Using light traps to suppress Helicoverpa

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The increasing implementation of IPM and efforts to reduce chemical inputs within the Australian cotton industry have led to a range of new and alternative pest management options being evaluated.

One such option under development by a commercial firm at Narrabri is the patented Vortex Light Trap, which uses a vortex of water to capture insects attracted to light.

We tested an array of prototype vortex light traps during January 2002 as part of an Australian Cotton CRC Summer Scholarship project. Light traps have long been used as a very efficient tool for monitoring insect abundance.

Less well known are attempts to use light traps to suppress populations of insect pests in broad-acre cropping systems.

In Texas during the 1960s a number of large scale trials were undertaken to suppress heliothis and looper moths in cotton and tobacco. The results from these trials were mostly inconclusive, and the technique fell from favour.

We investigated the effectiveness of vortex light traps at capturing Helicoverpa moths and, whether egg densities were reduced in surrounding cotton.

Nine vortex light traps were positioned 100 metres apart in a 3x3 array in an Ingard cotton field at Auscott Narrabri.

The lights were run each night from December 28, 2001 onwards. A nearby field served as a nil-treatment comparison and there was a buffer field inbetween.

We monitored trap catches and undertook extensive insect checks in the two fields until January 31, 2002.

Light Trap Catch Results

Helicoverpa armigera and H. punctigera moths were the dominant species of insect captured by the Vortex light traps during the study period (Table 1). Ladybird beetles were the only beneficial insects that were captured in high numbers.

The estimated number of Helicoverpa moths captured each night varied throughout the study

Leah MacKinnon checks one of the solar powered array of light traps.

TABLE 1: Estimated total numbers of insects caught between December 31, 2001 and January 31, 2002

Helicoverpa moths	29,472
Green mirid adults	3576
Other large moths	14,707
Green vegetable bugs	124
Small moth assorted species	79,080
Damsel bugs	16
Ladybird beetles	24,112
Lacewings	245
Dung beetles	20,020
Netelia wasps	329
Other beetles	9500
Other wasps	1398
Crickets/grasshoppers	23,023

(Figure 1).

There are a number of possible reasons for this: The regional abundance of adult moths changes across time; windy conditions (over five metres per second) reduce moth flight; and the effective radius of light traps varies substantially with the intensity of moonlight — dark nights catch more moths.

During our study the mean catching rate ranged from 18 to 246 Helicoverpa moths per trap per night. It is notable that during our study there were two full moons and only one new moon.

Insect scouting check results: Beneficial insects

Overall the scouting checks showed that throughout the study period there was no significant difference in the density of total predators between the treatment and control fields. The trap array captured a high number of predatory ladybird beetles (Table 1). But very few ladybird beetles were recorded in the insect scouting checks in either field, and there was no significant difference in the density of ladybirds in the treatment and control fields.

The insect checks did show a consistently higher density of spiders in the treatment field, and a consistently lower density of lacewing eggs in the treatment field. We cannot say whether these differences in spiders and lacewings eggs are related to the light traps, and we can't determine whether these differences had an impact on our counts of Helicoverpa egg densities.

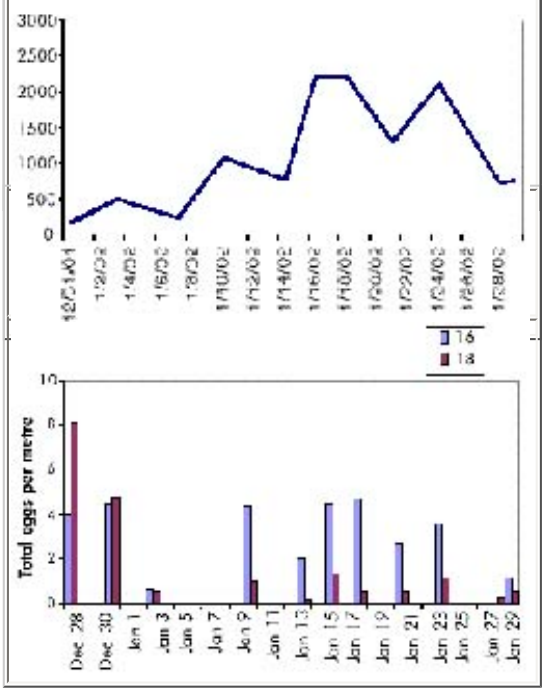
Insect scouting check results: Helicoverpa

In our analysis we utilised both the Auscott standard scouting data and our own counts from the treatment and control fields. The CSIRO scouting locations were centred within a 16 hectare area in and around the light trap array in the treatment field, and in an equivalent area within the centre of the control field. Auscott's scouting checks were generally undertaken closer to the edge of each field.

Prior to the deployment of the light traps the treatment field had consistently higher Helicoverpa egg pressure than the control field. Auscott's data shows that from November 22 to December 31, 2001 the average total egg density was 5.1 eggs per metre in the treatment field versus 3.0 eggs per metre in the control. Following the deployment of the light traps this trend was reversed and the treatment field had fewer eggs than the control.

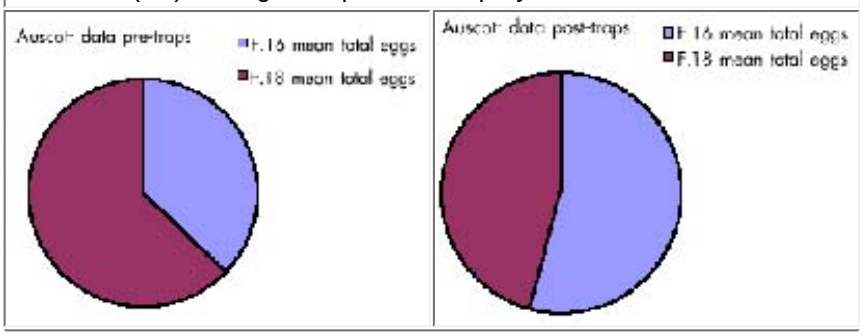
Auscott's scouting records show that once the light trap array was operational the average total egg density was 1.09 eggs per metre in the treatment field versus 1.3 eggs per metre in the control.

FIGURE 1: The mean estimated number of H. armigera and H. punctigera moths captured per night by all nine light traps



Counting the catch. Note the pile of heliothis circled.

FIGURE 3: Auscott counts showing the proportion of total eggs laid in Field 16 (control) versus Field 18 (Treatment) before (3a) and after (3b) the light traps were deployed



The CSIRO scouting checks show an even greater difference. From January 1 to 31, 2002 the mean egg density was 0.65 eggs per metre in the treatment field versus 2.6 eggs per metre in the control field (Figure 2).

These results in Figure 2 suggest that the light traps were capturing enough Helicoverpa moths to reduce egg densities in the surrounding cotton, or interfering with their behaviour. The light traps were spaced 100 metres apart — effectively one light trap per hectare of cotton within the array.

But their area of influence was probably larger than this. There was no significant difference between the densities of eggs recorded from the sampling points inside the light array and the density of eggs at the four sampling points 100 metres outside the array.

This suggests that the minimum area of influence of the nine light traps was at least 16 hectares. The extent of the area of influence outside the trapped area is unknown. On average the Auscott egg counts from close to the edge of the treatment field were higher than the CSIRO counts close to the array, but less than the egg counts in the control field. This suggests that there was a gradient of effectiveness of the light trap array across the whole of the treatment field (and possibly into the neighbouring field), but we did not collect sufficient data to map it.

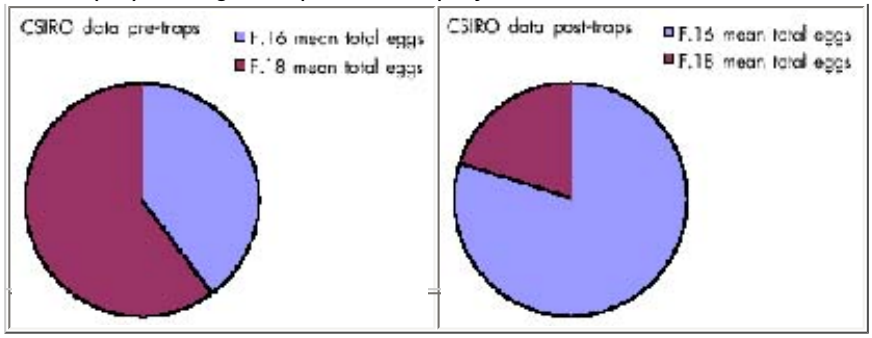
The overall proportion of eggs laid in the treatment field relative to the control is shown in Figures 3 and 4. Auscott's data indicates that throughout January, after the deployment of the light traps, there was a 27 per cent reduction in the proportion of eggs laid at their sampling points around the periphery of the treatment field. Over the same period the CSIRO data indicates that following the deployment of the light traps there was a 67 per cent reduction in the proportion of eggs laid within the 16 hectare area surrounding the light trap array.

Conclusion

Helicoverpa moths were the predominant insect species captured by the vortex light traps within the cotton field. Preliminary results support the hypothesis that the continual removal of adult moths from the treated field reduced Helicoverpa egg densities within the whole field, and especially within the 16 hectare treated area of intensive sampling.

The area of influence of an individual trap remains to be fully quantified. It must be stressed that this work only involved two fields over part of a single season. Such unreplicated experiments require cautious interpretation because other (unknown) factors could contribute to the differences shown. Our study showed promising results — but it also highlights

FIGURE 4: CSIRO counts showing the proportion of total eggs laid in Field 16 (control) versus Field 18 (Treatment) before (4a) and after (4b) the light traps were deployed



Intensive checking suggested a reduction in heliothis numbers in the treated area.

the need for careful evaluation in the future.

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