

Spotlight

ON COTTON R&D

WINTER 2019

Exercise Blueprint:
focus on biosecurity
preparedness

Cotton and grains
combine in Helicoverpa
control

Girls to the front:
celebrating women
in science



Ian Taylor

In the Spotlight

Welcome to the June edition of *Spotlight*.

As our cover attests, we acknowledge the role of women in the industry with the celebration of International Day for Women and Girls in Science and International Women's Day with some words of encouragement and advice from just some of our many female scientists and industry leaders. Fittingly, as I write this, it has just been announced that Senator the Hon. Bridget McKenzie has been appointed to the Agriculture portfolio – becoming Australia's first female Agriculture Minister.

We are also delighted to bring you the results of a recent sleep study that confirms that cotton sleepwear and bedding creates a better environment for a good night's sleep. While cotton has always had a reputation as the premier fibre for bedding, to have quantified this scientifically gives cotton a powerful marketing tool to take to brands and consumers.

I'd also like to acknowledge the passing of Stuart Bray, who was integral in measuring and improving water use efficiency across the industry. Stuart worked tirelessly to promote R&D and was a main promoter of the 'measure to manage' ethos.

In the lead-up to the industry's biosecurity preparedness simulation Exercise Blueprint, we've included an update on Dr Murray Sharman's investigations into cotton blue disease. Research works in many ways to address exotic threats, whether information gathering on specific strains or how these disease threats are spread and manifest themselves in other countries. All those working on the land also carry a responsibility to keep an eye out for, report and halt the spread of pests and diseases.

We have been delighted to see the excellent outcomes of our Grassroots Grants investment funding. These small grants allow grower-focused groups to implement real change on the ground. Applications open again in July and we are looking forward to seeing new ideas and initiatives. Recently we've seen record breaking crowds at field days to introduce growers to ag technology, farmers from the Northern Territory travelling south to investigate cotton growing, and more than 10 weather stations erected across the growing regions. The grants have also led to practice change in the way we manage insects such as mealybug and whitefly.

Ensuring the industry maintains and grows its capacity and adaptivity is a key focus for CRDC. This applies to people working on farms as much as those in research and development. The value in supporting the growth of a future, capable industry of people is evident in this edition. From our PhD students such as Rhys Pirie inventing new methods to recycle glass into low cost, useable agricultural products to Dr Dean Brookes' look at DNA to detect insect pests and diseases, the value of supporting researchers in their PhD studies and through the Science and Innovation Awards is evident. Many previous ABARES Science and Innovation Award winners have been scientists who have had long associations with CRDC research.

We also take a look at how Nuffield scholar Daniel Kahl and family are doing their bit at Merced Farming near Wee Waa to give young people a close up look at cotton farming in a quest to create future farm managers. Through investment in our cotton growers through programs such as Nuffield and Future Cotton Leaders, along with our research projects, creating a capable industry prepared for an evolving future is assured.

Finally, CRDC has been working in partnership with GRDC and the grains industry to manage an old foe of the cotton industry, Helicoverpa. The nature and outcomes of the research with NSW DPI shows the effect of changing cropping landscapes and how we must all work together to address common issues and threats to productivity and insecticide resistance. The ability of both the cotton and grains industry to address evolving issues is a great outcome for our farmers.

Ian Taylor
CRDC Executive Director



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Postal Address:

PO Box 282, Narrabri NSW 2390

Offices: 2 Lloyd Street,
 Narrabri NSW 2390

Tel: 02 6792 4088

Fax: 02 6792 4400

Email: spotlight@crdc.com.au

Web: www.crdc.com.au

Communications Manager/Editor:
 Ruth Redfern

Editorial co-ordinator:
 Melanie Jenson

Editorial Contributors:
 Melanie Jenson, Ruth Redfern.

Design: Deacon Design

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ON THE COVER:
 Girls to the front: celebrating women in cotton and science.
 Image courtesy Cotton Australia.

Want to see more of Spotlight?

This edition can be viewed online at: www.crdc.com.au

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Northern exposure

CRDC's Acting General Manager of R&D Investment Allan Williams headed to the Gulf of Carpentaria in Far North Queensland in May to attend the NT Farmers' Georgetown Regional Roadshow.

The event included a tour of trial and commercial cotton crops and provided information about cropping opportunities in the region.

Researchers from CSIRO and the Queensland Department of Agriculture, Forestry and Fisheries joined representatives from Cotton Australia, Cotton Seed Distributors, GRDC and industry bodies representing northern farmers to discuss the expansion of alternative agriculture (to grazing) in these areas. Allan says that it was his first visit to this region, and that it was a wonderful opportunity to gain an appreciation of the unique challenges presented in developing a cropping industry in such a remote sparsely populated area.



Prospective growers and industry representatives from southern and the northern regions met at a field day at Georgetown to discuss plans for the industry going forward.



OWEN WILSON

Keeping an eye on the cotton calendar

COTTONINFO'S 2019 Cotton Calendar is full of the furry and not so furry – but they're all found on cotton farms!

The calendar features beautiful imagery of the diverse fauna found on farms, along with 12 top tips on how to attract and maintain them. Tip #5 is where the *Petaurus breviceps*, better known as a sugar glider comes in – *Protect living and dead standing trees with hollows*, while #6 is *Leave large fallen logs and rocks as 70+ species use them as habitats!* for animals such as the *Lophognathus bursi* pictured above.



PHIL SPARK

The 2019 calendar is the latest in the CottonInfo calendar series, which focuses each year on different elements of cotton production. In 2018, the calendar showcased pests and beneficials from cotton grower and photographer Johnelle Rogan, alongside CottonInfo's 12 top integrated pest management tips. In 2017, it featured researchers, growers, consultants and CottonInfo team members talking best management practices across the range of CottonInfo topics. In 2019, it focuses firmly on natural resource management.

"The Australian cotton industry is committed to improving the environmental footprint of cotton farms and is a global leader in setting industry-lead sustainability targets for biodiversity," says Stacey Vogel, CottonInfo's technical lead for natural resources and catchments, who developed the calendar with CottonInfo communications manager, Ruth Redfern.

"Research has shown that 130-plus species of fauna can be found on cotton farms, although habitat fragmentation, land clearing and invasive species continue to threaten biodiversity.

"CRDC is investing in new, innovative technologies to assist cotton growers manage biodiversity, and RD&E to better monitor and report industry progress against biodiversity targets," Stacey said. (See our story on drone revegetation this issue).

CottonInfo is issuing monthly blog posts on the 12 top natural resource management tips showcased in the calendar: these can be accessed at the CottonInfo website or by following CottonInfo on twitter.

For more

www.cottoninfo.com.au/blog

www.twitter.com/cottoninfoaust

It's official: cotton is better in bed

WE all cherish a good night's sleep – it's essential for mental and physical health. The good news is those cotton pj's and bedding you love may help ensure you get it, especially on those warm nights.

A new study by researchers at RMIT, supported by CRDC and its US counterpart Cotton Inc. provides a scientifically based evaluation of the attributes of cotton rich and synthetic products in a dynamic hot sleeping environment.

This study is the first of its kind and was critical to objectively measuring and quantifying the performance attributes of cotton versus synthetic sleep products.

"Fibre composition in sleepwear and bedding significantly influence the sleeping microenvironment, particularly the microclimate temperature next to our skin, which in turn affects sleep quality," says Olga Troynikov, Professor of Functional Materials and Human-Centred Engineering at RMIT.

The research team tested bedding and sleepwear made from 100 percent cotton; a 60:40 cotton-polyester blend and 100 percent polyester. Typical summer sleeping conditions in a hot environment were chosen as hot ambient sleep environments can have a major negative impact on sleep quality.

"The results suggest that it would be expected that sleeping in cotton and cotton/poly blend in hot conditions over time would be less likely to result in chronic sleep disruption than 100 percent



polyester systems," Olga said.

"In terms of humidity and temperature of the next-to-skin microclimate, cotton and poly/cotton were within the scope of an optimal sleeping environment.

"For example the humidity levels of the 100 percent cotton ensemble remained within the noted human comfort range of 40 to 60 percent across the entire sleep cycle, providing an optimal humidity environment for sleep comfort.

"The results demonstrate that cotton provides superior attributes to synthetic products and provide commercial product developers and consumers with objective evidence of the superior performance of cotton products in a hot sleeping environment."

In the past, the main focus of sleep studies has been on the effects of different environments on sleep quality. Research on sleeping thermal microclimates and their effect on sleep quality is scarce and before this study, the effects of cotton sleepwear and bedding

on sleep had not been objectively studied or quantified.

This research provides brands, retailers and consumers with confidence that cotton fibre products will give a better opportunity for improved sleep quality. It gives customers another reason to use this natural fibre.

Brooke Summers represents Australian cotton on an international level as its Supply Chain Consultant and through programs such as the Better Cotton Initiative. She says the research offers another reason why brands and consumers should choose cotton over synthetics.

"This is an important piece of work for the Cotton to Market program because it confirms what we've all suspected – you sleep better in cotton," Brooke said.

"Most importantly, this research may open up a new suite of brands in the home textiles space to us, brands that are looking for sustainable, quality raw materials that are now proven to help their customers sleep better.

"Cotton Australia will take this research to a number of home textiles brands; we've already started conversations with Sheridan and IKEA."

For more

Allan Williams

allan.williams@crdc.com.au

Familiar face for ED role

DR IAN Taylor has been announced as the new Executive Director of CRDC.

Ian takes over the role from Bruce Finney who late last year moved to start a role with NSW DPI at Orange. Ian is no stranger to the organisation, having been the General Manager of R&D Investment at CRDC for the past five years.

CRDC Chair Richard Haire made the announcement in early March.

"On behalf of the CRDC board, I am thrilled Ian will step into this role, as he is the ideal person, having been an integral member of CRDC's executive leadership team, where he provided sound guidance and wise

counsel," Richard said.

"In his role as general manager, Ian has overseen CRDC's investment into cotton RD&E for the past five years.

"As evidenced by our recently released *Innovation.Investment.Impact* report, CRDC plays a key role in ensuring the strength and stability of the cotton industry, delivering real impact for growers, cotton communities and the wider industry.

"Ian's sound leadership, strong relationships with CRDC's extensive portfolio of stakeholders, and thorough strategy development – demonstrated most recently through his role in

developing the CRDC Strategic RD&E Plan for 2018-23 – will serve us and the Australian cotton industry well.

"One of Ian's key priorities in the role will be ensuring a strong future for cotton innovation, research and development, in partnership with the industry and in collaboration with our fellow research and development corporations.

"Bruce Finney, Ian and I worked very closely together as a leadership team, and I look forward to continuing this strong relationship with Ian – all the while providing a new direction, and a new era, for CRDC." Richard said. (See story next page).

A passion for cotton science

A love of science has brought Dr Ian Taylor to the role of CRDC Executive Director.

THRILLED with his recent appointment, Ian says it is an honour to be able to serve this dynamic and forward-thinking industry.

“The cotton industry is one of the most innovative industries in Australia and this is reflected in both cotton’s history and its future,” Ian says.

“The pioneers were incredibly innovative and forward thinking and we see the same thinking in the current generation of growers, researchers, marketers and other industry people, that’s why we are world leaders.

“The industry is rapidly evolving, so this is an exciting time to be in this role.”

Ian’s most recent role at CRDC was General Manager of R&D Investment, which means overseeing all the research that CRDC invested in, but that’s far from the start of the story, which began around 20 years ago.

Ian first became involved in the cotton industry in 1995.

“I undertook an industry placement with the Centre for Pesticide Application and Safety and spent a lot of time on cotton farms undertaking aerial spraying drift trials,” Ian says.

“My immediate impression was that of an industry seeking to determine its future

“My immediate impression was that of an industry seeking to determine its future.”



and ensure that in the midst of challenging times it was prepared to change to meet expectations of society and community.”

While this initial interaction with the cotton industry cemented Ian’s future work; it was during his horticultural degree that his enduring passion was flared.

“My base degree was in horticultural technology, and it was during my study Associate Professor John Harden introduced us to the world of crop protection: I loved it – entomology, weed science and pathology,” he says.

“I went on to study weed science after receiving a GRDC PhD scholarship and had some great supervisors – Steve Adkins at UQ, Steve Walker at QDPI and Kathryn Galea at UQ Gatton.

“I was fortunate to receive a Sir Robert Menzies scholarship and travelled to the United Kingdom to study at Long Ashton Research Station under the supervision of another great weed scientist Nick Peters, who has since passed away.”

After an invite to the Australian Cotton Research Institute, there was no looking back.

“On my return to Australia I was invited by GRDC to present at a meeting to discuss the introduction of herbicide-tolerant GM crops: this is where I first met cotton industry researcher Graham Charles,” Ian says.

“Graham invited me to the research station at Myall Vale, where I also met Grant Roberts.

“I applied for a position some weeks

later at ACRI and was fortunate to become a new weed scientist in the industry in 2000 – and I have been involved in the cotton industry ever since.”

Ian has an obvious passion for science, no doubt fostered by being surrounded by some equally-as-passionate scientists and industry leaders.

“I loved my time as a scientist and met some great industry people such as John Watson, Cleave Rogan, Gary Fitt, Greg Constable, Adam Kay, Bruce Pyke and Bruce Finney.

“I have been passionate about cotton ever since I joined the industry and this new role at CRDC is a culmination of that.

“I worked with CRDC from 2005-2008 as the Crop Protection R&D Program Manager before moving into agribusiness and taking my family to Melbourne, then on to Singapore.”

However, the call of the cotton fields was too strong and Ian was back in Narrabri and CRDC in the role General Manager R&D in 2013, taking over from Bruce Pyke, who was retiring. Ian now lives just out of Narrabri with his wife Kara and three children.

“It is just fantastic to be able to take on a role like this, and to be based rurally in the heart of cotton growing.”

For more

ian.taylor@crdc.com.au

Have your say with the grower survey

UNDERSTANDING cotton growers is naturally vital to CRDC, and the annual grower survey is one of the methods to gain this understanding. The CRDC Grower Survey also gives growers the opportunity to compare their practices to others and gain a greater insight into all aspects of how others view the industry and manage their farms.

CRDC has made the surveying process quick and simple. The format has been shortened and the survey is completed on-line or via a phone call with the research team. Better still are the rewards more broadly for industry, as growers have the opportunity, through their responses, to influence research and extension direction and focus.

“The information we collect via the survey is enormously helpful in helping us to: measure on-farm practices and practice change; measure the impact of our RD&E investments; and ensure that CRDC and CottonInfo are continuing to meet the needs of our growers,” says CRDC Communications Manager Ruth Redfern.

“It allows us to see growers’ views on research, development and extension.

“This information helps to inform CRDC about the benefits of the research it invests in.

“We can also track and quantify change in industry practice by comparing



MELANIE JENSON

Growers and farm managers will receive an invitation in early June to participate in the survey. For all growers with an email address on file with CRDC, you'll receive an email invitation to participate – simply click on the link in the email to provide your feedback.

data from 20 years of surveys.”

Surveys include core questions and focus areas to investigate specific aspects of the farming system. This year the focus is on water, energy, nutrition and soil, IPM, NRM, weeds and disease controls, research trials, community and industry sentiment.

The way the survey results are delivered has also changed. Further to the PDF report, an on-line, interactive ‘digital dashboard’ introduced in 2018 has been well received. It has received hundreds of

views since going live on CRDC’s website in early February, with particular interest from growers comparing the regional data. Previous editions can be found online at CRDC’s electronic library Inside Cotton. Growers will receive an emailed invitation to participate in the survey in early June.

For more

www.crdc.com.au/growersurvey
www.insidecotton.com.au

Must-have manual is here

WORLD-CLASS R&D is one reason Australian cotton growers are the best in the world. One publication, updated annually, collates all this information as an easy to follow manual, that is being mailed out to all *Spotlight* subscribers with this edition.

The *Australian Cotton Production Manual*

is a labour of love for CRDC and CottonInfo as they seek to bring crop managers the latest information and science around cotton growing. It’s a manual for the newcomers to industry and the most



experienced.

“We are continually learning new things about how to be the most sustainable and successful cotton producers in the world,” say CRDC Executive Director Ian Taylor.

“The culmination of this research is found in the manual, along with discussion about important considerations for both productivity and

profitability.”

The manual is also available from the CRDC website at www.crdc.com.au/publications

Consultants' report now on-line

THE Qualitative Report on the 2017-18 cotton season: A survey of consultants has been released and is now available on-line. CRDC and Crop Consultants Australia (CCA) have thanked all those consultants who took the time to be a part of the survey, which is an important asset for many sectors of the industry. Data was collected by CCA from 63 cotton consultants representing 494 cotton growers, covering 293,785 hectares. CRDC commissions this survey each year to provide current and longitudinal knowledge of on-farm practices and attitudes, to aid the RD&E effort within the Australian cotton industry. To download a copy, go to www.crdc.com.au/publications/cotton-consultants-survey

Vale Stuart Bray



THE COTTON industry has acknowledged the passing of one of its long-term researchers, Dr Stuart Bray.

Stuart is well known across the cotton industry for his contribution to water use efficiency and irrigation management RD&E through various roles including with Water Smart at NSW DPI. He facilitated the Water Wise Program in North West NSW, organising an impressive number of Introduction to Irrigation Management Courses and many, many field days. Stuart was a valuable team member for several other cotton-focused irrigation projects and was a team member for the Sustaining the Basin (STB) project.

Fellow irrigation specialist, colleague and friend Peter Smith says Stuart was multi-talented and known for his skills of high level organisation, facilitating and video production.

Stuart was fondly referred to by the STB team as ‘Golden Tonsils’ because of the golden velvet tone of his voice, heard on many of its project video and audio recordings. Stuart was a great ambassador for the STB project in the Peel and Namoi Valleys.

“Stuart ‘retired’ from NSW DPI a couple of times but enjoyed working with people and the land so much that he couldn’t stay out of it,” Peter said.

“He always brought thoroughness and professionalism to his work coupled with a clear customer-focus that always shone through.

“His ease with and understanding of people and congenial sense of humour made him a delight to work with.

“His effect on nearly everyone who had the pleasure of encountering him was a positive and warm experience.”

CRDC Executive Director Dr Ian Taylor acknowledged the tremendous contribution Stuart made to improving water use efficiency across the industry.

“Stuart was a pioneer in the irrigation sector and we are grateful for his passion, vision and commitment to the industry,” he said.



MELANIE JENSON

Upgrade for world’s best breeders

AUSTRALIAN-BRED cotton varieties will continue to lead the world in terms of yield and fibre quality, with a multimillion-dollar infrastructure injection.

An \$18 million upgrade of CSIRO’s Cotton Breeding and Research Facilities at the Australian Cotton Research Institute (ACRI) was approved by the Parliamentary Standing Committee on Public Works in February. Three new buildings will replace existing facilities that were built in the early 1970s, including a cotton breeding and processing facility, a laboratory and a plant equipment workshop. Construction is likely to start mid-2019 with completion in 2021.

CSIRO’s cotton breeding expertise is world-renowned and largely based out of ACRI at Myall Vale. The CSIRO breeding program has delivered more than 113 cotton varieties to date, which are high yielding, high quality, disease tolerant, widely adaptable and highly sought after globally by cotton mills.

The Australian cotton industry produces yields that are three times the world average. This has only been

possible by having access to the world’s best varieties matched with the world’s best management practices, making the most efficient use of our resources. The continued improvement in disease resistance of the varieties has also been a key part of the success of the industry.

CSIRO Senior Research Scientist and plant breeder Dr Warwick Stiller said the new facilities will bring much greater capacity for research including cotton breeding, Bt resistance monitoring and cotton nutrition.

“It’s terrific to have the go-ahead for these new facilities that will enable CSIRO to continue operating a world-class cotton research facility out of Myall Vale,” he said.

“This investment demonstrates CSIRO’s ongoing commitment to ensuring a robust and profitable cotton industry in Australia, today and well into the future.

“We will continue to provide Australian growers with varieties that have traits uniquely suited to Australia’s vast range of climatic and growing conditions.”



SwarmFarm Robotics, based in Queensland's Central Highlands say their business development would have been super-charged if it had the type of dedicated support offered by AgFrontier from the start.

Meet us at the ag frontier!

Farmers are often also innovators, engineers and fabricators – and with a new program to nurture the growth of agtech startups, the opportunity exists to take those ideas from the paddock to the people.

THE AgFrontier Regional Agtech Incubator will provide the opportunity for regionally-based startups in inland Queensland and Northern NSW to work and grow in a dedicated program designed specifically for rural businesses with a practical understanding of agriculture. The program is a combination of events and co-working with intensive support both face to face and through immersive experiences. Participants are supported through ongoing, intensive coaching and mentoring as well as site visits.

The Queensland Central Highlands Development Corporation (CHDC) and X-Lab are leading the ground-breaking program, with support from CRDC.

CHDC's Agribusiness Development Coordinator and CRDC Board Director Liz Alexander says AgFrontier was one of only four successful incubator funding applicants from across Australia who collectively received more than \$1.7 million from the Australian Government's Incubator Support initiative in January.

Ten individuals and/or businesses will soon be announced to participate in the 14-month program, which includes tailored workshops, virtual coaching and the businesses fostered by X-Lab's startup network and tech ecosystem.

Participants will have access to national and international investor and peer networks, including an opportunity to

Rural events showcase agtech

AgFrontier builds on the success of the AgTeCH: Build it, Use it, Profit events which are major biennial innovation and technology showcases for the Australian agricultural community, held in Emerald, Central Queensland, and Mungindi, NSW in conjunction with the Mungindi Cropping Group.

AgTeCH19 will be held in Emerald on November 6 2019. The event brings together the smartest minds at the intersection of agriculture, machinery and technology to explore the future of agribusiness and showcase the latest innovations to improve farm and business profitability.

The interactive format with discussion panels by leaders and innovators encourages conversation, information-sharing and networking, and attendees experience first-hand the technology debated throughout the forum with working demonstrations in the field. In addition, CRDC's fellow research and development corporation, AgriFutures Australia, is bringing its highly successful agtech event, evokeAG, back in February 2020. Early bird tickets are currently on sale.

For more

www.chdc.com.au

www.evokeag.com

travel to the the US. They will showcase their product or service at the Emerald AgTeCH19 and Mungindi AgTeCH20 events and can pitch to relevant investors at the Incubator's conclusion.

"We understand what it's like to have competing seasonal demands from your business and the challenges of isolation and poor connectivity because we live and operate in a regional setting," Liz Alexander says.

"This shouldn't be a barrier to producers and industry members bringing their unique solutions-based, innovative approach to agtech development."

Finding ideas on farms

One example of an agtech startup taking flight from farms is SwarmFarm Robotics, based at Gindie, in Queensland's Central Highlands.

SwarmFarm believe that their business development would have been super-charged in its trajectory if it had had this type of dedicated support from the start.

"CHDC knew from our experience that we needed to provide a regionally-based tailored program to address these unmet needs and put the ag back into agtech," Liz says.

"We will connect, support and unlock opportunities for innovative agricultural startups, scale-ups and spin-offs, who also have the potential to go global, while still operating a regionally-based business.

"We have had a high number of applicants stretching from North Queensland down to Narrabri in NSW, with a diverse range of ideas and innovations.

"Around 40 percent of the applicants are market ready and 25 percent have a prototype.

"It's exciting to see so many ideas that are waiting to be developed to this stage.

"Agtech innovation is certainly alive and well in the bush."

For more

www.chdc.com.au/agfrontier

Girls to the front

IN order to achieve full and equal access to and participation in science for women and girls, and further achieve gender equality and the empowerment of women and girls, the United Nations General Assembly this year adopted a resolution declaring February 11 as the International Day of Women and Girls in Science.

CEO of Science & Technology Australia and Chair of Australian National Commission for UNESCO, Kylie Walker, said the day was an important reminder of how important it is to support and encourage young women and girls to consider a future in science, technology, engineering or mathematics.

With that, we thought we'd ask some cotton industry women in science and agriculture for their words of encouragement or advice.

Dr Karen Kirkby, NSW DPI – What I love about working as a pathologist is helping growers improve productivity which plays a vital role in sustaining the rural communities I live and work in.

Katie Broughton, CSIRO – There is an increasing awareness around the benefit of diversity in the workplace, so it is encouraging that there is a growing number of women in both science and ag. There are so many inspiring women embracing careers in STEM, and some incredible opportunities out there for those that are willing to jump in and give it a go.

Fiona Anderson, CCA – Working in agriculture offers diversity and interesting challenges with exposure to innovative technologies, research projects, extension activities and working with different stakeholders – all in a single day!

Nicole Macdonald, USQ – I'd say that there are so many creative and unexpected ways you can use your talents in agriculture, there's heaps of support (get ready to make great friendships) and opportunities for you to find your voice and use it to make positive change. Turn up, listen, ask questions, put your hand up, and persist in helping to create the future



in an industry that is essential to the health and wellbeing of the world.

Stacey Vogel, CRDC – Be brave. Ask questions. Wear sunscreen.

Lou Gall, Gwydir Valley Irrigators Association – Deciding to embark on a career in agriculture was the best move I could have made. I have worked across horticulture, broadacre, cotton, sugarcane, turf, forestry and pest control. I have worked and travelled internationally and experienced some of the most innovative industries in Australia. As our amazing industry moves forward there will be opportunities for motivated people to drive innovation, growth and adoption of transformative technologies. The next 30 years will be even more exciting than the last 30.

Susan Maas, CRDC – My career in science has given me the opportunity to make an impact while doing something I really enjoy and can be passionate about.

Dr Mary Whitehouse, CSIRO – Being a scientist in the agricultural sector is rewarding and fulfilling because of the theoretical and practical nature of the work. That is, I enjoy examining relevant theoretical concepts and then applying these to industry challenges. Not only is my work interesting, but it has relevance as I am part of a team solving problems for a dynamic and engaged agricultural industry.

Sally Knight, farmer, Australian Cotton Awards – What I love about STEM is development of the 'I can/will make it happen' approach. I am energised by this attitude. I realise STEM is a specific acronym, but really, the concept is a solution approach, a life skill to nurture, like a green light that says 'go girl!'

Simone Heimoana, CSIRO – The motivation that keeps you going often lies in the sense of achievement as well as personal satisfaction: a sudden brain flash after being stuck in a dead end, overcoming multiple challenges to solve problems, positive collaborations, knowing that you have contributed something applicable, beneficial and useful to society, helping to make this world a better place.

Janelle Montgomery, CottonInfo, researcher of the year 2016 – My career in agriculture spans 30 years in research, development and extension, it's been challenging, inspiring, and hugely rewarding. A career in agriculture provides a rich and stimulating working environment. I always wanted to work in agriculture and I wanted a job that would make a difference and contribute significantly to the Australian economy.

Brooke Summers, Cotton Australia – If you want to work alongside passionate, genuine people who are constantly innovating, then working in agriculture is for you.

War on waste yields ground-breaking technology

New research turning waste glass into everyday products could save tens of millions of tonnes of glass from going to landfill every year while providing benefits for cotton growers.

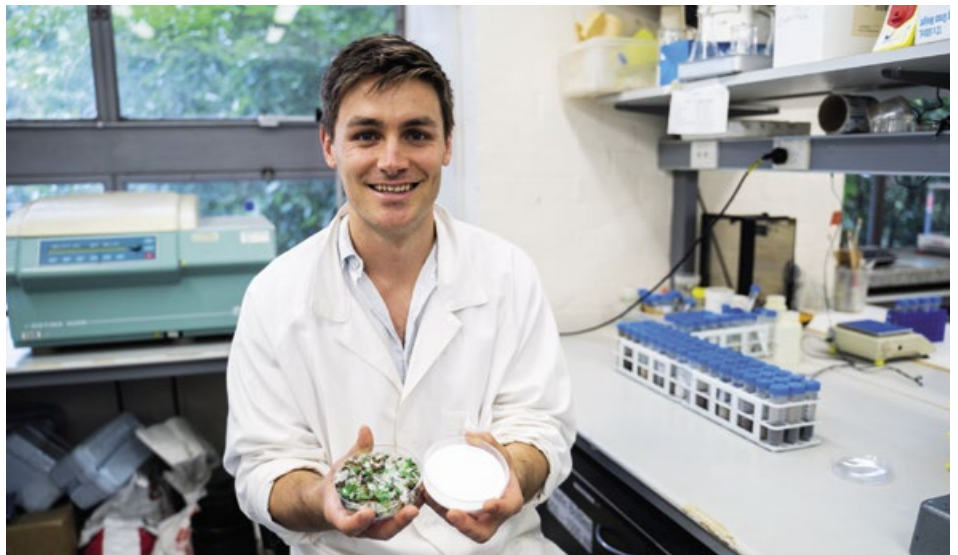
Drawing inspiration from the ABC TV's recent *War on Waste* series, CRDC-supported PhD candidate Rhys Pirie has made a breakthrough on what do to with waste glass, and it's good news for farmers.

Rhys was awarded the CRDC-supported ABARES Science and Innovation Award for Young People in Agriculture in 2018 for his focus on re-purposing organic wastes (such as livestock manure, biosolids and cotton gin trash) as fertilisers and soil ameliorants. His aim is to help growers optimise resource efficiency and improve their environmental impact. Rhys was further honoured with the Minister's Science and Innovation Award from the high-calibre field of 10 awardees. He's also been awarded the Warwick and Nancy Olsen PhD Scholarship for his work.

Rhys, together with Professor Damien Batstone of The University of Queensland (UQ), has developed a method to extract liquid silicate from waste glass which can be used to make thousands of products, from concrete sealers and fertilisers to detergents and toothpaste.

"Rhys was originally looking for a cheap alternative to using conventional potassium silicate as a 'nutrient binder' for manure-based fertiliser pellets as part of his PhD focused on next-generation fertilisers, and at Prof Batstone's suggestion started looking at waste glass as a cheaper source of silicon," CRDC R&D Manager Allan Williams says.

"Rhys's work is wonderful example



Rhys Pirie is revolutionising the way we view waste products through CRDC-supported research.

of the unexpected but exciting turns that PhD studies can take.

"The glass processing technology has the potential to revolutionise multiple supply chains."

Rhys is looking at ways in which waste glass could also be used to create a low-cost silicon-based additive to increase fertiliser efficiency.

"Fertiliser is one of the largest variable cost inputs to farmers and new forms of fertiliser which may be more efficient from an agronomic perspective are generally not more efficient from an economic perspective," Rhys said.

"Resolving this requires low cost ways of improving fertiliser efficiency at ultra-low-cost, so using plant-available silica from waste glass is a promising avenue."

It's estimated to be more than 50 percent cheaper than conventional methods of producing silicate, requires less energy, raw materials and capital, along with the reduced social and economic costs compared to landfilling material. UQ's method results in nearly all of the glass being turned into saleable products.

"The transition towards circular economies is gaining momentum and something I've always been interested in," Rhys said.

"My PhD has highlighted how we need to make use of both the raw materials in 'waste' streams and the energy embodied in them during manufacture.

"That's what this process does and we're pretty confident that it will create positive, far-reaching and virtuous economic cycles."

The research was co-funded by CRDC and the Department of Agriculture and Water Resources. UQ's commercialisation company UniQuest has filed a patent covering the process and is now seeking commercial partners.

For more

Rhys Pirie

r.pirie@uq.edu.au

Researchers reaching new heights

The Australian Association of Cotton Scientists' (AACS) conference is taking new shape this year, with the return of some old favourites and addition of some new ideas.

CRDC is a major sponsor of the conference, to be held at The University of New England in Armidale from October 28 to 30.

Conference chair Oliver Knox said things are shaping up nicely.

"The theme this year is *Taking Cotton Science to New Heights*, and we've created a program in response to feedback and suggestions at meetings," Oliver said.

"The Devils' Advocate session will make a return, the conference dinner is booked for Tuesday evening, and we've lined up some new-look sessions that we know will be of benefit to all."

While Australian cotton scientists are known for their outstanding mental capability, maintaining mental health is relevant to everyone.

"It's been a tough year for many of us and the current outlook is that it will not be getting easier any time soon," Oliver said.

"As such we will be opening the conference with a session to focus on our wellbeing and resilience, as we thought it would be useful to explore the signs that either we, or others are struggling and to give guidance on what we can do to help."

Mary O'Brien will provide insights from her 'Are you bogged mate?' mental health campaign, while Annette Stevenson, who runs UNE's counselling services, will bring further guidance on coping and self-worth.

Mid-conference, the links between cotton scientists' research and *myBMP* will be explored. Former grower and CRDC Chair Mike Logan and CRDC's Allan Williams will present a *Journey through the life of BMP: past, present and future*. Allan was integral in the creation of BMP 20 years ago and is the



The Devil's Advocate session is back at the cotton scientists' conference this year, and if it is anything like previous year's, you won't want to miss it – pictured is NSW DPI's Dr Mary Whitehouse getting right into character from a previous conference!

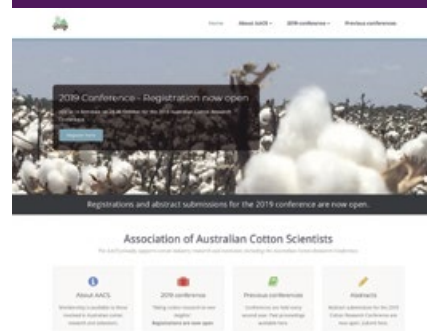
current chair of the International Cotton Advisory Committee's Expert Panel on the Social, Environmental and Economic Performance of cotton.

Communicating good science important to cotton industry scientists, and as such the conference will close with a session on communication.

"For this we'll be getting insights from Mary McMillan, a UNE lecturer and science communicator, Kirsti Abbott, the UNE Discovery team leader, and Michael Mills a science theatre performer who has a comedic alterego, Professor Flint," Oliver said.

"Of course research will fill in the rest

New AACS website



The AACS website has been updated with a fresh look and new hosting arrangements that should serve its membership well in the future. The website will feature information about the AACS as well as current and past conferences. The site will be used to highlight events, job opportunities and create a member directory for those who would like to create a profile to share details about their research work, recent publications and more.

of the conference and we're looking forward to sorting through the abstracts and building the rest of the conference around researchers and their work.

"So please, sign up, keep checking the website for updates and we all look forward to seeing you in Armidale in October."

Early-bird registration is \$320 and \$220 for students. To be eligible for student registration requires enrolment in a course of study relevant to the cotton industry. Registration is inclusive of all catering and events including the conference dinner.

Registrations are open via the AACS's fresh new look website.

For more

www.australiancottonscientists.org



Taking tech to trees

A drone with the capacity to plant a hectare of trees in less than 20 minutes is just one of the revegetation methods set to be trialled by the new CRDC Landcare Tech-Innovations 2021 project.

LED by Dr Rhiannon Smith from The University of New England in collaboration with ecosystem restoration experts, the research aims to improve capacity for cost-effective revegetation on cotton farms by trialling new and improved direct seeding technologies using drones and tractors. Under the National Landcare Program's Smart Farming Partnership initiative, CRDC secured a \$1.3 million grant to implement the three-year *Cotton Landcare Tech-Innovations 2021* project. The project will focus on four key research areas: innovation, technology, biodiversity and collaboration.

"Your average cotton farm is in a semi-arid region and occurs on a very heavy clay soil which dries out very quickly and combined with variability in rainfall and high temperatures, you get a huge natural impediment to getting native vegetation established," Rhiannon said.

"What this project is doing is investigating a number innovative technologies including drones as an alternative to traditional expensive and time-consuming revegetation methods such as tube stock planting or traditional direct seeding by tractors that can only be done when the soil is quite dry so the tractors don't get bogged.

"In contrast, drones come into their own if you've got a saturated soil that's

more likely to allow seeds to germinate and get established in floodplain species that naturally flower and seed after a flood event.

"We're planning on replicating natural conditions, so we're more likely to get successful establishment of native vegetation around cotton farms."

The drones being trialled have been developed by BioCarbon Engineering using technology built at Oxford University.

"BioCarbon Engineering have developed a drone that has a 15 kilogram payload with a modified air rifle on it," Rhiannon said.

"These drones can shoot seeds into the ground at 40 metres per second while hovering two metres above the ground, all controlled by someone sitting in a vehicle.

"Usually we would require a tree planting team to achieve large-scale revegetation."

The seeds being ejected by the modified air rifle are no regular seeds either. They're water soluble seed capsules that are pumped full of seeds, fertiliser, microbial amendments and anything else that's required to get seeds germinated and established. The seeds are protected in that capsule until there's enough moisture at the site to break down the capsule and allow the seeds to germinate and establish.



Rhiannon is looking for cotton growers to be involved in this groundbreaking work. Growers from the Murrumbidgee, Macquarie, Namoi, Gwydir and Border Rivers regions are encouraged to get in touch. Rhiannon is looking for four to five hectare sites on floodplain soils. There will be five sites in each of the regions.

Contact Rhiannon at rsmith66@une.edu.au

Rhiannon will now move this planting methodology on cotton farms.

"Growers understand the range of ecosystem services provided by native vegetation in the landscape.

"For example, natural pest control services provided by birds and bats that live in native vegetation deliver direct economic benefits to cotton production.

"Biodiversity and native vegetation allow growers to perhaps diversify their income streams as well. For example, carbon sequestration may be an attractive option as an alternative income stream for unproductive areas of the farm.

"The benefits of biodiversity and native vegetation for sustainable agriculture in general are immense and go a long way in supporting healthy, vibrant environments for cotton growing communities."

For more

[www.crdc.com.au/
cotton-landcare-tech-innovations](http://www.crdc.com.au/cotton-landcare-tech-innovations)

Are you keeping an eye out for the Australian cotton industry's most unwanted?

Australia's agricultural and cotton industries are lucky to be free from many of the world's most damaging pests and diseases.





Exotic plant pests and diseases are capable of damaging our environment, reducing yields and changing the way we manage our crops and farms. Being familiar with the pests that represent the greatest risk to the cotton industry is important so that people are able to respond to an exotic pest incursion quickly, reducing the likelihood of more severe impacts.

Australia's biosecurity system helps protect us from exotic plant pests and pathogens, however there is always the possibility that exotic pests can enter the country.

"It is important that we are prepared for the entry of any

exotic pests and diseases by having a line of defence – us!" says CottonInfo Biosecurity Technical Lead Sharna Holman from QDAF.

"Growers and agronomists are regularly looking for things that are out of the ordinary and may be affecting their crops.

"Monitoring cotton crops for signs of pests and disease is something growers and agronomists do a number of times during a week.

"This could be as part of a formal crop checking program or as simple taking the time to stop and look at something that

catches your eye from the ute or tractor.

“Ensuring that you are aware of our industry’s most unwanted pests and the need to quickly report any sightings greatly increases the chances that new pests or diseases might be eradicated before they establish.”

High priority pests

A risk assessment was carried out as part of the industry’s Biosecurity Plan which identified 15 high priority pest threats for Australian cotton production. These pests and diseases were prioritised according to the likelihood of entering and establishing in Australia, as well as the potential impact on the industry, environment and community.

For example, the brown marmorated stink bug (BMSB) is a high priority pest both for the cotton industry and many other Australian pulse and horticultural commodities. This pest is classified as posing a high risk because of its highly mobile behaviour, lack of effective lures and tendency to readily hitchhike within shipping container and machinery freight.

If BMSB established in Australia, this pest would be difficult and expensive to manage as it is adapted to a wide climatic range and feeds on over 300 species of agricultural and ornamental



Brown marmorated stink bugs are one of the high priority pests for Australian agriculture including cotton.

plants. In recent years there have been a significant increase in the number of brown marmorated stinkbugs detected within cargo entering shipping ports in Queensland, Victoria and Western Australia. So far each of these detections has been contained with swift and effective response measures.

As an industry, we also need to be particularly vigilant not just for BMSB but also a range of other high priority pests and diseases for the cotton industry.

“One of the ways you can raise awareness within your business is to include a biosecurity component as part of your workplace inductions and tool shed meetings so employees are aware of your on-farm biosecurity practices as well as what to do if they see something unusual.

“Another way of raising awareness within the workplace is to include Exotic Cotton Pests biosecurity posters in the shed or office to act as a reminder to staff and visitors.

“If you do think you have spotted what could be any of the exotic pests or diseases or unusual symptoms, contact your department of primary industries or agriculture immediately – you can do this by phoning the Exotic Plant Pest Hotline on 1800 084 881 from anywhere in Australia.”

Cotton industry high priority pests

Brown marmorated stink bug
(*Halyomorpha halys*)

Cotton boll weevil (*Anthonomus grandis*)

Cotton stainer; red bugs (*Dysdercus* sp.)

Bt resistance cotton bollworm (*Helicoverpa armigera* carrying Bt resistance alleles)

False Codling moth (*Thaumatotibia leucotreta*)

Tarnished plant bug and Western plant bug
(*Lygus lineolaris* and *Lygus hesperus*)

Whitefly (*Bemisia tabaci* exotic biotypes)

Cotton aphid (*Aphis gossypii* exotic strains)

Cotton leaf curl disease (CLCuD)

Fusarium wilt (*Fusarium oxysporum* f.sp. *vasinfectum* exotic strains)

Texas root rot (*Phymatotrichopsis omnivore*)

Blue disease (Cotton Leafroll Dwarf Virus)

Bacterial blight (*Xanthomonas axonopodis* or *X. campestris* PV *Mavacearum* exotic strains)

Verticillium wilt (*Verticillium dahliae* exotic strains)

For more

Sharna Holman

sharna.holman@daf.qld.gov.au

www.cottoninfo.com.au

Preparing for exotic threats: Focus on blue disease overseas

Exotic diseases of cotton are found close to our shores, with cotton blue disease alive and well in our northern neighbourhoods.

The discovery of cotton leafroll dwarf virus – the causal agent of cotton blue disease – in Timor-Leste in 2013 sparked a biosecurity concern for CRDC and the Australian cotton industry. A new project was initiated soon after to further investigate this potentially devastating disease which as yet has not been detected in Australia. It has been reported in many cotton growing countries and has caused serious disease issues in south and north America. It is spread via the cotton aphid (*Aphis gossypii*) and can result in severe stunting of cotton plants and yield loss.

Dr Murray Sharman of QDAF has been investigating blue disease in Timor since 2013 with support from CRDC and says with the recent expansion of cotton into north-western Australia, the industry needs to be mindful of potential biosecurity threats in neighbouring countries. This means finding out as much as possible about the strains of the disease in Timor, its hosts and levels of infection.

However, it is not so straightforward. Cotton is not grown as a commercial crop in Timor-Leste, it's found in backyard gardens of subsistence farmers, with three species naturalised to the region.

“After the initial discovery in 2013, through my CRDC project, we went back for a further look and found the virus associated with blue disease was common in backyard cotton plants, with 30 percent of plants testing positive,” Murray said.

“Based on genetic sequences we found there is a lot of diversity in the virus, even between valleys just 20km apart.

“This diversity was higher than has been reported across the whole of South America, where it was prevalent in commercial crops prior to resistant varieties being grown, hinting at a spread from Asia to the rest of the world, not vice versa as was perhaps previously assumed.



MURRAY SHARMAN

“While we did find that the virus was present in many plants, it was actually difficult to be sure if a plant was infected based on visible symptoms alone. This leads us to think perhaps the strains of the virus strains that we have found so far in Timor-Leste may not cause a significant disease, much like the non-symptomatic strain of cotton bunchy top virus which is commonly found in most production regions in Australia.

“The other possibility is that the varieties of cotton grown in Timor-Leste have some tolerance to the virus.”

Murray says the disease can be spread to Australia through living plants – likely ornamentals or aphids – which can be potentially blown to our northern shores. As such Murray has just returned from surveillance in the Kununurra region.

“We also need to find out if there are other hosts. As cotton is rare in Timor-Leste but the virus is not so it appears the virus probably survives in more than just cotton.

“We know that ornamental hibiscus is a host for the virus in Timor-Leste, so that's one host we think could pose a threat if imported as live plants.”

Murray's recent surveys have found evidence of other aphid transmitted viruses being present in Timor-Leste and northern Australia which leads us to think that a pathway for virus-carrying aphids may exist between these two regions, possibly aphids

Cotton leaf roll virus, the cause of cotton blue disease, observed by QDAF's Murray Sharman in Thailand.

carried on the wind. While these other viruses are not damaging to cotton crops, it provides evidence that there is a risk of an incursion pathway into northern Australia.

Another endemic disease of Australian cotton, cotton bunchy top (CBT), may help researchers learn more about the exotic blue disease, to improve preparedness in the event of an incursion. There are two virus species in Australia related to CBT which are as genetically similar to blue disease as they are to each other.

“The main host of CBT is cotton – so managing volunteers is imperative to break the cycle of the virus and the aphid vector,” Murray says.

“There are 12 other known hosts of CBT but any outbreak can always be explained by the presence of infected volunteers/ratoon cotton.

“Farm hygiene – weed removal – also reduces risk of other insect pests, so it makes good sense to always maintain a farm free of weeds, including volunteer cotton.”

CRDC continues to monitor potential pathways in the North, with Murray travelling to far north QLD in June to conduct further research.

US experience heralds warning

Meanwhile, researchers are looking closely at the US, where blue disease has been confirmed in Alabama, Georgia and the Florida Panhandle.

Cotton blue disease symptomology was initially observed in cotton crops at the end of 2016 in Alabama and has expanded rapidly.

“Probably the biggest thing we can learn from the US experience is that each incursion is likely to be very different,” Murray says.

“It appears likely that the virus was blown into the southern States from somewhere in the Caribbean region by a hurricane, but the strain that has arrived there is different (possibly a distinct species) to the strains that are causing typical blue disease in South America.

“It is quite widespread now in the southern States spanning about 900km, so it either moved very quickly when it arrived, or more likely it was present in the US for two or three seasons before it was really recognised as something different.”

This is a concern because the US didn't have a similar virus before the cotton leafroll virus causing blue disease arrived, whereas Australia has the endemic cotton bunchy top virus which has a lot of similar symptom types when compared to the exotic blue disease.

“I suspect if cotton leafroll dwarf virus did arrive in Australia and caused blue disease, it could be visually assumed to be the endemic cotton bunchy top for some time,” Murray said.

“This could increase the chance of it spreading further before we realise which would make it

What does cotton blue disease look like?

Plants displaying typical cotton blue disease symptoms tend to have leaves that are smaller, thicker, more brittle and leathery and leaf edges tend to roll downwards and under. Leaves have an intense green colour with yellow veins. Reddening of stem, petioles and leaf veins can occur in some infections. Plants become stunted due to a shortening of the branch internodes and produce many branches, giving a bunchy zig-zag stem habit. Plants infected at an early stage display the most severe symptoms being very stunted, sometime laying prostrate on the ground with pronounced zig-zag stem habit. Some of these symptoms are similar to what is seen for the endemic cotton bunchy top. However, one consistent difference in symptoms is that cotton bunchy top almost always causes some leaves to have a chlorotic (pale yellow) mottle pattern around the leaf margin of older leaves but this symptom is absent from typical blue disease seen in south America.

more difficult to successfully eradicate if that was attempted.”

Murray has observed that in the US and Timor-Leste, there is variation in symptoms when compared to South America.

“We need to remain vigilant to any unusual symptoms as well as to symptoms of cotton bunchy top that may seem more severe than expected.

“In the US, they are not considering eradication as an option and they are now moving towards looking for management strategies such as effective aphid control and identifying breeding material with resistance.”

Murray is working with US researchers to understand the relationship between different strains of cotton leafroll dwarf virus, how these relate to the disease symptoms they cause and implications for Australia.

For more

Murray Sharman

murray.sharman@daf.qld.gov.au

Exercise Blueprint: preparing industry for when it's 'not a drill'

We don't know where and we don't know when an exotic pest may make its way to our shores, but what we do know is that we need to be ready.

The Australian cotton industry's readiness for a biosecurity emergency will be tested with a simulation exercise in coming months. *Exercise Blueprint* will test the industry's response to the detection of the exotic cotton blue disease.

CRDC and Plant Health Australia (PHA) have joined forces to create the simulation exercise, which is used to provide in-depth practical training on biosecurity issues using real world examples to test response readiness. Along with assessing the preparedness of an industry to a pest incursion, simulation exercises can be used to increase the understanding of the required roles and resources, identify communication gaps, and highlight the interaction between industry and government departments during a response.

It will involve stakeholders meeting in Toowoomba over several days to work through the response.

"We expect the exercise will achieve increased engagement between cotton industry stakeholders and relevant government emergency response personnel and researchers," CRDC R&D Manager Susan Maas said.

"It will provide a platform for an investigation of response structures for a cross-border response operation between NSW and Queensland."

Cotton Australia holds the official role for biosecurity stewardship in the Australian cotton industry and works with the Australian Government as the signatory under the Emergency Plant Pest Response Deed.

"The process through the deed is very clear, but we want to make sure every sector of the industry is on board and clear what their roles are, so we are confident in how we will react," Susan explained.

"While Cotton Australia is the signatory, everyone in the industry has a role to play.

"Biosecurity preparedness is also a key aspect of CRDC's current (2018-2023) strategic plan and as such we are committed to holding this and another exercise during this current plan."

At a previous industry biosecurity workshop the focus was insect pests so this time around, disease is the focus. Deciding what to focus on is assessed on the likelihood of the disease arriving and level of impact.

"This is the first foray into a biosecurity



MURRAY SHARMAN

Exercise Blueprint will focus on the cotton industry's reaction and preparedness to an incursion of cotton blue disease.

exercise at a larger scale," Susan said.

"It's about identifying gaps, to help with preparedness: what are the types of info we need on hand; where are the information gaps; and having people involved in the process so we need to know who is responsible for what.

"While there are other commodities that can be affected by the same diseases and pests, we are looking largely at the cotton industry response at this stage.

"However to increase the benefit from the exercise, representatives from the sugar industry have been invited to observe."

Early detection and response to an exotic pest incursion can mean the difference between eradication of the threat, or long-term management, which can be problematic. *Exercise Blueprint* has been designed to allow discussion of the eradication option. This will include working through the type of information growers may need in the initial communication process and how information will be communicated throughout growing regions.

The exercise is being funded by CRDC and organised with a planning committee with members from PHA, Cotton Australia, CottonInfo, QDAF, NSW DPI, Australian Department of Agriculture and Water Resources and cotton industry representatives.

"The target is the entire cotton industry – so that includes not just the growers, but ginners, agronomists, researchers, peak industry bodies, federal and state government.

"These are the parties that would be involved if we had a genuine biosecurity response to a pest of cotton."

Are you a good mate?

Definition of mate:

a person with whom one is in close association; a good friend.

Would you walk into a mate's house with mud on your boots? No, you wouldn't, and keeping in mind our farms are also homes and livelihoods, we need to be aware of foreign material entering our homes through all types of traffic, whether it be on foot or four wheels.

A key principle of good farm biosecurity is ensuring all visiting your farm are aware of your biosecurity protocol.

It's important that we respect our mates, neighbours and community by taking an active role in protecting our industry and local farms against pests and diseases. There are cotton growing regions and farms fortunate to be free of pests and diseases such as Verticillium wilt and mealybug, as well as exotic pests and diseases that aren't found in Australia – and the easiest way to manage these pests and diseases is to



MELANIE JENSON

Growers Nigel and Beth Burnett run a myBMP certified farm with Better Cotton Initiative accreditation at Emerald. They are pictured with CottonInfo's biosecurity warriors The Lone Stranger and his sidekick (AKA Dr Oliver Knox and Sharna Holman).

not get them in the first place.

"A good mate starts conversations, and a good farming mate knows to start conversations about on-farm biosecurity,"

says QDAF's Sharna Holman, CottonInfo's Biosecurity Technical Lead.

"These conversations can be informal and relaxed but they help make sure you both can enjoy a pest and disease-free farm now and into the future.

"Talking about on-farm biosecurity and asking your neighbour and any visitors to follow any biosecurity practices doesn't have to be uncomfortable; a good mate will respect your wish to protect your farm, as well as protecting their farm.

"These on-farm biosecurity conversations are crucial to have with anyone coming onto your farm – and you often only have to talk about it once. It's not just about protecting your farm, it will also help protect your neighbours or mates' farms; something that will be appreciated by them as well.

"Through implementing on-farm biosecurity practices in your business, you can help protect your region and the industry from the introduction and spread of endemic and exotic insects, weeds and diseases."



MATT & DAISY TOSCAN, 'CAVASO', DARLINGHURST

Matt Toscan and his family grow cotton, grain and prunes on their farm 'Cavaso' in Southern NSW. Being in a relatively new cotton growing region, biosecurity is important to Matt as they are currently free of pathogens and problem weeds.

"The easiest option is not to get them in the first place" said Matt.

"We've got biosecurity signs with phone numbers to call before you enter.

"We've also got clean down pads where the water is not going to go back into our recycling system or onto the farm.

"We talk to our contractors not just

about coming clean but about where they have been.

"We aim to set a high standard for ourselves so that we can expect people to do the same when come here; that is turn up clean and leave clean."

Australia's agriculture and horticulture industries including cotton have joined forces to change the way airborne pests and diseases are detected.

Airborne sampling offers faster, clearer detection of pests

iMapPESTS: Sentinel Surveillance for Agriculture will rapidly monitor and report the presence of airborne pests and diseases affecting major agricultural sectors including grains, cotton, sugar, horticulture, viticulture and forestry. The five-year project is being led by Horticulture Innovation Australia, through funding from the Australian Department of Agriculture and Water Resources as part of its Rural R&D for Profit Program and funding from 16 partner organisations including CRDC.

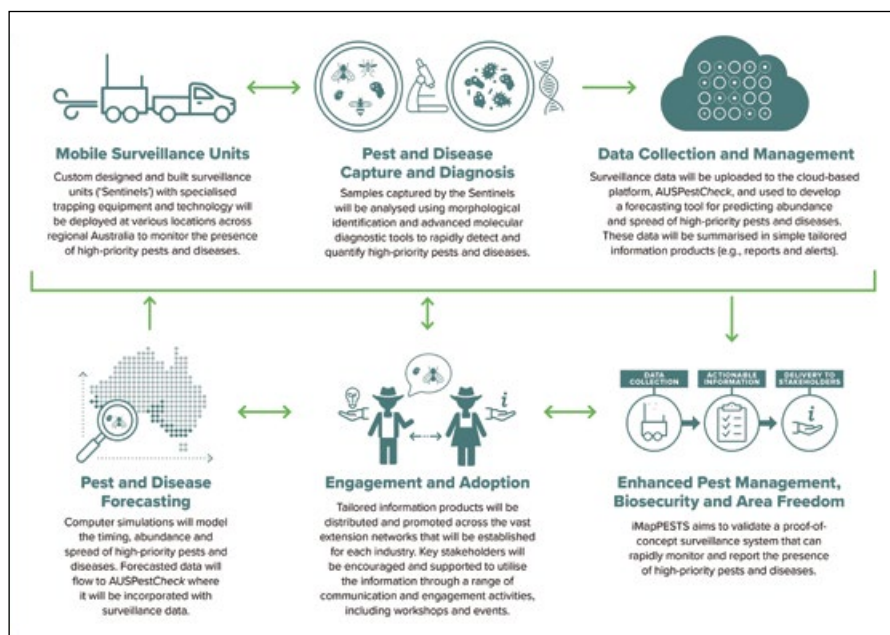
The project involves building a custom-designed prototype 'sentinel' mobile surveillance unit designed to offer optimal sampling of either airborne fungal spores or airborne insects. It is expected up to eight units will be built during the project and deployed across the country, starting at South Australia's premier agronomic cropping trials site at Hart, north of Adelaide.

How the sentinel works

Dr Rohan Kimber is the project's lead scientist at the South Australian Research and Development Institute (SARDI) and he's guiding technology partners to build and deploy the sentinel prototype.

The sentinel incorporates a trailer equipped with airborne samplers, power supply, telemetry to move the data along with automated robotics which can change the samplers according to the day or the capture criteria. After the sentinel captures airborne spores and insects, the data is recorded via a cloud-based system and the physical samples sent to a laboratory for identification. It can deliberately target many long-distance dispersal insects such as aphids and thrips. Information about high priority pests for each major agricultural sector are being collated by project partner AUSVEG, with the agricultural sectors involved.

SARDI will examine the samples which will be married to diagnostic results. Researchers will look at ways to visualise the information and feed it through to



end users, potentially via tablet or phone, showing them what pests or diseases the sentinel is detecting in an area at a particular time. The data will be made available to researchers at CSIRO to forecast diseases and send out warnings to crop managers.

"We can then start looking at what these patterns may reflect, to potentially determine when conditions are going to be favourable for an insect or the disease, flag potential outbreaks, incursions or flight of these pests and diseases that growers may need to be warned about," Rohan says.

Agriculture Victoria will use samples to investigate the application of new pest diagnostic techniques for the broadscale detection of exotic pests and diseases.

With support from CRDC, Dr Dean Brookes of The University of Queensland (UQ) will develop cotton species-specific contingency plans for high-priority insect species, a boll weevil surveillance and eradication plan and novel methods for assessing host plant feeding by trapped insects to increase general preparedness for exotic cotton insect threats.

This research will inform and prepare

Australia's cotton industry for the arrival of any high-priority insect species.

Ultimately, the project has the potential to provide crop managers with valuable information allowing them to be more proactive in managing airborne pests and diseases which they may find difficult to monitor or predict. A key feature of the sentinel is its ability to provide localised information that impacts a specific region, which may not apply to growing regions in other parts of the country.

Growers are encouraged to provide feedback on this project, including what information is important and relevant by contacting CRDC R&D Manager Susan Maas to express their interest in the project and stay up-to-date on where and when the sentinels will be deployed in their region.

For more

www.ausveg.com.au/biosecurity-agricultural/biosecurity/imapests/

Susan Maas

susan.maas@crdc.com.au

Cross-industry management of *Helicoverpa* underway

CRDC is working with GRDC and the grains industry to address growing resistance levels in *Helicoverpa*.

With the introduction of transgenic cotton, *Helicoverpa armigera* is no longer front of mind as a major pest of concern for cotton growers. However the latest results from the industry-wide resistance surveillance program show levels of resistance to indoxacarb in *H. armigera* has increased in areas of Central and Northern Qld.

Expansion of the pulse industry in eastern Australia has significantly increased selection pressure on key insecticides to control *Helicoverpa*. Selection pressure is further increased in northern grains regions, as a longer growing season allows more generations of insecticide exposure per year. This has important implications for the use of these products in cotton and highlights the need for a cross-industry approach to promote stewardship of key insecticides to control *Helicoverpa*.

Resistance surveillance monitoring and detection of early-stage resistance in grains will increase preparedness in cotton and horticulture industries. This 'pre-emptive approach' is supported by CRDC and GRDC. Annual resistance testing is important for quantifying shifts in resistance frequency and is used to inform the industries' responses to changes in resistance that might impact on efficacy of important selective insecticides. The research will also improve management in multiple crop types. To further support this the GRDC has released a strategy to support the pulse industry to manage resistance to key *Helicoverpa* insecticides.

Under the joint CRDC/GRDC project *Conventional insecticide resistance in Helicoverpa – monitoring, management and novel mitigation strategies in*



LISA BIRD

H. armigera have come under the microscope in resistance testing as part of research being supported in collaboration with GRDC.

Bollgard 3, resistance monitoring in pulse crops is now pivotal for assessing the impact of insecticide use in pulse-dominant landscapes on the risk profile of *H. armigera*.

"*H. armigera* represents a significant challenge for maintaining productivity in multiple agricultural sectors," says NSW

DPI's Dr Lisa Bird, who leads the research.

"Larvae have a direct impact on yield because they cause feeding damage to fruiting structures in fibre and pulse crops, oilseeds, coarse grains and occasionally, winter cereals.

"Management of *H. armigera* is also problematic because it has a strong track

record of developing resistance to a whole range of insecticidal classes.

“Although widely distributed right across Australia, *H. armigera* is more common in the northern and coastal regions of the eastern states, particularly in warmer areas – and insecticide use in these areas in particular creates the greatest risk for resistance development.”

Surveillance expands in Central Qld

In May 2018, with additional support from GRDC, the project was expanded to include surveillance in key grains production areas of Central Queensland. Lisa says this was in response to concerns that resident *H. armigera* populations in regions dominated by pulse production could have an increased risk of developing resistance due to ecological factors unique to northern cohorts.

This targeted surveillance in northern grains regions provides detailed and regionally-specific information for quantifying changes in resistance frequency, which will improve the level of preparedness in grains and other industries that play host to this pest.

Since April 2018, resistance surveillance has targeted populations in chickpea-dominant landscapes of Queensland’s Northern Highlands and in pulse growing landscapes of the Burdekin region. Data has also been collected in the mixed farming landscape of the Dawson/Callide region from pulses and cotton.

Elevated indoxacarb resistance in northern populations

The past five seasons have seen significant differences in regional frequencies of indoxacarb resistance with levels of resistance consistently higher in Central Qld compared with more southern regions (Figure 1A and B).

“The past five seasons have seen significant differences in regional frequencies of indoxacarb resistance with levels of resistance consistently higher in Central Qld”

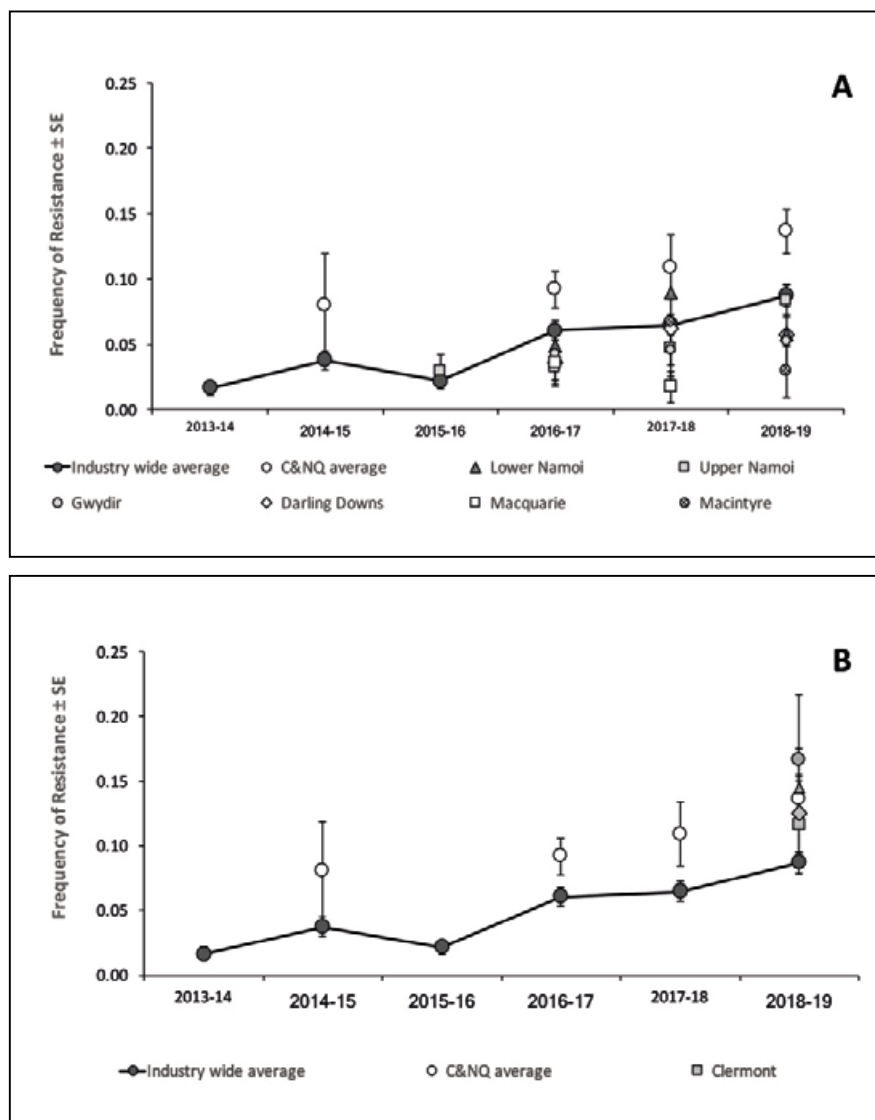


Figure 1. Annual regional frequency of indoxacarb resistance in eastern Australian compared with southern Qld and NSW (A) and central/northern Qld (B) ± binomial standard error (SE).

“Our resistance surveillance program has found average indoxacarb resistance in central and northern regions of Qld are 2.4-fold higher than levels recorded in southern Qld and NSW during 2018-19 and this is likely associated with ecological differences unique to northern regions,” Lisa said.

“For example, a longer growing season in the north would support a higher number of insect generations per year compared with southern regions and therefore contribute to increased selection pressure in northern populations.”

The latest research from NSW DPI also found evidence that diapause in indoxacarb-resistant *H. armigera* incurs a fitness penalty.

Lisa explains that a competitive disadvantage in individuals carrying genes for indoxacarb resistance may favour a decrease in resistance frequency and may provide some explanation for the elevated indoxacarb resistance observed in northern populations where diapause does not occur.

“From a resistance risk perspective, this means that adoption of resistance management tactics will be critical for maintaining efficacy of key insecticides in more northerly growing regions,” she says.

For more

Lisa Bird

Lisa.bird@dpi.nsw.gov.au

Rising levels in Central Queensland



Resistance monitoring in pulse crops is now pivotal for assessing the impact of insecticide use in pulse dominant landscapes on the risk profile of *H. armigera*.

Since 2013, monitoring for resistance to selective insecticides (indoxacarb, chlorantraniliprole and emamectin benzoate) utilised the F₂ screening method. This involves testing the grandchildren of moths collected from field populations.

The major advantage of this method is researchers have the capability to pre-emptively detect early-stage resistance. In other words, F₂ screening provides an effective early warning system for resistance and the opportunity to implement mitigation tactics to minimise the risk of field failures and reduce impacts on productivity.

The first six years of this revised system of resistance monitoring has just been completed. The recent pattern of very low emamectin benzoate resistance continued in 2018-19, with no insects testing positive for resistance to this insecticide. Resistance to chlorantraniliprole also remained consistently low over the past six seasons with an average annual frequency of 0.5 percent. While this is good news the situation is quite different for indoxacarb.

While industry-wide indoxacarb resistance was similar in 2016-17 (6.1 percent) and 2017-18 (6.4 percent), latest

results from the 2018-19 season indicate that 8.7 percent of the *H. armigera* population currently carry genes for indoxacarb resistance, which is a small but significant increase from the previous two seasons.

Levels of indoxacarb resistance have generally been lower than the industry average in cropping regions of southern Qld and NSW. In 2018-19 the southern average was 5.6 percent (Figure 1A).

In contrast, during the three seasons since 2016-17 annual frequencies of indoxacarb resistance in Central Qld was significantly higher than the industry average (9.2, 10.9 and 13.6 percent in 2016-17, 2017-18 and 2018-19, respectively) (Figure 1B). Results from the 2018-19 season indicate indoxacarb resistance in the pulse-dominant region of the Northern Highlands around Clermont was similar to that recorded in the Emerald Irrigation Area (11.7 and 12.5 percent, respectively). Resistance in the Dawson/Callide regions

was 14.5 percent, while the highest frequency was recorded in the Burdekin region where an estimated 16.7 percent of the *H. armigera* population carry genes for indoxacarb resistance.

Implications for management

H. armigera has a very strong track record for developing resistance in response to selection pressure from insecticides. The risk of spray failures is high for pyrethroids and carbamates due to historical resistance to these products.

“The risk of indoxacarb resistance development is elevated in some areas of Central and Northern Queensland, but is still low for chlorantraniliprole and emamectin benzoate, based on current resistance frequency data,” NSW DPI researcher Dr Lisa Bird said.

“However, it is highly likely that resistance will increase rapidly due to selection pressure if there is over-reliance on these products.”

New strain of resistance

Researchers investigating insecticide resistance in *Helicoverpa armigera* have found a new strain of resistance.

In 2017, a new form of indoxacarb resistance in *H. armigera* was isolated from a population sampled on the Liverpool Plains in NSW. Preliminary results from genetic analyses indicate the gene conferring indoxacarb resistance in this new strain is inherited as a largely dominant trait. There was also significantly higher survival and faster larval development compared with the previously characterised indoxacarb-resistant strains.

“This combined with a very high degree of genetic dominance suggests that development of this type of resistance could be rapid under certain conditions of selection, especially if successive generations of *H. armigera* are exposed to indoxacarb applications,” NSW DPI’s Dr Lisa Bird says.

“This means very careful adherence to the IRMS to avoid this situation in Australia.

“It is not surprising to find a diverse genetic basis for resistance to indoxacarb in *H. armigera* as this species is well known for its ability to develop multiple detoxification systems to overcome the lethal effects of pesticides.”

In 2013 NSW DPI identified a gene that conferred high level resistance to indoxacarb in field populations of *H. armigera*. The project supported by CRDC and GRDC found that gene did not confer cross-resistance to other

“Preliminary results from genetic analyses indicate the gene conferring indoxacarb resistance in this new strain is inherited as a largely dominant trait.”



LISA BIRD

Helicoverpa insecticides including those produced by Bollgard cotton. The lack of cross-resistance between indoxacarb and other selective insecticides suggests that rotational strategies should be effective for managing resistance to indoxacarb in *H. armigera*.

In the most extensively studied colony of resistant insects (GY7-39 strain) resistance was incompletely dominant and conferred by a single major genetic factor.

As in the GY7-39 strain, resistance in the strain isolated in 2017 is likely associated with upregulation of metabolic detoxification enzymes. However, molecular analysis has confirmed that the specific enzymes responsible are different in the two strains.

Regardless of the causal mutation for resistance, with multiple risks to indoxacarb efficacy on the increase, growers must consult the IRMS to ensure that selection pressure applied by any one chemical group is minimised across successive generations of *H. armigera*.

For more
The Insecticide Resistance Management Strategy
www.cottoninfo.com.au/publications/cotton-pest-management-guide

Grains management strategy released

The grains industry is now a major user of *Helicoverpa* insecticides with product use especially high in pulse crops such as chickpeas.

To support resistance management in grains, a resistance management strategy (RMS) for *H. armigera* in Australian grain crops was released in April last year. A key aspect of its development was industry-wide consultation with leading growers and advisors in the cotton and grains industries. This consultation highlighted that there is regional concern about resistance in pulse crops, which are now a pivotal part of the Central Queensland farming system.

The National Insecticide Resistance Management (NIRM) working group of the Grains Pest Advisory Committee (GPAC) developed the Grains RMS which was endorsed by CropLife Australia.

“In grains and pulses, rotating a broad range of selective options will reduce over-reliance on any one chemical group,” Lisa said.

“Growers should also use economic thresholds and avoid prophylactic sprays.

“Following these recommendations and complying with label instructions will minimise the risk of spray failures occurring as the result of insecticide resistance and maintain effective insecticide control of *H. armigera* into the future,” she said.

For more

The Grains RMS is available at:
www.grdc.com.au/GRDC-FS-Helicoverpa-resistance-management



AMANDA THOMAS

Making an impact at the grassroots level and beyond

A group of farmers from the Northern Territory and Western Australia got their first look at a cotton crop recently on a tour ‘down south’.

ABOVE: Stu Dentson talks the 112-strong crowd of growers and consultants through the ins and outs of remote sensing technology at Gin Gin.

The trip was supported in part by CRDC through its Grassroots Grants program, creating partnerships far and wide, sharing knowledge and growing the cotton industry.

The tour was led by NT Farmers’ Andrew Philip, visiting farms and businesses in Toowoomba, Goondiwindi and Narrabri to learn more about the cotton industry, as cotton has become a crop of interest for northern region farmers and industries.

“It was fantastic and everyone we met was so helpful, engaging and open,” Andrew said.

“Not only did we learn more about the way the crop is grown; but how the industry operates – the biggest thing it’s given us is confidence that in the future we can go down south and learn even more.

“This is absolutely vital if we want to grow the industry up here.

“We’ve learned so much and now through sharing our experience and word of mouth about the trip it’s creating more interest and building momentum and enthusiasm.

“The Territory is virtually a greenfield site, so the experience has been invaluable in our efforts to move forward in the North.”

Andrew said applying for the grant was a quick and simple process. Over the past seven years, CRDC Grassroots Grants have supported 72 projects valued at around \$630,000. The grants (of up to \$10,000) are available to industry groups and cotton grower associations.

“The value for industry and for us is in providing initiatives designed by growers and crops managers with their direct need and benefit needs in mind,” CRDC Executive Director Ian Taylor says.

“Recent surveys have shown growers and

consultants desire more on-farm trials and the ability to run events on short notice, often in response to seasonal issues, which can effect practice change.”

CottonInfo Gwydir Valley Regional Extension Officer (REO) Janelle Montgomery says small grants can be just what is needed to get on-farm trials, demonstrations or workshops off the ground. She said the Gwydir Valley cotton community has used the small grants over the years to do all those types of activities.

“In 2016-17 the Gwydir was hit hard with silverleaf whitefly (SLW) and the Macquarie Valley was only a season or two away: the consultants and growers needed information on managing whitefly, they didn’t want to go through a similar season again and southern valleys wanted to avoid it if possible.

“Thanks to a CRDC Grassroots Grant, area wide management (AWM) groups were able to get a consultant and grower from Emerald who lived through the horrendous whitefly incident in 2000-2001 to share their experiences first-hand with local growers and consultants, which had a significant impact.

“The value of going soft early season, knowing your chemical choice will have some impact, IPM and area wide management were all topics of discussion.

“With mealybug also just around the corner, the information was very relevant to this new pest too.

“The following season saw a dramatic turnaround in thinking: softer chemical was chosen early in the season by the majority in the Gwydir and while it ended up being a lower pressure (insect) year, I believe as a result of the AWM meeting growers and consultants were more aware of chemical choice and impact, their confidence in softer products improved and the spray program was carefully considered.

“Flowing on from this initial grant, CottonInfo and Crop Consultants Australia (CCA) built on the momentum with SLW presentations at CCA webinars, CottonInfo webinars and further visits

to AWM meetings by industry entomologists Paul Grundy and Jamie Hopkinson.”

In the Macquarie Valley earlier this year, flow on effects from the grants led to the largest field day on record, looking at how growers can take advantage of ag technology, remote sensing and the Internet of Things (IoT) to create smart farms.

At the beginning of the 2018-2019 season the Macquarie Cotton Growers Association (MCGA) put in a CRDC Grassroots Grant application, with the aim to learn more about “this smart farm stuff”. As a result, local CottonInfo REO Amanda Thomas, along with locals Stu Denston, Sinclair Steele and Tim Gainsford travelled to an automation field day at Griffith.

“We saw some great technology and innovation with some farms that can fully automate irrigation,” Amanda said.

“We knew we were a few steps behind that, but it gave a guide on where we needed to start, as well as seeing the end goal in action.

“We took what we’d learned back to the Macquarie with the aim of trialling a suite of tools on farm and getting a grower’s honest view of technology.”

The on-farm trial used LoRaWAN gateway with sensors for fuel and water tank monitoring, soil probes, an AWS weather station along with channel water level, canopy temperature and MACE meter sensors. LoRaWAN gateways are designed to capture and send small packets of sensor data on a low frequency in an energy efficient way. Currently there are seven in the Macquarie valley with two more on the way.

Stu was a part of the trial, managing three farms with some distance between them. Having the sensors in place now means he can have information every 15 minutes on water and diesel levels.

“It has been great with monitoring our bore water tank that feeds our cattle troughs, especially in hot, dry weather – I need to know there is an issue as soon as possible, not when the tank runs dry.

“Giving farm staff access to this info has helped immensely, especially in storms situations. To know the pump is still going without have to drive through the mud at 4am is a game changer.

“I have been able to have workers spraying and running irrigation channels at the same time; this would not be possible without the sensors in place.”

The MCGA decided to hold a field day at “Karamea” near Gin Gin to showcase this technology and offer the “remote management experience” from the growers’ point of view.

“During the field day we got to see the technology from the perspective of what the grower can see on their phone and computer, then we did a farm tour to show it in action on the farm,” Amanda said.

“To date it was the most well attended field day



ANDREW PHILIP

we have ever hosted, with around 112 people.

“This showed us that there are many who are sitting on the fence waiting for others to trial this technology before they commit to it.”

Amanda and Stu say the Grassroots Grants have been a valuable part of Macquarie cotton growers learning about smart farm technology.

Stu says one of the most attractive things about the grants is that they “support us to trial with little or no risk to the grower”.

“The feedback is that other growers are interested in learning from other growers as well as the traditional extension methods or a sales pitch from commercial partners,” he said.

“Feedback has told us that practice change is more likely if we have seen things being used in a ‘real farm’ situation that we can relate to.

“We also have the opportunity to have further input into developing the tools based on the grower experiences and preferences for the next stages of development.”

“We are very thankful to CRDC for this great initiative and hope it continues into the future”.

“It’s not just about how to grow cotton, but knowing what’s involved in terms of machinery, infrastructure and industry guidelines such as myBMP,” NT Farmers’ Andrew Philip says.

For more

Allan Williams

allan.williams@crdc.com.au

Applications for CRDC’s annual Grassroots Grants program open on 1 July, and close on 30 November. Applications are reviewed on a first-come first-served basis. All details, including the Guidelines for Applicants and the Grassroots Grants application forms, are available at www.crdc.com.au. Completed forms are to be submitted to research@crdc.com.au. Interested applicants are encouraged to discuss their project ideas with CRDC’s Acting General Manager of R&D Investment, Allan Williams.

All eyes on industry achievers

All eyes will be on Griffith this July as growers, researchers, agribusiness and industry representatives celebrate the amazing depth of talent and commitment of people in the Australian cotton industry.

The 2019 Australian Cotton Industry Awards recognise the industry's best and brightest and includes growers, researchers and industry members from across the country. Finalists were announced in May, and Cotton Australia CEO Adam Kay says each finalist has been recognised for the significant contribution they have made to a wide range of areas, including best practice farming, research and development, innovation and industry advocacy.

The finalists:

Bayer Grower of the Year

Tim Leifels & Katie Ledingham,
Alice Downs Farms Pty Ltd, Moree, NSW
Tom & Charm Arnott,
Fairfield Farming Co, Boggabilla, NSW
Ben & Kim Witham,
Mundoora Farming, Coleambally, NSW

AgriRisk High Achiever of the Year:

James Traill and Ashley Tunks,
One Tree Agriculture Pty Ltd, Warra, Qld
Craig Charters, Gabo Pastoral Co,
Quirindi, NSW
Stu & Fran Crawford, Crawford
Agriculture, Narromine, NSW

Adama Chris Lehmann Trust Young Cotton Achiever of the Year

Nick Beer, "Merrilong", Spring Ridge, NSW
Billy Browning, "Narramine Station",
Narromine, NSW
Murray Connor, Australian Food & Fibre
Moree, NSW

Cotton Seed Distributors Researcher of the Year

Dr Jamie Hopkinson –
QDAF, Toowoomba, QLD
Kieran O'Keeffe –
CottonInfo, Griffith, NSW
Dr Linda Smith – QDAF, Brisbane, QLD



Nick Beer

Billy Browning

Murray Connor

Get on down to Griffith

The awards evening promises to be a wonderful event full of anticipation and recognition.

"Griffith is a terrific destination for our awards," Sally said.

"Our evening is in full planning mode and we look forward to utilising local theming, music and photography services.

"Destination NSW have joined us to highlight everything 'local', with our menu celebrating the district's primary producers in both cuisine and beverages.

"The theme this year is simply 'white' and dress code is lounge.

"The evening format will enable some great networking opportunities, and we look forward to welcoming you on the night."

The gala event will be held at Griffith Exies on July 24, 2019 in conjunction with the Cotton Collective. Tickets are available on the Awards' website, from Griffith Exies or phoning (02) 6962 1211.

Event organisers and industry stalwarts Sally Knight and Lynda George are delighted with the call for nominations response. The awards judging panel has travelled to the finalists' originating regions to meet and assess each of the candidates. Cash prizes are on offer for the winners across all categories, with an additional research bursary for Researcher of the Year.

"The quality of nominations is testament to an innovative and constantly evolving industry," Sally said.

"The annual awards program is an important opportunity to recognise the

hardworking, innovative and dedicated members of our cotton industry and we have been delighted with the response."

Meanwhile nominations are still open for the 2019 Role of Honour recipient. Entries can be lodged via <http://www.australiancottonawards.com/roll-of-honour> and close Friday July 5, 2019.

For more

www.australiancottonawards.com



Ethics, professionalism and safety – all in the agronomist's toolbox

Looking at the behaviour of some sectors of the community, the media, and even some of our politicians, one would be forgiven for believing that ethics and professional standards have long gone out the window in Australia.

The term “it’s not personal – it’s just business” seems to be used as the universal excuse for poor choices and even poorer behaviour.

The news however, is good for those of us who still believe in a strong work ethic and professional standards – so too do your customers. The bar set low by others offers an easily opened window of business opportunity. All you need to do is set that bar high for your own operation and ensure it is maintained.

Behavioral theory tells us that our ethical values are strongly molded by our upbringing and the cultural experiences of our childhood.

It stands to reason then, that is not until someone makes their way to higher levels of schooling or even the workforce, that some of these well embedded moral guideposts (be they valid or not) might be questioned. These days, ethics is taught widely in Australian schools as part of the Australian Curriculum. These courses focus on teaching students the role of critical thinking in decision making and appreciating consequences.

Not all consequences however can be anticipated without the benefit of experience and hindsight. It is here that only the wisdom of mentors and a professional guiding hand can assist. Therefore continuing professional development and standards are paramount to anyone wishing to progress their career – including those in agriculture.

Crop Consultant’s Australia (CCA) is a not for profit organisation with the express purpose of promoting and enhancing crop consultancy as a profession. In doing so, members are offered a two-tiered level of membership, based on their experience and qualifications. In becoming a member of the CCA, a consultant subscribes to a strict code of conduct which has been developed and reviewed over the past thirty years to retain relevancy and consistency.

The CCA Code of Conduct presents members with a set of guidelines to ensure that they uphold the values of both their profession and the association. They are far from onerous but provide members with a guiding light in terms of professional practices and standards in their businesses and



CCA has a Code of Conduct to ensure members uphold the values of both their profession and the association.

expectations of their staff.

The 16-point document covers issues such as “maintaining the highest standards of honesty, integrity, service delivery and professional competence” through to “continual evaluation and monitoring of technical information.” CCA members can (and have been) disciplined in the past for breach of the Code, and as such, their clients can be assured that a membership with CCA brings with the highest standard of professionalism.

The Code also helps to guide the Association in the decision-making process regarding the types of training it provides on an annual basis. This year, at the CCA annual Seminar on June 20-21 in Narrabri, attendees will not just hear the latest in research updates and product development.

As a key aspect of professional business operations, CCA will be shining the light on practical WH&S in the paddock. Guest speaker Alex Thomas has a passion for positively influencing WH&S culture, specifically in rural sector. Alex’s business is not the average WH&S enterprise and CCA is fortunate to have Alex sharing her story and her wisdom with our attendees to help them take meaningful action in preventing work related illness and injury.

As always, CCA Seminars are offered at a heavily discounted price to members, and this year CCA has adopted a new system of membership renewal whereby new members can join at any time of the year and receive a full of year membership from the date of joining. Applications for membership can be made online, and the approval process (by the Board) is swift allowing new members to make the most of their membership discounts at Seminar time.

For more

www.cropconsultants.com.au

Addressing on-farm challenges: How do we make our managers?

Wee Waa cotton grower Daniel Kahl's struggle to fill management roles to help run his family's expanding business led him on a research tour of the world.

Daniel was awarded a Nuffield scholarship two years ago, with support from CRDC and Cotton Australia, with the aim of finding out how the cotton industry can better address an on-farm skills shortage in the middle management sector.

"The resolution of this issue is as multifaceted as the skills requirement of the 'missing middle,'" he says.

"What is important is the creation of a pathway that engages the next generation of farm managers at a young age and sets them on a trajectory towards a career in agriculture and farm management that will allow them to enjoy professional and personal development and provide the opportunity to build a career in agriculture without necessarily coming from a farming background.

"This will allow the agriculture industry to further build its capacity and not be hamstrung by a lack of human capital.

"Through the scholarship I found that this is not a problem unique to Australian agriculture and there are a number of initiatives around the world attempting to address the issue."

Daniel says an effective pathway in early secondary schooling would engage the students to consider where their food and fibre comes from, before giving those with an inclination towards agriculture a head start by setting them on a path towards gaining core skills and experience to begin their career.

The future of agriculture will be in "thinking jobs" as farms require employees with increasing levels of digital skills as well their traditional skill set.

"We need to change the way young people see agriculture and bridge the growing urban-rural divide, which impacts people's perceptions of farming and potential career prospects that someone with an interest in agriculture might place on the industry," Daniel says.

Daniel's thoughts line up with CRDC-supported research which found that farming's reputation tends to be one of low wages, long and inflexible working hours and few career development prospects and training opportunities: for those without any direct skin in the game and the opportunity to benefit from profitable businesses, this perception provides very little incentive for new entrants.

From his overseas study, Daniel suggests the development and adoption of teaching packages which use agriculture as the vehicle to deliver STEM subjects in schools on a national level. He says an outreach program to give students the opportunity to spend time on farm is an important factor in attracting people to the industry.

"We have some great existing models for school-based traineeships to provide young people with an interest in agriculture with a head-start on their careers and building necessary skills, which we could expand to start creating a more formalised training pathway and instilling importance on further education.

"We certainly need to better link farmers and potential new entrants, to provide a continued pathway from trainee to further training.

"Countries such as the Netherlands have found value in partnerships between vocational and tertiary educational institutions, tying further learning to hands-on experience, more readily accessible to more participants and streamlining the advancement of people to farm management positions.

"We should also make it easier to recognise agricultural skills by developing more targeted and specialised qualifications to measure them, while also bringing more achievable specialist learning to the farm."

The role of growers

While much of Daniel's learning is relevant to organisations such as Cotton Australia and CRDC, there are still ways for growers to train and encourage their middle managers. These include hosting secondary school students to farms; using former school networks; supporting vocational education training and gap year initiatives. Daniel says he would rather employ students over backpackers, as the latter do not contribute to improving long-term capacity in the industry.

"We'd rather be spending our time training potential future managers than backpackers," he said.

He says that growers must realise that if a student/trainee finds farming is not for them or they find employment elsewhere, that's okay.

"Not every trainee we have will necessarily want





to stay on farm – if even one in five trainees goes on to a career in our industry after a year with us, to me that’s a good outcome.

“One of our past trainees left us to start an assistant ginner’s job, which we totally supported, as they’re still in the industry and gaining valuable managerial experience they can take with them later: what’s important is that we’re providing opportunities for people to embark on a career path into agriculture and hopefully some choose farm management.”

They've hosted school-based trainees in the past, while at the moment they have three students working with them – one through the Cotton Australia Gap Year program and one each from TAS and PLC in Armidale.

"My brothers and I went to TAS and from that we've maintained connections and host a farm tour for TAS geography students and we've had students return for gap years or summer work," Daniel says.

"Two of them are considering taking another gap year to continue working and we often have gap students come back just for the summer to work or during other holidays.

"I'd encourage growers to consider whether they can provide opportunities in their business through a school-based traineeship or gap year.

"It will provide an opportunity for someone to begin on their career path as well as having the potential to develop into longer term employment, meaning growers will see a return on the investment and training they might otherwise spend each year on seasonal labour.

"It can be a win-win for both the grower and the trainee or student and ultimately will help to build greater depth in our industry."

CRDC R&D Manager Rachel Holloway said on behalf of the industry, CRDC would like to congratulate Daniel on his Nuffield report and encourage growers to continue to participate in this valuable scholarship program.

"Building adaptive capacity in the cotton industry is a key component of CRDC's current strategic plan and is the impetus behind supporting people like Daniel through the Nuffield Scholarship," she said.

"The opportunity to travel overseas and study an agricultural topic of your choice is a great one.

"These scholarships are designed to improve the knowledge of not just an individual, but an industry and agriculture more broadly.

"CRDC is taking important learnings from Daniel's work, with recommendations addressed through past and current CRDC-supported projects."

For more

www.nuffield.com.au/daniel-kahl/

CRDC's role in building capacity

In CRDC's new strategic plan (2018-2023) the *Building adaptive capacity of the cotton industry* goal has several important facets.

This strategic focus is key to helping the industry plan and manage the significant changes occurring in the industry due to rapid advances in technology; to minimise the disruption of climate variability; and to ensure the people in the industry have the skills to adapt to these changes.

The CRDC's 2018 Grower Survey revealed that 72 percent of growers who responded considered that 'skilled employees' had greater than 10 percent impact on the yield and quality of the 2018 cotton crop. The evidence of supporting 'staff development' is fundamental in ensuring a skilled and capable workforce.

"The cotton industry has invested in social research expertise and these researchers are leading the way in future workforce research, technological advances, community resilience and our social licence to farm," R&D manager Rachel Holloway says.

"We have also supported a number of programs to strengthen the industry's collective knowledge and leadership skills."

There are several projects focused on understanding and improving on-farm skill development.

The *Understanding and planning future workforce* project will provide an understanding of the demand and supply of future skills and training needed

"The cotton industry has invested in social research expertise and these researchers are leading the way in future workforce research."

by on-farm supervisors and next-gen workers. Industry researchers Gordon Stone and Jeff Coutts will deliver their final report this year into measuring and reporting the value of capacity building on farms and research to improve workforce capability. They will provide case studies and extension tools to further develop resources for managers and staff on cotton farms.

CSIRO's Trudy Staines has been a vital conduit for the cotton industry to the education sphere and students. Her CRDC project continues to ensure the industry engages with graduates at university field days, promoting the industry and communicating through education conferences the need to increase the capability in cotton sciences. In collaboration with Cotton Australia, Trudy chairs the Capability Steering Committee who meet to enable a pipeline of development from primary school, high school and graduate engagement to ensure the cotton industry increases capability within the cotton industry.

CRDC supports training and leadership opportunities for growers, researchers, graduates and industry stakeholders through: the Nuffield Australia Farming Scholarship, the Future Cotton Leaders Program, UNE's Cotton Production Course, the Australian Rural Leadership Program and CRDC's Grassroots Grants. Cotton Australia provides for increasing skills and capacity through support of AgriSkills, Peter Cullen Trust, Young Farming Champions, the Australian Rural Leadership Program and the Gap Year initiative.

For more

CRDC Strategic RD&E Plan 2018-23

www.crdc.com.au/publications/crdc-strategic-plan

Making their way into agriculture

The Kahls have three young people working with them this year: Indi, Sarah and Luke. None of them had previous experience with cotton farming, and they're loving the experience.

When *Spotlight* turns up to interview them, Indi's just jumped off a laser bucket, while Sarah and Luke have been out spraying.

Indi and Sarah are taking a gap year, while Luke is still unsure whether he'll pursue tertiary education, or return to his family's farm.

Interestingly, all three agree that farming isn't easy to get into if you don't have contacts already in the game.

"It's hard to get into farming without being in it, if you don't have connections," Indi says. "It's not that easy to get someone to give you a go".

Luke and Sarah both agree, having made their connection with the Kahls by word of mouth through fellow students who had also worked for them during gap years.

They say there is a difference between 'just working' and being trained, with new skills to take forward. At Merced, Daniel says it's important for his current farm managers to not just give direction on 'how' to do a task, but also explain 'why'. Everyone agrees this makes you pay more attention to the task at hand, especially to the finer details and understanding what the end goal is.

Daniel said the 'gappies' as they are affectionately known, bring enthusiasm and energy to the outfit, and from a managerial perspective, it is rewarding to see them improve skills and maturity.

Having only left school last year, it's a big step for young people to move to an entirely new area to work, but they all say they it's a great experience and the Kahls and the community have been really welcoming, which is important to them. As Indi says "if you don't enjoy it, the quality of work goes down".

Sarah and Luke knew a few people locally through school, but Indi didn't know a soul. Now she's playing rugby, along with Luke, for the Narrabri Blue Boars, while Sarah has found a new team to support!



Indi Harcombe, Vic Kahl, Luke Vagg and Sarah Vivers with Daniel Kahl.

Sarah:

Sarah she's not from a farming background; Sarah finished year 12 at PLC last year and her family live just outside Armidale. Extended family who are farming have been her main point of contact for agriculture prior to coming to Merced. Now she's hooked. Planning to study ag science or agribusiness, she really wants a rural life. On her first day on the job, she drove an excavator and now she loves it, having racked up around 100 hours and filling her with a sense of accomplishment doing something she never thought she would. In fact she is enjoying it so much she's considering working for another year or studying externally.

"I absolutely love the hands-on skills aspect. If you are going to study ag-related subjects at uni and aren't from a farming background, this experience gives you a greater understanding of farming, what it entails and what farmers go through, for example drought.

"You can only understand something so much without actually experiencing it yourself."

Indi:

From a mixed farming background at Orange, Indi is passionate about ag, from working outside to R&D. Indi is a part of Cotton Australia's Gap Year program. With a clear plan for her future, initially she wanted to go ringing in the Northern Territory. However, seeing a facebook post about the gap year program and the willingness of the cotton industry to take her on changed those plans.

Through vocational training in Year 12 Indi completed a Certificate III in

Agriculture. This year, she is undertaking a Diploma in Agriculture through Tocal which will knock a year off her ag production management degree she will study next year. It's being able to work outside while also studying that appeals to this farmer.

"I love thinking outside the box, and I was running some small trials back home looking at soil amelioration and a few other things and would like to continue that type of work down the track.

"I've learned that it's important to pay attention to the small things and finer details, to fix something before it becomes a problem."

Luke:

Luke finished at TAS last year and says while he's had farming and machinery operation experience, it has been good to learn about a different sector of farming. His family has heavy earthmoving equipment and also run sheep and goats on their Ivanhoe property. This is the first time he's been involved in intensive broad scale farming. Taking on responsibilities and learning new skills related to cotton farming and management are all things he will take back to his own farm, should he go that way.

"There are lots of crossover skills, the way they manage here will help me manage people later on.

"I heard about the Kahls through a friend at school who had come out, and it sounded like something I also would like to do.

"I think word of mouth is important and if other schools get a couple of students out onto cotton farms, others will follow."

DNA may hold key to difficult pest detection

University of Queensland research scientist Dr Dean Brookes will use his CRDC-supported 2019 Science and Innovation Award to focus on scanning irrigation water for DNA left behind by pests and pathogens on cotton farms. The research offers a potentially new way to identify pests or pathogens that are often difficult to find and therefore monitor.

In late February, Dean was awarded a Department of Agriculture and Water Resources and ABARES Science and Innovation Award, supported CRDC. This innovative thinker's inspiration for the winning project comes during his PhD research into the cotton pest green vegetable bug, which was proving difficult to find in the field during drought.

"I knew the bugs were there, but they can be hard to find," he said.

"It got me thinking about different ways of tracking pest species without having to actually spot them.

"DNA of various organisms is sitting in the field, in the soil and on plant material.

"As irrigation water runs through the field it's going to collect a lot of that material and – depending on the organism – we might be able to detect it by filtering the water for their DNA."

This DNA is known as environmental DNA (eDNA). Finding it has proven popular in conservation biology as a highly-sensitive way of detecting organisms.

The most common use is in river systems where researchers take a sample of water to look at fish species diversity. It's a great way to get information about the diversity of organisms that are in an environment.

The approach could also be used to complement traditional pest and disease surveys.

"It gives you a sense of the industry as a whole, where you fit into it and why the work you're doing has value."

The project will start with two species; silverleaf whitefly and reniform nematode, in a proof-of-concept study. If successful, the highly-sensitive technology could one day also be used as a surveillance method to help identify and contain biosecurity incursions before they can devastate the industry.

Path to success

Dean's Science and Innovation Award comes on the back of a continued relationship with cotton industry research organisations and industry bodies. He's been involved with several initiatives supported by CRDC.

Dean was a CRDC PhD candidate studying green vegetable bug (GVB) ecology (see next article). He attended the World Cotton Research Conference in Brazil to present his PhD research on a separate CRDC study tour.

"The presentation was an opportunity to gain experience in presenting at international conferences, as well as gain exposure for my research in a forum of global experts," Dean says.

"Through this interaction I also intended to make connections with other cotton researchers who may have experience with GVB and as well as other insect pests of cotton.

"I visited Brazilian academic Professor Antonio Panizzi of the Brazilian Agricultural Research Corporation, as he has worked and published extensively on these pests in Brazil for decades. This presented a unique opportunity to gain insights into GVB and other sucking pests from a leading expert in this field."

Dean was chosen to participate in the



Dr Dean Brookes is making an impact on how pests are located and managed, thanks to industry support.

Australian Future Cotton Leaders program last year, which is supported by CRDC and Cotton Australia.

"The support that the cotton industry has provided to me over the years has helped my professional development immensely and I doubt I would be where I am now without those opportunities and the conversations I've had because of them," he said.

"Everyone in the cotton industry is always happy to speak about what they do and shown interest in the research I've been doing.

"It gives you a sense of the industry as a whole, where you fit into it and why the work you're doing has value."

More recently, Dean has been working on CRDC's contribution to the Australian Government's Rural R&D for Profit project *Improving Plant Pest Management through Cross Industry Deployment of Smart Sensor, Diagnostics and Forecasting* and the development of iMapPESTS technology (see article page 21).



Dean found that green vegetable bug populations came from two different evolutionary lineages, with each having its own distinct region of habitation.

Improving knowledge of an emerging pest

The green vegetable bug, *Nezara viridula*, has recently become a more significant pest of Australian cotton.

This led CRDC to support PhD research to find out more about green vegetable bug (GVB), its hosts, movement around cotton regions and the relationship between global populations of this pest. This type of research gives scientists the necessary information by which the industry can formulate effective, sustainable management plans for this pest.

Dr Dean Brookes of The University of Queensland undertook the research as part of his PhD study, completing the three-year project in 2018.

GVB samples were collected from northern and eastern Australia from a variety of weed and crop hosts, with an emphasis on cotton. Abundance was low during the project due to dry conditions, but about 800 adult insects were collected. Dean found that the populations came from two different evolutionary lineages, with each having its own distinct region of habitation.

“The genetic structure of eastern Australian populations indicates that these bugs do not disperse large

distances, over at least one year. This means that the GVB found in cotton come from host plants locally, rather than moving large distances into cotton like the green mirid.

“This genetic differentiation between their populations shows that they remain relatively localised in the short term. This means their abundance is a local problem, and so the plants they feed on will need to be investigated independently for each of the cotton growing regions, or at least where weed and crop hosts, as well as climatic conditions, differ significantly.

“Pest pressure was low for the duration of the project and so this pattern may be different during seasons when these bugs are present in high numbers. In years of high abundance host plants might be found between growing regions and allow for the recruitment of GVB over a wider area.

“I also found that GVB came into Australia from two places, one lineage that arrived with Europeans sometime since 1788, and another from Asia at

some unknown time. There may be differences between the two that are important for cotton pest management but this still needs to be tested.

“The Asian lineage is found across northern Australia and the European across most of the east coast, but the two have mated when they came into contact, probably in North Queensland.

“If cotton is grown regularly in northern Australia then we may need to treat the GVB populations there as a separate entity, as there may be significant differences in their biology which could affect their host use and abundance in cotton.”

Dean says future research that addresses the host use of GVB should investigate populations from each cotton growing region independently, as local conditions, such as the crop and weed host plants used by GVB each season before cotton becomes attractive, will be the most relevant to late season numbers of this insect in cotton.

For more

Dr Dean Brookes

dean.brookes@uqconnect.edu.au



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