



Sorghum pest management



The suite of potential pests

	Impact on the crop
<i>Helicoverpa armigera</i>	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 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

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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



Monitoring and Management

The basics:

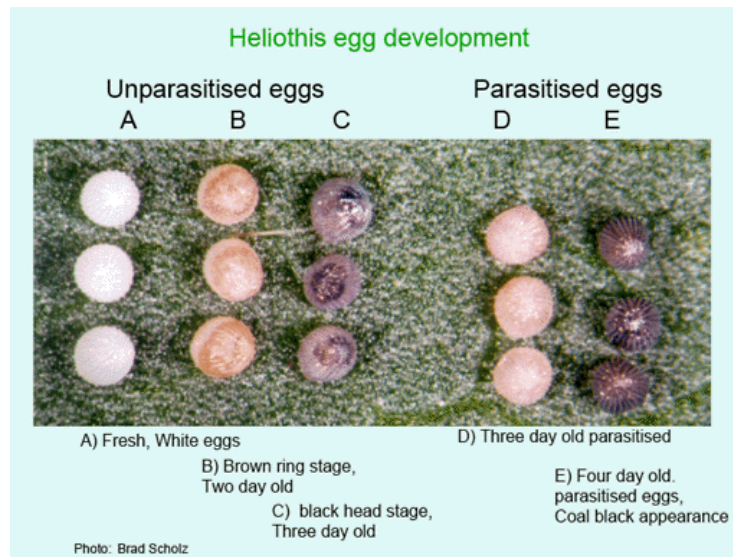
80% of eggs laid prior to flowering

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
 - Parasitism by *Trichogramma*, predation by *Orius*, cannibalism 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



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

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

Influences on product choice

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

[Helicoverpa in chickpeas](#) |
 [Sorghum midge](#) |
 [Helicoverpa in sorghum](#) |
 [How to use](#)

Helicoverpa (corn earworm) in sorghum – threshold calculator

One corn earworm larva is estimated to consume 2.4 grams of sorghum during its lifetime. The economic threshold (that is, the number of larvae per head where the cost of control is equal to the value of the grain saved) can be calculated below.

Helicoverpa threshold in sorghum

Estimated cost of control (\$/ha)	<input type="text" value="0"/>
Row spacing (cm)	<input type="text" value="0"/>
Estimated crop value (\$/t)	<input type="text" value="0"/>
Average number of heads per metre of row	<input type="text" value="0"/>
Break-even threshold for this example: <input type="text" value="0.00"/> larvae per head	

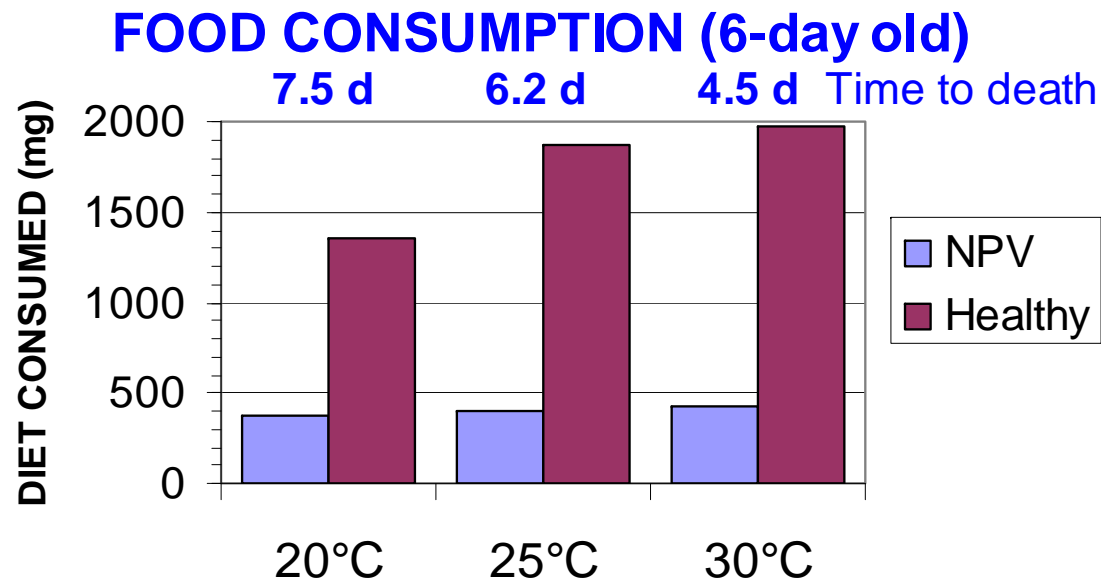
Calculating potential yield loss

A cost-benefit comparison of potential yield loss versus the estimated cost of control is another way to determine action thresholds.

Using the above row spacing, average heads per metre and expected crop value.	
Actual counts of larvae	<input type="text" value="0"/> (per head)
Potential yield loss:	<input type="text" value="\$0.00"/> /ha

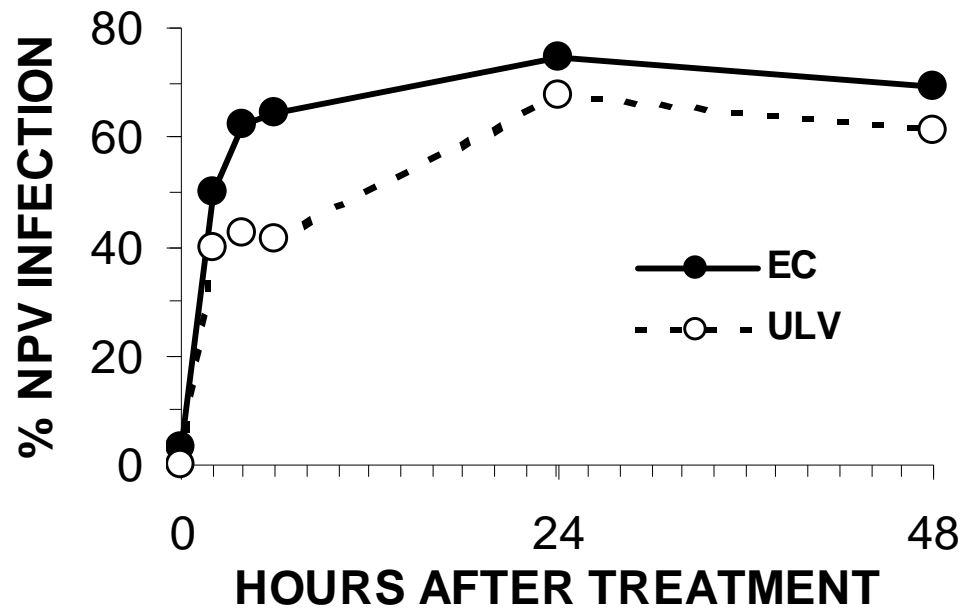
Getting the best out of NPV

- NPV has greatest efficacy against larvae up to 4th instar (<13 mm)
- Low volume (<10 L/ha + Optimol[®])
 - coverage remains an issue – ingestion active
- Influence of cool weather on efficacy or speed of kill
 - 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 helioverpa in field crops

NPV stands for nucleopolyhedrovirus. NPV is a disease of helioverpa (or heliothis) caterpillars that occurs naturally in the Australian environment. Australian farmers have access to commercially produced formulations of NPV for the treatment of helioverpa infestations in crops. NPV is safe and environmentally friendly. It is ideally suited for inclusion in an integrated pest management (IPM) approach to controlling *Helioverpa 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 helioverpa 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 helioverpa with NPV.



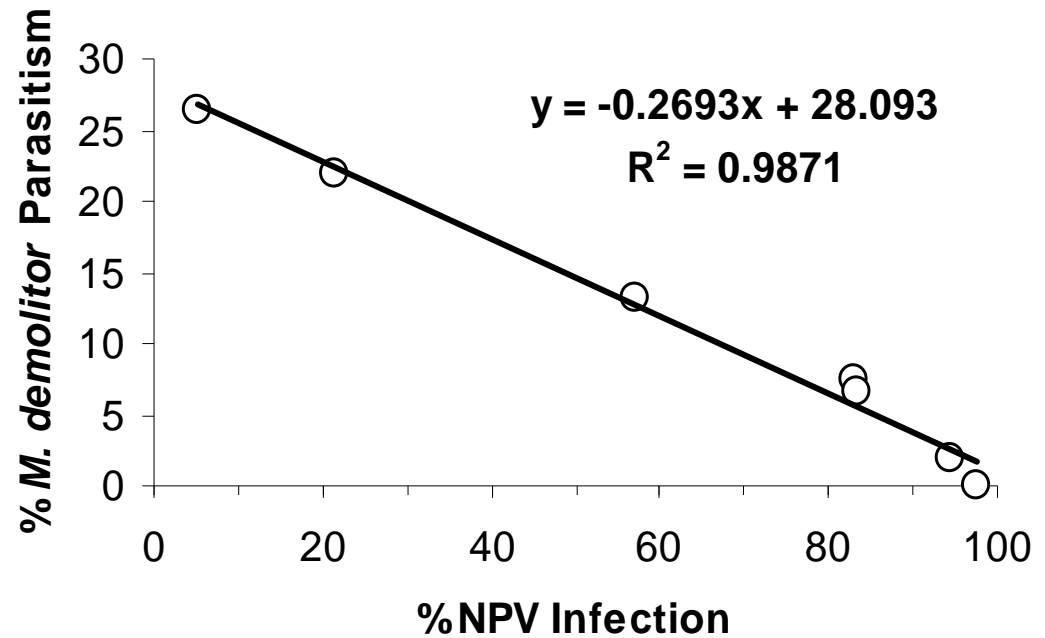
Figure 1. An NPV-infected helioverpa larva that has ruptured, releasing millions of infectious virus particles (Photo: C. Heauwell, DPI&F)




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 heliothis larva

Yellow anthers



Brown anthers



But, better to go early than late

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

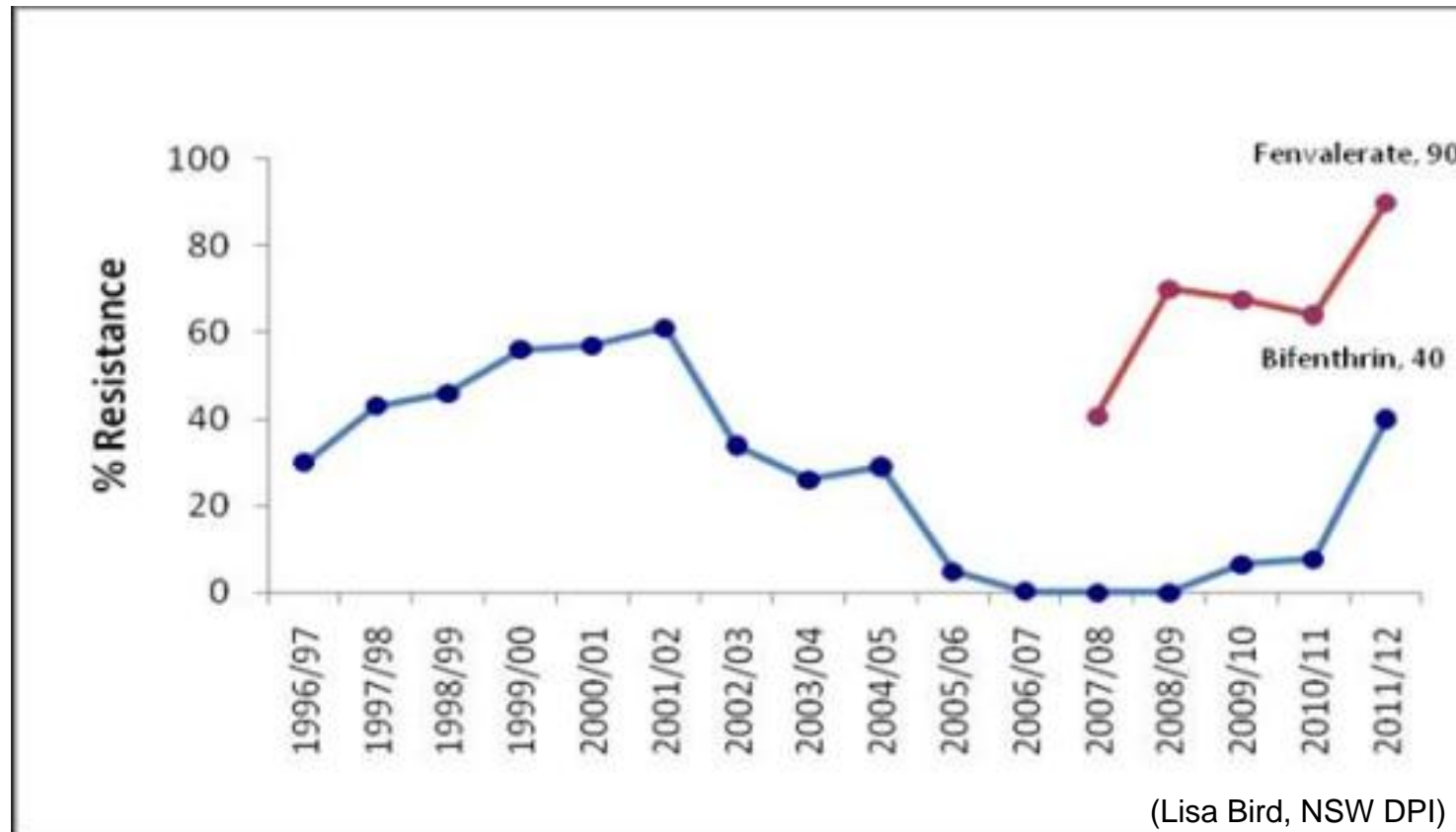
Midge Resistance

- Physical resistance to placement of egg in the floret
- Allowed increased flexibility in terms of planting time
- Where spraying still required
 - SP use will impact on *H. armigera* resistance
- Extreme midge pressure will put strain on the resistance





Multipest considerations



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

Why?

- midge spraying in sorghum?
- sp use in chickpea?

Management and control

Threshold

- Based on midge numbers – early morning monitoring
- Incorporates compensation, MR, insecticide residual
- On-line calculator available – (www.thebeatsheet.com.au)

[Halticoverpa in chickpeas](#) | **Sorghum midge** | [Halticoverpa in sorghum](#) | [How to use](#)

Midge in sorghum – threshold calculator

The yield loss estimates in the calculator assume that spraying results in a 100% kill and that there is no midge damage prior to chemical application. It also assumes that you will receive the same average midge pressures over 4-5 days. In reality research has shown that one well timed insecticide for midge (just on from panicle emergence and before midge even enter the crop) will still only prevent 70-80% damage potential in lower rated sorghum hybrids. In 8 rated hybrids, yield losses can be reduced by over 90% with this spray timing.

Collecting data to use in the calculator

Generally, peak midge activity occurs between 9-11 am, and this is the best time to look. Sorghum heads are most attractive to midge at mid flower. Midge flies are only 1-2 mm long, and the easiest way to 'get your eye in' is to look at the top half of mid flowering panicles and look for movement of the small red flies against a still sorghum panicle looking from side on and slightly above side on one section of the sorghum panicle at a time. Keep your eyes focused over a couple of locations of florets for several seconds at a time to detect female midge walking around the floret or jiggling up and down probing their ovipositor into each floret. On windy days shelter the panicle for 10-30 seconds before scanning each panicle, to allow you to more accurately see midge movement. Monitor for midge over 10 metres of row in at least 4 different locations in your crop. It may be necessary to spray only one section of crop at a time, or the whole crop accordingly.

Number of midge	<input type="text" value="0"/>	per metre row
Midge rating of sorghum hybrid used	<input type="text" value="0"/>	
Row spacing	<input type="text" value="0"/>	m
Crop value	<input type="text" value="0"/>	\$/ha
Cost of control	<input type="text" value="0"/>	\$/ha
Residual life of chemical used	<input type="text" value="0"/>	days

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



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

Rutherglen bug

Trial work to date:

Characterised damage – dry and irrigated

Provisional threshold

- Need field validation of provisional threshold



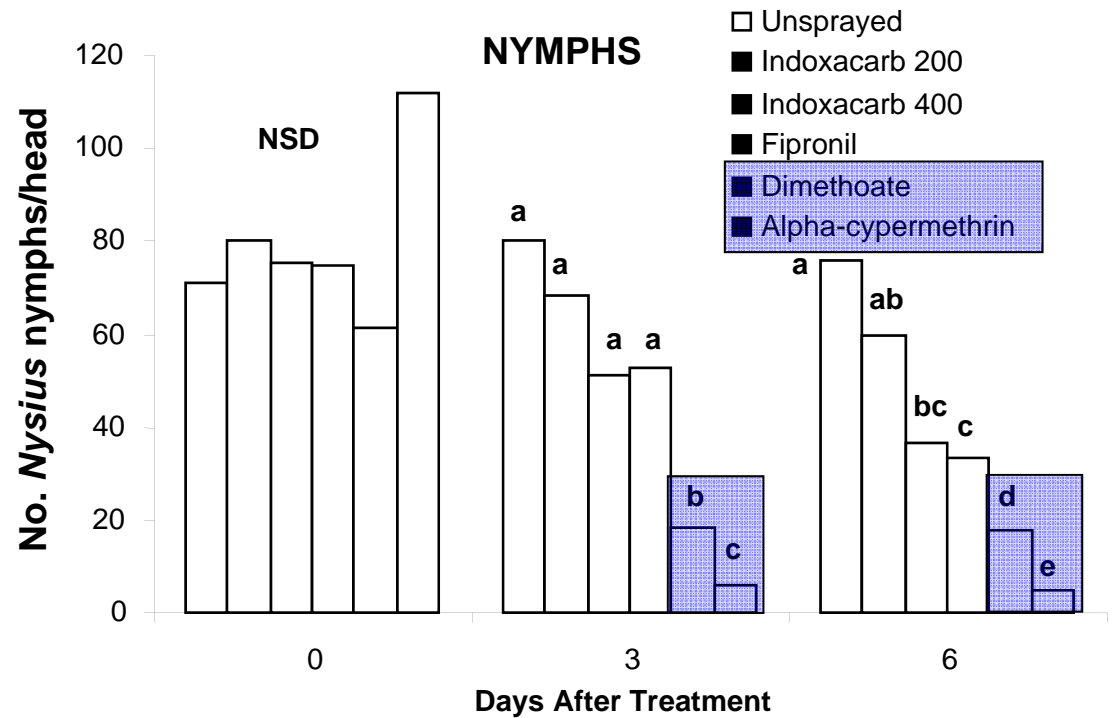
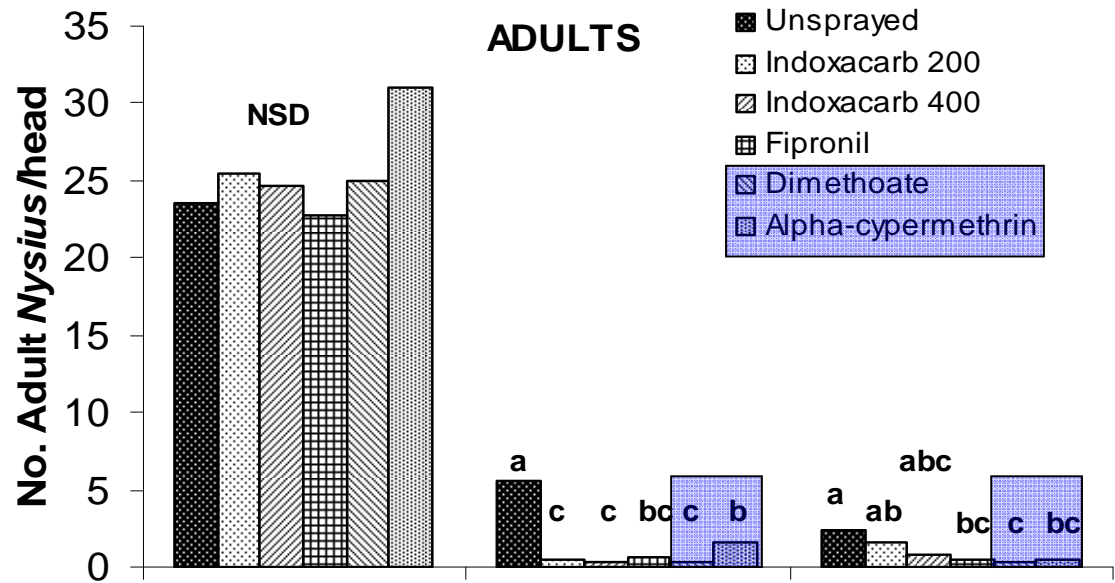
Insecticide evaluation

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

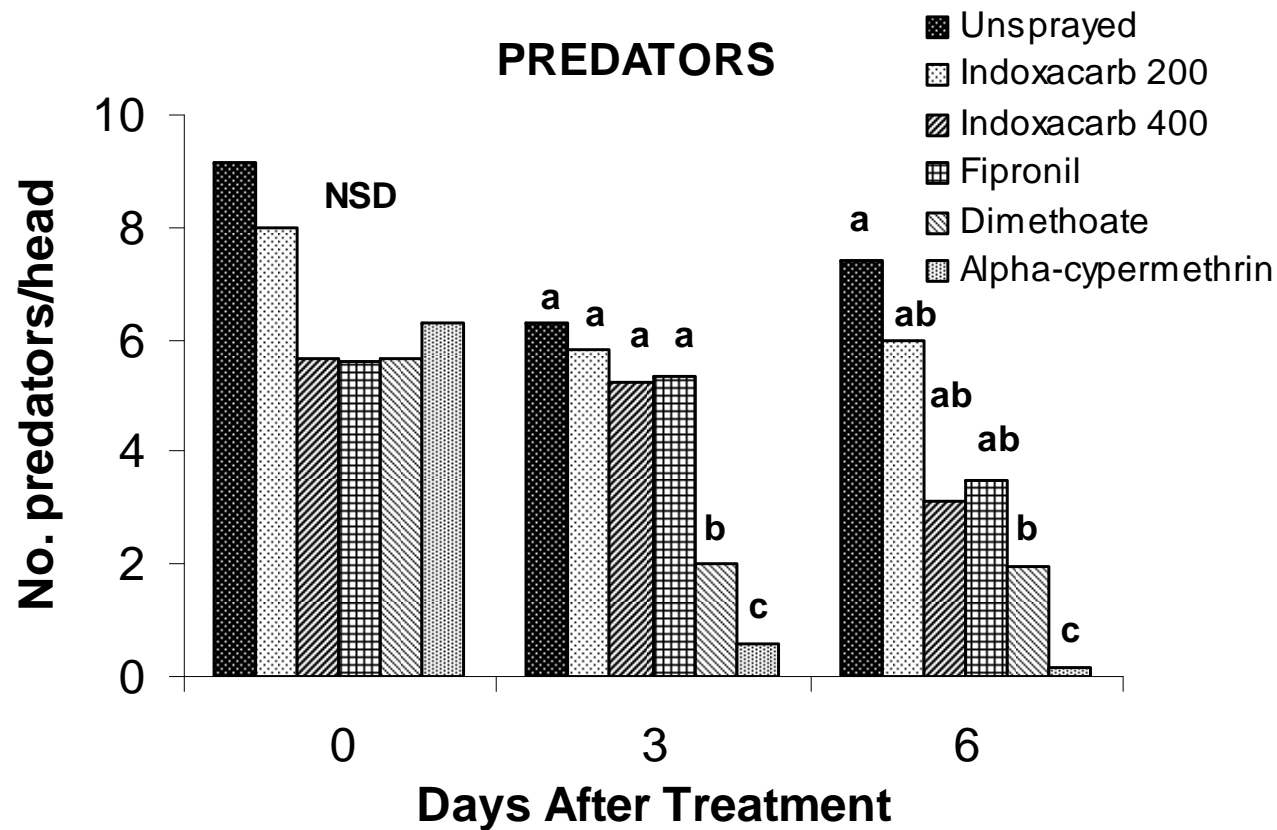


Characterising damage





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



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

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



Other sorghum pests

Sorghum head caterpillar

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



Yellow peach moth

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

