Part 1 - Summary Details

CRDC Project Number: **CSP 122C**

Project Title: Field Experiments at ACRI

Project Commencement Date: 1/07/02 **Project Completion Date:** 30/6/05

Research Program: On-Farm

Part 2 – Contact Details

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Part 3.3 – Final Reports

Background

Costs associated with growing cotton on ACRI are part of an agreement between NSW DPI and CSIRO. This project funded a small part of the net costs as charged by NSW DPI. The following table lists CSIRO Plant Industry, Land and Water and Entomology CRDC and CRC field research projects at ACRI. CSIRO's Leitch lease is a separate operation to ACRI and those costs were not included in the project.

The CSIRO Cotton Research Unit is a mission-directed strategic research team driven by impact. We address major national challenges for a future, valuable and sustainable industry. We are world leaders in cotton science and are a multi-division team, not a collection of projects.

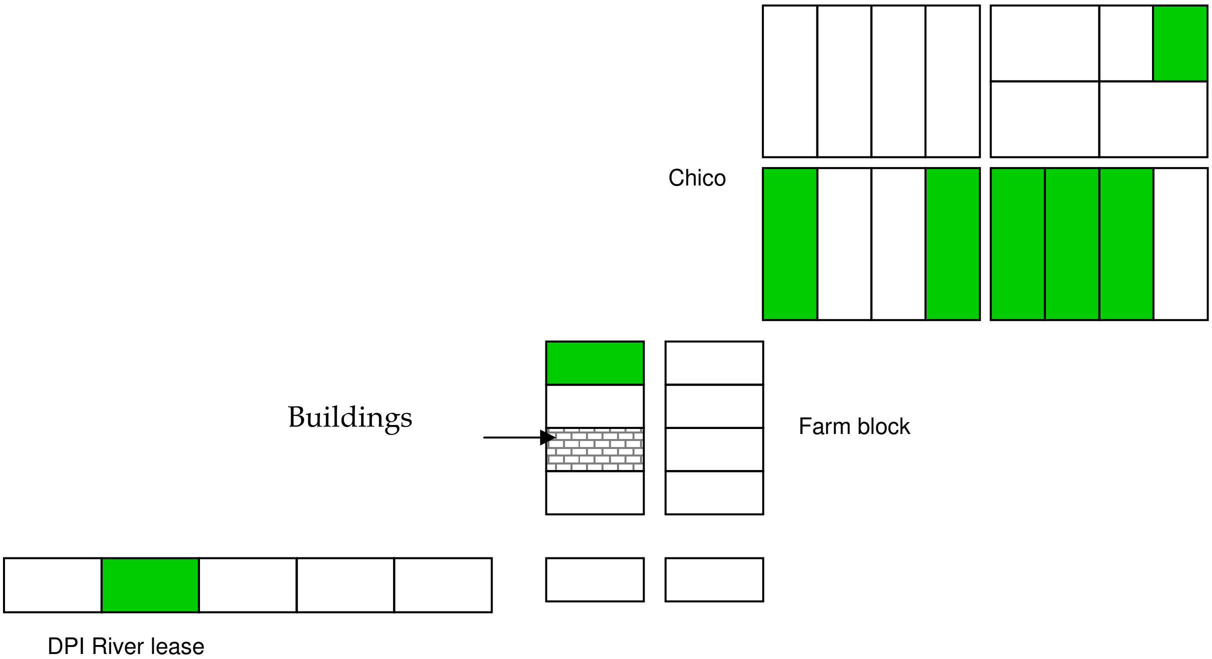
Ref	Short Name	Project Leader
CRDC 158	Water relations of the cotton plant	Neilsen
CSP 121	Plant Breeding Fibre Quality Lab	Constable
CSP 141	Post Graduate – crop physiology	Roche
CSP 147	Incorp. aphids, insecticides etc in IPM	Wilson
CSP 151	Support, develop, eval cotton mgnt packs	Bange/Deutscher
CSP 159	Breeding improved cotton varieties	Constable
CSP 161	Physiology of High Retention Cotton Crops	Yeates
CSP 162	Effects and Mgnt of Green Mirids in Cotton	Duggan
CSP 163	Delivering Science to Agribusiness	Bange
CSP166	Cotton Crop Mgnt for Improved Fibre Qual	Bange
CSP 165	Aphids - Control, ecology, BT resistance	Wilson
CSP 164	Cotton Irrigation Mgnt	Richards/Yeates
3.1.22 AC	Weed resistance modeling	Roberts/Werth
3.1.35 AC	Optimising Cotton Farming Systems	Roberts
3.1.36 AC	Nutritional Constraints to Cotton Production	Rochester
CSE90C	Ecology of Helicoverpa	Tann
CSE103C	Impact AWM on beneficial populations	Dillon
CSE102C	Monitoring BT Resistance	Downes
6.1.2 AC	Impact of Predation on Cotton Pests	Whitehouse
CLW3C	Rhizosphere Biological Functions	Knox
CRC47C	Quantifying Deep Drainage	Nadelko

Detailed aspects of each specific project will be reported in their annual and final reports.

Objectives

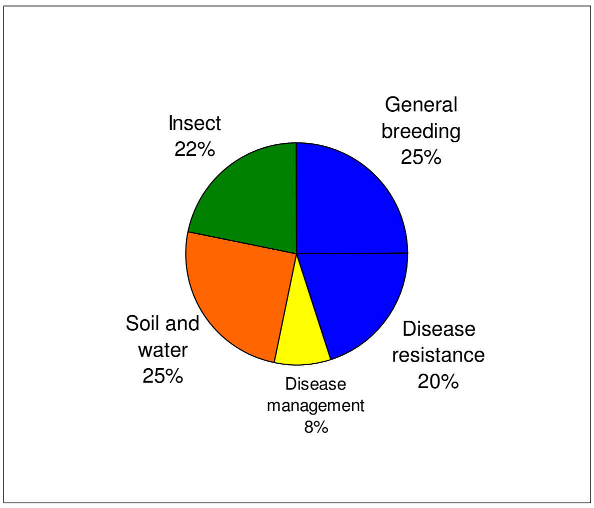
The aim was to conduct the routine management operations required on experiments done by CSIRO in CRDC and CRC funded projects at the Australian Cotton Research Institute in the disciplines of Plant Breeding, Entomology and Agronomy. The funds were paid direct to NSW DPI to part fund field operation costs.

The following simplified map of ACRI shows the fields occupied by CSIRO field cotton research in 2004/05. Rotation with wheat means there is less than 50% occupancy by cotton in any one season and that CSIRO occupies about 50% of the cropped area each season.



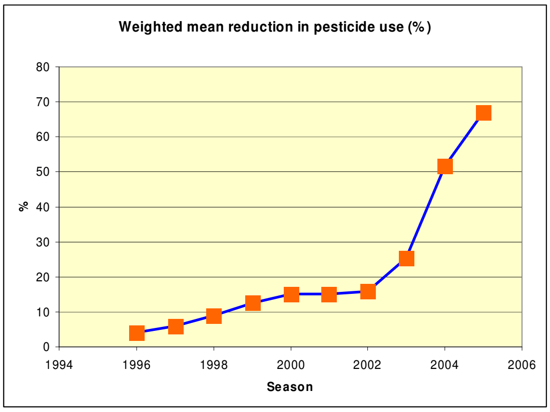
Conclusions

Our longer term analysis of factors contributing to yield improvement in the Australian cotton industry have shown breeding new varieties is responsible for 45% of the improvement, with soil and water management and insect management responsible for about another 25% each. CSIRO's field research portfolio covers these factors in great detail with environmental sustainability as an important criterion for all research and management recommendations. Of great importance is that our Decision Support Systems group maintains the dual objectives of delivering science to agribusiness, while continuing to ensure environmental responsibility is also promoted. Although this last point maybe unpopular, it is a role and position we feel obliged to maintain.



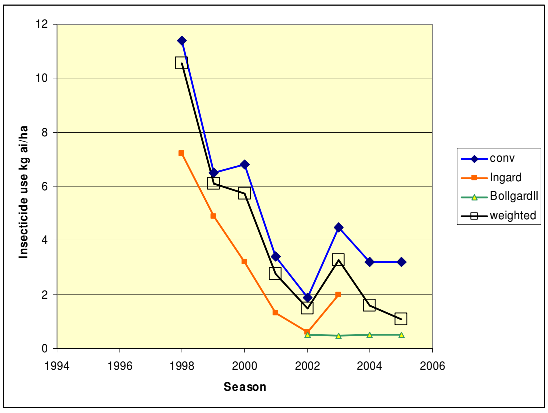
Thus CSIRO field research projects which have been partly supported by this CRDC funding have addressed important issues of relevance to future viable and sustainable cropping systems (see list in section 1).

The change in pesticide use as affected Bt cotton has been well documented but the data actually shows that IPM has made a greater contribution than Bt cottons. There have been varying percentages of area to conventional, Ingard® and Bollgard®II cotton in the past nine years. This graph shows the weighted mean percentage reduction in insecticide use in the industry attributed to Bt cottons.



Note small percentage reductions from 1996 to 2002 because of a 30% cap on Ingard for resistance management and only 50% reduction in pesticide application to Ingard compared with conventional. The high value for percentage reduction in the Bollgard®II era is due to low insecticide applications and to a large percentage adoption of Bollgard®II (78%) in 2005.

It is more instructive to compare active ingredient of insecticide used with each trait, as IPM in conventional cotton has reduced insecticide use overall. The following graph shows active ingredient of each trait and a weighted mean for all traits (data from CCAA surveys via Bruce Pyke). Amounts have been estimated for 2003/04 and 2004/05 as they are not available.



Note the substantial decline in pesticide use in conventional cotton and the low requirement in Bollgard®II, giving a low value for industry use overall in 2004 and 2005. Ingard was withdrawn from 2003 and will not figure in further calculations. Overall, insecticide use in 2004 was 1.6 kg/ha, only 15% of that applied in 1998. This reduction has been due to IPM (71%) and Bt transgenics (29%), although note the 'spike' of insecticide use on conventional cotton in 2003 as a result of heavy *Helicoverpa* pressure (or maybe a 'dip' in 2002 because of low pressure). It is probably better to attribute the reduction in pesticide use to the landscape package of IPM and Bt combined – Bt has provided an IPM platform and raised confidence in IPM principles.

This analysis shows heavy emphasis of research on IPM at ACRI is entirely justified.

Impact on the Cotton Industry

Economic benefit to growers and industry is through increased yield and fibre properties – a CIE report in 2002 calculated that CSIRO's cotton breeding program and decision support projects have added $5.2b in net present value to Australia's cotton industry. That equates to about $260,000 pa for each cotton grower.

Benefits to the environment from research are a 70% reduction in pesticide use (from the combination of IPM and BT transgenic varieties). In addition, the cotton industry now achieves twice the yield for the same irrigation water as was the case 20 years ago.

Industry investment in research would appear to be providing substantial rewards and supporting overall field costs at ACRI are an important component of that funding.

Part 4 – Final Report Executive Summary

This project has part funded field operation costs charged by DPI to CSIRO for experiments on ACRI at Narrabri. More than 21 projects have been supported over the three years and all field operations have been done well through collaboration within CSIRO and between CSIRO and NSW DPI.

CSIRO field research has addressed all important areas for yield and sustainability: breeding, disease resistance, soil and water management and insect management. Results of that research have substantially improved industry performance and value. Cotton breeding and decision support systems have been estimated to have added $5.2 to regional economies in the past 20 years. IPM research (by all research organisations) has been successful in substantially reducing the volume of insecticide used on cotton.