An overview of *Helicoverpa* in southern NSW cotton crops

Louise Lawrence, CSIRO Entomology and Scott Hardwick, Agrisearch Ltd, NZ

Grains are the traditional field crops grown in southern NSW but there has been a rapid expansion in cotton, from 1000 ha in the 1998-99 growing season to 16 000 ha in 2001-02. Depending on the availability of water, it is expected that the area planted to cotton will continue to expand, at least in the short to medium term.

Southern cotton growers face different production and environmental issues to their northern counterparts. For example, the shorter growing season means production systems have little tolerance of insect or pathogen damage. At present a majority of production is based on traditional 15 inch systems augmented by applications of plant growth regulators to minimize the period between planting and harvest. However, alternative production systems based on ultra narrow row (UNR) configurations are also being used by some growers to achieve a shortened growing season.

Cotton growers in the region want IPM strategies that suit their short growing season. This is particularly important in high input systems such as UNR where *Helicoverpa* thresholds are less than half those normally used.

It is also important to ensure that any increase in cotton production in southern NSW and northern Vic doesn't impact on the traditional crops which have low insecticide use, established IPM strategies for some pests and strategies to retain beneficial insects. Early season insecticide use on cotton could disrupt these systems on adjacent properties. Furthermore concerns were raised as to whether or not changes in the balance of crops being grown would affect the dynamics of *Helicoverpa*. It was also considered important that any IPM strategies for cotton had to be integrated into AWM strategies already in place for other crops.

In an Australian Cotton CRC project, Scott Hardwick from CSIRO took up the challenge to help cotton producers develop management systems that encouraged the retention and build up of beneficial insects in their crops and which included recommendations on crop sequencing, refuge crops and the use of Area Wide Management (AWM).

Trap crops

Chickpeas

Chickpeas proved to be a useful tool in reducing *Helicoverpa* build up early to mid-season. They were not, however, very efficient at intercepting *H. armigera* emerging from diapausing pupae in the soil.

Monitoring showed that the first *H. punctigera* eggs were laid in late-August/early-September as moths migrated into the area, which led to the general recommendation that trap crops be destroyed in late-October mid-November when the first large *Helicoverpa* larvae were observed. However, in warmer years this may need to be earlier. Commercial chickpea crops showed similar *H. punctigera* infestations to trap crops.

As very few beneficial invertebrates were found in chickpeas, such crops appear to be of little importance as beneficial refuges in the cotton areas of southern NSW.

Pigeon peas

In late season pigeon pea trap crops, *Helicoverpa* egg laying began in mid- to late-December whilst larvae were found from late-December on, with densities being highest in early-March. Modelling showed that *H. armigera* pupae resulting from eggs laid after mid-January have a 50% chance of entering diapause whilst those from eggs laid after late-February will almost certainly enter diapause. This means it is possible that a small number of late season *Helicoverpa* adults could be generated by pigeon pea trap crops. In a cool growing season, these have the potential to damage late maturing cotton.

Pupal surveys showed late season pigeon pea trap crops could generate significant numbers of diapausing pupae.

Collecting in pigeon pea revealed a wide range of beneficial invertebrates and when *Helicoverpa* larvae were reared through they produced at least six species of parasitoids.

Cotton

Egg laying patterns showed two periods of increased egg pressure per growing season - in December/early-January and from the second week of February till mid-March. The first peak is probably due to *H. punctigera* moving out of winter and spring crops such as chickpeas that are becoming less attractive as they hay off. When reared to adults, 75% of eggs laid in this period proved to be *H. punctigera*.

Eighty to ninety percent of eggs in the second, late season, peak are *H. armigera* and the moths laying these could be the offspring from survivors of the spray regime in cotton in the region or come from maize crops which are haying off.

The numbers of beneficial insects in cotton were quite low. They tended to increase in the first half of the growing season then declined rapidly. This decline coincided with the opening of the spray window for synthetic pyrethroids. There was a trend to greater numbers of beneficials in Ingard® cotton which may be linked to the reduced number of sprays applied to it.

A wide range of beneficial invertebrates was collected from cotton crops, with spiders being the most common. Although parasitism rates were low, rearing of *Helicoverpa* larvae from cotton revealed at least five species of parasitoids.

Beneficial species

Companion crops for beneficials

Plantings of lucerne as beneficial companion crops, either as stand alone blocks or as strips in the cotton crops, yielded large numbers of beneficials throughout the season. Spiders and lady birds were the most common predators.

Bush remnants

The highest numbers of predators in waste areas and bush remnants were found in spring and winter while numbers were lowest in the middle of the growing season. In spring and winter, there were generally more predators in bushland than the grassy/weedy waste areas. Once again spiders were the most common predators – at both sites. As different types of vegetation supported different species of predators, in any agroecosystem it is important to ensure a range of vegetation types.

Wastelands and remnant vegetation are an important source of predators particularly when no other plants are available as they provide a source of beneficials when crops are planted. However, there is little knowledge on the movement of beneficials in the region and so the contribution of these areas to populations of beneficial in cotton is unmeasured.

Diapausing pupae

The main source of diapausing pupae in the southern cropping area was cotton. They were potentially contributing 77-95% of the total diapausing pupae in the Hillston region of southern NSW.

In southern NSW, the impact of increasing areas of cotton on the numbers of diapausing *H. armigera* pupae is likely to be related to the crop which it is replacing. If it replaces grazing or early maize there could be a significant increase in the number of diapausing pupae.

Information from this project was used in developing an IPM strategy for cotton in southern cropping areas and this, along with associated technologies, was incorporated into an AWM strategy for the region.

Research in this project and an allied GRDC one showed that AWM of *Helicoverpa* spp. in mixed cotton and grains producing areas of southern NSW using IPM and associated technologies is feasible and achievable although the drive for earliness in cotton can present obstacles to the adoption of all aspect of the program.

Contact: Geoff Baker, CSIRO Entomology ph 02 6246 4406, fax 02 6246 4000 email geoff.baker@csiro.au