



Monitoring

A decision-making tool

You can't manage it if you can't count it





Monitoring in an IPM context

Broaden the perspective from focus on in-crop monitoring

Assessing risk – post and pre-season
environmental drivers
non-crop host abundance
fallows
pest abundance



Planning

rotations
crop selection
timing
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)
Etiella (moths)	Lentils	Sweep net, pheromone traps
Helicoverpa	Winter pulses/canola	Sweep net/ cut and bash/ bucket
	Summer pulses	Beat sheet
	Sorghum	Shake heads in bucket
Mirids	Summer pulses	Beat sheet
Pea weevil	Field peas	Sweep net
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



What are some of the issues you have with monitoring?

Frequency of sampling

Sampling strategy

Patchy distribution

How many samples?

Migrant pests – when to start monitoring

Night active pests and soil dwelling pests

Very low thresholds – do I need to bother with sampling?

Monitoring beneficials

Record keeping



Frequency of sampling

Frequency of sampling – key considerations

- **Risk**
 - Seasonal pest abundance
 - Crop susceptibility/vulnerability
 - Management/control options
 - 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

The number of samples and sampling plan

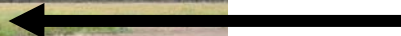
Completely random is not always appropriate



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

Stratified random sampling – improves the population estimate

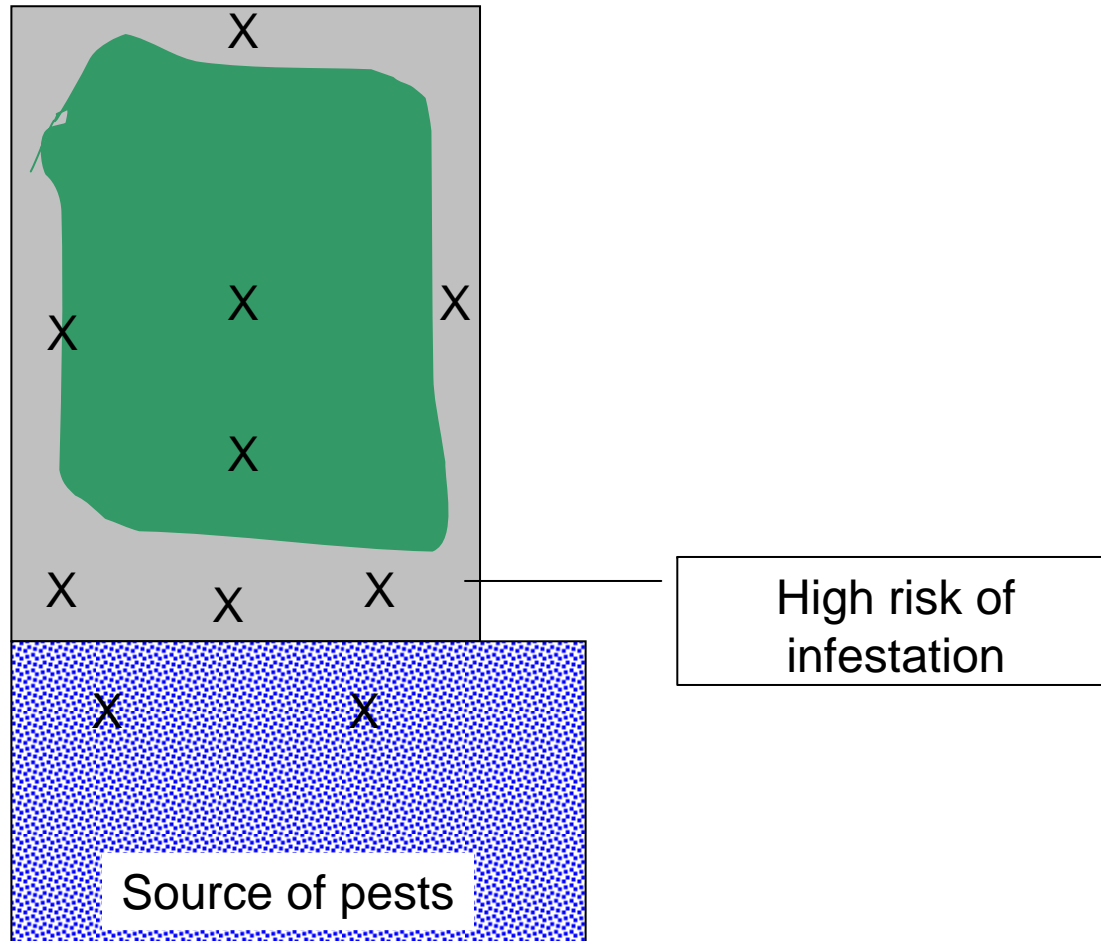
- Based on knowledge of likely pest distribution



Brassica weeds – source of virus



Chickpea crop



X = sampling points



Patchy distribution in the field

Patchiness can be a result of:

Pest biology

reproduction, infestation and rate of dispersal = hotspots

Crop

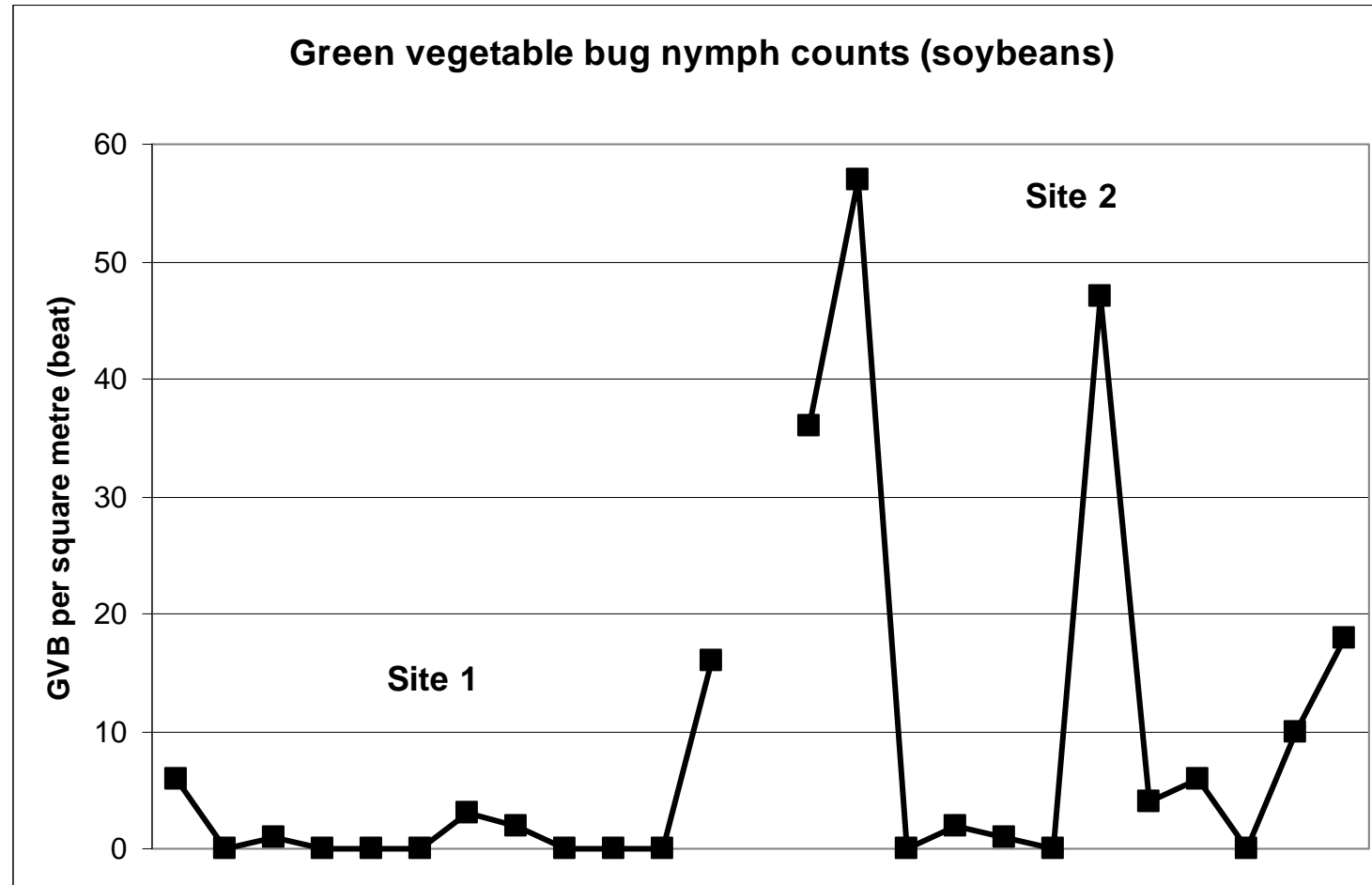
differences in growth/attractiveness, uneven maturity

Random sampling best for patchy pests





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





How many samples?

Always a compromise between time and precision.

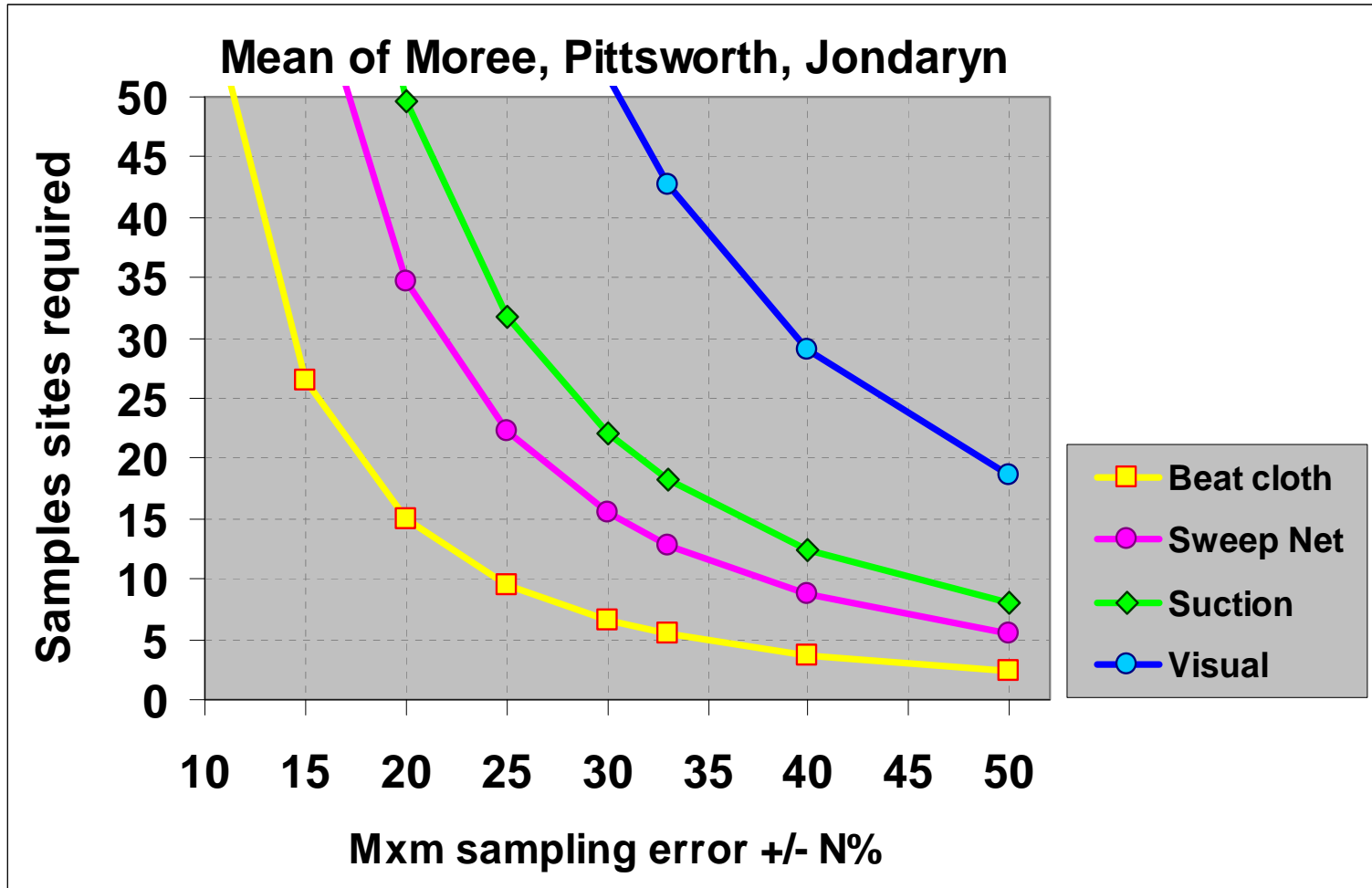
Be aware of the variability between samples when averaging

- 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.



Sampling error and number of samples





Migrant pests – when to start monitoring?

e.g. *Helicoverpa*, *Etiella*

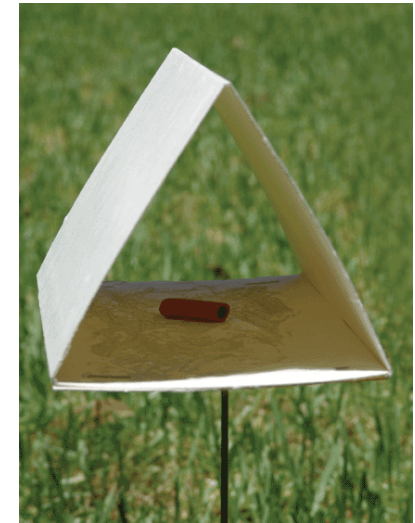
Pre-emptive monitoring

pheromone traps (*Helicoverpa* sp, *Etiella*)

Models to predict likely timing of infestations

Cottassist *H. armigera* emergence model

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



Pheromone trap for *Etiella* (SARDI)

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



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



Hoverfly larva 'sampling' aphids

Sampling for earth mites



Assess risk



Sampling strategy

How often to check

Sampling technique

Number of samples

Where to sample

When to sample (time of day)

+

Additional considerations