Decision Making for Insect Management in Grain Crops

# Integrated Pest Management pilot workshop for advisors

## Winter Pulses - South

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# Contents



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# Key pests of winter pulses

## Chickpeas, faba beans, lupins, field peas, lentils

| Pest | Emergence | Vegetative | Flowering | Podding - Grainfill |
|---|---|---|---|---|
| Mites | | | | |
| Lucerne flea | | | | |
| Weevils | | | | |
| Snails | | | | |
| Aphids | | | | |
| Helicoverpa | | | | |
| Etiella (field pea, lentils) | | | | |
| Pea Weevil (peas) | | | | |

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# Viruses, aphids and pulses

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# Viruses & Pulses

**Management requires an integrated approach**

Viruses are

- aphid-vectored
- Some are seed-borne

Increased risk if:

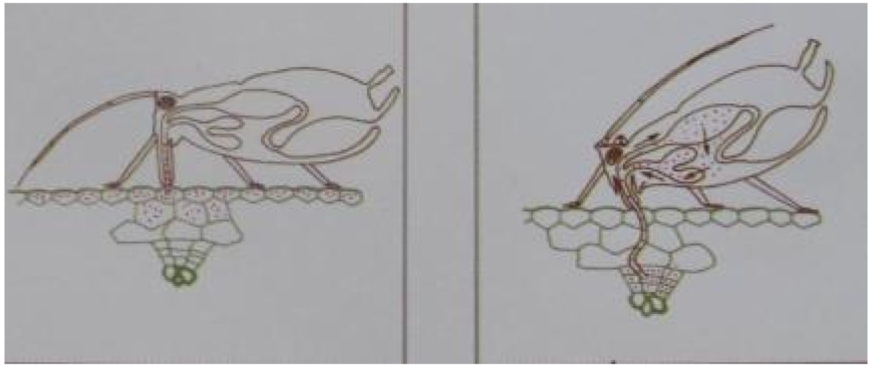
- High rainfall (> 500 mm/year)
- Irrigation region
- Clover/medic pastures and other hosts nearby
- Green bridge (weeds and volunteers)

Cowpea aphid on volunteer vetch

# Aphid virus transmission

**Non-Persistent (N-P) vs. Persistent (P)**

CMV
AMV
BYMV



BLV
BWYV

(image: D Persley, DAFF Qld)

| Non-Persistent (N-P) | Persistent (P) |
| --- | --- |
| Need only very short feeding times | Need feed for several hours to acquire virus |
| **Insecticides <u>not</u> usually fast enough to reduce transmission** | **Insecticides may reduce virus transmission** |

- Monitoring and aphid thresholds do <u>not</u> apply to aphids carrying virus

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# Assessing risk: aphids and virus transmission


## Transmission of viruses by different aphid species

| Aphid species | Cucumber mosaic virus (non-persistent) | Pea seed-borne mosaic virus (non-persistent) | Beet western yellows virus (persistent) |
|---|---|---|---|
| Green peach aphid | ✓ | ✓ | ✓ |
| Pea aphid | ✓ | ✓ | |
| Cowpea aphid | ✓ | ✓ | ✓ |
| Bluegreen aphid | ✓ | | |

Ex GRDC factsheet "Aphids and viruses in pulse crops"

# Managing aphids and virus impact

Minimise sources of virus (green bridge, weeds)

**Sow**

- virus-free seed
- resistant cultivars
- Into standing stubble
- Higher seeding rate

Virus-infected plants scattered through a chickpea crop

**Control**

- Seed dressing where risk of persistent virus

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# Flowering to grain fill

## Native budworm

### Etiella moth

Aphids

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# Native budworm

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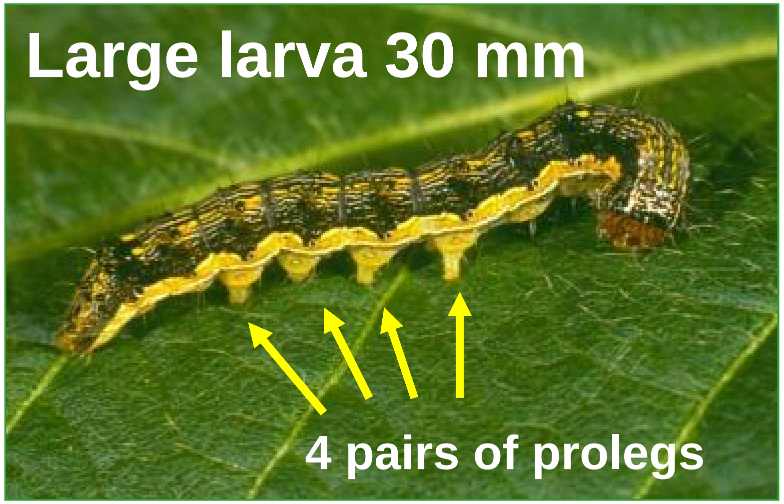
# Native budworm life stages

***Helicoverpa punctigera***

**Eggs:** fresh, brown ring, about to hatch **Only 0.6 mm diameter**




| Helicoverpa size categories | | | |
|---|---|---|---|
| Very small | Small | Medium | Large |
| 1-3 mm | 4-7 mm | 8-23 mm | 24-30+ mm |

**90 % of damage caused by these larvae**

# Monitoring budworm

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## Early warning – moth activity

- Pheromone traps

## In-crop monitoring

- Sweep net

# Dynamic thresholds for native budworm

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| | **K – grain loss kg/larva/ha** | **P** – grain price $/tonne | **C** – cost of control $/ha | **ET** – larvae per 10 sweeps |
|---|---|---|---|---|
| **Field peas** | **50** | 350 | 10 | **0.6** |
| **Lentils** | **60** | 435 | 10 | **0.4** |
| **Faba bean** | **90** | 335 | 10 | **0.3** |
| **Chickpeas - desi** | **30** | 275 | 10 | **1.2** |
| **Canola** | **6** | 580 | 10 | **2.9** |
| **Lupins** | **7** | 300 | 10 | **4.8** |
| **Field peas** | **50** | 350 | 10 | **0.6** |

**ET = (C x 1000) / (K x P)**

$$ET = (C \times 1000) / (K \times P)$$

**Developed in Western Australia:* Source: DAFWA

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# Example ready reckoner: chickpea

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Control is warranted if the cost of control is less than the value of the yield loss predicted.

| | Value of yield loss ($/ha) | | | | |
|---|---|---|---|---|---|
| Chickpea price ($/t) | 1 larva/10 sweeps | 2 larva/10 sweeps | 3 larva/10 sweeps | 4 larva/10 sweeps | 5 larva/10 sweeps |
| 200 | 6 | 12 | 18 | 24 | 30 |
| 300 | 9 | 18 | 27 | 36 | 45 |
| 400 | 12 | 24 | 36 | 48 | 60 |
| 500 | 15 | 30 | 45 | 60 | 75 |
| 600 | 18 | 36 | 54 | 72 | 90 |

Value of yield loss = (cost of control x 1000)/ (30 x chickpea price)
based on DAFWA estimate of potential yield loss 30 kg/ha per larva/10 sweeps

# Do receival standards for defective grain make yield thresholds irrelevant?

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Faba bean as an example

| Cost of control ($/ha) | Grain price ($/t) | | |
|---|---|---|---|
| | 300 | 400 | 500 |
| 15 | 0.6 | 0.4 | 0.3 |
| 20 | 0.7 | 0.6 | 0.4 |
| 25 | 0.9 | 0.7 | 0.6 |
| 30 | 1.1 | 0.8 | 0.7 |
| 35 | 1.3 | 1.0 | 0.8 |
| 40 | 1.5 | 1.1 | 0.9 |

Based on DAFWA yield loss estimate of 90 kg/ha per larva per 10 sweeps.

| | |
|---|---|
| Faba beans Canning grade | **2% Max by weight,** includes 1% Max by weight Poor Colour |
| Faba beans #1 grade | 6% Max by weight includes 3% Max by weight Poor Colour **3% Max by weight total of all other Defects** |
| Faba beans #2 grade | **10% Max by weight**, includes 7% Max by weight Poor Colour |
| Faba beans #3 grade | **20% Max by weight** of which 7% Max by weight bin burnt, caked, heat damaged, sprouted |

# Other considerations

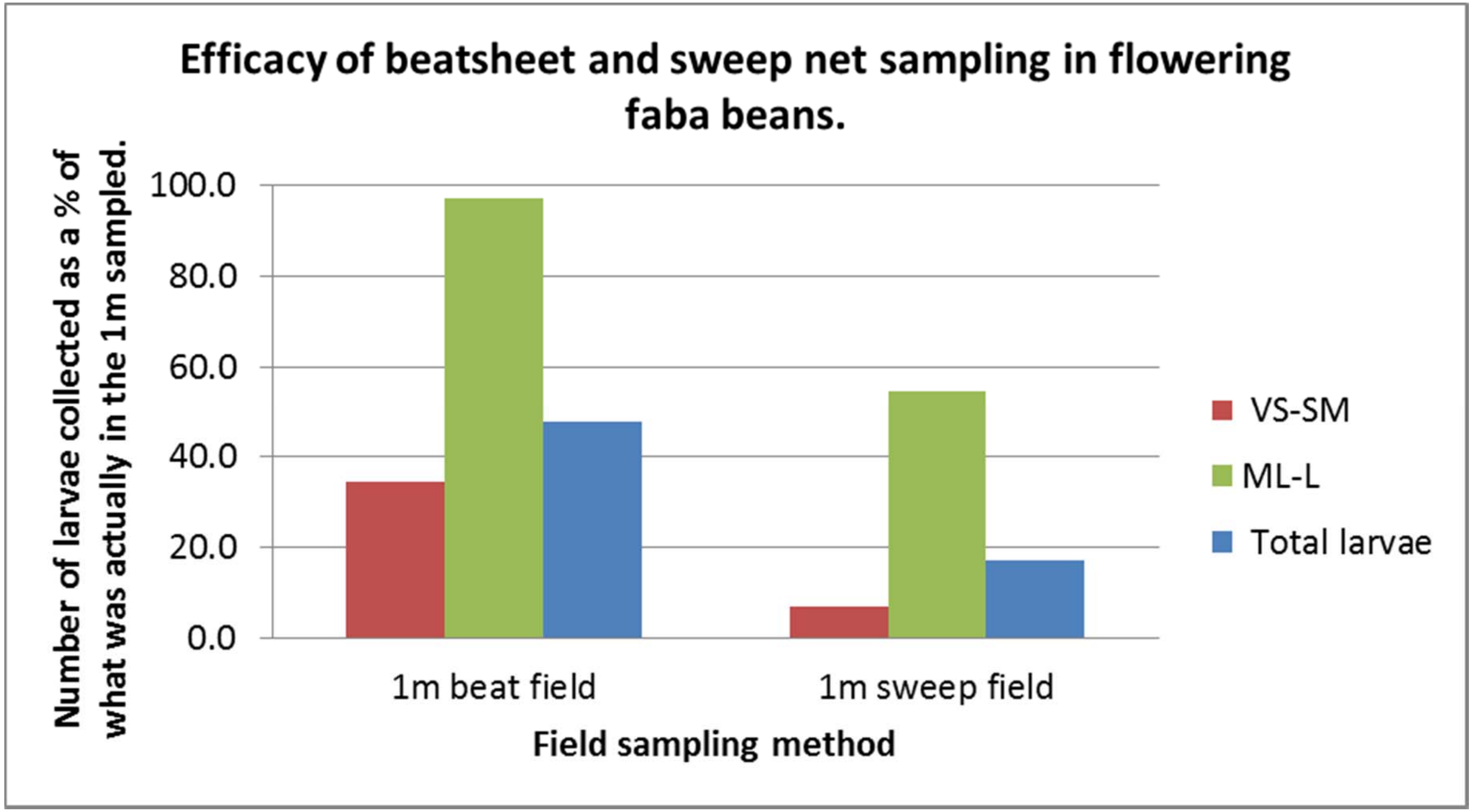
Egg and early instar mortality high

Hot weather – small larvae burrow

Soft options – NPV, Bt?

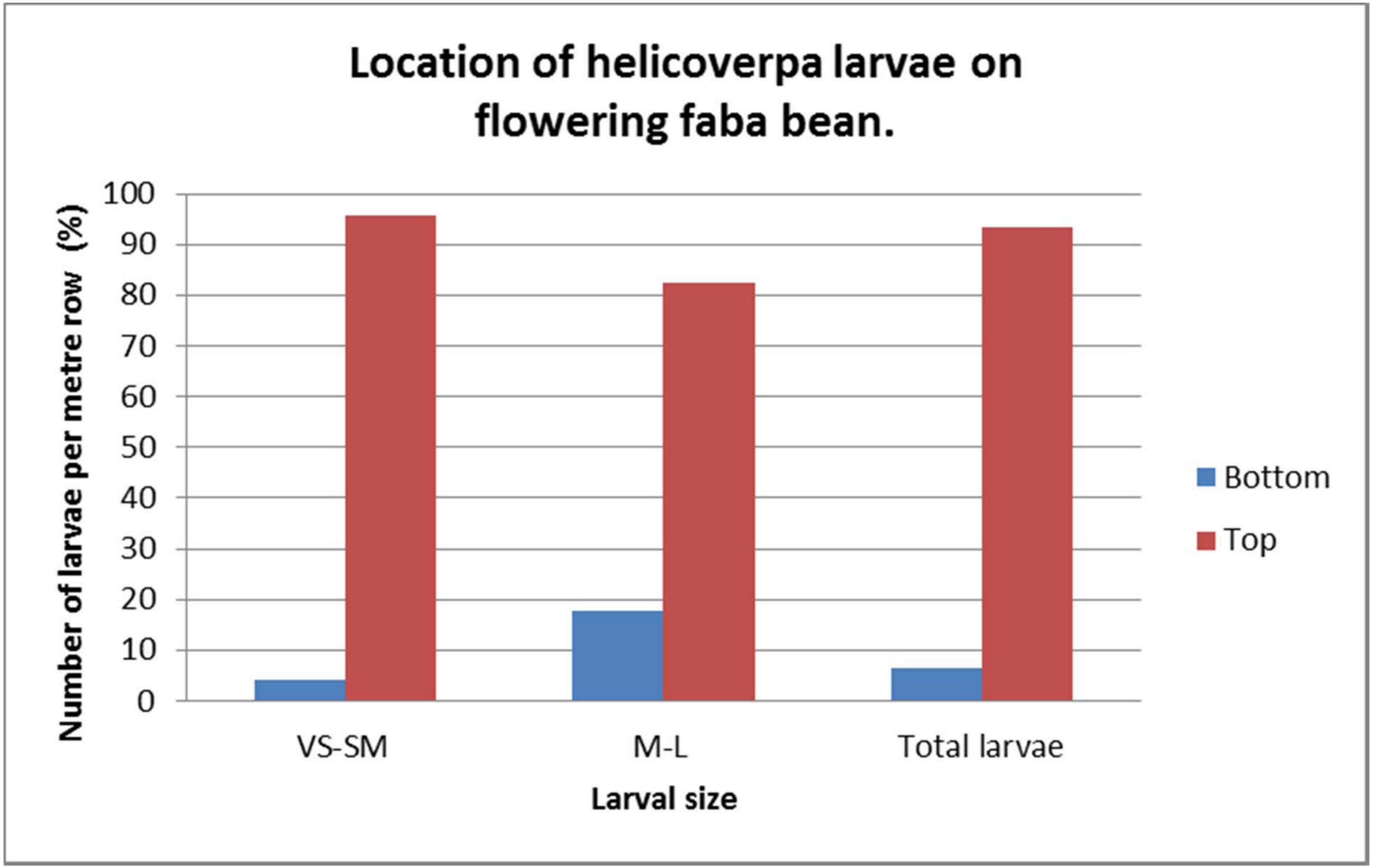
Target small – medium larvae

# Faba beans - sampling




45 cm row spacing
Average plant height = approx 60 cm
mean larval density 5-8 per metre row

QDAFF, 2014


Location of helicoverpa larvae on
flowering faba bean.
Number of larvae per metre row (%)
100
90
80
70
60
50
40
30
20
10
0
VS-SM
M-L
Total larvae
Larval size
Bottom
Top

QDAFF, 2014

# *Etiella in lentils*

# *Etiella* in lentils

- Larvae remain enclosed within pods until close to maturity
  - Damage levels not known until harvest
  - Not exposed to chemical sprays
- Sprays must target adult moths before egg lay
- Therefore require early warning system
- Very low tolerance for damaged lentil grain


http://www.graintrade.org.au/commodity_standards

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# Early warning system – *Etiella*

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*Etiella* degree-day model

- Forecasts timing of initial moth flight
- Uses daily max/min temperatures
- Date when the model reaches 351 D-days is the date to start monitoring for moth flights
- Download the model from the SARDI website www.sardi.sa.gov.au
- Input max/min temperatures from www.bom.gov.au/climate/data
- **PestFacts newsletter provides model D-day outputs during spring**

# *Etiella* flight model output

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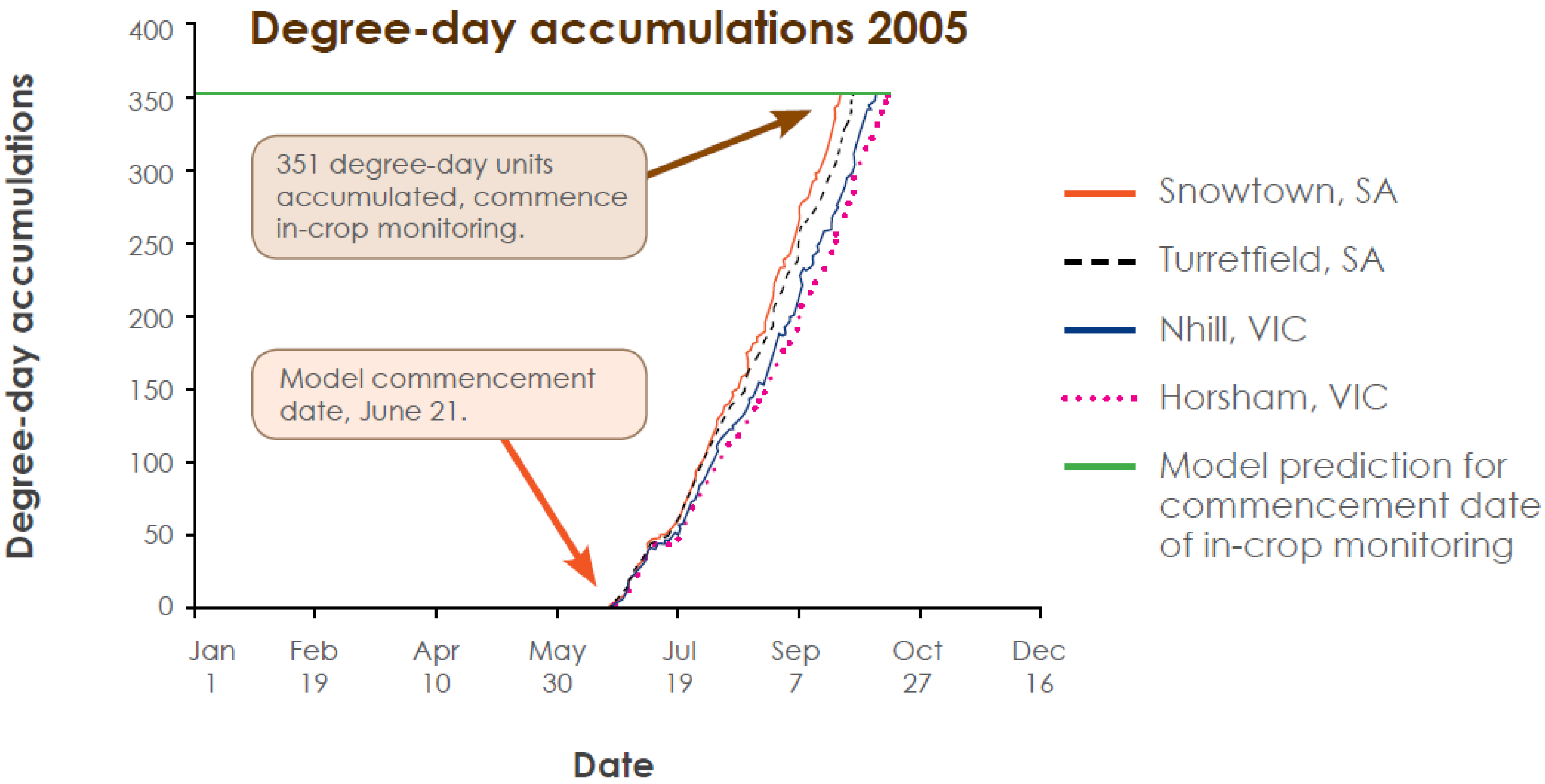


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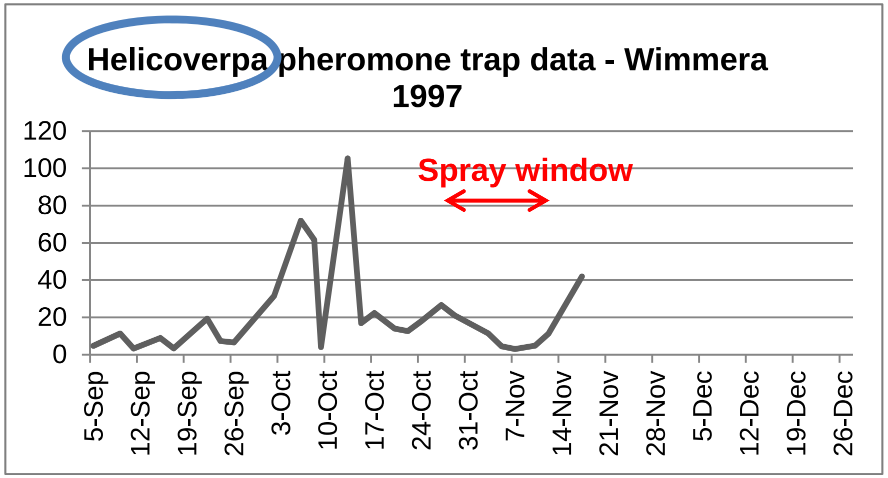
# Can we control *Helicoverpa* and *Etiella* with one spray?

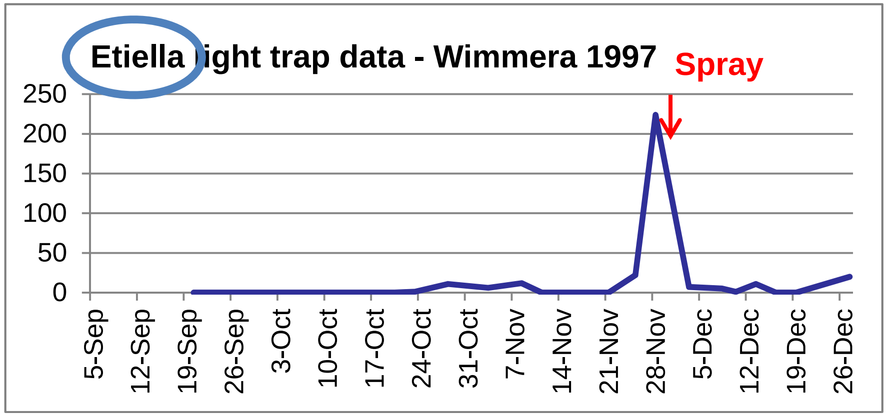
- Not in all years.

  eg. Wimmera 1997.

- However in some years YES.

- Requires close monitoring and use of the *Etiella* model.




*Adapted from M. Miles, H. Brier, Lentil Focus Proceedings 2002*

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# Aphids – direct damage

| | Threshold |
|---|---|
| Chickpea | None |
| Lupins | Treat at appearance of clusters on flowering plants (NSW) |
| Faba beans | 10% plants heavily infested (Vic) |
| Field pea | None. Assess % plants infested. |
| Lentil | None |

# Winter pulse best bet

| Pest | Post harvest, Pre-sowing | Establishment - vegetative | Flowering - grainfill |
|---|---|---|---|
| Aphids<br>– direct damage (not virus)<br>Cowpea<br>Green peach<br>Blue-green<br>Pea aphid | Remove green bridge (aphid hosts) to minimise build up during autumn and spring.<br>Sowing into standing stubble may reduce aphid landing and delay aphid build up in crops. | Control in-crop weeds to minimise sources of aphids.<br>Conserve beneficial insects that will suppress small aphid populations and reduce the likelihood of outbreaks.<br>High nitrogen may make the crop more attractive to aphids | Conserve and monitor beneficials that suppress aphids.<br>Be aware that use of SPs, OPs and carbamates may flare aphids. Monitor post application for flaring.<br>Limited knowledge of damaging levels.<br>If control is required, use soft options (e.g. pirimicarb). |

# Virus in chickpea

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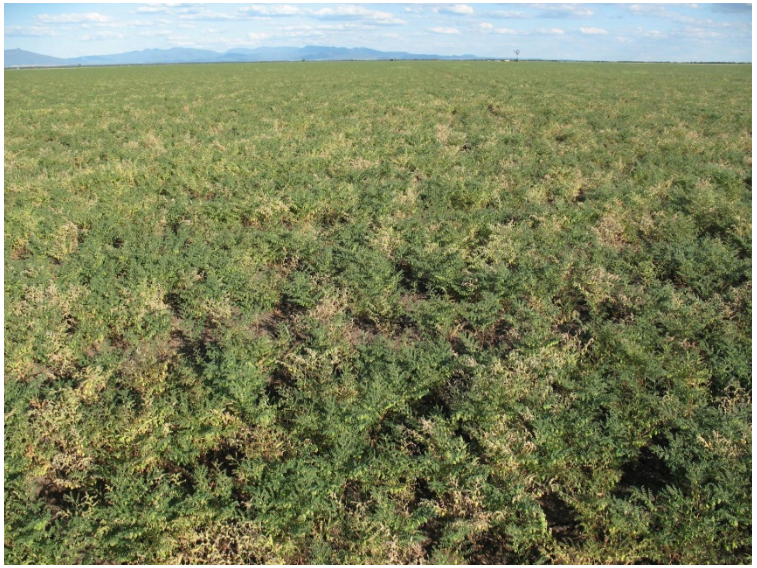

Edgeroi chickpea crop (11km NW of Edgeroi) with ~50% symptomatic plants throughout block 2012. (M. Sharman, DAFF)

Virus symptoms in chickpeas showing reddening 2011 (M. Sharman, DAFF)

- Losses are often difficult to estimate but can be 100% if infections are early in the cropping cycle and at high incidence
- if infection is very late in the season then those plants may still have produced some pods but it is likely the seed quality would be poor as the plants would have shut down (died) prematurely.

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# Pea weevil

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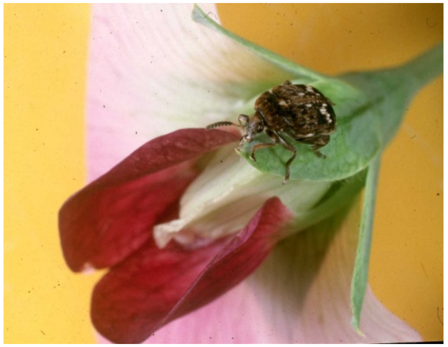
# Pea Weevil (PW): a southern Pulse IPM case study



- 1980's  - emerged as major pest
  - no effective natural enemies
  - no cultural controls
  - insecticidal control difficult
    - Timing must  prevent egglaying

- 1986-1992: coordinated research on PW biology/ecology across 3 States
  - objective to generate new knowledge to improve management

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# Pea Weevil: the key R&D findings

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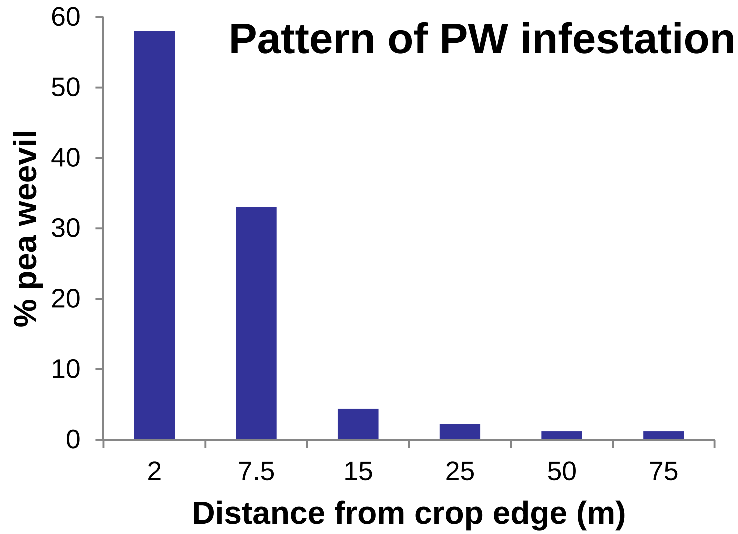
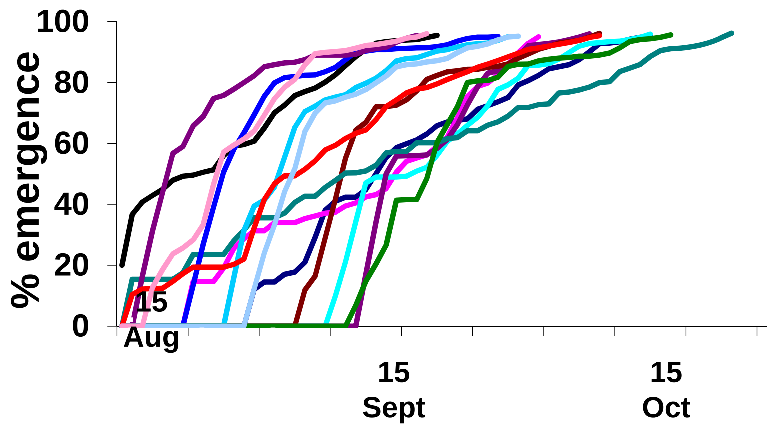
- PW invasion of pea crops
  - Occurs from crop edge, PW infestation remains highly skewed
  - Timing of invasion (start date & duration) is temperature dependent
    - Predictive models were developed




- Rate of Pea Weevil Development
  - Rate of ovarian development
  - Egg to adult: Pea crop consistently harvestable 3-4 weeks before first PW adults develop

Estimated timing of PW invasion, SA, 1986-2002



# Pea Weevil - The IPM Strategy

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- Optimised Insecticidal Control
  - Border spraying (outer 40m, < 1/3rd of average crop area)
  - Accurate timing guidelines:
    - date for 1st spray
    - need for 2nd spray (and date if required)
  - Marked reduction in grain infestation levels and spray costs
- Early Harvest followed by grazing
  - Yield losses minimized, and
  - Prevents PW dispersal and carryover within the district