Cotton
RESEARCH & DEVELOPMENT

Final Report

Project Code Dan 168C
Cotton Industry Development Officer - Gunnedah

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January, August & Final Reports

REPORTS

Part 1 - Summary Details

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

CRDC Project Number: **DAN168C**

January Report:	☐	Due 29-Jan-02
August Report:	☐	Due 02-Aug-02
Final Report:	☒	Due within 3 months of project completion

Project Title: Cotton Industry Development Officer - Gunnedah

Project Commencement Date: 1-7-02 **Project Completion Date:** 30-6-03

Research Program: Technology Transfer and Extension

Part 2 – Contact Details

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Signature of Research Provider Representative: _____

Part 3.3 – Final Reports (due 3 months after completion of project)

(The points below are to be used as a guideline when completing your final report. Postgraduates please note the instructions outlined at the end of this Section.)

Introduction:

This project was to be a 3 year term. However, in August 2002, the CRC IPM training coordinator left his position creating a vacancy. I took this opportunity and I acted in the role of the training coordinator while still for filling the IDO role in Gunnedah. The cotton extension management committee, nominated the role of IPM training coordinator has having the higher priority. Therefore, some of the objectives for the IDO position were not started in the first year of the project.

1. Outline the background to the project.

Broad extension activities

This project was a continuation of the previous Cotton Industry Development Officer position at Gunnedah, (project DAN144C).

The position of Industry Development Officer (IDO) of Gunnedah is part of the National Extension Team. This position has been successful in increasing technology adoption by local growers. As well as playing a role in national extension activity, the position also has worked with local growers and consultants to develop extension programs focusing on local production issues.

Large scale farm trials / demonstrations form a critical component of extension activities. The promotion of BMP to growers and the local community are also key components of this position. The position provides strong links between growers, consultants and researchers.

The position is pivotal to the promotion of IPM systems within the Upper Namoi. During the last 3 years the position has assisted in the development of a number of area wide management groups. This work included the use of comparative analysis techniques to help group member examine their farming practises. The further development of area wide management groups should be a key component of any future projects within the valley.

During the 2002-03 season Mark Hickman was the leader of the Farming systems focus team. This team has been involved in a number of national programs including, UNR cotton, Pix® management, pupae management and crop rotation selection.

Specific focused project: Sustainable nitrogen management in stubble retention systems

Stubble management

Over the last three years there has been an increase in the number of growers using minimum tillage stubble management strategies for cotton production. Benefits from planting cotton into standing stubble include, improved seedling growth, reduced impact from cold shock, reduced pest infestations, reduced pesticide runoff and improved fallow efficiency (WUE). Despite these benefits there are also a number of management problems that remain unsolved. One if these is fertiliser application and management. Investigation of practical nitrogen (N) management began at the commencement of this project. This involved the establishment of two sites, one (+/-) stubble VS conventional and the second site was a conventional site. At both sites the nitrogen rates varied from nil strips to excessive rates.

Minimizing Nitrogen Losses

Nitrogen recovery rates are generally less than 50% of applied nitrogen. Cotton crops recover about 33% of N applied on average: about 25 % remains in the soil at crop maturity, however, in an unavailable form (organic). The remainder of the N applied (that is 42% of N applied) is assumed lost from the system.

It is not uncommon to see growers apply more than 200kg/ha of nitrogen. This means that approximately 100kg/ha N is lost from the system. Denitrification is recognized as a key method by which nitrogen can be loss from the farming system, however there is also the potential for excessive nitrogen to be lost by leaching through the soil beyond the root zone.

Research conducted by Ian Rochester showed that in unsaturated heavy clay soil leaching of nitrogen is minimal. However, recent data reported from farming systems trials by Nilantha Hulugalle indicate that up to 200 kg/ha N may be leached from the soil. In a nitrogen fertiliser trial conducted in the Upper Namoi valley during 1999/2000, considerable rates of nitrogen lost due leaching were detected.

Leaching of nitrogen beyond the root zone not only represents a direct loss in income to growers but can also have a significant environmental impact over the long term. This includes an increase in nitrogen of ground and surface water.

There is limited knowledge of the extent of nitrogen leaching under high nitrogen application rates and across different soil types and application methods (timing of applications). It was initially thought that minimum tillage systems would reduce the potential leaching of nitrate nitrogen however; recent research indicates a different outcome. Leaching of nitrate-N under standing stubble treatments were higher than leaching found under a conventional tillage system.

In a focused project, the extent of nitrogen leaching will be examined across key cotton soils. This will be done by regularly sampling selected commercial cotton fields. A specific trial will be established on a commercial field where a minimum tillage stubble retention system has been deployed. At this site different fertiliser application strategies will be examined that aim to minimise nitrogen loss by leaching.

2. List the project objectives and the extent to which these have been achieved.

Projects aims have been divided into general extension activities and the specific nitrogen management trials.

General extension

Assist in developing national extension programs

As part of the Farming systems national focus team, I help develop and implement a series of limited water workshops for irrigated cotton across a variety of cotton production valleys. The valleys included Dalby, Bourke, Gunnedah, Hillston, Moree , Trangie and Narrabri. A total of 150 growers attended these workshops. The workshop incorporated information on the implications of different irrigation management strategies. The decision support model, Ozcot was used to help determine potential outcomes from various management options.

Develop extension priorities with local growers and consultants and link/adapt national extension activities into local.

A planning meeting was held with the local research and development committee. At this meeting a local work plan was developed which included the national priorities where appropriate.

Implement programs with promote the adoption of IPM, particularly for insect control and resistance management for both conventional and transgenic technology.

Programs that were commenced include the collection of heliothis eggs from local crops. The assessment of heliothis eggs for Trigagramma infection also occurred. This activity was promoting the need to use soft chemistry within the valley. In addition, it address the concern that these parasitoids did not reside in the Upper Namoi Valley. Area wide group activities such as recording and disseminating the beneficial insect counts on a weekly basis also assisted in the implementation of IPM activities in both transgenic and conventional cotton.

Assist in the delivery of IPM short course and establishment / ongoing development of Grower Support Groups. (Incorporating IPM and BMP)

A total of six IPM short course were completed . Of the 66 participants that started the course, 79% achieved accreditation in the competency of “plan and implement long term disease, pest and weed control.” My main focus on area wide grower groups was focused on the Harparary area. This group were the most activity and therefore drew most of my attention.

Co-ordinate the collection of egg samples from the local district for resistance testing
This is an on going activity. The 2002-03 season was a low pressure season, making egg collections very hard to complete. As an IDO I acted as the coordination person for the valley. Once the eggs were at my office I would arrange for these to be sent to the appropriate researchers for testing.

Assist in implementation of BMP particularly for insect pest management and water management
Little to no activity in this area, except through my involvement with the IPM Short Course.

Conduct a number of field days to promote SOILpak decision support system (DSS).
No soilpak days conducted. Ozcot was used extensively in the limited water workshops for irrigated cotton. A handful of CottonLOGIC setup enquires were also handled.

Conduct a number of field days to promote SPRAYpak decision support system.
Not achieved.

Promote the use of other DSS's to growers and consultants. This will include the OzCot model.
Refer to activities associated with the Limited water Workshop with irrigated cotton.

Produce a trial booklet detailing local trial results.
The complication of trial results did commence, however there is a lot of analysing and reporting to be done.

Distribute a local grower newsletter on a frequent basis, which promotes research results on current production issues.
The publications of Cottontales and "Whats Happening in R and D" were used to complete this objective. Due to limited time, only 4 cottontales were produced, and 1 growers magazine article on local R and D activities.

<u>Specific projects to be investigated within the district.</u>

- **Promote joint Area Wide Management Strategies within multi-cropping areas of the district (Cotton)**

On going process. For the 1st year of this new project, one area wide group (Harparary) was focused on due to time commitments to other tasks.

- **Identify herbicide damage symptoms in cotton resulting from off target drift of non-cotton herbicide.**

This project has been completed. Results need to be complied into extension material for the cotton Industry. This will be a collaborative effort with Andrew Storrie from NSW

Agriculture Tamworth. The format of this extension material is still to be confirmed. Some information is planned to be provided in Weedpak.

- **Water Use efficiency in minimal tillage (standing stubble) systems.**

Not achieved

- **Promote novel tools for IPM systems in the Upper Namoi.**

Not achieved

Nitrogen Management

Objectives Year 1:

- **Establish a trial comparing the level of nitrogen leaching in conventionally prepared and minimal tillage systems (standing stubble).**
  One site with a standing stubble combination was established and monitoring had commenced in the 2002-03. Numerous teething problems developed with this program. Problems ranged from faults with soil coring equipment to the sites being to high in chloride causing analytical problems with the desired nitrate test.

- **Establish three satellite trial sites on different soil types. One site will be in the Upper**
  Namoi with other sites selected in other districts. These sites will be monitored for nitrate leaching and used for field days.
  No satellite sites were established. Due to the above mention problems.

- **Examine the impact of split applications of nitrogen on nitrate leaching.**
  One site was established in a conventional field at Carroll. Monitoring via soil core samples was conducted and samples are in storage waiting analysis.

3. Detail the methodology and justify the methodology used.

Trigagramma Assessment:

Heliothis eggs were collected from sorghum crops grown within the Upper Namoi Valley. Heads of sorghum plants were hand spun to remove eggs. These eggs were then placed directly into plastic wells and covered for hatching. Once the eggs hatched, the wells were assessed for contents. Any trigramma were sent to Brad Scholz for species identification.

Nitrate Leaching

Soil cores were taken from small nil strips, and within other nitrogen plots. Samples were taken at pre field 2002-03 nitrogen applications, directly post sowing and post harvest. There was seven depths (0-180cm+) per core were taken . These samples where then ground, extracted and placed in a frozen state for future analysis.

Beneficial Insect register.

Weekly results of beneficial insect counts were submitted to me from the Harparary growers as part of an activity under taken by this area wide group. An average value for

each farm was submitted. These results were disseminated to all members to increase grower confidence in IPM systems being implemented.

4. Detail and discuss the results including the statistical analysis of results.

Heliothis eggs collected from sorghum crops across the Upper Namoi indicate an average of 53.6 % for viable eggs being infected with trigagramma. Samples were collected during sorghum flowering in January 2003. The range was 23-91% of viable eggs being infected. On average each infected egg produced 2.2 wasps. On analysis the dominant species was *trichogramma pretiosum,* which has been the released species on the Downs. This is a significant result for a valley that believed they did not exist.

Soil nitrate results are not available, however samples are in cold storage waiting analysis. This is a project that will continue under the guidance of local IDO Penny Van Dogan and Mark Hickman.

Beneficial counts averaged across the district were generally low. An average figure of 1.6 beneficial insects per metre was recorded consistently during the months of January and February. This result while low still generated confidence within the growers that the IPM system within the valley was worthwhile.

Limited water workshops generated much interest and were a timely program to conduct. Evaluations from the workshop (49 of possible 150) indicated many participants changed their pre workshop strategies as a result of the workshop to handle the limited water situation. Also, 75% of responses indicated they would use an irrigation-scheduling tool like Ozcot to help with irrigation decisions.

5. **Provide a conclusion as to research outcomes compared with objectives. What are the "take home messages"?**

The "take home messages" from these seasons activities include the following. Grower confidence in IPM systems is slowly increasing. Growers that are involved in area wide groups are especially benefiting. This increased confidence will only be encouraged by data indicating the potential trigagramma infection that is possible in the Upper Namoi. Overall it is hard to draw to many conclusions since this was only 1 year in a 3 year project.

6. Detail how your research has addressed the Corporation's three Outputs - Economic, Environmental and Social?

The positions of IDO for Gunnedah contribute to all three of these corporate outputs with extension programs incorporating both national and local issues. In addition the Gunnedah IDO role has an intricate relationship with the CRC Farming System Focus team.

7. Provide a summary of the project ensuring the following areas are addressed:

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

B other information developed from research (eg discoveries in methodology, equipment design, etc.) are changes to the Intellectual Property register required?
All of the above are not applicable.

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.

Project has ceased, therefore no more activities are planned under this project.

9. **List the publications arising from the research project and/or a publication plan.**

PRESENTATIONS AND PUBLIC RELATIONS

McIntyre, G., Pyke, B., Hickman, M., Shaw, G., Gibb, D., Dugdale, H., Delaney, K., 'Cotton Industry Benchmarking Study 2001- A Review', 11th ACGRA Australian Cotton Conference, 13th –15th August 2002, Brisbane Queensland, pp75-82.

Hickman, M., Storrie, A., and Cook, T., 'The Effects of Simulated Herbicide Drift On Cotton Growth,' 11th ACGRA Australian Cotton Conference, 13th –15th August 2002, Brisbane Queensland, pp127-132.

Dalton, W, McIntyre G.T., Gibb, D., Hickman, M.,and Kauter, G., 'Australian Cotton Cooperative Research Centre IPM Short Course – An Industry Learning Together', Third World Research Cotton Conference, 10th – 14th March 2003 Capetown, South Africa, (proceedings in print).

Gibb,D., Hickman, M., and Macpherson, I.,'Monitoring Fruiting Factors As A Tool In Insect Management', Third World Research Cotton Conference, 10th – 14th March 2003 Capetown, South Africa, (proceedings in print).

Hickman, M., Storrie, A., and Cook, T., 'Impact On Yield When Simulating Herbicide Drift Onto A Commercial Cotton Field', Third World Research Cotton Conference, 10th – 14th March 2003 Capetown, South Africa, (proceedings in print).

Seminars, Workshops & Trade Shows:

Hickman, M.A., Dalton, W., 2002, Emerald IPM Short Course (Components 1-4), 9th July 2002 – 7th May 2003, Emerald.

Hickman, M.A., Dalton, W., 2002, Goondiwindi IPM Short Course (Components 1-4), 29th October 2002 – 28th May 2003, Goondiwindi.

Hickman, M.A., Dalton, W.,2002, Moree IPM Short Course (Components 1-4), 7th August 2002 – 15th May 2003, Moree.

Hickman, M.A., 2002, Mungindi IPM Short Course (Components 1-4), 29th October 2002 – 16th May 2003, Mungindi.

Hickman, M.A., 2002, St George IPM Short Course (Components 1-4), 30th July 2002 – 29th May 2003, St George.

Hickman, M.A., 2002, Wee Waa IPM Short Course (Components 1-4), 29th October 2002 – 30th May 2003, Wee Waa.

Media interviews:
Hickman, M.A, 2002, Australian Cotton CRC IPM Short Course, Rangemedia Publishing Company, Video Interview , November , Gunnedah NSW.

Hickman, M.A, 2003, Moree IPM Short Course Promotion, 2VM Radio Interview, May, Moree NSW

10. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. Where possible include a statement of the costs and potential benefits to the Australian cotton industry or the Australian community.

The impact of the IDO position is accumulative over time. The Gunnedah IDO position provides local growers with advice and technical knowledge that increases management practice adoption and confidence in topics such as IPM. It is impossible to separate out a direct impact from the individual position in terms of the overall impact on the Australian Cotton industry. Rather it is a contributing member towards the national program of the Australian Cotton CRC extension team. Expect this position incorporates national issues and in particularly addresses local Upper Namoi issues.

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.

This is the final report for project DAN168C. This project ceased after 1 year of operation. Mark Hickman was the IDO for the Upper Namoi, however Mark moved into the position of IPM training coordinator with the department of primary industries, based at Toowoomba. Hence why this final report outlines some objectives being achieved.

While Mark was the IDO for the Upper Namoi it provided a mechanism for the Upper Namoi Cotton Grower Association to identify research and extension needs at both a local and national level. The IDO, is responsible for conducting farm demonstrations to improve the adoption new technology and management practices by local cotton growers.

The IDO position had a continued focus on the area of integrated pest management (IPM) and area wide insect management (AWM). Growers groups improve the level of communication between neighbours and consultants and this has facilitated a reduction in the use of pesticides by growers in a regional by providing increased confidence.

Mark was able to document a significant level of trigagramma activity in the sorghum crops of the Upper Namoi. He was able to foster and further develop the confidence in IPM through his involvement with the local area wide Harparay group.

In addition to the local Upper Namoi commitments Mark was the CRC Extension Team Leader for the Farming System focus group. While in that capacity Mark help develop and deliver a series of information workshops on limited water strategies in irrigated cotton. This was a successful; the workshop that featured in seven production valleys and a total of 150 attending growers.

Special project: Nitrogen Management and minimum tillage

This project aimed at clarifying the degree to which nitrogen is lost in cotton production due to leaching of nitrate beyond the root zone. This involved assessing losses under different soil types and stubble management practices. Recent research has highlighted a disturbing picture with significant nitrate leaching occurring the minimal tillage systems. Leaching associated with conventionally and minimal tillage (standing stubble) systems were compared. In addition, an assessment of nitrogen loss under a ‘once off’ or ‘split application’ was also assessed.