reproduce. This theory is unproven however and overseas experience indicates that this strategy may have minimal impact on populations.

"In our case, we think soil fumigation is the wrong approach as we've spent years developing soil structure and biology and are very reluctant to threaten that," Peter said.

"In terms of cropping management we may well have to consider incorporating non-host crops like maize or sorghum for a few years within our cotton rotation to avoid significant yield loss.

"That will be easier said than done though as we, like most of the irrigation farmers here, can grow other crops using our existing machinery but are not set up to handle the grain come harvest time. We don't have the required harvesting equipment and are not set up for grain handling or storage.

"What we are really hoping for is that whatever management techniques we use, we are able to create an environment where the reniform nematode is kept at manageable levels – a little like we were able to do with the symphlids a few years ago and with some luck that experience will stand us in good stead to manage this new challenge."

alternatives to a cotton-on-cotton rotation when many growers are not equipped with the machinery, infrastructure or available land to diversify into other crops and crop/fallow rotations.

Theodore growers Peter and Diana French, "Nandina", are well-aware of the production threat posed by reniform nematode having experienced yield losses in areas of their 2012/13 cotton crop due to plant damage by the parasites.

In an effort to help generate as much data as possible surrounding reniform nematode behaviour under Australian soil types, conditions and crop varieties, the Frenchs are participating in a QLD DAFF trial to assess management options under high populations in country cropped to wheat compared to fallow cotton country.

Greg and Dan Austin, KB Cotton, are also participating in QLD DAFF trials which comprise replicated strip plots comparing the effects of irrigated wheat to bare fallow on the nematode population.

"We really appreciate the Frenchs and Austins agreeing to conduct these trials. On-farm trials are the best way for us to gain an understanding of how to manage this problem," Linda Smith said.

Bartley Bauer Plant Pathologist Ecosciences Precinct Brisbane, Linda Scheikowski Plant Pathologist QLD DAFF Toowoomba, John Lehane Senior Experimentalist QLD DAFF Toowoomba and Linda Smith QLD DAFF Plant Pathologist Brisbane spent time at Theodore recently undertaking soil sampling work in cotton fields.

Crop rotation constraints

In other countries where reniform nematode is present in cotton, management strategies centre on crop rotation with peanuts, maize rice or sorghum, variety selection with nematicides and pre-season sampling for nematode populations.

According to Theodore-based Cotton Consulting Services agronomist Simon Struss, the difficultly for many Theodore growers, particularly those in the irrigation area, is a lack of available land for rotation, the economic cost of moving from a cotton-on-cotton rotation and the unsuitability of higher value rotation crops like peanuts to the region's heavy clay soils.

"Unfortunately this plays into the hands of the nematode but at the end of the day, growers need to balance their management with economics," Simon said.

"We are also looking at potential options for insecticide use but we have a lot of work to do before we can begin to understand the relationship between level of infestation and dollar return."

Data needed for assessment

Simon said it would be difficult to make an accurate assessment of reniform nematode's impact on the Theodore cotton growing region until quantitative data on populations and spread was made available.

"I suspect the results will show that the nematode damage has been severe in some blocks and has had a more subtle impact in other blocks. That subtle damage has possibly been masked in recent years by the climatic conditions but until we have some solid data to prove our suspicions, we can't really assess the level of the beast," he said.

Early observations showed that the majority of damage occurred in paddocks to the east and north of Theodore township with yield losses estimated to be around 30% on average but as high as 50% in the worst affected areas.

While these yield losses were patchy and not general across the Theodore region, they nevertheless represented a significant financial cost to individual growers.

Best management practice

Dawson Ag Consulting agronomist Damien Erbacher is working with a number of the affected growers and said at this stage, growers were simply continuing with normal best management practices to mitigate against future crop damage from the nematode.

"We have already begun managing for reniform nematode because we know it is here. We have been liaising with the relevant departments and authorities in Australia and specialists in the United States to ensure we learn from the experience of others and have the most up-to-date information at hand," Damien said.

"At a farm level, growers are continuing to do best practice basics when it comes to insect and disease management particularly in terms of weed treatment and farm hygiene.

"That said, we are waiting to see the results of threshold testing which will help us make some strategic decisions for the spring plant."

"THE RESOUNDING MESSAGE FROM INDUSTRY IN EARLY MANAGEMENT CENTRES ON FARM HYGIENE ..."

NITROGEN NUTRITION: INDUSTRY TRENDS

INGRID ROTH & IAN ROCHESTER DRAW ON THE 2011 GROWER SURVEY, THE CROP CONSULTANTS AUSTRALIA SURVEYS AND RESEARCH PROJECTS TO LOOK AT THE VARIATION BETWEEN AUSTRALIAN COTTON FARMS IN NITROGEN FERTILISER RATES, APPLICATION METHODS AND TIMING.

Making the most of fertiliser inputs has become a key issue for growers and consultants over the past few seasons – with questions about timing, placement and rates.

It's no wonder nutrition is such a hot topic when considering the combined effect of increasing application rates and price increases has led to fertiliser input costs quadrupling over the past two decades according to *Boyce Chartered Accountants Cotton Comparative Analysis 2012* (Figure 1).

Surveys show rates of applied nitrogen have almost doubled over the past 15 years. In the 2010-11 season irrigated cotton crops received an average of approximately 220 kg N/ha applied compared with 125 kg N/ha in 1997 and 176 kg N/ha in 2001.

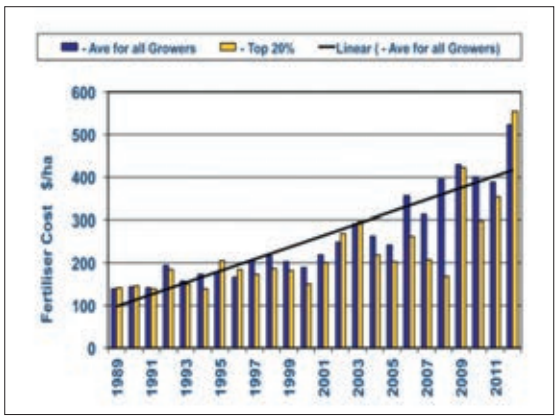


Figure 1: Rising fertiliser input costs for cotton crops from 1989 to 2012

Source: Boyce Chartered Accountants Cotton Comparative Analysis 2012

Data are from agronomic experiments at the Australian Cotton Research Institute (ACRI) and cotton breeders' field's show there is wide variation between farms (Table 1) that is not clearly linked with yield (Figure 2).

The ACRI data showed that high yields can be attained from moderate (less than 200 kg/ha) N fertiliser rates. Similar trends were seen for phosphorus and potassium. Note that these are rates of fertiliser applied for the cotton crop only and do not take into account existing soil levels or field history.

Applied Fertiliser (nutrient rates)	Irrigated			Dryland		
	Avg.	Min	Max	Avg.	Min	Max
Preseason nitrogen – solid fertiliser (kgN/ha)	142	11	350	89	50	150
Preseason nitrogen – gas fertiliser (kgN/ha)	155	60	300	84	50	140
In season nitrogen – solid fertiliser (kgN/ha)	99	9	300	45	0	180
In season nitrogen – gas fertiliser (kgN/ha)	83	11	200	40	20	60
In season nitrogen – water applied fertiliser (kgN/ha)	57	9	250	5	5	5
Total applied Nitrogen	217	30	534	96	33	330
Preseason phosphorus – fertiliser (kgP/ha)	42	1	250	14	2	50
In season phosphorus – fertiliser (kgP/ha)	20	1.0	100	13	3	40
Total applied Phosphorus	40	1	250	16	2	50
Preseason potassium – fertiliser (kgK/ha)	32.6	0.4	120	7.6	0.4	20
In season potassium – fertiliser (kgK/ha)	15.2	1.1	60	2	2	2
Total applied Potassium	28.3	0.4	120	6.7	0.4	20
Zinc fertiliser (kgZn/ha)	6.9	0.2	105	3.7	0.2	15
Sulphur (kgS/ha)	6.3	0.1	55	2.4	1	6
Trace elements *	21	7	65	4	4	4

Table 1: Rates of fertiliser applied to irrigated and dryland cotton in 2010-11
Source: 2011 Cotton Grower Practices Survey – the CCA survey measured similar rates.
(Averages exclude zero values)

VALUE OF GROWER SURVEY

CRDC invests in grower surveys to gain a clearer picture of on-farm practices, helping to target research and extension efforts. This year CRDC are investing in a single, consolidated survey of growers to make it simpler for you to provide input to industry and research.

Ingrid and Guy Roth of Roth Rural are undertaking the survey along with regional research "Think Tanks" and a review of data about farming practices.

To find out more about this season's management decisions, the 2013 Cotton Grower Survey will be in mailboxes next month. It is of huge value if you can contribute your farm's input to this industry survey.

Typical trend?

The 2010-11 season was a very wet, with flooding and waterlogging in several regions. This reduced yields in some areas, particularly the Darling Downs and Central Queensland. Some growers applied extra nitrogen in an attempt to recover crops. (The Dawson Valley was not included in the 2011 survey due to flooding).

"If cotton soils are severely waterlogged before January, more N is likely to be lost and cotton crops may respond to extra N," says CSIRO's Dr Ian Rochester.

"When fields are waterlogged in January or later, N loss is less likely as the N has already been immobilised to an organic form. In these cases, extra N is unlikely to help, particularly in fields with a history of high N rates.

"It might give a green flush but not follow through to yield."

Application method and timing

Ingrid Roth says the 2011 Grower Survey shows approximately 70 percent of farms used split applications of N in the 2010-11 season, 20 percent applied all up-front and 10 percent all in-season. The proportion of N applied upfront varied widely between farms with no apparent influence on yield (Figure 3).

"Growers and consultants reviewing these findings at a recent round of regional CRDC 'Think Tanks' highlighted that timing of fertiliser application in 2011 was greatly influenced by the wet season," Ingrid said.

"For many farms it was too wet in the winter of 2010 to get fertiliser on, resulting in more being water-run or side-dressed.

"Most growers commented that they are aiming now to put more fertiliser on upfront.

"It will be interesting to see how this compares with what growers have done in 2013, which was a very different season."

Placement

Research recommends that on clay soils, N is best applied by deep drilling pre-sowing.

"SURVEYS HELP TARGET RESEARCH AND EXTENSION EFFORTS ..."

"Deep placement into cold soils before sowing slows and reduces the loss of N compared with shallow fertiliser application to warmer soils when applied in-crop," Ian said.

"We first reported trials on timing of N fertiliser application in 1988 and we've repeated the trials every decade or so to see how it compares with changing varieties.

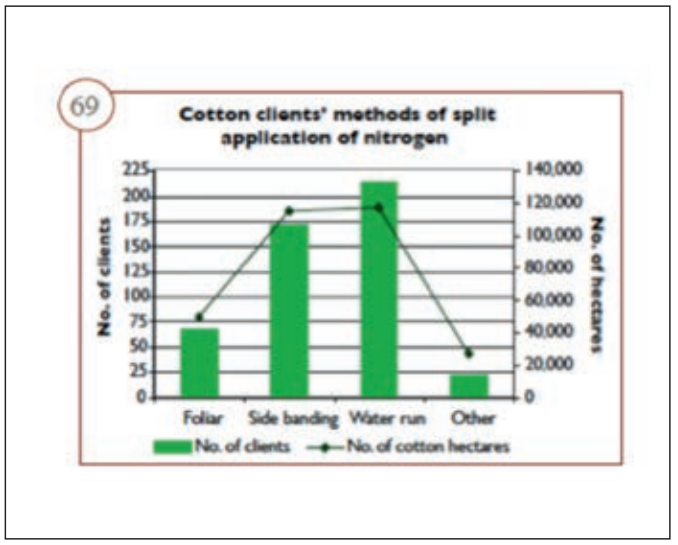


Figure 4: Methods of in-season application of nitrogen in the 2010-11 season

Source: CCA Qualitative report

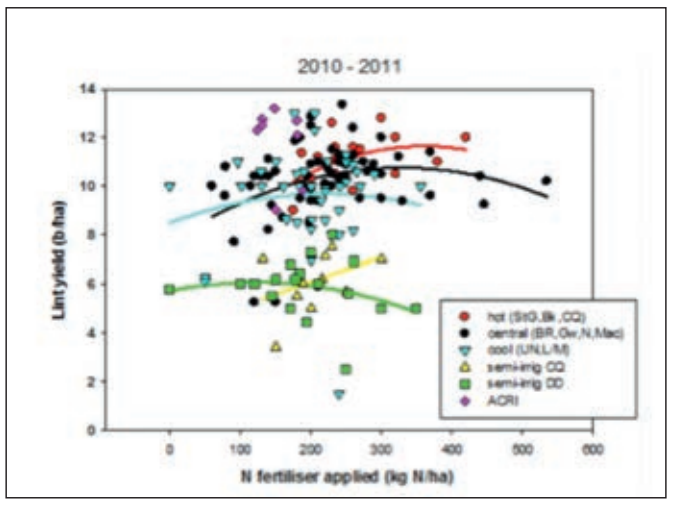


Figure 2: Applied nitrogen rates on farms and in research trials at ACRI in 2010-11

Source: 2011 Cotton Grower Practices Survey and CSIRO research sites at ACRI.

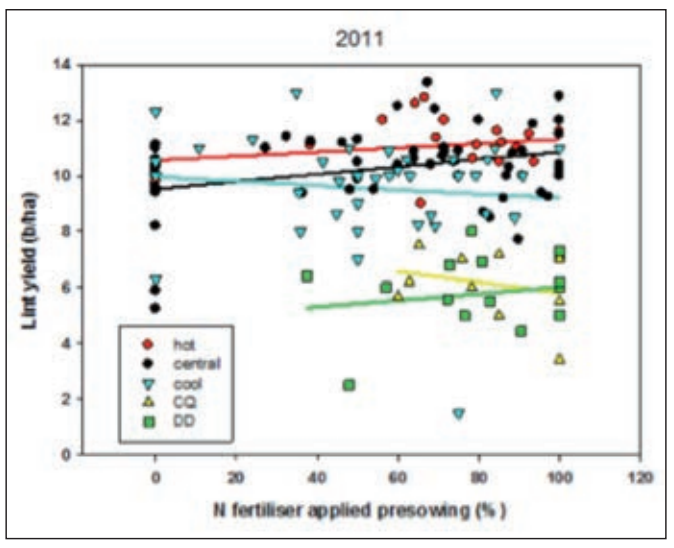


Figure 3: Proportion of Nitrogen applied upfront vs yield in 2011

Source: 2011 Grower Survey

"Today's plants grow more quickly and take up more nitrogen but the principle of timing of nitrogen application has stayed the same.

"These experiments have always found that it is just as efficient to apply all the nitrogen upfront by deep placement in winter rather than side-dressing or water-run

"Many growers think that in-crop applications are more efficiently used (being applied when the crop is taking up N rapidly) but denitrification is temperature driven – it is higher when N is applied to warm wet soil and much slower in cold soils. Essentially, these factors balance each other out."

How are growers deciding fertiliser rates?

The Grower Survey found 81 percent of growers used soil testing when deciding fertiliser rates in 2011 and 38 percent used leaf or petiole testing. In 2010, 69 percent of growers soil tested every season. Field history, target yield and agronomist recommendation are also major influences on fertiliser decisions.

To continue to monitor these trends growers are urged to take respond to the survey.

"Your input to the 2013 Cotton Grower Survey will help us to compare fertiliser and other practices in the hot season of 2012-2013 with the wet season of 2010-11," Ingrid said.

WHAT RESEARCH IS UNDERWAY?

The recent regional CRDC think tanks all had a lot of discussion about improving the efficiency of fertiliser applications.

This included fertiliser placement and timing and better understanding the interactions between soils, nutrition and root development.

In some regions, growers are seeing large yield differences between head ditch and tail drain ends of the field – raising concerns about nutrient loss down the row and options for management.

In response to these issues, CRDC are preparing a project proposal to undertake regionally spread on-farm nitrogen use efficiency trials, measuring losses and plant uptake under different strategies in different environments.

This will complement the research already underway by Ian Rochester (New CRDC project: *Improving cotton productivity with crop nutrition*) and current extension efforts. Funding has been gained under the Australian Government's Carbon Farming Futures *Filling the Research Gap* program for a new project to measure nitrogen losses as emissions from the surface irrigation water (including storages, channels and tailwater), and to deep drainage. This project will be led by Dr Ben Macdonald, CSIRO who is also leading a CRDC-funded project to review emissions (including nitrogen lost to the atmosphere as nitrous oxide) from irrigated soils under different crop rotations.

Carbon dynamics influence nitrogen efficiency and a new post-doctoral position supervised by NSW DPI's Dr Nilantha Hulugalle will increase the understanding of soil carbon dynamics and potential losses in erosion and runoff under different rotations, planting beds and water management strategies through his CRDC project *Closing the soil carbon balance in cotton-farming systems.*

SOIL TESTING – WINTER IS IDEAL

Soil sampling is most effective when carried out at a depth of 30 cm at the same time each year, between July and September. Within a 200 ha area, at least 10 samples are recommended, collected on a zigzag or grid pattern. For similar soil types, the samples can be bulked for analysis. NutriLOGIC will adjust for the time of sampling in assessing your fertiliser requirements. For more information see NutriLOGIC, NutriPAK and the Soil Health module of *my*BMP.

More information:

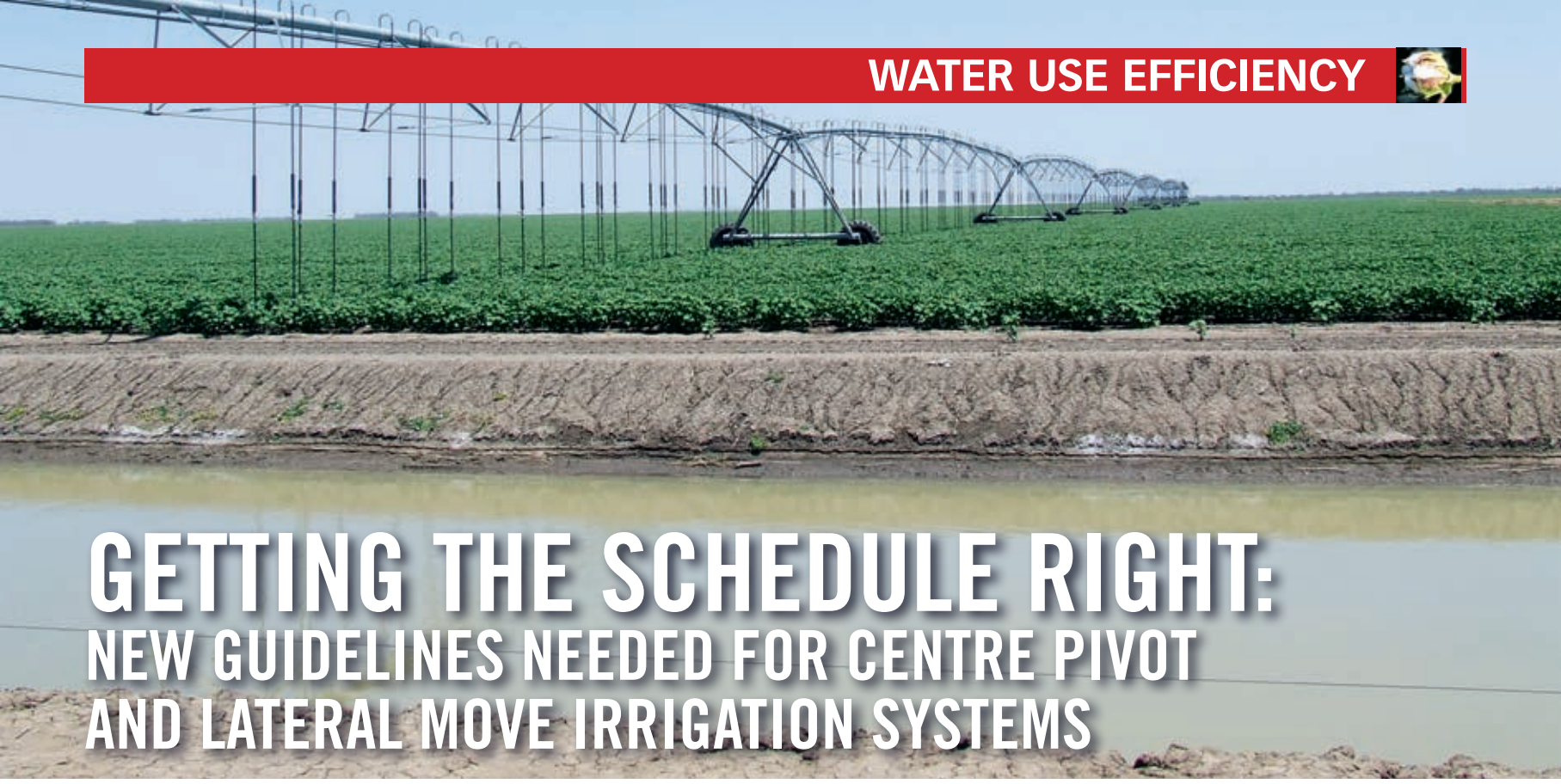
www.*my*BMP.com.au

SOILpak: The SOILpak series aims to provide a range of best soil management practices to optimise crop and pasture yields. http://www.dpi.nsw.gov.au/agriculture/resources/soils/guides/soilpak/cotton

NutriLOGIC: cottassist.cottoncrc.org.au/NutriLOGIC/NutriGeneral.aspx

NUTRIpak: www.cottoncrc.org.au/industry/Publications/Agronomy_Nutrition/NutriPAK

Cotton Production Manual 2012-13



GETTING THE SCHEDULE RIGHT:
NEW GUIDELINES NEEDED FOR CENTRE PIVOT AND LATERAL MOVE IRRIGATION SYSTEMS

RESEARCHERS AND GROWERS ARE POOLING THEIR EXPERTISE TO DEVELOP MUCH SOUGHT AFTER INDUSTRY GUIDELINES FOR MANAGING CENTRE PIVOT AND LATERAL MOVE (CPLM) IRRIGATION SYSTEMS, AS SPOTLIGHT'S MEG STRANG REPORTS.

More and more cotton farmers are looking for better water use efficiency, and incentives such as the NSW Sustaining the Basin Irrigated Farm Modernisation Project, have resulted in a dramatic increase in the use of CPLM technology.

"However, switching from furrow irrigation to a CP or LM system requires a very different mindset," said NSW DPI's Janelle Montgomery, Cotton Industry Development and Delivery Water Use Efficiency Technical Specialist (NSW).

"It's a completely different approach to irrigation, and currently there are more questions than answers about the best way to manage these systems," Janelle said.

"Growers are thirsty for more information. They want detail on complex issues like irrigation scheduling and water savings, as well as practical information about problems like finding the right sprinkler package and how to avoid bogging in wheel tracks."

Addressing specific issues

CSIRO research scientist Dr Rose Brodrick, a specialist in irrigation scheduling and plant water relations, says there are many issues specific to CPLM that haven't been addressed by previous industry guidelines designed for furrow irrigation.

"We need to develop guidelines on CPLM irrigation and scheduling to add to WATERpak, the CRDC's irrigation management guide," Rose said.

"We've started this process by bringing together experienced growers and leading researchers at a CPLM water scheduling workshop held in Gunnedah last December.

"We wanted to tease out some of the challenges and to find out how these are handled on farm by experienced industry players."

"SWITCHING FROM FURROW IRRIGATION TO A CP OR LM SYSTEM REQUIRES A VERY DIFFERENT MINDSET."

Janelle Montgomery has found the ways growers manage CPLM are diverse and there is no one size fits all solution.

Workshops well attended

The workshop attracted a lot of interest from growers and agronomists. Participants varied from those with extensive knowledge of overhead irrigation, to new players about to install their first CP or LM machine and keen to calculate water saving potential.

Switching from furrow irrigation to a CP or LM system does not automatically equate to reduced water inputs, and management mistakes can be costly, particularly if system failure results in a water deficit that reduces crop yield.

There are also critical financial issues to consider. The increased energy costs of running CPLM systems, compared to traditional furrow irrigation, can end up outweighing water savings, so growers need the right tools to make investment decisions.

In the field

Andrew Watson "Kilmarnock" Boggabri acquired a lateral move irrigator in 2012, and has just finished his first cotton season using overhead irrigation.

"We'd been warned about the dangers of failing to keep up with water demand, so we adopted the approach that we'd grow the crop first, and worry about water efficiency second," he said.

"At the end of the season we'd used 6.1 ML/ha on our LM crop, compared to 6.8 ML on the furrow crop.

"There are so many new entrants into this style of irrigation, we really do need some guidelines that can be used as a starting point, but there's very little published data available on growing cotton under sprinkler systems."

No one size fits all solution

Janelle Montgomery has found the responses to CPLM management are diverse, and what works in one situation might not be suitable on another farm with different soil types and circumstances.

"It's unlikely there's going to be a one size fits all solution, but we're aiming to bring together a range of information that will be useful for growers adopting this technology across the various growing regions," explained Janelle.

The growers and scientists who met in Gunnedah will be invited back to take part in a follow up workshop in August to discuss the results of the last season and their plans for the 2013-14 crop.

Meanwhile the CRDC continues to work on compiling a new set of industry guidelines that will assist growers in making the most out of centre pivot and lateral move irrigation systems.

PUMP PERFORMANCE EVALUATION PAYS OFF

A PUMP EFFICIENCY TRIAL AT GOONDIWINDI HAS HIGHLIGHTED THE IMPORTANCE OF TESTING INDIVIDUAL PUMPING SET-UPS TO IDENTIFY THE OPTIMUM OPERATING POINT TO ACHIEVE MAXIMUM EFFICIENCY.

National Centre for Engineering in Agriculture's Phil Szabo installing the pump efficiency monitor at "Macintyre Downs".

Hamish Johnstone of "Macintyre Downs" Goondiwindi thought he was burning a fair bit of diesel at his lift pump.

His rough dip stick measures of his fuel tank showed he was using up to 55 to 60 litres of diesel per hour, which adds up when you are pumping water for a large number of hours (eg 10 pumping events over eight days, 24 hours a day – or about 1920 hours) over a season. The pump specifications might tell you not to run your engine at more than 1800 RPM and at these revs you should be pumping about 135 ML/day, but these specs do not take into account varying conditions.

What an irrigator thinks he is pumping may be quite different in reality.

The pump at Macintyre Downs in question moves tail water into the storage or lifts it into the main supply channel for recirculation. Both pumping efforts are very different. As well, the pumping conditions change as the storage fills.

In order to get some accurate data on his diesel consumption, Hamish agreed to trial a Pump Efficiency Monitor (PEM) which was developed by the National Centre of Engineering in Agriculture (NCEA). The testing was undertaken by NCEA's Phil Szabo and NSW DPI's Janelle Montgomery who is also the Cotton Industry Development and Delivery Team Water Use Efficiency Specialist (NSW).

The PEM continuously logs water flow, diesel consumption and hydraulic head, parameters that are needed to examine pump performance. This data can then be used to determine a combined efficiency of the pump and diesel engine.

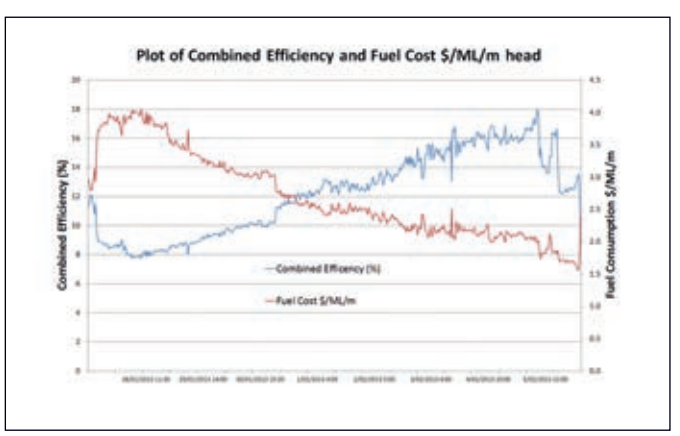


FIGURE 1. Over the monitored full irrigation event at "Macintyre Downs" it could be seen that when combined efficiency increases, fuel costs decrease.

"You will never really know if you never measure – remember the old adage 'measure to manage'," Janelle says.

Water flow, total dynamic head and diesel consumption data were collected with the PEM unit during a single pumping event that aimed to fill an empty 1800ML ring tank as quickly as possible after a significant rainfall event.

"The combined engine and pump efficiency is much lower than what you would expect if examining pump efficiency on its own," Janelle said.

"Unfortunately with diesel engines it is difficult to determine the actual pump efficiency, as the amount of power that the engine delivers to the pump cannot be measured with any accuracy."

"Pump efficiency is defined as energy output / energy input.

"Any losses of energy in the system through worn out impellers, cavitation, leaks, poor maintenance etcetera will reduce the pump efficiency."

During the test, at the start of pumping with the engine speed set to 1800 RPM (pump 630 RPM) and only three metres total dynamic head (TDH) (as the on-farm water storage was empty) the pump was achieving a flow rate of 138 ML/day with fuel consumption of 45 L/hr. This duty point is off the pump curve resulting in severe cavitation.

The pump was run at 1800 RPM for the entire pumping event. As the TDH increased as the storage filled, to a maximum seven metres, the flow rate reduced to 120 ML/day.

However, this same water flow rate (120ML/day) could have been achieved with the engine running at 1550 RPM (pump 550 RPM), resulting in significantly decreased fuel consumption. A spot check at 1550 RPM determined fuel consumption to be 25L/hr. That's a saving of at least 20L/hr.

From the data gathered over the entire pumping event (Figure 1), fuel consumption per megalitre per metre of head decreased from a maximum of 2.7L/ML/m at the start of pumping to a minimum of 1.04L/ML/m at the end of the pumping event. As the storage fills the pumping conditions are changing due to increasing TDH. The pump is very inefficient when the TDH is low (storage empty) and improves as the TDH increases.

The data collected with the PEM shows that creating an artificial head when the storage is empty (achieved by closing valves to increase height of water in distributor tank) improves the pump efficiency and reduces diesel consumption.

"The monitoring trial has proven that there are gains to be made from taking a closer look at our pumps," Hamish said.

"The savings can be significant, especially if you are talking about 15 to 20 litres less diesel usage per hour.

"It doesn't take long to do the sums on how those savings add up over just one season."

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BRINGING RESEARCHERS TOGETHER

AUSTRALIAN COTTON RESEARCHERS WILL HOLD THEIR FIRST CONFERENCE IN NARRABRI THIS SEPTEMBER.

This September 9 to 11 the Crossing Theatre at Narrabri will be the venue for the Association of Australian Cotton Scientists' inaugural Australian Cotton Research Conference.

According to conference organising committee chair Mary Whitehouse, CSIRO Ecosystem Sciences' Senior Research Scientist, the aim of the conference is to provide researchers with the opportunity to discuss concepts and the latest findings, facilitate networking and collaborations between scientists, and enhance a sense of enthusiasm and vibrancy around cotton research, however attendance to the conference is open to anyone with an interest in cotton

"As this conference focuses on research, it will provide the opportunity to explore ideas that currently may not have practical application, but from which could come the innovative developments of the future," Mary said.

"Each conference day (September 9,10,11) will include a plenary lecture, research talks, and a small session called "The Devil's Advocate" where participants will discuss, over a glass of wine, some concepts derived from the talks of that day.

"Presentations on a given day will largely follow the same theme as the plenary speaker of the day, but they will also cover a wide array of cotton associated research topics, ranging from plant breeding and agronomy, cotton pathogens and pests, to post harvest challenges and social economics."

The plenary speakers include a formidable line-up of researchers, with Dr Greg Constable, Dr David McKenzie, and Professor Myron Zalucki. Greg Constable is an internationally renowned plant breeder, agronomist and plant physiologist who has won numerous awards. In his plenary talk he will discuss recent developments in plant breeding and possible future directions.

CSIRO Ecosystem Sciences' Senior Research Scientist Mary Whitehouse is the chair of the inaugural conference organising committee.

Dr David McKenzie's expertise is soil science. He has an insightful view of soil assessment and management, especially in light of recent challenges associated with mining. Prof Myron Zalucki is an insect ecologist who has done trail-blazing work on Helicoverpa ecology and feeding behaviour. His plenary talk will highlight some of this work and future challenges for Helicoverpa management.

The conference will also host the first Annual General Meeting of the Association of Australian Cotton Scientists on Wednesday, September 11.

For more conference information and registration, please visit www.cottonscience2013.com.au

see our website

Researcher Alison McCarthy and Darling Downs grower John Cameron at the NCEA Open Day.

NCEA

NCEA SHOWCASES FUTURE FARMING

THE LATEST TECHNOLOGY IN COTTON RESEARCH WAS SHOWCASED BY THE NATIONAL CENTRE FOR ENGINEERING IN AGRICULTURE (NCEA) WHEN IT HOSTED CRDC AND COTTON AUSTRALIA FOR A FULL TOUR OF THEIR FACILITIES AND OPERATIONS.

Part of the University of Southern Queensland, NCEA is the University's largest Centre of Excellence, currently attracting $3 million each year in R&D investment from agricultural industries such as sugar, horticulture, livestock and cotton.

The two-day visit provided CRDC Program Managers and Cotton Australia representatives with insights into the full range of research expertise and activity being undertaken by the centre as well as specific in-field updates on research with application in the cotton industry.

The underlying theme in the work relevant to cotton is 'measure to manage'.

NCEA is mixing engineering and software programing expertise to prototypes for assessing crop stress to schedule irrigations, delivering remote application of irrigation water in furrow systems, detecting weeds in fields and improving the accuracy with which fuel usage can be assessed.

Other areas of work include better ways to analyse and use information already available on farm and assessing the feasibility of alternative energy sources for cotton.

There are currently six CRDC projects underway with NCEA, covering:

- Assessing the impacts of new harvesting technologies on cotton (ie new round module pickers)
- Development of a protocol for assessing on farm energy use and associated greenhouse gas emissions and the development of an energy calculator: 'EnergyCalc Lite'
- The feasibility and development of alternate energy sources for cotton
- Optimal irrigation of cotton via real-time adaptive control
- Commercial prototype smart automation system for furrow irrigation of cotton

CRDC Program Manager Tracey Leven said the industry's partnership with NCEA is highly valued.

"We see the evolution of remote sensing technologies playing a key role in offering farmers a future where there is significantly more information with which to make decisions," she said.

"Research is currently in the data collection phase. More data won't always translate into more information or better decision making capacity.

"Opportunities for those doing the research to spend time with those who will ultimately use the research are invaluable at this time.

"The Cotton Australia Research Advisory Panels play a key role in helping to direct research to be relevant.

"Understanding the context in which farmers make decisions helps researchers to address more target questions, which in turn ensures that the products of their work offer value to cotton farmers."

Peter Verwey is leading the cotton industry Development and Delivery (D&D) Team's geospatial revolution, with the aim to have more information at the fingertips of growers and the industry.

THE GEOSPATIAL REVOLUTION

THIS 'REVOLUTION' IS HELPING PUT AUSTRALIAN COTTON RESEARCH 'IN ITS PLACE' AS THE TECHNOLOGY ALLOWS US TO TURN DATA INTO KNOWLEDGE.

Geospatial tools are already well established in farming systems. Tractor guidance is commonplace. Precision agriculture reports against mapped fields. Aerial application of chemicals follows mapped runs using GPS.

Most people have used a car satellite navigation unit, and online maps such as Google and Bing have revolutionised how we see the world around us. Put simply, geospatial information describes the location and names of features beneath, on or above the earth's surface. At its simplest this can mean the basic topographical information found on a map, but also includes different location-related datasets combined into complex layers that can show (in an agricultural sense) information such as land use, disease and pest outbreaks, and research locations. Geospatial technology allows us to turn data into knowledge.

"QUERIES AND REPORTS CAN BE CONDUCTED INTO SPECIFICALLY TARGETED AND DEFINED REGIONS OF INTEREST"

CRDC research – past, present, future

The initial phase of a project being undertaken by Peter Verwey at Australian Cotton Research Institute is to collate spatial information from past and present CRDC-funded cotton research into a geospatial database.

This will allow queries and reports to be conducted into specifically targeted and defined regions of interest. This could include, for example, quantifying what cotton varieties have been trialled in a particular valley or alternatively to determine where a particular variety has been trialled across the industry. The technology will also be applied to *my*BMP.

Mobile application

Most phones and tablets now have a built in GPS that knows where the device is located. Peter said apps being developed by the Cotton Industry Development and Delivery Team will use this location data to filter the information being delivered to the app so it is relevant to the user and their region.

"A Cotton Industry Calendar app will show coming events either nationally or limited to the events that are planned for the user's locality," he said.

"The information could also be integrated, for example, into a Weeds Identification Tool, which could limit or filter information to possible weed species expected in a geographic location, meaning users get the information which is most applicable to them.

"Geospatial information is also critical to the efficient management of biosecurity events, for example the occurrence of an exotic disease that could threaten the cotton industry.

"Maps can be produced to show the extent of known infections, as well as possible areas and routes for the disease to spread.

"By using geospatial analysis it is possible to define complex scenarios to control and manage the disease. Examples of this could be restricting the movement of farm equipment, or using climate data to map the potential for airborne spread."

Location is everything

"The location of anything is becoming everything" is the catchphrase of an independent project at Penn State University in the US, which is a world-leader in geospatial research. They say "Where mapping was once confined to surveyors and specialists, the science of geography and 'knowledge of place' has become 'ordinary' and commonplace, and it is now accessible to everyone".

"The Australian Cotton industry is taking its first co-ordinated steps towards making this happen," Peter says.

"This project will bring a sense of place to the catalogue of research that has been funded by CRDC and allow new linkages to be made between research projects and a deeper level of questions to be asked concerning that research."

Further information:

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NEW FACES AND NEW TECHNOLOGY GREET TRADE SHOW VISITORS

THE COTTON INDUSTRY DEVELOPMENT AND DELIVERY TEAM'S REGIONAL DEVELOPMENT OFFICERS WERE AT THIS YEAR'S AUSTRALIAN COTTON TRADE SHOW AT MOREE TO LAUNCH FANTASTIC NEW PRODUCTS AND SUPPORT GROWERS WITH THEIR INFORMATION REQUIREMENTS.

The Trade Show, held in late May was also another opportunity for the newly appointed team to continue to strengthen their industry networks and to listen to concerns and needs of the industry.

"The RDOs really enjoyed the opportunity the trade show presented," Border Rivers RDO Sally Dickinson said.

"Our display included information people could take away with them as well as assisting people with the exciting new industry mobile applications we helped launch at the show.

"These included the *Cotton Industry Events Calendar, EnergyCalc Lite* and *Cotton Symptoms* mobile apps, which created a lot of interest from the many growers and consultants keen to see and make use of these great new resources."

The Australian Cotton Production Manual 2013 was also released at the trade show.

"The manual is a valuable resource for the industry evidenced by the keenness of people visiting the team's display to get their hands on a copy to take away with them," Sally said.

The D&D Team with support from Cotton Australia also oversaw the organisation of the speaker forums, held both mornings of the trade show. The first day addressed the topic "Labour: A scarce resource in a competitive environment". Leading researcher Ruth Nettle started proceedings with results from her latest cotton industry workforce study. Enlisting the overseas labour force and tapping into seasonal labour programs was covered. Craig Trindall spoke of the value of local indigenous people as a sustainable work force in the industry.

Day two featured "The weather: New forecasting systems and dealing with variability". Speakers from the Australian Government Bureau of Meteorology included Field Inspector, Observations and Engineering Branch, Mike Funnel, who looked at how to use new forecasting systems. Local weather forecasting at the farm level with BOM's Met eye was explained by Vernon Carr, National Manager of Public and Agricultural Weather, while NSW Climate Services Centre Manager, Dr Aaron Coutts-Smith outlined next generation forecasting and warning systems. CSIRO Plant Industry Senior Principal Research Scientist Dr Michael Bange demonstrated the CliMate App and CottAssist tools.

"The Trade Show was an outstanding success for the D&D Team," Ian said.

"The team worked very hard to ensure the apps and the *Cotton Production Manual 2013* would be launched on time.

"It really was a credit to the team."

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Boggabilla grower Graham Cook gets a first look at the new EnergyCalc Lite iPad application with Border-Rivers Regional Development Officer Sally Dickinson at the Australian Cotton Trade Show in Moree.

AWARDS CELEBRATE OUR DYNAMIC INDUSTRY

Finalists for the 2013 Australian Cotton Industry Awards were announced at the Australian Cotton Trade Show in Moree late last month.

Celebrating its 10th anniversary, the Awards recognise excellence and achievement in Australia's cotton industry throughout the supply chain, from growers and ginners to product suppliers, consultants, agronomists and researchers.

The 2013 Awards finalists are:

Monsanto Grower of the Year and AgriRisk High Achiever of the Year:
Hamish and Fraser Bligh (Brookstead Qld)
John and Ros Cameron (Bongeen Qld)
Tim, Katrina, Kevin and Rhonda Conlan (Tara Qld)
Graham and Kylie Cook (Boggabilla NSW)
Robert and Kate Flanagan (Hanwood NSW)
Glen and Julieanne Rogan (St George Qld)

Chris Lehmann Trust Young Achiever of the Year, sponsored by Bayer CropScience:
Sophie Gulliver (Narrabri Qld)
Susan Madden (Dubbo NSW)
Rhiannon Smith (Armidale NSW)

Cotton Seed Distributors Researcher of the Year:
Graham Charles (NSW DPI Research Agronomist/Weeds Scientist, Narrabri)
John Marshall (Extension and Development Agronomist Cotton Seed Distributors Dalby)
Janelle Montgomery (NSW DPI Irrigation Officer, Moree)

The recipients will be announced at the 2013 Australian Cotton Industry Awards "Celebrating a Decade of Success" Presentation and Cocktail Party on Wednesday August 7 at the Crossing Theatre, Narrabri.

"The Australian Cotton Industry Awards are held to recognise our industry's highest achievers and celebrate another great cotton season," Cotton Australia CEO Adam Kay said.

"Join us for a relaxed and fun night of top class entertainment, great food and drinks with your industry peers and friends.

"This year's particularly special as we celebrate our 10 year anniversary."

Tickets are $65 and include pre-dinner drinks, cocktail party and entertainment.

see our website

Book at www.crossingtheatre.com.au or (02) 6792 4654.

BE ON TIME EVERY TIME WITH NEW CALENDAR

With the new *Cotton Industry Events Calendar* application on your mobile phone or tablet you'll never miss another event again!

The calendar app is brought to you by the Australian Cotton Industry Development & Delivery Team and was launched at the Australian Cotton Trade Show at Moree in late May.

With so many cotton-related organisations holding events, meetings and programs these days, it can be hard to keep track of what's on – and when.

This app is the first calendar of its type for the industry - encompassing events from all major industry bodies as well as grower associations and agri-business.

When fully developed the public will be able to upload cotton related events through the *my*BMP website and (after moderation by the D&D Team) will appear in the list of calendar events.

This app provides a list of Australian cotton events in calendar form – from industry-wide events, or the search can be restricted to an area within 300 kilometres of your location.

With this app there is no need to pick up the phone or the pen to RSVP. Users can RSVP to listed events and to manage RSVPs through the application.

The app can be accessed downloaded on Android devices through the Google Play Store by searching for "Cotton Calendar".

It is coming soon on iPhone and iPad devices from the iTunes store or can be accessed directly at *my*bmp.com.au/calendarapp

see our website

*my*BMP Manager Jim Wark looks through the new Cotton Industry Calendar app, launched at the Australian Cotton Trade Show.

2013 PRODUCTION MANUAL LAUNCHED AT TRADE SHOW

The 2013 edition of the *Australian Cotton Production Manual* was launched at the Moree Trade Show in May.

CRDC Research & Development Specialist Susan Maas edited the new publication and said following on from the popularity of the last two manuals, the publication was well received by growers and consultants at the Trade Show.

"We really aim for this to be the go to guide for cotton growing in the Australian system," Susan said.

"This isn't just for new growers, because we have been able to involve some of the best researchers and technical experts to build this publication.

"We really encourage all growers and agronomists to have a look – select a chapter and challenge your knowledge and what you are doing now."

In response to interest from growers and consultants a new chapter introducing basic physiology of a cotton plant has been included.

"Brought together by CSIRO's Sandra Williams, CSIRO Plant Industry's Dr Michael Bange, and drawing on a number of other publications, 'An Introduction to the Cotton Plant', will be a must-read for new or experienced growers and consultants looking to focus on the basics and really 'think like a plant' to make important agronomic decisions," Susan says.

"The manual is also now divided into four sections that the D&D Team are building campaigns behind, so this provided an opportunity to challenge growers across these themes."

Cotton For Profit – In the quest to continue to maximise profitability, growers need to improve yield while managing input costs. This section outlines some key production issues for the 2013/14 crop, with a particular focus on input efficiencies.

Better Farming Future – Profitability needs to be maintained into the future, and this section outlines key production issues that will not only impact on the current crop, but also on the future of the industry. The chapters in this issue cover the principles of managing for the long term.

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

The Business of Cotton – This business of cotton can be complex. This section identifies issues across a range of topics including economics, marketing, finance, insurance, as well as the safety and management of the human resources involved in cotton.

This publication is one of a series of key products proudly brought to the industry by the Australian Cotton Industry Development & Delivery (D&D) Team.

QLD DAFF's Geoff McIntyre and Darling Downs grower John Cameron with the new Australian Cotton Production Manual launched at the Australian Cotton Trade Show in late May.

"Thanks again to the researchers, industry and the D&D Team who have contributed to reviewing and updating the *Cotton Production Manual 2013*," Susan said.

The manual will be posted to *Spotlight* subscribers, with additional copies available from CottonInfo Regional Development Officers.

This resource is supported by additional information on best practice at *my*BMP.com.au

see our website

KNOWLEDGE ON THE GO

The new cotton industry *Cotton Symptoms* iPad app lets users go mobile with the vast wealth of knowledge and experience the industry has to call upon to help diagnose "What's wrong with my cotton crop?"

Cotton Industry Development & Delivery (D&D) App Specialist Peter Verwey was part of the development team and says the app contains the information provided in the *Cotton Symptoms Guide.*

After extensive in-field testing, the Symptoms app was on display at the Australian Cotton Trade Show in May.

In addition to providing an easy to navigate platform to access the information provided in the guide and steps to help determine the cause of a symptom, the app provides additional support and linkage to industry through the 'Take Photo' link.

"When an unidentified symptom is observed, it is best practice not to automatically remove the plant from the field as this may impact on the opportunity to correctly diagnose the problem and spread a pathogen or pest," he said.

"The 'Take Photo' link allows users to select a photo from the gallery or take a photo with their device, email it with a description and their current GPS location to allow assistance with diagnosis."

Peter is quick to point out that the development of the guide and the app would not have been possible without the incredible support from researchers and industry.

"Many people across multiple organisations have been generous in providing photos and technical information," he said.

"We would also like to thank the Cruiser R&D Fund for sponsoring the field guide and *Cotton Symptoms* app."

The Cruiser R&D fund has been established by Syngenta Crop Protection and Cotton Seed Distributors to support research into problems associated with stand establishment. Every kilogram of cotton seed sold with Cruiser seed treatment helps with funding stand establishment research projects such as this guide and app.

The D&D Team also acknowledges the additional financial assistance of CRDC in order to complete this app.

Peter is already looking to the future for app development.

"This is the first in what we hope to be a number of apps to help growers and industry. I also hope that we are able to expand into android and mobile platforms," he said.

The *Cotton Symptoms* app is undergoing final adjustments and will be available for download in time for next season. It will be found at www.*my*BMP.com.au or the Apple iTunes store and search for "CRDC Cotton Symptoms".

For more information contact Peter Verwey: peter.verwey@dpi.sw.gov.au

email us

D&D Team App Specialist Peter Verwey and Macquarie Regional Development Officer Amanda Thomas.

Janelle Montgomery has been working with growers to bring the EnergyCalc Lite iPad app to the industry.

LOW-JOULE COTTON GROWING

Designed specifically for the Australian cotton industry, *EnergyCalc Lite* is used to assess on-farm energy use costs and greenhouse gas emissions associated with diesel, petrol, LPG and electricity consumption.

Growers can use the new iPad application to examine energy use across key farming operations such as irrigation, tillage, harvest and also establish benchmarks to compare energy use between operations.

EnergyCalc Lite was launched at the Cotton Trade Show by the Australian Cotton Industry Development & Delivery Team.

"This iPad app has come at a time when cotton growers are facing significant electricity and diesel costs and they want to know right now how to reduce their on-farm energy consumption," says Janelle Montgomery, NSW DPI Irrigation Officer and D&D Team Water Use Efficiency Specialist.

"*EnergyCalc Lite* is the first step in finding this out."

Funded by CRDC, *EnergyCalc Lite* was developed by the National Centre for Engineering in Agriculture (NCEA) and road-tested in the last cotton season by Janelle and Hamish Johnstone, "Macintyre Downs", Goondiwindi who recorded his energy use into the app as various operations took place over the season. Hamish also suggested a number of changes to be sure the program was user friendly and relevant to Australian cotton growers.

He believes *EnergyCalc Lite* is a great tool to look more closely at his on-farm energy use.

"Water pumping is a significant energy user and with *EnergyCalc Lite* I can compare our older pumps and engines and see how they are performing compared to our newer infrastructure," he said.

"Likewise it's possible to compare different tractors and even farming systems."

Importantly, the app fits neatly with *my*BMP, with its ability to automatically update the best practice checklist in the energy module when using *EnergyCalc Lite*.

EnergyCalc Lite is freely available on the iTunes App Store by searching "CRDC EnergyCalc" For further information please contact Janelle Montgomery on 0428 640 990 or janelle.montgomery@dpi.nsw.gov.au

email us

Craig Barsby, Stewart Brotherton, Darren Young, Rob Ingram and Chris McCullagh discuss the opportunities for improving the cotton production systems in Emerald.
The Central Highlands Cotton Growers & Irrigators' Association undertook a detailed survey of Emerald region growers in winter 2012. This project, funded by CRDC aimed to better understand the limitations and opportunities for cotton production in Central Queensland.
It was followed up with a forum held in Emerald on April 15, involving a review of survey findings, targeted presentations from a number of researchers and Cotton Australia. The meeting was well attended by growers and consultants with lively discussion of a number of research, extension, policy and management issues for this region.

HAVE A SAY IN RESEARCH

THE COTTON INDUSTRY'S COLLECTIVE COMMITMENT TO RESEARCH, SHARING OF KNOWLEDGE AND IMPROVED PRACTICES IS A KEY TO ITS SUCCESS. CRDC EXECUTIVE DIRECTOR BRUCE FINNEY TALKS ABOUT THE VALUE OF GROWER ADVICE IN DEFINING RESEARCH PRIORITIES TO SUSTAIN SUCCESS.

Our industry is often recognised by others for its progressive approach to tackling challenges and the commitment of people working together across all aspects of the industry. As the industry reports that this season's harvest will produce in excess of 4.3 million bales of cotton, with record levels of quality and yields from both irrigated and dryland crops it's good to reflect that these results are testament to those attributes and the product of years of collective commitment to research, sharing of knowledge and improved practices.

Equally whilst we celebrate these results the industry acknowledges that there is no room for complacency when profitability remains under pressure and the operating environment for agriculture is increasingly complex and uncertain. There is little doubt that the commitment of capable people working together will be just as critical to the future success of the industry as it has been in the past.

Understanding trends & performance

Critical to the on-going success of the industry is an understanding of our current performance and future R&D needs that help us plan and adapt to potential challenges. Grower surveys are one of the key ways in which we are able to understand the current performance of the industry. These surveys are valuable benchmarking tools allowing each of us to know how we are performing against each other whether that be at a grower, industry or international levels.

For example by understanding efficiencies achieved by other growers, individual growers can identify the best opportunities for improving their own efficiencies. At an industry level we can ascertain where we sit globally in relation to all aspects of cotton growing from yield to quality and water use efficiency.

Similarly, advice from Cotton Australia's R&D advisory panel members who represent local cotton grower associations, ginning organisations and Crop Consultants Australia on future research investments is extremely valuable. These panels consider research applications in detail and are very effective in reporting their views on the merit of the applications to CRDC. To further support this advice, CRDC has also commissioned feedback sessions or "Think Tanks" in many cotton growing regions to consider research priorities as expressed by growers and consultants in recent surveys. These regional meetings worked through the trends in the 2011 Grower Survey which identified local RD&E needs. Undertaken by Guy and Ingrid Roth of Roth Rural and Regional, the sessions were an opportunity for open discussion and feedback on R&D issues. A summary of the major issues and priorities from each region's session will be collated and help guide future R&D investments. Just as importantly, we will be reporting back to each region.

Culture of information sharing

With such a wealth of available experience and knowledge within the industry, the sharing of information is vital to our ongoing success. Information sharing equals learning, which in turn leads to more successful farming. Growers can expect the 2013 CRDC Grower Survey in July. We thank you in advance for your participation in this survey and the resulting improvements we can make to research, development and delivery, tailored to your needs as a grower.

Most importantly please have a say in your research. Talk to your local Cotton Australia R&D advisory panel member and regional development officers, and participate in forums and surveys.