

PLAIN ENGLISH SUMMARY

Cotton crops in Australia are attacked by a wide range of pests, the key ones being the larvae of *Helicoverpa* spp., green mirids and mites. To sustain production, the cotton industry currently relies heavily on synthetic insecticides for the control of these pests. A major focus of the cotton industry is to reduce the dependence on insecticides and maximise the long term sustainability of the industry. One way this can be achieved by developing an alternative pest control strategy which minimises insecticide use and places much more emphasis on the role of beneficial insects. This project has developed methods for conservation, augmentation and utilisation of beneficial insects in an integrated pest management (IPM) program in cotton. It has described the numerical and functional responses of beneficial insects and determined some of the factors operating in cotton and other crops that influence the efficacy of beneficial insects. Studies to conserve and utilise beneficial insects particularly predators in the cotton agroecosystem for integrated pest management (IPM) strategies in normal and transgenic cotton were carried out between July 1995 and June 1998.

The study examined habitat diversity and its implications for the conservation and use of predatory insects of *Helicoverpa* spp. in cotton systems. The utility of crops such as sunflower, safflower, sorghum, lucerne and tomato as refugia for predatory insects and as trap crops for other cotton pests such as green mirids were examined. The lucerne crop was found to serve as a refugia for predatory insects and trap crop for green mirids when interplanted with cotton. The refugia function of interplanted lucerne was attributed to the abundance of floral nectar, alternate prey, shelter, mating and oviposition sites in the lucerne crop. Thus given the abundance of food resources, shelter, oviposition and mating sites in the lucerne, higher numbers of predators were not inclined to move from the lucerne strips to forage the adjacent cotton crop. Envirofeast® product applied at the rate of 2.5 kg/ha to the cotton crop was found to attract the beneficial insects from the lucerne to the cotton. The optimum size and the length of lucerne/cotton interplants required to effectively manage green mirids and generate beneficial insects in cotton was 8 or 12 metres of lucerne for every 300 metres of cotton. Lucerne crops planted as borders to a cotton crop were found to generate beneficial insects but were not effective in managing green mirids in cotton blocks which had more than 300 rows.

The IPM program developed in this project integrated Envirofeast® sprays, lucerne strips, gemstar virus, tracer and synthetic insecticides. The IPM program has reduced synthetic insecticide sprays and achieved a similar level of control of cotton pests and lint yield to that of conventional insecticide managed transgenic and normal cotton. In the IPM strategy, 50-80 per cent of synthetic insecticides were replaced by biological sprays. When the IPM strategy was used without Envirofeast® sprays on both normal and transgenic cotton, the cotton crop suffered a yield loss of 1.24 - 4.57 bales per hectare in the case of normal cotton and 0.74-1.24 bales per hectare on transgenic cotton.

The numbers of beneficial insects per metre were found to be significantly higher ($P < 0.001$) and green mirids per metre significantly lower ($P < 0.0001$) in the IPM managed plots with lucerne strips than on the conventional insecticide managed transgenic and normal cotton crops.

Studies to determine the consumption rate per day and factors affecting predatory beetles showed that *Helicoverpa* spp. or prey densities can affect their consumption rate through competition. Increasing prey density from 5 to 60 *Helicoverpa* spp. eggs increased the consumption rate of transverse ladybirds from 2.5 to 25 eggs per day. Higher predator densities can also affect their consumption rate. Some of the other factors affecting the consumption rate of predatory beetles were the use of synthetic insecticides particularly pyrethroids, food resource, rainfall, relative humidity, temperature, irrigation, soil cultivation.