Part 1 - Summary Details

CRDC Project Number: **CRC30C**

Project Title: An investigation of the importance of native and non-crop vegetation to beneficial generalist predators in Australian cotton agroecosystems

Project Commencement Date: **Project Completion Date:**

CRDC Program: Catchment & Environment

Part 2 – Contact Details

Administrator: (Name & position of officer responsible for all correspondence).

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Signature of Research Provider Representative: _____

Part 3 – Final Report Guide (due 31 October 2008)

Background

Beneficial insects (generalist predators and parasitoids) occur within cotton agroecosystems in Australia, but farming systems do not always encourage their survival. Recent changes in cotton production, like the cultivation of genetically modified cotton, the formation of area wide management groups and the subsequent reduction in pesticide applications, have all contributed to the survival of beneficial insects on cotton properties. Populations of generalist predators can be found on other common crops (e.g. winter wheat, sorghum and lucerne), but the planting of such crops varies, depending on water availability. Little attention has been given to the non-crop vegetation (native trees, grasses and shrubs and introduced weeds) surrounding cotton fields and the role it may play in supporting populations of beneficial insects. In this study, various habitats were sampled and the spatial and temporal patterns of several generalist predator species investigated. Potential resources provided by the habitats and ways of improving habitats were also identified. Finally, the movement of generalist predators between habitats and cotton at small (field) and large (area-wide group) scales was investigated.

This study was done in northern New South Wales, in a cotton growing area surrounded by a planted windbreak of native trees and shrubs, mature river red gum trees (*Eucalyptus camaldulensis* Dehnh.), pastures, dryland lucerne (*Medicago sativa* L.) and a travelling stock route (corridor of communal grazing land). A suction sampler was used to collect the following predators: Heteroptera - *Nabis kinbergii* (Reuter); Neuroptera - *Mallada signata* (Schneider) and *Micromus tasmaniae* (Walker); Coleoptera - *Coccinella transversalis* (Fabricius), *Diomus notescens* (Blackburn), *Hippodamia variegata* (Goeze) and *Dicranolaius bellulus* (Guerin-Meneville). Three years of sampling were undertaken, commencing in July (winter) and ceasing in February (summer) of each year. Oviposition sites for some of the predators were identified. Predator species differed in their preferred oviposition habitats. Predators were found to be present in the surrounding habitats throughout the sampling period and there were significant differences in predator abundance between years and months for all habitats. Rainfall influenced the annual variations in predator numbers, and the monthly variations in predator population abundance were attributed to summer pesticide applications as well as a mass spring emergence of *M. tasmaniae.* It was found that the surrounding habitats supported populations of predators by providing resources like oviposition sites, and that habitat specialisation by different predator species means that a range of habitats is needed to support a suite of generalist predators.

Cotton is irrigated using irrigation channels. These channels also provide indirect irrigation to the surrounding habitats, particularly along the tail drain. An experiment investigated the impact of the irrigation channel on arthropods within the habitat immediately adjacent to the irrigation channel and compared it with a non-irrigated habitat nearby. Two sections of the same native windbreak, one adjacent to the irrigation channel and the other away from the irrigation channel were sampled using a suction sampler from July (winter) to December (summer). Arthropods were sorted to Order. There was no significant difference in the total numbers of arthropods collected in the two sections of the windbreak. However, significantly more Araneae, Neuroptera, Coleoptera, Hymenoptera and Homoptera were present in the irrigated section. As many predators are found within these orders, irrigation has the potential to increase predator populations within the windbreak

The surrounding habitat is only valuable to cotton growers if predators move from the habitat into cotton. The movement of generalist predators between a windbreak and a cotton crop was investigated by applying fluorescent dyes to the native windbreak and placing yellow sticky traps in the cotton to catch marked predators. Whilst small numbers of marked predators were found within the windbreak, no predators were collected on the yellow sticky traps, suggesting that predators did not move from the adjacent vegetation into the cotton during this experiment.

A further study investigating the colonisation patterns of the generalist predators in newly planted cotton, indicated that they colonised fields very early, in some cases 2 weeks after planting (when cotton cotyledons were newly emerged from the soil), and were highly mobile over distances of 500 m. The observed migration distance of 700 m supports the suggestion that predators were not only migrating from adjacent vegetation but also from further afield. This means that cotton producers need to take the broader landscape into consideration when looking at the spatial pattern of habitats on their properties and adjacent areas.

The regional movement of generalist predators over distances of 10 km was investigated using three seasons of data collected by researchers at the Australian Cotton Research Institute. The movement of generalist predators varied depending on the pest pressure, spray activity and spatial pattern of cotton and native vegetation. The mobility of predators means that spatial patterns need to be widened when considering habitat management.

The results of this thesis will assist cotton growers in the management of the surrounding non-cotton habitats. For example the maintenance of a variety of habitats like grasses, shrubs and trees is needed to support a range of predators. These habitats can be enhanced if they are able to access water in dry times. The mobility of predators suggests a broader spatial scale should be considered when planning the spatial arrangement of these habitats in cotton-growing districts.

Objectives

1. List the project objectives and the extent to which these have been achieved.

Methods

2. Detail the methodology and justify the methodology used. Include any discoveries in methods that may benefit other related research.

Results

3. Detail and discuss the results for each objective including the statistical analysis of results.

Outcomes

4. Describe how the project's outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

5. Please describe any:-
   a) technical advances achieved (eg commercially significant developments, patents applied for or granted licenses, etc.);
   b) other information developed from research (eg discoveries in methodology, equipment design, etc.); and
   c) required changes to the Intellectual Property register.

Conclusion

6. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. What are the take home messages?

Extension Opportunities

7. Detail a plan for the activities or other steps that may be taken:
   (a) to further develop or to exploit the project technology.
   (b) for the future presentation and dissemination of the project outcomes.
   (c) for future research.

8. A. List the publications arising from the research project and/or a publication plan.
   (NB: Where possible, please provide a copy of any publication/s)

   B. Have you developed any online resources and what is the website address?

Part 4 – Final Report Executive Summary

Provide a one page Summary of your research that is not commercial in confidence, and that can be published on the World Wide Web. Explain the main outcomes of the research and provide contact details for more information. It is important that the Executive Summary highlights concisely the key outputs from the project and, when they are adopted, what this will mean to the cotton industry.