INTEGRATED PEST MANAGEMENT IN RAINGROWN COTTON

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Introduction

Management of insect and mite pests attacking cotton crops relies heavily on the use of insecticides. In raingrown crops on the Darling Downs, an average of 8 to 12 insecticide sprays are applied to control the major pests - thrips, mirids and heliothis. In order to reduce the dependence on insecticides in cotton production, alternative management tactics are being evaluated as part of a program towards the development of an integrated pest management package. One of the key elements of our approach was to evaluate parasitoids.

How were the trials conducted?

In 1992, two research trials were conducted - one on the Darling Downs (Warra) and one in Central Queensland (Biloela). Four unreplicated treatments were set up at each site - unsprayed, biological, reduced spray and conventional. The biological treatment used only *Bacillus thuringiensis* (Bt) and relied on the conservation of natural enemies, plus the release of egg and larval parasitoids when available. The reduced spray treatment aimed to avoid the early season use of disruptive insecticides, and encourage the use of 'soft' options whenever possible. The Central Queensland site was terminated prematurely because of the drought conditions. Several consultants also ran trials comparing 'reduced spray/soft options' versus conventional management.

In 1993, two research trials were conducted - one on the Darling Downs (Warra) and one in the South Burnett (Byee). Treatments were similar to those of the 1992 trials.

Egg parasitoids used in these trials were reared at QDPI Toowoomba or purchased from one of the commercial insectaries. Crops were scouted at least twice per week to monitor pest and predator activity. Additional sampling was carried out to assess predator abundance using a suction machine, and egg and larval collections were made to determine parasitism levels. Fruiting progress was monitored by weekly counts of squares, bolls and open bolls in 4 x 1 m lengths of row per treatment.

What were the results?

1992/93: Mirids invaded the plots during early November (Figure 1). No action was taken against mirids on the biological and unsprayed plots while mirids were sprayed on the conventional (2 sprays) and reduced (1 spray) using omethoate. Mirid populations increased on the former two treatments during late November and December, and feeding damage delayed square production (Figure 2). The conventional and reduced set fruit early but suffered soil moisture stress in late January and consequently did not respond to mid-February storm rains. In contrast, the biological and unsprayed responded to the storm rains and set fruit later in the season. Despite a 3 week difference in harvest date, quality parameters were apparently similar for cotton from each of the treatments (Table 1).

Table 1. Yield and quality characteristics for the Warra trial, 1992/93.

Treatment	Conventional	Reduced	Biological	Unsprayed
Yield (bales/ha)	2.47	2.35	2.10	2.00
Harvest date	13 March	13 March	5 April	5 April
Turnout	40.0	39.9	39.5	39.3
Maturity	0.95	0.94	1.01	1.00
% Maturity	84.4	83.4	88.2	87.7
Fineness	169	169	172	176
Length	1.06	1.04	1.07	1.06
Uniformity	82.8	83.5	83.1	82.8
Strength	28.1	27.0	28.6	28.4
Elongation	6.3	6.1	6.4	6.5
Micronaire	4.3	4.2	4.5	4.6

Heliothis activity was light to moderate throughout the season (Figure 3). Peak egg densities were lower on the unsprayed and biological than on the conventional. Predator numbers were maintained on the biological and unsprayed compared to the conventional and reduced (Figure 4). As indicated by the yield result for the unsprayed treatment, natural enemies effectively maintained heliothis numbers below damaging levels. The use of Bt sprays resulted in a slight yield improvement over the unsprayed. Spray histories for each of the treatments are summarised in Table 2.

Table 2. Spray histories for treatments at the Warra trial, 1992/93.

Conventional	Reduced	Biological
4 endosulfan	4 endosulfan + Bt	8 Bt alone
2 endosulfan + omethoate	1 endosulfan + omethoate	
1 endosulfan + thiodicarb	1 endosulfan + thiodicarb	
1 esfenvalerate	1 thiodicarb + Bt	
1 dimethoate	1 thiodicarb	
	1 dimethoate	

Consultants' Comparison Trials

Results from four comparison trials carried out by consultants on the Darling Downs suggested that yields comparable to conventional management could be obtained using the reduced spray/soft options approach (Table 3). However, the reduced spray/soft options approach usually resulted in higher insecticide costs, and placed greater demand on a smaller range of 'acceptable' products.

Table 3. Yield data from comparison trials on the Darling Downs, 1992/93.

	Yield (bales/ha)		
Site	Conventional	Reduced	Unsprayed
Warra	3.06	2.91	-
Kupunn	1.98	1.78	0.57
Dalby	1.61	1.61	1.56
Formartin	2.62	2.62	-
Goondiwindi	2.44	2.64	-

1993/94 Preliminary Results: Heliothis activity at both sites was heavy to extreme, especially from late December to the end of the season. Preliminary estimates of yield at each site based on 38% gin turnout are presented in Table 4. Low soil moisture at Byee reduced yield potential at this site. Heavy heliothis pressure coupled with comparatively low predator numbers resulted in severe crop damage in the biological and unsprayed. The natural enemies were overwhelmed by the sheer numbers of heliothis. Frequent Bt sprays during the periods of most intense heliothis activity failed to reduce their numbers to aceptable levels. Details of egg and larval parasitism are presented elsewhere in these proceedings.

Table 4. Yield estimates for IPM trials at Warra and Byee, 1993/94.

Treatment	Warra	Byee
Conventional	2.47	1.42
Reduced	2.16	0.68
Biological	0.29	0.18
Unsprayed	Nil	0.32

Conclusion

A few key points have emerged from these studies during the first two years of experimentation.

. Mirids are a serious threat to the sustainability of cotton IPM. Most producers would find a 3-week delay in harvest time unacceptable.
. There are no 'predator safe' options for mirid control.
. Natural enemies can manage heliothis - in some seasons.
. A 'soft options' approach will often cost more - in the short term.
. Moderate levels of egg and larval parasitism resulted where selective insecticides were used.
. Releases of egg parasitoids were only partially successful.
. Bt sprays reduced infestation levels of rough bollworm and pink spotted bollworm.
. Bt sprays alone can not be relied on to control high density heliothis infestations after the commencement of squaring.
. Two years trial work is insufficient to make valid assessments of pest management in a very complex, highly variable and very unpredictable cropping system.

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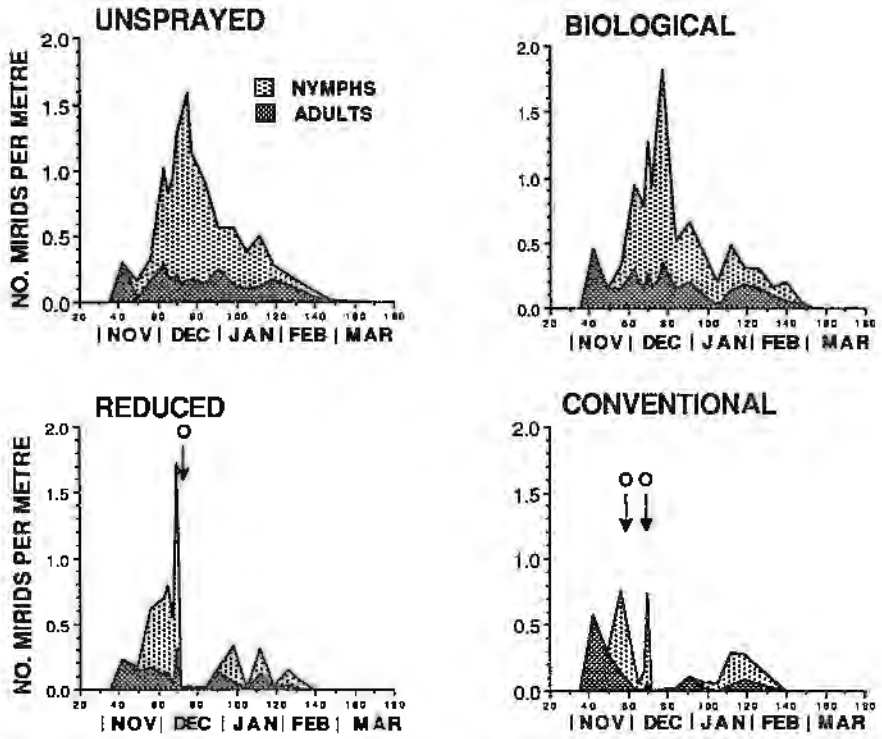

Figure 1. Mirid densities on each of the four treatments as determined by suction sampling at Warra, 1992/93. (O = omethoate spray)

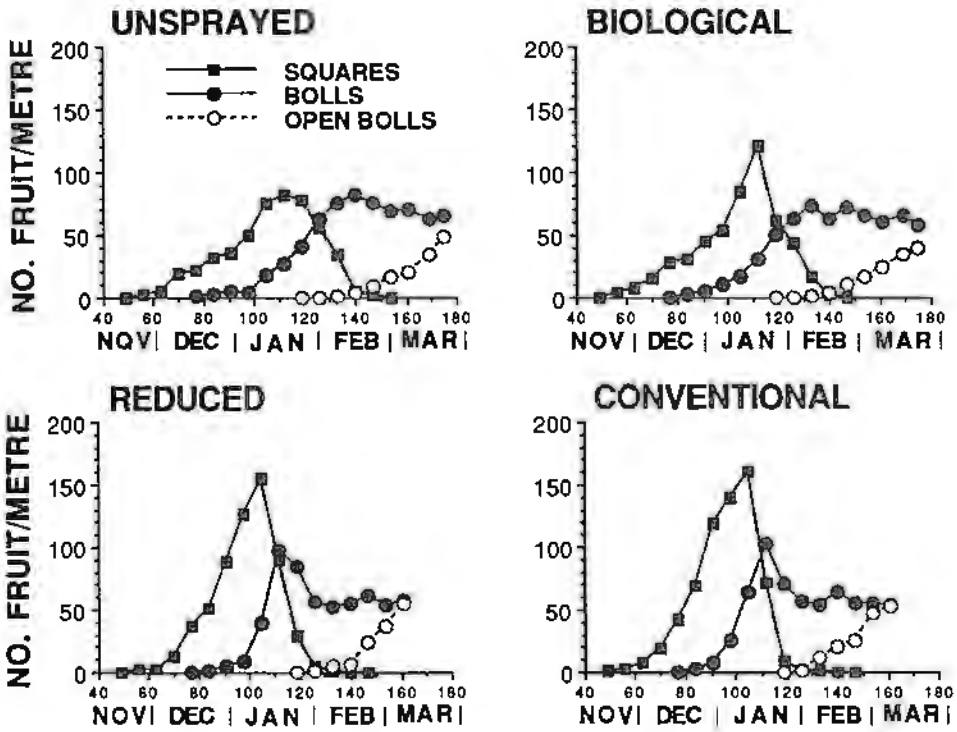

Figure 2. Fruit production on each of the four treatments at Warra, 1992/93.

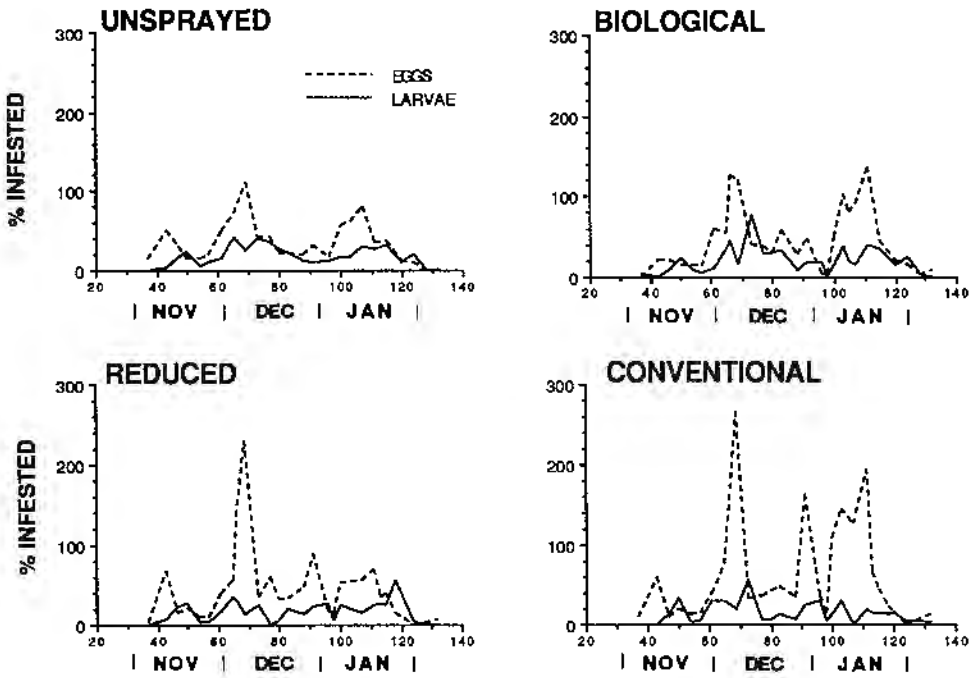

Figure 3. Heliothis egg and larval activity on each of the four treatments at Warra, 1992/93.

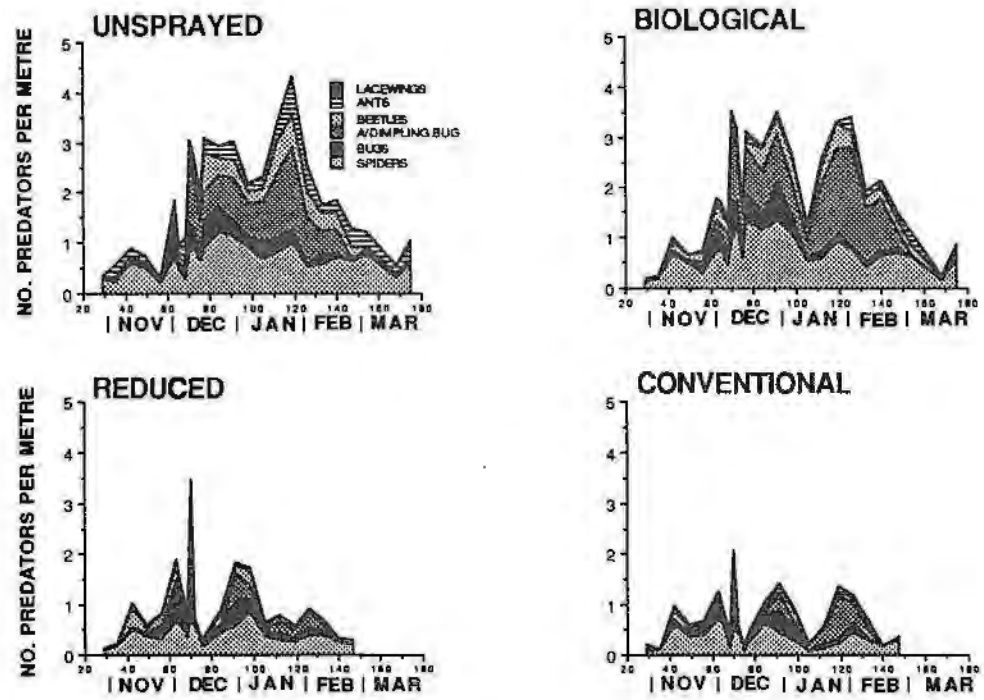

Figure 4. Predator densities on each of the four treatments as determined by suction sampling at Warra, 1992/93.