Decision Making
for Insect Management
in Grain Crops

Integrated Pest Management in Sunflower

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Insect pests of sunflowers

Decision Making for Insect Management in Grain Crops

Establishment	Vegetative growth	Budding – flowering - Maturity
True and False Wireworms Cutworms Black scarab beetles Thrips Wingless cockroaches Black field earwigs Mealybug?	Whitefly (a pest?) Soybean looper Field crickets	Rutherglen bug Helicoverpa Field crickets Green vegetable bugs (GVB) Soybean Looper

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Major pest

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Rutherglen Bug…..(& Grey cluster bug *Nysius clevelandensis*)

Can cause losses in sunflower at 3 stages:

Seedling establishment

i) Budding

ii) Grain fill

Damage at budding = Heads wilt, malformed or die

Damage at seed set - maturity

Reduced yield, oil content and quality, and seed viability (germination)

Damage higher in moisture stressed crops

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Damage to seedling crops

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Populations build up on weeds over winter –spring and move as hosts die off in summer.

Long host list, includes:
Caustic creeper, asthma weed, fleabane, fat hen, flat weed, sowthistle, khaki weed, bitter cress, pepper cress.

Higher risk when wet winter-spring and dry spring-summer.

In southern regions RGB nymphs can move from canola stubble to seedling crops.

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A strategy for budding - maturity

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RGB move into crops from local sources (weeds) and/or inland breeding areas – travelling on storm fronts (northerlies).

In outbreak years (like 2012) influxes can occur over weeks.

The aim of RGB control is to prevent eggs being laid.

Successful reproduction results in a population explosion.

The timing of egg lay means that nymphs are hatching as the heads start to turn down, and control is difficult.

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RGB population dynamics

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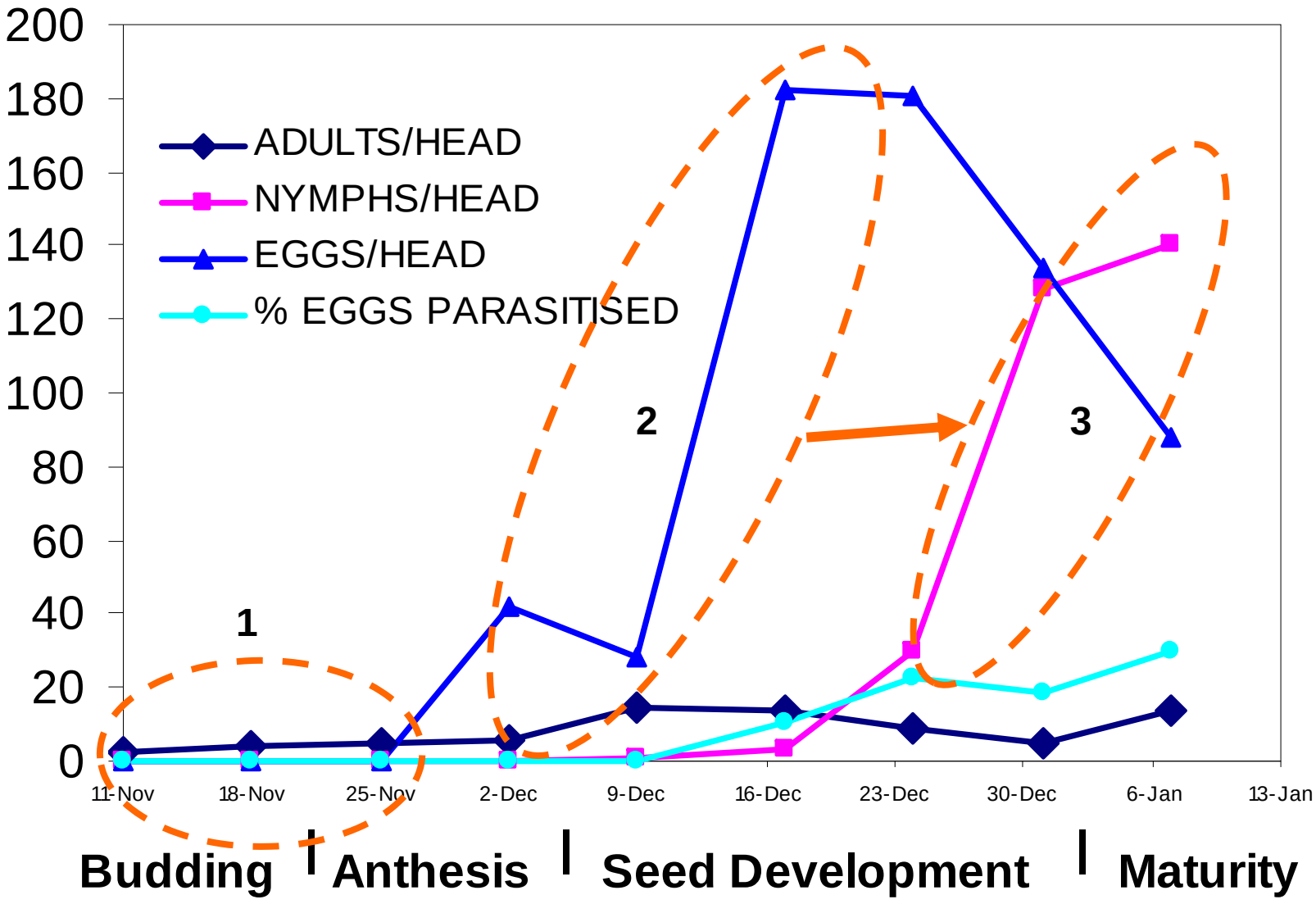

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A strategy for budding - maturity

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Monitor crops once a week from budding until at least 2 weeks post petal drop
-even if you have sprayed for RGB.

A spray at budding is warranted if:
i) Numbers exceed threshold
ii) Crop is moisture stressed

To prevent egg lay, control not later than petal drop

- Before heads turn down
- delayed as long as possible to maximise impact on the RGB adults
- Minimises impact on bees

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Thresholds

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Growth Stage	Threshold (number of adult bugs per plant)	
	Early plant (Aug-Oct)	Late plant (Jan-Feb)
Budding	10-15	30
Seed fill (petal drop)	20-25	30
Confectionary	5	5

From mid-late February, RGB females stop laying eggs. If the crop flowers after this date, then the risk of a large egg lay and nymphs feeding on seed is low.

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Monitoring RGB

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RGB are extremely patchy

- random sampling gives best estimate
- what technique do you use?

Current recommendation is to: **Count and average**

Example:

Randomly inspect 20 heads. Estimate number of bugs per head.

Calculate a field average.

Average number per head = total bugs/number of plants sampled.

Does averaging provide a representative estimate?

Are there alternative approaches?

- sequential sampling plan (Allsopp 1988)
- % infestation (back of the envelope)

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Monitoring RGB – sequential sampling plan

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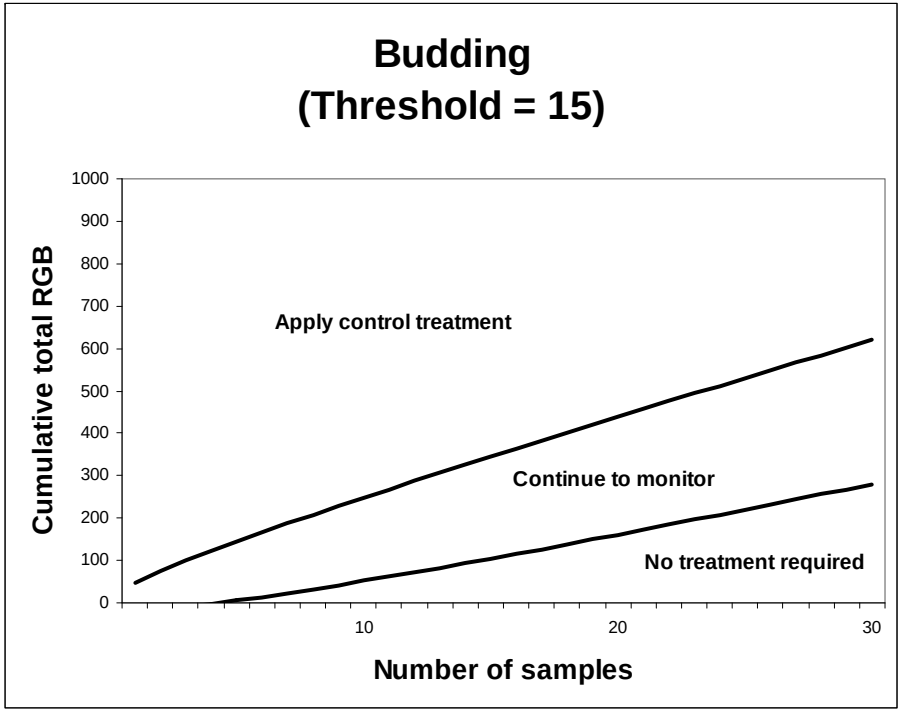
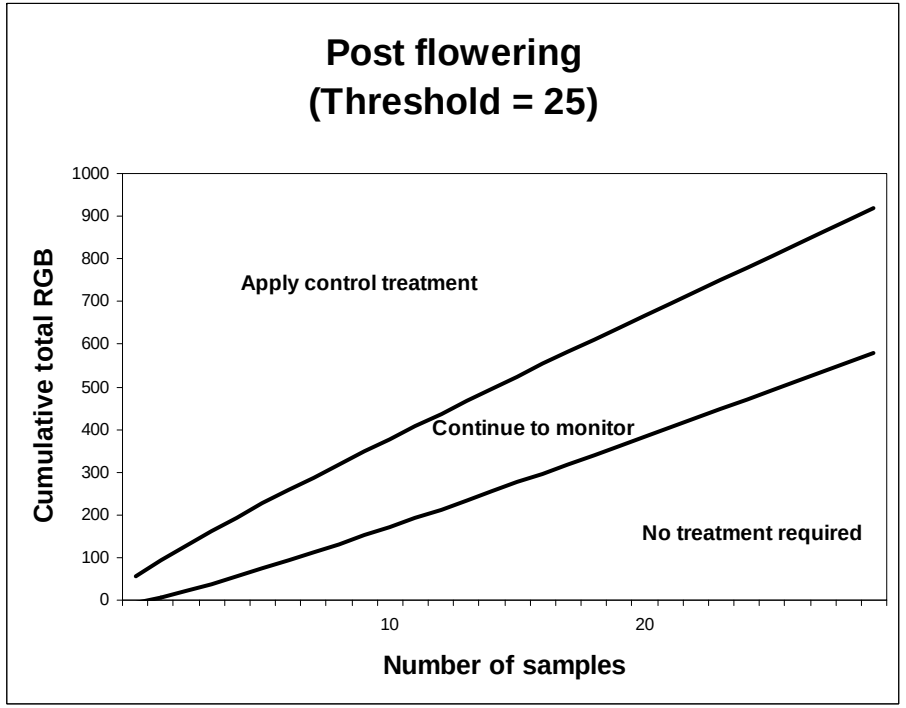
The sequential plan takes into account the patchiness and the threshold.





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Monitoring RGB – based on % infested heads

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These are 'back of the envelope' calculations that use a simplified monitoring approach.

Determine the proportion of the crop with above threshold infestations.

i) Randomly inspect 30 heads across the field.
ii) Record whether the head is:
    a) Uninfested (0 RGB)
    b) Infested, but below threshold
    c) Above threshold
iii) Calculate the % of heads above threshold

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Monitoring RGB – based on % infested heads

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Yield loss caused by RGB exceeding threshold =7.5% in an unstressed crop (Broadley et al 1986)

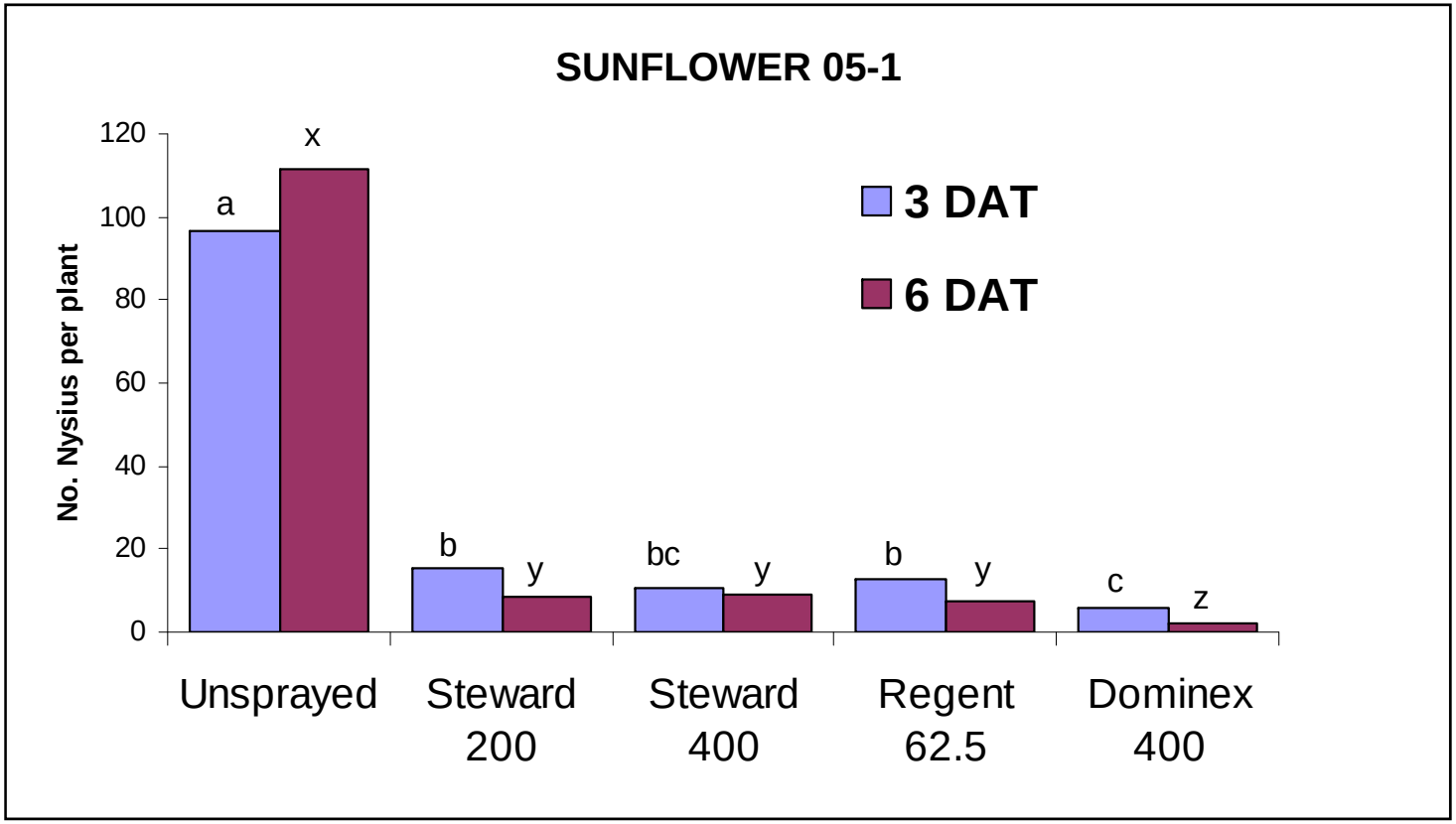
Example of calculation:
Control is only warranted (provides an economic advantage) when the cost of control > value of yield loss.

Expected yield = 1.5 t/ha
Grain price = $250/t
Potential return per ha = 1.5x 250 = $375/ha
18 of the 30 plants with RGB over threshold = 60% of heads potentially to lose yield.
Potential loss = 0.6 x $375 = $225/ha, well in excess of the cost of spraying per ha.

Using these same values we can calculate the breakeven level of infestation too.

If cost of control = $30/ha = 8% of the potential return per ha.
8% of 30 heads = 2.4 heads with infestations exceeding threshold.

Controlling RGB



No soft options – synthetic pyrethroids, carbamates

Be aware of the potential to flare helicoverpa, whitefly, loopers.

Repeated SP use will select for higher levels of resistance in *H. armigera*.

Controlling RGB

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Post treatment assessment

Reinfestation or survival?

What level of control do you expect / get?

What can you expect in terms of insecticide residual?

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Major Pest - Helicoverpa

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Two species of Helicoverpa

Helicoverpa armigera

- "local", resistant to SPs, methomyl

Helicoverpa punctigera

- immigrant, susceptible

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Helicoverpa Damage

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Damage:

Heavy infestations at budding – severe damage

Feed on leaves, buds, petals, bracts

- Damage to seed only significant when in extreme numbers
- Feeding on head – deformation, head loss or **secondary infections** e.g. *Rhizopus* head rot

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Management strategy for helicoverpa

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In CQ – assume they are *H. armigera*

Monitor for larvae at budding

- increased risk where large larvae developing on weeds in the field

Insecticide resistance is a major issue

– level of control achieved may not be satisfactory under high pressure.

The addition of NPV to Rutherglen bug sprays may suppress helicoverpa

- SP use will kill beneficials that may otherwise suppress helicoverpa (and whitefly)

Thresholds

- 2 small larvae or 1 medium larva per plant (Qld)
- > 4 larvae (5mm long or larger) at budding (NSW)

BUT

Up to 17 per head did not result in yield loss when feeding on filling heads

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Minor pests

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Whitefly

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In CQ, likely to be Silverleaf whitefly

-No control options registered, but not considered to cause yield loss, even in extreme numbers.

- when in low – moderate numbers, will be suppressed by natural enemies including parasitoids.

SLW eggs

SLW parasitoid

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Solenopsis mealybug

In CQ, a localised but potentially major pest of cotton.

Will colonise and reproduce on sunflower in the glasshouse, and in the field (Byee trial).

Symptoms in sunflower are obvious, but do not persist if the mealybug are removed.

-No control options registered, damage potential in the field unknown

- when in low – moderate numbers, will be suppressed by natural enemies including parasitoids, ladybeetles, lacewings.

Risk assessment – establishment pests

Higher risk	Reduced risk
Weedy fallows and volunteers	Weeds controlled at least 3 wks before sowing to reduce pest carryover
History of establishment pests	No history of establishment pests. Pre-sowing check with seed baits.
High level of retained stubble and dry conditions	High stubble and wet conditions
Emergence and establishment slowed by cool, dry or wet conditions	Rapid emergence
Parthenium weed close to seedlings - transmission of TSV by thrips	
Extreme pest pressure	Use of seed dressings in most seasons (not effective against cutworm)





Monitoring for soil insects

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Identify abundance and species present before planting

Soil sampling by spade

- Hand sort species
- Disadvantage – labour, time, difficult in some soils

Germinating grain baits

- Seed baits need to be spread around paddock
- Disadvantage – delay between germination and assessment
- Useful for: wireworms, earwigs, crickets, cockroaches

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Making control decisions

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Soil insects

- Seed treatment

  - wireworms, black scarabs, wingless cockroaches, earwigs.

- In-furrow spraying - wireworm and false wireworms

- Insecticidal grain baits - Chlorpyrifos.

  - bait applied onto the soil surface.

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Recognising soybean looper life stages

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How much does a looper eat?

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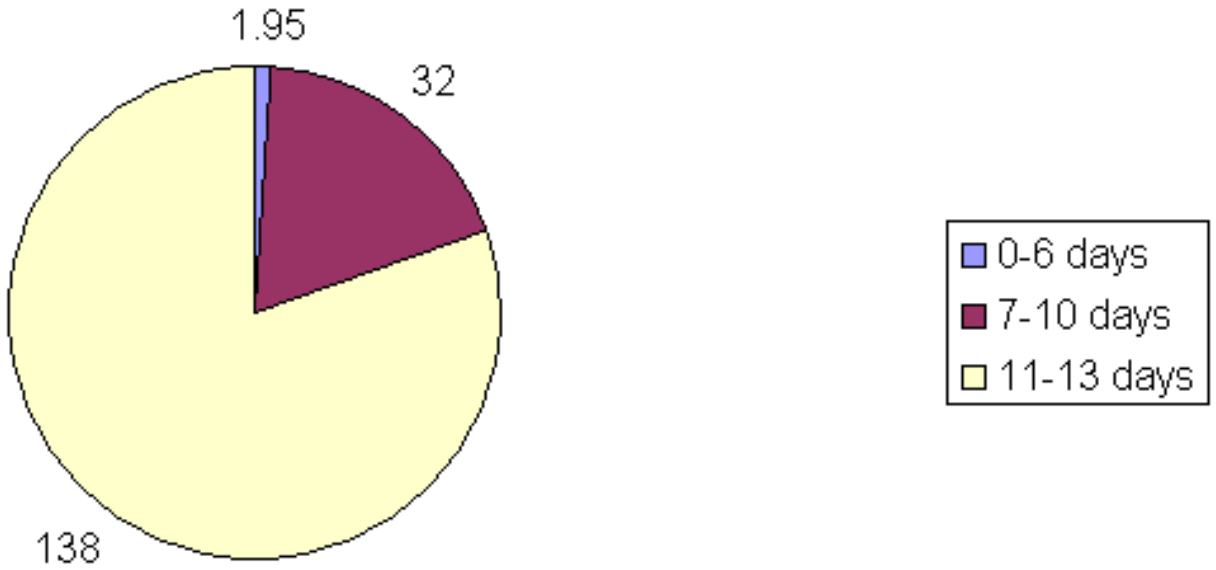
Leaf area consumed (square cm) (n=45)



80% of total leaf consumed in last 2 instars

On average, a total of 172 square cm per larva

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Threshold and management

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Preliminary

50% defoliation (~ 10 larvae per plant R1-R7)

Target larvae < 20 mm in length

80% of defoliation done by larvae > 20 mm

Bt effective even on medium larvae, and soft

Litomastix parasitised looper

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