COTTON RESEARCH & DEVELOPMENT CORPORATION

Spotlight on Cotton R&D

SUMMER 2013/14

LIFTING THE LID ON COTTON RESEARCH

Best Practice

IMAGE STACEY VOGEL.

The cotton industry supports spotlight nights along the Namoi River in NSW which are providing a greater understanding of biodiversity for local landowners and their families.

IN THE SPOTLIGHT

Australian cotton growers are admired around the world for always striving to improve their management practices. With many of these improvements based on industry R&D the results of the CRDC Cotton Growing Practices survey are an invaluable resource for CRDC and the industry as a whole in understanding its performance. In conjunction with the advice of Cotton Australia R&D Advisory Panels the results of surveys help tailor R&D programs to the needs of growers. In this edition we have highlighted some of the most recent survey findings. We would like to thank all those who took the time to be part of the 2013 survey.

Our articles on silverleaf whitefly and aphids, the tools and methods of management, should be of great interest to all growers and consultants seeking to achieve minimal crop damage and efficient control measures in producing the highest quality cotton come harvest time. The CottASSIST suite of online tools offers many advantages to farm managers in these aims, and we have shed some light on the science behind them in this issue.

Summer can also be a time of intensive fallow management and there are several reasons to abide by best practice – weed resistance and off-target herbicide drift damage being two key reasons. Bill Gordon has contributed a comprehensive article on the latest information in relation to best practice spraying of fallows. Tony Cook from NSW DPI has also shared the latest results from glyphosate resistance testing on sowthistle which is a timely reminder of the growing threat of resistance.

Moving onto the world stage we have included reports from recent international forums. CRDC Director Richard Haire shares his thoughts about the global cotton industry in light of the expanding and innovative man-made fibre industry. Richard attended the International Textile Manufacturers Federation Conference in Bregenz, Austria. He says while we face serious competition there is also an opportunity for the global cotton industry to rethink the approach to marketing of its product. CRDC R&D Manager Allan Williams' message from the 72nd ICAC Plenary meeting outlines the importance this organisation is playing in not only providing the forum for discussion of cotton issues of international significance, but also for agreeing on collective responses to issues that are beyond the ability of any one country to address. The threat posed to cotton's market share by man-made fibres is a case in point.

In this edition we have provided a snapshot of CRDC evolving research investments. Should anyone be interested in information on CRDC please feel welcome to contact us or access our website. Further we are very pleased to have Ruth Redfern joining CRDC as Communication Manager. Ruth comes from a local family farm that grows cotton and is highly experienced in rural communications with her most recent role being Public Affairs Manager with the National Farmers Federation in Canberra. We are looking forward to her playing a key role in the communication of research with the CottonInfo Team.

Lastly and most importantly let's hope there is a break from the extreme dry and hot conditions soon.

Bruce Finney

Australian Government
Cotton Research and Development Corporation

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CRDC is a research and development partnership between the Australian cotton industry and the Australian Government.
Cotton Research and Development Corporation
ABN: 71 054 238 316
Our vision: A globally competitive and responsible cotton industry
Our mission: Invest and provide leadership in research, innovation, knowledge creation and transfer.
Our outcome: Adoption of innovation that leads to increased productivity, competitiveness and environmental sustainability through investment in research and development that benefits the Australian cotton industry and the wider community.
Corporate background: CRDC was established in 1990 under the Primary Industries and Energy Research and Development Act 1989 (PIERD Act.) which outlines its accountability to the Australian Government and to the cotton industry through the Cotton Australia. CRDC is responsible to the Australian Government through the Minister for Agriculture, Barnaby Joyce. 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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SURVEY REVEALS VARYING FARM MANAGEMENT TECHNIQUES

THE 2013 CRDC COTTON GROWING PRACTICES SURVEY IS NOW COMPLETE WITH SOME VERY INTERESTING FINDINGS PARTICULARLY RELATING TO SOILS, NUTRITION AND FERTILISER USE, ENERGY, HARVESTING, AND HUMAN RESOURCES.

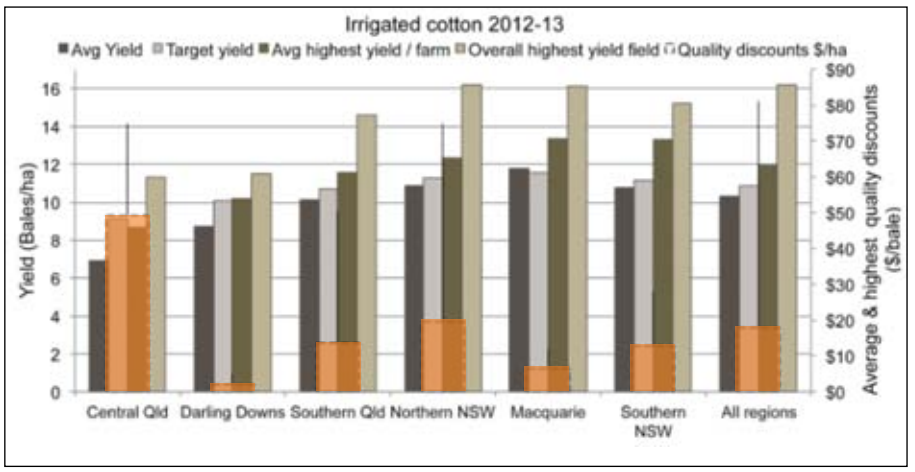

Figure 1. Yields and quality discounts of irrigated cotton 2012-13.

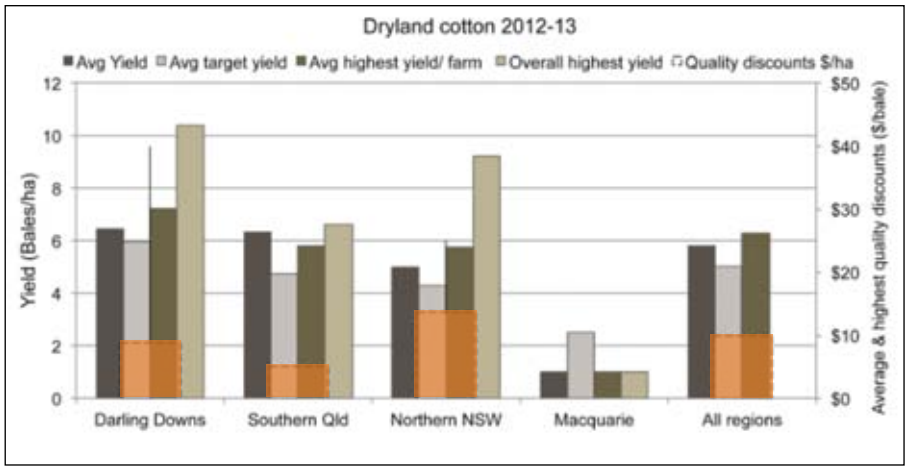

Figure 2. Yields and quality discounts of dryland cotton 2012-13.

The survey gathered information from growers on a range of factors relating to cotton production practices, yields and quality. Ingrid Roth who managed the survey on behalf of CRDC has extended a huge thank you to all the growers who took the time to return the survey or reply.

"The 2013 Cotton Growing Practices survey was designed to be a single, co-ordinated survey of cotton growers conducted by CRDC and its research partners in 2013," Ingrid said.

"While this did make it long, the survey will feed into additional research that will be further analysed and reported over the coming months."

The initial snapshot of information about the season's yield and quality results as well as nutrition rates and application has been revealed.

Most irrigated cotton farms in NSW achieved average yields close to target (see Figure 1), while Queensland

farms average yields fell a little short of their targets in 2012-13. In all regions there were some very well performing individual fields.

Dryland cotton, while well down in area from 2011-12 produced good yields for many growers and on average exceeded target yields (see Figure 2).

"The highest yield of irrigated cotton recorded was 16.2 bales/ha from a field in the Upper Namoi and 10.4 bales/ha the highest dryland yield recorded from a field in the Border Rivers (Macintyre) region," Ingrid says.

"Heat was a feature of the season in most regions, with over half of respondents indicating that their yields were impacted by extreme heat.

"Forty-three percent of growers received discounts due to micronaire. High micronaire is most often a problem when there is very hot weather in the growing season."

Nutrition and soils

Nutrition and soils were a major focus in this year's survey.

"It was really interesting to compare the fertiliser practices used in 2012-13 with 2010-11 which had much wetter conditions pre-planting," Ingrid says.

"In the 2010-11 season 60 percent of nitrogen was applied pre-season. However, the much drier 2012 winter only resulted in an eight percent increase in the proportion applied pre-season (68 percent).

"It was believed that this unusually low pre-season application was a result of the very wet winter causing more nitrogen to be applied in-season."

Nutrient rates in 2012-13 compared with previous years show that rates have remained stable over the last two seasons however increased in each of the 14 years prior.The average rate of nitrogen applied to irrigated crops in 2012/13 was 243kg N/ha (ranging from 93 to 370 kg/ha) and 84kg N/ha to dryland crops (ranging from two to 140kg N/ha on the 85 percent of farms that did apply N).

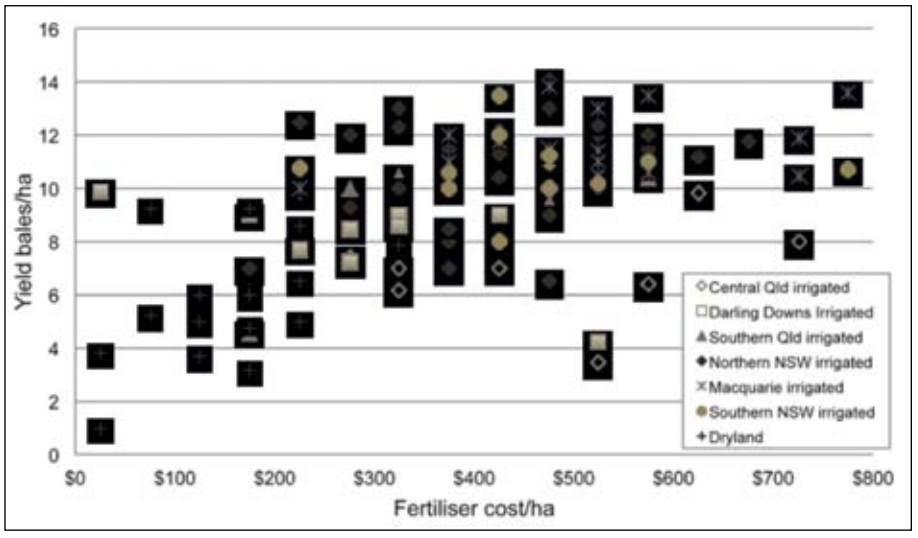

Figure 3: Fertiliser costs on irrigated cotton 2012-13.

Phosphorus and potassium

Phosphorus was applied on 76 percent of irrigated cotton crops (average rate 31 kg P/ha ranging from two to 180kg P/ha) and 62 percent of dryland crops (average 13kg P/ha, ranging from one to 30 kg P/ha). Three percent of irrigated farms applied potassium (average 24kg K/ha, range one to 80kg K/ha) and 23 percent of dryland farms used potassium at rates of 0.7 to 30kg K/ha (average 10kg K/ha). Zinc was applied to 59 percent of irrigated and 54 percent of dryland cotton farms and sulphur to 40 percent of farms.

The survey showed that rates of all nutrients and the forms of nitrogen applied vary greatly between farms. Reflecting this, the costs of fertiliser inputs are highly varied (Figure 3), though are roughly aligned with yields removed.

"We found that 75 percent of irrigated crops had fertiliser input costs between $300 and $600/ha," Ingrid says.

"With dryland cotton, fertiliser costs were all below $350/ha with 40 percent of farms reporting costs between $151 and $200/ha. A further 40 percent of dryland crops received less than $150/ha in fertiliser inputs."

From the survey it was found that last season 75 percent of farms surveyed had varied fertiliser application rates across fields with field history being the most common basis for variation.

Wet weather and nitrogen

Another interesting finding of the survey is that, manures and composts are used by 39 percent of surveyed farms at least sometimes as part of their nutrition program. The use is highest on the Darling Downs and in Southern NSW, "likely due to closer proximity to feedlots and poultry farms".

One thousand surveys were distributed through the CRDC's contact lists with replies received from over 350 people. Of these, 165 completed surveys were received from across Australia's cotton growing regions (many others replied that they did not grow cotton in the 2012-13 season). The surveys received represent an area of 92,687 ha of irrigated cotton (23 percent of the irrigated cotton crop) and 9853ha of dryland cotton (27 percent of the industry's dryland cotton crop).

"The survey has gathered new information about fertiliser application methods and timing. The full report will be released shortly, and will be reviewed with researchers and highlights reported in the next issue of *Spotlight*."

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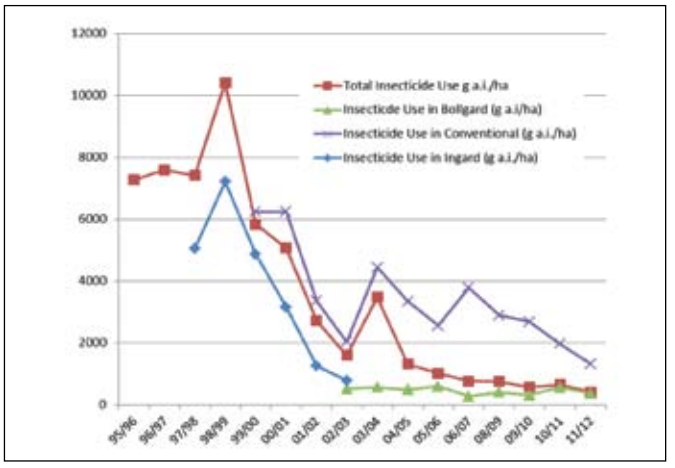
"MOST NUTRIENT APPLICATION RATES HAVE INCREASED OVER THE PAST 16 YEARS, BUT WERE RELATIVELY STABLE OVER THE PAST TWO."

ADHERING TO THE IRMS: AS IMPORTANT AS EVER

WHILE THE INDUSTRY IS USING FAR LESS INSECTICIDE OVERALL, IT NOW HAS A MUCH HIGHER RELIANCE ON FEWER PRODUCTS, MAKING THE IRMS GUIDELINES AS IMPORTANT AS EVER. COTTONINFO STEWARDSHIP SPECIALIST SALLY CEENEY EXPLAINS WHY.



ABOVE: Reduced insecticide use is a great success story for the Australian cotton industry, however with reliance on fewer products, the IRMS guidelines are more important than ever.

The Insecticide Resistance Management Strategy (IRMS) for cotton is designed to help keep insect control costs in check and to protect cotton yield from insect damage. These things can only be achieved when insecticide efficacy is reliable.

Historically, the IRMS was developed as a way to manage the resistance issues with *Helicoverpa armigera*, particularly to synthetic pyrethroids. More than two decades later, today's cotton industry has evolved to grow more than 90 percent insecticidal transgenic cotton and the IRMS has evolved with it. The Strategy now balances the resistance risks for the range of key pests, including mirid, aphid, mites and silverleaf whitefly and to do so, all commercially available insecticide actives are considered.

The current dominance of Bollgard II technology has meant a change in the types of insecticides most commonly used. Table 1 illustrates how the make-up of the IRMS has changed in response to both industry needs and product availability. While the number of chemical groups has remained similar, the past five years has seen a significant decline in the range of insecticides available for use in cotton within these groups, with the greatest reductions occurring in products targeting Helicoverpa and aphids.

The range of products registered for mirids has remained the same, with new products replacing those being withdrawn from the market. However the way these products are represented in the IRMS has changed significantly, recognising that mirids can be the target for the first foliar insecticide in cotton and at they have become the pest species likely to require control on more than one occasion within a season.

Higher reliance on fewer products

A great success story for the cotton industry is that it is now using far less insecticide overall. This hasn't diminished the need to adopt a strategic approach to insecticide decisions. With reliance on many fewer products, the IRMS guidelines are more important than ever.

Resistance is an outcome of exposing pest populations to a strong selection pressure, such as an insecticide. By having fewer products to choose from, the selection pressure on those particular products can be increased if use patterns aren't strategic.

Having fewer products available also means that losing the effectiveness of one due to resistance would have a much greater impact on the cotton farming system. If there are fewer options for future decisions, other aspects of the IPM program may become compromised.

An example of this is the neonicitinoid group of insecticides. Aphid resistance to neonicitinoids has already been widespread. If resistance were to become entrenched in aphid populations, this may influence seed treatment decisions, as well as requiring changes in approach for mirid and/or silverleaf whitelfy control as alternative products may not be specific in their control of aphids.

	IRMS 2008/09	IRMS 2013/14
Number of distinct chemical groups (across all target pests)	21	20
Helicoverpa products	18	12
Aphid products	13	8
Mite products	10	13
Mirid products	0*	11

*Historically, the IRMS only included products for helicoverpa, aphids and mites.

Table 1: The changing make-up of the IRMS over time. Source: CRDC, CCA survey data

The IRMS is now largely a pre-emptive management strategy that aims to protect the current capacity in the industry. Effective use of the IRMS helps protect the cotton grower's choice to grow either transgenic or conventional cotton and within each system to achieve reliable, affordable and sustainable control of insect pests.

Bollgard II not infallible

The Bollgard II technology in an excellent platform for cotton IPM, however the technology doesn't guarantee that the industry will continue to have very low insecticide use into the future. Twice weekly monitoring for insect pests equips pest managers to make spray decisions only when thresholds are reached, crop damage is occurring and beneficial insects aren't able to keep the pest population in check.

The IRMS is designed to be highly compatible with the IPM needs of modern cotton production. Within the range of insecticide products still available for use against each target pest, there are differences in their compatibility with the aim of conserving beneficial insect populations. The IRMS identifies the products that are least disruptive to beneficial insects and recommends their use earlier in the season.

Resistance can be selected inadvertently as a range of pests can be present in the field at the time one pest population reaches a spray threshold. Following the IRMS minimises the impacts of inadvertent selection.

Stable systems that maximise natural pest mortality will be key to the industry continuing to achieve its current levels of success in very low insecticide reliance.

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KEY FEATURES OF THE IRMS MID-SEASON

- No use of dimethoate before February 1 (except in CQ)
- No use of Steward after January 31 (December 15 in CQ)
- Only one application of Admiral for silverleaf whitefly
- Non-consecutive applications of Shield, Intruder and Confidor
- Expect field failures with SPs – high levels of resistance present in *H. armigera* populations.

For details about why these use windows are recommended in the IRMS, refer to the Cotton Pest Management Guide 2013/14 edition.

AVOIDING LARGE DISCOUNTS:
MAINTAINING OUR REPUTATION FOR QUALITY BY MANAGING SILVERLEAF WHITEFLY

"GLASS, CHINA, AND REPUTATION ARE EASILY CRACKED, AND NEVER MENDED WELL."
BENJAMIN FRANKLIN

Adult silverleaf whitefly feed from vessels that transport the sugar-rich products of photosynthesis around the plant.

Australia has an enviable reputation for being a reliable supplier of high quality uncontaminated cotton. It is important that the industry continues to use best management of silverleaf whitefly to avoid honeydew contamination of lint so that it maintains its place in the international market.

Individual penalties for sticky cotton are incredibly severe. However this is a pest and a problem that requires commitment to IPM and a group approach at a local and industry level, as a problem in just one year could have long lasting and wide reaching consequences.

CSIRO Plant Industry's Lewis Wilson and Simone Heimoana have been researching how to manage some of the risks associated with contaminated lint. *Spotlight* asked Lewis about how we get this sticky situation.

"Pests such as aphids and silverleaf whitefly feed from the phloem vessels that transport the sugar-rich products of photosynthesis around the plant," he said.

"During this process a proportion of plant sugars (sucrose, glucose, fructose) are altered into new sugars such as trehalulose and melezitose. The excess sugars, both the plant and altered sugars, are passed out of the insect as honeydew.

"The honeydew is a problem when it contaminates cotton lint as it makes it sticky. Sticky lint leads to problems in the spinning mills when the sugars accumulate on the machinery and cause fibres to stick to it, eventually necessitating shut-down for cleaning.

"Compared with aphid honeydew which appears wet, glossy and sticky on leaves and bolls, whitefly honeydew often dries to an almost matte lacquer-like consistency, and though visible on the leaves and bolls, may be dry to the touch.

"This is deceptive as the main SLW sugar, trehalulose, has a low melting point and is hygroscopic (attracts moisture). In the spinning mills, apparently clean cotton can suddenly cause problems when heat generated through friction causes the trehalulose to melt. It then attracts moisture and becomes sticky."

Fields with contaminated lint must be managed carefully. It is best to leave harvest of these fields as late as possible to allow time for honeydew levels to decline, however current information does not identify how long or what conditions are required before it is safe to harvest.

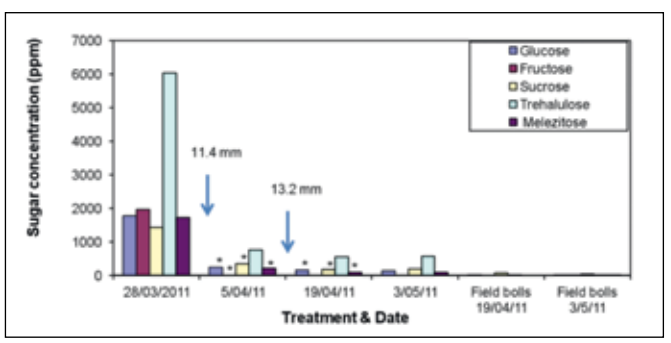

Figure 1. Reduction in sugars of artificial SLW honeydew over an extended period clearly shows the effect of rainfall, ACRI, 2012. The asterisks indicate sugars showing a significant decline from the previous date.

"We have begun to investigate the fate of honeydew on cotton lint to understand if there is natural breakdown, wash off from rain and/or degradation from sooty moulds. This work is being done in collaboration with Dr Michael O'Shea (SRA) and Dr Paul De Barro (CSIRO)," Simone says.

"So far this research has shown that the decline in sugar levels on bolls appears to be largely due to rainfall washing the honeydew from contaminated bolls.

"Preliminary data suggests that even 20mm of rain can substantially reduce honeydew contamination. Decline in honeydew levels appears to be slow in the absence of rainfall.

"In a series of experiments we have exposed artificial SLW honeydew to a range of conditions. While there was a significant decline in levels of honeydew on bolls following rainfall, there was relatively little decline when there was no rain."

The researchers say this poses a real risk in situations where crops with open bolls are contaminated, the honeydew dries and appears non-sticky then the crop is defoliated and harvested during a dry period. In this situation the lack of rainfall means that much of the sugar will still be present and may cause problems later.

Furthermore, contaminated lint gradually grows sooty moulds which may help breakdown sugars but may also cause reduced grades, leading to discounts. This is especially a risk where the contaminated crop experiences humid conditions or light rainfall that promotes sooty mould growth.

"So while rainfall may help reduce honeydew contamination of affected crops, it is risky to rely on it and even if rainfall does occur it exposes crops to risks of downgrades," Simone said.

"Contamination with honeydew is a serious issue, with no quick fix once it is present.

"Growers should reduce the risk of contamination by adopting best practice management of SLW, including adopting IPM to build beneficials, removal of weed and volunteer hosts, co-ordinating tactics such as implementing a tight planting window through area-wide management and adherence to the SLW threshold matrix and IRMS."

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To help growers and consultants manage the risks posed by silverleaf whitefly (SLW), the CottonInfo Team has produced a new factsheet to cover all management issues. Susan Maas, CottonInfo IPM Specialist told *Spotlight* that silverleaf whitefly require a year-round IPM approach.

"SLW can be managed however, as they are highly mobile, can rapidly develop insecticide resistance and population increase can be exponential, success takes a regional approach with everyone doing their part," she said.

"SLW are known as IPM enforcers, especially in some grain crops, where there are no insecticide options. In these systems, successful suppression of SLW through strong IPM has been proven to be possible. SLW should be viewed as a symptom of problems with the IPM system. Remember that every spray decision for every pest is also a decision about whitefly.

"There are measures that can help to suppress SLW populations across the landscape.

"Work with your neighbours to coordinate tactics such as planting within a tight window, avoid or delay the use of disruptive insecticides and control host weeds over winter, including cotton volunteers.

"Active management commences from peak flower, with twice-weekly monitoring. The threshold matrix has proven to be robust in SLW management.

"The matrix is a dynamic threshold, so it is important not to respond based on one data point, as SLW populations will naturally fluctuate. Be prepared to reach for the right product at the right time and always adhere to the IRMS."

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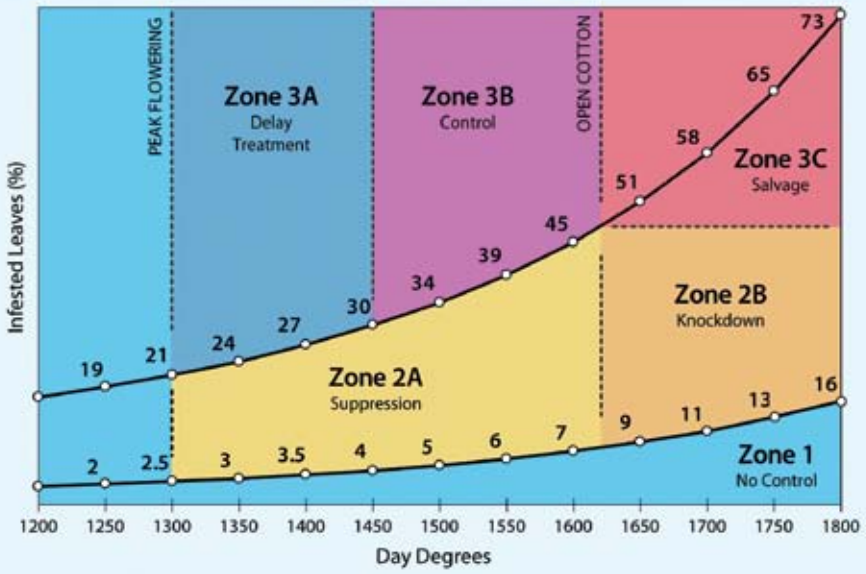
SLW THRESHOLD MATRIX



NOTES	
Sampling protocol	Sample 20 leaves 3rd, 4th or 5th node below the terminal/25 ha weekly from first flower (777 DD) and twice weekly from peak flowering (1300 DD). Convert to % Infested leaves. Infested leaves are those with 2 or more adults. Uninfested leaves are those with 0 or 1 adult.
Day Degrees	Daily Day Degrees (DD) are calculated using the formula; DD = [(Max °C – 12) + (Min °C – 12)] ÷ 2 For day degree information from your nearest SILO weather station visit www.cottassist.com.au For a mid-September planting in Emerald, long term average weather data predicts the duration of Zone 3A is 9 days, Zone 3B is 11 days and Zone 3C is 14 days.
Zone 1 No Control	Insecticide use is not warranted for fields with low SLW densities. In this zone the risk of yield loss or lint contamination is negligible, even when populations are sustained throughout flowering and boll fill.
Zone 2A Suppression	This Zone represents a wide window of opportunity for the most economic and low-risk control of SLW. Conventional (non-IGR) insecticides, such as diafenthiuron (Pegasus), can control or provide useful suppression of low-medium density populations. Movento can control a wide range of nymphal population densities.
Zone 2B Knockdown	Lint contamination can result from uncontrolled medium density populations in-crops with open bolls. Early action in Zone 2A can prevent the need for higher-risk remedial action in Zone 2B. Pegasus may be effective for remedial control (knockdown) of population densities up to 45% infested leaves in Zone 2B. (NOTE: The Pegasus label indicates that the product may not give satisfactory control of populations >25% infested leaves. This is based on an overseas sampling model. For Australian conditions this equates to ~45% infested leaves). Efficacy will depend upon coverage and environmental conditions. For higher densities approaching the Zone's upper boundary, an application of Zone 3B products may ultimately be required.
Zone 3A Delay Treatment	Controlling high density populations before 1450 DD is not recommended due to the likely resurgence of the population and need for additional control to protect lint from honeydew. Delay control until Zone 3B.
Zone 3B Control	Where populations are mid to high density, targeting an application when the crop is between 1450 and 1650 DD, (allowing the product to be come active prior to the onset of boll opening), greatly reduces the risk of lint contamination and the need for further controls. IGR products such as pryiproxifen, trade name Admiral, and non-IGR products such as Spirotetramat (trade name Movento), are effective in this zone. ENSURE ONLY A SINGLE APPLICATION OF ADMIRAL OCCURS WITHIN A SEASON. Delaying IGR use beyond 50% infested leaves or 1650 DD can result in yield loss, lower efficacy of the IGR and significant lint contamination. Do not apply more than 2 applications of Movento within a season. Use the higher rate when periods of high pest pressure or rapid crop growth are evident, when longer residual control is desired or when crops are well advanced.
Zone 3C Salvage	Once the populations exceeds 50% leaves infested, the use of an IGR by itself is unlikely to prevent lint contamination due to the inherent time delay in population decline following application. Rapid knockdown of the population using a conventional insecticide is required before applying the IGR (or similar). The lack of insecticides offering robust knockdown of SLW at high densities make this a 'high risk' zone.

Check the APVMA website for other control options that may become available in cotton under permit – www.apvma.gov.au

WHAT CAN I DO TO SUPPRESS SLW ON MY FARM?

UP FRONT TACTICS:

- Employ IPM principles across the farm and throughout the year to build beneficials.
- Co-ordinate tactics such as a tight planting window; delaying use of disruptive insecticides; and shared adherence to IRMS through area-wide management.
- Create a host free period, by destroying crop residues immediately after harvest, controlling host weeds in and around cotton fields, and use of non-host crops in rotation.
- Plant okra-leaf varieties.

ACTIVE TACTICS:

- Adhere to the IRMS. Avoid repeated applications of products from same chemical group. Do not apply more than the maximum number of applications. DO NOT apply apply Admiral more than once within a season.
- Late SLW adult immigration and developmentally delayed crops are not covered by the threshold matrix. In these situations focus on avoiding honeydew contamination of lint, using options such as early defoliation, a knockdown insecticide and if sufficient time, an IGR.

STICKY COTTON

- It is important that the whole industry maintain best management of silverleaf whitefly to avoid contamination with honeydew and maintain Australia's reputation for uncontaminated cotton.
- If sticky cotton is suspected, delay harvest and allow weathering time, especially rain, dew or high humidity. Recent research has shown that decline in honeydew on bolls appears to be slow in the absence of rainfall.

KNOW WHEN COTTON APHIDS WILL AFFECT YOUR YIELD

CSIRO'S SANDRA WILLIAMS, LORETTA CLANCY AND LEWIS WILSON EXPLAIN HOW A WEB-BASED TOOL HAS BEEN DEVELOPED FOR INDUSTRY AND HOW VALUABLE IT CAN BE FOR FARM MANAGERS.

IMAGE: CSIRO

Aphids can quickly build up large populations, stunting the growth of cotton and affecting boll development.

Manual calculations of yield loss from pests are complicated. That is why CSIRO, with support from CRDC has developed the on-line CottASSIST Aphid Yield Loss Estimator to assess the potential effect of this pest on yield. This tool allows crop managers to 'look ahead' to decide on control options or if natural enemy populations are providing sufficient control.

There is five years of research from CSIRO's Drs Lewis Wilson and Simone Heimoana behind the Aphid Yield Loss Estimator looking at the effect of aphids on the yield of cotton crops. The research involved infesting cotton crops with aphids at different times and densities and controlled them at various stages of build up. This allowed the researchers to compile a large data set relating aphid population development and yield loss. Predictive equations were developed from this data and form the basis for the Aphid Yield Loss Estimator.

The Aphid Yield Loss Estimator should be used from seedling to first open boll and is particularly relevant in the latter half of the season. Once boll fill commences, demands on the sugars produced by photosynthesis are higher and plants have diminished capacity for compensatory growth compared to situations where aphid infestation occurs early in the season. Nevertheless crop sensitivity to yield loss declines as the crop gets older. This means that approaching open cotton, the decision whether to spray is less clear cut, and referring to the Estimator is useful for preventing unnecessary spraying.

By entering scores of aphid abundance users can keep track of population growth rates and obtain estimates of the likely effect on yield. Each entry of new counts enables this estimate to be adjusted, allowing for faster or slower development of populations.

Sampling cotton aphids is tricky. They are patchy in the field, small in size and too plentiful to count quickly. A simple scoring system has been developed for use with the Estimator which involves scoring the density of aphids on the underside of main-stem leaves on the third or fourth node below the terminal. A complete description of this scoring system can be found in the latest *Cotton Pest Management Guide*.

How does it work?

Estimating yield loss starts with taking the aphid scores to calculate the sample aphid score (SAS) which basically allows for the time between the current and previous scores. The SAS is calculated as: SAS = (Previous score x days since last score) + ((current score – previous score) x days since last score/2). The SAS is then accumulated across sample dates to give a 'cumulative seasonal aphid score' (CSAS) which is used in the formula to estimate yield loss.

This formula predicts yield loss using the CSAS, the time remaining (TREM) in the season from when the aphids were first found and the cotton

PREVENTING HONEYDEW CONTAMINATION OF COTTON LINT

In the weeks leading up to defoliation, protecting open cotton from aphid honeydew requires consideration.

Simple presence/absence sampling can be used very effectively at this time. Check field edges first. Choose an expanded leaf close to the plant terminal. Score it as 'present' if there are more than four aphids in an area two centimetres squared ($2cm^{2)}$. When more than 50 percent of leaves are infested, aphids require control to protect lint from honeydew. A perimeter spray may be as effective as a spray across the whole field, depending on aphid distribution.

Aphid honeydew contains different types of sugars to whitefly honeydew. Both can cause problems at ginning and further along the value chain during spinning if present at certain concentrations. This makes the management of honeydew a priority issue in the lead up to defoliation.

If aphid control is required, carefully consider which insecticide to use. While dimethoate is an option available in the IRMS, avoid its use if pirimicarb has been used earlier in the season, as a strong cross resistance can be selected between these products.

If whiteflies are also present, prioritise the use of a softer option or a product that controls both species. For very late infestations, be aware of insecticide withholding periods. Also consider whether defoliation can be brought forward. There is no advantage in combining an insecticide with the first defoliation.

growing period for a particular region (season length, SL). For any given CSAS a longer TREM will result in a higher yield loss.

Yield loss

To start entering aphid scores, firstly register with CottASSIST (registration is free and very quick) and enter details for the farms and crops you wish to monitor.

To get the results, select Aphid Analysis from the CottASSIST main menu. The results will show the data and charts for yield loss, CSAS and AAS. The yield loss and CSAS charts have a horizontal green line on them which indicates the nominal threshold of four percent yield loss which justifies aphid control. If further information is needed, go to the 'About' tab from below Aphid Yield Loss in the CottASSIST main menu.

SLW and mite tools

Other CottASSIST tools are available that can help with various management decisions, all are based on the latest cotton research. Similar to the Aphid Yield Loss Estimator are the Mite Yield Loss Estimator and the Silverleaf Whitefly Matrix Tool, which help with control decisions for these pests. The Crop Development Tool can be used to track cotton growth.

CottASSIST is available to use on all internet browsers and hence a range of mobile devices, particularly tablets, both iPad and android.

For further information or help using the tool, contact:
Loretta.Clancy@csiro.au
02 6799 1547
Sandra.Williams@csiro.au
02 6799 1585

email us

COTTASSIST HAS A NEW HOME:
www.cottASSIST.com.au

see our website

The CottASSIST Aphid Yield Loss Estimator

WHEN DO YOUR PIGEON PEAS FLOWER?

PIGEON PEAS ARE THE MOST POPULAR CHOICE OF REFUGE IN AUSTRALIAN COTTON AS THEY CAN BE HIGHLY PRODUCTIVE, ATTRACTING MORE THAN TWICE THE EGG LAYS THAN COTTON REFUGES AND PRODUCING TWICE AS MANY HELICOVERPA MOTHS.

However, as CSIRO Ecosystems Services' Dr Mary Whitehouse says, individual pigeon pea refuges vary greatly in their ability to attract and produce Helicoverpa. Poor performing refuges may compromise our defense against Helicoverpa developing resistance.

"One of the reasons pigeon pea may do poorly is variability in pigeon pea seed quality – particularly in respect to when pigeon peas are programmed to flower," Mary said.

"Flowering pigeon peas are very attractive to Helicoverpa, but flowering in many pigeon pea varieties is triggered by shortening day lengths in autumn as the season draws to a close.

"The pigeon pea variety used in cotton refuges, Quest, was chosen because it flowers on longer day lengths, during summer, at the time when cotton is most attractive to Helicoverpa."

However, the day length necessary to trigger flowering in pigeon pea used in refuges may have changed over time. Pigeon pea has not been used as a commercial crop in Australia since the 1980s, and therefore seed production has not been subject to any quality control for 30 years. It is possible that the day length needed to trigger flowering is now shorter or quite variable in cotton pigeon pea refuges.

"If we want to keep pigeon pea as the most productive refuge for cotton, we need to improve its reliability," Mary says.

"If some pigeon pea refuges are now flowering only on shorter day lengths, we can select for pigeon peas that respond to longer days and therefore reduce this form of pigeon pea variability.

"To this end, I'm conducting a survey this season to see when pigeon pea crops are flowering in relation to day length."

SEND IN YOUR OBSERVATIONS

To get an idea on the extent of the variability in pigeon pea, Mary hopes to obtain information on as many pigeon pea crops as possible.
In particular, she is interested in:

- where the crop is planted (that is its latitude and longitude - in order to estimate day lengths for that location);
- when the crop was planted (to take into consideration the effect of crop maturity on flowering); and
- when about 10 percent of the field is flowering.

This information will indicate the extent to which pigeon pea is variable with respect to flowering, and whether changes to pigeon pea's response to day length are strongly contributing to the variability.
Pigeon peas that flower at the same time as cotton offer the best performance as a refuge crop and are more able to counter the development of resistance in Helicoverpa. Growers and/or consultants are encouraged to be a part of the survey. E-mail your observations to Dr Mary Whitehouse - mary.whitehouse@csiro.au

email us

IMAGE: BILL GORDON

THE UNINTENDED CONSEQUENCES OF HIGHER SPRAYING SPEEDS

SHOULD WE BE RETHINKING HOW WE SPRAY OUR FALLOWS IN SUMMER? SPRAY APPLICATION EXPERT BILL GORDON SAYS 'YES'.

It has been more than a decade since I first started promoting coarse droplets (and larger) applied through air induction nozzles for summer fallow spraying in an attempt to help minimise spray drift.

At that time we demonstrated that good efficacy could be achieved for a range of translocated products like glyphosate in the low stubble cotton systems that were typical at that time. Our travel speeds were typically lower, less than 20 to 22 km/h, and our application volumes were often around 50 L/ha for translocated products during summer.

Since that time, stubble retention in many fallows has increased, the weed spectrums we are targeting have changed, and spraying speed for fallows has generally increased. These changes, combined with the use of larger droplets, have had two unintended consequences.

The first impact is related to deposition and efficacy, particularly when operating at higher travel speeds. The second impact is related to the level of risk applicators are prepared to take when they spray, by assuming that using larger droplets will stop spray drift.

It is important to consider what is required to maintain the balance between achieving good efficacy and the need to eliminate large spray drift events.

Impacts on efficacy when spraying speed increases

Good timing, a robust rate of product and a suitable water rate are all crucial factors for obtaining efficacy. However, efficacy is not only about producing enough droplets to cover the intended target, it is also about getting the droplets to land (and stay) where you need them.

Where a droplet will land is affected by its size, its velocity (speed), the prevailing air movement and the formulation or adjuvant effects. These are all factors that can affect the deposition of droplets onto a target when spraying occurs at higher speeds (km/h in the mid to high 20s or above).

Higher travel speeds introduce new problems, including:

- More horizontal (forward) movement of large droplets, resulting in more shadowing or misses of smaller weeds in and around crop and behind standing stubble. This is much more noticeable in a head wind–tail wind situation, than a cross wind (across the rows).
- Poorer penetration of stubble and larger grass weeds by droplets at the larger end of the coarse spectrum (or coarser). This is a function of the droplets ability to penetrate the stubble (without being intercepted by it), as well as number of droplets produced as the droplet size

" MAINTAIN THE BALANCE BETWEEN ACHIEVING GOOD EFFICACY AND THE NEED TO ELIMINATE LARGE SPRAY DRIFT EVENTS"

increases. Moving from the small end of the coarse spectrum (towards medium) to the larger end of coarse (towards very coarse) can reduce the number of droplets produced by a factor of up to three times.

- Higher travel speeds cause the tyres to displace more air, moving droplets away from the wheel tracks. This contributes to poorer wheel track control.
- Increased travel speeds increase the wake effect (air movement) around machine, particularly around the wheels and in the centre of the sprayer. This air movement reduces deposition in these spots and increases the upwards 'suction' behind the sprayer, which increases drift potential. The wake effect produced by self-propelled sprayers travelling at higher speeds is most noticeable on the deposition of spray droplets on the downwind side of the machine, especially in standing stubble adjacent to the wheel tracks.
- Most importantly, higher travel speeds can result in reduced retention of larger droplets onto grasses and other hard to wet leaf surfaces. This problem may be increased with the addition of some oil based adjuvants, especially when used with air induction nozzles operated at the larger end of the coarse spectrum, where the adjuvant can collapse the air within the droplets.

Some of these impacts can be addressed with sprayer setup (wheel track nozzles for knock down herbicides), nozzle selection (spray quality) and the choice of adjuvant.

Air movement and dust at 25km/hr.

Air movement and dust at 35km/hr.

Application parameters to improve efficacy at higher speeds

- Operating nozzles that produce droplets at the smaller end of the coarse spectrum (towards medium).
- Reducing the nozzle spacing from 50cm to 25cm (which may not be practical at lower application volumes due to nozzle blockages when orifice size is reduced). Where it is not practical to have a narrower spacing on the whole boom, consider using a narrower spacing around the centre of the machine and adjacent to the wheels.
- Using wheel track nozzles (increased nozzle size for increased flow) adjacent to the wheels (not just on the wheels themselves, but out for 1-1.5 m either side), but only for knockdown, or non-residual products in fallow situations.
- Increasing water rates to around 70-80 L/ha (even for translocated products) where speeds (km/h) are in the mid-20s or higher.
- Operating in a cross wind situation, where possible.
- Maintaining boom height to achieve at least a double overlap.

Unfortunately many of the factors that tend to improve efficacy at higher travel speeds also contribute to an increase in the likelihood of spray drift occurring, particularly during the wrong conditions for spraying.

Spray drift risk and the weather

The risk of off target movement of product that is associated with all spraying activities is governed by how much product we leave in the air, either as droplets or as vapour.

Careful product selection can minimize the vapour component, but what can happen to any droplets that remain in the air after they have been released is purely a function of the weather conditions during spraying, and for several hours after the spraying has taken place.

Most of the damage we have seen in recent years as a result of spray drift has been attributed to the movement of airborne droplets as a result of spraying under the wrong conditions, which nearly always occur at night.

Increased danger of air movement at night

In terms of spray drift risk daytime spraying is always safer, particularly when the sun is heating the ground and the wind speed is consistently above three to four km/h. This is because air movement over a warm surface tends to be more turbulent, which helps air to mix and brings airborne droplets back to the surface.

Spraying at night when the ground has cooled, and surface temperature inversion conditions are likely to exist is dangerous because the air flow across the surface becomes less turbu-

lent and more laminar (where the air flow becomes parallel to the ground). Typically wind speeds less than 11 km/h at night will be laminar, which can lead to droplets remaining suspended in the air for long periods of time. These droplets will continue to move with that airflow until the inversion breaks some time after sunrise.

In a single, un-replicated, drift study conducted in the summer of 2011, which compared the amount of drift produced from daytime spraying versus night time spraying, the amount of chemical remaining in the air after spraying at night was five to six times greater than that which occurred from spraying after sunrise. The amount of chemical remaining in the air from night spraying was equivalent to one hectare's worth of chemical for every 60 hectares that were sprayed at night, even when using a coarse spray quality.

The balancing act: efficacy versus drift potential

The point of summer fallow spraying is to control the target weeds.

We do this to conserve moisture, retain nutrients and to reduce the weed seed bank for future crops and fallows. The more efficient these operations are, particularly in relation to completing spraying while the target weeds are most susceptible, the better the outcome is likely to be.

If the desire is to get over the country as quickly as possible, so we can target weeds while they are most susceptible, this is a valid strategy. However with increased speed, there is usually a need to reduce droplet size to the smaller end of the coarse spectrum to maintain efficacy. This will increase drift risk, particularly if the conditions are wrong.

In my view, this means that the only safe time to spray when travelling at higher speeds is during daylight hours, when the sun is clearly up and heating the ground, the wind speed is above three to four km/h, and a suitable downwind buffer exists.

Until our understanding of air movement at night improves, night spraying should be considered to be too high a risk for spray drift.

Bill Gordon Consulting Pty Ltd
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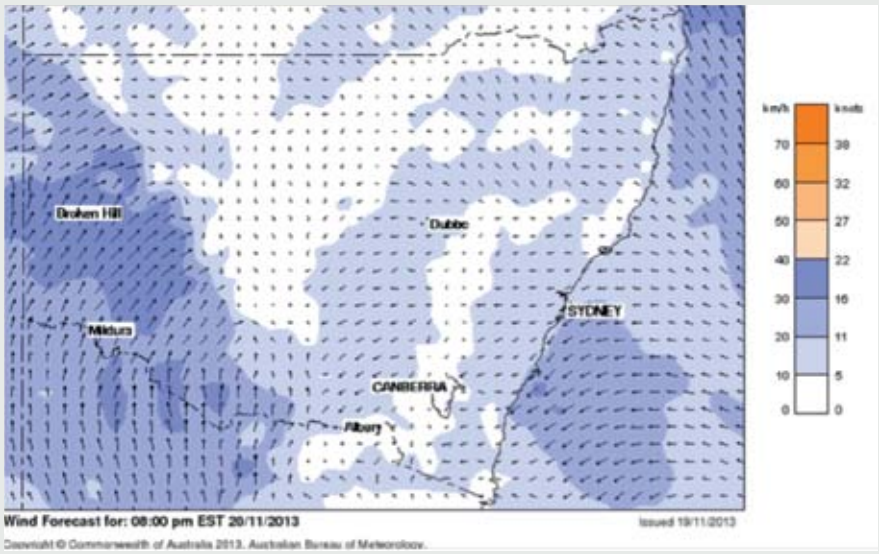
email us



WIND FORECASTING

CottonInfo specialist Jon Welsh says farm managers and spray rig operators can access wind modeling forecasts from the Water and The Land (WATL) link from the Commonwealth Bureau of Meteorology website. The site is updated daily and covers three-hourly intervals on a seven-day timescale on wind speed and direction for all Australian States. Wind forecasting can be particularly useful when identifying intense cells of wind approaching a given location which may have a detrimental effect on spray efficacy. The following image is an extract from the WATL site, showing a frontal system approaching south-western NSW.
Source: http://www.bom.gov.au/watl/wind/

UNE COTTON PRODUCTION COURSE READY TO ROLL IN 2014

Enrolments are open for The University of New England (UNE) 'Cotton Production Course' for 2014. Now operating under the banner of CRDC, the Cotton Production Course is co-ordinated by UNE and is recognised as the only cotton-specific tertiary level cotton training program. Targeting students from all sectors of the industry from banking and the agribusiness sector through to farm management and agronomy, the course is designed to equip students with the skills to operate within the cotton industry.

Now in its 18th year, the course is continually updated with information on cutting edge scientific research and methods. This provides students with most relevant knowledge and skills required to keep the industry moving forward at the pace to which it has become accustomed by embracing change and new technology.

The course offers four subjects specific to the production of cotton, at both undergraduate and postgraduate level. Students can enroll in a diploma of agriculture, Graduate certificate in Cotton Production, or Master of Agriculture, and complete all four subjects. All subjects are also offered on an external basis to allow those already in the workforce to work and study. The UNE teaching year begins in late February and finishes in mid-October, which allows students to conduct their studies in the off season and to work uninterrupted for the bulk of the cotton season.

Residential schools are held in regional areas so students experience first-hand the practical operations in the industry, and allow experienced cotton industry key operators and researchers to provide input into the delivery of the course material.

The Cotton Production Course is co-ordinated by Brendan Griffiths. Brendan has been based in Goondiwindi for the past 16 years in his own consultancy and research practice, with more than 20 years' experience in cotton and broad-acre farming systems. It is through this first-hand experience at field level that the material delivered in the cotton course can be put into the context of the field decision making processes.

For enrolment, course information or information on CRDC study scholarships contact Brendan Griffiths on bgriffi2@une.edu.au or visit The University of New England website at www.une.edu.au

email us

see our website

WIN THE WAR AGAINST VOLUNTEERS – TIMING AND VIGILANCE

CONTROL OF UNWANTED COTTON IN THE FARMING SYSTEM CAN BE ACHIEVED THROUGH TIMELINESS AND VIGILANCE, AS COTTONINFO'S **NGAIRE ROUGHLEY** EXPLAINS.

As well as in-field volunteers and ratoons, unwanted cotton is often found growing along roadsides, in channels and taildrains and on other non-crop areas around the farm.

The argument for effective eradication is strong: when it is not in the crop row making money, volunteer and ratoon cotton is just another weed that can negatively impact on the production system. Negative impacts, such as hosting insect pests and cotton viruses, extend beyond individual farms, making volunteers a problem requiring collective effort from all growers.

For the past three seasons, more than 90 percent of the consultants participating in the Crop Consultants Australia's Annual Cotton Practices Survey have reported the prevalence of cotton volunteers on farms has remained the same or increased. After the 2011/12 season, 35 percent of consultants nominated the control of cotton volunteers as the single most important factor in managing back-to-back cotton crops.

NSW DPI Weeds Research Agronomist Graham Charles says the timeliness of control operations is critical in effectively managing volunteer and ratoon cotton.

"When plants are small and actively growing, the use of registered herbicides is most effective as is it easier to achieve complete coverage on all leaves, with better penetration and translocation of the product," he said.

"Paraquat based herbicides such as Gramoxone and Spray.Seed250 are generally effective on non-stressed plants up to eight nodes.

"Interestingly, while sunlight is necessary for herbicidal activity, it can also limit efficacy through rapid desication of plant material.

"Some growers have found that spraying under cloudy conditions, or towards the end of daylight hours increases control and reduces regrowth.

"Low light intensity can slow the rapid speed of action, allowing for a more thorough kill when the sun rises the following day."

Graham says hill and furrow cultivation may be a more cost effective option than herbicides for controlling larger or stressed plants, as it destroys the root system and prevents recovery of any growing points. More advanced plants may require double knock strategies – for example, an application of Spray.Seed250 will slow the growth of larger or stressed plants, which can then be followed up with cultivation to control any survivors.

NSW DPI Pathologist Karen Kirkby took this image while out on the NSW Annual Disease Survey recently and says volunteers "are still a problem".

Volunteers along channels, taildrains and other areas around the farm can be effectively managed through hand chipping

"Controlling volunteers as they appear can be as simple as ensuring all farm vehicles carry a hoe, and utilising the changeover time between irrigations to pull out rogue cotton plants," Graham says.

"Spot spraying is another effective mechanism for low density situations. Ideally, a relatively high rate of herbicide should be used, from a different herbicide group than previous applications."

ON-FARM: NEEK MORAWITZ "ARGOON" EMERALD QLD

Why do you control volunteer cotton and how do you do it?

The way I see it, volunteer cotton is no different to any other weed. There is no simple solution but timeliness and a vigilant attitude are essential. My management strategy is to control as early as possible using various chemistry options in-crop, combined with regular road grading and manual removal of stray plants along head ditches and irrigation channels. Occasionally I will send someone out on a quad bike to pull weeds, but primarily we stay on top of things by keeping an eye out when out irrigating or driving around. It's important to get on top of your volunteers quickly – acting early, when plants are small can save a lot of time and effort later on. If you can start the season with a clean farm, it's not difficult to maintain.

Why is it important in your management system?

The presence of volunteer cotton is a threat to my production system. Allowing weeds such as volunteer cotton to grow unchecked not only increases the risk for pest and disease incursions, but also reduces the efficiency of various farm operations. Plants growing in channels can cause siphon blockages and restrict the flow of water which can negatively impact on the entire irrigation system.

Why is it everyone's problem?

The control of volunteer cotton is not just in the interest of individual growers but across the industry as a whole. However, we as growers are the key to maintaining the viability of Australian cotton against various pest and disease threats that are intensified through the presence of unwanted cotton.

LATEST RESULTS SHOW LIKELIHOOD OF GLYPHOSATE RESISTANCE IN SOWTHISTLE

ALTHOUGH MORE TESTING IS NEEDED, THE LIKELIHOOD OF RESISTANCE MEANS SOWTHISTLE SHOULD NOT BE CONTROLLED WITH GLYPHOSATE ALONE.

As reported in the spring edition of *Spotlight on Cotton R&D,* initial testing for glyphosate resistance in common sowthistle (*Sonchus oleraceus*) has been underway.

While further experiments are needed to reliably confirm resistance, the message is that growers and consultants should be considering management decisions carefully. NSW DPI's Tony Cook has been investigating the response of sowthistle to glyphosate in glasshouse trials at two growth stages; the large rosette/early bolting stage and the late bolting/early flowering stage, as anecdotal evidence indicates that growth stage has a major impact on expression of resistance/tolerance.

"While not officially resistant yet, the majority of researchers believe there has been a significant shift in sowthistle's response to glyphosate," Tony said.

"The Glyphosate 450 label states that sowthistle greater than three centimetres in diameter should be treated with 1.6L/ha of product, yet my experiments have shown that some populations are surviving and recovering easily."

"In the experiments, one biotype survived 2L/ha of Touchdown HighTech while the 'susceptible' had only one weak survivor (all other plants were killed)," Tony said.

"These plants were treated at the large rosette stage (approximately six weeks prior to Image 1).

"However, when applied at a larger early flowering growth stage the population under suspicion showed early signs of reproductive potential by producing flower buds."

Image 2: Early flowering sowthistle treated with 2L/ha Touchdown HighTech. At left is the potentially resistant biotype. At right is the susceptible. Note the flower buds developing on potentially resistant plants whereas the susceptible is slowly but steadily dying.

Image 1: Large rosette sowthistle treated with 2L/ha Touchdown HighTech. At left is the potentially resistant biotype and (at right) the susceptible plant.

KEY POINTS

If glyphosate resistance is confirmed in this species it will have serious implications such as:

- Another threat to glyphosate tolerant crops, particularly in cotton systems that are sensitive to the alternative Group I chemistry that can often be used to control this weed.
- More use of Group B or I modes of action to control these populations. Group B resistance is already confirmed so the potential for multiple resistance exists.
- Spread of glyphosate resistant sowthistle will be rapid due to wind borne dispersal of seed and frequency of glyphosate applications in fallows, crops and non-agricultural areas.
- Glyphosate resistance in sowthistle is likely to co-exist with other glyphosate resistance species in paddocks. One option to control one GR species may not be suitable for the other.
- Sowthistle has the ability to grow all year so efforts to control the weed will have to be spread over various seasons, crops and fallows.

An issue for Tony and his research was trying to find a classic susceptible population that died over a good range of growth stages.

"The 'susceptible' population I used was sourced from Tamworth and probably had some glyphosate history as it was collected from around buildings," he said.

"I will need to collect some other populations from coastal or tableland environments that are likely to have close to no glyphosate control history." However the results reiterate the importance of people on farms to keep their eyes open and report any irregularities to industry scientists.

"It has been said before, that growers, their staff and consultants are the eyes of the industry when it comes to early detection of threats, whether it be weeds, pests or diseases," Tony says.

"In relation to the cotton industry in particular, it is a sign to also be looking for alternative herbicides in cotton for sowthistle."

WHAT TO KEEP AN EYE OUT FOR AFTER SPRAYING

- **LONE SURVIVORS AMONG DEAD PLANTS**
- **STANDS/PATCHES OF SURVIVORS**
- **PLANTS THAT MAY INITIALLY SUFFER THEN BEGIN TO REGENERATE**

WHAT TO DO IF DETECTED

- Contact a specialist for details of how to collect, store and send a sample correctly. Avoiding the spread of seeds from suspect plants is vital, so correct handling of the weed to avoid this is imperative.
- IN NSW: Tony Cook 02 6763 1250
- tony.cook@dpi.nsw.gov.au
- IN QLD: Michael Widderick 07 4639 8856 Michael.widderick@daff.qld.gov.au

email us

MANAGING CLIMATE RISK

WITH THE SUMMER CROPPING SEASON IN FULL SWING, ATTENTION TURNS TO HOW MUCH RAIN AND HEAT IS ON THE WAY. HOWEVER, WHEN PLANNING FOR RESOURCE ALLOCATION DURING THIS PERIOD THERE ARE A NUMBER OF KEY CLIMATIC INFLUENCES WHICH MAY ASSIST IN ON-FARM DECISION MAKING.

IMAGE: MELANIE JENSON

While researchers face challenges in weather prediction and climate forecasting during the summer period, it is important for growers to be aware of the available information to assist in on-farm decision making. An awareness of observed historical data in cotton growing regions can help add some perspective on summer moisture risk management.

Global seasonal forecasting models have limited value for precipitation through the summer season. There is little correlation with El-Niño Southern Oscillation during the summer period meaning that the 30-day average of the SOI will have little relevance to predicting rainfall. Similar limitations exist with other published ocean indices; Niño 3.4 or Indian Ocean Dipole. When planning for likely scenarios through the growing season there are three areas of forecasting that may be useful.

SEASONAL TEMPERATURE FORECASTS

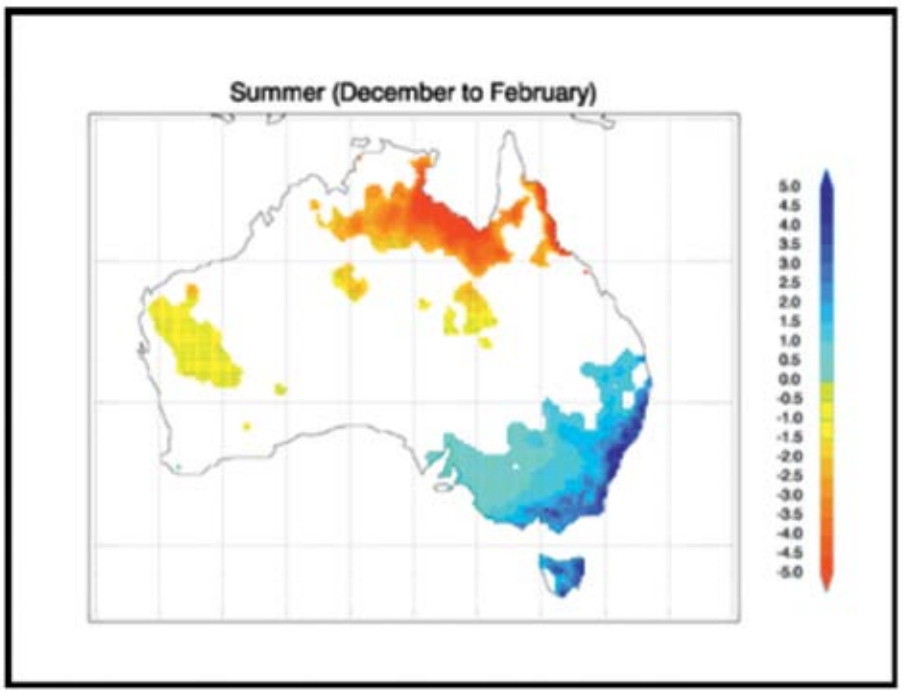
Most international seasonal forecasting models offer regular guidance in one month or three monthly lead times. Temperature forecasts on a seasonal timescale usually offer greater skill than precipitation. These forecasts will aid in predicting extreme periods of heat or alternatively anticipated periods of cooler weather. When monitoring our moisture balance sheet, temperature guides can be useful in determining likely evaporation levels in storage dams, fallows and impacts on planted crops through the summer period.

TRACKING THE MADDEN-JULIAN OSCILLATION

The Commonwealth Bureau of Meteorology (BOM) offers useful commentary on the eastward progress and strength of the MJO. The MJO has proven to be relatively unpredictable in terms of its strength and ability to influence precipitation but is none the less a useful guide to possible changes in weather patterns. This phenomenon is most active from November to April.

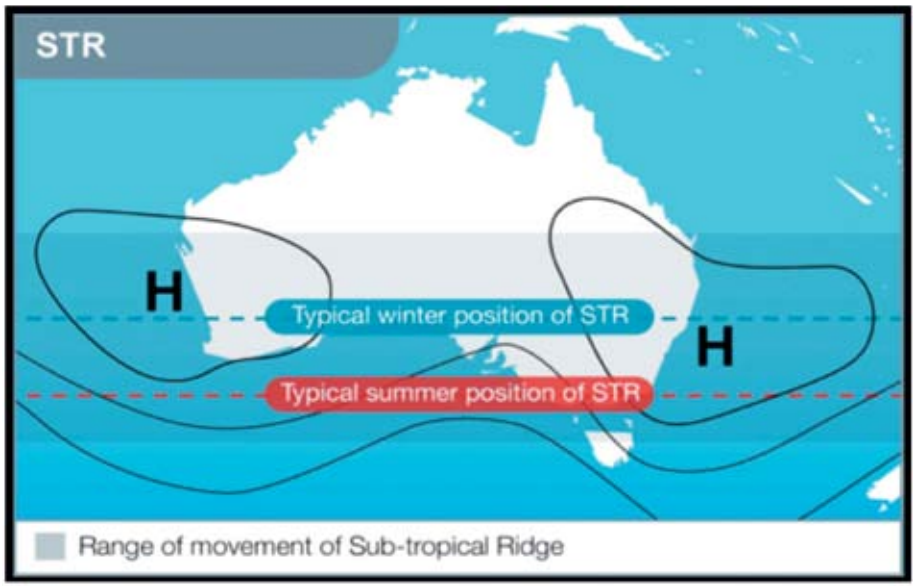
TASMAN SEA BLOCKING INDEX

Climate scientists have also discovered an air pressure gradient in the Tasman Sea that has a measured influence on our summer rainfall, particularly in regions from the western Darling Downs southward. A 'blocking' Index has been created by BOM scientists to enable us to monitor the degree of splitting of the upper tropospheric mid-latitude westerly airstream which makes moisture more available to cotton growing areas. Farmers would be aware that a high pressure system in the Tasman Sea can often redirect tropical moisture elsewhere, keeping inland areas dry.



This map illustrates the relationship between daily rainfall and the atmospheric "Blocking Index" through summer. The areas of blue shading indicate an increase in rainfall under a positive "Blocking Index".

Given the complexity of monitoring various layers of atmospheric pressure, this index has relatively low predictability on lead times greater than seven days. The figure below shows a positive correlation between the 'Blocking' Index and precipitation (mm/day) for the summer period: that is, a positive blocking Index relates to a positive increase in our rainfall anomaly.



The figure illustrates the position of the sub-tropical ridge in both the summer and winter seasons; Source: www.bom.gov.au

WHY SUMMER RAIN IS HARD TO PREDICT

CLIMATE RESEARCHERS FACE A MORE COMPLEX AND DYNAMIC WEATHER SYSTEM DURING THE SUMMER MONSOON THAN IN WINTER AND SPRING SEASONS WHICH PRESENTS A RANGE OF CHALLENGES FOR SEASONAL FORECASTING.

Tropical moisture is the primary source of our precipitation in summer, and is influenced largely by convective moisture and circulation patterns at a local level, rather than seas surface temperature anomalies and air pressure anomalies in the central Pacific or Indian Oceans.

Changes in frontal activity, wind direction, humidity and storms are well known by farmers through seasonal cycles through a calendar year.

In the winter season, our moisture sources originate from the Indian Ocean and the tropical Pacific Ocean with activation mechanisms usually triggered by a range of atmospheric indicators from the south of the continent. The position of the sub-tropical ridge is at a higher longitude, directing southern ocean fronts through southern Australia.

In the summer season, the sub tropical ridge moves southwards, allowing lower air pressure in the north of Australia and relatively higher and more stable air through southern Australia.

Researchers have identified the key drivers of the winter/spring seasons over a number of years, building reasonable skill simulating the land, sea, air circulations through this period enabling varying degrees of forecast accuracy through growing areas. The basis for winter/spring forecasting skill has been developed around the El-Niño Southern Oscillation phases (El Niño/ La Niña) and the impact on convective moisture availability and air pressure gradients (SOI) on rainfall and temperature in eastern Australia.

However in the Australian summer or wet season many of the statistical correlations with SOI and other climate drivers used in the winter/spring show little, if any connection with rainfall throughout our region.

Seasonal predictions of the Asian-Australian monsoon remain very difficult as scientists struggle to understand the local air-sea-land interaction and moreover, create simulations necessary for forecasting.

The onset of the monsoon each year is strongly influenced by the Madden-Julian Oscillation (MJO), a tropical disturbance that propagates eastward around the globe every 30 to 60 days. The MJO has been identified as the strongest mode of variability in the Australian region through summer. It should be noted that not all variance in the tropical monsoon is attributed to MJO.

WHAT DOES HISTORY SAY ABOUT OUR SUMMER RAINFALL RELIABILITY?

A SIMPLE STATISTICAL ANALYSIS ON REGIONAL RAINFALL DATA CAN ILLUSTRATE THE RELIABILITY OF SUMMER GROWING SEASON RAINFALL.

By calculating the Co-efficient of Variation (CV) are able to estimate the reliability of our monthly rainfall at a given location. The CV is calculated by dividing the standard deviation by the mean. The CV does not identify changes in amounts of rainfall, however provides an indicator of the reliability of achieving the average for a month in the calendar year.

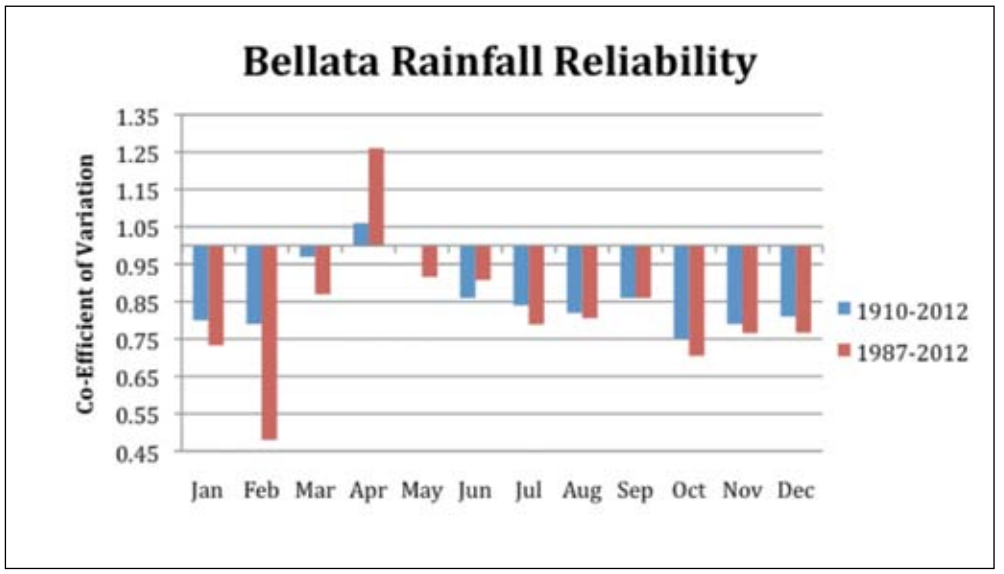
The following charts illustrate the reliability of rainfall in three cotton growing areas in Eastern Australia; Dalby, Southern Queensland, Bellata, Northern NSW and Hay, Southern NSW. Where the CV is close to zero, historically this is the most reliable in terms of achieving the mean for that month. A distribution where the CV is less than one is considered to have low variance, while those with a CV greater than one are considered to have high variance. Those months showing a high CV illustrate greater variability in monthly totals across the study period.

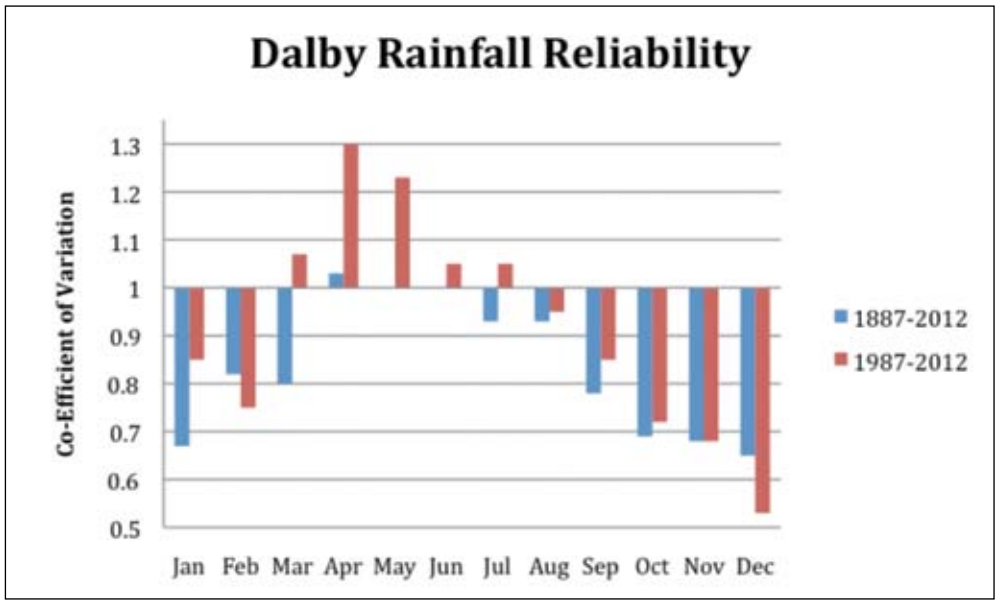
Looking at the contrast on the three locations we are able to assess the different rainfall characteristics and suitability for a range of agricultural practices.

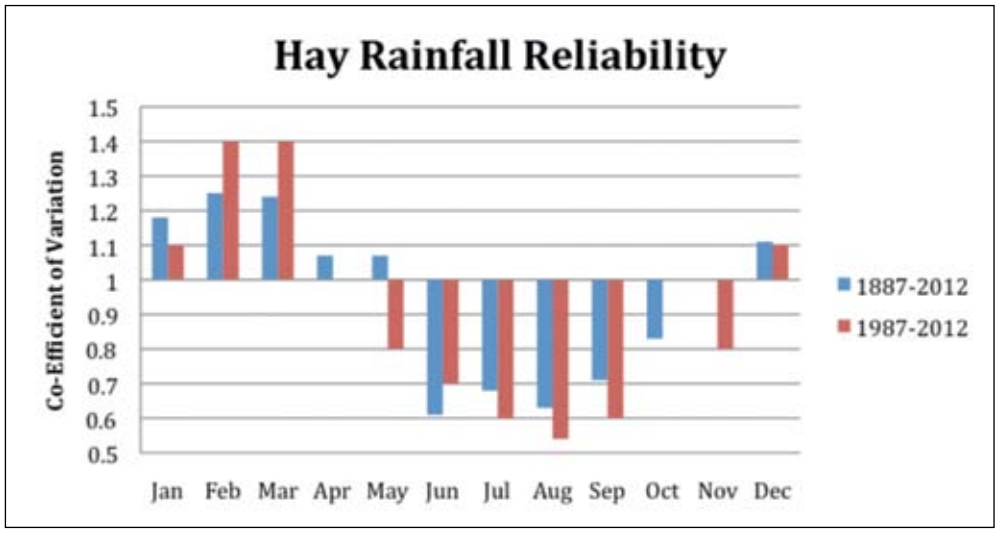
The key features of the Bellata rainfall analysis show a well aligned reliability index with the key growth patterns and farming practices necessary for dryland cotton, particularly during planting (October), boll fill (February) and harvest (April).

The Dalby analysis indicates that there is a greater probability of receiving the monthly mean from October through to December than later summer months.

The Hay analysis test shows a well defined climate between winter and summer season rainfall reliability. The summer season co-efficient of variation values illustrate a poor reliability of rainfall, with a reverse relationship from June through to September in the winter crop growth cycle. Calculating the co-efficient of variation for your region may be useful in building risk profiles when planning for both winter and summer cropping operations.







" LOOKING AT THE CONTRAST ON THE THREE LOCATIONS WE ARE ABLE TO ASSESS THE DIFFERENT RAINFALL CHARACTERISTICS AND SUITABILITY FOR A RANGE OF AGRICULTURAL PRACTICES."

CONTINUOUS IMPROVEMENT IN NRM OUTCOMES THE KEY TO NEW ROLE

THE COTTONINFO TEAM IS CONTINUING TO DELIVER BEST PRACTICE ADVICE BASED ON THE LATEST RESEARCH FOR ALL PARTS OF THE COTTON FARMING ENTERPRISE WITH THE RECENT APPOINTMENT OF STACEY VOGEL TO THE ROLE OF NATURAL RESOURCE MANAGEMENT (NRM) TECHNICAL SPECIALIST.

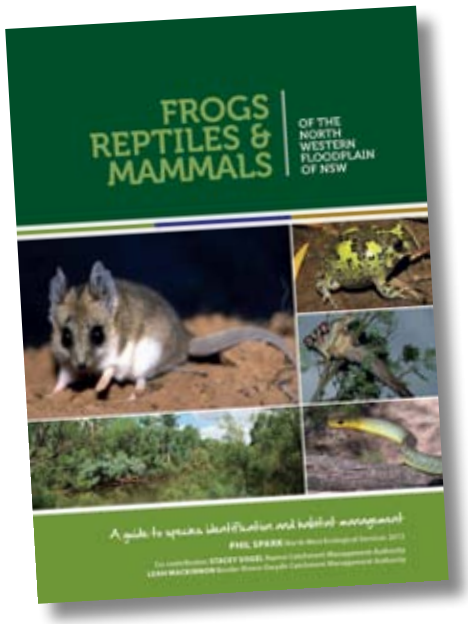
ABOVE: David and Sam Maxwell "Siera Vista" Wee Waa on the Namoi River spotlighting for nocturnal native animals.

RIGHT: Phil spark, ecologist with North West Ecological, wrestling a carpet python from out of his shirt much to the amusement of (from left) Eliza Haire (Yarie Lake), Declan Carolan (Burren Junction), Sam Maxwell (Wee Waa), Sam Hatton (Wee Waa) and Stella Carolan (Burren Junction).

Stacey has been delivering natural resource management programs for almost 20 years. The past nine have been spent in the Namoi Valley providing technical NRM advice and support to cotton growers through her role with the Namoi Catchment Management Authority and the Cotton Catchment Communities CRC. Stacey's impact is evident in her ability to package NRM information into guides like the *Birds on Cotton Farms, Pests and Beneficials in Cotton Landscapes* and the *Frogs, Reptiles & Mammals of the North Western Floodplain of NSW.*

Stacey says her experience has highlighted strategies that work well to engage the farming community.

"Growers want regionally-specific information and confidence that the best practice recommendations being provided are backed by the latest research outcomes," she says.



In her role as CottonInfo NRM Technical Specialist, Stacey will lead and co-ordinate the CottonInfo NRM "In It Together" campaign and lead the continuous improvement of the industry's best practice recommendations for NRM.

"Over the next eight months I will be working with the CottonInfo Team on a comprehensive review and update of the *my*BMP Natural Assets Module, provide NRM training and information to the Regional Development Officers and develop activities that increase the capacity of cotton growing families to manage natural resources on farm," Stacey said.

"My aim in this new role is to help the cotton industry implement on-farm practices that improve the environment and productivity of cotton farms."

Stacey will also focus her attention on the riparian zone of cotton farms, to better understand its condition, update BMPs and to demonstrate the achievements of cotton growers efforts to date in managing this part of the landscape sustainably by benchmarking the condition of this natural asset.

By trying new ways to engage growers and their families in managing the natural resources on their farm, Stacey has enjoyed a great deal of success with her innovative community engagement ideas.

"NRM can be a hard sell at times, especially if there is little obvious economic or production benefit in undertaking a particular NRM activity," she says.

"I think in rural areas 'environmental management' has a lot of negative images and is often seen as a threat to farming businesses. I think we need to re-think how we market environmental messages so that it is seen by rural communities as an activity that we should all be 'in it together'.

"I have been inspired by the success of our recent NRM engagement activities where we worked with 'social networks' to engage, entertain and inform.

"I think the reason this has been so successful in the Lower Namoi Valley where it was trialled, was because it provided this remote, rural community with free family events and the events where developed around what brought these 'social networks' together, for example, gardening, exercise and children.

"We translated this interest into a native plant gardening workshop with the Australian Botanical Gardens, kayak trips on the local river, and family wildlife spotlight evenings."

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The new Wincott committee of Chair Bec Fing, Vice-Chair Vanessa Corish, outgoing Chair Michelle Smith, Secretary Sally Dickinson, Treasurer Alison Benn and Public Officer/Co-secretary Sandy Young.

WIN WITH WINCOTT

WINCOTT – WOMEN IN COTTON – WAS ESTABLISHED IN DECEMBER 2000 WITH THE OBJECTIVE TO SUPPORT RURAL WOMEN ACROSS THE AUSTRALIAN COTTON INDUSTRY BY FACILITATING OPPORTUNITIES TO CONNECT WITH OTHER RURAL WOMEN AND DEVELOP BOTH PERSONAL AND PROFESSIONAL KNOWLEDGE AND SKILLS.

With 14 successful years under its belt, a new committee on board and a bucket load of enthusiasm, Wincott is looking to the future and want to ensure the organisation is reaching women in all facets of the cotton industry and meeting their needs.

The new executive is headed by president Rebecca Fing, with vice president Vanessa Corish, secretaries Sandy Young, and Sally Dickinson and treasurer Alison Benn.

"Mental health of our farming families, communication and relationships, networking and a better technical understanding of the cotton industry are our topics of interest," said Bec.

"Wincott is keen to establish itself as a 'go to group' for women in the industry.

"From Hillston to Emerald, Wincott is happy to help out. If it's an issue for women in cotton, it's an issue for Wincott."

DO YOU WANT TO HEAR FROM US? WE WANT TO HEAR FROM YOU!

WIN AN iPAD MINI

Wincott can't survive without local contacts and financial means and are currently calling for corporate sponsors and regional representatives.

Whether you want to hear about Wincott's coming activites, become a corporate sponsor or a regional rep, sign up to Wincott (or re-subscribe) to receive the quarterly newsletter and go into the draw to win an iPad Mini donated by Monsanto Australia. To make your Valentine's Day, the iPad will be drawn on February 14 2014.

For more details log onto wincott.com.au or contact Wincott Secretary Sally Dickinson at **sally.dickinson@cottoninfo.net.au** or phone **0407 992 495.**

WORKING WITH REGIONAL NRM BODIES

WINCOTT SUPPORTED THE NAMOI CATCHMENT MANAGEMENT AUTHORITY & AGRICULTURE IN ITS ROLL-OUT OF A SERIES OF NRM FIELD DAYS IN THE LOWER NAMOI CATCHMENT RECENTLY.

The field days included day time and nocturnal kayak trips and family wildlife spotlight nights. More than 30 landholders and their families turned out for the events, with just over 70 paddlers in total taking to the water.

The kayakers paddled eight kilometres down the Namoi River and Lower Pian Creek, along the way learning about the riverine environment, its native plants and animals. Guest presenter was renowned ecologist Phil Spark who captured a variety of species of local wildlife, including frogs, microbats and reptiles to amaze participants with the diversity of animals that lived locally.

Local landholder and Wincott member Sally Knight "Warrenbri" Merah North said the kayaking day was "an enjoyable reminder of what treasures we have around us to enjoy".

"It was a great reawakening of just how special our neck of the woods is, and we thank the sponsors of such a memorable, fun and informative day," Sally said.

An inaugural family evening kayak and spotlight night was also held at "Yellowbank" near Wee Waa. The event was organised by CottonInfo NRM Technical Specialist Stacey Vogel.

""Yellowbank" has a great diversity of suitable habitats for native wildlife and hence we saw lots of different animals including two species of owls (barking, and barn), many brushtail possums, and apparently a couple of crocodiles and sharks!"

Wincott's support of these field days is a continuation of its support for NRM, along with the recent completion of a Wincott project funded by CRDC to engage rural women in discussion regarding NRM knowledge and extension methodology.

A Wincott farm safety and NRM luncheon at "Merah North" was a great opportunity to discuss the important topics of farm safety and natural resource management in our farming businesses, according to local cottongrower Alice Burke.

"A forum for farming women and industry professionals to dialogue and network is an immensely valuable initiative, and it allowed us to provide feedback about accessing NRM information and implementing it on our farms.

"It was wonderful to then take the family on a kayaking tour of a local waterway with ecological experts, to learn more about our local environment."

Charlotte and Alice Burke, Dougall and Sam Burke "Doreen" Spring Plains on the Lower Pian Creek Kayak trip.

FIGHTING FUSARIUM WITH ALTERNATIVE CROPS

CAN CROP ROTATIONS LOWER FUSARIUM RISKS FOR COTTON?

IMAGES: LINDA SCHEIKOWSKI

Glasshouse bioassays along with field trials form the basis of research into rotation crops and their effect on the Fusarium pathogen.

Crop rotation is an efficient and economical weapon for controlling some plant diseases. However, because the Fusarium wilt pathogen can persist in the absence of cotton plants, not all crop rotations may assist in lowering the *Fusarium* population in the soil.

With support from CRDC, the DAFF QLD cotton pathology group has investigated the influence of different summer and winter rotation crops on the level of *Fusarium* in the soil in a three year irrigated field trial conducted at "Cowan", Cecil Plains.

Fusarium wilt is a disease of cotton caused by the soil-inhabiting fungus *Fusarium oxysporum* f. sp. *vasinfectum (Fov)*. This fungus or 'pathogen' invades the cotton plant via the roots and colonises the vascular tissue in the stem, spreading throughout the whole plant causing stunting, wilting and plant death, especially when susceptible varieties are grown on heavily infested soils, and weather conditions are favourable for the development of the disease.

DAFF QLD plant pathologist Linda Smith is the project officer and says "We know that the one rotation prior to cotton that consistently shows less disease is a bare fallow treatment compared to a cotton treatment".

"Economically a fallow does not offer an immediate cash return but indications from the trials suggest that the severity of the disease may be significantly reduced in the following cotton crop," she said.

For farming systems where cotton is grown less often, maize and sorghum were identified as good alternative crop options in combination with a fallow. Either of these crops with a fallow lowered the levels of *Fusarium* in the cotton compared to when the rotation simply alternated cotton and fallow.

"In artificial inoculation trials, maize and sorghum were shown to be less well colonized by *Fusarium* than cotton, with infection largely restricted to the root/crown region," Linda says.

"However, fallow is an important component of rotations that are effective in suppressing *Fusarium* disease risk.

"We wouldn't expect to see as low inoculum levels in cotton-maize or cotton-sorghum systems where a crop was grown every summer."

In terms of winter cropping options, Linda suggests that wheat is a better option than chickpea for managing *Fusarium,* as results suggest that inoculum levels won't build up as fast on wheat as chickpea. Cotton following wheat in the wheat-cotton-cotton rotation had the lowest disease rating and performed significantly better than other rotations (maize, sorghum, cotton and chickpea).

In artificial inoculation trials *Fusarium* was isolated from the stem of 73 percent of chickpea plants compared to 45 percent of wheat. Inoculated chickpea plants were visually less advanced than untreated chickpea plants, suggesting that the increase in *Fusarium* in cotton following chickpea maybe, in part due to the ability of *Fusarium* to colonise and reproduce on chickpea.

Linda has encouraged growers and consultants to continue to monitor the presence and severity of *Fusarium*.

"Once introduced into a field the Fusarium wilt fungus cannot be eradicated. It becomes a permanent management consideration" she said.

"Spores of the fungus can survive in the soil for at least 10 years, even in the absence of cotton. If highly susceptible cotton varieties are continuously grown in infected fields, the *Fusarium* population in the soil will build up to the point where production may not be possible even with the most resistant varieties of cotton.

"This highlights the need for an integrated approach to ensure the best possible management of this disease."

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Some growers may have concerns about corn stubble management in a cotton cropping system however NSW DPI's Nilantha Hulugalle says a permanent bed system can be maintained by careful management of the harvesting and post-harvest procedures.

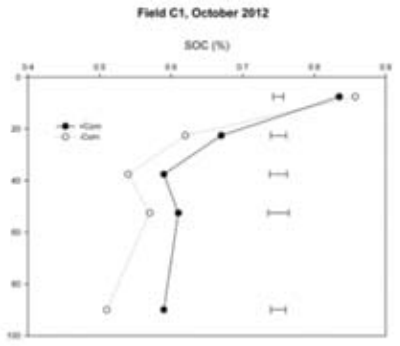
CORN IN COTTON SYSTEMS:
DOWN TO THE ROOT OF THE MATTER

CHRISSY BROWN SPOKE TO DR NILANTHA HULUGALLE ABOUT THE BENEFITS OF INCLUDING CORN IN COTTON FARMING SYSTEMS.

Trials being carried out to investigate carbon sequestration, soil quality, water conservation, yield and profitability in cotton based farming systems are pointing to some significant benefits that may accrue by including corn in a cotton cropping rotation.

The project, led by NSW DPI Principal Research Scientist Nilantha Hulugalle, is now in its third year and is looking at the effects of selected crop and soil management practices on production, as it is thought that these practices could be used as surrogate indices of soil carbon sequestration and water conservation.

Early results suggest that including corn in the cotton cropping system may have some very beneficial outcomes for production, the environment and economics.



The rotation-tillage treatment subplots where corn has been added into the rotation have significantly higher soil organic carbon at depths below 60 cm. In response, the root systems of the following cotton crops are exploring more of the soil profile at depth.

Sowing corn increased soil organic carbon at depth (60 to 120cm), which has not been previously reported in research. The increase in carbon at depth approximates the carbon in corn roots.

"A large proportion of the root mass of the corn crop is below 60 cm. The deeper root system means that corn can access moisture and nutrients from different parts of the profile for different periods of time,"Nilantha said

"At this time, the change in soil organic carbon hasn't translated to increased soil moisture holding capacity, however benefits may accumulate over time."

Nilantha explained that they have observed that the cotton sown after corn had deeper and more extensive root systems than that in control plots.

Supporting the ACRI plot results, soil organic carbon was higher in the top 30 cm of soil after corn than after cotton at the irrigated on-farm survey sites in the Namoi and Macquarie valleys and the Murrumbidgee Irrigation Area.

A further observation that supports anecdotal evidence of cotton's better performance after corn was the measure of black root rot infestation in cotton.

"While the lowest disease pressure was experienced where both corn and wheat were grown in rotation with cotton, there was also significant reduction where corn was alternated with cotton in a continuous summer cropping program using permanent beds/minimum tillage," Nilantha says.

Trial results have also been measured in terms of their economic performance.

"With very similar variable costs and water application, gross margins reflected yield results with the two permanent bed treatments that included corn returning the highest gross margins both per hectare and per mega litre," Nilantha said.

"The cotton-wheat-corn on permanent beds achieved the highest gross margin returns of $2458/ha and $445/ML. The lowest returns were from the continuous cotton with conventional tillage of $1418/ha and $267/ML."

Nilantha says while the results of the cotton-corn rotation experiments are not conclusive as they are only for a single cropping cycle, research is continuing.

"I feel that we may have seen different results across the treatments if the weather had been drier, as our work was done under wet and waterlogged conditions (including the 2011-12 floods), which suited corn well but not cotton," he said.

"However, the economics and disease responses should not change very much. We shall see what future research brings."

Effect of Corn rotations on black root rot infestation in cotton, December 2012 (sampled by Peter Lonergan, NSW DPI cotton pathology unit)

Historical cropping system	+/- corn	Black root rot score	Seedling dry weight (g/plant)
Conventional till/continuous cotton	Corn	7.7	0.26
	Control	8.5	0.18
Permanent beds/continuous cotton	Corn	7.2	0.25
	Control	9.6	0.23
Permanent beds/cotton-wheat	Corn	5.3	0.31
	Control	6.1	0.26
SEM			
Historical cropping systems (HCS)		0.59*	0.02
Corn (C)		0.37*	0.01*
HCS x C		0.65	0.02

*, significantly different at 95% level of probability

Some growers may have concerns about corn stubble management in a cotton cropping system. Nilantha says "Many growers who sow corn consider their residues to be 'bulky' and manage them by either burning or incorporating with intensive tillage. However, our experience suggests that this is unnecessary. A permanent bed system can be maintained by careful management of the harvesting and post-harvest procedures".

Nilantha says the following corn stubble management methods were successfully incorporated into their system:

Harvesting: with a New Holland TR85 harvester with a seven-metre open front. This left the corn stalks approximately 40cm high with the remainder being shredded as it went through the machine.

Slashing of stubble: with a four-metre Howard slasher. Corn stalks approximately 10cm high remained.

Root cutting: with a four-row hydraulic powered root cutter. This cuts the root system approximately five cm below the surface of the bed.

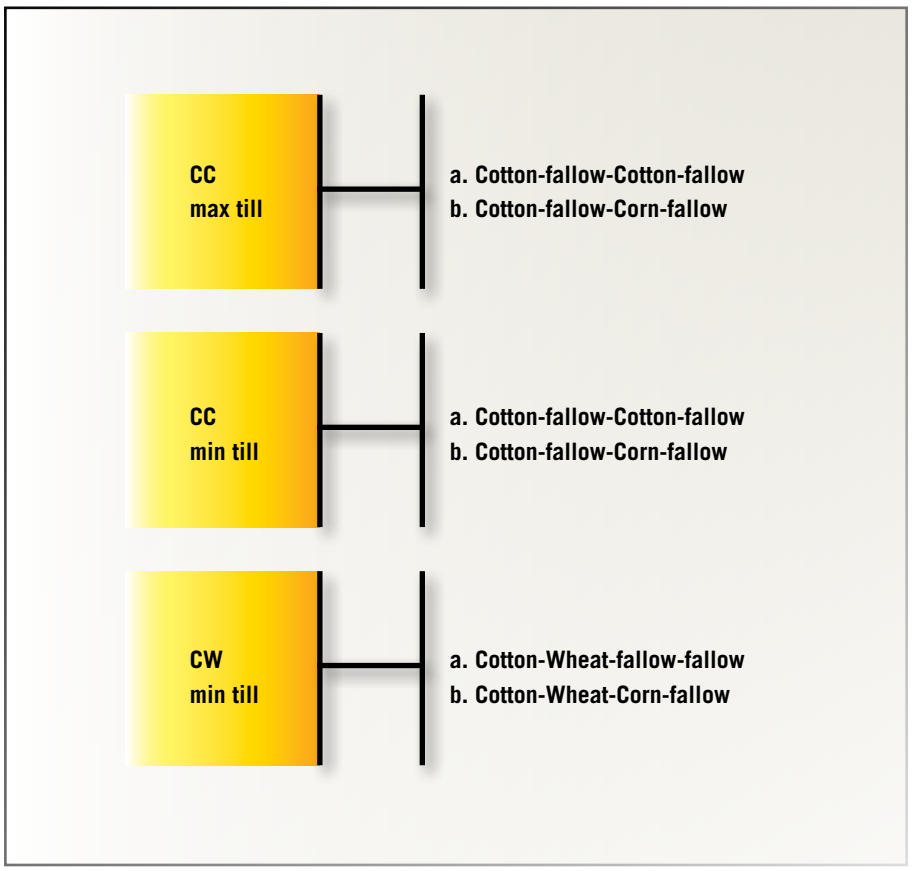


Figure 1: Rotations trial, indicating the inclusion of corn since 2011 through the creation of sub-plots.
The role of corn in cotton farming systems is being evaluated through its addition to the crop rotation and tillage treatments that have been under long term evaluation at the Australian Cotton Research Institute, Narrabri. The initial stand-out results from the trial are that the cotton crops following corn significantly out yielded their sub-plot counterparts. Cotton-wheat-corn sown on permanent beds achieved the highest cotton yield at 10.7 bales per hectare, closely followed by the cotton-corn sown on permanent beds at 10.1 bales per hectare. This was a significant increase in the cotton yield over the conventionally-tilled continuous cotton of 28 and 35 percent, respectively.

UNDERSTANDING NITROGEN LOSS

IN 2009 AGRICULTURE ACCOUNTED FOR ABOUT 15 PERCENT OF AUSTRALIA'S GHG EMISSIONS AND NITROUS OXIDE IS THE KEY GHG EMITTED FROM AGRICULTURE.

Broad-acre irrigated agriculture results in indirect emissions of nitrous oxide and the cotton industry is supporting a new research project to find ways to reduce these levels.

CSIRO Land and Water researcher Dr Ben Macdonald will lead the project and says that "sustainable agriculture is a key goal and within this we are looking at ways of reducing our greenhouse gas emissions whilst achieving productivity gains".

Emissions of nitrous oxide from water held on farm will be measured in an effort to better understand the relative contribution of irrigation water to the total greenhouse gas (GHG) emissions of irrigated cotton farming.

Total nitrogen loss

The project team is aiming to provide a better understanding of total nitrogen losses associated with irrigation and recycling of the irrigation water in flood irrigated cotton production systems. This will support the development and promotion of more efficient nitrogen management practices.

"Nitrous oxide (N_2O) be emitted directly from land surfaces but can also be lost indirectly through soluble nitrous oxide in water," Ben said.

"There have been no emissions measurements of nitrous oxide in surface water run-off or through leaching in Australia, however, we do know that under furrow irrigated cotton significant amounts of nitrate nitrogen can move off the field in surface water runoff, with the scale of losses influenced by stubble cover, slope, duration of irrigation and irrigation flow rates. We also know that more than 10kg of nitrate nitrogen is lost via deep drainage.

"We want to know how much N_2O is being lost through surface water runoff and deep drainage, it could be a significant amount.

"It is estimated that a plant sees about 40 percent of nitrogen applied and we want to know what proportion of nitrogen is lost through emission of the GHG nitrous oxide."

In 2009 agriculture accounted for around 15 percent of Australia's GHG emissions and nitrous oxide is the key GHG emitted from agriculture.

"Once nitrous oxide is emitted it stays in the atmosphere for a long time and absorbs more heat than other greenhouse gases," Ben says.

"Nitrous oxide is 298 times more effective than carbon dioxide as a global warming gas. Therefore we need to look at nitrous oxide losses as this is where we can make the most significant gains in reducing GHG emissions.

"Aside from global warming considerations, nitrogen fertilisers are a significant cost so nitrogen use efficiency is an important factor."

CRDC's Climate, Carbon and Soils Research Manager Allan Williams will manage the project.

"CRDC is interested in this project as it ties in with another current project looking at nitrous oxide emissions from the land surface," Allan says.

"Outcomes of this indirect emis-

ABOVE:
Ben Macdonald taking a water sample during gas emission measurements. The chamber in the background is used to collect gas emissions from the irrigation water.

LEFT:
Tony Nadelko taking a gas sample from the measurement apparatus. The gas samples are sent to the CSIRO Black Mountain Butler Laboratory to determine the nitrous oxide and methane concentrations.

sions project will round off the industry's understanding of the losses of nitrogen from irrigated cropping systems.

"The information will also be used to identify potential management strategies to reduce GHG emissions that are targeted at the most significant sources."

Components of the project

"Firstly we are trying to understand how the different components of the irrigation network contribute to nitrous oxide emissions," Ben said.

"To do this we are going to be measuring dissolved inorganic nitrogen and nitrous oxide in the irrigation water within each of the components of the irrigation system – the head ditch, furrows, tail drain, return channel and water storage.

"If nitrogen in these facilities is significant then we will proceed with the next phase of the project which is to investigate the effects of farming systems on indirect emissions and what we may be able to do to lower nitrogen losses and nitrous oxide emissions."

Another component will be carried out at the Australian Cotton Research Institute to measure deep drainage losses of nitrogen fertiliser. CSIRO Land and Water already has a lysimeter installed which measures the amount of water being lost to groundwater during each irrigation.

The lysimeter also allows researchers to look at the water chemistry using what is known as 'a tracer' (stable nitrogen isotope ^{15}N) to calculate nitrogen losses. This will help give an idea of total N moving in the plant, atmospheric and water phases.

Ben says that one of the important features of this project is that it has been set up to work in with already existing CRDC-funded projects.

"We will be collaborating with other organisations so will be working across a number of different research projects. This allows us to extend across other existing projects and capitalise on existing works."

This project is supported by funding from the Australian Government.

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NUTRIENT LOSS IN RUNOFF AND TAIL WATER

UNDERSTANDING WHERE AND WHY NUTRIENT LOSSES OCCUR IS VITAL FOR IMPROVING FERTILISER USE EFFICIENCY AND PROFITABILITY. DAFF QLD'S DUNCAN WEIR DISCUSSES HOW MONITORING RUNOFF AND TAIL WATER MAY HOLD SOME ANSWERS.

Optimising fertiliser efficiencies is an important management focus in driving improved profitability for cotton growing. When calculating nutrient requirements of a crop, potential losses need to be considered. Losses can result from immobilisation, leaching, volatilisation, de-nitrification, crop removal, erosion and runoff.

Duncan Weir says the potential for nutrient loss in tail water and runoff has been shown to be relatively high, however with limited research from irrigated fields in Australia it is difficult to get a good understanding of nutrient loss under different farming conditions.

"This is made more complex when you consider that tail water is now recycled within the system," Duncan said.

"While the importance of nutrient loss from fields is uncertain, and given that nutrients removed in the tail water are not immediately returned to the field, they need to be accounted for as part of nutrient management.

"In general, farm management practices and systems that reduce sediment loss and water runoff will reduce nutrient losses."

Management and loss

The research shows the importance a farming system has on levels of loss.

Duncan said research has shown that dissolved nitrogen and phosphorus in runoff increases with increase in cover under reduced tillage systems when fertilisers were surface applied and incorporated. However when fertiliser was applied into the subsurface, concentrations of dissolved nitrogen and phosphorus decreased with increased cover.

Phosphorus

"Phosphorous is predominantly transported in the sediment of runoff and losses are directly correlated with sediment concentration," he said.

"Trial work by Dr Mark Silburn using a rainfall simulator on a cotton hill–furrow system with a range of on-ground cover (zero to 60 percent) found total phosphorous losses in a single runoff event decreased exponentially with increased soil cover and that the loss of phosphorous was dominated by sediment phosphorous. There was only a small contribution from dissolved organic phosphorous.

"Research comparing sub-surface drip and furrow confirms the link between sediment loss and phosphorus, with losses in the furrow system (over a full season) ranging between 0.35 – 1.20 kg/ha, whereas losses in sub-surface drip were negligible."

Nitrogen

Nitrogen (N) loss in tail water appears to be more complex than P losses. In addition to sediment forms, Nitrogen can also be readily lost in runoff as Nitrate N.

Mark Silburn's research showed that nitrogen lost under bare soil was predominantly sediment N but under wheat stubble cover losses were in a nitrate-N form. Estimated nitrogen losses were seven percent of applied N or 28 kg/ha per season.

Looking at furrow compared to sub-surface drip research, Duncan found nitrogen removal by runoff of 18kg/ha in the furrow system (200kg pre plant). These losses occurred in the first five irrigation events, while later irrigations did not contribute further. The highest individual N loss coincided with an inter-row cultivation.

"Accumulated N losses of 11.3 kg/ha was measured in the second year. The lower N loss was attributed to higher optimisation of irrigation as a result of lower rainfall."

In addition to optimising irrigation to reduce runoff, improvements in nutrition efficiency, through timing nitrogen availability to plant needs can reduce nitrogen losses. Research in sugar cane demonstrated a 10 fold reduction nitrate-N concentrations in tailwater was achieved through use of a slow release nitrogen fertiliser product that better matched N availability with plant needs.

The bigger picture

In addition to being a source of fertiliser inefficiency, nutrient loss in tailwater and runoff also reflects other issues in the system such as erosion, irrigation inefficiency or timing of nutrient availability.

"Nutrient losses can also impact on natural water ways and wetlands. Growers must maintain their tail water recycling systems and endeavour to prevent nutrient rich water entering natural systems.

"Further understanding or perhaps new real time monitoring technologies in the future may provide opportunities to better understand and respond to nutrient losses in runoff, and in turn enable growers to further understand and improve fertiliser efficiency. However for the moment, best practice in terms of optimising water use, applying nutrition to meet crop demands, and managing for sediment loss are known means that will help to minimise this source of loss."

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STRONG INTEREST IN COTTON RESEARCH

CRDC's call for Preliminary Research Proposals (PRPs) earlier this year resulted in the highest interest ever, with 119 applications valued at over $15m for the 2014/15 year received. With the assistance of the Cotton Australia Research Panels, the CRDC R&D team have now reviewed these applications and 66 Full Research Proposals (FRPs) valued at $9.3m will be evaluated for the 2014/15 year.

"It is very promising to see the interest in cotton industry research continuing to increase," CRDC Executive Director Bruce Finney says.

"Not only has the quantity, but the quality also continues to rise.

"These FRPs are now being reviewed by the Cotton Australia Research Panels and the CRDC R&D team in preparation for CRDC's February 2014 Board meeting where these applications will be considered.

"This follows from a record investment year in 2012-13, where CRDC invested $16.7m in R&D, its largest ever amount of investment in industry R&D with 260 research projects funded across the research portfolio.

This ensured important R&D capacity and knowledge was maintained post-Cotton CRC.

Importantly in the final year of the *2008-13 Strategic Plan*, CRDC finished the year well positioned to deliver future outcomes for industry and the community. CRDC's formal Annual Report has been approved by the Minister for Agriculture Barnaby Joyce MP and is publicly available from CRDC's website and hard copies on request.

FORUM DELVES INTO THE FUTURE

Thinking about what the Australian cotton industry of the future will look like will be the aim of a Cotton Futures Forum being held in Brisbane in December.

Organised by CRDC, the forum is looking to harness the passion and enthusiasm of the cotton industry and imagine what the future could be like. This will help CRDC identify key priority areas for R&D investment.

"Basically we want to throw the doors open and challenge all the assumptions we make about how cotton is currently grown, processed and used," CRDC's Paula Jones said.

"A key question to ask ourselves is 'if we were starting the industry today from scratch, and with existing hindsight, would we still grow, process and used cotton in the way we currently do or would we find new technologies and ways of doing things?'"

"The Futures Forum is aimed at really analysing what has become the status quo in the industry and asking if there are other ways to do things and how can they be improved.

"The forum will help us prioritise those areas were we think we can make the most difference and help CRDC target their investments in the new 'Futures Themes' established in the Strategic Plan.

"Then as an industry we can say to the research and investment sectors, 'here are the areas we would like improved, what great ideas do you have to help us achieve this this?'

"By approaching research in this way it opens up avenues for new ideas and research disciplines to come to the industry.

"We want to make sure we have the best ideas coming in and find innovative ways of making the industry more profitable, sustainable and competitive in the future."

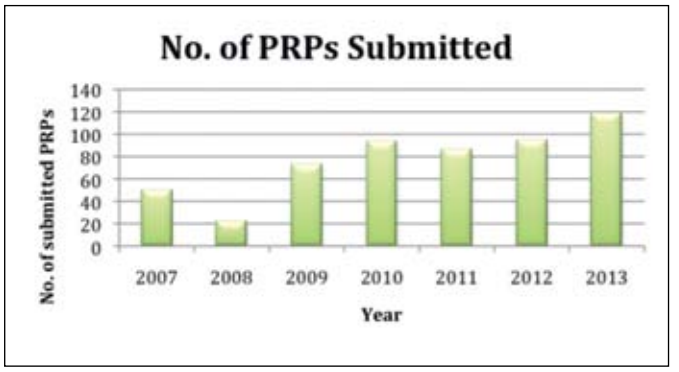
The forum will include Cotton Australia, Cotton Seed Distributors, grower panels, researchers, research providers, government and industry organisations.

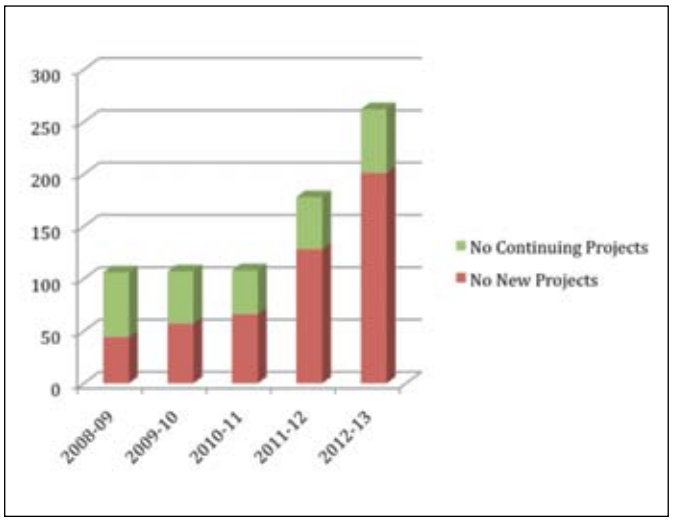
POSTIVE RESPONSE TO INDUSTRY OPPORTUNITIES

CRDC recently announced a call for post graduate, under graduate and travel scholarships and bursaries. The response was very positive especially in regards to the number of PhD applications which all had strong candidates identified in the application. Recipients of the scholarships and bursaries have now been advised and will be undertaking their studies or travel in the New Year. Congratulations to all those who were successful.

SPECIAL THANKS

Special thanks go to Cotton Australia staff and the Advisory Panel members who make a significant investment of their time in providing advice to CRDC on the FRPs. This is very much appreciated by CRDC and makes an enormous contribution to industry RD&E investments. Those panel members that willingly give of their time and provide this important advice include: John Cameron, Tony Taylor, Joe Robinson, Geoff Brownlie, Rob Collins, Hugh Ball, Nigel Corish, Rodney Smith, Rob Lowe, Toby Moore, Stewart Denston, Matt Holding, Damien Erbacher, Bill Tyrwhitt, Andrew Greste, Nev Walton, Andrew Parkes, Steve Ainsworth, Neek Morawitz, Bob Dall'Alba, Lyndon Mulligan, Greg Morris, Wayne Towns, Nigel Corish, Tony Bailey, Tobin Cherry, Brendon Warnock, Scott Hogan, Barb Grey, Andrew Greste, Glenn Rogan and Alex Roughley.





" BASICALLY WE WANT TO THROW THE DOORS OPEN AND CHALLENGE ALL THE ASSUMPTIONS WE MAKE ABOUT HOW COTTON IS CURRENTLY GROWN..."

DIGGING DEEP FOR ANSWERS TO BETTER SOIL HEALTH

SOIL MANAGEMENT IN COTTON FARMING SYSTEMS REMAINS A HIGH PRIORITY FOR GROWERS IN THE GWYDIR VALLEY, ALICE DEVLIN REPORTS.

Dr Michael Braunack takes an interested group of growers, staff along and consultants through the effects of compaction at "Telleraga" near Moree.

The adoption of minimum till and controlled traffic is widespread and has become the norm for most cotton growers, however the desire for continued improvement remains. Advancement in technology is seeing larger, heavier machinery entering the field and potentially creating increased compaction, prompting Gwydir Valley growers to look again at the issue: how it can be mitigated and how to best adapt to the new practices.

Gwydir Valley Regional Development Officer (RDO) Alice Devlin and Gwydir Valley Irrigators' Lou Gall organised a workshop to address the issue, enlisting CSIRO's Dr Michael Braunack.

"Growers in the Midkin and Telleraga Area-Wide Management groups know all too well how important soil structure is for production, so we came together in July to assess how they're tracking on managing their soils for optimum production," Alice said.

"Growers and their staff were able to get down into soil pits at "Telleraga" to see first hand the state of their soils and Michael demonstrated the variability between soils in fields of close proximity, particularly those that have undergone different management and rotations.

"The contrast in soil structure and root development was quite significant.

"The wheel tracks stood out very clearly, and the message to those in attendance was "Maintain your wheel tracks and work on getting the best soil structure across the rest of the field".

This message was not lost on the participants, as discussion shifted to the best strategies to repair and mitigate compaction in the areas outside wheel tracks.

"Cycles of wetting and drying are important in these clay soils, which under the right conditions will begin to repair themselves," explained Michael.

"The use of cereal crop rotations was agreed as a potentially effective strategy, but under dryland management the cycles of wetting and drying are often more limited.

"Often mechanical tillage is required to repair compaction, and this can be done a number of ways. The fix is short term however, it is the long term management and decision making that will really influence the state of your soil."

Australian Food and Fibre (AFF) General Manager Joe Robinson said it had been a number of years since they'd had the opportunity in the Gwydir to get into soil pits and really look at issues like compaction.

"We're all aware of the impact that a wet pick and heavy machinery can have on the soil, but to actually see it close up is such a powerful tool," he said.

Alice says the success of the day was partly due to participants being physically able to break off the clods and really see and feel the soil structure.

"They could see where the roots were growing, and importantly where they were stopping," she said.

Along with managers, there were a number of their staff at the field day, and Alice was particularly pleased they had indicated that their understanding of compaction increased by simply being able to see what is going on below the surface, both under the wheel tracks and in between them.

"These are the guys actually operating the machinery, so it's vital that they have a good understanding of the issues, not just the managers and agronomists," Alice said.

While growers agreed that the day was valuable in provoking thought and discussion around soil management, there was a consensus there are research questions that need answering, and industry support of continual improvements in knowledge of soil management is vital.

"The discussions raised a lot of questions as to how to limit and alleviate compaction," Alice said.

"It was agreed the issue can be managed at two key levels – avoiding and remediating.

"Avoiding compaction involves of course controlled traffic and maintaining good wheel tracks, as well as limiting passes across the field.

"However the different techniques for remediation are varied and there doesn't appear to be a clear option which stands out as the best, so the group want to look at trialling some different mechanical methods, such as centre and side busting, as well as using cereal rotations and wetting and drying periods."

The Telleraga group are now also keen to conduct some long term monitoring of the impacts of the round bale pickers, particularly under wet conditions which hasn't really happened in the Gwydir yet.

Alice has since been in discussion with Michael Braunack and Murray Connor (AFF) to investigate running a long-term trial after picking next year at "Telleraga".

"At this point we are looking to investigate different compaction remediation techniques, assessing how current remediation methods are working and also monitoring long-term impacts of round bale pickers," Alice said.

" MAINTAIN YOUR WHEELTRACKS AND WORK ON GETTING THE BEST SOIL STRUCTURE ACROSS THE REST OF THE FARM…"

*Alice is currently on leave, however Megan Hamilton megan.hamilton@elders.com.au is overseeing the Gwydir RDO position.

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LINKING GROWERS TO INDUSTRY SPECIALISTS

THE IMPORTANCE OF RESEARCH AND DEVELOPMENT FOR THE PROGRESS OF THE INDUSTRY IS WELL RECOGNISED BY AUSTRALIAN GROWERS WHO ARE VERY QUICK TO ADOPT NEW TECHNOLOGIES, ACCORDING TO DARLING DOWNS REGIONAL DEVELOPMENT OFFICER JOHN SMITH.

"On the Darling Downs the cotton industry is a well established mature industry as opposed to other areas such as Southern NSW where it is rapidly establishing itself as a successful alternate enterprise for the broadacre irrigated farming systems," John says.

"An important component of the development roles is adapting the broad industry information for each location: on the Darling Downs this is very much about management factors around the farming system, outside of varieties.

"Changes in these factors are the little 'one percenters' that added together can add significantly to farm profitability over time."

Development officers are also responsible for linking cotton growers with the wealth of industry knowledge and experience that the cotton industry has developed over many years of research and development investment. In this vein, John says a conversation about overhead irrigation systems following a local Cotton Growers Association meeting led to a workshop in Chinchilla, where growers are making use of desalinised water from the coal seam gas process to irrigate crops. However because the desalinated water needs to be taken year-round, growers are using overhead irrigation machines as they offer flexibility in water application.

"However these systems are a new concept after many years of furrow irrigation and syphon changes," John says.

"The overhead systems allow a higher degree of water management because the amount applied can be accurately dialled in, this means that small amounts of water can be applied effectively creating a much longer irrigation season allowing greater use of the water and minimising the amount that needs to be stored which is then subject to losses in the storage systems.

Linking growers and specialists

"Through the CottonInfo network I was able to link this group of growers with cotton industry irrigation specialists Dr Lance Pendergast, the CottonInfo Water Use Efficiency Specialist (QLD) and QLD DAFF's Graham Harris.

"We enlisted Lance and Graham for two days and on the first day they conducted an assessment on a newly installed overhead machine. Results from the assessment were presented during the workshop which enabled focussed discussion around the irrigator.

"The irrigator assessment covered all aspects, from suitability of the pump (flow rate and efficiency), operating pressures, nozzle selection for the intended use and evenness of water application along the machine. The assessment demonstrated this machine was setup very well.

"The second part of the workshop was conducted back at the shed and allowed more general discussion around management aspects of this new irrigation system including irrigation scheduling to match crop water demands.

"The industry knowledge and experience offered by Lance and Graham was invaluable with growers saying they were pleased they had attended the workshop.

"Responding to the direct needs of growers and offering information and guidance in a timely way is always well-received." he said.

"It is very relevant at the moment with many new machines in the market place and growers are trying to maximise their effectiveness on-farm so there is a level of uncertainty of what they are doing is right.

"They also enjoyed the independent advice and assessments from Lance and Graham, they 'told it like it was'."

John and the CottonInfo Specialists will continue to work with the Western Downs growers as they continue to improve and adapt to new management techniques.

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Growers in discussion with CottonInfo Team members about the management requirements associated with overhead irrigators at Chinchilla this year, where water from CSG production is being used for cropping.

GETTING THE MOST FROM YOUR PRECISION PLANTER

IF CERTAIN ASPECTS OF PLANTING AREN'T IDEAL, YIELD MAY BE AFFECTED FROM THE START, SAYS KIRRILY BLOMFIELD.

TOP: Field day guest speaker David McGavin operating the Meter Test Stand. ABOVE: Upper Namoi grower Ian Carter has made several planter adjustments, with this stand the result.

Upper Namoi RDO Kirrily Blomfield says this may explain the high level of attendance at field days throughout cotton growing valleys in late winter/early autumn which concentrated on how growers could get the most from their precision planter in the lead up to cotton planting.

The initial field day in the Upper Namoi was instigated by Kirrily and grower Angus Duddy "Rossmar Park", Caroona. Angus was keen to optimise his planter's performance and was enthusiastic about the potential of singulation technology, so suggested the idea of a field day.

Singulation is the placement of seed in the row; which should be evenly spaced with no seeds double dropped or missed. Singulation technology works by replacing the existing disc in the planter's meter with a flat disc with holes. The planter vacuum is run higher than normal to ensure each hole is filled with a seed (reducing misses). Double seed pick-ups are avoided through a 'double eliminator', which fits inside the meter and part covers several holes on the disc which is enough to knock off any double seeds.

"Going on the ensuing grower adoption of precision technology and improved practices this field day was certainly a success," Kirrily said.

"Some growers learned they were able to 'tweak' their planting techniques, while others made more significant changes in planter upgrades to improve singulation and added seed firmers."

The technology is relatively new in cotton fields here and there is a lack of trial work into effect on yield. However Kirrily says yield advantages from improved singulation are proven in corn crops in the US, with studies showing yield advantages of 0.2t/ha.

Angus Duddy says since installing the technology he has improved the singulation of his John Deere vacuum meters "conservatively by 10 percent", from the high 80s to the high 90s, with each row varying slightly from one another. Angus has also since trialled a monitor which displays real-time singulation readings.

"It allows me to see the performance of our planter in real time – with changes in things like vacuum and seed size immediately obvious," he said.

Kirrily says she was amazed at the subsequent, broader adoption of information since the field day.

Upper Namoi grower Ian Carter also made several planter adjustments. Ian converted his planter to include vacuum meters with singulation technology, residue managers in front of the discs with seed firmers following.

"The combination of these additions has led to an excellent cotton planting result, with an even, healthy plant stand," he reports, "the rate worked out perfectly and it was planted at 10km/hr."

Ian believes seed firmers are particularly important when planting large-seeded crops like cotton with a disc planter.

"The V-shaped trench left by the discs makes it difficult for cotton seed to fall to the bottom of the trench, where the best seed/soil contact and moisture is," he said.

"The seed firmers ensure that this occurs, which was especially important this season, due to the marginal sowing moisture for our dryland cotton."

A test stand to test vacuum and finger meters performance enabled growers to see how their planters were performing at actual planting speed and hence were able to assess if seeds were being placed at the right rate and spacing, and whether a single or multiple seeds were being deposited during planting. Major outcomes from the tests were:

- Many of the planter meters weren't operating as optimally as growers thought.
- Decreasing planting speed increases singulation, resulting in more even seed distribution along the row. No real surprises here for growers, but it did help identify optimal speed and vacuum pressure.
- Seed lubricant can have a dramatic influence on singulation – particularly with cotton seed. A talc/graphite mix improved singulation by about five percent,with many growers adopting this method.
- Vacuum planter meters typically singulate from 90 to 95 percent for cotton. The addition of the technology to the meter improved singulation to the top end of the 90s. Seed lubricant used with singulation technology achieved the best performance.

CSIRO Crop Physiologist Dr Mike Bange says the technology appears to be another tool in the kit of trying to achieve uniform plant stands for cotton.

"It is the uniformity of stand which is most important with cotton, rather the actual plant population numbers (within reason) that will deliver yield and quality," he said.

"Using this technology along with other practices such as using quality seed, good tractor driving, sound agronomy, even the use of talc and/or graphite with the seed will all contribute to uniform plant populations."

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IMAGE: MELANIE JENSON

ICAC: THE GLOBAL ISSUES

CRDC'S ALLAN WILLIAMS ATTENDED THIS YEAR'S ICAC PLENARY MEETING ON BEHALF OF THE CORPORATION AND HAS BROUGHT HOME SOME SOBERING FACTS ABOUT THE THREAT POSED BY MAN-MADE FIBRES TO THE GLOBAL COTTON INDUSTRY.

CRDC actively supports the participation of the Australian Government in the International Cotton Advisory Committee (ICAC). It is the most representative international forum that exists for the cotton industry, and for building understanding and knowledge of issues affecting the whole sector. Importantly, it is evolving from its traditional role of providing information on the world cotton market and serving as a clearinghouse for technical information on cotton production.

ICAC is playing an increasingly significant role in not only providing the forum for discussion of cotton issues of international significance, but also for agreeing on collective responses to issues that are beyond the ability of any one country to address. The threat posed to cotton's market share by man-made fibres is a case in point.

As ICAC only meets annually, meeting agendas are invariably wide and varied and 2013 was no exception. Nevertheless, a number of issues are recurring themes at Plenary meetings, for example the sustainability of cotton production, the threat posed by man-made fibres and the declining terms of trade in growing cotton. The following discussions built on presentations made to the previous meeting in Switzerland, and allowed for some in depth discussion in Colombia.

Australia was represented by Peter Ottesen (Department of Agriculture, Canberra), Dr Christopher Parker (Department of Agriculture - Washington) and Michael Murray (Cotton Australia).

Competition from Man Made Fibres

In 2012, the Plenary meeting was provided some sobering statistics about the erosion of cotton's market share, and as a result established a Task Force on the Challenges from Competing Fibres, chaired by Kevin Latner, Cotton Council International. The Task Force reported to the 2013 Plenary meeting that the current market share of cotton continues to decline and that cotton would face strong competition from alternative fibres for the rest of this decade. Over the past five years, cotton has lost another seven percent of its market share in the fibre market and 12 percent in textiles; synthetic fibres meanwhile have increased their market share by 20 percent.

The Task Force also made a number of recommendations on how to improve cotton's competitiveness: **Improving quality control through testing and identification (labelling).** The Task Force chair emphasised the importance of having standardised HVI testing as a means of ensuring the consistent and accurate description of the raw cotton being traded. Equally important was to ensure that consumers were made aware of what they are

buying. The interesting observation was made that as more clothing is made from cotton blends, the visibility of labels that detail what the clothing is made from has decreased, with labels increasingly sewn into the side seam, where it is more difficult to find, rather than the collar.

To improve cotton's value, consumers need to what they are actually buying and the Task Force recommended that Governments should introduce and/or enforce fibre content labelling requirements to enable consumers to exercise preferences in favour of cotton

Price volatility.

The report noted that while difficult to control factors such as weather, changes in consumer preference and market speculation all affected the volatility of the cotton price, government policies and interventions had the biggest impact on price volatility.

The Task Force recommended that Governments should avoid interventions in cotton markets, since the damaging consequences can increase price volatility, endanger contract sanctity, disrupt trade and cause a loss of market share to fibres with more stable prices. It also suggested that Governments should heighten transparency in cotton polices, and improve systems of providing statistics; uncertainty regarding government policies and inadequate statistics contribute to uncertainty and lead to poor decision making.

Promotion of the social and environmental benefits of cotton.

The Task Force also recommended that the cotton industry itself should communicate the positive attributes of cotton for the environment, economy and human health and wellbeing, using the results of ICAC's Expert Panel on the Social, Economic and Environmental Performance of cotton (SEEP).

" DATA COLLECTION AND REPORTING GUIDED BY AN AGREED SET OF INDICATORS WOULD BE MORE GLOBALLY RELEVANT, COMPREHENSIVE AND EFFICIENT."

Sustainability Indicators

The SEEP Expert Panel, chaired by CRDC's Allan Williams, is tasked with providing information to ICAC on the impacts of cotton production and to recommend policies and practices to governments for improvement.

SEEP current's work is on sustainability indicators and Allan Williams presented to the Plenary meeting the Executive Summary of the soon-to-published report '*Measuring sustainability in cotton farming systems: towards a guidance framework*'.

The report draws together the work of programmes and initiatives seeking to reduce the possible negative impacts of cultivating cotton (including *my*BMP), with a focus on the question: by what indicators or measures should the sustainability of cotton farming be assessed? It was argued that answering this question at the global level could give rise to a range of potential benefits for the cotton industry:

- An opportunity for the global cotton industry to discuss, debate and reach agreement on what the priorities are for measuring the sustainability performance of the cotton industry, and thus act as a starting point for a collective response to the issue of the environmental, economic and social performance of the cotton industry
- A better understanding of current levels of environmental, economic and social 'performance', an essential first step in improving performance so that actions are targeted at the most critical areas requiring improvement.
- Data collection and reporting guided by an agreed set of indicators would be more globally relevant, comprehensive and efficient;
- Help the cotton industry better meet market needs: the expectations of retailers and consumers are changing and they have increasingly high expectations both about how products are produced with respect to their environmental and social impact, and – more importantly – about access to that information.

Developing suitable sustainability metrics internationally will allow the cotton industry to define how its sustainability is to be measured, demonstrate its commitment to continuous improvement, and the highlight positive impacts of growing cotton. It will help maintain cotton's 'social licence', by providing retailers and brands, and consumers, with evidence about the sustainability of the cotton in their products.

The 2013 Plenary meeting also marked the final meeting with Dr Terry Townsend as Executive Director of the ICAC, with Dr Townsend stepping down after 14 years in the role (and 26 years with ICAC) at the end of the year. The new Executive Director will be Mr Jose Setté of Brazil.

The next Plenary meeting of the ICAC will be held in Thessalonika, Greece from 2 – 7 November, 2014.

The 72nd Plenary meeting of the International Cotton Advisory Committee (ICAC) was held in Cartagena, Colombia from 29 September to 4 October. ICAC is an association of governments of cotton producing, consuming and trading countries, including Australia. Formed in 1939 and based in Washington, D.C, it is the world's oldest international agricultural commodity body, and predates the formation of the Food and Agriculture Organisation (FAO) of the United Nations.

The Australian delegation to ICAC Plenary Meeting in Colombia this year, CRDC's Allan Williams, Washington-based Dr Christopher Parker, Department of Agriculture, Cotton Australia's Michael Murray and Australian Government Department of Agriculture's Peter Ottesen.

MAKING OUR WAY IN A MAN-MADE FUTURE

IN SEPTEMBER CRDC DIRECTOR RICHARD HAIRE ATTENDED THE INTERNATIONAL TEXTILE MANUFACTURERS FEDERATION CONFERENCE IN BREGENZ, AUSTRIA WHERE HE BECAME CONVINCED IT IS URGENT FOR THE COTTON INDUSTRY TO ACT IF IT IS TO SUCCESSFULLY COMPETE WITH MAN-MADE FIBRES. HOWEVER SIMULTANEOUSLY, THERE EXISTS A MARKET OPPORTUNITY TO BE CAPTURED.

The conference is typically focussed on the downstream sectors of the global textile industry. With the title, *Rebalancing the power between manufacturing and retail*, the agenda was weighted towards activities in the man-made fibre space and it provided some interesting insights into the thinking of our competitors.

It was simply impossible not to marvel at the stunning innovations taking place in the man- made fibre industry and the way that sector is embracing branding, digitalisation and its supply chains.

In comparison, cotton seems slow-moving, reactive and old fashioned. I am reminded of the old saying "if you always do what you have always done, you will always get what you have always got". If the international cotton industry continues on its current pathway, I believe we will continue to lose our share of the global textile market.

And in perhaps the biggest insult, the man-made Tencel is being promoted as "the fibre with biological origins", potentially neutralising our industry's major selling point. There were some major themes that become apparent over the three days.

The cotton industry globally should be concerned that some man-made fibres are now being promoted as "the fibre with biological origins", potentially neutralising our industry's major selling point, says Richard Haire.

Cotton is too slow to act

The cotton industry globally (and perhaps locally as well) is painstakingly slow when it comes to decision-making and action.

Yes, the cotton industry is different. For many of its producing countries, cotton is as relevant to their social and political agendas as it is to their economic agendas. The international cotton industry has commendably, always sought to be inclusive. However, I see the price of that inclusiveness as strategic ossification for the industry and our competitors have exploited this weakness with quite devastating consequences.

We are not customer friendly

Our basic business model often works against the principles of supply chain co-operation/collaboration. In fact it could be argued that our business model has created several win/lose interfaces along the supply chain rather than the apparent position of the man-made fibre industry that seems intent on partnerships and collaboration.

We should not underestimate the impact the extreme cotton price volatility of three seasons ago has had on demand.

Learning from Europe

In just 30 years, Western Europe's spinning industry has declined dramatically. Countering this decline in the primary textile segment, the European brands of spinning machinery, Rieter and Saurer, dominate the high end of the market with a combined market share of around 50 percent of category and 18 percent of the total market.

European textile distribution is very firmly in European hands with retailers such as H and M (Sweden), Marks and Spencer (UK), Inditex (Spain) C and A (Belgium/Germany) and Next (UK) filling the top five slots for European retail sales.

Europe has also built real strength in the technical fibres with 80 percent of the global technical textiles (textiles where function is the main attribute) produced in Europe. And Lenzing is the world's leading producer of cellulosic fibres with 21 percent of the market.

This adaptation from fibre conversion (spinning) to fibre manufacture and textile distribution has been driven by market forces in response to an uncompetitive cost position. What does the Australian industry (and for that matter the global cotton industry) need to do to respond to these same cost competitiveness issues? It is after all, a real challenge to sustain cotton's cost competitiveness against fibres primarily using waste as their feedstock.

The man-made fibre industry is seriously committed to innovation and technology

Every presentation at the conference from a man-made fibre company had innovation as a core characteristic of its system. Based on some back of the envelope calculations, they seem to spend about 1.5 percent of turnover on R&D. And they seem to be getting great results. My own sense is that the greatest rewards have come from:

- finding new applications for their products; and
- developing innovative finishing techniques based around performance rather than appearance.

Industries such as automotive, health and medical, and sportswear have been particularly receptive to synthetic fibre innovation.

The next generation would appear to be in areas such as energy and water harvesting, data transfer/capture and applications of 3D printing and plasma finishing. Aged care is also on their radar as the industry seeks biomedical applications for the greatest needs of the elderly-assistance, monitoring, protection.

Unfortunately, many of the fibre-based characteristics that enable such innovation are more readily developed in a factory than in a paddock.

On technology

The digitalisation of commerce has fundamentally changed industries and supply chains. Today there are an estimated 2.4 billion internet users globally. Within just two years this number is expected to grow to five billion.

These disruptive technologies have radically changed marketing and retail, finance and banking, media and communications. How does agriculture embrace these technologies to avoid extinction? How could the use of this technology fundamentally disrupt our industry and where does our industry sit in terms of its uptake of this technology and its use of social media?

> " THE REALITY IS THAT THE SOURCES OF OUR TRADITIONAL STRENGTHS – NATURALNESS AND COMFORT- ARE NO LONGER THE POTENT WEAPONS THEY WERE…"
>
> **Richard Haire**

What does a brand stand for?

Brands which convey a promise must deliver on that promise every time. Brands which represent certain attributes must be true to those representations.

Cotton is struggling for its brand. Cotton Incorporated from the US has done the heavy lifting in years past to promote cotton generically but attempts to secure international support for a global program have failed over many years.

Brands such as BCI, CMiA, BMP, Pure Brazil, Cotton LEADS and Organic Cotton have attempted to secure a market advantage beyond mere fibre characteristics but what do these brands really stand for?

What can we conclude?

Let me wrap up with some thoughts, in part informed by and in part stimulated by attendance at Bregenz.

I do think there is an opportunity for Australia to stand apart from the rest of the global industry and build a brand.

I doubt that any alternate brands can comprehensively and accurately represent what Australian cotton stands for. We are universally respected in the cotton community because our industry (our product, our practices, our conduct) has always possessed great independence and integrity.

I think there is value in the Australian Cotton industry developing a long term product and marketing strategy that goes beyond a "grow it and they will come" mentality. This strategy should look more broadly than where or who to sell to and should look at the business model currently used and research the potential interest in and benefits of an alternate model.

The strategy should consider potential applications for the cottons that we are developing now for production in the next 20 years. It should consider if our processing technology will be fit for purpose for next generation cottons. And it should consider what enhancements future technologies can bring to cotton so that we can start to envision new markets, customers and applications.

I also think we need to engage with certain man-made fibre companies to identify how cotton can be used to enhance the functionality and appearance of their fibres. This should extend to engagement with current and potential customers and brand owners.

There is universal recognition that cotton is a wonderful fibre that can add desirable characteristics to many yarns and products. But we are at the stage where, should cotton disappear from the face of the Earth, man-made fibres would quickly fill our space. I doubt you could have made that statement 20 years ago.

In conclusion, the man-made fibre industry no longer sees us as a threat. That industry has its own strategy, they have an endless pipeline of innovative products and as each year passes, they erode our market share. The reality is that the sources of our traditional strengths (naturalness and comfort) are no longer the potent weapons they were as the competition finds ways to replicate these features while addressing our major weakness, fibre performance, reliability and supply.

The Australian cotton farmer is producing a unique product with outstanding characteristics. Our farming systems are best in class, our product in the top two in class and our tertiary industry (financing, logistics) are best in class. We can consistently deliver on a brand promise of quality, integrity, agility and responsibility. If we can add innovation and creativity to our DNA we will have the complete package. But we need to take that first step in the long, long journey to build that brand.