Decision Making
for Insect Management
in Grain Crops

Monitoring and Thresholds

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Monitoring in an IPM context

Broaden the perspective from focus on in-crop monitoring

Assessing risk – post and pre-season environmental drivers

→

Planning

rotations
crop selection
timing & frequency
prophylactic treatments

Keeping records

Summary of Monitoring Techniques

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Pests	Crop	Monitoring technique
Mites/lucerne flea	All seedling crops	Visual/ vacuum sampling
Soil insects	All seedling crops	Soil sample/ germinating baits
Aphids	Canola, pulses, winter cereals	Visual, sticky traps
Armyworm	Winter cereals	Sweep net (or bucket) Visual for damage/frass
Beetles/weevils	Winter cereals	Pitfalls and visuals (often at night)
Diamondback moth	Canola	Sweep net (for larvae)
Etiella (moths)	Lentils	Sweep net, pheromone traps
Helicoverpa	Winter pulses/canola	Sweep net/ cut and bash/ bucket
Pea weevil	Field peas	Sweep net
Rutherglen bug	Canola	Bucket, visual (seedlings)
Slugs	All crops	Shelter traps

Key issues around crop monitoring

Frequency of sampling

Frequency of sampling – key considerations

- **Risk**
  - Seasonal pest abundance
  - Crop susceptibility/vulnerability
  - Management/control options available
  - Response time
- **Environmental factors**
  - Temperature
    - rate of crop growth
    - Rate of pest population growth
  - Rainfall
    - Can reduce pest populations
    - Make sampling difficult/impossible

Sampling strategy : where to take samples

Completely random is not always appropriate

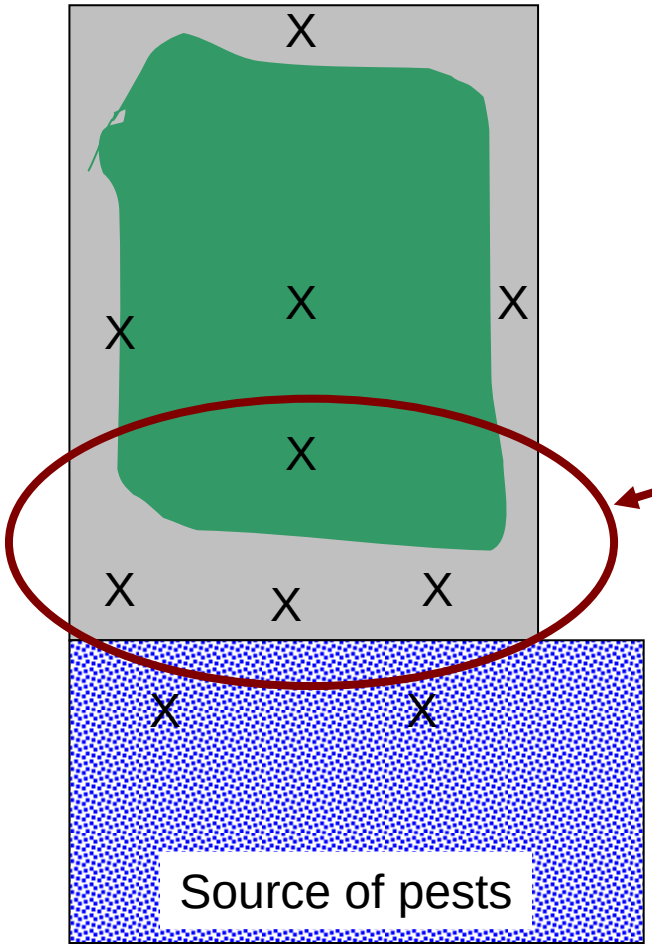
- Patchy distribution of pests (aphids)
- Invasion from the edge (mites, aphids, pea weevil, Rutherglen bug)

Stratified random sampling – improves the population estimate

- Based on knowledge of likely pest distribution

Brassica weeds – source of virus

Chickpea crop



Higher risk of infestation

More samples from here

X = sampling points

If pest distribution is patchy

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Patchiness can be a result of:

Pest biology

reproduction, infestation and rate of dispersal = hotspots

Crop

differences in growth/attractiveness, uneven maturity

Random sampling best for patchy pests




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How many samples?

Always a compromise between time and precision.

Be aware of the variability between samples when averaging

- can be minimised by using an appropriate sampling strategy and technique for the target pest
- experience with the pest can guide

Confidence (in the estimate) critical as the pest population approaches threshold.

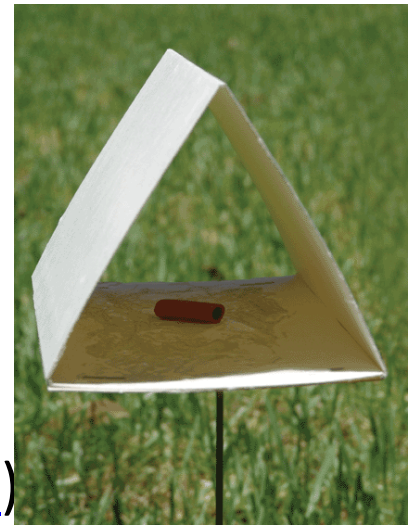
Migrant pests – when to start monitoring?

e.g. Helicoverpa, Etiella

Pre-emptive monitoring

pheromone traps (helicoverpa sp, Etiella)

Day degree model for Etiella (www.sardi.sa.gov.au)



Pheromone trap for Etiella (SARDI)

Or **When the crop is susceptible**

Pheromone trap for helicoverpa

The pest is only active at night or below ground

Traps

- Shelter traps (snails, slugs)

Baits

- Germinating seed baits (false wireworm)

Visual examination of soil, stubble around plants where they shelter during the day (cutworm, armyworm, slugs, snails)……or at night!

Pre-sowing checks for soil insects!

The threshold is very low – do I need to bother with sampling?

Risks of not sampling

- applying insecticide when not needed
- timing of action – early or late
- missing other pests
- missing the impact of beneficials/weather

Monitoring beneficials

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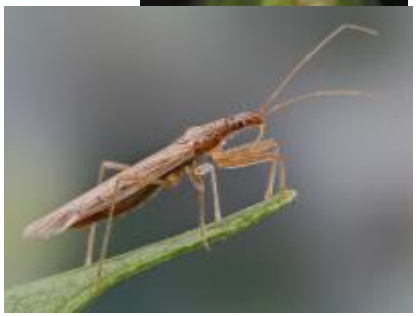
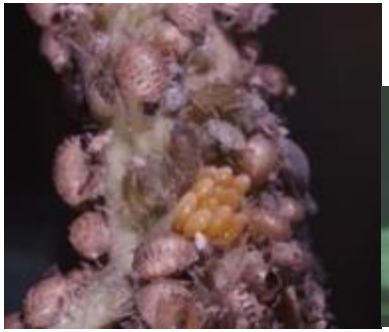
Sample when sampling for pests

Observe:

- Beneficials (eggs, adults and juveniles)
- Parasitism (aphid mummies)
- Parasitised eggs
- **Changes in pest populations over time**



Predatory earwig, parasitised armyworm



Ladybird eggs, green lacewing eggs, parasitised aphids

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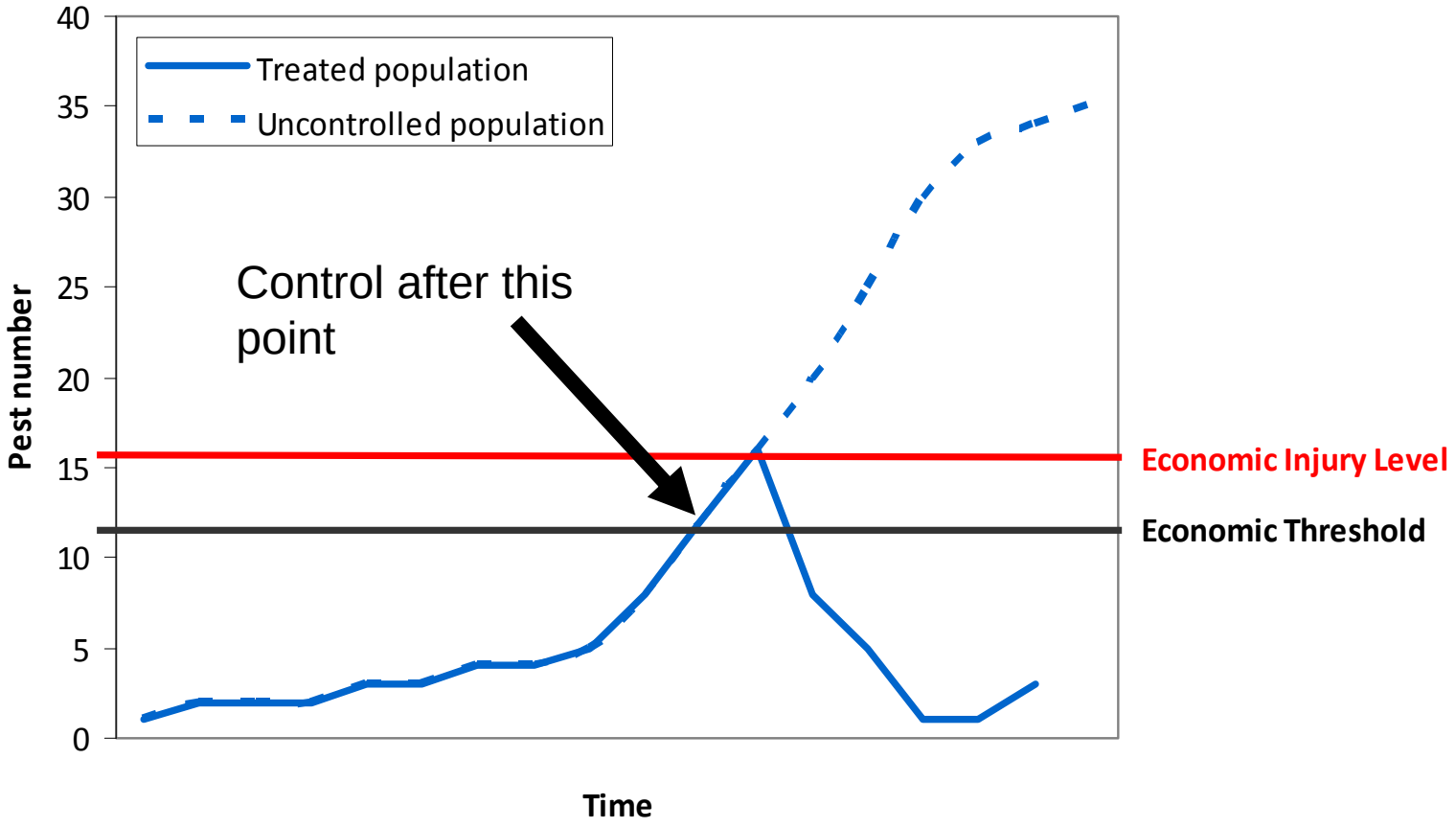
Record keeping

Essential for:

- Estimating pest densities (assessing variability)
- Reviewing trends in pest populations
- Post-treatment assessments
- Assessing risk from season to season
- Planning
- Learning

Thresholds

The pest density that warrants control to prevent economic crop loss.



Thresholds are a cornerstone of IPM

Provide a basis for making decisions about control

Minimise the risk of:

- unnecessary and poorly timed sprays
- inducing outbreaks of pests
- selection for insecticide resistance




How thresholds are derived

Quantify the crop response to insect damage

- Characterise damage
- Replicated trials with specific pest densities and crop stages
- Assess impact on crop growth, yield, quality
- Done in conjunction with sampling and insecticide efficacy trials

Can take several years to get a result.




Yield and quality thresholds

Threshold are calculated to protect:

Yield

Economic losses generally not incurred if threshold exceeded slightly

Quality

Significant economic losses/discounts may apply if threshold is exceeded.




Dynamic and fixed thresholds

There are relatively few dynamic thresholds

Most are fixed numbers

- Rate of pest damage (D) was probably used in calculating ET originally, but Cost and crop Value are likely to be out of date
- Best bets
- Experimentation, record keeping and experience will validate and/or refine

Economic thresholds expressed as:

- no. of pests per sample unit (e.g. #/m2(beat sheet), #/10 sweeps)
- % leaf area removed
- % defective/damaged seed (by weight or count)

Using economic thresholds

Use the appropriate sampling technique for the threshold

Economic threshold

= economic breakeven point

Experience will inform use of fixed thresholds

Use calculators and ready reckoners where available

Potential yield loss caused by Helicoverpa (Sweep net sampling)

Chickpea price ($/t)	Helicoverpa density (larvae per 10 sweeps)					
	1	2	3	4	5	6
200	6	12	18	24	30	36
300	9	18	27	36	45	54
400	12	24	36	48	60	72
500	15	30	45	60	75	90
600	18	36	54	72	90	108

Helicoverpa economic threshold (sweepnet sampling)

Cost of control ($/ha)	Chickpea price ($/t)							
	200	250	300	350	400	450	500	550
10	1.7	1.3	1.1	1.0	0.8	0.7	0.7	0.6
15	2.5	2.0	1.7	1.4	1.3	1.1	1.0	0.9
20	3.3	2.7	2.2	1.9	1.7	1.5	1.3	1.2
25	4.2	3.3	2.8	2.4	2.1	1.9	1.7	1.5
30	5.0	4.0	3.3	2.9	2.5	2.2	2.0	1.8
35	5.8	4.7	3.9	3.3	2.9	2.6	2.3	2.1
40	6.7	5.3	4.4	3.8	3.3	3.0	2.7	2.4