Helicoverpa management in chickpea

Recent research by the Department of Primary Industries and Fisheries (DPI&F) has resulted in a change in recommendations for making control decisions for *Helicoverpa* in chickpea. The decision to spray can now be based on the relationship between the *Helicoverpa* damage potential, the chickpea grain price, and the cost of control, rather than a fixed number of larvae per square metre.

Key points

- The period of crop susceptibility to *Helicoverpa* is early pod set through to maturity.
- The damage potential of *Helicoverpa* is 2 grams of lost yield per larva.
- Grain quality (% defective grain at harvest) does not decline within the range of larval densities that is economic to control to prevent yield loss.

Crop checking

- Check crops regularly – usually once per week increasing to twice a week from early pod set onwards, or when larval numbers approach threshold.
- Use a beatsheet (see instructions).
- Do not include eggs and very small larvae in the count used to calculate threshold. They are difficult to assess accurately, and are not reliable indicators of subsequent populations of larger larvae. A large number of eggs and very small larvae is indicative of a recent egg lay and may warrant rechecking a few days later.

PULSE AUSTRALIA

GRDC Grains Research & Development Corporation

Queensland Government Department of Primary Industries and Fisheries

Using a beatsheet to sample *Helicoverpa* in chickpea

1 A standard beatsheet is made from yellow tarpaulin material with heavy dowel on each end, and is typically 1.3 m wide by 1.5 m long. The extra width catches insects thrown out sideways.

2 **Place the beatsheet with one edge at the base of a row.** On a 1 m row spacing, spread the sheet across the inter-row space and up against the base of the next row. Draping over the adjacent row may be useful for row spacing less than 1 m, or where there is canopy closure, to minimise larvae being thrown off the far side of the sheet.

3 **Using a 1 m long stick (dowel, heavy conduit), shake the row vigorously 5–10 times to dislodge larvae from the plants.**

4 **Size and count larvae on the sheet. Record on datasheet.**

Beat at least 5 metres of row per field

Economic thresholds

Making a control decision

Loss of yield and quality only occurs from pod set to maturity

Vegetative to early flowering:	High populations have no impact on yield or quality. In rare situations, control may be warranted during the vegetative and flowering stages, when pest pressure is extreme (>20 medium to large larvae per square metre).
Mid-flower/early pod set to maturity:	Based on the value of crop loss calculated (refer to the Yield loss table)

- Recent research by DPI&F has determined the consumption rate of a *Helicoverpa* larvae surviving from hatchling to pupation is 2.0 g of grain.
- Loss attributed to a particular larval density is calculated on the basis that medium and large larvae are doing the majority of damage.
- Control decisions are made by comparing the value of the potential yield loss with the cost of control.

Using crop check data to calculate larval numbers and the potential economic loss

STEP 1: Determine the field average for small, medium and large larvae

Only count larvae that will cause damage:

- You need to take several samples and calculate the average numbers for both small and large larvae per metre of row. (refer to larval size guide).
- Numbers of very small larvae (<3 mm) cannot be assessed accurately in the field with a beatsheet. Very small larvae are not included in threshold calculations for this reason. Regular crop monitoring will ensure these larvae are picked up in subsequent counts.
- Not all small larvae will survive to become large larvae. A survival rate of 70% from small to large is average for field populations. Apply this rate to the number of small larvae (small x 0.7) when calculating the number of larvae per square metre for the threshold calculation.
- Larger larvae cause the vast majority of pod damage. Control decisions need to be made to prevent larvae reaching these stages.
- Sampling is by the linear metre, however, the level of infestation in a square metre depends on the row spacing (e.g. a crop with 1 m row spacing has 1 row metre per square metre (m^2), whilst a crop with 50 cm row spacing has 2 row metres per m^2, and therefore double the potential infestation within the crop). You will see the correction for row spacing in the formula below.

$$\text{No. of larvae per } m^2 = \frac{(\text{No. small larvae} \times 0.7) + \text{No. medium larvae} + \text{No. large larvae}}{\text{row spacing (metres)}}$$

Helicoverpa larval size categories and actual sizes

Actual larval size	Larval length (mm)	Size category
	1-3	Very small
	4-7	Small
	8-13	Medium
	14-30 +	Large

STEP 2 : Calculate the value of yield loss that will occur if larvae are NOT controlled

$$\text{Yield loss (\$/ha)} = \frac{\text{Avg No. of larvae per m}^2 \times 2.0^{\Phi} \times \text{chickpea price (\$/t)}}{100}$$

$^{\Phi}$ 2.0 g consumed by each larva

The following table has been produced using the equation in Step 2, for a range of larval densities and crop prices. Doing this calculation allows growers and consultants to answer the question **'what will I lose if I don't spray?'**, or alternatively **'What will I potentially save if I do spray?'**.

The value of crop loss caused by Helicoverpa *larvae in chickpea, for a range of larval densities and grain prices = breakeven cost of control (1:1 benefit:cost).*

Chickpea price ($/t)	Value of crop loss ($/ha)				
	1 larva/m²	2 larva/m²	3 larva/m²	4 larva/m²	5 larva/m²
300	6	12	18	24	30
400	8	16	24	32	40
500	10	20	30	40	50
600	12	24	36	48	60
700	14	28	42	56	70

STEP 3 : Review the calculated yield loss in relation to the cost of control and the working benefit:cost ratio

- In deciding to spray, you need to consider the benefit:cost ratio. For example, if your preferred benefit:cost ratio is 1.5 to 1 you wouldn't initiate control measures until you save $1.50 in crop yield for every $1 you spend on the control.
- As well as providing the yield loss in dollars per hectare, the table above also gives you a guide as to the per hectare 'break even' cost of control measures.
- For example, if your cost of control is $24 per hectare, and you are using a 1.5:1 benefit:cost ratio, you would want your saving in crop yield to be $36 per hectare before you commenced spraying. Therefore, based on the current market price for the crop and the sampling you have completed, you can determine when the infestation gets to a point that would justify the commencement of spraying.

Grain quality:

- Recent trials have shown that in the range of 1 to 4 larvae per m², defective grain is well below the level at which penalties apply (6% by weight, NACMA standard). Given this result, we can be confident that within the range of larval densities for which it is economic to control (Yield loss table above), the potential cost of quality loss does not need to be factored into the economic threshold.

Other considerations:

- At present there are no data on the behaviour of larvae in extremely moisture stressed crops versus crops with adequate soil moisture. So it is unclear whether there is greater or earlier flower and pod feeding when foliage appears to be less attractive.

Pod damage cannot be used as an economic threshold:

- Pod damage indicates lost yield and cannot be used in the same way as the larval economic threshold, which is designed to prevent yield loss occurring.
- Compare the number of undamaged pods as well as the number of damaged pods (per metre of row), to better evaluate the amount of damage relative to the overall pod load.

Timing of control

Yield and quality loss does not occur during flowering

- Spraying during flowering to prevent loss of buds and flowers does not protect yield. However, depending on the insecticide being used, a spray may need to be applied to small larvae during flowering to prevent large larvae developing by pod set.
- Quality assessments on grain harvested from all sites showed no significant difference in quality for any of the time of spraying treatments, other than the untreated.
- In rare situations, control may be warranted during the vegetative and flowering stages, when pest pressure is extreme.
- The application of a spray during flowering may be necessary if using products that are only effective against small larvae. This is done to prevent a population of small larvae from causing damage as large larvae during pod set and pod fill.

Larval feeding behaviour

Explaining the pattern of crop damage

Extensive observational studies of small and large larvae in chickpea showed that small larvae are primarily foliage feeders whilst large larvae feed on pods and foliage (Figure A). Neither small or large larvae were observed to have any preference for flowers, which supports the data that show no yield loss is incurred when *Helicoverpa* larvae are tolerated during flowering.

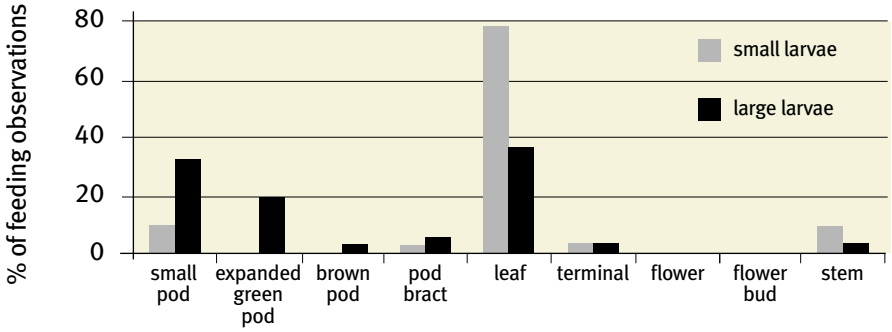


Figure A. The feeding preferences of small and large Helicoverpa *larvae on chickpea when allowed to select feeding sites over a 4 to 6 hour period (small larvae were third instar, large larvae were 4th-5th instar).*

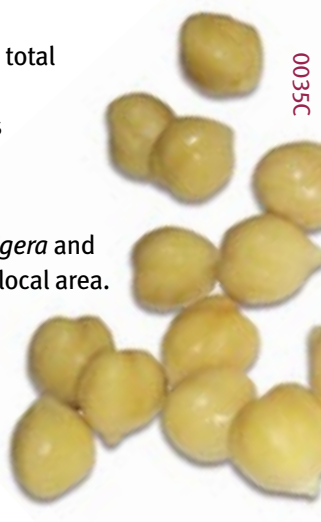
Control considerations

There are additional factors that may influence the control decision, timing and product choice, including:

- Age structure of the larval population and crop finishing conditions in relation to time to desiccation or harvest. For example, a late egg lay is unlikely to result in economic damage if the crop is 7–10 days away from harvest.
- Proportion of *H. armigera* and *H. punctigera* making up the total *Helicoverpa* population. Visual identification, time of year, pheromone catches and local experience will help with this determination.
- Spray conditions and drift risk.
- Resistance levels for *Helicoverpa*, the proportion of *H. armigera* and *H. punctigera* in the population and recent spray results in local area.
- Insecticide Resistance Management Strategy (IRMS).
- Insecticide options, residual and withholding period of the products.

For more information:

DPI&F Entomology
Ph: 07 4688 1369
Mob: 0407 113 306
Fax: 07 4688 1199
Email: melina.miles@dpi.qld.gov.au



0035C