



Monitoring and Thresholds





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

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)
Helicoverpa	Winter pulses/canola	Sweep net/ cut and bash/ bucket
	Summer pulses	Beat sheet
	Sorghum	Shake heads in bucket
Mirids	Summer pulses	Beat sheet
Pod sucking bugs	Summer pulses	Beat sheet
Rutherglen bug	Sunflower, sorghum, canola	Bucket, visual (seedlings)
Slugs	All crops	Shelter traps
Sorghum midge	Sorghum	Visual
Whitefly	Sunflower, summer pulses	Visual



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

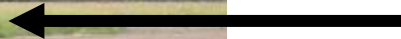
Completely random is not always appropriate



- 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



If pest distribution is patchy

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





How many samples?

Always a compromise between time and precision.

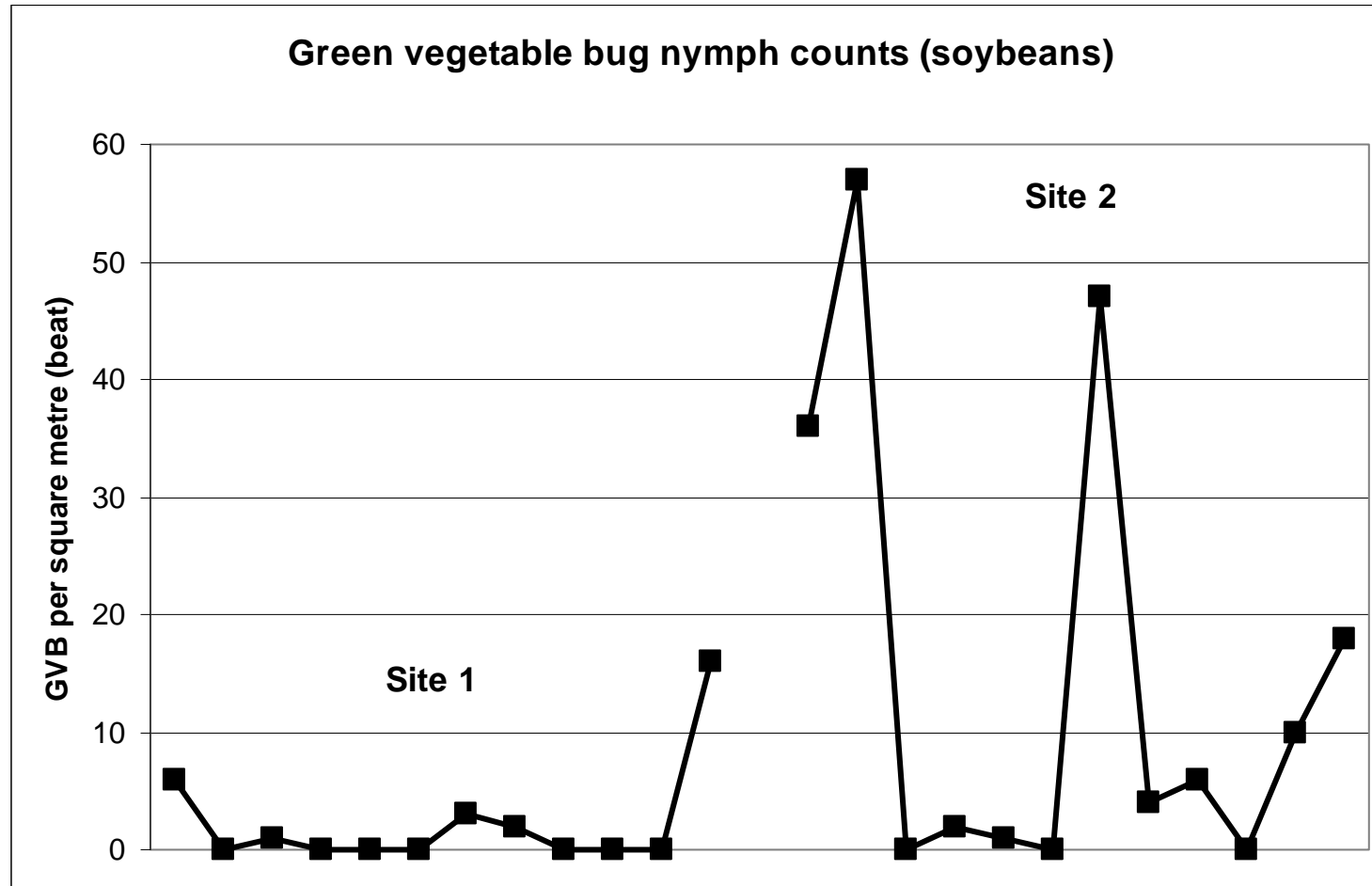
Be aware of the variability between samples when averaging

- 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.

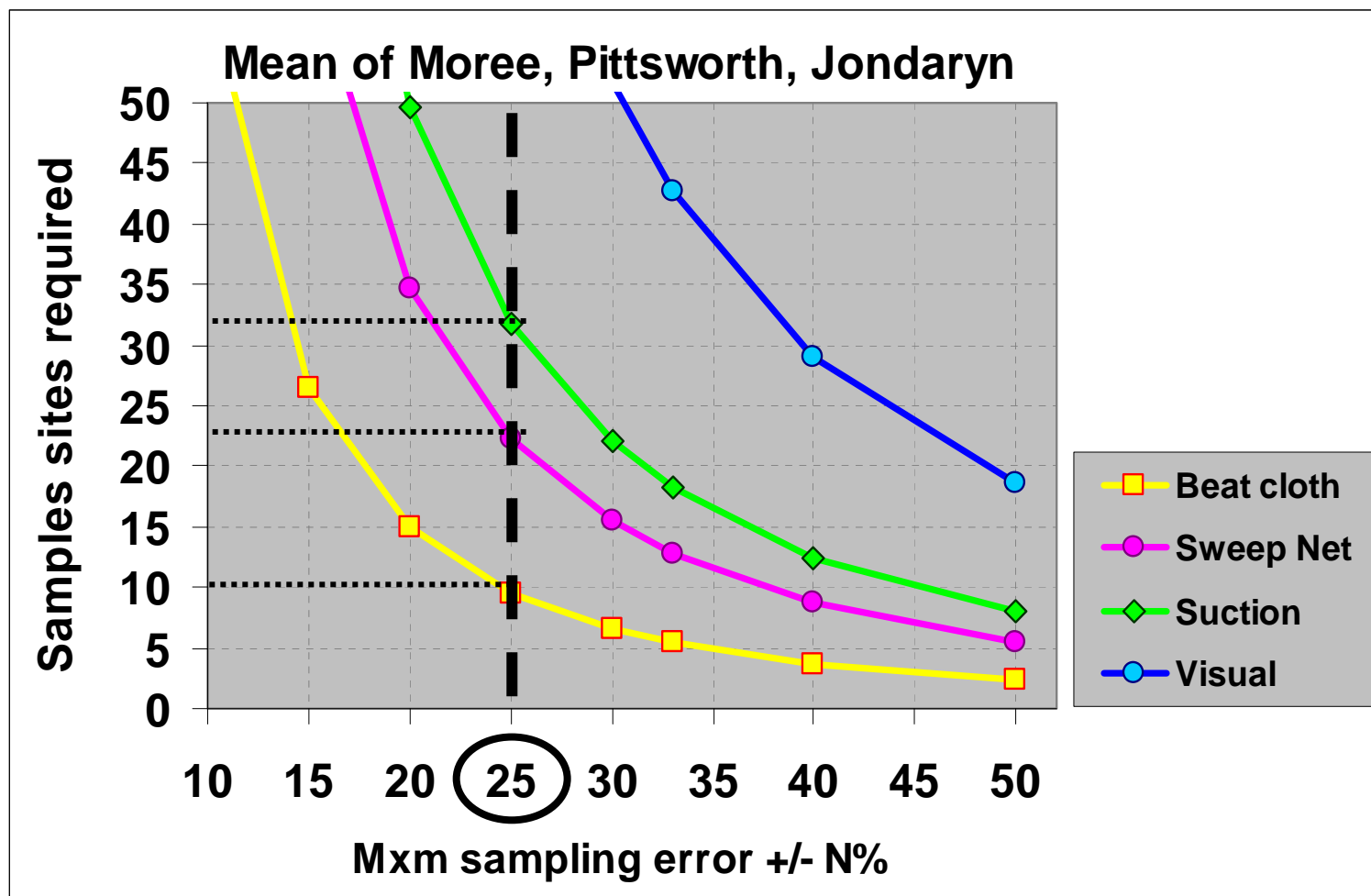


How patchiness can influence estimates of pest numbers: Green vegetable bug





Sampling error and number of samples





Migrant pests – when to start monitoring?

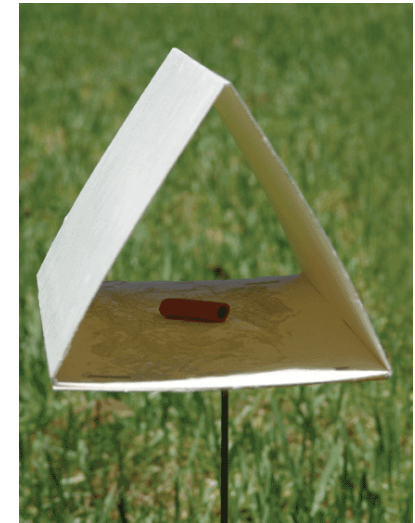
e.g. Helicoverpa, armyworm, Rutherglen bug

Pre-emptive monitoring

pheromone traps (helicoverpa)

lure traps (armyworm)

watching the weather patterns



Pheromone trap for
Etiella (SARDI)

Models to predict likely timing of infestations

Cottassist *H. armigera* emergence model

(<http://cottassist.cottoncrc.org.au/DIET/about.aspx>)



Pheromone trap for helicoverpa

Or **When the crop is susceptible**



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

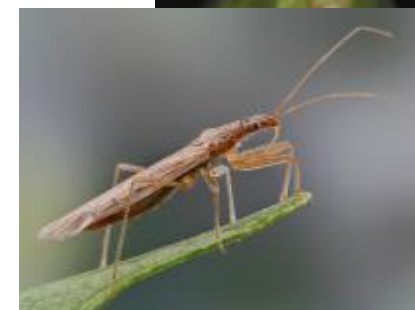
- applying insecticide when not needed
- timing of action – early or late
- missing other pests
- missing the impact of beneficials/weather

Monitoring beneficials

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

Record keeping

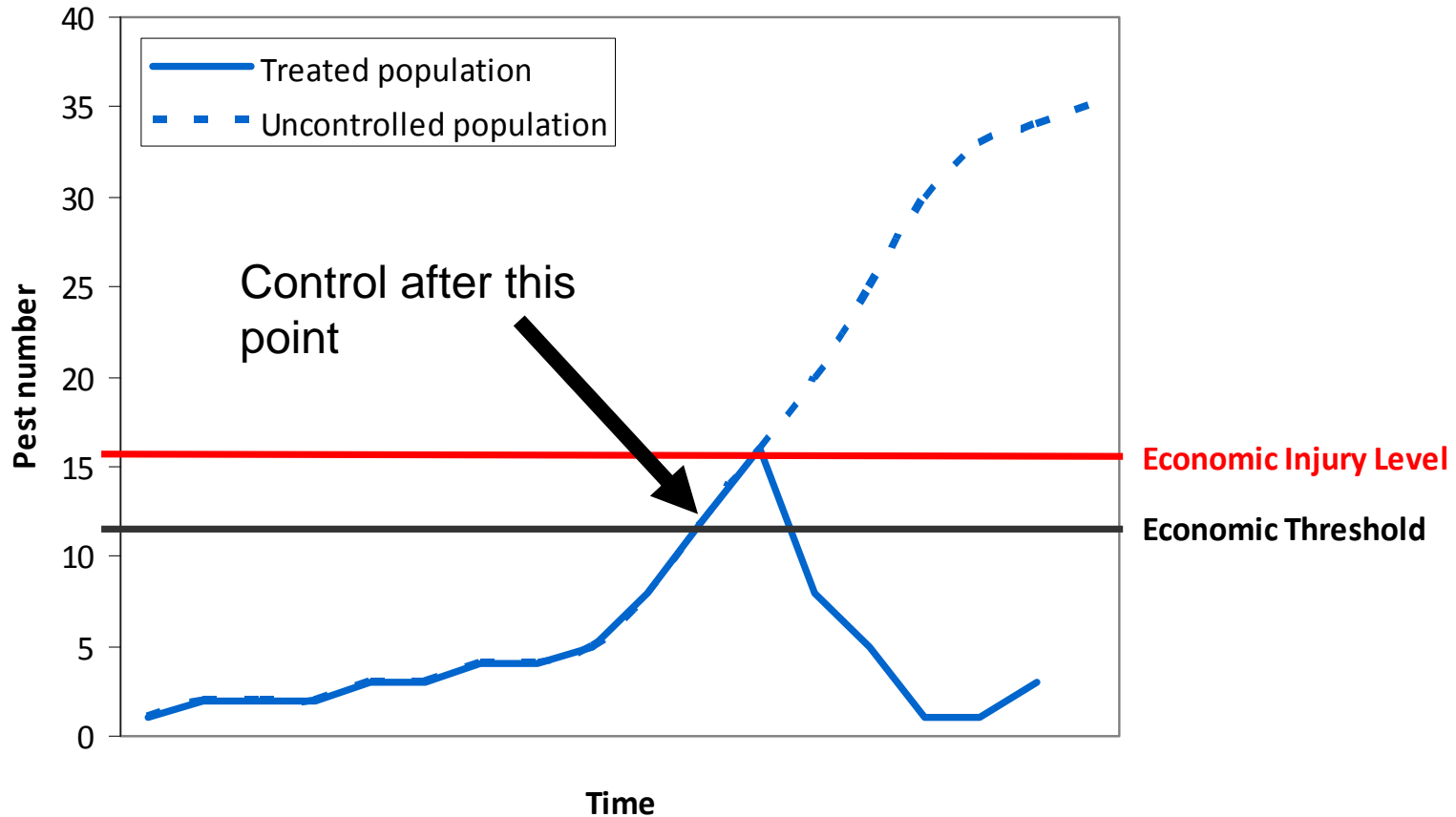
Essential for:

- 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



Resources

WWW.IPMWORKSHOPS.COM.AU

Ready reckoners – major pests (handouts)

Updated pest management notes for:

Chickpea

Sorghum

Maize

Winter cereals

Sunflower

Summer pulse pest identification

Calculators – www.thebeatseet.com.au