

FOUR YEARS OF IPM IN RAINGROWN COTTON

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Introduction

Most pest management practitioners agree that our current approaches are not sustainable and integrated pest management (IPM) is the way of the future. IPM in cotton means different things to different people and there is some element of thought that our present IPM approach is more of an ideal than a reality. True integration, involving modifications to make diverse tactics compatible and reduce counter effects, is the essence of the approach (Pedigo 1989). Attitudes must change! The idea that '**the only good bug is a dead bug**' must give way to an appreciation of the ecological role of a pest species and acceptance of their presence. This change can only come about by education at all levels.

Methods

In our project we evaluated various tactics for insect pest management in raingrown cotton on the Darling Downs, with the aim of developing a sustainable IPM package. In as much as it was a research project, it has also served well for the development of IPM approaches and the education of participants and interest groups.

We have now completed four years of intensive trials at the Warra property of Jeff and Marilyn Bidstrup. The basic trial design incorporated four large-plot (3 - 6 ha) unreplicated treatments in skip-row raingrown cotton. The treatments were:

1. **unsprayed** where no action was taken to control insect pests.
2. **biological** where no chemical (insecticide) treatments were used, natural enemies were conserved, and releases of egg and larval parasitoids of heliothis were made in conjunction with treatments of

pathogens *Bacillus thuringiensis* (Bt) and nuclear polyhedrosis virus (NPV).

3. **reduced** where there was a reliance on more selective insecticide options, especially early season.
4. **conventional** which followed the cooperator's standard treatments.

Results and Discussion

During the four seasons of the study insect pest activity was extremely variable, a true reflection of the uncertainty that faces producers each time a crop is sown. Green mirids were very damaging in 1992/93 and 1995/96 (see Simpson *et al.* 1996). Heliothis activity was high to extreme in 1993/94 and 1995/96 and relatively low in the other two seasons (Figure 1).

The variable pest activity also highlights the importance of evaluating pest management programs over many seasons to avoid misleading 'impressions'. Who could forget the devastation caused by the extreme heliothis activity of the 1993/94 season on the Darling Downs? To put some perspective into this argument, the yield from the unsprayed in each of the other three years was very respectable (Table 1). At first glance the yield increase between the unsprayed and the conventional should not demand a quantum effort beyond no sprays, but in reality this does not seem to be the case. The short term economics justify the expenditure on insecticides, especially while cotton prices remain high.

Table 1. Yield estimates in bales/ha and (number of sprays) for the respective treatments at the Warra IPM site, 1992/93 to 1995/96.

	Unsprayed	Biological	Reduced	Conventional
1992/93	2.00	2.10 (10)	2.35 (11)	2.47 (10)
1993/94	Nil	Nil (12)	2.17 (8)	2.46 (8)
1994/95	3.69	3.75 (2)	3.82 (2)	3.88 (4)
1995/96	2.42	4.39 (10)	4.07 (11)	4.42 (13)

At the end of the season it is easier to look back and say we should have done this or that, but while the season is underway and with no insight to the future, day to day pest management decisions which tolerate some pest activity, involve beneficial insects and rely on plant compensation are very difficult. It is in this area that we need to develop understanding and skills.

With some of the pest management tools becoming available to us, it is less likely that the devastation of the 1993/94 season would occur again. Progress has been made with food sprays, biological pesticides and more selective insecticides which offer greater scope to conserve natural enemies in the cotton crop. However, based on relative estimates of predator populations, we can not always count on abundant predators in the cotton crop (Figure 2). The relatively low predator densities recorded during the past three seasons may have been the result of the severe regional drought. Continuing studies will reveal whether a return to more reliable rainfall results in higher predator numbers. Studies with alternative refuge crops will also help clarify the contribution these might make to predator populations in cotton.

Our initial approach was to supplement the action of natural enemies with Bt sprays if it was apparent that the infestation would not remain below threshold. Experience over the first three seasons of trials demonstrated that Bt sprays alone did not adequately fulfil this role, particularly when heliothis activity was moderate to high. Thus NPV has replaced Bt in our trials since the 1994/95 season and has provided a better platform around which natural enemies can be manipulated. Results using NPV are presented elsewhere (Murray *et al.* 1996).

Inundative or supplementary releases of egg and/or larval parasitoids are not yet economically acceptable. Releases are also complicated by practical problems associated with mass producing and manipulating a biological agent. Until this technology is improved, our approach must be to conserve agents that already exist in our fields. We have consistently recorded egg parasitism levels of 50 to 70% and larval parasitism of 30 to

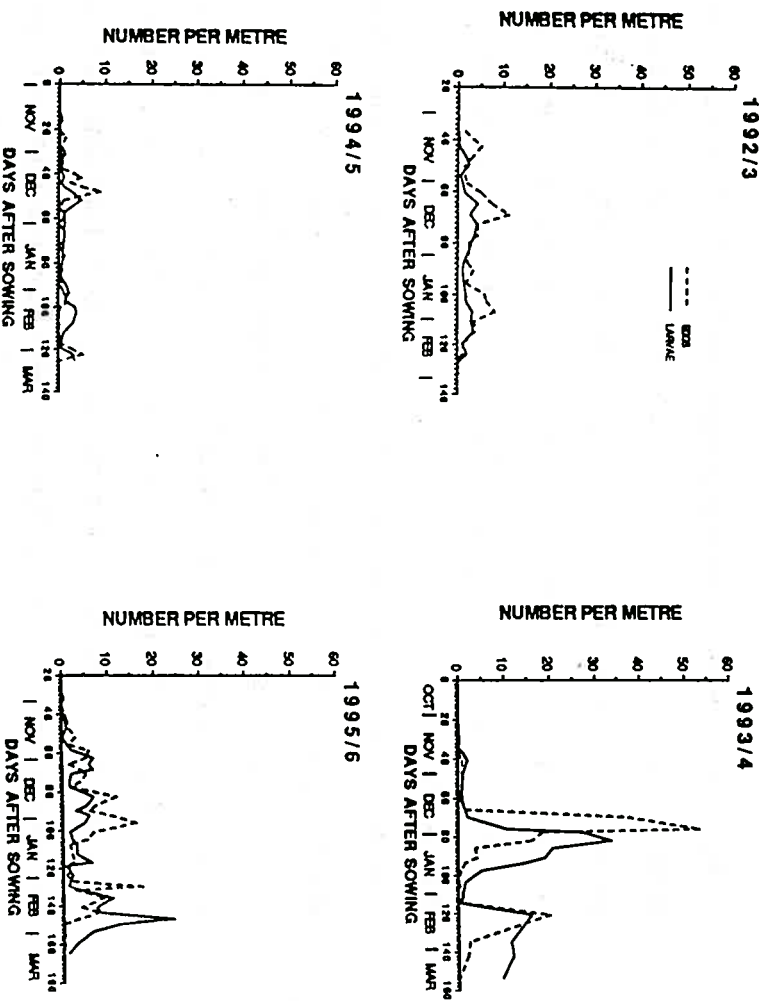


Figure 1. Heliethis egg and larval activity on unsprayed cotton at Warra during 1992/93 to 1995/96.

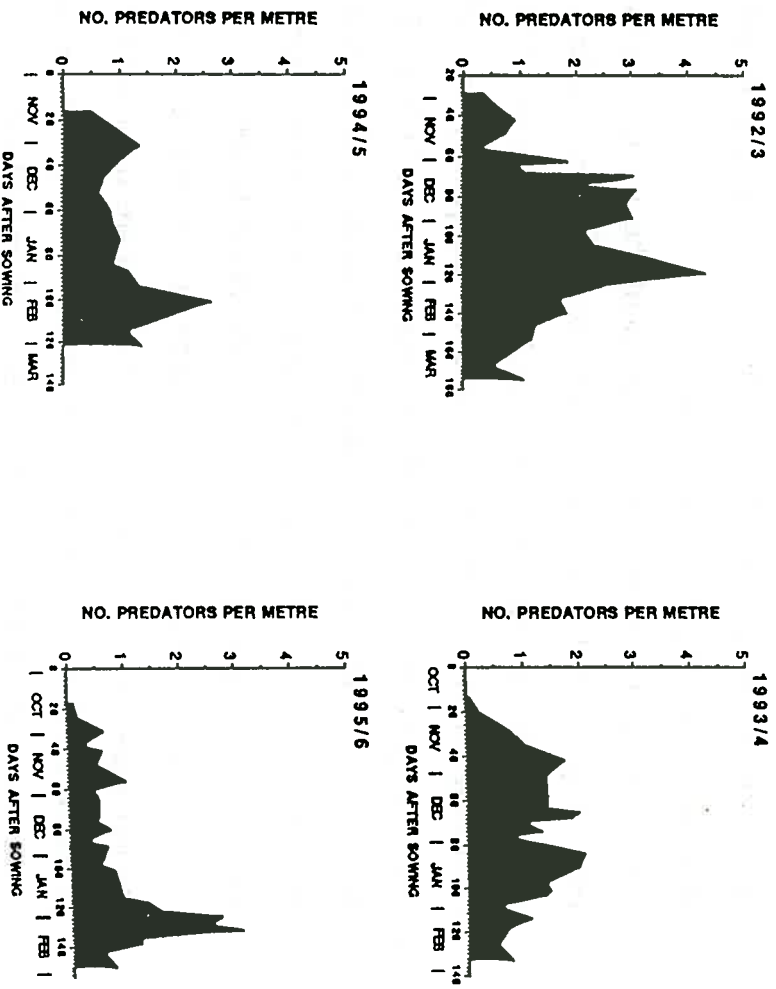


Figure 2. Predator densities on unsprayed cotton at Warra during 1992/93 to 1995/96.

50% in Darling Downs cotton crops. These contributions must not be ignored, especially when pest densities are near threshold.

Cotton aphids were controlled by natural enemies on the unsprayed and biological treatments in each year of our study. However, the populations tolerated were greater than those normally tolerated by conventional management. Because of the high solubility of honeydew in water, honeydew residues resulting from aphid infestation were washed off by rainfall. At no time were aphids a problem when open bolls were present.

The acceptance of some larvae surviving in the crop is an essential component of the IPM philosophy. We should not expect a biological desert. In some respects the deteriorating situation of increased resistance in heliothis has introduced us to this concept, but we need to develop this much further. The cost of not changing our attitudes could be the sustainability of the cotton industry. Other industries share similar concerns about heliothis management. With the pending adoption of Bt cotton, and an associated reduction in insecticide use, the stage is set to embrace the IPM approach more than ever before. Success will depend on the commitment the industry is prepared to make and continuing progress with alternative control technology.

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