Cotton Research & Development Corporation

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Spotlight on Cotton R&D

Autumn 2008

- Plant X - Biological control is here
- The magic of mulch
- 10 page capacity building feature

Dealing with drift

Australian Government
Cotton Research and Development Corporation

Autumn, March 2008

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

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

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

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

Corporate background

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

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Spotlight

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The quest for sustainable competitive advantage

Consulting widely through the development of the new five-year Strategic R&D Plan has engaged many people to think deeply about the future of the industry. A CRDC forum held in Moree during February attracted 80 producers, researchers and agribusiness working in cotton. As well, experts from outside the industry lent experience and insights that added greatly to the discussion and synthesis of ideas. Feedback from participants who attended the forum has included observations as to the impact the process of developing the Plan has had on fostering new thinking within the industry.

What has emerged? Three themes for our future have emerged and remain constant. The first is that the competitive advantage we enjoy in our global markets is being eroded and under threat. While more risky, closer relationships with our customers, novel products and transformed supply chains point to a more competitive future – if attainable. Secondly, costs of production continually threaten livelihoods of farmers and the local economies that rely on our high-value crop. Finally, irrespective of what influence the markets and the cost price squeeze exert, a lack of human resources and capacity to remain open to new technologies and to innovate is at the core of our capacity to respond to change.

How we are addressing all three points is encapsulated in this issue of Spotlight and the capacity of our R&D to deliver breakthroughs and some of which are covered here. In particular, Plant X together with a new biological agent appears as emerging and innovative technologies. These may both add new life to extending important transgenic traits and underpin cotton's sustainable production. A new lower-cost crop rotation exploiting vetch and wheat in the rotation is described. It shows the potential for a new cotton production system that also saves water, reduces nitrogen and energy use – the three factors which are also at the centre of a cotton production system more in tune with water and carbon challenged environment.

An extensive feature on the industry's capacity building initiatives and successes in this issue shows why capacity building is a vital new filter through which all future R&D should be considered. Regardless of science breakthroughs, novel products or improved farming systems, unless the cotton industry at large has the capacity to understand and apply the technologies, then these breakthroughs do nothing to sustain the industry's competitive advantage.

On behalf of the CRDC I wish to acknowledge the importance of the input, assistance and encouragement we have broadly received in developing the new Plan in close consultation with our stakeholders the Australian Government and the Australian Cotton Growers Research Association.

Finally the CRDC anticipates submitting the 2008 -13 Strategic R&D Plan to the Minister for Agriculture, Fisheries and Forestry in April and subject to approval launching the new Plan to the industry at the ACGRA Cotton Conference in August.

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

Cover Photo: Photo Melanie Jenson. Phenoxy damage has been widespread throughout cotton growing regions this season. "Sappa" farm manager Sandy Belfield shows a severely damaged plant.

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

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Plant X has been found to destroy cotton pests and is currently being commercially developed as an environmentally friendly alternative to chemical sprays.

Dr Robert Mensah

Bio-control: new weapon in the pest war

A newly discovered behaviour-modifying plant extract, Plant X, could revolutionise the way the industry controls pests in cotton, potentially resulting in less reliance on synthetic insecticide and moving toward biological control.

With initial R&D investments from CRDC and supported through Cotton CRC, along with financial and practical support from Growth Agriculture Pty Ltd, a Wee Waa based agribusiness, the novel product is undergoing pre-commercialisation trials with a view to a market launch within three years.

Development of the product has required an investment of $500,000. The project is headed by Dr Robert Mensah, director, research leader and principal research entomologist at NSW DPI's Cotton Health Unit at the Australian Cotton Research Institute (ACRI) in Narrabri.

Dr Mensah discovered the plant's insect repellent properties and said the discovery and development of the plant extract (semio-chemical) allows primary insect pests such as Helicoverpa and green mirids to modify their feeding and oviposition behaviour, so reducing infestations on cotton crops.

Dr Mensah discovered Plant X while carrying out a research study to identify an alternative crop to grow as a refuge and trap crop alongside the cotton plant.

"I found a plant which was growing on a farm which had no insects on it," he explained.

"Together with my research colleague Angela Pitt, we decided to test it on insects to find out the effects. When we tried to force them to feed on the plant under strict no-choice conditions it was clear they would rather die of starvation than feed on it!"

This was the beginning of six years of painstaking research. In 2002 CRDC believed the Cotton CRC had established leadership in behavour-modifying chemicals and encouraged them to take on Plant X development. Consequently the project has continued under the auspices of the CRC ever since, he explained.

"It has taken time to research this plant's properties," Dr Mensah said.

"But we decided to find out which part of the plant was toxic to the insect and found that all parts of the plant except the roots were toxic to the insect. We experimented with spraying it on to the cotton plant and discovered that the insects did not feed on it once it contained the spray.

"The product also deters egg laying and is toxic to smaller stages of insect."

Dr Mensah and his team identified two fractions of the plant which they have developed into a more stable spray product.

"Plant X is much better for the environment than chemical sprays as it is a natural plant extract," Dr Mensah said.

"Over time, plants have evolved to contain chemical compounds (SPCs) that help protect them against predation or attack by insects or to attract insects that assist in reproduction processes. Some SPCs extracted from non-hosts and applied to host plants have the ability to alter the behaviour of pest species, particularly moths, which then avoid or reject the host."

Dr Mensah said that in late 2006 a significant planting of Plant X was carried out to produce bulk plant material to allow for the production of enough extract to test under field conditions.

Now the Plant X fresh and dry material is being formulated into a stable spray product for testing against Helicoverpa and other sucking pests in cotton this season.

"This new technology will reduce crop damage and minimise synthetic insecticide use without sacrificing cotton yield," said Dr Mensah.

Growth Agriculture Pty Ltd, which began operations in 1992, is an importer, wholesaler and manufacturer of a unique range of products heavily focused on foliar nutrition and integrated pest management (IPM) in crop production. Company managing director Kerry Watts said, "the partnership allows us to continue our commitment to Australian agriculture and to genuinely live up to our objective to develop and provide products which will enhance agricultural production, enabling primary producers to maintain viable enterprise, whilst taking care of the land and environment."

Mr Watts is excited about the potential of Plant X-derived products and the opportunities the partnership between the Cotton CRC and Growth Agriculture provide in seeing the cotton industry given an environmentally acceptable alternative to current pest management practices.

"It is also exciting to think that the Australian cotton industry can be at the forefront of developing technology that has the potential to extend well beyond the cotton industry and Australia, leading to an internationally recognised product that can be utilised across numerous cropping industries," Mr Watts said.

Dr Mensah's research colleague Angela Pitt at work researching the amazing properties of Plant X.

Biological fungicide

Plant X is Dr Mensah's second discovery - in 1997 he discovered 'food spray' which attracts beneficial insects to the ordinary cotton plant when sprayed, and currently he is also working on a type of fungus which is lethal to insects such as mirids.

'We have produced a fungal insecticide (myco-insecticide) which has spores that can attach to an insect when it is applied to the cotton crop," Dr Mensah said.

"The fungal spores then grow and colonise the whole insect, causing the insect to rot and keeping the cotton insect-free."

The fungal insecticide is a biological organism and is self-perpetuating when applied to the cotton crops.

Dr Mensah is working with Sydney company Becker-Underwood Pty Ltd to develop and commercialise the fungal products.

The products are BC667 (Beaveria spp.) and BC 639 (Metarhizium spp.). Large scale testing of the product is underway with the partner company and the product is expected to be on the market in two to three years' time.

? For further information on either of these breakthroughs, contact Robert Mensah
tel: 02 6799 1525
email robert.mensah@dpi.nsw.gov.au

Growing cotton in 'ultra-narrow rows' (UNR) has won the backing of some growers who are finding it a more efficient and economical way to grow the crop than with conventional one-metre spacings.

While scientists are working on pin-pointing the benefits of growing UNR cotton, among them Dr Rose Roche of CSIRO Plant Industry, who has spent the last seven years conducting field experiments in collaboration with growers, some growers are singing the praises of UNR.

Their testimonies back up much of the preliminary research findings - that when cotton is planted in rows less than 40cm apart it, produces better yields and requires less maintenance.

"Across all our experiments the average lint yield in UNR plantings was 15.9 percent higher than in conventionally spaced cotton, which is planted one metre apart," Rose said.

"However, yield differences were not consistent, ranging from four bales per hectare higher to no difference at all.

"While UNR looks like a promising option for higher yields for growers, further research and evaluation of agronomic requirements and economic benefits are needed to understand under what circumstances growing UNR would be a consistently better option than one metre spaced cottons," she says.

The UNR experience

By Mary Ann Day, Photography: Courtesy Mal Pritchard

Dr Rose Roche has been investigating the use of Ultra Narrow Row plantings strategies in cotton.

Ultra Narrow Row cotton at left of photo at Twynam Agricultural's 'Merrowie' farm, Hillston.

UNR - same place earlier in season.

Allen Williment, director of Williment farms at Theodore in Queensland has certainly found that growing cotton in ultra-narrow rows is far more efficient than the conventional method.

He has been a fan of UNR for five years and is convinced that it is a better method.

"I think the fibre quality with UNR is about the same – the only thing that seems to affect the fibre is rain - and that goes with living in central Queensland," he said.

"This is our fifth crop of UNR cotton. I find it a lot easier to grow cotton on 38cm (15 inch) rows than on the conventional metre row.

"Now we have no cultivating involved-we simply irrigate it as and when it is needed, and go in with a spray tractor, but there is no need to do anything else. We used to cultivate the crop two to three times a year and carry out four workings in the field with the tractor during the crop, and now we have less work."

Mr Williment, whose 480ha farm grew 240ha of cotton last year and this year is growing 160ha, said the crop yields were also higher.

"We achieved a farm yield average of 11.93bales/ha (4.83bales/ac) and, under the conventional method, the closest farm yield average in the Theodore district was around 10.13 bales/ha (4.1 bales/ac)," he said.

The only disadvantage he sees to the UNR method is the special harvesting machinery needed, as it has a lot more moving parts.

"Apart from having to have specialised picking equipment, the UNR method is far better," Mr Williment added.

"We have also made significant financial savings with this method, so it was well worth investing in the equipment."

At another farm, at Hillston, Mal Pritchard, agronomist from Twynam Agricultural Group, Merrowie, has also backed up the merits of growing cotton in ultra narrow rows.

The 30,000ha mixed farm runs merinos and crops wheat, winter legumes and maize and is growing 545ha of cotton this year.

"Of this 545ha, we grew 382ha on one-metre row spacing, and 163ha at 38cm (15 inch) spacing," Mr Pritchard explained.

"The narrow row has been grown here since 1998. Originally we grew it in ten inch configurations with six rows on a two-metre bed, which required "stripper" harvesters.

"Now we have moved to 38cm (15 inch), with four rows on a two-metre bed, which is the ideal size for John Deere spindle pickers.

"The reasoning behind us using narrow rows is that the crop has full ground cover sooner, due to higher plant population, and may therefore produce a crop earlier, so reducing the risk in the autumn of running into cold or wet weather.

"In our situation here at Hillston, while there have not been significant advantages in yield, we can see there is potential, with the high numbers of squares – it is just difficult to mature.

"The ground cover makes the crop more competitive with weeds, but also makes access difficult if weed control is required, such as with cultivation or directed sprays. Having access to Roundup Ready or Liberty is important with narrow rows.

"We are taking part in a trial in co-operation with CSIRO and Dr Rose Roche this year looking at the direct comparison between the spacings in plant growth characteristics, which we hope will give us some more information about the best way to cultivate UNR cotton."

New rotation: New system

Dr Nilantha Hulugalle has discovered rotation systems that can improve water and nitrogen use.

Strong indicators that a new cotton farming system is evolving from five years of cotton-wheat-vetch rotations is already promising high yields coupled with lower production costs.

The breakthrough has emerged from a novel cotton-wheat-vetch rotation system in research conducted at ACRI by Dr Nilantha Hulugalle.

The results appear to be nothing but good news for cotton farmers seeking to bust the cost/price squeeze where, according to long-term Boyce reports, even the most efficient producers are on a declining margin of profit.

Reduced irrigation frequency and lower N requirements – the key inputs in today's cotton farming system, are the primary benefits of the rotation, according to Dr Hulugalle.

He says reduced erosion and runoff, improved water infiltration with much lower pesticide and nutrient runoff, all point to positive environmental performance indicators.

In the trial crop plant growth by the end of February was 30cm taller than conventional trial plots adjacent and green bolls a third greater in number.

Sowing cotton into standing wheat and vetch stubble retained on beds and in furrows is proving to increase profitability and environmental outcomes through improved water use, he says.

"At the research station, we made up our own toolbar from spare parts. The eventual cost was only $600 in materials, so farmers looking to set up their own trial plots do not have to spend large amounts to improve the rotation on their own farms.

"While it can reduce erosion and runoff, increase water infiltration, reduce off-field movement of pesticide residues and nutrients, and also reduce heliothis moth infestation in young cotton, key benefits appear to be increased soil water storage during the early part of the cotton season and improved nitrogen availability due to N fixation by the vetch.

"The reduction in input costs means that overall profitability per hectare is likely to be higher on the farm-scale application of the rotation.

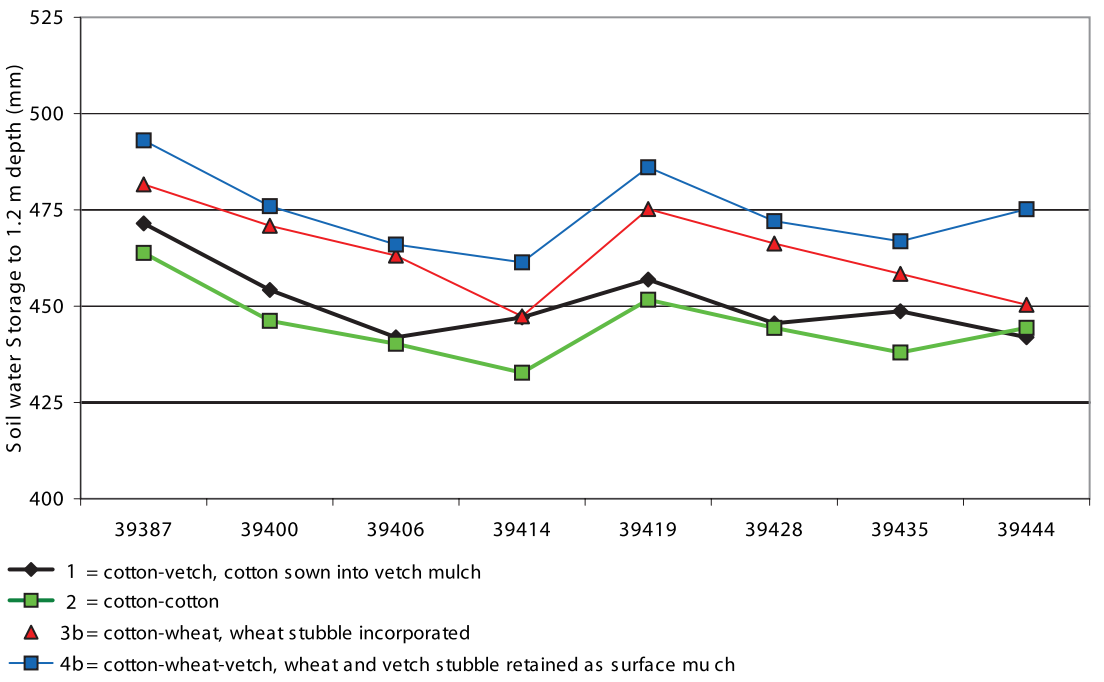
"Where irrigation water, rather than area of land is the limiting resource on a farm, a cotton-wheat-vetch system appears to be more profitable."

Growers face increasing challenges due to low prices, increased costs and limited water.

Dr Hulugalle began the research in 2002 comparing rotations. These included cotton-winter fallow-cotton, a cotton-vetch-cotton rotation, a cotton-wheat rotation where wheat stubble is incorporated, and a cotton-wheat-vetch rotation where vetch is sown into standing wheat stubble.

All rotations were sown on permanent beds with supplementary irrigation.

On the basis of the results so far, the inclusion of vetch between cotton crops has not been profitable. This is because cotton yield in the cotton-vetch-cotton rotation was lower than that in cotton-winter fallow-cotton. This contrasts with previous research which found that cotton-vetch-cotton was more profitable than cotton-winter fallow-cotton. However, sowing vetch after wheat in a cotton-wheat rotation has increased profitability relative to cotton-wheat alone.



Management of the system

It is clear that vetch plants must be controlled before planting cotton. Trials have established that a mowing/slashing operation at 50 percent flowering followed by running a set of coulter discs along the plant line to cut off the runners, and finally two applications of a Gramoxone®-based herbicide is required.

The final two steps can be combined with suitable machinery modifications. Most farms can easily adapt toolbars with coulters and herbicide nozzles to manage the system.

Where vetch and wheat stubble is retained in furrows during irrigation, waterlogging can occur. Waterlogging during irrigation events is avoided by retaining the stubble in the furrows only until the start of the irrigation season. At this point, except for a two metre long buffer strip in the furrows at the tail drain end of the field, the point of a sweep (V-shaped tillage implement which performs shallow tillage over broad widths) is run through the furrow to a depth of 10-cm to clean out the stubble from the furrow bottom. This facilitates water flow through the field.

The retained two metre strip slows water flow just enough to sediment out dispersed clay. Excess salts and nutrients adsorbed onto clay particles are deposited in the furrow and do not move off field with runoff.

Spotlight will publish further details of the trials, together with the results from the current crop, in the June 2008 Winter edition.

? To begin your own onfarm trial or to discuss the research, contact by Dr Nilantha Hulugalle, ACRI. Tel: 02 6799 1533.

"… large quantities of the non-volatile products, applied on a large number of farms at around the same time, has caused the problem. Night spraying would have to be considered the most likely source."

The phenoxy question: not a volatility issue

By Bill Gordon

Farm manager Sandy Belfield 'Sappa' Moree has suffered phenoxy damage to every field on the farm.

This cotton plant exhibits severe characteristics of phenoxy damage with stunting and minimal boll production.

Large scale spray drift onto cotton crops has occurred in almost every cotton growing valley again this year and in areas such as St George, virtually every cotton crop has been affected, with 'community drift' and night spraying the likely causes, according to experts.

Pesticides application consultant, Bill Gordon says: "It would be easy to suggest that volatility was a major factor in such large scale drift events, but I do not believe this is the case.

"It is much more likely that large quantities of the non-volatile products, applied on a large number of farms at around the same time, has caused the problem.

"In particular, night spraying would have to be considered the most likely source."

Mr Gordon said what we are seeing with large areas expressing symptoms of herbicide damage is probably the result of community drift events, where the cumulative effects of a lot of people spraying similar products around the same time with setups and nozzles that contribute to the overall problem.

Every application produces some small droplets, many of those do not make it to the intended target and remain airborne.

The finer the spray quality, the greater the risk that this will happen.

Spraying during day light hours where the ground is heated by the sun, and when air movement and mixing occurs as the wind blows is usually sufficient to dilute clouds of small spray droplets that may become airborne, and the risk of causing damage at reasonable distances down wind is quite low.

"Spraying at night is a different proposition – it's high risk," Mr Gordon stressed.

"The likelihood of causing damage to a sensitive crop several kilometers downwind is greatly increased when night spraying, particularly on large flood plains where broad acre cropping and cotton coexist."

At night when the wind speed is low (less than three to four km/h) or absent, the air in contact with the ground will behave like water (air is also a fluid) and flow gently to the lowest point, carrying with it any small droplets containing chemical that have become airborne during spraying.

Lower parts of a catchment, such as along rivers, are the most likely areas to be affected by community drift. Cotton is regularly damaged by spray drift because of where it is grown.

If water drains onto a property, so will spray drift from a number of sources if night spraying occurs in that area.

Mr Gordon said phenoxy damage to cotton is just a symptom of a much larger problem with the movement of chemicals away from the site of application.

"The real problem is a lack of control over where chemical ends up," he said.

"This is largely due to poor nozzle selection, not monitoring conditions closely enough and having a general disregard for surrounding crops and the environment by continuing to spray when conditions are simply not suitable."

He says that sometimes the best decision is not to spray.

Reducing the Spray Drift Problem

Bill Gordon says that areas like the Brigalow-Jimbour Flood Plain on the Darling Downs have largely been able to eliminate spray drift through the efforts of committed growers groups, education and practice change facilitated by subsidies to change to coarse and extremely coarse nozzles.

While most large scale drift events happen over night, fixing the problem probably won't, unless the whole industry makes the required changes to how and when they operate their spray rigs.

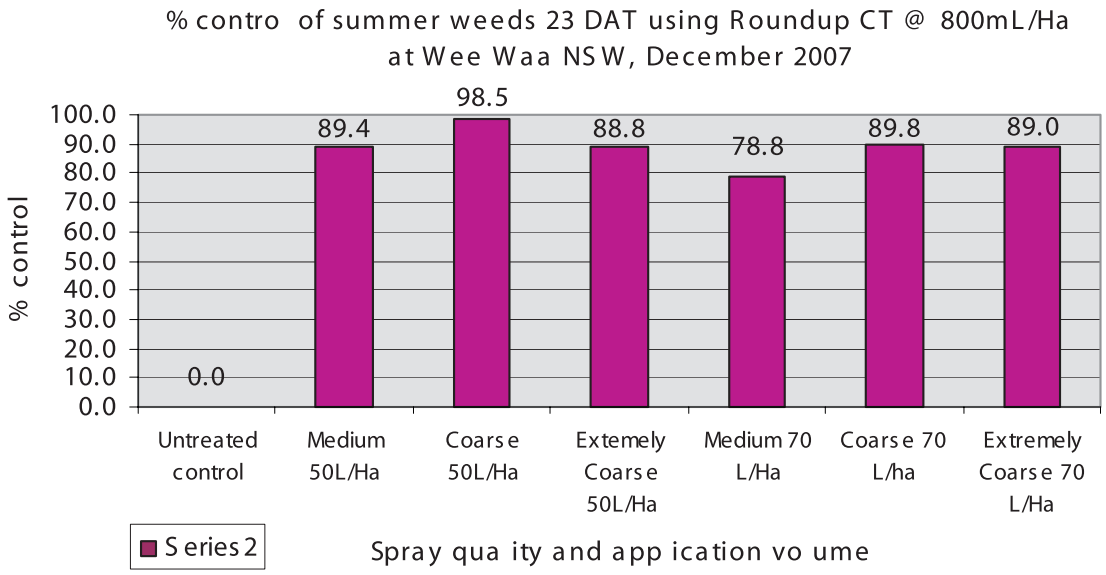
The CRDC and GRDC funded project "Drift management extension strategy for the Northern Region" delivered by Bill Gordon Consulting has been trying to address the issue of spray drift on a number of fronts, by completing trials and working with chemical and application equipment suppliers, resellers and advisors, training providers, and directly with the applicators themselves.

"When we can get people involved in learning about how spray drift occurs and how to prevent it, more than 80 percent of participants in our training make positive changes to how they operate their spray rigs," he says.

What can applicators do?

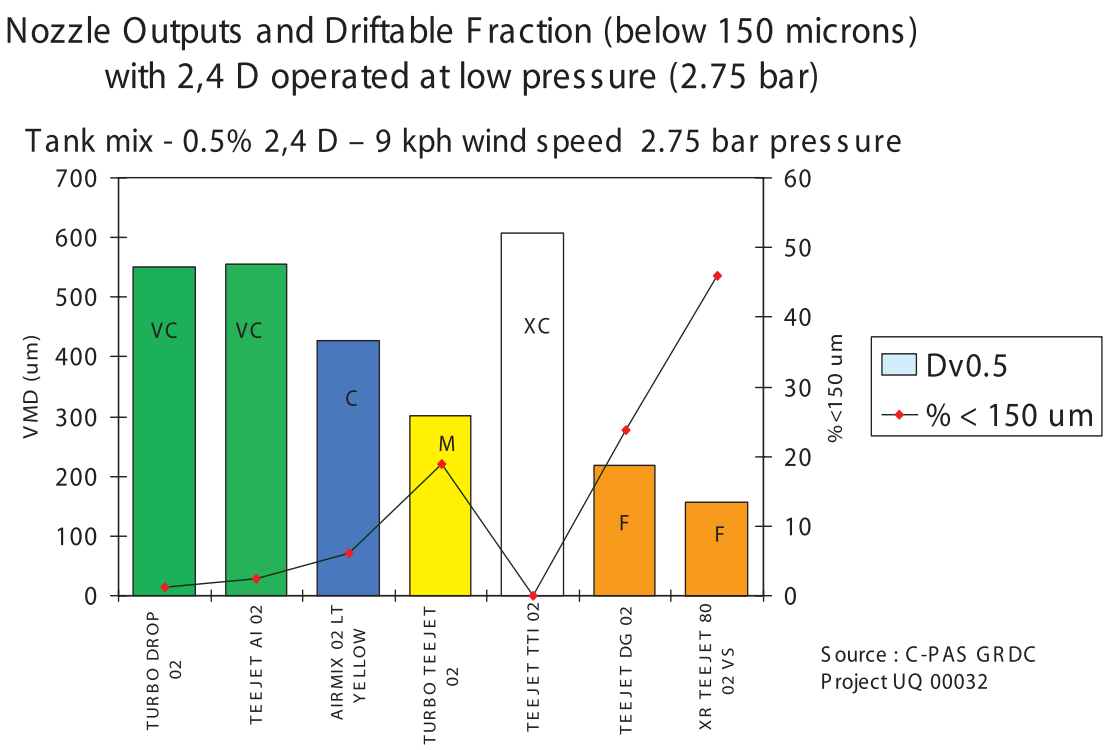
- Following label directions would be a good start. If the product label requires that it is applied using a coarse spray quality make sure you know what that actually means and that the nozzles being used can actually produce a coarse spray quality or larger.

- Use the coarsest spray quality that will provide acceptable control – have a look at the recent trial results for a range of products showing coarse spray qualities work.



- Conduct simple risk assessments - ask yourself are coarse droplets actually coarse enough for the spraying event you are about to do to prevent drift? - probably not for night spraying. Remember if a nozzle produces five percent of its volume in driftable droplets, every 100 hectares you spray during unsuitable conditions you could be leaving up to five hectares worth of chemical in the air – is it worth the risk?

- If spraying at night, perhaps the safest option is to only use nozzles that produce an XC spray quality and monitor conditions closely and often – if the wind stops you should stop spraying. If nozzles producing XC don't solve the problem then we should stop spraying at night – it is that simple.



What can advisors and resellers do?

- Stop recommending fine droplets (if you haven't already), and don't recommend medium droplets for fallow spraying – we don't need them.

- Convince yourself that coarse spray qualities work very well in most situations, and be aware of the limitations that may arise with their use.

- If you sell nozzles or provide advice on application, make sure that you know how to select the most appropriate coarse nozzle for a situation and how to operate the nozzles correctly, so that you can pass that information on to your clients. (If you are not sure where to get that information, then attend one of the CRDC and GRDC funded workshops on application and spray drift management).

- If you have clients who spray at night, insist they change to XC droplets and have a way of monitoring the conditions regularly.

? **For more information or to run a workshop for your clients on how to manage drift and improve their application, contact CRDC 02 6792 4088, or Bill Gordon on 0429 976 565.**

Spotlight on Capacity Building

Fast Track to improvement

CRDC has joined forces with 11 other Australian agricultural R&D Corporations, to co-fund Co-operative Venture Capacity Building (CVCB) projects that 'fast track' education and training initiatives and generate greater returns on investment.

Eight projects (five of which are detailed here) aiming to 'fine tune' delivery of research to growers, consultants, researchers and the broader cotton communities are underway by CRDC, Cotton CRC and extension staff from NSW and QLD DPI&F.

"In Fast Track, capacity building (CB) is about improving a person's ability to increase the effective uptake of research. The projects are innovative ways to ensure cotton producers and other customers of cotton knowledge can access and benefit from R&D investment," said Helen Dugdale, program co-ordinator.

Improving capacity within the regional extension program

Principal Extension Officer, Geoff McIntyre, DPI&F Dalby.

Regional extension officers, responsible for the delivery and implementation of cotton industry extension plans including the Best Management Practices (BMP) program, will receive more mentoring, support and improved internal processes due to a Capacity Venture Capacity Building (CVCB) project by Principal Extension Officer, Geoff McIntyre, DPI&F in Dalby.

"The key is planning and outcomes - instead of what we did, it's more about what we have achieved which is not only important to growers, researchers and funding organisations but essential feedback for our people in the field," explains Mr McIntyre.

"The biggest message from a 2006 review of the regional extension program, coupled with benchmarking information from Boyce & Co and the annual CCA survey, is that we need to identify our achievements contributing to better cotton quality and production.

"Improved internal processes based on CVCB models will help measure adoption of R&D by growers and provides guidelines to plan, engage, evaluate and report more effectively."

He said good extension meant working closely with local CGAs, growers and consultants and that more guidance will be offered to extension officers to tailor their plans to suit the RD&E priorities and issues for growers in their region.

School-based traineeships shape future

In a joint initiative that aims to better understand how to build the industry's future capacity, five Indigenous students from Narrabri and Wee Waa High School are enjoying paid work experience at the Australian Cotton Research Institute and CRDC in Narrabri. It is part of a school-based traineeship program developed by CRDC's Helen Dugdale in response to the need to fast-track capacity building.

The Cotton CRC's Dr Paula Jones agreed to join the pilot exercise which aims to better understand how to engage the cotton industry with school-age people.

"This exciting new capacity building project will foster greater engagement between the Indigenous community and the cotton industry as well as provide students with the necessary employment skills and training to access jobs in the industry. In the future we hope other businesses will use the approach," Mrs Jones said.

The traineeships, available to Year 11 students, provide an opportunity to gain paid work experience, a nationally recognised qualification and credit towards their Higher School Certificate. Completion requires 800hrs of work over two years which could be undertaken one day a week, or in blocks over the school holidays.

The successful applicants, Bronwyn Scott and Rusty Musset from Wee Waa High School and Beau Quick, Lynette Collis and Natasha Booby from Narrabri High School said they were looking forward to pursuing careers in administration, IT and production in agriculture after leaving school.

Funding for the project came from Cotton CRC's Communities Program with additional funding and support from CRDC, Namoi Catchment Authority and the Aboriginal Employment Strategy.

? Information contact Dr Paula Jones on 02 6799 2440 E: Paula.Jones@csiro.au

Capacity Building

It's all about people

The terms 'capacity' and 'capacity building' can be initially confusing, until we understand the terms describe the role and growth of people, their skills and attitudes to making the most from their industry.

When the new CRDC Strategic Plan is launched mid-2008, the document is expected to contain extensive references to 'capacity building' and will reflect industry leaders' view that without successful development of the industry's people, it would face a very uncertain future.

Capacity is much more than having enough people available to handle the casual or farm-hand workload on a cotton farm. As this issue of *Spotlight* aims to address, capacity building of the managers and farmers to make the decisions and to understand the highly complex farming system that cotton production represents is equally, if not more important.

CRDC and its industry partners recognise that it is one thing to have the knowledge available for farmers and the post-farm-gate ends of industry – yet ensuring best practice and the most appropriate technologies are adopted and put into place day to day is a matter of capacity.

A skilled and available workforce is one of the key outcomes expected from industry's investment in capacity building. To have the skills, significant investment by the industry for the industry's sustainability is vital. The new CRDC Strategic Plan shall highlight not only the industry's expectations, but detail how this can be attained over the next five years and well beyond.

In this *Spotlight* feature on capacity building, we shall explore:

- Leadership and the role of joint investment in people
- New skills development
- Prior skills recognition
- Fast-tracking research capacity
- The place for education
- What the industry means for its people

Recognition of learning & skills in extension workshops

Cotton growers and staff completing extension activities conducted by CRDC, CRC, Cotton Australia, various service providers and R&D programs could acquire partial or full Vocational Education and Training (VET) qualification including Diplomas or Certificates in agriculture, according to Mark Hickman, National Cotton Training Coordinator, Queensland Department of Primary Industries and Fisheries.

"I am currently investigating the potential merging of cotton extension activities with the vocational education and training sector and aligning routine extension programs conducted by field officers to various VET competencies," Mark explains.

He said the cotton industry was already seeing benefits through an association with the VET sector, both in terms of adoption and structural development of the courses and that several short courses have already been completely or partially aligned.

Mark points out that simply attending an extension event would not automatically give an individual a certificate or Diploma of Agriculture, rather the accumulative attendance at various field days, short courses and practices implemented on the farm will be aligned (mapped) towards a qualification. The VET qualification is given by registered training organisations, such as Tocal College, after a thorough and rigorous process.

? For more information: Mark Hickman
07 46 881 206 mark.hickman@dpi.qld.gov.au

Courses currently mapped to units of competencies

- Cotton IPM Short Course
- Cotton / Grains Irrigation Management Course
- Cotton Field to Fabric Short Course
- Soil health Course (partial aligned)
- Cotton Seed * Yr 10 = Cert. II in Agriculture (Specialising in cotton production)
- Cotton Basics * Yr 11-12 = Cert III in Agriculture (Specialising in cotton production)
- Machinery training for Cotton and Grains.

*For secondary schools and pre vocational entry into the industry. Offered at Tamworth's Farrar Agricultural High School.

Many industries seek common capacity

"Breakfast meetings at Theodore, Moura and Baralaba last year were held to measure interest in cross rural industry communication where community can participate in debate and share information," says Susan Maas DPI Development Extension Officer in Emerald.

"Twenty landholders, including graziers, dryland farmers and irrigators attended and revealed they were up to date on opportunities and activities relevant to their sector and that industry associations and DPI keeps them well informed.

"The group said they liked the idea of cross industry sharing and benefited from information supplied about Nathan Dam, the soils mapping project proposal and DPI regional activities however, most felt 'time poor' and already committed to several meetings for their sectors.

"The CVCB project proved communication within rural industry's is working well. It also introduced irrigators to the Central Queensland Farming Systems project and Dawson Catchment Coordinating Association (DCCA) received valuable feedback on the soils mapping proposal and now aims to make it more workable.

"The Theodore group said they would like to be kept up to date with activities in all industries and extensive components of the land use maps completed during the meetings were an excellent tool for discussion between neighbours."

Veronica Chapman – bringing researchers together.

Capacity to understand cotton catchments tested

Instigator of a successful cotton industry induction day gathering 40 researchers and staff from the Catchment Program of Cotton CRC to Narrabri last August, Veronica Chapman said in terms of a capacity building project, it was a simple activity which met the desired outcomes.

The event involved visits to the Australian Cotton Centre and a cotton farm and presentations from Cotton CRC, CRDC and Namoi CMA staff. The day was also attended by sub-program leaders of the Cotton CRC Catchment Program, some extension staff and representatives of the local CMA and CRDC.

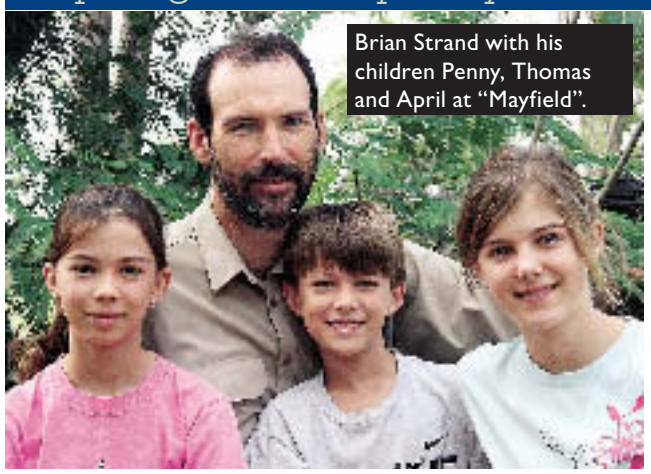
Veronica, of Qld DPI&F said: "The cotton industry invests heavily in catchment research including surface and groundwater systems, biodiversity and ecosystem services, on-farm storages and wetlands.

"I thought it would be beneficial for researchers in these areas to gain a better understanding of cotton production systems; the cotton industry and its bodies; the Cotton CRC and the role that their project could play in improving Natural Resource Management (NRM) in the cotton industry."

Feedback reveals participants improved their industry knowledge and are now better informed with contacts and industry-relevant information.

There is also an appreciation of the wealth of knowledge available in the program and communication amongst researchers and industry staff has improved.

Spotlight on Capacity Building



Brian Strand with his children Penny, Thomas and April at "Mayfield".

Diploma in Agriculture a bonus for BMP farm managers

Cotton growers achieving Best Management Practice (BMP) certification of their farms, could acquire vocational qualifications and an industry-first BMP manager certification.

Four growers, Stuart Higgins from Jandowae, Jason Sinclair from Condamine, and Brian Strand and Shaun Fleischfresser from Dalby, have already received Diplomas in Agriculture from Tocal College at Paterson, NSW.

The person responsible for aligning the Cotton Industry BMP manual against national training competencies from the Vocational and Technical Education sector is national cotton training co-ordinator from the QLD Department of Primary Industries and Fisheries, Mark Hickman.

"This initiative acknowledges current and acquired skills developed during BMP certification and years of life long learning," Mr Hickman said.

"Growers generally possess numerous environmental, production and financial skills and I believe they should be formally recognised."

Mr Hickman said only growers who had achieved BMP accreditation for the farm could apply.

"Growers must provide sufficient evidence of documentation and practices adopted during BMP certification and complete a Recognition of Prior Learning (RPL) interview followed by a farm tour," he said.

"Simply holding a BMP accreditation certificate does not automatically grant a formal qualification.

"Rather, a thorough 'evidence portfolio' was required and gathering more documentation could be required."

In January, the ACIC BMP committee formally endorsed the qualification.

"Certifying the grower as well as the farm adds even more value to achieving BMP and I encourage all certified BMP growers to consider this opportunity," said Louise Adcock, newly appointed general manager of the BMP program. Recipient Stuart Higgins said he had been on the BMP journey for the past five years and completed BMP late 2006.

He said although he already had a degree in Agricultural Science, it was important to continually improve yourself and take advantage of opportunities.

"It's a bit confronting having someone look at the farm under a microscope, but it's worth it, another string to the bow that makes you more employable," he said.

Brian Strand, farm manager of "Mayfield" in the Nandi district said the farm had been BMP certified for several years and was continually improving under the BMP process.

"I already have an Applied Science degree but still think the BMP certificate is worthwhile for farm employees like myself. It's recognition of special skills you gain from being involved in the BMP process and working on a BMP farm," Mr Strand said.

"When an employee moves on, it proves to be valuable evidence of the skills they have acquired. Also, RPL makes the whole process quite simple because it focuses on the skills you have, not how you got them."

? For further information, contact Mark Hickman, DPI&F, 07 46881206 or mark.hickman@dpi.qld.gov.au

Managing the new BMP

David Taylor "Neilo" Toobeah, Von Warner "Bullamon Plains" Thallon, BMP general manager Louise Adcock and Ben Stephens, Auscott Narrabri.

According to BMP general manager, Louise Adcock, the cotton industry should be proud of what is has achieved with BMP and grower commitment to sustainable environmental performance over 10 years.

"Now its time to develop and implement the next phase of the program which focuses on land and water management and climate change," she said.

Louise is the newly appointed general manager of the cotton industry's Best Management Practices (BMP) program.

She describes herself as 'an agronomist by trade', however she brings a wealth of knowledge and experience to Cotton Australia which includes five successful years as Environmental Programs manager for the Ricegrowers' Association of Australia.

Louise describes herself as being passionate about agriculture and is looking forward to continuing the cotton industry's proactive approach to addressing industry sustainability issues.

"The next phase of the BMP Program will be more relevant, practical and make better business sense," Louise said.

Her new position represents a first for the industry in environmental management where the investment for the position is equally shared between Cotton Australia, CRDC and CRC.

? For more information on the new BMP, contact Louise Adcock, Cotton Australia Limited, Ph: 07 4639 4908, E: louisea@cotton.org.au, Website: www.cottonaustralia.com.au

Future Cotton Leader - Brendon Warnock

"Since the program I understand the purpose of industry advocates such as Cotton Australia and Growcom (Queensland Horticultural industry advocate) and appreciate the need to positively engage state and federal politicians," explains Brendon Warnock, manager of Warnock Agronomics Cotton Farm, Narrabri.

"I am now more focused and my mentor Mark Panitz, policy and advocacy manager for Growcom, opened my eyes to the various ways that Growcom represents growers and influences government policy."

Brendon said the Future Cotton Leaders Program further enhanced his skills and confidence and he is looking forward to implementing his new skills working within industry organisations such as Cotton Australia, local CGA and the Namoi Valley Water User Group.

Spotlight posed questions of Brendon that may concern a future cotton leader.

Q: What will the cotton industry look like in 2030?

A: There may be expansion of cotton into Northern valleys such as the Burdekin and the Ord which could potentially reduce fluctuations in the size of the Australian crop and improve our market security.

Q: How will the cotton industry operate then?

A: The spirit of co-operation within the industry will strengthen and the focus will remain on continuous improvement. Research will continue to play a significant role.

Q: What recommendations do you have for the industry?

A: Cotton growers in the Murray Darling Basin need to become specialists at dry land and reduced irrigation farming. We need to maximize our ability to convert irrigation, rainfall and stored soil moisture into revenue.

Q: What do you need to do now to achieve this future?

A: I need to develop our dryland and reduced irrigation farming systems and improve soil structure and water use efficiency. We are minimising tillage and including rotation crops. We need to take advantage of every drop of water on our farm.

A cotton industry equips for the future: Brendon Warnock, Bachelor of Agribusiness, University of Queensland; Secretary of Lower Namoi Cotton Growers Association, Lower Namoi representative on the Cotton Australia Grower Member Advisory Committee, Participant in Namoi Water shire rates working group.

What participants said about the Australian Future Cotton Leaders Program ...

Brendan Barry, 29 Agronomist Tandou Farm, Menindee NSW.

"It made me think about my future and the skills I may need. I've also become more involved in the community and industry."

Dale Clark, 33 Senior Agronomist, CGS, Warren NSW.

"I now challenge traditional thinking and promote new ideas. I also have a great network of contacts outside the program that provides feedback and support."

Greg Hutchinson, 28 Farm Manager, Moura.

"The program highlighted that I'm already doing the right things and that the future is bright. Because of my enthusiasm, our local CGA sponsored me $10,000 to attend the International Cotton Institute in Memphis, USA."

Ross Burnett, 26 farmer, Emerald.

"The program gave me the confidence to provide ideas and input into the local industry. I've now become the treasurer of the local CHCG&IA."

Philip Firth, 47 Share farmer, Wee Waa

"Since the program I've reassessed my priorities and developed better personal skills and confidence. I'm focusing on improving communication between growers and researchers."

PhD Students A valuable investment

Investments in higher studies proven

Since 1992 CRDC has funded 79 PhD student projects and of these, 47 are known to work in cotton related science and a further 18 work in other science related fields and three work on farms, according to Helen Dugdale, program co-ordinator.

"The cotton industry is committed to investing in R and D through enthusiastic young scientists. In return, they have made tremendous contributions," she says.

This year CRDC is investing in 15 PhD student projects investigating treatments and controls for pests and weeds, high yielding cotton and water use efficiency. Other research topics include rotation cropping systems, nutrition, biological amendments, crop planting configurations and combating sodicity.

Students receive $32,000 per year over three years. There is a call for applicants every September and information is available on www.crdc.com.au and in *The Australian* newspaper. Students are selected in November.

Protein discovery excites black root rot study

Jason Moulynox PhD Student

In his final PhD year at The University of New England, Armidale, Jason Moulynox is investigating the biological control of black root rot in cotton which could decrease yield losses, reported as high as 40 percent on some cotton farms.

To date, Jason has positive results from two bacterial soil treatments and is also testing an anti-fungal protein treatment.

"We are working to isolate the reason bacterial treatments are effective. We suspect they may be competing for nutrients in the root zone and limiting the ability of the black root rot fungus to take hold but there is still a lot of work to do," he said.

"The anti-fungal protein we are using was originally discovered in radish.

"We have developed a method of producing the protein in a more pure form for use in our trials. Our experiments so far we have shown that the protein inhibits growth of the fungus in culture.

"If growers would like to participate in future trials please contact me," he said.

Currently there is no proven treatment available to growers for black root rot which is a soil borne fungal disease caused by *Thielaviopsis basicola* attacking the roots of cotton seedlings, causing stunting and the characteristic blackening of the tap root.

? E: jmoulyno@une.edu.au or 02 6773 3170.

Jason Moulynox PdD Student Bachelor of Science (Hons) 2000, UNE, majoring in microbiology, Molecular and Cellular Biology.

Ecosystem questions answered in a carbon economy

Rhiannon Smith,
Bachelor of Natural Resources
(Hons) UNE

University of New England PhD student, Rhiannon Smith, is researching the benefits of native vegetation on cotton farms of the Namoi floodplain.

Carbon sequestration, erosion mitigation, forage production and biodiversity conservation are some of the 'ecosystem services' or benefits from floodplain vegetation Rhiannon is measuring.

She has also mapped the woody vegetation of the Namoi floodplain using SPOT5 satellite data to gain a better understanding of the amount and distribution of vegetation on cotton farms across the valley.

"I am measuring a range of benefits of the non-crop vegetation on cotton properties for landholders," she said.

"I have developed an equation to estimate total tree biomass and the amount of carbon stored in the above-ground components of trees.

"Soil sampling has been completed to measure the amount of carbon stored under different vegetation types managed in various ways.

"Landholders will be able to use this information to tell which vegetation types are most valuable for carbon sequestration and how vegetation can be managed to maximise its carbon potential for a carbon-neutral future.

"We have also conducted bird surveys in five different vegetation types across the valley to measure the importance of different habitats for bird conservation.

"About 100 species were recorded, many of them declining woodland species. Landholders will be able to use this information to identify the most valuable bird habitats on their properties, and the rest of the community might be surprised to find out just how much vegetation and wildlife there is on Namoi cotton farms, and how important it is."

Environmental flows maintain diversity

Susan Lutton
B Science (Hons),
Queen's University Belfast

With decreased frequency and magnitude of flooding of some Australian river systems, CRDC funded PhD student Susan Lutton is investigating "aquatic biodiversity and the ecological value of water storages on irrigation farms", in the Border Rivers Catchment.

"My results will help growers wanting to optimise on-farm biodiversity and also highlight the importance of natural wetlands in maintaining biodiversity across the catchment," explains Susan.

She said aquatic research will hopefully change people's perceptions that environmental flows are 'wasted' water but instead are ways of maintaining aquatic and floodplain biodiversity.

"Increased aquatic communities attract more bird life which help to naturally control pests on farms," she said.

Since 2005, Susan has visited 100 on-farm storages, collecting fish and macroinvertebrate (bug) samples to compare diversity with nearby natural wetlands.

"Overall farm storages were less diverse than natural wetlands. Nine fish species, including two exotics, were found in the natural systems while storages had six native and two exotic species (no eel-tailed catfish)," she said.

"Only 34 different macroinvertebrate taxa were found in the storages compared to 84 taxa in the natural wetlands.

"In my limited sampling of pumped water I found that more native fish species were sucked through the pumps than exotics. It would be fantastic if we could somehow reverse this so only exotic species, such as European carp, were removed from the river channel," she says.

Susan has a paper published titled, *Drivers affecting the aquatic biodiversity and the ecological value of water storages on irrigation properties* and it presents a conceptual model.

Spotlight on Capacity Building

Opportunity

Education leading to improved capacity

Industry invests in education to boost its competitive edge

Education and training is an essential component of CRDC's strategic plan. Each year CRDC and its staff commit to investing in organising, supporting and promoting various educational and training activities across the cotton industry.

"Although we are an R & D organisation we understand the importance of generating educational and training opportunities to build capacity in the industry now and into the future," says CRDC's Helen Dugdale, program co-ordinator.

CRDC's involvement in educational activities is far reaching and benefits primary and secondary school students, university students, researchers and growers, extension officers, various rural organisations and people already working in CRDC and the cotton industry.

TAFE / VET

CRDC is involved in Skills Recognition, Training and Career Pathway Programs known as "Cotton Basics" and "Cotton Seed", with training delivered to more than 105 participants and pre-vocational training is available through to Diploma level qualifications.

The program is also available at Farrar Memorial Agricultural High School, NSW.

- Short courses for both producers and commercial consultants are aligned with national competencies to ensure skills are recognised, nurtured and valued.
- Soil Health Workshops
- Irrigation training course with CRC for Irrigation Futures, CRDC, GRDC and NPSI for over 120 growers and consultants.
- Managed a Qld Farmbis project that aligns national training competencies with BMP. Four farm managers are now recognised with a Diploma of Agriculture from Tocal College.

Vocational Training

At the Cotton Field to Fabric Training course at CSIRO in Geelong, 137 have attended since August 2007.

One tenth of the participants are external to Australia and the course now attracts people from China, Indonesia, Thailand, Vietnam, Brazil and South Africa.

Participants can gain a formal qualification from the Australian Quality Training Framework (AQTF) as the course is aligned with six national competencies for vocational training and education.

CRDC sponsors training of its staff and provides opportunities for further study.

University Students

- CRDC sponsors one or two students per year to do 4 units in Certificate of Cotton Production at UNE, and also sponsors lectures at the residential part of course.
- Annual Scholarship for a young farmer/ agronomist to undertake the above course. This year's recipient is Jemima Maslen, Hay. Apply in November.
- CRDC has funded 79 PhD students since 1992. This year, 15 PhD students will receive $32,000 pa to support their research and operations.

Community

Industry R&D expenditure sponsors and contributes to the Australian Cotton Exhibition Centre, Narrabri. Support of Wincott (Women in Cotton), while once critical to the organisation, is now no longer required as the group has secured its own revenue sources.

CRDC is actively involved in many forums with universities and farmers organisations to support education issues and to learn better how to encourage agriculture and science.

CRDC program manager Helen Dugdale shows CRDC-sponsored student Natasha Booby the ropes at the corporation's Narrabri headquarters

Primary And Secondary Students

- RiverHealth Education Conference at Inverell attended by 230 school students and teachers from schools NSW and Qld
- Funding for students from Walgett, Wee Waa, Narrabri primary and St Francis Xavier Narrabri Catholic primary to attend RiverHealth 2007
- Sponsor and help with the "Science & Engineering Challenge"
- Contribute to annual youth Camp with Moree Rotary for Year 10 students from schools across northern NSW.
- Student visits to Cotton Exhibition Centre, Federation Farm and Australian Cotton Research Institute (ACRI).
- Sponsor students to participate in local and international tours. In 2007, Year 12 student, Alexander Rogan of St George visited Russia.
- School Based Traineeships, in conjunction with Cotton CRC and the Aboriginal Employment Strategy in Moree.

Scholarships And Recognition

- RIRDC (Rural Industries R&D Corporation's) Rural Women in Partnerships Corporate Directors Course, supported by CRDC investment. Apply before May 08.
- Young Cotton Scientist of the Year. Awarded annually at the DAFF and Bureau of Rural Science – Young Scientist Awards in Canberra. Winners in 2007 were Angus Crossan, Environmental Scientist and William Conaty, Irrigation Scientist, both from University of Sydney.
- Cotton Consultants Australia education bursary - part of the Chris Lehmann Trust.
- Future Cotton Leaders Program – 21 current recipients
- Australian Rural Leaders Program (ARLP) - one person per year. Mark Morton, Principle Focus, Armidale successful applicant in 2007 and this year's successful applicant is Barb Grey, a cotton farmer from Mungindi.
- Field to Fabric – CRDC has sponsored 16 growers to attend the course

? For further information on scholarships and education opportunities available, please contact Helen Dugdale at CRDC on Ph: 0267 924088 Email: helen.dugdale@crdc.com.au

James Neilsen (BAgr Sci, PhD Crop Agronomy/ Physiology)

James grew up in Hobart and undertook a degree in agricultural science at the University of Tasmania. During his undergraduate degree James found agronomy and plant physiology to be where his interests were and his honours thesis investigated the competition between two weed species in plantation forestry.

After his degree he spent time surveying and classifying the soils in forestry regions of Southern Tasmania, prior to undertaking a PhD investigating water use efficiency in the dairy industry.

It was the chance to work outside that motivated James to become involved in agricultural science.

"I had a long term interest in science at school and came from a household where my father was a research scientist in biology," said the enthusiastic Post Doctoral Fellow.

James has been involved in the Australian cotton industry for five years and is now based at the Australian Cotton Research Institute in Narrabri.

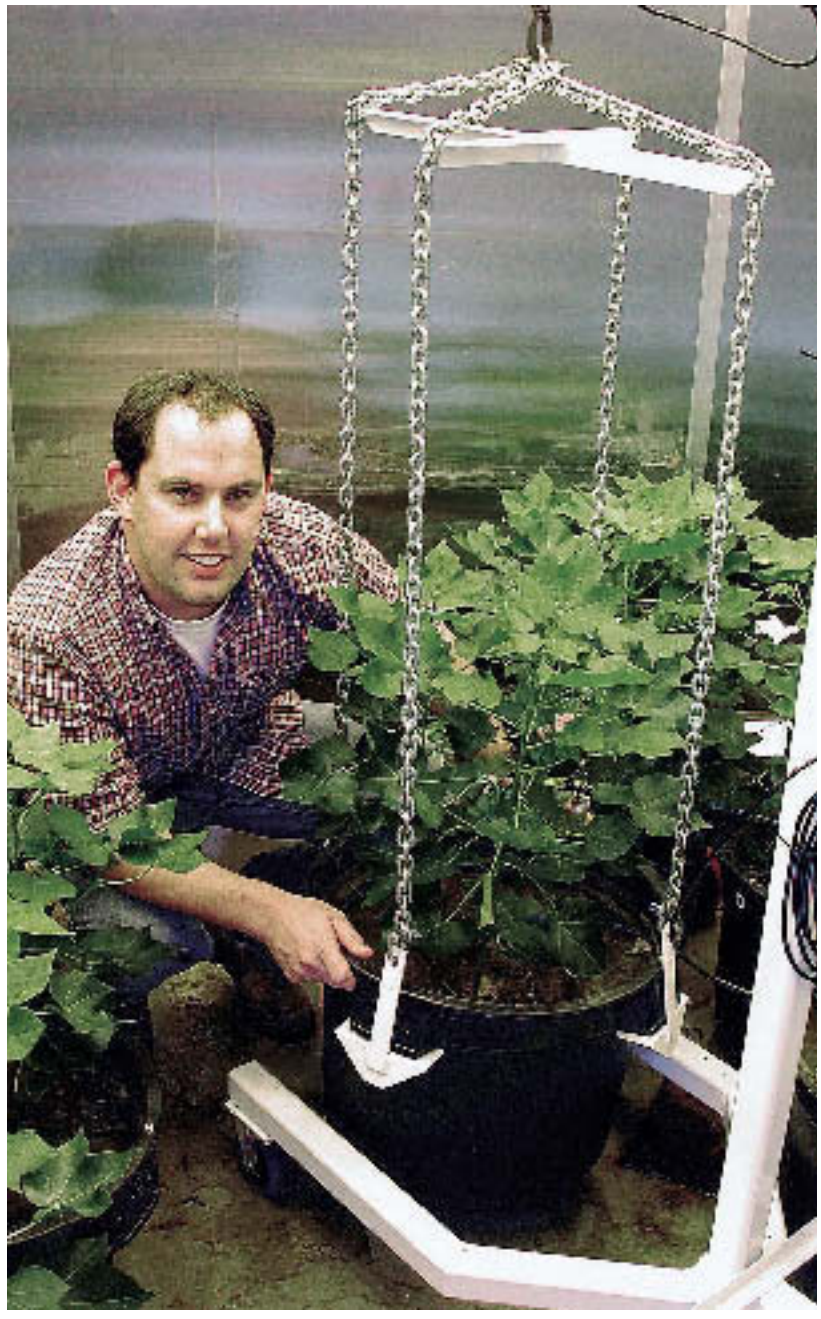
"I am currently researching the response of cotton plants to soil type and climate," James said. (See December Spotlight p12 "Taking Climate Into Account")

"My research has lead to an improved understanding of the basic responses of cotton plants to soil moisture stress and how this is influenced by climate and soil type."

James said his passion is to use science to improve the productivity of agriculture, in particular the cotton industry, in the face of declining resource availability and increased public pressure on the agricultural sector.

"I love that my job has the ability to impact on the industry and inspire change in production methods and practices," he said

The knowledge created through research is vital in developing improved irrigation strategies for cotton.



Susan Maas, B Applied Chemistry

"My dad worked for the Department of Primary Industries so I have been involved in agricultural research since I was very little, helping with quadrants and germination counts whilst still in primary school," says Susan Maas.

"Of course that meant that in early high school I was definitely not going to be a researcher and considered accounting, yet as a senior I fell in love with chemistry and a career in science was inevitable."

After completing a bachelor of Applied Chemistry at Central Queensland University Science, Susan worked as an environmental chemist for a coal analysis laboratory contracting to mines.

"After four years in the mining industry I was looking for a bit of a change and moved into a Natural Resource Management extension role with QDPI&F in cotton industry.

"I then had opportunity to become regional cotton extension officer."

Susan spent the majority of her life based in Central Queensland, growing up on a hobby farm in Biloela and is currently based in Emerald with her husband and two children.

"I love that my job allows me to go in the field and talk with growers and consultants," she said.

"And I really enjoy the sustainable production approach the cotton industry has."

Fire-starter's capacity begins with the young

Building the capacity of our future leaders and forming a lasting commitment to our youth and the sustainable use of the environment and the industries it supports was a major aim of the 2007 NSW Youth River Health Conference.

CRDC sponsored students Ben Zielke and Nicholas Drew from Narrabri Public School at the river conference.

Photos courtesy Jenny Easey

Providing school students with skills in natural resource management, and more importantly, to encourage them to be optimistic, have a sense of future, and be capable public speakers to communicate ideas in many different forms was the aim of the 2007 NSW Youth River Health Conference.

"Children comprise twenty percent of the population, but are one hundred percent of our future," says Olivia Greenwell, Fire-starter's project co-ordinator, who was responsible for co-ordinating the NSW conference.

Building the capacity of our future leaders and forming a lasting commitment to our youth and the sustainable use of the environment and the industries it supports was a major aim of the 2007 NSW Youth River Health Conference.

CRDC sponsored students to attend the conference from Wee Waa Public School, Walgett Community College Primary School, Narrabri Public School and St Francis Xavier School – Narrabri, who have all indicated their interest in presenting a workshop at a future conference.

Held in November at Inverell, adults took a back seat at the event as 200-plus Year 5 to 11 students taught each other about an area of interest or issue relevant to New South Wales' environment, and learnt from each other about the most effective ways of dealing with these problems.

The conference and the lead up months of preparation provided students with skills in natural resource management, public speaking and the ability to communicate ideas in many different forms.

This process involved students working with expert mentors prior to the event, and resulted in curriculum materials that will be in New South Wales schools in the future.

"Most importantly, the process was about promoting kids teaching kids as the highest form of learning and aiming for a cultural change in the way we view, use and perceive our natural environment and the resources and industries it supports," says Olivia.

"The 2007 New South Wales Youth River Health Conference was less about a conference and more about a lasting commitment to our youth and the sustainable use of our environment – this is no 'flash in the pan' concept, it is the future of learning and the future of our coasts, oceans and catchments wherever they may be."

The students showcased presentations they had spent up to six months preparing, on issues concerning them about the state's coasts, rivers, creeks and waterways. They had a day of on the ground activities to put into practice their knowledge of natural resource management, with Border Rivers-Gwydir CMA managing this day.

The students also had an opportunity to quiz an expert panel on "How Can Schools encourage their community to be more environmentally sustainable?" with speakers Kirk Coningham – Communications Director, Murray Darling Basin Commission, Rick Colless – Council Whip, NSW Legislative Assembly, Liz Blair – Environmental Education Officer, Border Rivers Gwydir CMA and Kelvin Brown – Aboriginal Advisory Committee, Border Rivers Gwydir CMA.

This expert panel was facilitated by Arron Wood the conference MC, and Fire-starter's founder and allowed students the opportunity to ask questions as wide ranging as how to get sponsorship to run their school's own river health conferences, the effects of climate change, politics and the environment and also local Northern NSW Aboriginal environmental practices.

The event has been hailed as a success, according to evaluation responses, with 90 percent of participants "loving" the conference and 88 percent loved the Kids Teaching Kids concept as a way of learning.

"The 'Kids teaching kids' concept aim to give responsibility for learning back to the learner and teach them the skills to manage that approach, then we start to have the emergence of different students," Richard Wood, Firestarter's Workshop Manager has said.

The conference was supported by The Australian Government with Border Rivers-Gwydir Catchment Management Authority, Murray Darling Basin Commission, The Inverell Shire Council and The Cotton Research and Development Corporation, Northern Inland Regional Waste and Inverell RSM Club.

Good news for students and the environment alike has been the recent announcement of a 2008 conference for NSW to be held in Tamworth titled the 2008 MDBC NSW Youth Environment Conference.

? For further information, contact Helen Dugdale, CRDC, 02 6792 4088 or Olivia Greenwell, Fire-starter, 03 9329 3736, or oliva@fire-starter.com.au www.onelifeoneworldourfuture.com

Overhead irrigation: profitable or not?

By Graham Harris, DPI&F/Cotton CRC, Fred Chudleigh, DPI&F, Toowoomba, and Anna Shaw, formerly NSW DPI, Dubbo

When contemplating a significant capital investment such as the purchase of a centre pivot or lateral move (CPLM) irrigation system a comprehensive analysis should be undertaken.

While there will be no single answer to the question; "Will the investment be profitable?", the ideal steps to explore this can be:

1. prepare a steady state profit analysis at the whole farm scale for the current farming system (the "without" scenario) and the one with the CPLM investment (the "with" scenario). If the analysis is promising undertake Step 2.
2. undertake a financial analysis over the life of the investment for the "without" and "with" scenarios.
3. complete an economic analysis to calculate and compare the Internal Rate of Return and the Net Present Values for the "without" and "with" scenarios.
4. perform a marginal analysis to calculate the marginal return and payback period for the CPLM investment.

This approach will not only identify the viability of the CPLM investment but also the gaps in information that may exist and their importance.

In 2005 the Cotton Catchment Communities CRC funded a project to assess the profitability and risk associated with converting existing furrow irrigation systems to CPLMs with five cotton-grain irrigators with CPLMs in five different cotton districts – Emerald, Darling Downs, Macintyre, Macquarie and Lower Lachlan. This article presents the results for Farms B and C.

This approach will not only identify the viability of the investment but also the gaps in information that may exist and their importance.

STEADY STATE PROFIT ANALYSIS

A steady state profit analysis was conducted on each farm to determine the annual operating profit for the "without" and "with" scenarios. The return on assets for each was then calculated using the annual operating profit and the value of assets for each farm (the land, improvements and machinery). Table 1 summarises the input information for Farm B and Farm C used in the analysis. This input data was obtained through interviews with the farm manager.

All co-operators who grew cotton with sprinkler irrigation suggested a reduction in irrigated water use over surface irrigation – across the five farms the reductions ranged from 26 to 59%. On Farm C the reduction in irrigation water use with the lateral move irrigated sorghum was 40% over furrow irrigated sorghum. The reduction in irrigation water use by sprinkler irrigated wheat compared to furrow irrigated wheat ranged from 0 to 33%.

A gross margin for each crop option was drawn up using the machinery and operational information provided by each co-operator. The results of the steady state economic analysis of each case study farm "without" and "with" investment in the CPLM systems is summarised in Table 2.

> The "with" and "without" scenario analysis approach is a robust method to assess the economic and financial performance of investment in CPLMs.

TABLE 1 Profitability Analysis data for "without" and "with" Scenarios for Farms A, B and C

Farm A	Without Centre Pivots			With centre Pivots			Crop
	Area (ha)	Yield (t/ha)	(ML/ha)	Area (ha)	(t/ha)	(ML/ha)	Price ($/t)
Farm Size	[illegible]			450			
CPLM Cotton				360	7.0	8.0	$450
CPLM Wheat					6.0	3.0	[illegible]
Furrow Cotton	330	8.0	9.0				
Furrow Pigeon Pea	20	4.0	2.0	25	4.0	3.0	

* Cotton yields in bales/ha and price in $/bale

Farm B	Without Lateral Move			With Lateral Move			Crop
	Area (ha)	Yield (t/ha)	Water (ML/ha)	Area (ha)	Yield (t/ha)	Water (ML/ha)	Price ($/t)
Farm Size	800			800			
CPLM Cotton				66	9.5	9.2	$450
CPLM Maize				22	10.0	3.1	$197
CPLM Sorghum							$153
Furrow Cotton	210	8.5	4.5	210	8.5	4.5	$453
Furrow Sorghum	105	4.0	2.5	105	4.0	3.5	$153
Furrow wheat	105		2.0	105		2.2	
Long Fallow	105			105			
Raingrown [illegible]	80			15			
Raingrown sorghum	60	5.2		45	5.0		$153
Raingrown wheat	60	3.5		45	3.0		$181

* Cotton yields in bales/ha and price in $/bale

Farm C	Without Lateral Move			With Lateral Move			Crop
	Area (ha)	Yield (t/ha)	Water (ML/ha)	Area (ha)	Yield (t/ha)	Water (ML/ha)	Price ($/t)
Farm Size	2000			2000			
CPLM Cotton				59	7.9	[illegible]	$471
CPLM Sorghum				26	5.0	1.5	$159
Furrow Cotton	480	8.0	7.5	480	8.0	7.5	$471
Furrow Sorghum	240	5.0	2.5	240	5.0	2.5	$159
Raingrown sorghum	300	1.8		280	1.8		$168
Raingrown wheat	900	2.5		840	2.5		$153

* Cotton yields in bales/ha and price in $/bale

TABLE 2 Steady state economic analysis of Farm B and farm C "without" and "with" investment in the lateral move system

		Farm A		Farm B		Farm C	
		Without	With	Without	With	Without	With
Size	ha	450	450	800	800	2,000	2,000
Land & Improvements	$	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Plant & Equip	$	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Asset Value	$	$9,452,600	$10,207,600	$5,464,300	$5,749,200	[illegible]	$11,776,000
Total Gross Income	$	[illegible]	$1,862,000	[illegible]	$1,402,540	[illegible]	[illegible]
Farm Variable Expenses	$	[illegible]	[illegible]	[illegible]	[illegible]	$1,161,793	[illegible]
Farm Gross Margin	$	$534,605	$780,048	$586,843	$818,722	$1,062,945	[illegible]
Total Operating Overheads	$	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Annual Operating Return	$	$309,188	$500,504	$321,878	$441,256	$456,857	[illegible]
Return on Assets		3.84%	5.01%	5.89%	7.68%	4.04%	4.33%

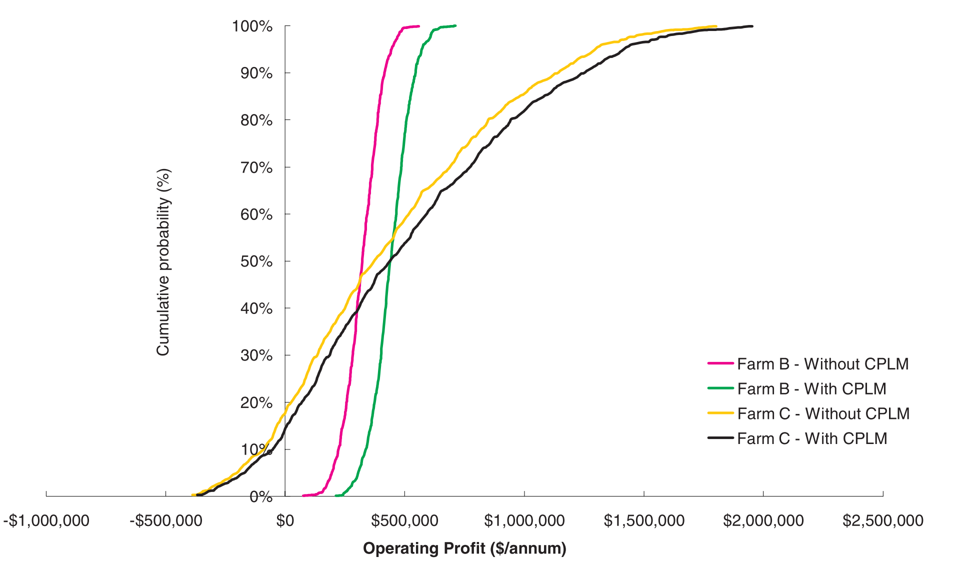


FIGURE 1 Distribution in annual returns for the "With" and "Without" scenarios for Farms B & C

The annual farm gross margins for each farm increases with the investment in the CPLMs – an increase ranging from $75,000 to $327,000 across the five farms. The annual total operating overheads increase across the farms from $11,000 to $49,000. The annual operating return increases for all farms following investment in the CPLMs – the increase ranging from $49,000 for Farm C to $305,000 for Farm E. The increase in return on assets resulting from the investment in the CPLMs ranges from 0.3 to 9.3%. The most notable thing is the range in economic data across the five case study farms. This range in outcomes is clearly evident in the distribution in annual operating profit for Farms B and C in Figure 1 shown by the respective cumulative probability curves. The further right a cumulative probability curve is the more positive the outcome for the respective farming system.

For Farm B the existing and proposed farming system always generates a positive annual operating return, with the investment in the lateral move always better then the existing farming system. For Farm C there is a chance (around 20% or 1 in 5 years) that there will be a negative operating return with the existing farming system. The investment in the lateral move always increases the operating returns but the improvement is only slight – more intensification of the cropping system is possibly needed to increase the annual operating returns. The risk of a negative return is reduced to around 14% (1 year in 7) through investment in the lateral move.

It must be remembered that these outcomes are based on the ranges in yields and prices specified by the co-operators, and their assumption of a reliable water supply from year to year.

FINANCIAL ANALYSIS

After the Steady State Profit Analysis a 20 year financial analysis was performed on two of the case study farms – (Farm A and Farm B). This analysis considered the cash flow of the business and included debt repayments, drawings by the investor and taxation. The expected values of the probability distributions for yield and price were used to generate the nominal cash flows for the "without" and "with" scenarios. The likely variability in the cash flow outcomes was assessed by simulating the expected business cash flow 1000 times using the range in yields and prices specified by each irrigator. This process enabled a comparison of the variability in cumulative cash flow between the "without" and "with" scenarios over the 20 year investment period to be made (see Table 3).

For both farms the investment in the CPLMs results in an increase in nominal returns over the 20 year investment period. The returns for Farm A are less ($0.76m) compared with that for Farm B ($2.02m). The cash inflows and cash expenses increase much more for Farm A compared to Farm B owing to the greater investment in land and infrastructure by the Farm A manager.

Analysis of the risk associated with the investments (based on the range of yields and price expectations by the farm managers) showed that the range in cumulative cash flows for Farm A was less than that for Farm B. The greater range in possible outcomes for Farm B is due the greater range in crops grown on this farm compared to that on Farm A.

ECONOMIC ANALYSIS

An economic analysis over the life of the investment was then completed for Farm A and Farm B. This analysis examines the economic efficiency of the investment over the 20 year investment life. This analysis was based on a Present Value framework – this converts the future cash flows to their present cash equivalent, providing the decision maker with some of the information needed to make investment decisions between alternative farming systems. The internal rate of return (IRR) and the net present value (NPV) were then calculated for the investment in the CPLMs. The IRR is a measure of the rate of return on an investment and is calculated in nominal terms before tax and interest has been deducted – it can be compared

PROFITABLE OR NOT – centre pivot or lateral move irrigation system

to the average unfranked dividends paid on shares over a similar investment period or the return before tax on long term fixed investments. The NPV is the sum of discounted values of future income and costs associated with an investment. A distribution of outcomes for NPV was also generated using the range in yield and prices expected by the farm manager. This enabled the chances of achieving the investment goals to be determined. The results are presented in Table 4.

The analysis indicates that investment in the CPLMs on both farms results in an increase in the IRR – the improvement is greater for Farm B.

The NPV values show that if the Farm A investor had an opportunity cost of capital of 10% over a 20 year investment period, then the present value of benefits foregone by continuing with the existing farming system would be $3.71 million. Investment in the centre pivots would reduce this to a loss of $3.09 million.

On the other hand, the Farm B investor with an opportunity cost of 10% over a 20 year investment period with the existing farming system would forego $0.51 million of present value benefits. Investment in the lateral move results in an increase in the net present value of benefits to $0.59 million.

The calculation of NPV in Table 4 was extended to a distribution of outcomes by simulating each investment model 1000 times. The distribution for NPV allows the chances of achieving the 10% return or better before tax and interest to be determined. The results of this analysis for Farms A and B are shown in Figure 2.

Farm A has no chance of achieving a 10% return or better before tax and interest with the existing furrow irrigation system. Similarly, investment in the centre pivot systems does not achieve a 10% return or better – although it is better then the current system. This is based on the current yield and price assumptions by the Farm A manager. If the farm manager has no opportunity to realise the farm assets and gain a greater return elsewhere, the future investment choice is between the farming systems.

The Farm B manager has a 26% chance of achieving a 10% return or better before tax and interest with the existing furrow irrigated farming system (and a 74% chance of not achieving this rate of return). This chance increases to 75% if the investment in the lateral move is made. The NPV of the investment in lateral move farming systems exceeds that from the original furrow irrigation system at all times.

MARGINAL ANALYSIS

Finally, a marginal analysis of the financial and economic impacts of investing in the CPLMs was conducted on Farms A and B. This analysis differs from that of the whole farm analysis. In the marginal analysis only the capital invested in the project and the extra or additional returns generated by the capital investment are considered. This method of calculation allows the benefits arising from the project alone to be accurately identified. This analysis examines the cumulative cash flow associated with the investment and calculates "pay-back" period – the time taken for the investment to generate sufficient cash to cover the initial set up cost. The distribution in NPV for the investment was also calculated.

For Farm A the cost of the investment in the five centre pivots and additional land is about $1,755,000. The project generates sufficient cash to cover the initial set up cost within three to four years. The project is expected to produce a cash surplus of about $6 million over the economic life of the pivots.

For Farm B the cost of the investment in the lateral move is $295,000 (this includes an allowance for associated earthworks totalling $45,000). No additional farming plant is required to undertake the new cropping system using the lateral move. The lateral move investment is expected to generate sufficient cash to cover the initial set up cost within 5 years of installation. The project is also expected to produce a cash surplus of about $1,200,000 over the economic life of the project.

The results of the 1000 simulations to calculate the distribution in marginal NPV for the CPLM investment are presented in Figure 3.

The greatest range in NPV exceeding a 10% marginal return on capital occurs with Farm A - this is the result of fewer cropping activities for this farm compared to that for Farm B. For Farm B all returns exceed a 10% marginal return on capital.

ROBUST

The "with" and "without" scenario analysis approach is a robust method to assess the economic and financial performance of investment in CPLMs. It is not possible to make a "rule-of-thumb" statement that the investment in CPLMs is or is not profitable – every farm business differs and so to do the water savings and yield benefits for the many crops that can be grown with these machines. Yield and prices risk, the extent of water savings and the risk of water availability all need to be considered when deciding on investment in alternative irrigation systems to current furrow systems. Other considerations include the availability of labour and the likely impact of changing energy costs on the viability of CPLM investments.

? For further information, contact your cotton extension team member.

TABLE 4 Economic analysis indicators for the "Without" and "With" scenarios for Farm A and Farm B

	Farm A		Farm B	
	Without CPLM	With CPLM	Without CPLM	With CPLM
IRR	5.5%	[illegible]	9.0%	[illegible]
NPV [illegible]	[illegible]	[illegible]	-$0.51m	$0.59m

TABLE 3 Financial analysis for Farms A and B – "With" and "Without" investment in CPLMs (cumulative values in $ millions over 20 years)

	Farm A			Farm B		
	Without Centre Pivots	With Centre Pivots	Difference	Without Lateral Move	With Lateral Move	Difference
Cash inflows	$32.21	$44.06	$12.45	$27.81	$34.88	$7.08
Variable Expenses	[illegible]	$25.04	[illegible]	[illegible]	[illegible]	[illegible]
Overhead Expenses	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Per... Drawings	$5.54	$8.34	$1.30	$5.07	[illegible]	[illegible]
Financial Expenses	[illegible]	[illegible]	$1.30	[illegible]	[illegible]	$1.02
Farm Cash Expenses	$27.70	$39.47	$11.68	[illegible]	$30.01	$5.05
Cash balance	$4.49	$5.19	$0.70	$4.85	$8.87	$2.02

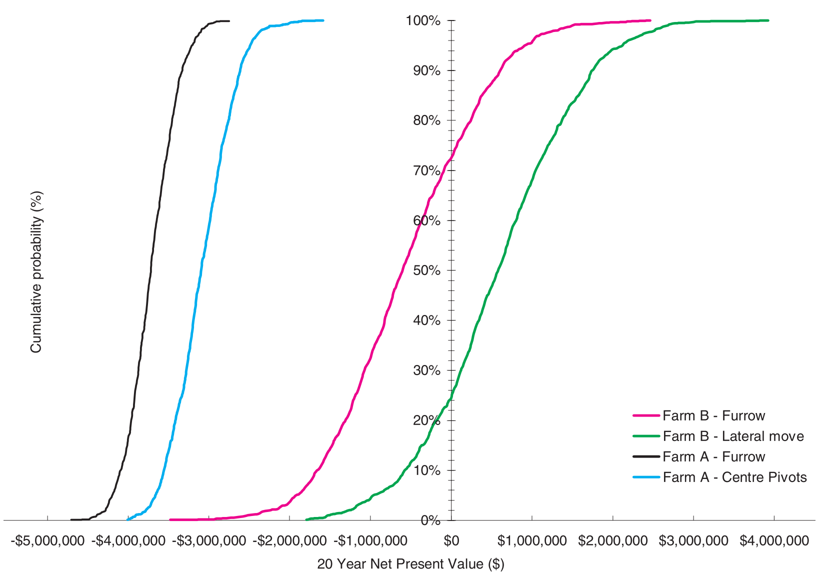


FIGURE 2 NPV distribution before financing and tax for Farm A and Farm B farming systems.

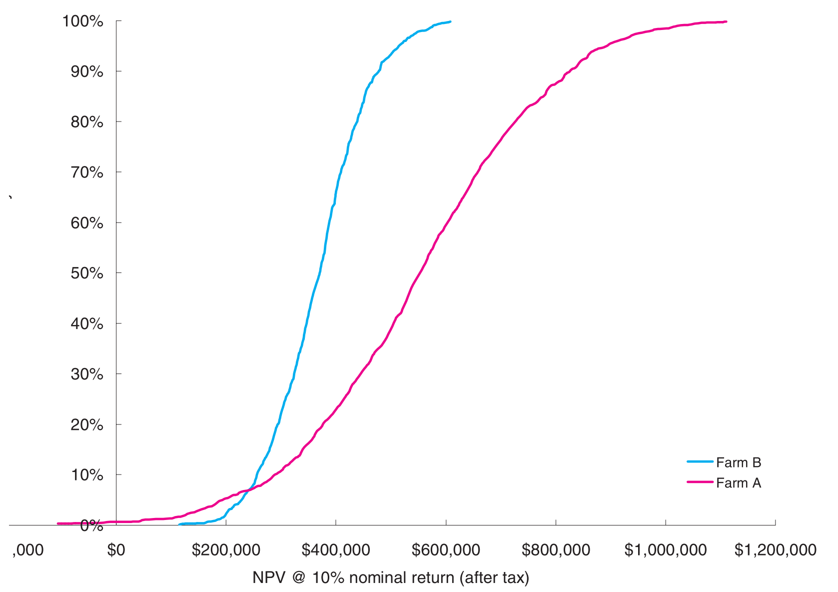


FIGURE 3 Distribution of marginal NPV for the CPLM investments on Farms A and B

Half the length: quarter the time

Bruce Crosby, recently divided one of his fields (above) in two to improve water use efficiency.

By Bruce Crosby, Janelle Montgomery and Melanie Jenson.

Cutting field length by half has resulted in more even water distribution, less waterlogging, shorter irrigation events and improved crop uniformity at Chinook, just east of Moree.

Manger Bruce Crosby recently reconfigured a field which originally had 1000 metre rows, and run times in excess of 12 hours (using single siphons) and an uneven crop emergence.

"The field was generally considered a hard field to water with some side slope issues and soil type variation," Bruce said.

"We noticed that crops in that field tended to be taller in the middle of the rows and realised we had a problem with even water distribution.

"Obviously due to the 12-hour run times the field was suffering waterlogging at the head-ditch end. Poor uniformity also affects efficiency by increasing deep drainage at the top end of the field.

"This lead to other issues with uneven defoliation and having to apply variable retardant rates and so on.

"We (irrigators) can't decide the amount of water we receive every year, the only thing you can do is alter the use of your water on-farm to make the best use of it.

"So we decided to cut the field in half making two fields of 490 metre runs to improve our water use efficiency," he said.

Irrigations have been reduced to as little as four hours in recent corn crops and Bruce says cost benefit of splitting the field is well worth it already.

"You have a more even crop that is not suffering waterlogging at the ends and you are saving water by avoiding deep drainage.

"We can water quicker and more often, putting the plant under less stress and all these factors go toward improved quality and yield and therefore the bottom line."

The 5000 ha property has 700 ha developed for surface irrigation, with water supplied from a Gwydir River licence and four bores.

Irrigation crops include cotton, corn, sorghum, soybeans and wheat grown on brown to black cracking clays, generally of good quality with no serious subsoil constraint issues.

Although set up for cotton the field was "planted to corn due to virtually nil river water and low cotton prices exposing us to potential quality down grades and very marginal potential returns," Bruce said.

Corn was planted at the end of December 2006 into a dry seed bed with very little profile moisture. It germinated on 25mm of rainfall at New Year. Once the crop had germinated the fields were irrigated filling the profile.

The crop received another five in-crop irrigations using double 63mm siphons every second furrow for each water run, on two-metre beds.

The target deficit using neutron probes was 50 to 60 mm. These in crop waterings came out evenly in as little as four hours – a far cry from the previous situation before cutting the field in half.

Importantly, the Cotton Community Catchments CRC Water Team members, Janelle Montgomery and Nathan Ferguson from NSW DPI evaluated the irrigation performance using the Irrimate system. Measuring the amount of water applied to the field, the advance rate of this water down the furrow and runoff allows us to model the actual irrigation event. Alternate management strategies such as changing flow rates and/or time when siphons are pulled, field length or slope can be assessed using the Irrimate™ system to find the most efficient irrigation application strategy.

"Ideally we like to evaluate irrigation performance before making changes to practice or field design. You may inadvertently reduce the performance of an already efficient field. However, it was obvious to Bruce where his issue lay, that his runs were too long and coupled with low flow rates and he had poor uniformity all of which were impacting on his production," Janelle said.

"After the field length was shortened, he felt the field was using water relatively efficiently, but he wanted to know just how efficient it really was.

"He already knew that fields with shorter runs were yielding higher."

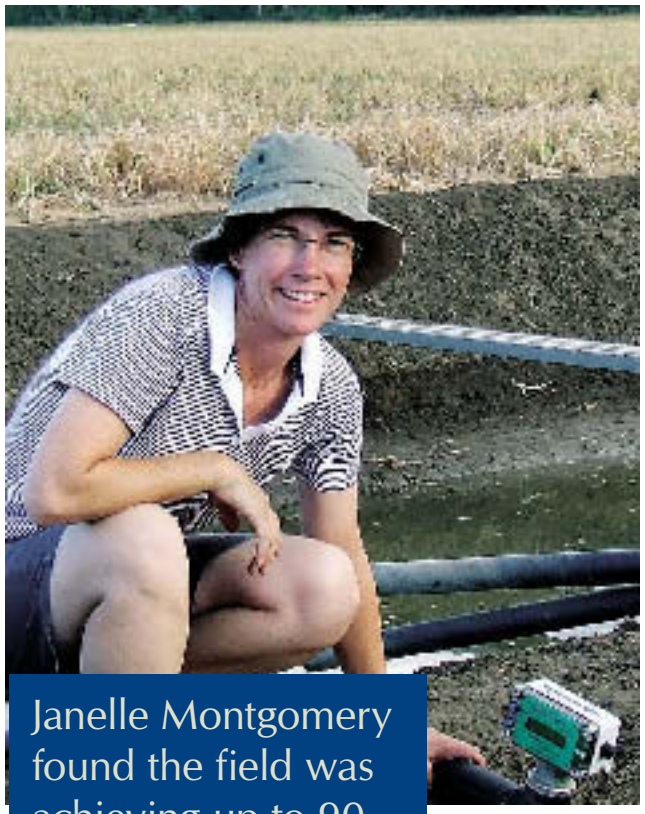
Janelle and Nathan found that Chinook was achieving up to 90 percent efficiency of application with good soil moisture replenishment without losses through deep drainage.

Bruce said that the information gathered through the Irrimate technology enables the irrigator to make informed management decisions, both short and long term, to improve watering efficiency based on calculated and measurable benefits.

Bruce said that the crop never looked back and went on to yield 10 t/ha of high quality corn now being delivered into the human consumption market at a premium price over feed corn. He believes with changes to other management decisions this can be improved on, with an aim of 12 t/ha for this season's crop.

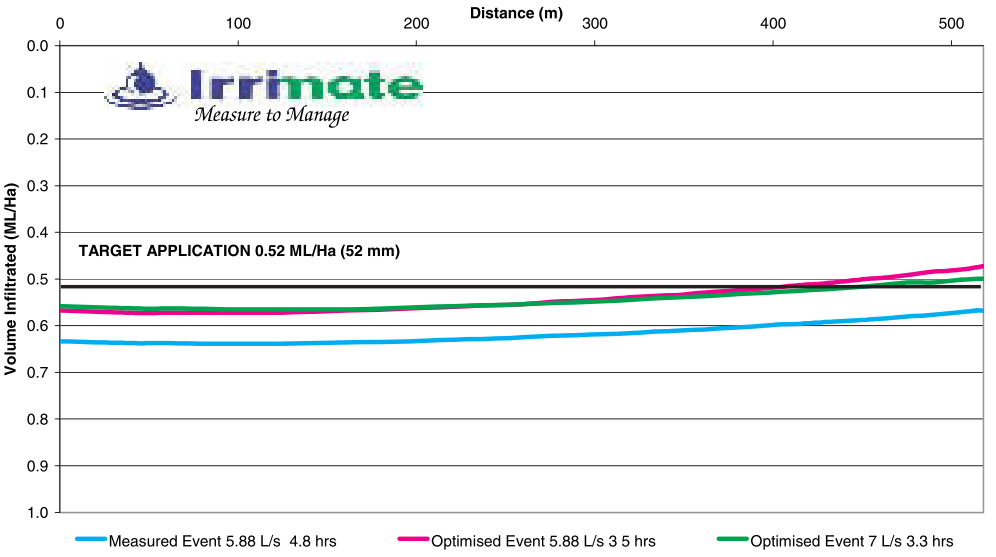
On the basis of these results another three fields have been cut in half covering 160 ha with new head ditch and tail drain systems and Bruce said even with only minimal irrigation due to in-crop rain, the performance of the fields in relation to their water use efficiency is already obvious.

continued page 22 ...



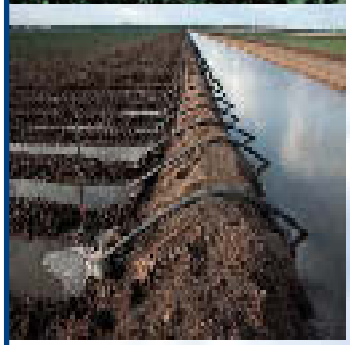
Janelle Montgomery found the field was achieving up to 90 percent efficiency of application.

For the measured irrigation event, the irrigation water reached the end of the row in around 2 3/4 hours and the furrow ran tail water for another 2 hours before the siphons were pulled. The application efficiency was 77 per cent and distribution uniformity 95%. Simply reducing the time to cut off increased the application efficiency to 91 per cent, with tail water being reduced significantly. This management option results in a water saving of 0.10 ML/ha/irrigation. Increasing the flow rate and reducing time to cut off also improved application efficiency and distribution uniformity. However, when the flow rate is increased even greater care should be taken in the timing when siphons are pulled. The higher flow rate has the potential to result in greater tail water.



The chart above shows an example of the Irrimate™ results for the measured and optmised irrigations. It illustrated differences in the infiltrated volumes from the head ditch (0m) to the tail drain (518m) for the measured and optimised events. The table below quantifies the efficiency of application and potential water savings.

Irrimate Measure to Manage	Measured Irrigation Event	IRRIGATION OPTIONS	
		Optimised Event 5.88 L/s, 3.5 hrs Reduce time to cutoff	Optimised Event 7 L/s, 3.3 hrs Increase head to increase flow rate to 3.5 l/s each siphon
Flow Rate - (l/s)	5.88	5.88	7.00
Time - Water Applied (min)	290	210	200
	4 hrs 50 mins	3 hrs 30 mins	3 hrs 20 mins
Time - Advance to	162	162	134
End of Field	2 hrs 42 mins	2 hrs 42 mins	2 hrs 14 mins
Target Application (mm)	52	52	52
Inflow - (mm)	99	72	81
Tailwater - (mm)	37	17	27
Water Infiltrated - (mm)	62	54	54
Application Efficiency (85% of tailwater recycled)	77%	91%	89%
Requirement Efficiency	100%	100%	100%
Distribution Uniformity	95%	92%	95%
Potential Water Saving - (ML/Ha)		0.10	0.09



Cotton CRC Water Priority Team

"Providing all cotton and grain irrigators with an opportunity to improve on-farm irrigation"

- Irrigation Training
- Timely Irrigation Updates
- Latest H_2O Efficiency Research

Emma Brotherton,
Team leader
QDPI&F,
Goondiwindi
(07) 4671-6714
emma.brotherton@dpi.qld.gov.au

What Bruce found while researching WUE

The changes may be as simple as:

- varying the head of the water in the head ditch to increase (or decrease) flow rates
- placement of the siphon so that the discharge end is under the water in the rotobuck
- changing flow rates by using larger or double siphons
- positioning of rotobucks so that water only runs down the water run rows
- more complex changes may involve levelling head ditches so that all siphons have similar flow rates along the length of the field, altering field slope when the field is re-levelled and splitting long fields in half to shorten row length

? For further information, contact
Janelle Montgomery
janelle.montgomery@dpi.nsw.gov.au
tel: 02 6750 6302,
or Bruce Crosby 0428 526 010

Most farmers dream of being able to turn the rain on and off to suit their crop needs.

Praising water from above

For Dalby cotton grower Brett Crothers, the shift to overhead water irrigation systems has allowed him to turn the rain on as he needs it.

Brett, who farms as part of a family enterprise on "Fairview" just 12km south of Dalby, put some 80 hectares under a lateral move irrigation system around five years ago, and hasn't looked back.

The lateral move has successfully watered rotations of wheat, sorghum, cotton and is currently over a crop of corn.

The effectiveness of the lateral move has seen the Crothers family put in place plans to extend the irrigator to cover 130 hectares and possibly widening to incorporate a total of 200 hectares.

Last June, the family also purchased another overhead system – a centre pivot – used to water 60 hectares. It's efficiently watered oats and corn, and has been earmarked to water a future crop of cotton.

According to Brett, one of the most significant bonuses of having overhead water systems in place is the flexibility. With flood irrigation, it was more of an "all or nothing" approach.

With the lateral and pivot, the Crothers are finding they can be much more precise with the amount and timing of water applications.

"If we get a small shower of rain, we can run the equivalent of an 'inch' of rain on top of it and make a small rain event have so much more impact," Brett said.

"Or if you just need a little water to finish a crop off, you can give it a quick 20mm without having to do a full flood irrigation.

"It also gives us the flexibility to plant dry."

And the water savings have been significant. Brett estimates a 30 percent reduction in water use since moving from flood to overhead. With the continual strain on water resources, savings like this can make all the difference.

The reduction in labour costs was another draw-card of the overhead systems.

"I'd say the lateral move takes about one-fifth of the work of flood irrigation and centre pivot is even less intensive - about half the work of the lateral move," he said.

That can mean significant time and cost savings for the average farmer.

The savings also flow on to other input costs. Brett has trialled the application of nitrogen through the overhead irrigators and has been very impressed with the results.

"We can get away with using about two-thirds of the nitrogen we previously used and we're seeing the plants respond within a day," Brett said.

"We're adding about a kilo of N for every two mm of water applied when required which means we don't have to have a huge surplus of nitrogen up front [prior to planting], so we're able to avoid the losses of nitrogen which can occur in water logging events."

Since irrigation first began in Australia back in the 1800s so much has changed.

Brett sees the use of nitrogen as an important issue for the industry and is currently making his property available for a research project to measure losses of nitrogen from soil to the atmosphere in the form of nitrous oxide in conventional farming methods.

Despite some promising summer rains, Brett laments the drought hasn't yet released its grip and his 5000 megalitres of available storage is still well under capacity.

Brett said he continued to look for new ways to make the most of the available water.

Water loss can be attributed to any number of factors such as evaporation, seepage and inefficiencies of open distribution systems and flood irrigation practices.

"We have installed underground poly-piping in a number of places to help avoid losses and we've connected all our ring tanks so that when we have limited we can move it to our better soils where it is going give us the best return," Brett said.

The Crothers are also adapting new methods to their flood irrigated paddocks such as watering on smaller deficits, trying not to let the profile dry down more than 60mm, and therefore allowing the water to run through quicker.

Since irrigation first began in Australia back in the 1800s so much as changed.

In recent years, the quest for water use efficiency (WUE) has become such a talked-about and studied practice. Brett strongly supports continued study and funding into WUE methods, summing up the need with one simple statement.

"We need to make every drop count."

Steve Yeates, left, Dirk Richards, right: Large scale replicated trials were used to accurately measure the water requirement of Bollgard cotton.

Boosting Bollgard II

By Melanie Jenson and Stephen Yeates

The introduction of Bollgard®II varieties into the cotton growing landscape created questions regarding its water requirements and irrigation scheduling and how it may differ from conventional varieties.

CSIRO's Stephen Yeates and Dirk Richards have been undertaking research since 2004 with the aim to develop principles of irrigation scheduling through agronomy and physiology research to optimise BollgardII® performance in all production regions.

"It was feared that a Bollgard®II plant with higher early fruit load and less likelihood of tipping, may be smaller at the start of flowering and hence cut-out prematurely," Stephen said.

"Premature cutout is commonly linked with reduced yield potential, so if premature cutout was a problem, management strategies tailored to Bollgard varieties would also be required."

A broader issue requiring research was the water requirement of genetically modified Bollgard cotton. Is its water requirement the same as conventional cotton?

Through a collaborative effort with James Nielsen of CSIRO, growers and the University of Qld, research was carried out over the 2004-05, 2005-06 and 2006-07 seasons at ACRI Narrabri, comparing the impact on yield and fibre quality, particularly fibre length and micronaire, of increasing irrigation deficits on both Bollgard®II and conventional cotton. An additional comparison was conducted with Andrew Parkes at Keytah, Moree in 2005/06.

"From these experiments we learnt that a balance is required between boll load and the plants response to water and pests to maximise crop performance," Stephen said.

Dirk Richards added that "Firstly, in situations with no stress, that is irrigation at modest deficits (60 to 75mm) and moderate insect numbers, Bollgard®II required 10 percent less irrigation water than the conventional cotton.

"This was because Bollgard®II had a shorter growing season due to higher early boll retention and fewer tipped plants. In this situation yield was also 10 percent higher in the Bollgard variety."

"Secondly when modest irrigation deficits were used and insect damage to fruit was low but terminals were tipped early by insects in the conventional variety, for instance, at Keytah, boll retention in both conventional and Bollgard was high. The varieties had similar growing season length, but water use efficiency was higher in the conventional variety due to the more favourable leaf canopy created by early tipping increasing its yield," the researchers said.

"Finally, Bollgard®II was less able to compensate for water stress, particularly from peak flowering (100mm deficit) to cut-out (120 mm deficit) and under stressed situations produced lower yields than conventional."

Stephen said the differences between Bollgard®II and conventional varieties when stressed could be explained by later growth in conventional from lower retention of fruit and higher levels of tipping.

The researchers found that up to cut-out (end of flowering), soil moisture extraction under fully irrigated conditions was the same in Bollgard®II as conventional cotton. Thereafter the conventional variety used more water as its cutout was delayed compared with Bollgard®II due to tipping out and lower fruit retention, which resulted in greater leaf area and delayed fruit maturation.

"We also learnt some important lessons about fibre quality" Dirk said.

"When stressed at cut-out, fibre length was reduced by similar amounts in Bollgard®II and conventional cotton.

"When stressed at peak flower, there was a greater reduction in fibre length in Bollgard II than in conventional. The effect of stress on micronaire was more variable, although it was less severe in Bollgard®II than conventional."

Options in limited water situations.

It was clear from the research that water stress during flowering is undesirable for Bollgard®II when fruit retention levels are high.

"Hence there appear few options to improve the management of Bollgard II in limited water situations without impact on yield and quality," Stephen says.

Future research aims to evaluate more frequent irrigation of Bollgard II prior to and during flowering as a means of optimising yields. The water requirement of these irrigation strategies will also be measured.

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Pictured Left; Boll weevil, Anthonomus grandis grandis Boheman, 1843 (Coleoptera: Curculionidae: Anthonominae). Status – Exotic (absent from Australia) High Impact Pest Species.

Below; Cotton Leaf Curl Virus, Exotic (absent from Australia) High Impact.

Biosecurity measures protect livelihoods and lifestyles

Australia's geographic isolation has kept it relatively free from many pests wreaking havoc overseas however today with millions of people travelling worldwide and an exotic pest able to hitchhike on a strand of hair, Australia's $1 billion a year cotton industry is fostering a world class biosecurity plan in preparedness.

Developed by the Australian Cotton Growers' Research Association Inc. (ACGRA) in conjunction with Plant Health Australia (PHA), the Australian Government, and state and territory governments, the comprehensive blueprint outlines not only how to actively prevent an exotic pest incursion but how to detect, respond and manage a crisis as growers, community, industry and governments. The plan also includes an Emergency Plant Pest Response Deed (EPPRD), a separate legal agreement between ACGRA, the Australian Government, and all state/territory governments that entitles the cotton industry to be involved in the decision-making process in the event of an incursion. The EPPRD enables growers to claim certain expenses and agreed value of the crop if a response is mounted under the EPPRD.

"Before we all had an agreed plan (PLANTPLAN), we'd be working it out as we went and that's definitely not the way to manage an incursion. We now learn from incursions such as citrus canker, sugarcane smut and the more recent outbreak of equine influenza. We're now all very clear on the roles and responsibilities of community, growers, industry and governments," says Rod Turner, General Manager Programs, Plant Health Australia (PHA).

According to ACGRA, the Australian Government has agreed to assist EPPRD signatories in the event of an incursion, but only if industries do their bit too. While, NSW DPI, QLD DPI&F and cotton breeding programs routinely check cotton fields for pathogens, PHA and the cotton industry are increasing biosecurity awareness.

ACGRA says while AQIS has strict controls of cotton plants and seeds introduced at the border, many pests are difficult to see and there is a chance of accidental introduction in packing material or in soil or plants in poorly cleaned machinery and equipment. Some pests can also arrive on people's clothing and boots.

Following the surveillance strategy, PHA is holding free workshops for researchers, cotton growers and consultants to help identify cotton boll weevil, tarnished plant bug, cotton leaf curl virus, blue disease, and exotic strains of Fusarium wilt and bacterial blight. PHA provides images tips for how and when to look for the diseases which are most likely to damage livelihoods.

Top Twelve Highest Risk Pests:

Invertebrates

- White fly
- Boll weevil
- Melon aphid
- Tetranychus mites
- Green Jassid
- Tarnished plant bug

Pathogens

- Cotton Leaf Curl Virus
- Fusarium wilt, (exotic races)
- Texas root rot
- Phymatotrichum root rot
- Verticillium wilt, (defoliating strains)
- Bacterial blight, (hypervirulent races)
- Blue disease

Spotted anything Unusual?
Emergency Plant Pest Hotline
1800 084 881.

Plant Health AUSTRALIA

ACGRA

Want more info?

The cotton Biosecurity Plan is available at http://www.planthealthaustralia.com.au or email: admin@phau.com.au or (02) 6260 4322.

"Biosecurity Awareness" Workshop – Narrabri, 9 May 2008

Identify specific exotic pests to the cotton and grain industries.

Understand Emergency Plant Pest Response Deed (EPPRD), PLANTPLAN (the Australian Emergency Plant Pest Response Plan) and industry and government roles and responsibilities under these arrangements.

? For information visit
http://www.planthealthaustralia.com.au/

R&D investments reward producers and nation

By Mary Ann Day

Each cotton enterprise has a clear picture of the range of benefits they gain from Bt cotton. The same applies to those who have embraced water measurement equipment to measure storages, syphon discharges and flow rates.

These are associated with management practices and technologies that have arisen as a direct result of their investment in R&D through levies. In addition, the community through its taxes matches producer's levies to create aggregated investment funds that are extended further through the input of research capacity from the industry's research providers such as CSIRO and NCEA.

So how should the cotton industry collectively report on the benefits of these technologies not just to the farm, but to the nation and how our investments spill over to the broader economy, community and environment.

HERO PROJECTS SHOW THE WAY

Two recently completed cost benefit analyses were conducted using a new R&D evaluation framework developed for the Council of Rural Research and Development Corporation Chairs by economics specialist consultancy ACIL Tasman. The first reports were released in February. Each industry R&D corporation nominated two projects to be studied.

The two analyses conducted for CRDC were termed 'hero' projects under the new framework. This is because they are areas of research investment selected by CRDC which were expected to have produced substantial financial, social, economic and environmental gains.

"When measured against the funds invested across all projects and activities supported by the CRDC over a four year period, the two hero projects examined provided an indication of very good minimum average returns," explained Bruce Pyke, general manager for Research and Extension, who helped to co-ordinate the evaluation exercise for the CRDC.

"For example" Mr Pyke said ,"the levy payers would receive an estimated return of $13 for every dollar invested over this period, while the industry as a whole would gain an estimated return of $12 for every dollar invested."

Mr Pyke added that "to achieve such good minimum returns on total funds invested, clearly very high returns were achieved from the funds invested in the hero projects alone".

Consultant David Collins of the BDA group carried out the cost benefit analysis for CRDC. The results will better position all research and development corporations, like CRDC, to demonstrate the value of the federal government's support of rural research and development initiatives.

Following the successful study of two 'hero' fields of R&D investment, CRDC and all other industry-based RDCs are set to study a random sample of research projects using the same methods perfected in the initial study. From these studies, a stronger appreciation of the need to consider impacts within and beyond the direct reaches of the cotton industry to regional and the national economy can assist CRDC and ACGRA in determining future investment priorities and decisions.

TWO HERO PROJECTS STUDIED

The first project analysed the R&D support provided for the successful deployment of Bt transgenic cotton. This project involved research inputs across a number of scientific areas on a collaborative basis with other public and private organisations. Through the CRDC investment, development of resistance to the transgenic varieties by major pest species has been successfully managed.

The second project studied was the development of tools and techniques for more accurately measuring water use efficiency.

This project provided a foundation on which water savings have subsequently been realised. The CRDC supported the successful development which led to the commercialisation of the Irrimate technology, which has enabled cotton irrigators to "measure and manage" their water resources for furrow irrigation more effectively.

"We think that through the CRDC investment, development of resistance to the transgenic varieties by major pest species has been successfully managed and the 'shelf life' of transgenic cotton has, as a result, been extended," Mr Pyke said.

He went on to mention some of the other benefits found in the results of the study of the first project.

"The evaluation also found there were economic gains, with cost savings to cotton growers from reduced chemical sprays, environmental benefits, from reduced volumes of chemicals in the environment and increased biodiversity of natural predators of pests of cotton and grains.

"Additionally, we were able to describe social benefits, too, with reduced worker exposure, improved lifestyle and reduced stress for farming families due to reduced use of insecticides, as well as the development of scientific expertise in Bt cotton resistance management in Australia."

TOP RETURNS FOR STEWARDSHIP OF BT AND IRRIGATION TECHNOLOGY

In their breakthrough study to measure returns on investment for public investment in R&D, BDA Group estimated that the CRDC investments in this research over the next 20 years return $201 for every dollar of levy payers' funds invested, or $87 for every dollar invested across the entire supply chain in Bt technologies.

The return over the next 20 years on matching funds provided by the federal government was estimated to $488 for every dollar invested.

"Had the CRDC not become involved in the investment, our resistance management strategy for Bt cotton would have been inadequate.

"Consequently, pest populations would have developed resistance to Cry1Ac, the toxin in single Bt gene Ingard cotton, prior to the introduction of double Bt gene Bollgard II cotton. Resistance to Bollgard II would then have occurred rapidly because even though it contains two Bt genes, one of them is Cry1Ac and therefore it would have appeared to the Cry1Ac resistant target pests as a much more susceptible single gene product".

Water measurement technologies track well

The return on the second 'hero' project, Irrimate, was also very good.

BDA Group estimates that CRDC investment to initiate this research has delivered a return of $131 for every dollar of levy payers' funds invested, or $22 for every dollar invested across the entire supply chain. The return on matching funds provided by the Federal Government was estimated at $184 for every dollar invested.

The results of the Irrimate project have provided a foundation on which water savings have subsequently been realised, as well as economic, environmental and social benefits, the study concluded.

"This project has resulted in variable and capital cost savings from reduced water applications on cotton crops, it has helped to identify and reduce deep drainage in cotton growing areas and has increased economic opportunities in regional Australia," Mr Pyke said.

"It has also enhanced the level of scientific and extension expertise in water management on farms and contributed to new tools for small and medium sized businesses that provide advisory services direct to cotton, grains and other irrigators."

The project contributed to the estimated 10 percent water saving achieved in the Queensland Rural Water Use Efficiency Initiative (RWUEI) in cotton and grains by 2003. By 2007 it has been estimated that water savings in NSW reached 10 percent, and it is estimated that another 10 percent saving is achievable by 2014. Without the project, only 50 percent of the achieved water savings under the RWUEI would have been realised by 2003 and the savings captured in NSW would have been delayed.

? For further information, contact Bruce Pyke, CRDC, 02 7692 4088

Industry farewells Dirk Richards

By Tristan Viscarra Rossel

Dirk Richards, one of the CSIRO's experimental scientists supporting the development of decision support, has recently left the industry in Narrabri to further his career in environmental management – and he'll be sorely missed.

When reflecting back on his career, Dirk said that his highlights were the nomination for the Elders Young Achiever of the Year Award, working with a tight-knit team at the ACRI and working with growers throughout the Australian cotton industry.

According to Dr Mike Bange of CSIRO Plant Industry, Dirk has been a true campaigner for the Australian cotton research community.

"Dirk has always undertaken his work with a consideration for natural resource issues. So, in a way, he is following his dreams by becoming a ranger with the NSW National Parks & Wildlife Service," he said.

"We wish him all the best in his new endeavour. His passion, dedication, and tenacious commitment to his work have benefited CSIRO and the cotton industry as a whole.

"His resilient character enabled him to take OZCOT to new levels within the industry, culminating in the development of HydroLOGIC."

In collaboration with fellow researchers from the Cotton Catchment Communities CRC Dirk conducted studies into the application of software for farm and crop management; the integration of irrigation knowledge with both agronomic and engineering tools; cotton plant response to irrigation management (especially Bollgard® II); and surface and overhead irrigation systems.

In 2006 he was nominated for the Elders Young Achiever of the Year Award in recognition of his research contribution to the Australian cotton industry.

Dr Bange said Dirk had a good understanding of how irrigated cotton growers determine their irrigation schedules, their attitudes to risk and irrigation practices.

"He used his knowledge of plant, soil and water relations to describe how cotton reacts to moisture stress," he said.

CRDC's general manager of research and extension, Bruce Pyke, explained that Dirk's research outcomes have helped the Australian cotton industry to understand how it is managing water and crops.

"Although we are no longer supporting the research project, Dirk's development and investigation of decision support tools, and the various experimental work he undertook to support that development, has helped us to ask a lot of questions about how to increase water use efficiency and better use historical climate information for irrigation and crop management," Mr Pyke said.

CRDC research program coordinator, Helen Dugdale, added that Dirk had been instrumental on the WaterPAK Committee, which developed *WaterPAK: A guide for irrigation management in cotton*.

"He has been not only a good researcher but also good at extending that research with the water extension team," she added.

Ingrid gets project team posting

Dr Ingrid Rencken has recently been appointed to the Sustainable Industries Initiative project team.

Ingrid has taken up the position of Resource Management Officer with QLD DPI&F based at Toowoomba. Ingrid takes over from Veronica Chapman who has moved on to another position with QLD DPI&F at Bund-a-berg.

"Ingrid brings to the project extensive technical and research skills in natural resource management," said NSW DPI Resource Specialist Rob Welsh.

In 2006 Ingrid completed her PhD from UNE looking at the importance of native vegetation surrounding cotton properties with her thesis title, ***An investigation of the importance of native and non-crop vegetation to generalist predators in Australian cotton agroecosystems.*** (See December ***Spotlight*** for a review of Ingrid's work.)

Prior to this, Ingrid worked in South Africa including research focusing on integrated insect pest management on vegetable and apple crops with the South African Agricultural Research Council.

Recently Ingrid has provided technical input into the production of the 2008 Biodiversity in Cotton Landscapes Calendar and associated fact-sheets.

? Ingrid can be contacted at the Toowoomba office of QLD DPI&F on (07) 46881099 or email Ingrid.Rencken@dpi.qld.gov.au

"Nobody on the planet can claim to have had so many cotton varieties released as he has."

Peter Reid: bred for success

By Tristan Viscara Rossel

When prominent CSIRO cotton breeder, Peter Reid, retired from full-time research in November 2007, he left behind a legacy of cotton varieties that have changed the way cotton has been managed right around the world.

Peter began his cotton breeding career in 1979. After a period working in entomology with the CSIRO in Narrabri, he moved across to the cotton breeding area and never looked back. "I found cotton breeding fascinating, and I've been privileged to be present during the real growth phase of the modern cotton industry," he said.

During his time in the industry, Peter said he witnessed Australian cotton progress from a marginal product to a respected product with good fibre strength and the highest yields in the world.

"Probably more than half of that improvement is due to better agronomy but a good proportion of that is due to breeding," he said.

Peter recounted the development of new cotton varieties as a highlight and mentioned working on Sicala 40, Sicot 189, and Sicala V-2.

Sicala V-2 was the first cotton variety with major resistance to verticillium; it made quite an impact on verticillium wilt both here and in many other countries.

Most recently, his work on the Sicot 71 family of cotton varieties, both transgenic and conventional, have been the pinnacle in terms of yield performance in Australia and overseas.

CSIRO cotton program leader, Dr Greg Constable, said that the impact of Peter's work on the industry is immeasurable.

"Nobody on the planet can claim to have had so many cotton varieties released as he has had, with such wide adoption globally. Our CSIRO cotton varieties are grown in Australia, the US, South America and Europe," Dr Constable said.

"Some Greek farmers visited us recently and said that that he's held in great esteem, like a god."

But none of this research has occurred quickly or haphazardly; some of these varieties have taken a decade to complete.

"It's a long, long process," Peter said.

"You need a lot of patience. Plant breeding is not suited for personalities who like a quick result.

"For instance, I made the cross right back in 1990 for the Sicot 70 and 71 family, and it didn't really have a commercial impact until 2002."

Dr Constable said that Peter is known for being quiet and meticulous; qualities that have served him very well as a plant breeder.

"He's a quiet sort of person and very good to have in the team. He has looked after many smaller details of the work, such as developing critical procedures for new research," Dr Constable said.

Peter has been responsible for two specific aspects of the cotton breeding program – earliness and disease resistance.

Earliness is required in some of the more southern and eastern cotton growing regions of Australia and Peter has been very successful in producing early-maturing cotton varieties.

But Greg said that it will be Peter's work in disease resistance for which he will be long remembered.

"Over time he has developed fantastic breeding lines and varieties with verticillium and fusarium resistance, and they will be the things that he's remembered for in the long term," Dr Constable said.

Peter is continuing to work with CSIRO Plant Industry as a part time CSIRO Fellow but is planning to move with his wife to the Hinterland in the "not too distant future".

"We've been in Narrabri for over 30 years and it's been great, but we feel it's time for a change now," he said.

"The course caused us to examine our lifestyle and set goals for our future. It alerted us to the dangers to our health and gave us strategies to help live a healthier and more productive life. We are encouraged to make some changes to our personal and family life. Hopefully better health outcomes will lead to better farm outcomes!" – Sustainable Farming Families cotton growers' workshop participant

Sustaining farming families' health high on agenda

By Melanie Jenson

Rural and farming families in general have a poorer health than their urban counterparts, with higher than average rates of premature death from heart disease, cancer and suicide.

A project partly funded by CRDC is to help farmers improve their families' health and to reduce costs to community from common health problems such as diabetes and cardiovascular disease.

The Sustainable Farm Families (SFF) project worked with a targeted group of farm families across a number of industries in improving their health management. Over a period of three years the families were regularly monitored and participated in annual workshops focussed on health improvement.

Participants were guided by workshop professionals to understand aspects of their personal health and develop their own action plans for personal health as well as their farm and family's health.

The project, funded by the Joint Venture for Farm Health and Safety, is an initiative of the Western District Health Service, Hamilton.

The CRDC funded two Sustainable Farming Families workshops in Dalby and Wee Waa as pilot programs to see how useful and successful they could be for cotton farming families.

"There was a total of 38 participants and all of them have said how worthwhile the program was," said CRDC's Helen Dugdale, who organised the workshops as part of her role as program manager.

"In fact, most participants suggested that the workshops should be extended to other valleys and to farm employees."

Two workshops were held in each of the towns, in May 2006 and February 2007.

"It was thought that even though these two towns have health facilities, do farmers actually avail themselves of these services? If not, why not? And what sort of health services do they require?" Helen said.

"These were all questions we wanted to address in the SFF but the main reason was to give cotton families exposure to health professionals and information that they may otherwise not have received.

"Really pleasing for us is that of the Action Plans, as set out by participants in the first year, 82 percent were acted upon with successful outcomes, for example appointments with specialists; losing weight, improving fitness and decreasing cholesterol levels."

Backing up Ms Dugdale's comments is the report from the RIRDC which provides an economic analysis of the SFF project.

Living Longer on the Land – A health program that provides an economic analysis of SFF in order to inform future decisions in resource allocation for rural health initiatives.

The cost savings predicted over 10 years in the reduction of Type 2 diabetes alone were around $155,000 for the 128 participants in the project, exceeding the total cost of the SFF project.

"This result shows that it really pays in economic terms to work with rural families and communities to prevent health problems," said RIRDC senior research manager Jane Fisher.

"Even without considering the savings associated with other major health problems that would be reduced through the SFF project, this investment already shows good long-term returns," she said.

? For more information about the report, Living Longer on the Land – A health program that works, visit www.rirdc.gov.au or call 02 6271 4160, or contact Helen Dugdale CRDC 02 6792 4088.

Safety in your pocket

A pocket guide to farm safety is making information readily available in a practical way to help improve safety on farms.

OH&S – a quick reference guide for broadacre agriculture is an RIRDC-managed joint research venture, which benefited from financial input from CRDC together with many other research and development corporations.

RIRDC senior research manager Jane Fisher said the aim of the booklet was to increase adoption of safe work practices on farm and to develop on-farm safety packages for all major commodity group producers.

"There is a lot of information relating to occupational health and safety in agriculture but it is often desktop based or more suited to use in an office environment," Ms Fisher said.

"This booklet is specifically designed so that farm workers can have a copy in the ute or tractor so they can quickly seek guidance on farm safety issues around the farm - while they're on the farm.

"The quick reference guide will advise users of best practice standards and OH&S legislation governing jobs commonly performed by people involved in broadacre agriculture.

"For example it gives simple but effective advice on the use, handling and storage of chemicals, working at heights and in and around grain storage areas, and loading and unloading of trucks and other farm vehicles.

"It also outlines the responsibilities and obligations of all people involved in broadacre farming when it comes to occupational health and safety."

? Copies of the booklet can be obtained through RIRDC by calling 02 6271 4160 or visiting the website at www.rirdc.gov.au or through Warakirri Agricultural Trusts on 03 5381 6913 or ORM on 03 5441 6176.

World fibre production rose in 2006 to 71.7 million tons and fibre consumption reached 68.7 million tons and it is projected to expand at an annual average rate of 3.3 percent.

Industrial countries consumed 41.6 percent, developing countries 52.4 percent and Central and Eastern Europe and former USSR countries six percent. World consumption of man made fibres was 37.4 million tons and cotton was 25.7 million tons with other fibres such as wool, silk, ramie, flax, hemp, jute, sisal and coir making up the remainder.

The production of organic cotton has increased to 57.9 tons which represented a mere 0.2 percent of the total cotton production for 2006 .

From this staple fibre consumption 46.3 million tons of yarn was spun of which 17.4 million tons contained cotton and seven million tons contained polyester.

Introduction to Short Staple Spinning

By M.H.J van der Sluijs - Textile Technologist
CSIRO Division of Textile and Fibre Technology, Geelong, Victoria

In today's highly competitive and incredibly global textile market, a cotton spinning mill cannot remain competitive and survive if it does not produce a quality yarn in a cost-effective way.

Textile technologist Rene van der Sluijs with CSIRO's textile and fibre technology division says that in order to achieve this; spinners need to know the important fibre properties of the cotton lint (such as staple length, staple strength and fibre fineness) and how they influence process performance, cost (raw material accounts for 50-70 percent of the total yarn manufacturing costs) [2] and quality of the yarn and ultimately the fabric.

"Originally cotton was only 'classified' subjectively, but due to greater demand on fibres by modern technology and high speed machinery, the need to rapidly and accurately determine the cotton fibre properties that will affect processing performance and yarn quality, high volume automatic testing systems were developed," Mr van der Sluijs said.

"This has given the spinner valuable information of the fibre properties of every bale of cotton purchased or wishes to purchase and ensures that a uniform quality level can be maintained and thus ensuring consistency in processing and yarn quality."

PROCESSING

Short Staple Spinning is the process of converting staple fibres up to the length of 60mm into a yarn structure involving a number of processes.

Figure 1 provides a flow chart of the processes used to produce a yarn on three spinning systems predominately used i.e. Open – End, Air – Jet and Ring Spinning.

OPENING, BLENDING AND CLEANING

Opening, blending and cleaning are the first operations at the spinning mill. A row of bales is opened and blended to ensure a consistent and homogeneous blend. The fibres are also cleaned to remove contaminants/ extraneous matter, such as leaf and bark.

CARDING

Carding individualises and aligns the fibres, and then condenses the fibres into a single continuous strand of overlapping fibres called "sliver".

Short fibres, trash and dust and fibre entanglements (referred to as neps) are removed during carding.

DRAWING

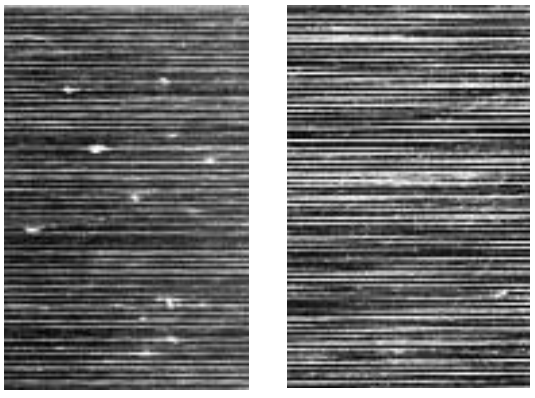
Drawing is the process where the fibres are blended, aligned and straightened. The drawing process also improves the uniformity of the sliver. The number of drawing passages utilized depends on the spinning system used and the end product.

COMBING

Combing is the process that removes short fibres, neps and other impurities such as vegetable matter and seed - coat fragments from the cotton that has already been carded.

Combed yarn is superior in quality when compared to carded yarn as it is stronger, more uniform and less hairy due mainly to the removal of short fibre and the alignment of fibres. Combed yarns are however more expensive than carded yarns (~10 percent) as combing involves additional stages and produces more waste. Approximately 25 percent of all cotton yarns produced world wide is combed [3] and the majority of Australian cotton is spun into combed yarn.

Figure 2 - Carded Yarn Combed Yarn



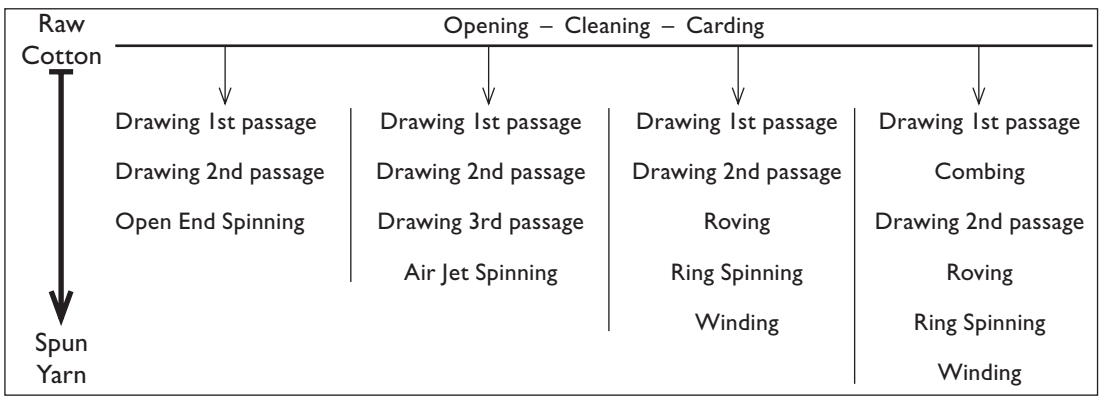


Figure 1 - Flow Chart showing processing routes for various spinning systems

ROVING

In preparation for ring spinning, the sliver needs to be condensed into a finer strand, known as a roving, before it can be spun into a yarn. The roving frame draws out the sliver to a thickness of a few millimetres and inserts a small amount of twist to keep the fibres together.

YARN COUNT

The count of a yarn is a numerical expression of its fineness, or weight per unit length (linear density). There are two main systems used to determine linear density.

1. In the direct system, the yarn count is determined by measuring the number of grams per thousand metres of yarn and is denoted as Tex. The higher the Tex value, the heavier the yarn
2. The indirect system known as English Cotton Count (Ne) is based on the number of 840 yard lengths in one pound weight of yarn. The higher the English Cotton Count value, the finer the yarn i.e. the more yarn length in one pound.
3. The yarn count can be converted from Tex to Ne or vice versa by using the following formula
   - 590.5/Tex = Ne
   - 590.5/Ne = Tex

SPINNING

There are three main spinning systems used commercially to produce cotton and other short staple yarns.

1. Ring spinning
2. Open - End spinning
3. Air jet spinning

RING SPINNING:

The technology for ring spinning was perfected by the end of the 19th century and became the standard for manufacturing short staple yarns world wide. There are currently 200 million spindles installed world wide, producing 60 percent of all the short staple spun yarns and it continues today to be the most dominant spinning system.

The majority of Australian cotton is spun into yarn using this spinning system. [4]

Ring spinning is the process of further drawing out roving to the final count needed, inserting twist to the fibres by means of a rotating spindle and winding the yarn on a bobbin. These three stages take place simultaneously and continuously.

Ring spinning is a comparatively expensive process because of its slower production speeds and the additional processes (roving and winding) required for producing ring spun yarns. It however still produces superior yarns for some end uses.

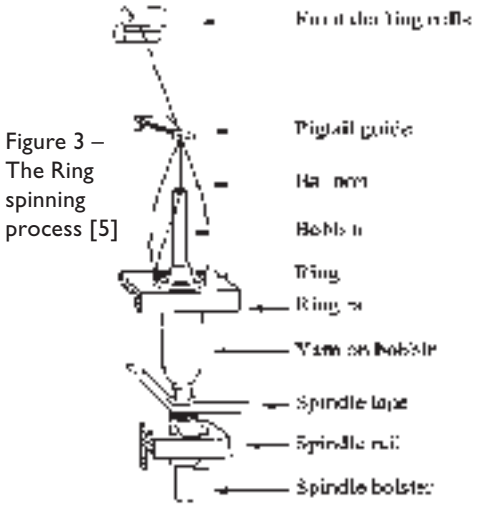


Figure 3 – The Ring spinning process [5]

OPEN - END SPINNING (ROTOR SPINNING):

This technology was introduced in the mid 1960s and there are currently 8.5 million spindles installed world wide and together with ring spinning account for over 90 percent of short staple yarn produced world wide.

Sliver is fed into the machine and combed and individualized by the opening roller.

The fibres are then deposited into the rotor where air current and centrifugal force deposits them along the groove of the rotor where they are evenly distributed. The fibres are twisted together by the spinning action of the rotor, and the yarn is continuously drawn from the centre of the rotor.

The resultant yarn is cleared of any defects and wound onto packages.

The production rates of open - end spinning is five to seven times higher than that of ring spinning and as the machines are fed directly by sliver and yarn is wound onto packages ready for use in fabric formation the yarn is a lot cheaper to produce.

Open-end spun yarns are more even, somewhat weaker and has a harsher feel than ring spun yarns. Open-end yarns are used in numerous products such as denim, towels, blankets socks, t-shirts, shirts and pants.

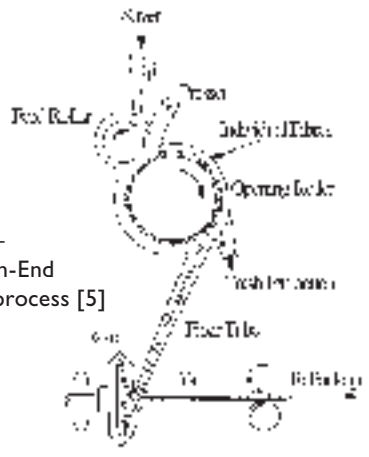


Figure 4 – The Open-End spinning process [5]

AIR - JET SPINNING:

This technology was introduced in the early 1980s and there are currently 500,000 spindles installed world wide producing about five to eight percent of all the short staple spun yarns world wide.

Sliver is fed into the machine and is further drawn out to the final count and twist is inserted by means of a rotating vortex of compressed air.

The resultant yarn is cleared of any defects and wound onto packages ready for use in fabric formation. The production rate of air jet/vortex spinning is three to five times higher than open end spinning and 10 to 20 times that of ring spinning and like open end spun yarns, air-jet spun yarn is a lot cheaper to produce as it also uses fewer production stages.

As is the case with rotor spun yarns, air jet yarns are more even, but weaker and have a harsher feel than ring spun yarns.

The yarns produced from these machines are mainly polyester/cotton blended yarns for woven sheeting and knitted lightweight shirting.

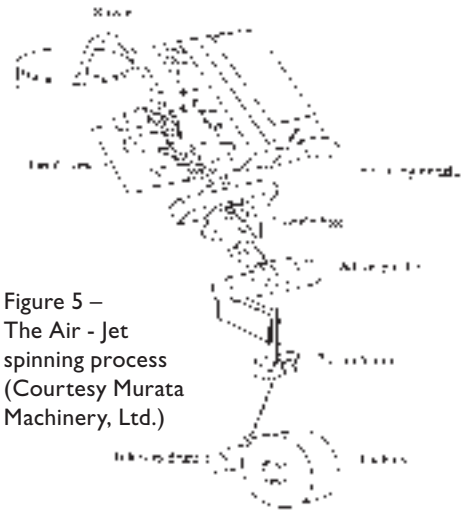


Figure 5 – The Air - Jet spinning process (Courtesy Murata Machinery, Ltd.)

WINDING

In the case of ring spun yarns, the winding process is a necessity and the final process in a spinning mill. The winding process is needed to transfer the yarn from small bobbins to larger packages and to remove defects in the yarn.

This will ensure more efficient processing during fabric formation. Packages from the rotor and air jet spinning systems can also be given a further winding operation if required.

TWISTING

Twisting (also referred to as Plying, Doubling and Folding) is the process of twisting two or more yarns together (Figure 7) for specific end uses and used mainly for yarns that are to be woven into fabrics.

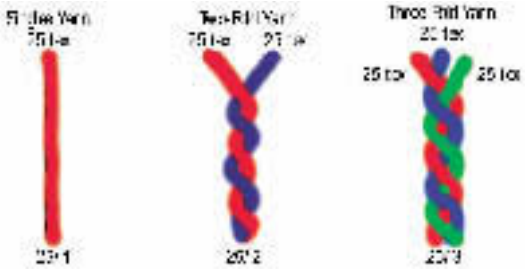


Figure 7 – Principle of twisting

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The only lasting competitive edge is a highly skilled, adaptable and motivated workforce
(Saul 1991)

Free day beats drought in 2008

New beginnings: cotton in a climate of change

As preparations step into a higher gear for the 2008 ACGRA Cotton Conference on Queensland's Gold Coast on 12,13 and 14 August, the exciting theme has begun to resonate as many are now viewing the drought as more behind than in front.

In addressing the 'climate of change' theme, Cotton Australia has played a well considered hand. The industry's peak body has successfully collaborated with the federal Department of Agriculture Fisheries and Forestry (DAFF) to stage a free 'Beat the Drought' day for conference attendees.

The organising committee has confirmed Beat the Drought day will be free to cotton farmers and their staff who attend the conference, and the free-day in a 3-day program lowers the overall cost for conference attendance in 2008.

Beat the Drought is a day-long program. It is geared to cotton farmers attending the full conference who are searching for ready-made answers and new strategies to implement. These are to include practical water use efficiency improvements, cutting energy consumption and reducing inputs such as N fertilisers. CRDC research (***Spotlight*** Winter 2007) has confirmed these are the three key inputs in cotton production which also have greatest longer-term implications for cotton production in a future carbon-driven economy.

Cotton Australia's Adam Kay has worked closely with ACGRA to stage Beat the Drought. He says the cotton industry's premier technology transfer meeting was clearly the best venue. The industry has a long history of combining research and practical guides for cotton production improvements at its conference.

Adam says DAFF has shown great energy and enthusiasm to support the industry's best and brightest steps for farmers to take home.

"The industry wants its farmers to be positioned to be resilient to future challenges while also being adaptable to meet a future variable climate," he said.

"It's a climate of change we're in and cotton has always been innovative in its response to challenges," Adam said. "A free day for conference attendees is the best way to present the take-home messages on beating the drought."

Cotton farming in a new era

A grower's capacity to create and adopt innovation is therefore just as vital as the actual R&D.

By Bruce Finney and Ian Taylor

Irrigated cotton growers no longer simply choose between Bt and conventional cotton.

They are evolving new farming systems with the flexibility to make decisions as to choice of crop and crop mix closer to planting windows. The farming system now includes a much wider mix of crops including Bt cotton, winter and summer cereals and pulse crops. Additionally, annual and permanent horticultural crops are not the oddities they once were to cotton growers. Beyond crop choice, dryland farming practices such as moisture conservation and planting configuration are being broadly incorporated into irrigated farming systems.

Is all this new? Of course not! Cotton growers have been evaluating alternative crops for ever. Dryland growers on the Darling Downs are very familiar with "muesli bowl" farming. But increasing water scarcity, declining profitability in cotton production and the boom in soft commodity prices are now driving a more rapid rate of change. That Australian cotton growers would respond this way only underlines why they are renowned for their innovation and adaptability to changed conditions.

Broader agricultural industry challenges such as shortages of skilled labour, rising input costs (including energy), access to and responsible use of natural resources are also important. The future also holds unanswered questions such as how agriculture will fit into a carbon economy, and what will be the implications?

WHAT IS A FARMING SYSTEM?

Conceptually, a farming system includes the integration not only of crops and livestock, but physical and chemical processes; biological and ecological interactions; economic, political and legal landscapes; climate and environment, agricultural practices, and energy.

As such, the farming system is highly complex, difficult to research and often poorly understood. Yet everyday, growers interact with their own farming system; adapting and adopting new knowledge, practices and technology to suit their particular conditions and improve performance, thus every grower has their own unique farming system. A grower's capacity to create and adopt innovation is therefore just as vital as the actual R&D.

It is with this background that CRDC's next strategic R&D Plan (2008-13) is being drafted with a focus on cotton production in a more profitable farming system with improved environmental performance.

At CRDC, our focus will include investment in developing leading farming systems knowledge, including how to optimise on-farm inputs, better management, improved yield and quality, protection from bio-security threats, understanding and adapting to climate change as well as natural resource challenges and opportunities.

CRDC already has in place many cross-industry research collaborations and we anticipate that these collaborations will only increase given the nature of farming systems challenges that lay ahead.

Looking to the future, the importance of economies of scope could well be replacing the importance of economies of scale.

CRDC Strategy for R&D investments in 'sustainable farming systems'

"Cotton production in a more profitable farming system with improved environmental performance "