Evaluation of companion crops as part of an integrated pest management package for GM cotton in the Kimberley.

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Introduction

Cotton was previously grown in the Ord during the 1960's and early 1970's. One major cause of the industry's demise was the development of insecticide resistance in *Helicoverpa armigera* (heliothis). Although heliothis was not the major pest initially, pesticides targeting a range of other insects conferred resistance. Spray records indicate that whilst only 12 insecticide applications were required to grow the first crops, this rose to 21 sprays in 1971 and to an average of 40 sprays in the final season of 1974 (Michael & Woods 1980).

As the development of genetically modified cotton (INGARD™) progressed through the mid-1990's, Department of Agriculture Western Australia, and Australian Cotton CRC scientists envisaged that it may be possible to develop a new cotton industry in the Ord. The new cotton industry would use integrated pest management (IPM) and INGARD™ as the cornerstones of the system. Field trials evaluating IPM systems commenced in 1996 and the first large scale trial (10—40 ha) was conducted in 1997.

Major features of the IPM system proposed for the Ord include;

- Winter cropping, instead of summer cropping, to avoid high pest abundance from pink bollworm, cluster caterpillar and loopers. These pests all contributed to the demise of the previous cotton industry. Heliothis pressure is also reduced in winter.
- Minimising the use of disruptive insecticides through crop scouting and the choice of selective "soft" chemistry in preference to broad-spectrum carbamates and pyrethroids.
- Endosulfan is not used on cotton at all. Although endosulfan is a relatively "soft" chemical and suits IPM systems it can be environmentally damaging and is considered unacceptable in northern Australia.
- Beneficial insects (parasitoids and predators) are nurtured and protected through the use of "soft" chemistry, feeding stimulants and habitat protection.
- Companion crops such as lucerne are planted as strips within cotton paddocks. The companion crop is expected to be more attractive to insect pests than cotton and draw pests away from the cotton. It should also support a good range of beneficial insects that feed on the pests and may then move into the cotton when the food resource in the companion crop is depleted.

attractive to the pests than the cotton and drew the pests away from the cotton. The companion crops also attracted more beneficial insects and their higher abundance in close proximity to the cotton may have encouraged dispersal into the crop where they contributed to the control of pest species. All four companion crops tested were attractive to heliothis and green mirids throughout the growing season. Lucerne was the least attractive of the companion crops but when niger was added to the lucerne it markedly increased the companion crops attractiveness to mirids and also beneficial insects. Niger's early flowering habit probably caused the improved attractiveness of the lucerne mix.

The use of companion crops to attract mirids away from the cotton has been very successful but two problems have been observed. Firstly, mirids are highly mobile and adults will move between the companion crops and the cotton. Secondly, companion crops appear to act as nurseries, breeding up mirids which then attack the cotton. We are now investigating a trap and kill approach to mirid control where soil applied insecticides are used on the companion crop. Early results have indicated that this is very successful at controlling mirid numbers in the companion crop with little impact on the beneficial insects.

Companion crops demonstrated a capacity to produce relatively large numbers of beneficial insects, both predators and to a lesser extent parasitoids. Although supporting data is not presented in this paper the presence of the companion crop significantly increased the number of beneficial insects found on the INGARD™ cotton and this should have a direct impact on the number of heliothis present in the crop. Lablab had the most consistent number of beneficial insects from season to season while beneficial insect numbers on other companion crops fluctuated widely from year to year. When considering the use of a companion crop in a farming system the consistency of lablab at attracting pests and beneficial insects may be an important consideration.

Acknowledgments

Department of Agriculture, Western Australia, has been generously supported in this research and particularly acknowledges the support of the Cotton Research and Development Corporation, Monsanto, Twynam Agricultural Group and the Ord River Cotton Company. We would like to thank Ms M Rainer, Ms E Green, Mr M Weston, Mr U Pufke and Mr M Darlington for technical assistance and collection of data during the trials. The integrated pest management trials would not be possible without the support and commitment of local growers who grew cotton in 2000 and 2001, particularly Mr W Bloecker, Mr D Menzel, Mr D Smith and Mr R.B. Dessert.

References

Michael, P.J. & Woods, W.M. 1980 An entomological review of cotton growing in the Ord River Area of Western Australia. Technical Bulletin No. 48 March 1980 Department of Agriculture of Western Australia.

Figure 1. The cumulative number of heliothis larvae per metre found on different INGARD™ cotton grown with different companion crops in 2000 and 2001.

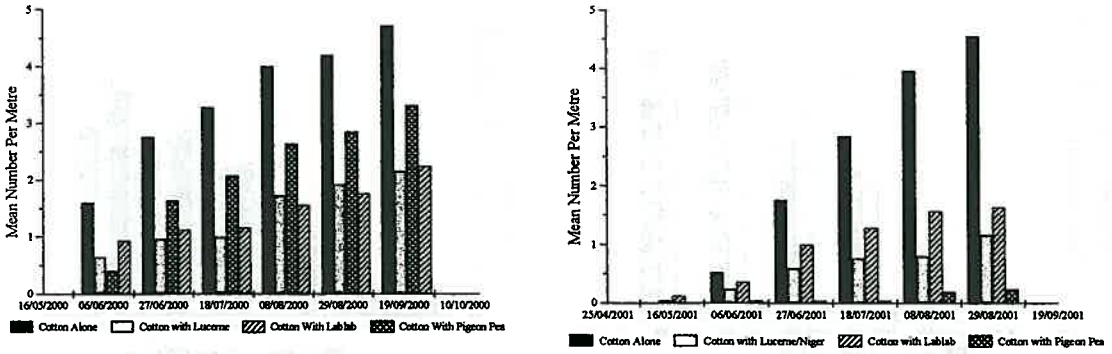

Figure 2. The cumulative number of heliothis per metre found on different companion crops in 2000 and 2001.

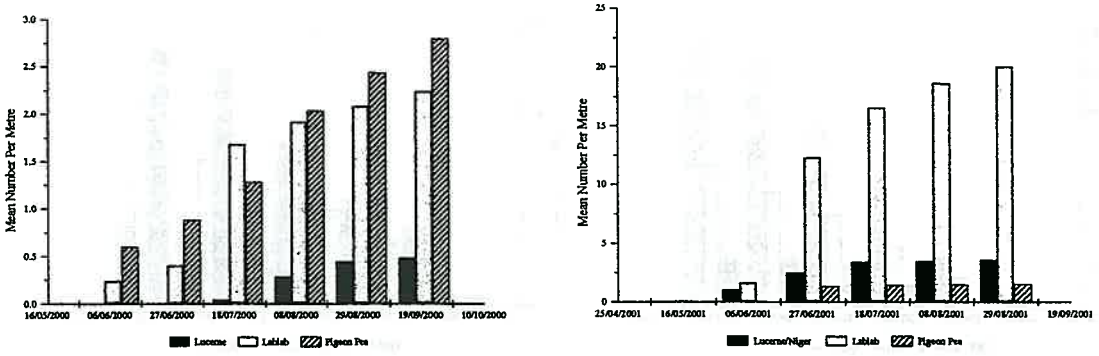

Figure 3. The cumulative number of mirids per metre found on INGARD™ cotton grown with different companion crops in 2000 and 2001.

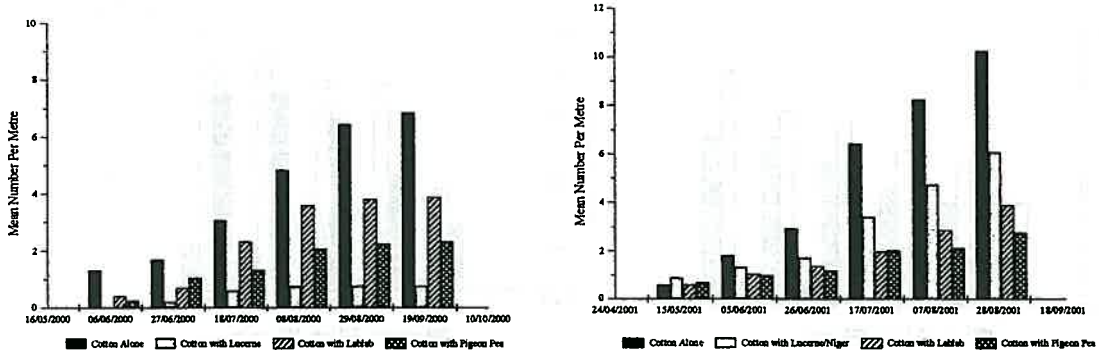

Figure 4. The cumulative number of mirids per metre found on different companion crops in 2000 and 2001.

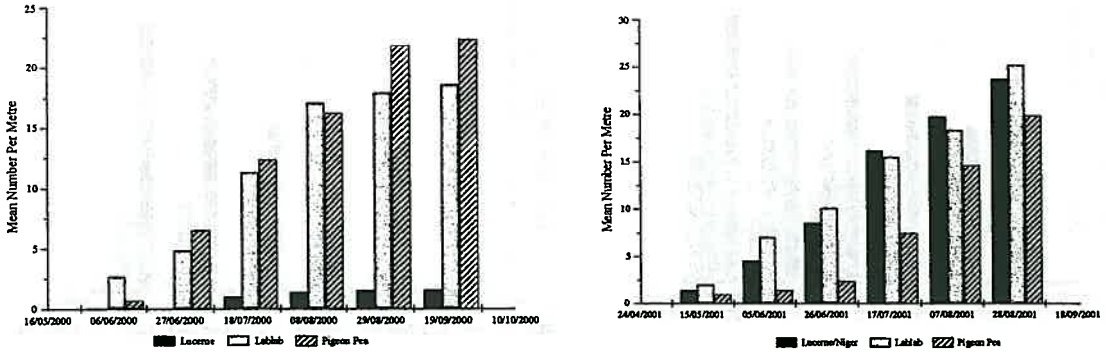

Figure 5. The cumulative number of predators per metre found on different companion crops in 2000 and 2001.

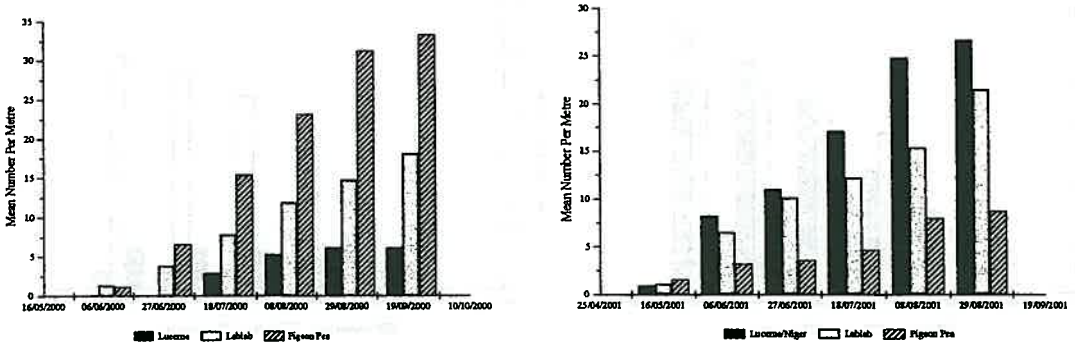

Figure 6. The cumulative number of parasitoids per metre found on different companion crops in 2000 and 2001.