Decision Making for Integrated Pest Management in Grain Crops

# Sorghum pest management

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# The suite of potential pests

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| | **Impact on the crop** |
|---|---|
| ***Helicoverpa armigera*** | Larvae feed on filling grain = Yield and quality |
| **Sorghum midge** | Prevent seed set = Yield |
| **Corn aphid** | Honeydew contamination = No impact on yield |
| **Rutherglen bug** | Adults and nymphs feed on setting and developing grain = Yield and quality |
| **Sorghum head caterpillar** | Larvae feed on filling grain = Yield |
| **Yellow Peach moth** | Larvae feed on filling grain = Yield |
| **Armyworm** | Feed on vegetative plants = no impact on yield |
| **Establishment pests**<br>Cutworm, FWW, crickets, black field earwigs, cockroaches | Adults and larvae feed on seed, seedlings = reduced plant stand or retarded seedling development |
| **Locusts** | In plague years = defoliation, feeding on developing and maturing grain = Yield and growth. |

# The focus of the discussion

| | Impact on the crop |
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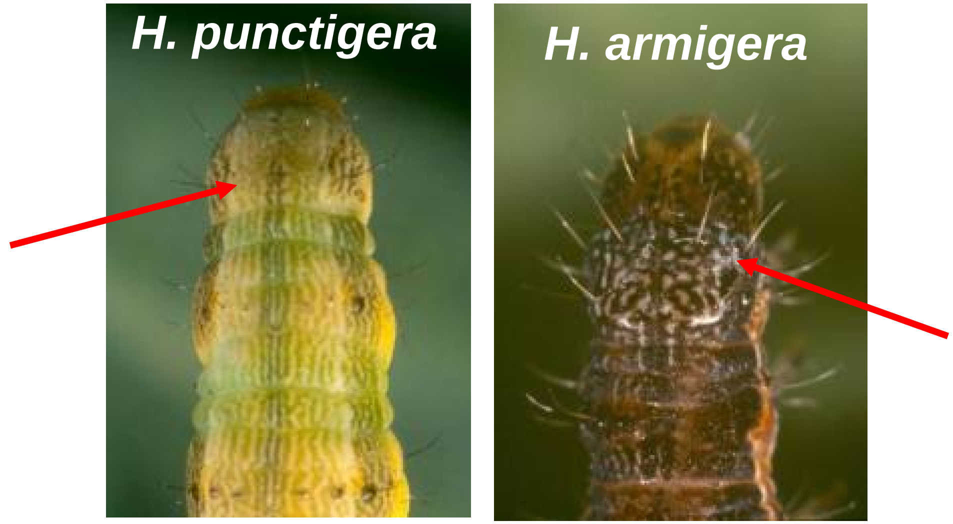
# *Helicoverpa armigera* – corn earworm

Only *H. armigera* in sorghum – no *H. punctigera*




**major driver of local populations = pest pressure**

- Chickpeas - Control in chickpeas, and pupae busting play a role in managing local populations
- Infestation of vegetative sorghum – control these populations?

**Sorghum is a sink for *H. armigera* in the system**

- Egg and larval parasitism, predation can be significant

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# Monitoring and Management

**The basics:**

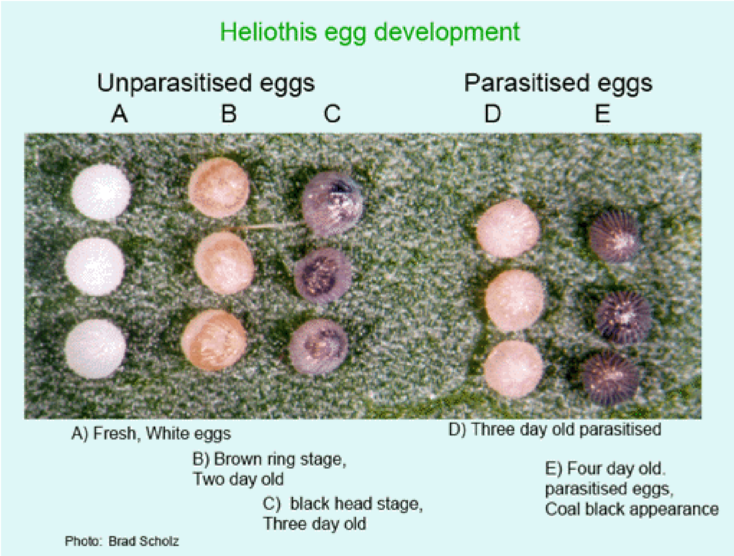
80% of eggs laid prior to flowering

Uniform crop flowering = uniform larval age

Also impacts on sorghum midge management

(**what influences uniformity of flowering, and can this be managed?)**

- Early instars feed on pollen, 4th instar and older feed on developing seed
- Egg density not a good measure of potential larval density
  - Parasitisim by Trichogramma, predation by Orius, cannabalism of early instars




# Managing Helicoverpa in sorghum

**How do you monitor?**

Visual, beat heads, spin heads

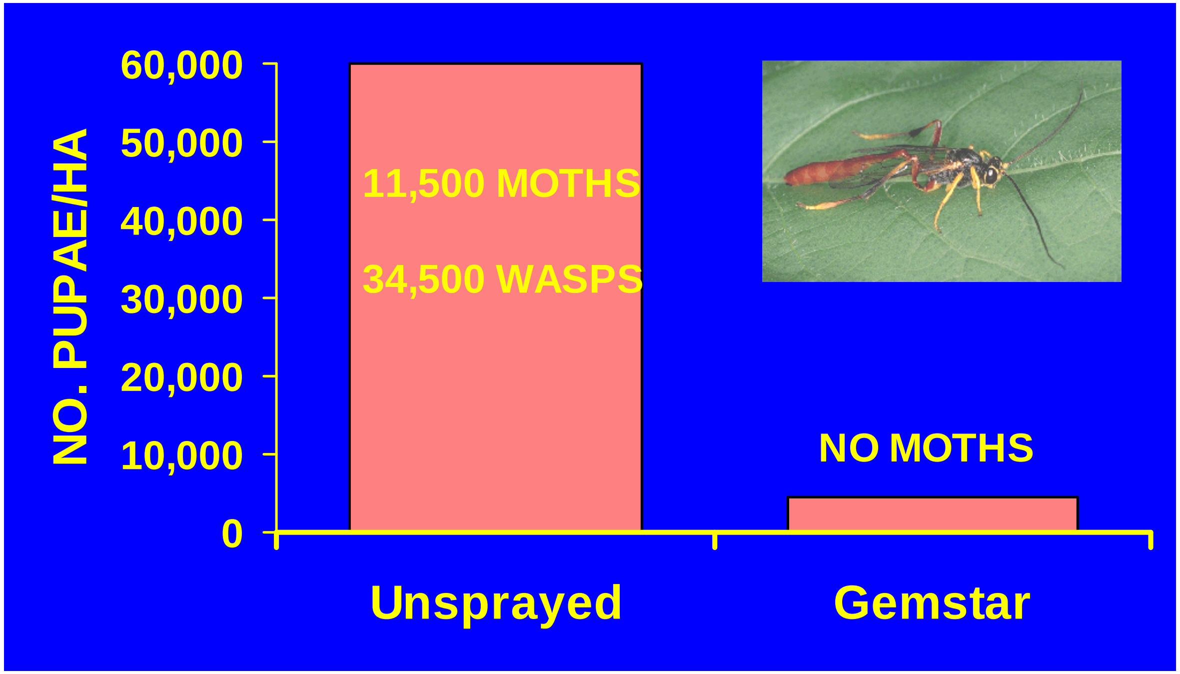
**What do you record, and why?**

**Monitoring and control decisions**

- getting the timing right
- the contribution of beneficial insects
- thresholds
- control options and considerations

# More than just the pests

**Importance of beneficials in your management decisions?**



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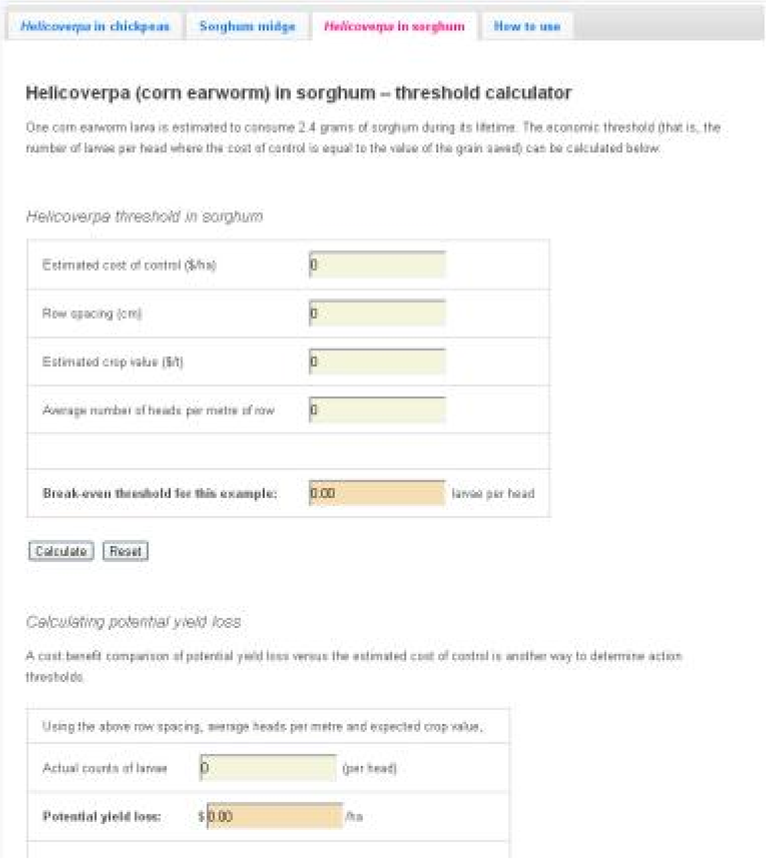
# Making decisions to control

**Threshold**

Based on a yield loss of 24 kg/ha yield loss per larva per m row.

On-line calculator now available – **demonstrate**

- there is compensation (applies to midge too) = larger seed beside seed that doesn’t fill
- Damage during maturity cannot be compensated for.




Influences on product choice

- Larval density and age
  - Crop uniformity and larval age spread

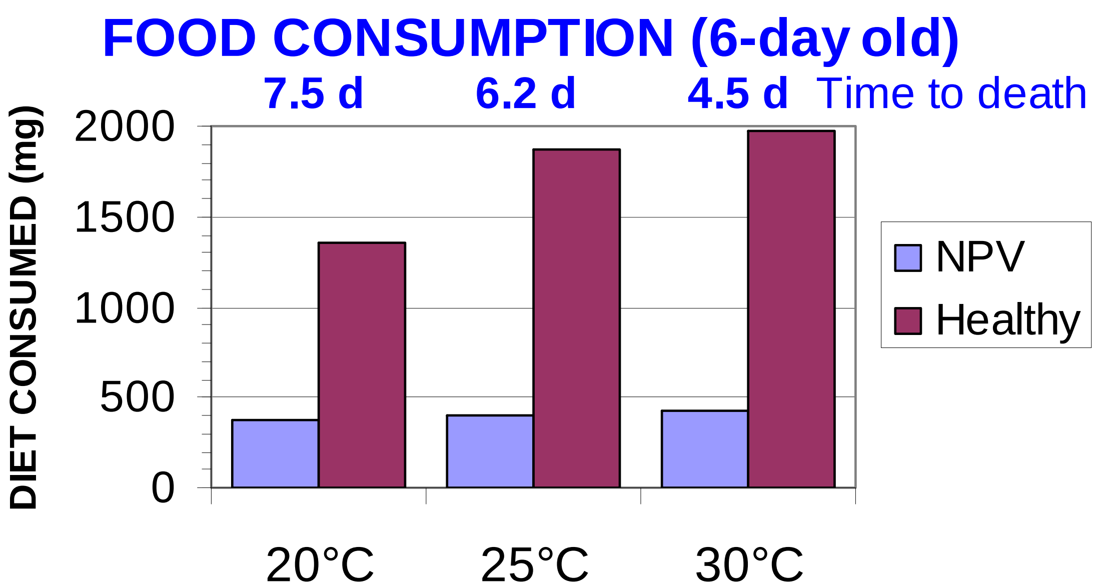
# Getting the best out of NPV

NPV is a % product

NPV is only effective against larvae up to 4th instar (<13 mm)

**Issues with NPV**

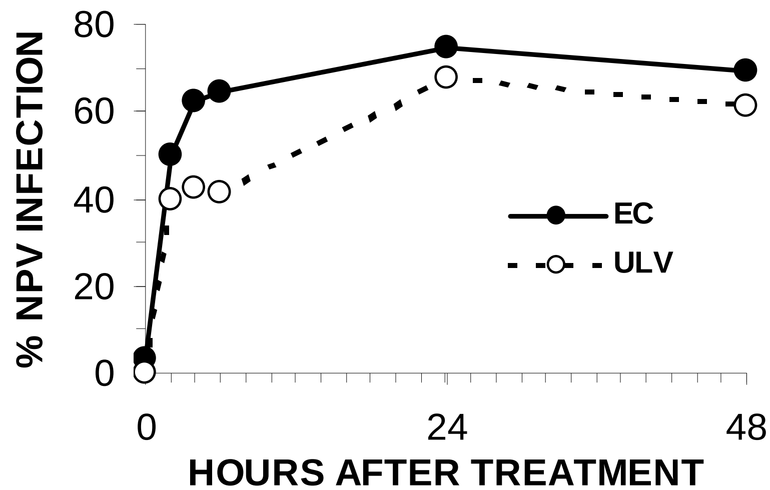
- Influence of cool weather on efficacy or speed of kill (understanding the 12 degree threshold for larval activity/feeding)

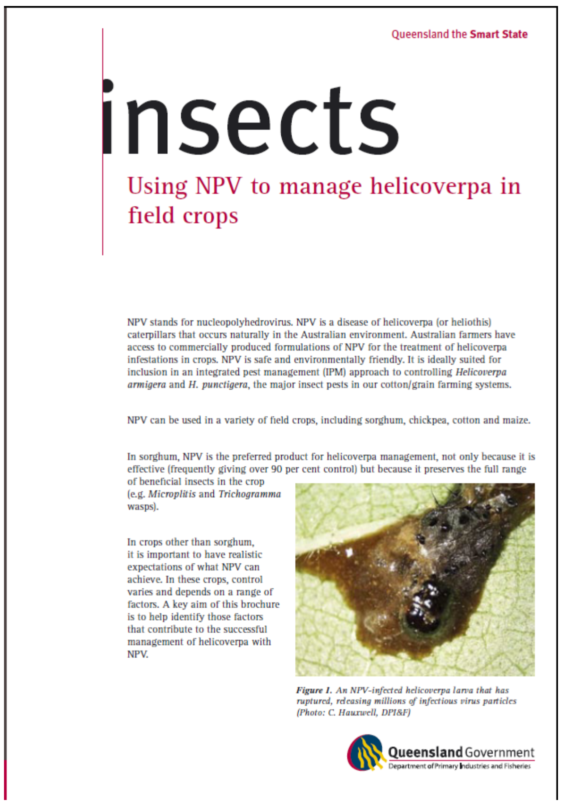


# Getting the best out of NPV

Acquisition is rapid (max uptake within 1 hour)

- focus on achieving optimal coverage



Queensland the Smart State

insects

Using NPV to manage helicoverpa in field crops

NPV stands for nucleopolyhedrovirus. NPV is a disease of helicoverpa (or heliothis) caterpillars that occurs naturally in the Australian environment. Australian farmers have access to commercially produced formulations of NPV for the treatment of helicoverpa infestations in crops. NPV is safe and environmentally friendly. It is ideally suited for inclusion in an integrated pest management (IPM) approach to controlling *Helicoverpa armigera* and *H. punctigera*, the major insect pests in our cotton/grain farming systems.

NPV can be used in a variety of field crops, including sorghum, chickpea, cotton and maize.

In sorghum, NPV is the preferred product for helicoverpa management, not only because it is effective (frequently giving over 90 per cent control) but because it preserves the full range of beneficial insects in the crop (e.g. *Microplitis* and *Trichogramma* wasps).

In crops other than sorghum, it is important to have realistic expectations of what NPV can achieve. In these crops, control varies and depends on a range of factors. A key aim of this brochure is to help identify those factors that contribute to the successful management of helicoverpa with NPV.

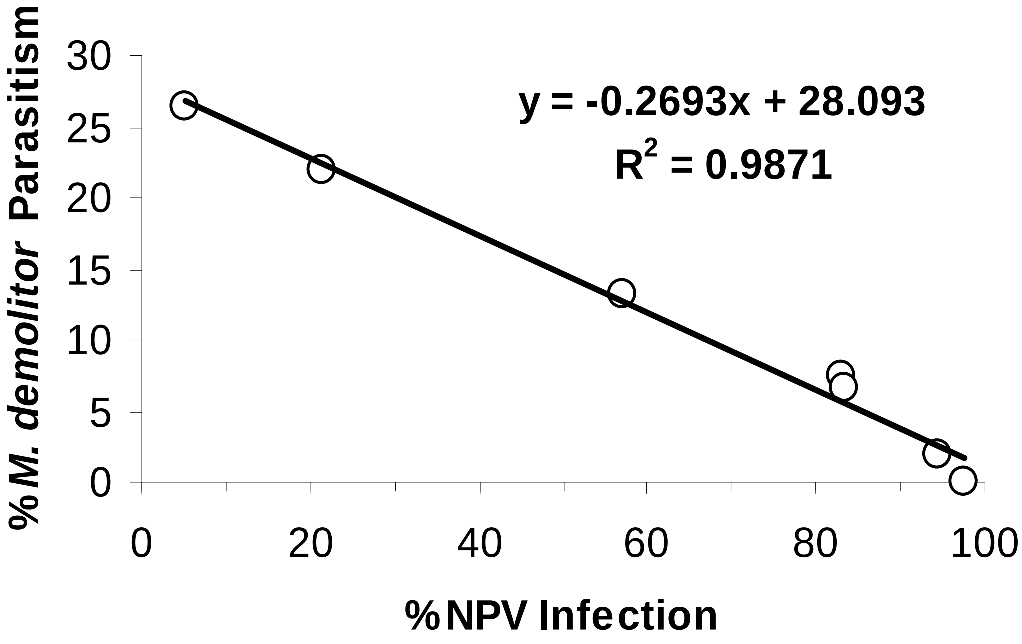
***Figure 1.*** *An NPV-infected helicoverpa larva that has ruptured, releasing millions of infectious virus particles (Photo: C. Hauxwell, DPI&F)*

Queensland Government
Department of Primary Industries and Fisheries

NPV has no impact on beneficials – but timing important to preserve *Microplitis* (needs a 3 day advantage to complete development)

- Beneficial activity more important where a single application may not give a high level of control
- benefits for other crops in the system

= Apply NPV 3 days post flowering (50% of heads with brown anthers)




*Microplitis* larva inside helicoverpa larva

**Yellow anthers**

**Brown anthers**

**But, better to go early than late**

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# Summary

- Crop uniformity makes control decisions simpler re. timing and product selection
- Sorghum potentially a sink for Helicoverpa and a source of parasitoids in the system
- Late crops, with larvae present past mid March, potentially harbour diapausing larvae – pupae busting consideration.

# Midge basics

**Midge populations driven by**

- Johnson grass – first generation in this host
- Successive generations in a local area – successive plantings and low MR varieties
  - 10 x increase in population each generation

**Midge Resistance**

- Physical resistance to placement of egg in the floret
- Has reduced the need for spraying considerably
  - But SP use will impact on *H. armigera*
  - Allowed increased flexibility in terms of planting time
  - Although extreme pest pressure will put strain on the resistance

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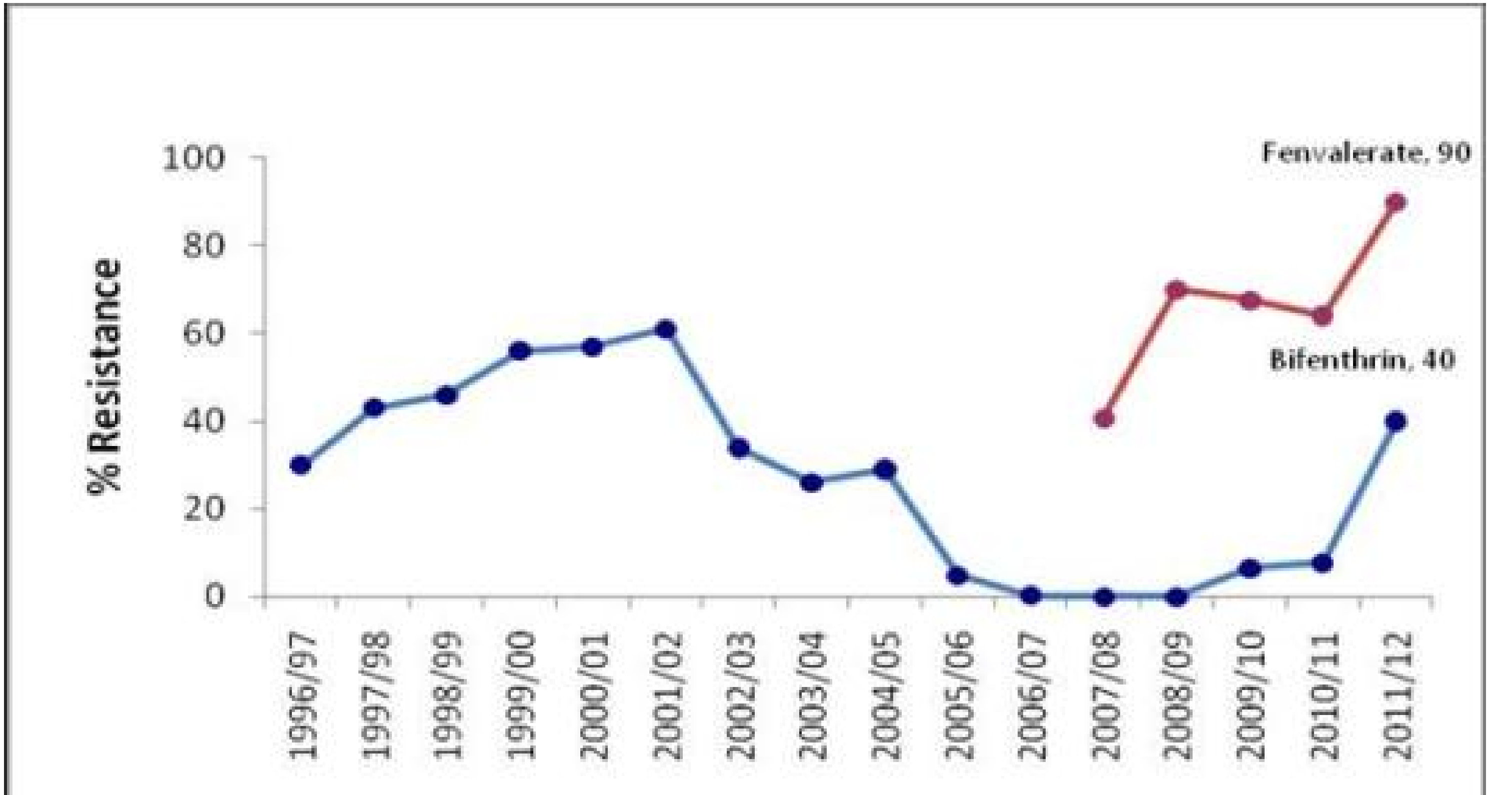
# Multipest considerations




(Lisa Bird, NSW DPI)

**SP resistance in *Helicoverpa armigera* increased in 2011/12 season**

**Why?**

- midge spraying in sorghum
- sp use in chickpea

# Management and control

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## Threshold

- Based on midge numbers – early morning monitoring
- Incorporates compensation, MR, insecticide persistence
- On-line calculator available – (demonstration)


**Sorghum midge parasitoids**
Contribute to overall population suppression – not midge control.

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# Strategy for managing sorghum

- Control alternate hosts in spring i.e. Johnson grass

- Plant early (prior to mid November)
  - Avoid high midge pressure
    - Reduce likelihood of spraying
    - Maintain efficacy of MR

- Manage the crop for uniform flowering
  - 3 week spread will result in midge from early heads attacking late heads in the same crop

- Highest possible MR for later plantings
  - Midge pressure increases as the season progresses

# Diagnosing causes of yield loss in sorghum at the end of the season

Sterility?
Midge?
Rutherglen bug?
Corn earworm?
Mice?
Birds?

**Discussion**

**How often are you faced with this sort of situation?**
**And how do you go about identifying what has happened?**

# Look at the pattern of yield loss

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## Sterility

- Large areas of head devoid of grain
- No evidence of shriveled grain in glumes
- Uniformity in where the poor seed set is in heads across the field
- High temperatures during flowering
- Persistent rain during flowering

## Sorghum midge

- Grain fails to develop – nothing in the glumes
- Squashed grain exudes pink fluid (midge pupa)
- Empty pupal cases visible (>2wks post flowering)
- No grain or frass on the ground

# Diagnosing causes of yield loss in sorghum

**Rutherglen bug**

- Grain fails to develop – nothing in the glumes (looks like midge damage)
- Small shrivelled grain that fails to develop further
- Spotting on maturing grain (feeding punctures + fungi/bacteria)
- Damage to the endosperm (developing seed)
- No grain or frass on the ground

**Corn earworm**

- Preflowering damage (grazing)
- Chewed and partly consumed grain
- Empty glumes – but open
- Grain or frass on the ground and in leaf axils

# Rutherglen bug

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**Trial work to date:**

Characterised damage – dry and irrigated

Provisional threshold

- Need field validation of provisional threshold

Insecticide evaluation

| Anthesis | Milky dough | Soft dough | Hard dough |
|---|---|---|---|
| Check for RGB<br>Control warranted if >20-25 bugs/head | | Control warranted if >30-50 bugs/head | No impact on yield or quality post physiological maturity |

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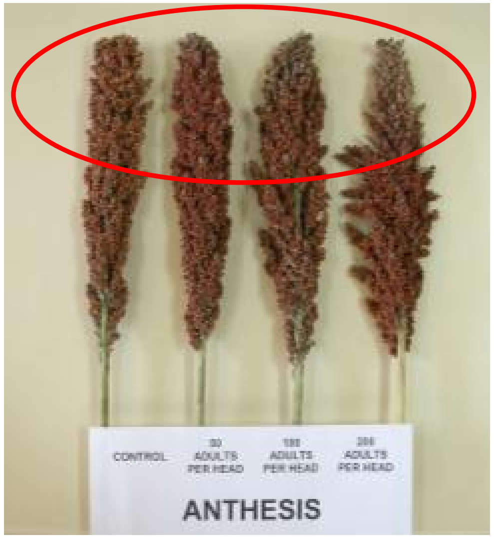
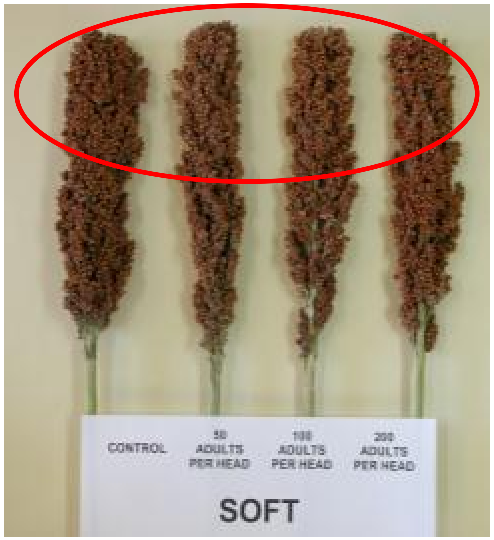
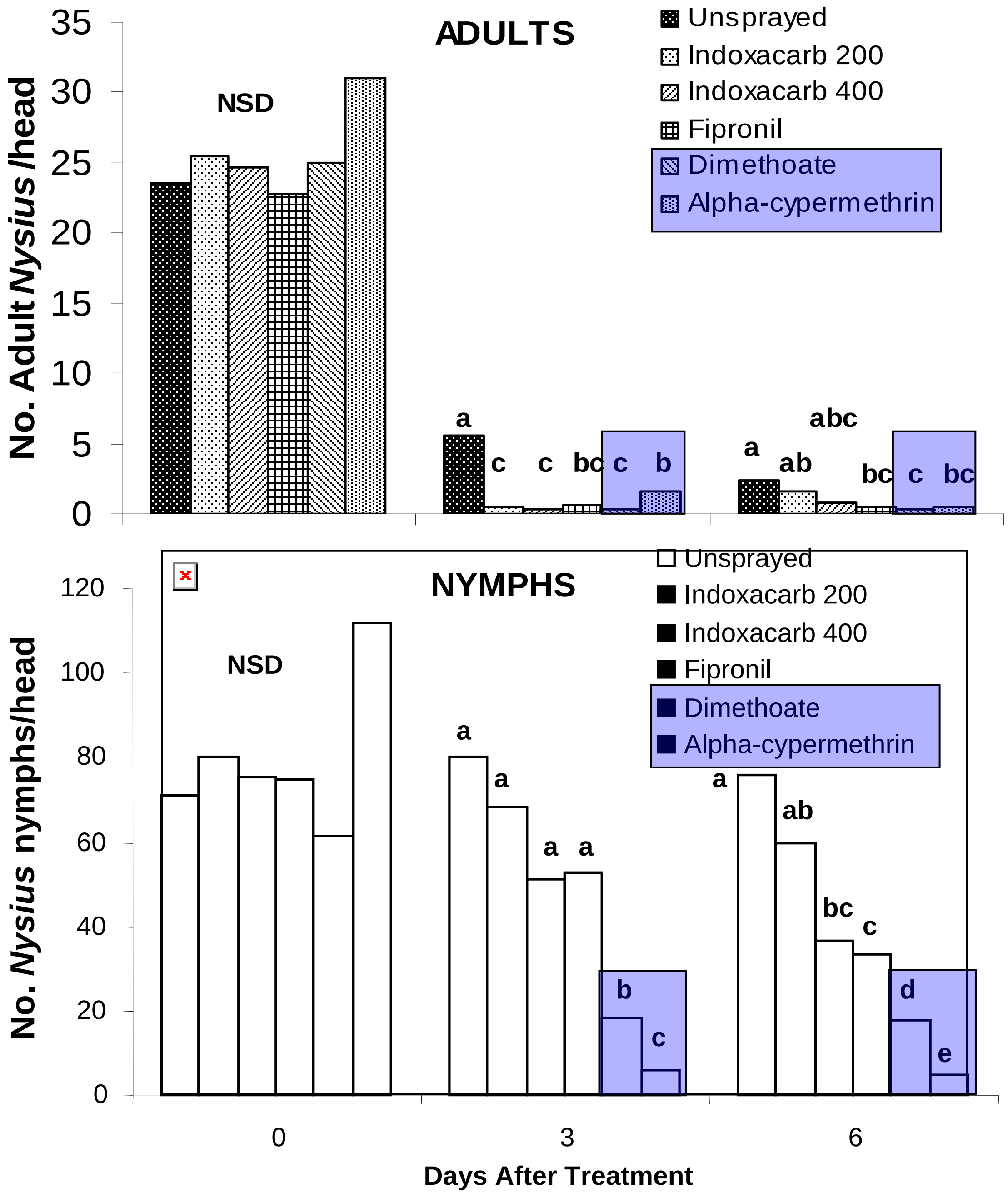
# Characterising damage









ADULTS
Unsprayed
Indoxacarb 200
Indoxacarb 400
Fipronil
Dimethoate
Alpha-cypermethrin
No. Adult Nysius /head
35
30
25
20
15
10
5
0
NSD
a
c
c
bc
c
b
abc
a
ab
bc
c
bc
NYMPHS
Unsprayed
Indoxacarb 200
Indoxacarb 400
Fipronil
Dimethoate
Alpha-cypermethrin
No. Nysius nymphs/head
120
100
80
60
40
20
0
NSD
a
a
a
a
b
c
a
ab
bc
c
d
e
0
3
6
Days After Treatment

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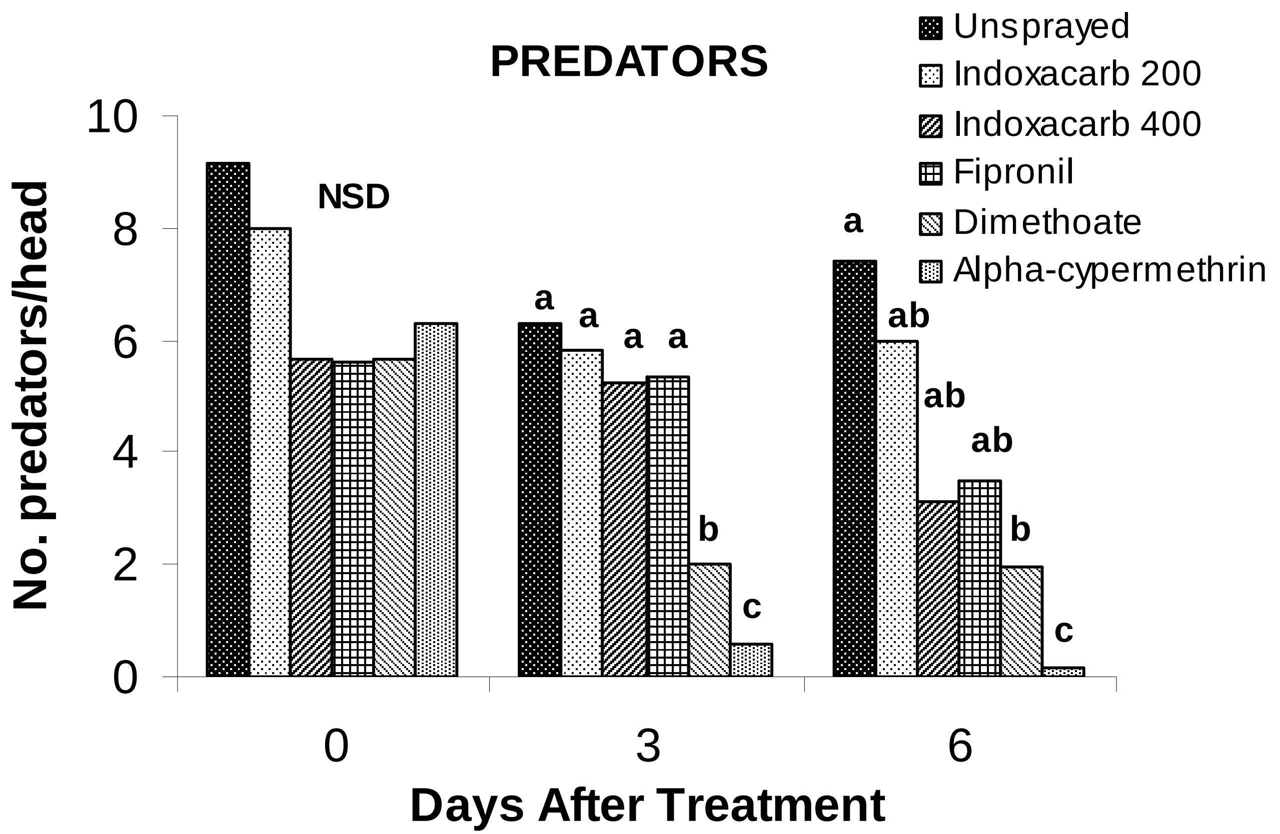
# RGB in sorghum insecticide evaluation – impact on predators (mainly spiders)

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# Other sorghum pests

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**Sorghum head caterpillar**

- No thresholds
- Beneficials likely to control small infestations (<10/m row)
- Webbing characteristic
- Monitor along with helicoverpa

**Yellow peach moth**

- Threshold ~ 0.4x helicoverpa threshold
- No webbing
- Monitor along with helicoverpa

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