



FINAL REPORT 2017

For Public Release

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: CRDC1621

Project Title: Regional weed management workshops for growers and their advisers

Project Commencement Date: 01/03/2015 Project Completion Date: 30/09/2017

CRDC Research Program: 1 Farmers

Part 2 – Contact Details

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Date Submitted: _____

Part 3 – Final Report

(The points below are to be used as a guideline when completing your final report.)

Background

1. Outline the background to the project.

Sustainable weed management in cotton farming systems is critical to the long-term production of profitable, high yielding cotton crops. The introduction of Roundup® Ready cotton in 2000 has seen a major shift in weed management in cotton, with greatly increased reliance on glyphosate for weed control, frequently at the expense of diversity in the cotton weed management program.

Roundup Ready cotton provides growers with a number of advantages, including:

- Earlier planting opportunity, with less time dedicated to weed management between spring weed emergence and planting
- Control of weeds which were previously more ‘difficult’ to control e.g. nutgrass
- Less crop yield impact from residual herbicides
- Reduction in the use of chipping and interrow cultivation
- More simple and ‘easy’ weed management program.

In parallel with and prior to the adoption of Roundup Ready crops, many cotton and adjoining paddocks and farms were also increasing their reliance on glyphosate with the conversion to zero till management in the non-cotton phase and/or prior to establishing cotton.

The high reliance of glyphosate has seen three major trends:

- Species shift towards surface germinating weeds in no-till farming
- Species shift towards weeds with higher levels of tolerance to glyphosate
- Selection of weeds resistant to glyphosate.

An increasing number of cotton growers are experiencing glyphosate control ‘failures’ on certain weeds on parts of their farms. Through travel, some growers have also been exposed to the glyphosate resistance issues (Palmer Amaranth in particular) currently being experienced in North American cotton systems.

This has increased the level of urgency to address the lack of diversity in weed management. As a reflection of this demand, ICAN has recently been approached by a number of cotton advisers to assist them in facilitating discussions on increasing diversity in weed management processes with their cotton grower clients.

Objectives

2. List the project objectives and the extent to which these have been achieved, with reference to the Milestones and Performance indicators.

This project aims to increase industry capacity to manage weeds in cotton systems, in response to increasing herbicide resistance/species shift. The project has delivered 21 regionally adapted training workshops for growers and their advisers. Workshops addressed weed management issues in the cotton industry and assisted participants to identify weed risks to their business from herbicide resistance and/or

species shift and to develop management strategies to delay or manage the onset of resistance.

The project has also built consultant capacity through two weed management Masterclasses conducted in Goondiwindi and Griffith in June 2016. A weed management / herbicide resistance concurrent segment was also delivered within the 2016 Cotton Conference.

Project objective 1: Increase grower weed management capacity

Milestone 1.1: Deliver a series of one day workshops targeted to cotton growers and advisers during Autumn & Winter 2016.

Performance indicator 1.1: 14 Regional weed management workshops delivered and post workshop feedback provided to CRDC.

Fourteen workshops were conducted in the period between picking and sowing (May and August) 2016 and post workshop feedback provided to CRDC.

Milestone 1.2: Deliver a series of one day workshops targeted to cotton growers and advisers Autumn & Winter 2017

Performance indicator 1.2: 7 Regional weed management workshops delivered and post workshop feedback provided to CRDC

Seven workshops were conducted in winter 2017. A detailed report summarising all workshops has been produced and provided to CRDC separate to this report.

Milestone 1.3: Develop & deliver Cotton Conference Masterclass - Weed Management in Cotton as part of 2016 Cotton Conference agenda.

Performance indicator 1.3: Cotton conference event delivered

A two hour concurrent session was developed and delivered at the 2016 Cotton Conference, consisting of a series of grower and researcher presentations followed by a 45 minute panel Q&A session.

Project objective 2: Increase consultant/agronomist weed management capacity

Milestone 2.1: Weed Management in Cotton – Agronomy Masterclass

Performance indicator 2.1: 2 consultant Masterclass's delivered and post workshop feedback provided to CRDC

Two weeds MasterClasses were conducted in the period between picking and sowing (May and August) 2016, located in Goondiwindi and Griffith. Highlights and outcomes were reported to CRDC in September 2106.

Project objective 3: Reporting

All reporting progress reports and this final report were delivered to CRDC according to the milestone schedule.

Methods

3. Detail the methodology and justify the methodology used. Include any discoveries in methods that may benefit other related research.

1. Regional weed management workshops

- Format:** 1-day classroom workshop
Target: Cotton growers and their agronomists.
When: First round of workshops commenced in May 2016 (Emerald), with the remainder of the workshops delivered during Winter 2016 & Winter 2017. Timing was discussed with local CottonInfo RDOs to help align with local priorities.
Presenters: Two ICAN facilitators/presenters per meeting (John Cameron, Mark Congreve). 1 or 2 local weeds researchers were engaged as appropriate (primarily Jeff Werth, Graham Charles or Eric Koetz).

Delivery was highly interactive, discussion and activity based, with some lecture component. The workshops linked with CottonInfo and used existing cotton communications to promote workshops. Significant focus was on how information is to be applied and adapted to local farming systems, with participants engaged in developing and discussing their own tailored management response in a farming systems context.

Reporting: Post-workshop feedback was collected and reported to CRDC

2. Weed Management in Cotton – Agronomy Masterclass

- Format:** 1-day classroom workshop
Target: Consultants
When: Two workshops were conducted, with dates and locations determined in association with CRDC and the CottonInfo team.

The focus and scope of these training days was developed in conjunction with CRDC and CCA, & promoted through the CCA and CRDC.

3. Weed Management in Cotton – 2016 Cotton conference

A 2-hour concurrent session “Outrunning Herbicide Resistance” was developed for the 2016 Cotton Conference. ICAN developed the agenda in conjunction with Guy Roth and John (Cowboy) Cameron, with John (ICAN) Cameron facilitating the session. Format consisted of presentation from Steve Madden; Ryan Pratten; Dr Christopher Preston; Jeff Werth and Tristan Perez. Followed by Three Minute Theses and a Q&A panel discussion.

Results

- 4. Detail and discuss the results for each objective including the statistical analysis of results.**

Project objective 1: Increase grower weed management capacity

Milestone 1.1: Deliver a series of one day workshops targeted to cotton growers and advisers during Autumn & Winter 2016.

Locations, number of attendees and dates are listed in the table below. A detailed report has been provided to the CRDC separate from this report.

Cotton workshop	Date	Number of attendees	Average rating# (1-5 where 1=poor and 5=excellent)
Emerald	Tuesday 31 May 2016	10	4.2
Warren	Thursday 9 June 2016	15	4.5
Narromine	Friday 10 June 2016	16	4.4
Hillston	Tuesday 28 June 2016	17	4.6
Hay	Wednesday 29 June 2016	13	4.9
Darlington Point	Thursday 30 June 2016	15	4.6
St George	Tuesday 12 July 2016	25	4.6
Goondiwindi	Wednesday 13 July 2016	13	4.5
Dalby	Thursday 14 July 2016	13	4.4
Pittsworth	Friday 15 July 2016	24	4.5
Moree	Tuesday 23 August 2016	15	4.2
Wee Waa	Wednesday 24 August 2016	16	4.4
Boggabri	Thursday 25 August 2016	18	4.3
Spring Ridge	Friday 26 August 2016	19	4.6

Milestone 1.2: Deliver a series of one day workshops targeted to cotton growers and advisers Autumn & Winter 2017

Seven workshops were conducted in winter 2017. Locations, number of attendees, dates and overall rating of workshop is shown in the table below. A detailed report has been provided to the CRDC separate from this report.

Cotton workshop	Date	Number of attendees	Average rating (1-5 where 1=poor and 5=excellent)
Dalby (second workshop)	Tuesday 11 July 2017	15	4.5
Chinchilla	Wednesday 12 July 2017	7	4.75
Talwood	Thursday 13 July 2017	12	5.0
Rowena	Tuesday 1 August 2017	11	4.6
Pallamallawa	Wednesday 2 August 2017	13	4.9
Bellata	Thursday 3 August 2017	15	4.4
Gunnedah	Friday 4 August 2017	19	4.7

Milestone 1.3: Develop & deliver Cotton Conference Masterclass - Weed Management in Cotton as part of 2016 Cotton Conference agenda.

A two-hour concurrent session was developed and delivered at the 2016 Cotton Conference, consisting of a series of grower and researcher presentations followed by a 45 minute panel Q&A session.

Project objective 2: Increase consultant/agronomist weed management capacity

Milestone 2.1: Weed Management in Cotton – Agronomy Masterclass

Locations, number of attendees and dates are shown in the table below. A detailed report has been provided to the CRDC separate from this report.

Cotton MasterClass	Date	Number of attendees	Average rating (1-5 where 1=poor and 5=excellent)
Goondiwindi	Tuesday 2 June 2016	56	4.4
Griffith	Tuesday 7 June 2016	42	4.3

Project objective 3: Reporting

All reporting progress reports and this final report were delivered to CRDC according to the milestone schedule.

Outcomes

5. Describe how the project’s outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

This was an extension project, however required the primary presenters/researchers to compile research from other projects in a format suitable for delivery to growers/consultants.

The industry outcome of this project was for growers and consultants to have capacity to implement IWM in cotton systems, including sustainable and best possible economic management of herbicide resistant and difficult to control weeds.

Through these workshops and masterclasses, a broad cross section of the industry are now better equipped to consider a broader cross section of integrated weed management options when managing their weeds to increase diversity of weed management; consider how these different tactics would impact their individual farming system; and understand the long term importance of using multiple weed management methods.

6. Please describe any:-

- a) **technical advances achieved (e.g. commercially significant developments, patents applied for or granted licenses, etc.);**
- b) **other information developed from research (e.g. discoveries in methodology, equipment design, etc.); and**
- c) **required changes to the Intellectual Property register.**

Please refer to report “Report workshop feedback and issues-incl 2017 Workshops-final.pdf” (provided to CRDC September 2017) for additional learnings and future research questions arising from the series of workshops.

Conclusion

7. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. What are the take home messages?

The series of grower workshops highlighted the continued heavy reliance placed on glyphosate by many cotton growers. The large majority of growers attending the workshops left with a higher level of understanding of the need to introduce additional diversity into their weed control strategies, and a number of potential solutions of how to achieve this. Workshop exit surveys suggest that there is a relatively high level of commitment to practice change from the majority of attendees.

For the broader cotton industry, the extension message around herbicide resistance needs to continue, as many growers attending the workshops appeared to underestimate the significance of the problem they are facing. In addition, the cohort of growers who didn't attend a workshop, are likely to be less engaged with these issues.

The workshops raised many questions from participants. Many of these were addressed during the workshops, however there are a number of issues require additional research or investment. Issues requiring further research or extension have been provided to CRDC for consideration in the detailed report provided to the CRDC which is separate to this report.

Key take home messages for growers and advisers were summarised as:

- greater diversity in weed management practices are required to delay the onset of herbicide resistance. This includes the use of a greater diversity of pre-and post-emergent herbicides as well as the inclusion of non-herbicide based tactics in the farming system
- management focus should be on stopping weed seed set via use of a more diverse range of weed management tactics
- when herbicide resistance occurs or is suspected to have occurred, testing should be conducted to evaluate what herbicide management strategies still work on that population.

Extension Opportunities

8. Detail a plan for the activities or other steps that may be taken:

- (a) to further develop or to exploit the project technology.**
- (b) for the future presentation and dissemination of the project outcomes.**
- (c) for future research.**

Please refer to report "Report workshop feedback and issues-incl 2017 Workshops-final.pdf" (provided to CRDC September 2017) for additional extension activities recommended and future research questions arising from the series of workshops.

Key extension opportunities include: (More detail can be found in the report detailed above)

- generation of relevant fact sheets, particularly surrounding the use of pre-emergent herbicides both prior to sowing and in crop as well as the use of non-herbicide options in crop
- plan and execute a coordinated communications plan targeted at 2+2+0, with messages scheduled appropriate the time of season and Valley
- develop a series of short three minute videos on key aspects of weed management in cotton systems, with particular emphasis on the use of pre-emergent herbicides at sowing and in crop. Other topics have also been nominated in the referenced more detailed report.

9. A. List the publications arising from the research project and/or a publication plan.
(NB: Where possible, please provide a copy of any publication/s)

B. Have you developed any online resources and what is the website address?

Not applicable

Part 4 – Final Report Executive Summary

Provide a one page Summary of your research that is not commercial in confidence, and that can be published on the World Wide Web. Explain the main outcomes of the research and provide contact details for more information. It is important that the Executive Summary highlights concisely the key outputs from the project and, when they are adopted, what this will mean to the cotton industry.

Regional weed management workshops for growers and their advisers

Twenty-one, one-day workshops targeted to cotton growers and consultants, and two one-day MasterClasses, targeted to consultants, were conducted from May 2016 to August 2017. Other project activity included input into the design and delivery of a weeds concurrent session at the 2016 Cotton Conference.

Locations of workshops were targeted by CRDC and ICAN, in conjunction with CottonInfo and the CCA, to cover the major cotton growing areas.

419 people attended the series, of which 98 were at the MasterClasses and 321 at the workshops.

Participant response was overwhelmingly positive, with feedback **averaging 4.6 at the workshops**, and **4.35 at the MasterClasses**, out of a possible 5 (5 being the highest).

Of those providing feedback, **100% indicated** that the **workshop would help with decisions in the field**.

MasterClass speakers	Grower workshop speakers
Jeff Werth, DAF QLD	Jeff Werth, DAF QLD
Graham Charles, NSW DPI	Graham Charles, NSW DPI
Andrew Somerville, Jubilee Consulting	Mark Congreve, ICAN
Tristan Perez, Queensland University of Technology	John Cameron, ICAN
David Thornby, Innokas Intellectual Services	Eric Koetz, NSW DPI
Graham Brodie, University of Melbourne	
Mark Congreve, ICAN	
John Cameron, ICAN	
Susan Maas, CRDC, CottonInfo	
Ian Taylor, CRDC	

Workshop overview

The increasing incidence of weeds that cannot be controlled with glyphosate is forcing a re-think on the range and diversity of weed management tactics used in Australian cotton production systems. The workshop agenda covered the topics that Australian cotton growers and their consultants need to be across to help drive weed seedbanks down.

Top 3 most valuable components of the workshops

- Pre-emergent herbicides & residuals
- Weed management strategies
- Networking

Top 3 weeds causing management problems

- Fleabane (x 114)
- Feathertop Rhodes grass (x 62)
- Rye grass (x 46)

Top 3 areas where additional information is sought

- Better understanding of residual herbicides – including yield impact, managing damage, plant backs to cotton, what to use where and when?
- Extension – application & set up for non-glyphosate options / farm hygiene / channel management / farming systems
- Herbicide resistance – levels / testing

MasterClass overview

The Masterclasses were specially targeted at cotton consultants. The objective was to discuss how consultants should lead clients to embrace diversity in cotton weed management tactics. Over reliance on one weed management tool is a recipe for herbicide resistant weeds. Greater diversity in weed management and a management focus on reducing the weed seedbank every season are the solutions.

Top 2 most valuable components of the masterclass

- Discussion on pre-emergent herbicides / residuals
- Networking

Top 3 weeds causing management problems

Griffith

- Ryegrass (x 14)
- Barnyard grass (x 13)
- Fleabane (x 13)

Goondiwindi

- Red pigweed
- Ipomoea spp.
- Volunteer cotton
- Feathertop Rhodes grass (especially in dryland)
- Glyphosate resistant awnless barnyard grass (especially in dryland)

Top 3 areas where additional information is sought

- Extension of integrated weed control concepts to growers
- Residuals
- Grower knowledge – extension processes to improve grower understanding and motivation to change