CRDC

FINAL REPORT

CRDC ID: CSP1903

Project Title: Science Leadership for cotton in northern Australia

Part 1 – Contact Details & Submission Checklist

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Part 3 – Technical Report

Executive Summary

The title of this project "Science leadership for cotton development in Northern Australia" required technical support for new cotton industries across a huge (1/3 of Australia) new and different region, climatically, biologically and culturally. As anyone associated with cotton in Australia knows since the end of 2019 investment and test farming of cotton in the tropical north was massive. To be efficient and effective in this environment with a small team this project has minimised overlap with other cotton projects, delivered resources and information collated from past northern cotton and relevant other broad acre crop R&D, entered into partnerships with local agencies / farmer groups e.g. CRCNA collaboration in the NT. Flexibility to address new issues was required e.g. the partnership with Vanderfield, CSD and the CRCNA project to address establishment challenges with rain grown cotton. From the onset assisting local technical skill development was a key activity, this encompassed research, crop monitoring and crop management and natural resources (suitable soils).

1. Delivery of resources and past information
Two industry publications were written in late 2019 early 2020 and distributed and supported by workshops during 2020, the 'Northern Newsletter' and one to one (information support and publications section). The aim being to focus the wave of new growers on the known but unique challenges for growing wet season cotton, that is reliable crop establishment, planting date, suitable soils, nitrogen, growth regulator and pest management. These activities were very effective for rain grow growers as the majority have attempted and persisted with zero tillage into uniform soil mulch cover with the knowledge farm level tailoring is required. Delivery of information and resources continued for the life of the project, although often hamstrung by COVID-19 restrictions.

2. Field research
Four activities are reported here. "NT rain grown cotton suitability, model calibration, validation and application" and "Monitoring of commercial cottonfields 2019/20 wet season" were planned from the onset. The "Cotton Row Spacing Comparisons 2020 & 2021 (rain grown) and " Maximising cotton seedling establishment in the Northern Territory 2021/2022" were in response to requests from growers and a serious problem for growers respectively.

NT rain grown cotton suitability, model calibration validation and application: Application of the locally validation OZCOT-APSIM model simulated cotton yields at 5 locations on 3 well drained cropping soils for 65 seasons. Key Findings: Locating soils with high availability of water to cotton is critical, the simulated yield loss of 14 to 26% for the soils with lower PAWC at Tipperary, Douglas Daly and Katherine is undesirable. Timely planting significantly increased median yield, with yield penalties of 17 to 40% for late planting (≥ 15 Jan) at all sites and soils. Sufficient mulch cover at planting to prevent drying of the seed slot, high soil temperatures and crusting was critical to crop establishment.

Monitoring of commercial cotton fields: 3 rain-grown and 3 irrigated cotton fields were monitored in the Douglas Daly – Tipperary region. Root penetration was very deep in Oolloo soils 230 to 300 cm and 180 to 240 cm in Tippera soils. Applying a significant proportion of N fertiliser in-crop by mid flowering was a successful strategy as there was no evidence in any field of soil nitrate accumulation below 150 to 210 cm due to the deep roots. Data from these sites was used for model validation and soil characterization.

Rain grown row spacing comparisons: When sown later, 7 and 25 January ,there was no yield benefit from rows wider than 1m. While 0.5 m rows matured 14 and 10 days earlier the small yield increase and weed suppression in 2022 is unlikely to justify the additional cost of stripper picking.

Maximising Cotton Seedling Establishment 2022: A preliminary comparison of 5 planter configurations sown into recently sprayed vs killed soil cover confirmed the need future focus on mulch cover x planter set up x climate/soil scenarios.

=Part 4 – Summary for public release

Project title:	Science Leadership for cotton in northern Australia	
Project details:	CRDC project ID:	*CSP1903*
	CRDC goal:	*3. Build adaptive capacity of the cotton industry*
	CRDC key focus area:	*1.1 Optimised farming systems*
	Principal researcher:	Dr Stephen Yeates, Principal Research Scientist
	Organisation:	*CSIRO*
	Start date:	*01 October 2018*
	End date:	*30 September 2022*

Objectives	• To provide science leadership to support for cotton evaluation and expansion into northern Australia.
	• To enhance the technical skills base for northern cotton production.
	• To establish partnerships with local agencies and commercial investors to
	  1. build an understanding short and long term production and risks, identify key management practices and fine tune identification of suitable soil resources.
	  2. Responded to any emerging R&D issues.	

Background	Investor interest in cotton as a broadacre base crop in northern Australia is very high. This project builds on past R&D that initially addressed known biophysical challenges to irrigated cotton production in the tropics, such as sustainable pest management, preventing N losses during the wet season and management options to minimise the impact of extreme climatic events. There is a need to assess yield potential and climatic risk reflects the broad range of potential new regions and any proposed developments are based on the best available science for cotton. With rain grown cotton evaluated for the first time since the 1960's in much of northern Australia. A key question to guide industry development and to support the establishment of local gins is what the area of suitable soils in the various regions is, that can be developed for (rainfed) cotton, and the expected variability in annual production by region. A local technical skills base to support a northern cotton industry needs to be developed.	

Research activities	*Research activities were in two forms*
	  1. *Delivery of resources, past and new information to support to sport the new growers, consultants, research personal and government departments approving / supporting investments.*
	Activities: Industry publications, workshops, the northern newsletter (listed below) and 1 to 1 meetings.
	  2. *Targeted field research to address the known objectives and respond to new questions.*	

	Four activities were conducted "NT rain grown cotton suitability, model calibration, validation and application" and "Monitoring of commercial cottonfields 2019/20 wet season" were planned from the onset. The "Cotton Row Spacing Comparisons 2020 & 2021 (rain grown) and " Maximising cotton seedling establishment in the Northern Territory 2021/2022" were in response to requests from growers and a serious problem for growers respectively.
Outputs	*Reports, workshop slides / notes, other presentations and publications (see below). Future scientific papers.* NT rain grown cotton suitability modelling found: *S*oils with high availability of water to cotton is critical, the simulated yield loss of 14 to 26% for the soils with lower soil water. Timely planting significantly increased median yield, with yield penalties of 17 to 40% for planting after 15 January. A cotton suitability modelling paper for possible NT rain grown regions is planned.
Impacts	The need for zero tillage + protective soil mulch for reliable rain grown cotton establishment via workshops and collation of past information was very effective for new rain grow growers as the majority have attempted and persisted with zero tillage. For rain grown cotton: Awareness of the need to identify soils with greatest soil water, created by presentations of modelling study analysis. Seedling establishment studies confirmed the short term need for more research.
Key publications	Tropical Cotton Production: Considerations for Northern Cotton Growers (2020) – distributed by email and in www.acresofopportunity.com.au Yeates SJ and Poulton PL (2019). Determining Dryland cotton yield potential in the NT: Preliminary climate assessment and yield simulation. Report to NT Farmers Association, Queensland Cotton and the Cotton Research and Development Corporation. CSIRO Agriculture and Food. Distributed by email and in www.acresofopportunity.com.au Report for NT Farmers Association (Yeates SJ) "Dry season cotton near Adelaide River, Climatic considerations for dry season cotton", March 2019. Contributed to all additions of the Northern Newsletter - www.acresofopportunity.com.au Guide to cotton plant and soil measurements 2021. Compiled by Jenny Stanford, CSIRO, Townsville, Qld.