Cotton Research & Development

Annual, Progress and Final Reports

## *Part 1 - Summary Details* **REPORTS**

*Please use your TAB key to complete Parts 1 & 2.*

**CRDC Project Number:** **CSE84C**

**Annual Report:** ☐ Due 30-September

**Progress Report:** ☐ Due 31-January

**Final Report:** ☒ Due 30-September
(or within 3 months of completion of project)

**Project Title:** Insect pest resistance and the role of induced responses to damage in Australian cottons

**Project Commencement Date:** 1/7/99 **Project Completion Date:** 30/6/2003

**Research Program:** 3 Crop Protection

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## *Final Report Executive Summary*

The cotton plant is highly resilient to insect damage and capable of both tolerating and defending itself against insect pests of various types. While transgenic Bt cottons increasingly provide a valuable management option for *Helicoverpa* spp., conventional host plant resistance (HPR) remains a valuable component for tolerance to other pests and to "support" transgenic technology by enhancing background levels of resistance. Our research on host plant resistance has been progressively integrated with research on the evaluation of Bt transgenic material. Through collaboration with Dr. Greg Constable we now have a range of breeding lines with combinations of HPR characters with Bt genes. Plant breeding is clearly a reliable vehicle for advances in IPM.

This project has built on previous work on host plant resistance where the value of certain morphological and biochemical traits have been identified for key groups of pests, particularly *Helicoverpa* and various sucking pests. In this project we have:

1. finalised field trials of arrange of cotton germplasm and identified some potential combinations of value
2. completed the first field evaluation of a potentially mirid tolerant variety with okra leaf and nectariless traits plus the Cry IAc Bt gene. Where mirids were abundant the nectariless trait showed promise, but further field research is needed.
3. Research potential synergies between Bt genes and conventional traits of high gossypol and high tannin. While we found no interaction of gossypol with Bt, there were consistent negative relationships between tannin and Bt proteins confirming earlier work by Olsen and Daly
4. Documented season-long efficacy of single gene and two gene combinations of Cry IAc and Cry 2Ab. This shown consistent high efficacy of the two gene combination, although this relies heavily on Cry 2Ab.
5. Substantially improved upon the quantitiative ELISA for Bt proteins and applied this to identify patterns in protein expression among varietal backgrounds, stages of development and agronomic treatments.
6. Developed experimental protocols to quantify induced changes in cotton biochemistry in response to *Helicoverpa* feeding and completed the first series of experiments which demonstrated clear induced responses within damaged tissues, but no systemic effect whereby damage to one tissue induces a defensive response in other parts of the plant.

IPM systems and transgenic Bt cottons have provided considerable economic and environmental benefits to the cotton industry through dramatic reductions in pesticide inputs over the last 5 years. The work completed in this project and the complimentary Cotton CRC funded project, have supported those changes through improved understanding of the performance of transgenic cottons. Commercial outcomes from our work with conventional HPR will occur over a longer timeframe and be reflected in improved varieties available to Australian growers and ongoing reductions in pesticide dependence if these varieties are used as a component of IPM.

A clear take-home message form this project is that the cotton plant itself and it capacity to express varying levels of insect tolerance and to respond to insect pests needs to be an ongoing focus of IPM

efforts. Ongoing focus of breeders on conventional traits for insect tolerance will add value to the quantum advances possible with transgenic approaches and could provide added stability for future pest management strategies.