Australian Government
Cotton Research and Development Corporation

FINAL REPORT 2016

For Public Release

Part 1 - Summary Details

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

CRDC Project Number: **CFEO1502**

Project Title: Economic and risk analysis for the Carbon Farming in the Australian Cotton Industry ERF EO Grant

Project Commencement Date: 01/07/2014 **Project Completion Date:** 05/04/2016

CRDC Research Program: 2 Industry

Part 2 – Contact Details

Administrator: Cara Brooks, Manager External Projects
Organisation: NSW Department of Primary Industries
Postal Address: Locked Bag 21
Orange NSW 2800
Ph: 02 6391 3651 **Fax:** 02 6391 3134 **E-mail:** external.funding@dpi.nsw.gov.au

Principal Researcher: Janine Powell, Economist (no longer employed by NSW DPI)
Organisation: NSW Department of Primary Industries
Postal Address: Australian Cotton Research Institute
21888 Kamilaroi Hwy
Narrabri NSW 2390
Ph: 02 6799 2469 **Fax:** 02 6799 1503 **E-mail:** janine.powell@dpi.nsw.gov.au

Supervisor: Fiona Scott, Senior Economist
Organisation: NSW Department of Primary Industries
Postal Address: Tamworth Agricultural Institute
4 Marsden Park Rd
Tamworth NSW 2340
Ph: 02 6763 1485 **Fax:** 02 6763 1222 **E-mail:** fiona.scott@dpi.nsw.gov.au

Signature of Research Provider Representative: _____

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.

In December 2012, CRDC successfully applied to the then Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) for a grant entitled "Carbon Farming in the Australian Cotton Industry" under the Carbon Farming Futures Extension and Outreach Program.

NSW Trade & Investment was listed on the grant application as a consortium partner and committed a project-funded research economist (Janine Powell) at 50% FTE for 2014-16. A letter of support from NSW Trade & Investment summarised the department's commitments as follows:

- Participate on the Reference panel (to meet annually).
- Provide economic supervision (in-kind) for the project-funded research economist.
- Provide the necessary research infrastructure for the project-funded research economist.

The aim of the economist was to conduct economic and risk analysis regarding the opportunities, benefits and risks involved in participating in the Australian Government's Emissions Reduction Fund (ERF) and implementing mitigation and sequestration practices. The ERF builds on the earlier Carbon Farming Initiative (CFI), which applied at the time of the grant application.

The economist was to work in accordance with the following objective in the Funding Deed between CRDC and DAFF: *Clarify to cotton industry participants the opportunities, benefits and trade-offs of participating in the ERF and/or implementing potential mitigation/sequestration options*. This was also objective 3 in the grant application.

Specific activities to be undertaken by the economist were:

- Economic and risk analysis to determine and cost the opportunities, benefits and risks involved in participating in the ERF and implementing mitigation and sequestration practices (activity 3.1 in the grant application). This activity was also to address improved input efficiencies such as nitrogen fertiliser and energy use savings (as per the agreed research proposal between CRDC and NSW DPI).
- Extension campaign to provide information and raise awareness about how the ERF specifically relates to cotton and grain farming systems, to promote the findings of the economic and risk analysis (activity 3.2 in the grant application).

The economic analysis was intended to have the following outcomes:

- Economic results integrated into cotton industry extension, best management practice (BMP) and adviser training materials.
- Demonstration of the value of improved input efficiency and emissions reductions from cotton and grain production systems.

Objectives

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

The relevant objective in the Funding Deed between CRDC and DAFF was: *Clarify to cotton industry participants the opportunities, benefits and trade-offs of participating in the ERF and/or implementing potential mitigation/sequestration options*.

The corresponding Key Performance Indicators for the economic analysis were:

- Economic model developed that is specifically tailored to cotton farming (by July 2015).
- Economic analysis of potentially relevant ERF methodologies undertaken for representative cotton farming scenarios (by July 2016).

The Key Performance Indicators have been met as outlined below.

Methods

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

The economic analysis involved a range of methods:

- Gross margin budgets for furrow irrigated cotton for owner operator and contracted operations for central and northern NSW and southern NSW for 2014-15 (see Milestone 3.1.2).
- Benefit-cost analysis of the social and economic benefits and costs of nitrogen (N) fertiliser use as a standalone practice and within a potential ERF project (see Milestones 3.1.3 and 3.1.4).
- Investment analysis of the viability of installing grid-connected solar panels to electric irrigation bore pumps (see Milestone 3.1.4).

Results

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

Milestone 3.1.1 Convene a working group. This group to determine opportunities, benefits and risks associated with practice changes.

The working group was convened and held regular face-to-face meetings and teleconferences to discuss new and developing policy in relation to the ERF, carbon research and relevant areas of economic analysis. The membership was Jon Welsh, Fiona Scott, Francois Visser and Angela Bradburn (Cotton Australia).

The working group supported the preparation of six factsheets outlining the opportunities, benefits and risks for cotton growers participating in the ERF by Jon Welsh with input from NSW DPI. The factsheets were recently published on the CottonInfo website at http://www.cottoninfo.com.au/publications/carbon-cotton-and-emissions-reduction-fund. The titles of the factsheets are provided in Section 9.

Milestone 3.1.2 Review gross margin and whole farm costs and returns in cotton production to include variables in irrigation practices, region grown, contract farming rates and owner operator farming costs.

The costs associated with growing a cotton crop were reviewed using a consultative process with many industry experts and four gross margin budgets for 2014-15 were prepared. The budgets are published on the NSW DPI website at http://www.dpi.nsw.gov.au/content/agriculture/farm-business/budgets/cotton. The titles of the budgets are provided in Section 9.

The budgets have been provided to James Quinn (CSD) to develop an online, interactive cotton gross margin tool in conjunction with the CottonInfo team and industry partners. The tool will allow cotton growers to change the reference budget to reflect their own operations and costs.

Milestone 3.1.3 Establish an economic model for agreed N mitigation and energy

efficiencies applicable to the cotton industry. Technical working group to determine applicable actions.

Nitrogen mitigation and energy efficiencies were analysed using appropriate economic and modelling techniques. Results were published in the Australian Farm Business Management (AFBM) Journal (at http://www.agrifood.info/AFBM/2015/Welsh_et_al.pdf) and communicated to industry by webinar, meetings and at the Australian Rangelands Carbon Conference (see http://western.lls.nsw.gov.au/__data/assets/pdf_file/0004/576040/rangelands-carbon-conference-program-summary.pdf).

Milestone 3.1.4 Refine results of draft economic summary into a benefit-cost analysis or other appropriate analysis

Two benefit-cost analyses were undertaken. The first was an analysis of participation in the ERF using the N fertiliser method, which was published in the AFBM Journal (see Milestone 3.1.3). The second considered emissions abatement associated with the installation of solar-to-grid connected bore pumps, for which the draft report was handed to Jon Welsh on 26 April 2016 for completion. More details are provided in the November 2015 progress report.

Milestone 3.1.5 Provide advice to Dr Francois Visser (QUT) to refine Carbon Cotton Management tool to incorporate (i) financial modeling of farming practices in grain and cotton production and (ii) carbon stored by native vegetation

Advice was provided to Francois Visser regarding his Carbon Cotton Management tool. Information on fertiliser, diesel, cotton lint and cotton seed pricing was provided for specific locations.

Milestone 3.2.1 Promote the findings of the economic analysis

As highlighted for Milestones 3.1.3 and 3.1.4, the economic analysis of the N fertiliser method developed for the ERF has been published in the AFBM Journal. Results were presented in a CottonInfo webinar (June 2015), at informal meetings with grower groups and representatives from the Department of the Environment at Narromine (August 2015) and at the Australian Rangelands Carbon Conference in Cobar (October 2015).

As highlighted for Milestone 3.1.1, extension material in the form of six ERF factsheets were prepared to ensure that key messages are communicated clearly to the cotton industry. The factsheets were recently published on the CottonInfo website.

Janine Powell and Jon Welsh met with the NSW Minister for Energy, Anthony Roberts, on 8 July 2015 on a cotton farm tour. They were invited to informally present their research on the feasibility of grid-connected solar installations for irrigation bore pumps to the Minister.

Jon Welsh presented interim results of the feasibility of hybrid diesel-driven generators and solar power to growers with Cotton Australia and the NSW Office of Environment and Heritage on 27 November and 4 December 2015.

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.

The project's outputs contribute to the intended outcomes presented in Section 1 as follows:

- Economic results integrated into cotton industry extension, best management practice (BMP) and adviser training materials:
  - As highlighted for Milestone 3.1.1, information for cotton growers on the opportunities, benefits and risks of participating in the ERF was recently published in six factsheets on the CottonInfo website.
- Demonstration of the value of improved input efficiency and emissions reductions from cotton and grain production systems.
  - As highlighted for Milestones 3.1.3 and 3.1.4, an economic analysis of the N fertiliser method developed for the ERF was published in the AFBM Journal. This showed that farmers applying N fertiliser at optimal crop requirement levels can reduce the carbon footprint of their cotton and achieve economic benefits at a crop enterprise level irrespective of ERF participation.

6. Please describe any:-

a) technical advances achieved (eg commercially significant developments, patents applied for or granted licenses, etc.);

No commercially significant developments etc. have arisen from this project.

b) other information developed from research (eg discoveries in methodology, equipment design, etc.); and

No discoveries etc. other than those described in other sections of this report.

c) required changes to the Intellectual Property register.

No changes required to the Intellectual Property register.

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?

Take home messages from the AFBM Journal paper highlighted for Milestones 3.1.3 and 3.1.4:

- Farmers applying N fertiliser at optimal crop requirement levels can reduce the carbon footprint of their cotton and achieve economic benefits at a crop enterprise level irrespective of ERF participation.
- An investigation of the viability for an avoided emissions project under a potential ERF method found significant economies of scale are required to offset high transaction and audit costs. A potential aggregation of ten farms in the lower Namoi resulted in a negative project return at the baseline ACCU price of $10 over the seven-year project life.

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.

As highlighted for Milestone 3.1.1, extension material in the form of six ERF factsheets were prepared to ensure that key messages are communicated clearly to the cotton industry. The factsheets were recently published on the CottonInfo website.

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)

- As highlighted for Milestones 3.1.3 and 3.1.4, the economic analysis of the N fertiliser method developed for the ERF was published in the AFBM Journal. The citation is:

  Welsh, J, Powell, J and Scott, F. (2015) *Optimising nitrogen fertiliser in high yielding irrigated cotton: A benefit-cost analysis and the feasibility of participation in the ERF*, Australian Farm Business Management (AFBM) Journal, Vol 12, pp51-69, http://www.agrifood.info/AFBM/2015/Welsh_et_al.pdf

- As highlighted for Milestone 3.1.1, extension material in the form of six ERF factsheets were recently published on the CottonInfo website at http://www.cottoninfo.com.au/publications/carbon-cotton-and-emissions-reduction-fund. Their titles are:
  - Opportunities for the Australian cotton industry to participate in the ERF
  - Fertiliser use efficiency in the irrigated cotton method (and opportunities to participate)
  - Industrial electricity and fuel efficiency method (and opportunities to participate)
  - Forestation method (and opportunities to participate)
  - Native vegetation regrowth method (and opportunities to participate)
  - Soil carbon sequestration method (and opportunities to participate)

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

- As highlighted for Milestone 3.1.2, four cotton gross margin budgets for 2014-15 were published on the NSW DPI website at http://www.dpi.nsw.gov.au/content/agriculture/farm-business/budgets/cotton.
  The budgets are:
  - Furrow Irrigated Bt cotton, Central & Northern NSW (owner operator)
  - Furrow Irrigated Bt cotton, Central & Northern NSW (all farming operations contracted)
  - Furrow Irrigated Bt cotton, Southern NSW (owner operator)
  - Furrow Irrigated Bt cotton, Southern NSW (all farming operations contracted)

- As highlighted for Milestone 3.1.1, extension material in the form of six ERF factsheets were recently published on the CottonInfo website at http://www.cottoninfo.com.au/publications/carbon-cotton-and-emissions-reduction-fund. Their titles are as per 9A above.

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.

An investigation of the viability for an avoided emissions project under a potential Emissions Reduction Fund (ERF) method found significant economies of scale are required to offset current high transaction and audit costs. A potential aggregation of ten farms in the lower Namoi resulted in a negative project return at the baseline Australian Carbon Credit Unit (ACCU) price of $10 over the seven-year project life. However, such a project could become more viable in the future if ERF participation transaction and audit costs are reduced and/or the ACCU price increases to more suitable levels.

Farmers applying nitrogen fertiliser at optimal crop requirement levels can reduce the carbon footprint of their cotton and achieve economic benefits at a crop enterprise level irrespective of ERF participation. Using a nitrogen budgeting approach, and therefore applying nitrogen fertiliser at optimal levels over a large area through repeated crop cycles, can offer savings when compared to an application above maximum yield requirements.

Six factsheets outlining the opportunities, benefits and risks for cotton growers interested in participating in the ERF have been published at http://www.cottoninfo.com.au/publications/carbon-cotton-and-emissions-reduction-fund

Four irrigated cotton gross margin budgets for 2014-15 were published on the NSW Department of Primary Industries (DPI) website at http://www.dpi.nsw.gov.au/content/agriculture/farm-business/budgets/cotton.

For more information please contact Jon Welsh, Technical Specialist, Cotton Info Team, 0458 215 335.