SCIENTIFIC EXCHANGE
Final Report

Part 1 - Summary Details

Cotton Catchment Communities CRC Project Number:

Project Title: Nicola Cottee attendance & presentation at the World Cotton Research Conference 5, Mumbai, India

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Part 2 – Contact Details

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1. What were the major findings, outcomes and highlights?

The impact of abiotic stress and hence the importance of incorporating stress tolerance into current conventional breeding programs was heavily emphasised at the WCRC 5. Although the majority of research presented was specifically concerned with water deficit, heat tolerance plays an integral role in drought tolerance and as such, the approaches and results from these projects are applicable to my own research. Sessions were focused not only the effects of abiotic stress on plant performance but also methods to detect tolerance to stress and hence integrate stress resilience into current cotton production systems. These issues were raised in sessions for drought and heat tolerance, crop improvement, climate change and adaptation, water balance, international cotton genome initiative and the biotechnology and breeding sessions. This highlights the importance of a holisitic approach to improve the stress tolerance of cotton crops. In particular, the importance of phenotyping under field conditions was highlighted by several presenters in the biotechnology field.

In particular, I found the presentation by Dr Saranga (Israel) entitled, 'marker assisted selection for improving drought resistance in cotton' to be particularly enlightening, impressive and entertaining. In breeding for improved drought tolerance, this research group has identified genotypic variability for QTLs associated with drought-adaptive physiological traits (osmotic potential, carbon isotope ratio and leaf chlorophyll content) which were found to modify non-target traits (including photosynthetic capacity, leaf morphology, metabolic and mineral profiles) under stress in the field. Similar to my research, this approach is physiology based, using biotechnology to improve the screening process. This research showed that marker assisted selection is a useful approach to enhance drought adaptive traits however, as part of the 'drought and heat tolerance' session, Dr Saranga also emphasised the need for phenotyping (including recombination and selection of these traits with high yield potential) to ensure that stress tolerance generated by genetic manipulation translates to performance under field conditions. I plan to continue correspondence with Dr Saranga regarding the techniques used by his research group, and the results generated.

A large number of researchers representing various cotton breeding programs around India and Pakistan were in attendance at the conference. I was approached by a number of plant breeders interesting in improving the heat and drought tolerance of their germplasm (mainly hybrids). In particular, the Northern Indian cotton industry has problems with plant emergence under high temperatures. It is likely that a combination of breeding for heat tolerance and heat mitigation using cover crops and minimum tillage may be advantageous for these breeding programs. Ankur seeds (located in Nagpur, India) have actually bred a 'heat tolerant' *G. arboreum* cultivar. Furthermore, the genotype associated with superior heat tolerance has a linked morphological marker – petal red spot. I am currently communicating with

plant breeders at this institute to see whether we can adopt their program for identifying heat tolerant cultivars and whether we can get access to germplasm to test the heat tolerance of this cultivar under Australian cotton production systems.

A representative from Monsanto presented new technologies they are using for high throughput screening for disease resistance. Of particular interest was seed chipping technology for DNA analysis in cotton (with a proposed 2012 release date), using an automated PCR. This technology is capable of analysing over a million samples per annum whilst still maintaining seed integrity for planting. Although this technology requires considerable investment, it illustrates the possibility for high throughput genotyping which may be developed for stress tolerance determination in the future.

Personally, the highlight of the conference was being able to present some of the research from my PhD to an international audience. I really enjoyed presenting to such an engaged audience and have never received so many questions following my presentation. I believe that both my research and presentation style were well received and the experience of presenting to such a critical audience was most beneficial for my career development.

2. **Detail the persons and institutions visited, giving full title, position details, location, duration of visit and purpose of visit to these people/places.**

As part of this conference, a 2 day technical tour was run around Nagpur, Central India. After 5 days of presentations from various representatives of the Indian cotton industry, I felt that after taking this tour, I was able to understand the challenges faced by cotton farmers and the industry as a whole. It became evident that although the Indian and Australian cotton industries vary greatly – the Indian cotton industry exclusively sells hybrids to farmers which produce low yielding and relatively low quality cotton under dryland and small scale (4 acres) conditions, the challenges faced by the industry in terms of breeding (for pest, disease and stress tolerance in conjunction with yield and fibre traits), as well as competition for area and market share were similar to those in Australia. This tour included visits to;

a. Morarjee Textiles Ltd: spinning, weaving, dying and treating Egyptian cotton to make high end dress fabrics for the UAE.
b. Central Institute for Cotton Research: use the world's 2nd largest germplasm collection (and 26 wild species of cotton) to find novel sources of resistance to pests, diseases and abiotic stress.
c. Ankur Seeds: with a 18% share in the Indian cotton industry, this company has a large collection of germplasm for novel traits including a heat tolerant G. Arboretum with an identifiable phenotype
d. Cotton Stalk Particle Board Unit: value adds to cotton stalk trash by mulching and compressing to make particle board.

e. Bajaj Steel Double Roller Gin Manufacturing Unit – this large engineering unit works 24 hours a day to create technologies to assist the industry. In fact, a gin component was awaiting shipment for Toowoomba!

3. **a) Are there any potential areas worth following up as a result of the travel?**

Communication will continue with Ankur seeds to find out more information about how they identified and developed their heat tolerant cotton cultivar. It may be worthwhile trying to get hold of some seed to test it in the Australian growing environment and determine the similarities/differences between the stress tolerant cultivar and our Australian bred cultivars. It would also be beneficial to keep in contact with researchers looking at water deficit tolerance, particularly from Dr Saranga's lab. There have been several genes highlighted in this conference, from multiple presenters that may increase the drought tolerance of cotton.

b) Any relevance or possible impact on the Australian Cotton Industry?

Incorporation of heat tolerant genetic material in combination with incorporation of biotechnology for stress screening into the Australian cotton breeding program may help in reducing yield decreases as a result of abiotic stress in the field. However, this research is still in its infancy and in the absence of field testing. Hence, benefits received from this research are foreseeable in the long term only.

4. **How do you intend to share the knowledge you have gained with other people in the cotton industry?**

Details relating specifically to the conference will be discussed amongst researchers at Myall Vale. I also intend to discuss some of the biotechnology work with colleagues at the CSIRO Black Mountain site as some of the genes identified throughout the conference may be interesting to this group.

5. **Executive summary. Provide a one paragraph summary of the scientific exchange, suitable for posting on the Cotton CRC web site.**

Attending the World Cotton Conference 5 in Mumbai provided an excellent opportunity to not only discover current research in the international cotton community but to also present the results of my own research to an enthusiastic, engaged and critical audience. The development of pest, disease and stress tolerant cotton hybrids with high yield and good fibre strength are key priorities of the Indian cotton industry. As such, a large proportion of research presented involved the discovery of genes associated with drought tolerance. However, a common theme of these presentations was the importance of an integrated approach to developing stress tolerant cotton production systems. The importance of phenotyping under locally adapted environments was strongly emphasised in this conference as well as the need

for more research into root function under stress. This approach is readily applicable to the Australian cotton industry and may improve local yields under hot and water limiting growing areas.