FINAL REPORT

CRDC ID: DAN2001

Project Title: Supporting Southern cotton production

Confidential or for public release? For Public Release

Recognition of support: The Research Provider NSW Department of Primary Industries (NSW DPI) acknowledges the financial assistance of the Cotton Research and Development Corporation in order to undertake this project.

Part 1 – Contact Details & Submission Checklist

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Part 2 - Monitoring & Evaluation

Achievement against milestones in the Full Research Proposal

Milestone	Achieved/ Partially Achieved/ Not Achieved	Explanation
1. Outcome: Annual project management		
1.1 Develop and present annual project plan to CRDC • Identify local issues emerged from previous year through networks of growers, consultants and other researchers • Fill research gaps in collaboration with CottonInfo Prepare trial plans incorporating these emerging issues	Achieved	Research gaps were identified yearly with R&D workshops in conjunction with CottonInfo, growers and consultants as well as communications with other cotton researchers from other regions of Australia. Experiments were thoughtfully designed between seasons to address the identified issues.
1.2 Mid-season progress report	Achieved	Verbal update with CRDC R&D manager (Susan Maas/Elsie Hudson) due to the timing of mid-season reports being too early to have much to report other than crops and trials have been planted.
1.3 End of season written progress report	Achieved	Written reports completed by researchers on the project (Hayden Petty/Beth Shakeshaft/Tim Green) and submitted formally to CRDC.
1.4 Southern R&D workshop hosted in conjunction with CottonInfo	Achieved	R&D workshop hosted at NSW DPI's Yanco Agricultural Institute yearly: 2022, 15 September, 18 participants. 2021, online pre-recorded videos (Covid-19 prevented physical meeting). 2020, online pre-recorded videos (Covid-19 prevented physical meeting). 2019, 14 August, 10 presenters.
1.5 Develop and present annual project plan to CRDC • Identify local issues emerged from previous year through networks of growers, consultants and other researchers • Fill research gaps in collaboration with CottonInfo	Achieved	Research gaps were identified yearly with R&D workshops in conjunction with CottonInfo, growers and consultants as well as communications with other cotton researchers from other regions of Australia. Experiments were thoughtfully

Prepare trial plans incorporating these emerging issues		designed between seasons to address the identified issues.
1.6 Mid-season progress report	Achieved	Verbal update with CRDC R&D manager (Susan Maas/Elsie Hudson) due to the timing of mid-season reports being too early to have much to report other than crops and trials have been planted.
1.7 Southern R&D workshop hosted in conjunction with CottonInfo	Achieved (was held a month later than planned due to the Cotton Conference being on the Gold Coast in August).	R&D workshop hosted at NSW DPI's Yanco Agricultural Institute yearly: 2022, 15 September, 18 participants.
1.8 Final report on the management and evaluation of factors that influence cotton production in the southern valleys	Achieved	See Technical Report
2. Research Question: Does having regionally based technical crop protection expertise improve IPDM outcomes?		
2.1 CottonInfo Pathology Technical Lead	Achieved	Tim Green appointed CottonInfo disease technical lead (January 2019-June 2020) replaced by Beth Shakeshaft (October 2020-June 2022)
2.2 Coordinate FUSCOM meetings	Achieved	2021, 10 December. Online due to Covid-19 restrictions. 2020, 12 November. Held online due to Covid-19 restrictions. 2019, 30 October. Held in conjunction with the Association of Australian Cotton Scientists research conference in Armidale.
3. Research Question: What are the key pathology issues that will impact productivity in cool, high yielding regions such as the southern regions on NSW?		
3.1 Liaise with plant pathologists at ACRI to oversee field evaluations of novel products to manage cotton diseases in southern region	Achieved	3 iterations of a field experiments to evaluate the efficacy of novel products on black root rot and Alternaria leaf spot (separately) conducted over 3 seasons.
3.2 Pathology research for Southern cotton	Achieved	Pathology research included sensitivity of Alternaria to Tebuconazole and fusarium seedling disease symptoms
3.3 Conduct both early and late season disease surveys in	Achieved	Disease surveys completed with Duy Le and Kieran

collaboration with ACRI based pathologists and the CottonInfo representative in southern NSW		O'Keefe in approximately 15 fields across the Southern valleys each early and late season.
4. Research question: What new IPM tactics or enhancements to existing IPM practices will lead to a reduction in broadspectrum insecticide use?		
4.1 Liaise with other entomologists to replicate compensation work from the north (mirid damage trials)	Achieved	Replications of Paul Grundy's compensation from mirid damage work was facilitated in the South by the NSW DPI cotton research team.
4.2 Liaise with CRDC to evaluate novel products to test efficacy against wireworms and early season thrips	Achieved	The first 2years of the project this was done in conjunction with the novel products for black root rot however in the third year it was facilitated in a fully replicated small plot experiment.
5. Research question: Does early season insecticides flare later season pests?		
5.1 Monitor fields for late season pest build up	Achieved	In-season monitoring of whitefly and mirids was conducted and correlated with the number and timing of insecticide applications throughout the season.
6. Research question: What agronomic practices can be implemented to improve yields in southern NSW?		
6.1 At least 3 research trials to be conducted either on site at NSW DPI Leeton Field Station or on commercial grower's farms in collaboration with CottonInfo, CSIRO and QDAF	Achieved	The following experiments were conducted in this project: 2019-20: Plant hormone; Variety x planting date; Establishment. 2020-21: Plant hormone; Anti-transpirant; Defoliation. 2021-22: Plant hormone; Anti-transpirant; P & K fertiliser.
6.2 Conduct on farm monitoring of commercial crops to identify growth and development habits under different management within southern valleys	Achieved	The retrospective micronaire survey has been used to assess the impact of various management practices on both yield and micronaire within the southern valleys.
6.3 Contribute to the Consultant and Grower extension documents through CottonInfo and Spotlight articles and/or through conference proceedings at the Australian Cotton Conference	Achieved	2019 Australian Cotton Production Manual, Chapter 6 and Chapter 15 reviewed and edited by Hayden Petty. 2020 Australian Cotton Production Manual, Chapter 6 reviewed and edited by Hayden Petty.

or the Australian Association of Cotton Scientists Conference		2021 Australian Cotton Production Manual reviewed and edited by Hayden Petty.
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6.6 Contribute to the Consultant and Grower extension documents through CottonInfo and Spotlight articles and/or through conference proceedings at the Australian Cotton Conference or the Australian Association of Cotton Scientists Conference	Achieved	2019 Australian Cotton Production Manual, Chapter 6 and Chapter 15 reviewed and edited by Hayden Petty. 2020 Australian Cotton Production Manual, Chapter 6 reviewed and edited by Hayden Petty. 2021 Australian Cotton Production Manual reviewed and edited by Hayden Petty.

Outputs produced

Output	Description
Reports	Detailed technical reports for each experiment where produced each year and submitted to CRDC as part of formal project progress reporting. These reports are listed in the appendices of Part 3 of the Final Report (Attachment 1: Part 3 – Technical Report) and the full reports are included for CRDC's records in Final Report Attachment 2: Technical Report Appendices).
Publications	Two research papers (variety × planting date experiment and plant hormone experiment) published in NSW DPI flagship publication Southern NSW research results 2021. Copies of these publications have been submitted with the report. Spotlight 2020, '*Cover crops in grain and cotton farming systems*' (H. Petty). Contributions to the following publications: Australian Cotton Production Manual (2022, Ch6 (H. Petty), Ch13 (B. Shakeshaft); 2021, Ch6 (H. Petty), Ch13 (B. Shakeshaft); 2020, Ch6 (H. Petty), Ch13 (T. Green), Ch15 (H. Petty))

	Cotton Pest Management Guide (2022-23, Diseases (B. Shakeshaft), 2021-22, Diseases (B. Shakeshaft), 2020-21, Diseases (T. Green)
Presentations	2019: R&D Workshop, '*2019 Agronomy Update*' (H. Petty) and '*YAI Research Update- Crop Protection*' (T. Green) Cotton Collective, Forbes Soil Health Workshop, (T. Green) 2020: High School Students Day, '*Common diseases and pests of cotton in the South',* (T. Green & A. Young) NSW DPI Cotton Field Day, '*DPI Cotton Field Day 2020 Agronomy Trials*' (H. Petty) Virtual FUSCOM 2020, '*2020 Southern cotton crop protection regional trial update*', (A. Young) 2021: NSW DPI Cotton Field Day, '*Field day handout*' (H. Petty, B. Shakeshaft and others) Virtual R&D Workshop, '*Zappa Trap*', (A. Young), '*SLW survey*', (A. Young), '*Plant hormone experiment*', (G. Panazzolo)
Extension resources and services	Two CottonInfo Fact Sheets (Alternaria Leaf Spot and Verticillium Wilt) published on www.cottoninfo.com.au. Copies have been submitted with the report. CottonInfo Youtube video, '*Post-harvest management of Fusarium Wilt*', (B. Shakeshaft), 2021 Contributions to CottonInfo e-news emails (B. Shakeshaft and T. Green), 2019-2022
Training and learning programs	Beth Shakeshaft: Graduate Certificate in Mathematics (CSU) Operate tractors and implements (Tocal) Hayden Petty: Cotton Production Course (UNE) Tim Green: Cotton Production Course (UNE)

Outcomes from project outputs

Outcome	Description
Extension services and training accessed	Alison Young assisted in the facilitation of the Integrated Pest Management course held at Total College (Yanco) in 2021. Contributions by Beth Shakeshaft and Tim Green to CottonInfo e-news as Disease Technical Lead. Contributions by Beth Shakeshaft, Hayden Petty and Tim Green to the Australian Cotton Production Manual and Cotton Pest Management Guide.
Increased knowledge about practices and products	The use of gibberellic acid (GA3) 10 days before first square appears to increase lint yield in a normal season. Three novel products tested showed some level of black root rot disease reduction in southern systems. Ideal planting window was determined to be late September-mid October with a yield loss of 64% when planted after the last week of October irrespective of variety.

	Permitted fungicide use improves the visual score of Alternaria leaf spot and may increase micronaire. Some high levels of imitated insect damage significantly reduced yield in the southern valleys, contradicting the replicated work from more northern areas, likely due to the shorter season length in the south. A relatively small study showed no reduced sensitivity of *Alternaria* sp isolates to tebuconazole in the southern valleys. Very weak correlation between isolate sensitivity and number/rate of tebuconazole applications in crop. The study should be continued over future years to monitor the situation. A retrospective survey correlating micronaire with management has identified some practices that may significantly impact micronaire. This study has led to a new project (DAN2306) and has been used to design field experiments to test the management practices.

Summary for public release

Project title:	*Error! Reference source not found.*	
Project details:	CRDC project ID:	***Error! Reference source not found.***
	CRDC goal:	*1. Increase productivity and profitability on cotton farms*
	CRDC key focus area:	*1.1 Optimised farming systems*
	Principal researcher:	***Error! Reference source not found.*** *Whiting (Leader Pulse and Oilseeds)*
	Organisation:	***Error! Reference source not found.***
	Start date:	*July 2019*
	End date:	*June 2022*
Objectives	• This project aimed to increase productivity and profitability of southern cotton farms by optimising southern farming systems. • To identify crop management practices to optimise yield and mitigate risk. • To explore novel management techniques to combat disease pressure specific to southern NSW. • To maintain cotton researchers dedicated to southern NSW with the capacity to address emerging and relevant research gaps.	
Background	The cotton industry has a long history of supporting research including cotton agronomy research. The research teams that developed cotton agronomic guidelines have primarily worked in northern NSW and southern Queensland, based at ACRI at Narrabri and Toowoomba. The extensive cotton agronomic knowledge is captured in the Australian Cotton Production manuals, a range of factsheets and online tools (MyBMP), as well as published in project final reports and peer reviewed journals. Northern research teams, particularly the cotton plant pathologists and cotton breeders have research activities annually in the south but they are limited with the frequency of visits and intensity of experiments. Many collaborate with local commercial and CSD agronomists, the southern CottonInfo officer and NSW DPI researchers to conduct experiments in the south. When research is not the primary focus of the collaborator it can make it difficult to get the quality and level of detailed data required.	

	This project employed a team of cotton researchers based at NSW DPI's Yanco Agricultural Institute focusing directly on agronomic and crop protection issues affecting cotton production in southern NSW.
Research activities	The agronomy component conducted designed and observational experiments on and off-site to investigate various management practices to optimise yield and quality. Experiments included plant growth regulators, fertilisers, planting dates and establishment tactics, anti-transpirants and cover cropping. The crop protection component conducted designed and observational experiments on and off-site to investigate new and emerging disease management practices, monitoring local pest pressure and laboratory experiments.
Outputs	Detailed technical reports are available for all experiments conducted throughout the project. Extension materials have been published and distributed through CottonInfo networks to the wider industry. Local R&D workshops to discuss research results and future research direction have been held annually throughout the project.
Impacts	Some key management practices to increase productivity have been identified. The planting window has been identified as late-September to Mid-October with significant yield loss observed after the last week of October. Plant growth hormones can be applied to increase yield in a season of 'typical' length. Some fungicides have also been identified as effective at reducing disease symptoms of black root rot and Alternaria leaf spot, however yield and quality results have not been determined. The retrospective micronaire study has identified some management practices that may significantly impact micronaire. This has been used to design experiments in a new project (DAN2306).
Key publications	**Southern NSW research results papers** • Petty H, Panazzolo G and Troldahl D 2021. Influence of sowing date and variety selection of growth and development of Cotton – Yanco 2019–20, T Moore, D Slinger and C Martin (eds) *Southern NSW research results 2021,* NSW Department or Primary Industries, pp. 72–79. • Petty H, Panazzolo G and Troldahl D 2021. Applying plant growth hormones during early season developmental stages to increase cotton yield potential in southern NSW – Yanco 2019–20, T Moore, D Slinger and C Martin (eds) *Southern NSW research results 2021,* NSW Department or Primary Industries, pp. 80–83.