Australian Cotton Cooperative Research Centre

COTTON information sheet

Has Your Pupae Busting Been Effective ?

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Introduction

Heliothis (*Helicoverpa sp.*) pupae that overwinter in the soil have a high risk of carrying insecticide resistance into the next season. Pupae busting, as soon as possible after picking, and no later than the end of August, is an important part of resistance management.

Heliothis survival through diapause can be minimised by cultivation that crushes the emergence tunnel (see Figure 1). When the moth emerges from pupation after such a cultivation it will be trapped and will die. Also, by exposing the emergence tunnel to predators, more pupae can be eaten or parasitised.

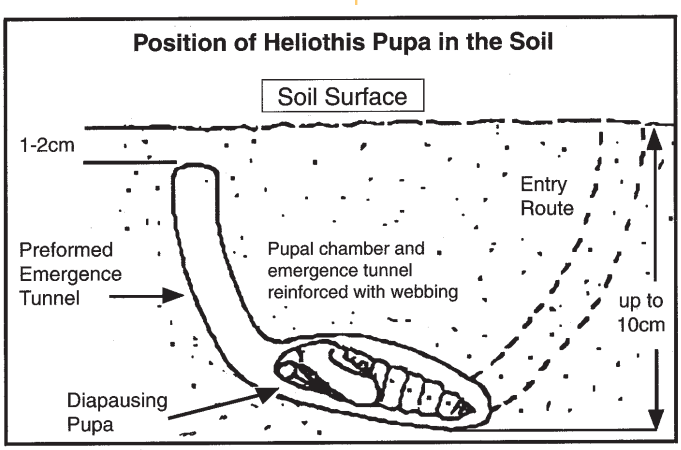

Figure 1 Generalised location of pupae below soil surface note pre formed emergence tunnel for moths

A good pupae busting operation will disturb the top 10cm of the soil, including the plant line and the furrows. A uniform cultivation of the top 10cm of soil is more effective than a deep working that turns up large clods.

The sooner the pupae busting operation occurs after pupation the more effective it will be due to :

- Increased exposure of a pupae surviving the busting operation to predators and parasites
- Increased likelihood that the disturbed soil will settle following rainfall, effectively preventing escape of moths emerging from any surviving pupae.

The only way to know whether your pupae busting is doing a good enough job is to get out in the field and have a DIG! To get a good cross section, it is best to sample over quite a few meters, in different parts of the field.

What to look for

Indications of adequate pupae busting will be:

- Good soil disturbance across the whole surface,
- Exposed pupae and/or
- Destroyed pupal chambers and tunnels.

When larvae are preparing to pupate they burrow and dig an emergence tunnel in the soil (see Figure 1). This tunnel will be 1-2cm below the soil surface and will be about the diameter of a pencil. By carefully scraping the top layer of soil with the side of a trowel, emergence tunnels can be detect-

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ed. As seen in Photo 1, the tunnels have well defined edges and are round.

Photo1: Pupal emergence tunnel revealed by scraping away surface few cm of soil with a trowel

Good pupae busting may leave pupae on top of the soil or embedded in loose soil, with the pupal chamber and tunnel completely destroyed. This will prevent the moths emerging from the soil in spring and make them more prone to predation or parasitisation in the meantime.

If the emergence tunnel has been destroyed by pupae busting it may still be possible to find live pupae in intact pupal chambers (Photo 2).

Photo 2: Live pupa found in intact pupal chamber. Chances of survival of this pupa are reduced due to improved access for predators and parasites. If this pupa is located at depth the loss of the emergence tunnel will doom the fragile emerging moth.

The pupae of *Helicoverpa* species are golden brown in colour and 1-2 cm in length (Photo 3). If still viable, they may 'wiggle' when you handle them.

Parasitised pupae are generally darker, slightly longer and rigid.

Photo 3; *Helicoverpa spp* pupae. Pupae found following cotton crops will be predominantly *H. armigera* the species with the most active resistance to conventional chemicals. NB Live pupae will actively move their tail from side to side when disturbed

You may find emergence tunnels still intact, but with only an empty (longitudinally split) pupal case inside. These moths will have already emerged.

A clean circular decapitation of a pupal case indicates a parasite has been and done its job killing the pupa. You may also find dead or 'squishy' pupae that have been parasitised or affected by a virus.

Your pupae busting will have been effective if

- Cultivation has been completed prior to the emergence dates for your valley
- Pupae physically destroyed
- Surviving pupae exposed to predators and parasites
- Pupal tunnels destroyed and sealed even if pupae survive.

Further information:

Short movies of moving pupae and pupae digging can be viewed from the Australian Cotton CRC Web site :
http://www.cotton.crc.org.au/Publicat/Pest

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