3.6 Objective 6 - Using trap crops effectively

3.6.1 Introduction

Trap cropping is an IPM tactic that can be utilised on a farm level or an area wide basis. Trap cropping is essentially a method of concentrating a pest population into a manageable area by providing the pest with an area of a host crop or an area of a preferred host crop. When strategically planned and managed, trap crops can be utilised at different times throughout the year to help manage a range of pests. In particular, utilising trap crops in the spring and summer has become an integral component of IPM in area wide groups.

Spring trap crops
Spring trap crops are designed to attract *Helicoverpa armigera* as they emerge from overwintering pupae in spring. A trap crop, strategically timed to flower in the spring, can help to reduce the early season buildup of *H. armigera* in a district.

Spring trap cropping, in conjunction with good *Helicoverpa* control in crops and pupae busting in autumn, is designed to reduce the size of the local *Helicoverpa* population. Over time, this strategy is anticipated to reduce *Helicoverpa* pressure on susceptible crops in the participating region.

This approach is used in different ways:

1. In southern areas, where there is a high incidence of overwintering *H. armigera*, an area of flowering trap crops acts to concentrate locally emerging *H. armigera* moths into a crop where they can be destroyed. The main period of emergence is September to October.
2. In Central Queensland there is minimal overwintering of *Helicoverpa* because temperatures are generally too warm to trigger diapause. Here spring trap crops are used to concentrate local *H. armigera* populations into areas where they can also be destroyed, at a time when there are few other hosts for the *Helicoverpa*.

Summer trap cropping
Summer trap cropping has quite a different aim from that of spring trap cropping. A summer trap crop aims to draw *Helicoverpa* away from a main crop such as cotton or mungbean and concentrate them in another crop such as sorghum, pigeon pea or lab lab. Once concentrated into the trap crop, the *Helicoverpa* larvae can be controlled. In Central Queensland cotton growers are using summer trap crops of pigeon pea as part of their insect resistance management strategy for Bollgard II® cotton.

Some summer trap crops may produce large numbers of beneficial insects that can then move into nearby crops, for example, the parasitic wasp *Trichogramma* in sorghum and maize.

Helicoverpa large larva, controlled using a virus in a pigeon pea trap crop.

3.6.2 First generation or 'Spring' trap crops in southern areas

An ideal first generation trap crop is very attractive to *H. armigera*, is a good nursery for beneficials, does not host secondary pests or diseases, does not become a weed problem and is easy to establish and manage.

Many winter crops have been trialed to measure their potential as a spring trap crop. Chickpea has consistently proven superior to all other crops in its ability to generate large numbers of *H. armigera*, however it is not a good nursery for beneficial insects. Chickpea has also proven to be agronomically robust, suitable for both dryland and irrigated situations.

Early season trap crops ideally direct eggs from *H. armigera* moths emerging from their overwintering diapause. These moths are the carriers of resistance from one season to the next. The trap crops must therefore be attractive from early October onwards.

Growers must ensure trap crops do not become future nurseries of *Helicoverpa*, and so effectively controlling populations in the trap crop by timely destruction of the crop itself is required. Because the trap crop will not be harvested for yield a fast knock-down insecticide is not required, therefore bio-pesticides like Bt and virus formulations may be well suited. In some seasons spring trap crops may be overwhelmed by *H. punctigera* and migrant *H. armigera* prior to the local emergence of moths from diapause.

Be mindful when selecting the type of trap crop to plant, as some effective trap crops such as field pea can also be a host for mirids.

More information on spring trap crops can be found in the publication '*Spring trap crop management guidelines*', which is available from the TRC, or from '*Trap-cropping: A fad or a useful heliothis management tool?*' available on the DPI&F Queensland website.

3.6.2.1 Managing chickpea as a spring trap crop

In all trials, chickpea recorded the highest *Helicoverpa* numbers.

Chickpea has proven to be agronomically robust and suitable for both dryland and irrigated situations. However the search for an alternative to chickpea has been driven by its problems, i.e. *Ascochyta* (a disease) control requirements and the lack of beneficial insect production in chickpea. Many crops have been assessed over the past few years including; field pea, canary, linseed, canola, mustard, niger, early sunflower, lentil and vetch. In all trials, chickpea recorded the highest *Helicoverpa* numbers, whilst many of the other crops were hosts for secondary pests such as mirids and green vegetable bugs.

When to sow

Strong healthy flowering crops are more attractive to *Helicoverpa* than non-flowering crops. For example, the recommended planting time for chickpea trap crops in Central and Southern Queensland is late July to early August. This will ensure that the trap crop is most attractive to *Helicoverpa* when the moths emerge from their winter diapause in late October - November. Check Table 19 to find the ideal planting time.

Table 19. lists the date at which 50% of plants will flower for a range of planting dates at each of the locations given for the Amethyst chickpea cultivar. It is based on long term average temperatures, and so should be considered as a guide only. Some plants will commence flowering earlier than the dates given, and generally the day on which 5% of plants are in flower falls about 5 days earlier than the 50% date. The dates at which 95% of plants will be in flower are generally 5 to 10 days after the 50% date. Amethyst chickpea will continue flowering whilst soil moisture is available.

Table 19. The date at which 50% of Amethyst chickpea plants will have commenced flowering for a range of planting dates and regions.

Planting Date	Gunnedah	Narrabri	Walgett	Moree	Goondi-windi	St. George	Dalby	Emerald
1st June	31-Aug	27-Aug	26-Aug	27-Aug	24-Aug	5-Aug	9-Aug	30-Jul
15th June	10-Sep	7-Sep	6-Sep	7-Sep	4-Sep	22-Aug	25-Aug	16-Aug
1st July	21-Sep	18-Sep	16-Sep	17-Sep	14-Sep	2-Sep	5-Sep	31-Aug
15th July	29-Sep	26-Sep	24-Sep	25-Sep	22-Sep	15-Sep	18-Sep	8-Sep
1st Aug	8-Oct	5-Oct	3-Oct	3-Oct	2-Oct	24-Sep	28-Sep	21-Sep
15th Aug	16-Oct	13-Oct	11-Oct	12-Oct	10-Oct	2-Oct	4-Oct	1-Oct
1st Sept	25-Oct	23-Oct	21-Oct	22-Oct	20-Oct	14-Oct	15-Oct	15-Oct
15th Sept	3-Nov	2-Nov	30-Oct	31-Oct	30-Oct	24-Oct	26-Oct	25-Oct
1st Oct	13-Nov	11-Nov	10-Nov	11-Nov	10-Nov	6-Nov	7-Nov	5-Nov
15th Oct	24-Nov	22-Nov	20-Nov	22-Nov	21-Nov	16-Nov	17-Nov	15-Nov

Size of trap crop
Research results have shown that blocks are more effective than strips or patches. It is recommended to plant a minimum of 2 hectares or 1% of the total cultivated area.

Where to plant the trap crop
To lessen the risk of the major chickpea disease *Ascochyta*, do not plant the chickpeas in or near old chickpea stubble. If you are planting commercial chickpeas, then plant your trap crop near those crops to simplify rotations and chemical applications. You can use some of your commercial chickpea crop as a trap crop, by slashing to prolong flowering until October.

Planting
The recommended plant stand is 20 / m². This rate is lower than crops planted commercially as the trap crop will not be harvested and lower populations will produce larger plants with a prolonged flowering period.

To promote a healthy plant, an inoculant and starter fertiliser should be used along with a seed treatment for *Ascochyta*. Treatments for various diseases such as *Botrytis* grey mould, *Phytophthora* and *Pythium* are also recommended, along with selecting a variety with disease tolerance.

Fungicides
The management of the chickpea disease *Ascochyta*, relies on program applications of fungicides. Even if the crop appears free of the disease, early application of a fungicide is critical in restricting its development.

Crop scouting
Once established, chickpea trap crops should be regularly checked on a weekly basis for insects and diseases. Visual checks are the best method to look for eggs, small larvae and the presence of any disease. Each visual check can be carried out by scouting 5 chickpea plants within one meter. This should be repeated at least 6 time at random sites throughout the crop.

Checking a chickpea crop.

Using insecticides on the trap crop
Spraying maybe required to protect the trap crop from large infestations of *H. punctigera* if they occur, to prolong its usefulness and to make sure that it does not become a nursery for *H. Punctigera*. If spraying is necessary, consider using biological products like Gemstar® or Dipel SC®. This will ensure that there is no pre-selection for resistance, and minimal disturbance to beneficial insects in the area.

Destroying trap crops
To avoid creating a nursery for *H. armigera*, the trap crop must be destroyed prior to the pupation of the first large *H. armigera* larvae. To destroy the trap crop, use at least one full disturbance cultivation. To do this, slash the crop before ploughing it out using a disk or chisel plough so that the stubble is completely incorporated.

For more information refer to the '*Spring Trap Crop Guidelines*' available from the TRC.

3.6.3 Trap crops in Central Queensland

In Central Queensland there is minimal overwintering of *Helicoverpa* because temperatures are generally too warm to trigger diapause. Here spring trap crops are used to concentrate local *H. armigera* populations into areas where they can also be destroyed, at a time when there is a natural gap in the availability of host plants for *H. armigera*.

Bollgard II® requirement
A requirement for Central Queensland in the guidelines for pest management in Bollgard® II cotton, suggests that 1% of the Bollgard® II cropping area should be planted to a chickpea trap crop. This crop must be monitored regularly for *Helicoverpa*, and if substantial numbers of large larvae are found during the last half of September, the crop should be ploughed down as soon as possible. If not, all chickpea trap crops should be effectively cultivated by the 30th September.

Summer trap crops
There is considerable interest in summer trap cropping, which has quite a different aim from that of spring trap cropping. A summer trap crop aims to draw *Helicoverpa* away from a susceptible crop such as cotton or mungbean and concentrate them in another crop such as sorghum, pigeon pea or lab lab. Once concentrated in the trap, the *Helicoverpa* larvae can be rigorously controlled or the crop destroyed. In addition, some summer trap crops may produce large numbers of beneficial insects that can then move into nearby crops, for example, the parasitic wasp *Trichogramma* in sorghum and maize. In Central Queensland cotton growers are using summer trap crops of pigeon pea as part of their insect resistance management strategy for Bollgard II® cotton.

The summer trap cropping including in-season and end of season concepts, are still in a research phase and any benefits are not yet quantified. At this stage, summer trap cropping for *Helicoverpa* (other than in Central Queensland) is not being promoted as a tool for *Helicoverpa* management.

The diversity of the cropping system on the Darling Downs, provide a 'natural' system of trap crops. An alternative approach to specifically planting summer trap crops, is to manage the current range of crops (particularly winter cereals, sorghum and maize) to act as a trap or a beneficial nursery.

For more information on trap cropping visit the DPI&F, Queensland website.

3.6.4 Last generation trap crops

Pigeon Pea can be used as an attractive last generation trap crop.

The aim of a 'last generation' trap crop is to attract moths emerging from non-diapausing pupae under cotton. These pupae will have had intense insecticide resistance selection on the cotton crop. Concentrating the eggs from these moths in the trap crop allows the resulting larvae to be controlled using biological insecticides such as a virus or by cultivation to kill the resulting pupae. This reduces the number of moths contributing to the next generation which contributes to resistant management. However, in practice the benefits of the last generation trap crops are less clear (refer to '*Using trap crops to prevent the development of resistance*' in objective 4).

The trap crop would be planted in December to January in eastern Australia, to ensure that it was highly attractive to *H. armigera* late in the cotton season. The trap crop must be sufficiently attractive to change the local distribution of *Helicoverpa* moths, drawing them into the trap crop area and effectively concentrating egg laying in the trap crop. The attractiveness of the cotton crop relative to the trap crop may significantly influence the potential effectiveness of this strategy. The eggs and larvae in

the trap crop can be destroyed using biological sprays, and the pupae controlled using cultivation. Care is needed to ensure that the trap crop doesn't become a nursery for pests. The area of trap crop planted is also important, with most area wide management groups using 1% of the total farm area as a starting point. This area can be reused to plant the spring trap crop (discussed earlier). As yet however there are no data to justify that 1% is sufficient.