Decision Making
for Integrated Pest Management
in Grain Crops

Crop establishment pests

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Key crop establishment pests

- > 40 invertebrate species threaten seedling establishment in crops and pastures
- Control tactics for these species presently relies heavily on the application of pesticides

Pest group	Example species
Earth mites	redlegged earth mite, blue oat mite
Lucerne flea	lucerne flea
Slugs, snails	grey field slug, black keeled slug; white and conical snails
Beetles & weevils	false wireworm, pasture cockchafers, mandalotus weevil
Caterpillars	common cutworm, pasture webworm
Other	earwigs, millipedes, slaters

What are the IPM options for crop establishment?

- Cultural ✓
- Biological ?
- Chemical ✓ ….can we be more strategic?

Key principles :

- Paddock histories and managing pre-season risk
- Pest ID
- Strategic use of pesticides
- All decisions underpinned by monitoring

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Paddock histories and managing pre-season risk

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Risk profiles for crop establishment

Example: Earth mites and lucerne flea

High risk	Reduced risk	Low risk
• Forecast for dry or cool, wet conditions that slow crop growth • Pasture going into crop • Susceptible crop being planted (canola, pasture, lucerne)	• Thin/sparse pasture in the previous spring • Low weeds in paddocks and along fence-lines • Higher sowing rate used • Optimal plant growing conditions during establishment	• Following a cereal or pulse • paddock with low weeds • Sandy soils (lucerne flea only)

Full Risk profile table in printed resources

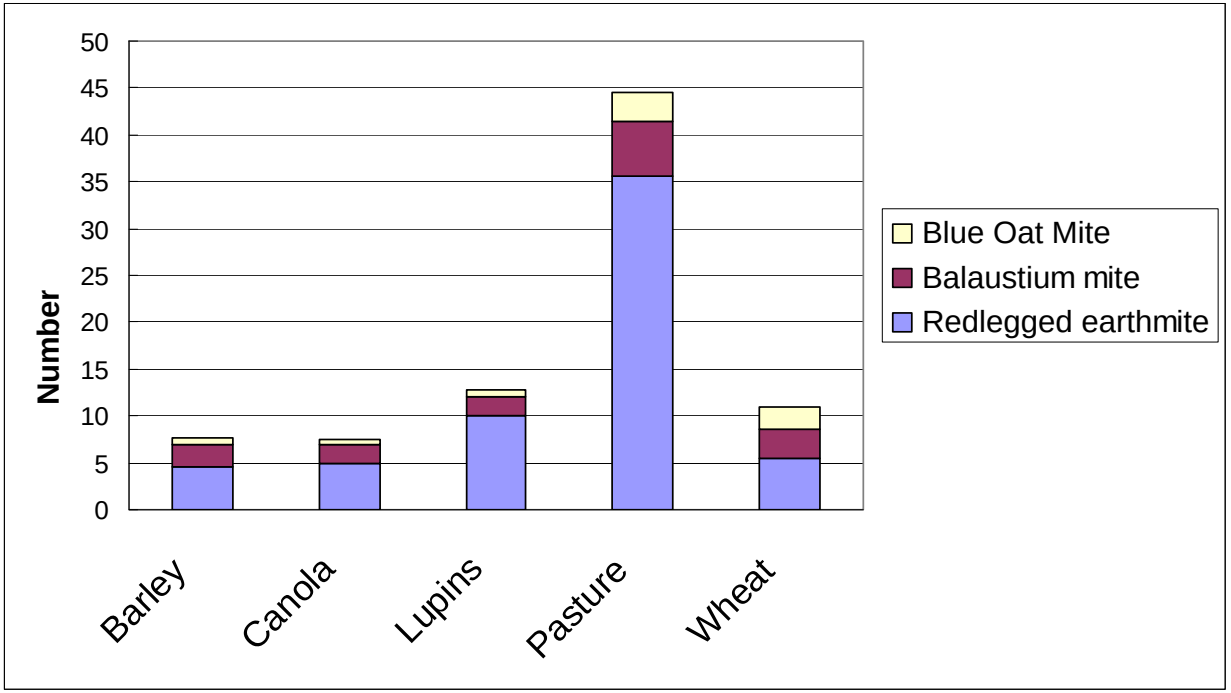
Make use of paddock histories

… helps with crop selection to reduce pest populations and negate the need for chemicals

- **'Resident'** pests are more predictable with paddock history information (e.g. mites, LF, slugs, snails, cockchafers, false wireworm)
- **'Transient'** pests (mobile across large distances) more difficult to predict (eg aphids, caterpillars)
- **Records** of paddock histories and soil type are particularly useful when planning to sow susceptible crops, such as canola

Example
Pre-season planning & crop selection

Number of **mites** in canola following 2 years of various crops



- Be careful following pastures, unless mite populations were controlled in the previous spring

Micic *et al.* 2012. *GRDC WA Updates*

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Pest identification is essential to making decisions

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Many similar looking pests behave very differently!

RLEM

BOM

Balaustium

Bryobia

ID and Seasonality?

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
RLEM												
BOM												
Balaustium												
Bryobia												

ID and Damage?

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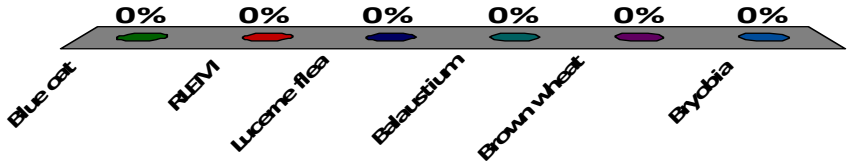
Who did this?

1. RLEM/blue oat mite
2. Slugs
3. Lucerne flea
4. Balaustium mite
5. Bryobia mite



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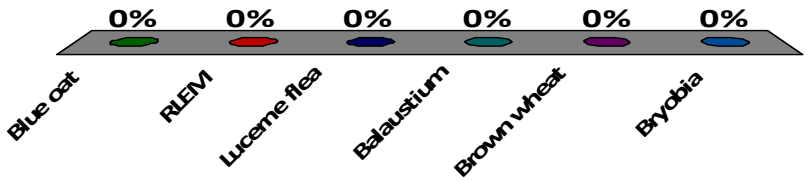

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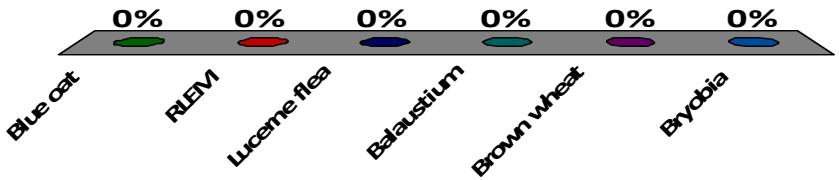

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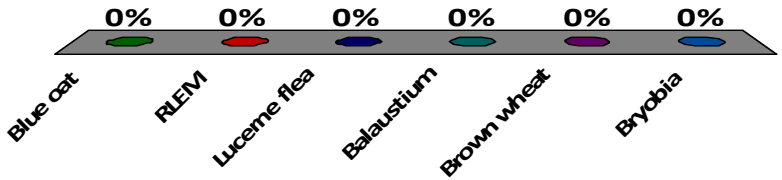

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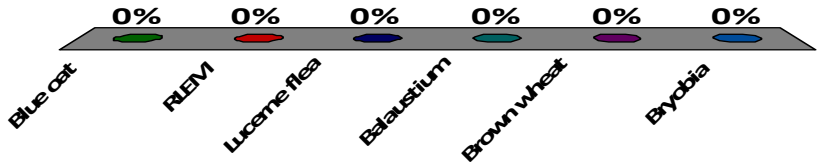

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Strategic use of pesticides
e.g. earth mites and lucerne flea

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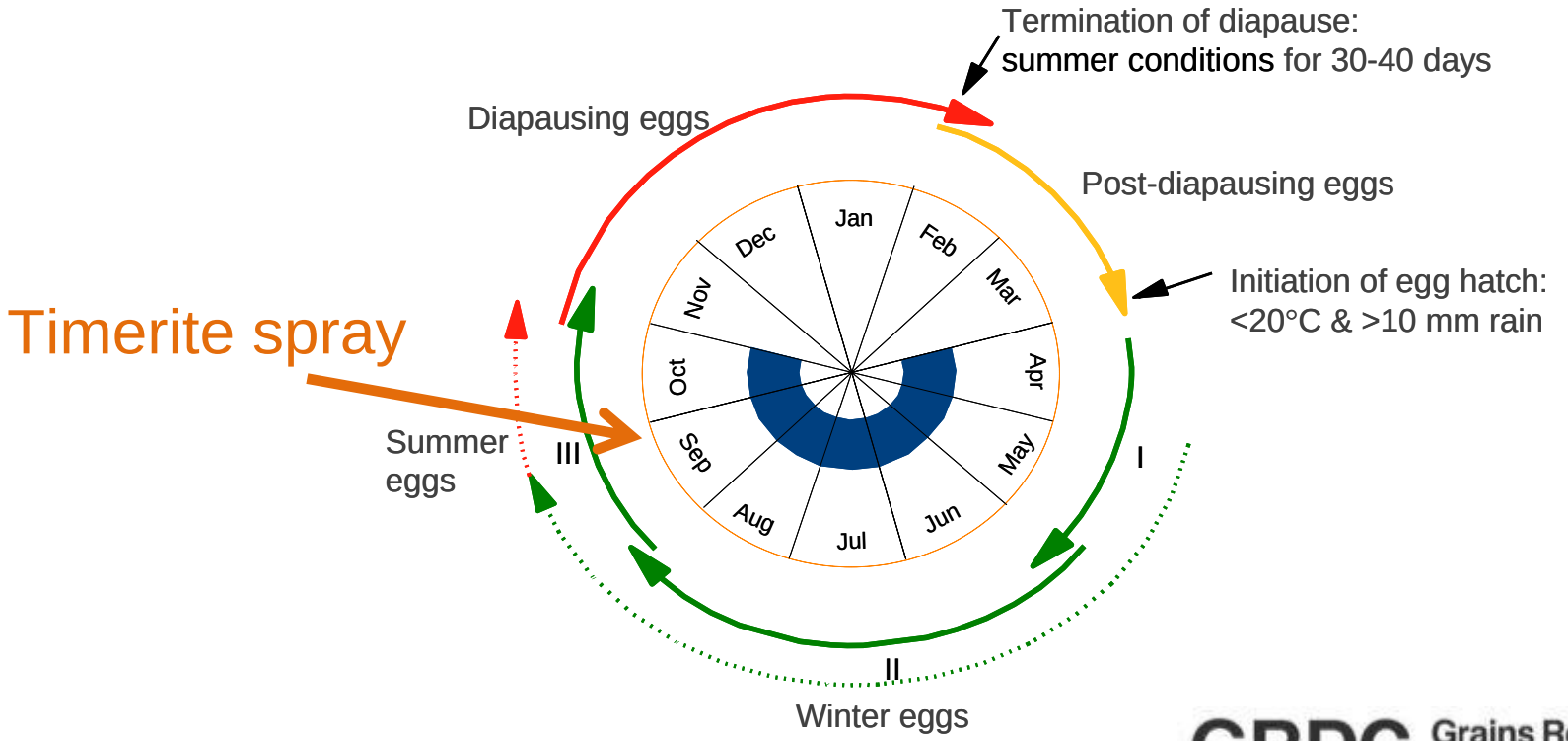
Pre-season control of RLEM

Timerite®

http://www.wcdi.com/Grow_Timerite.htm

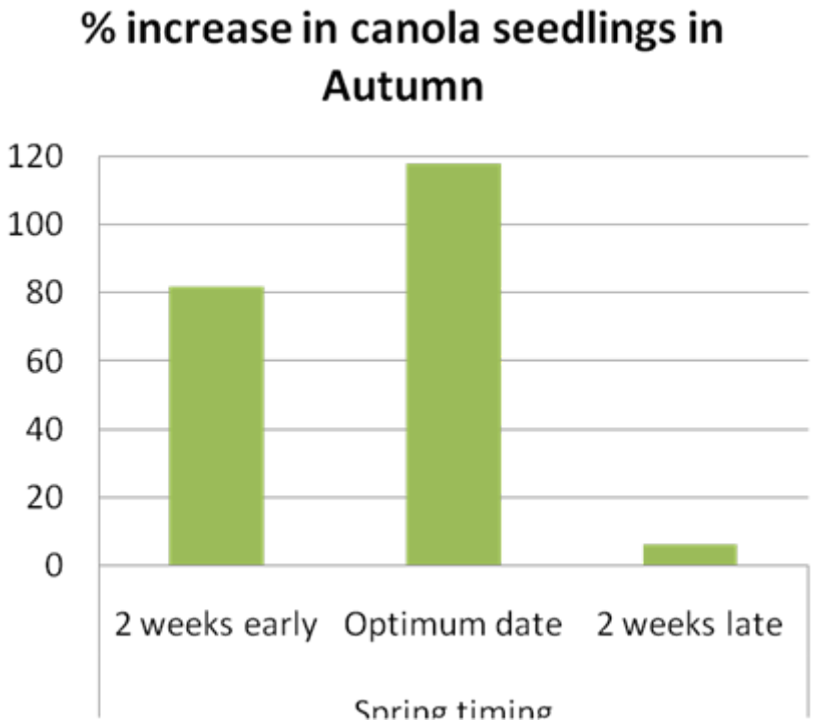
- Reduces the carry-over of pest eggs (>95%)
- Timing of spray is critical
- Freely available tool



RLEM lifecycle

Timerite for RLEM (cont.)

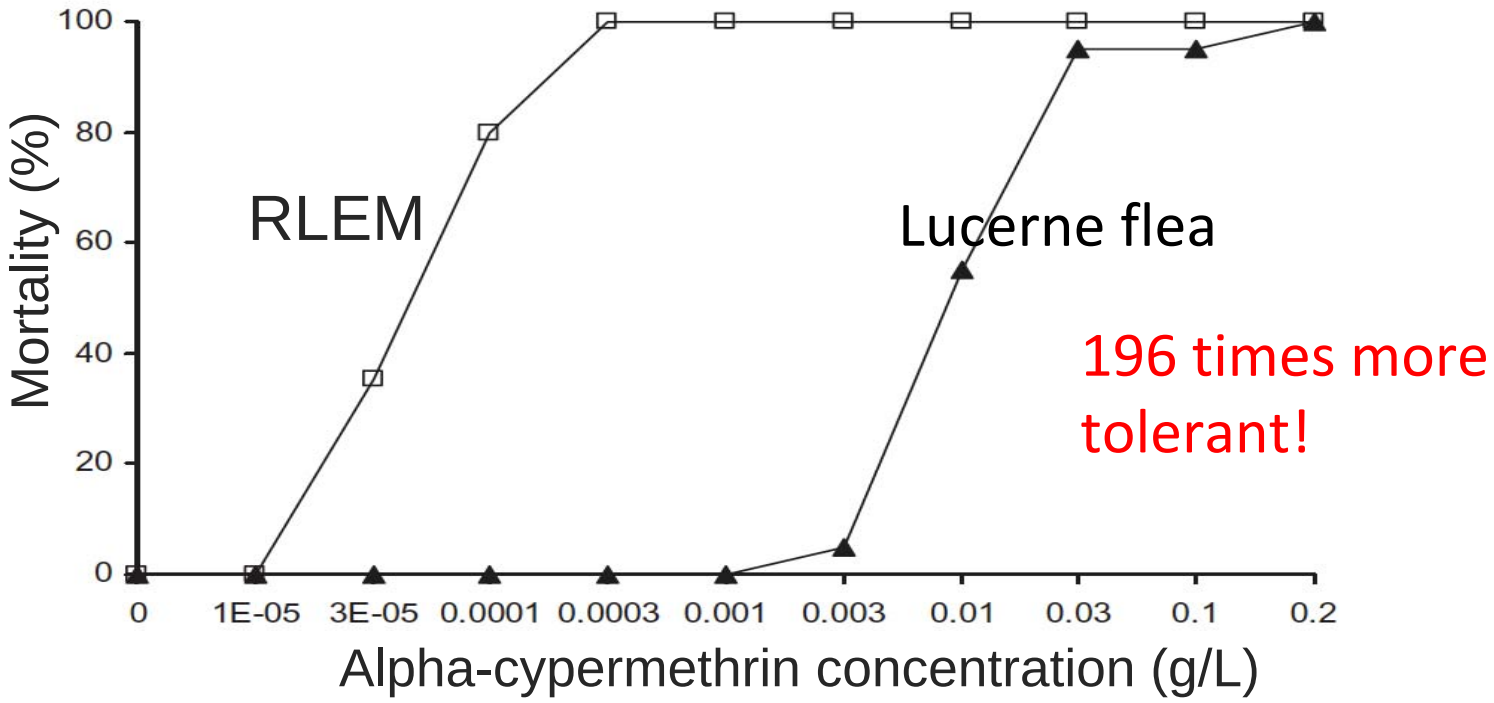
- Residual chemicals needed to target later emerging eggs
- Timerite provides excellent control of RLEM, in autumn
- Not applicable to other mites and lucerne flea



Adapted from AWI Ltd: Timerite© Information Package (sourced from Bayer)

Tolerance to insecticides

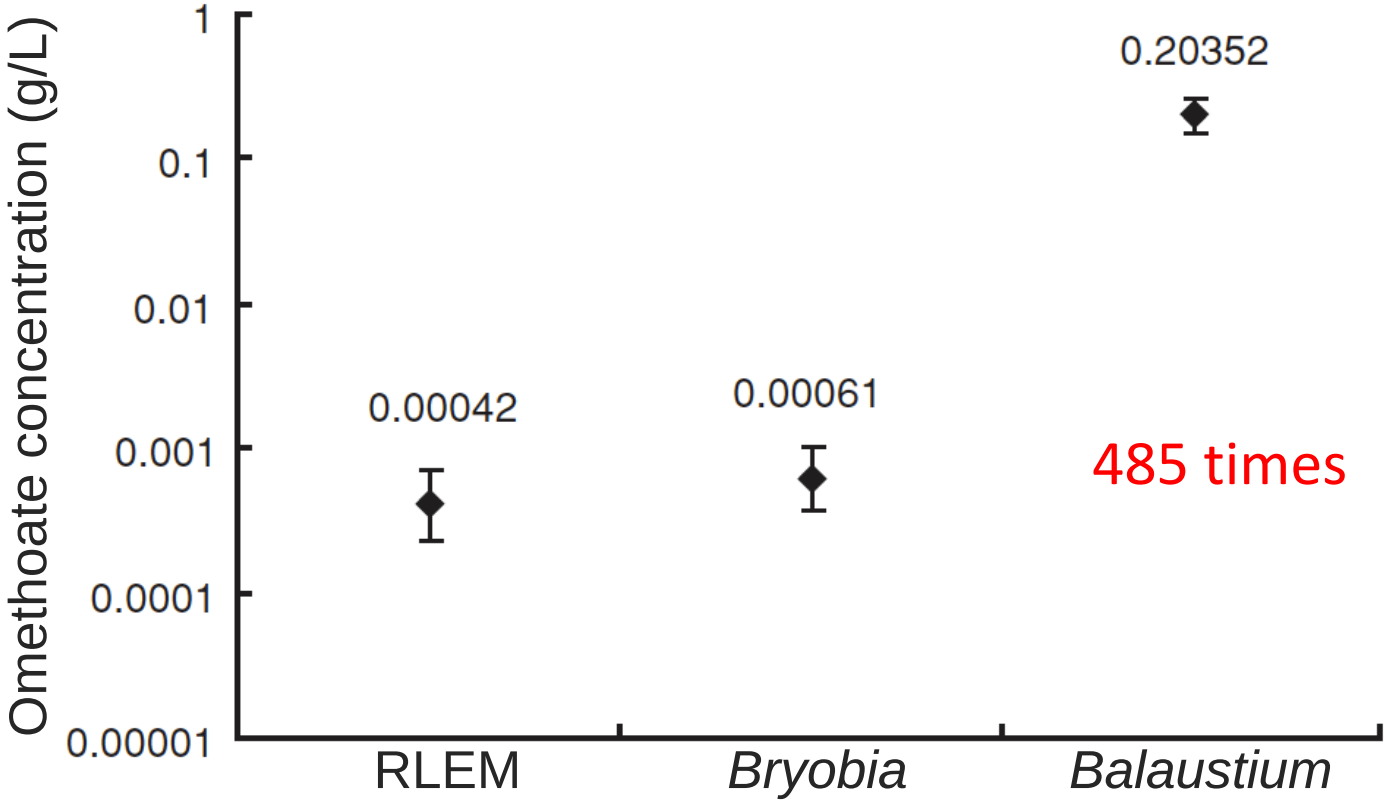
Insecticide response curve: RLEM vs LF



Roberts *et al*. 2009. *Aust. J Entomol.*

Tolerance to insecticides

Insecticide response curve: comparison of mites



Arthur et al. 2008. *Aust. J Exp. Agric.*

Tolerance to insecticides

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chemical testing - summary

Chemical class	RLEM	BOM	*Bal.*	*Bry.*	LF
Organophosphates	H-VH	H-VH	VL	H-VH	H-VH
Synthetic pyrethroids	H-VH	H-VH	L-VL	VL-H	L-VL
Neonicotinoids*	H	H	VL	VL	H

Efficacy
- V High
- High
- Low
- V Low

* = *Tested as seed dressing only*

Research with unregistered chemicals does not constitute a recommendation for that particular pest species. Chemicals have been largely tested against g a.i./L rather than at recommended application rates. All pesticide applications must accord with the currently registered label for that particular pesticide, crop, pest and region.

Tested actives

Organophosphates: omethoate, dimethoate, chlorpyrifos, phosmet, methidathion
Synthetic pyrethroids: bifenthrin, alpha-cypermethrin, lambda-cyhalothrin, gamma-cyhalothrin, esfenvalerate
Neonicotinoid: imidacloprid

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Insecticide resistance in RLEM

Chemical	Population	LC50 value	Resistance ratio
Bifenthrin	Control	0.03	
	WA	6881.97	243,027
	Control	0.03	
	WA (Gen 2)	7122.17	268,694
Alpha-cypermethrin	Control	0.02	
	WA	942.81	59,353
Omethoate	Control	0.10	
	WA	.26	---

- Resistance also found to be heritable
- Resistance located > 20 properties in WA (>900 km apart)
- Movement is known between WA & east coast
- Implications: need for careful management of insecticides

Adapted from Umina 2007. *Pestic. Sci*

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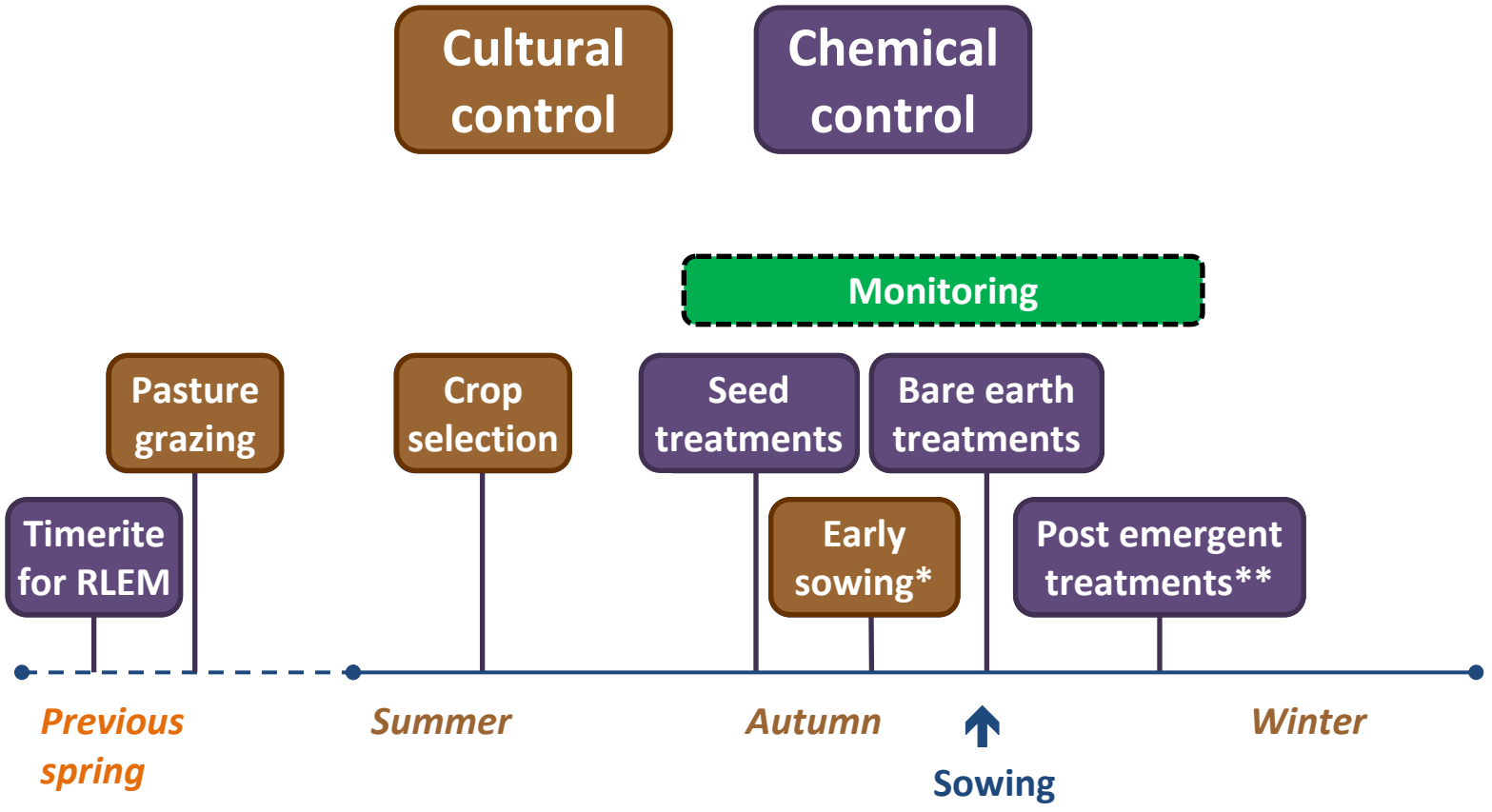
Decision timeline for earth mites & lucerne flea



** Also consider other sowing tactics (eg. increased seed density)*

*** Consider spot spraying for lucerne flea*

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Slugs:
Need the full IPM ‘arsenal’

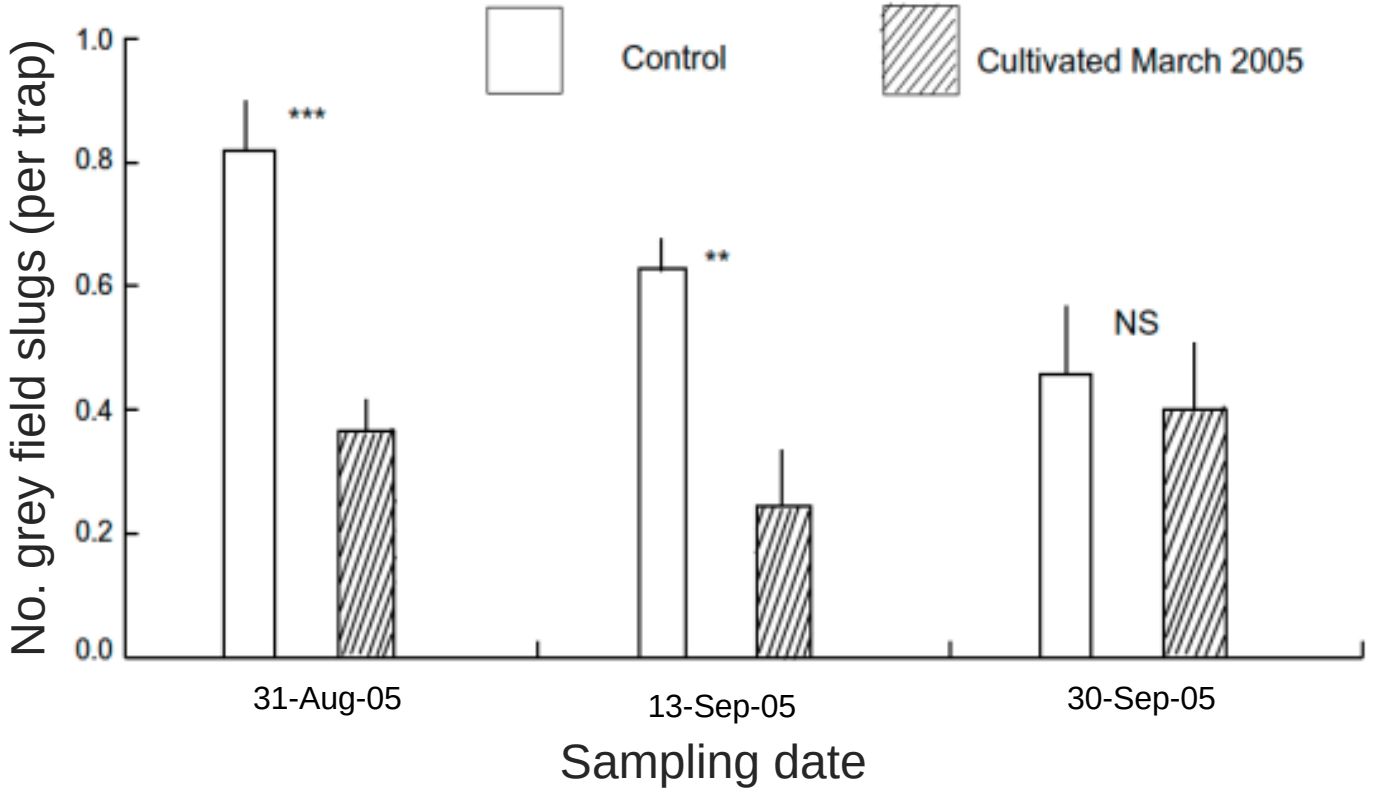
- pest ID
- understand paddock history
- cultural control
- monitoring
- strategic use of baits

What drives slug numbers? Moisture!

Contributing factors :

- Previous paddock history/pop'n size
- Low/no cultivation
- Stubble retention (habitat & moisture)
- Heavier soils (retain moisture)
- Rainfall: >450mm/year
- Summer rainfall increases populations

Cultivation & slugs



- Cultivation reduces slug numbers
- Rolling also consolidates seed bed, restricts slug movement

Adapted from Nash *et al.* 2008. *Biol. Control*

Integrate: no one tactic is enough!

Cultural

Consider paddock history! Then:

- Burn; general cultivation
- Control summer volunteers
- Cultivate worst areas
- Plant early
- Roll to consolidate seedbed

Biological

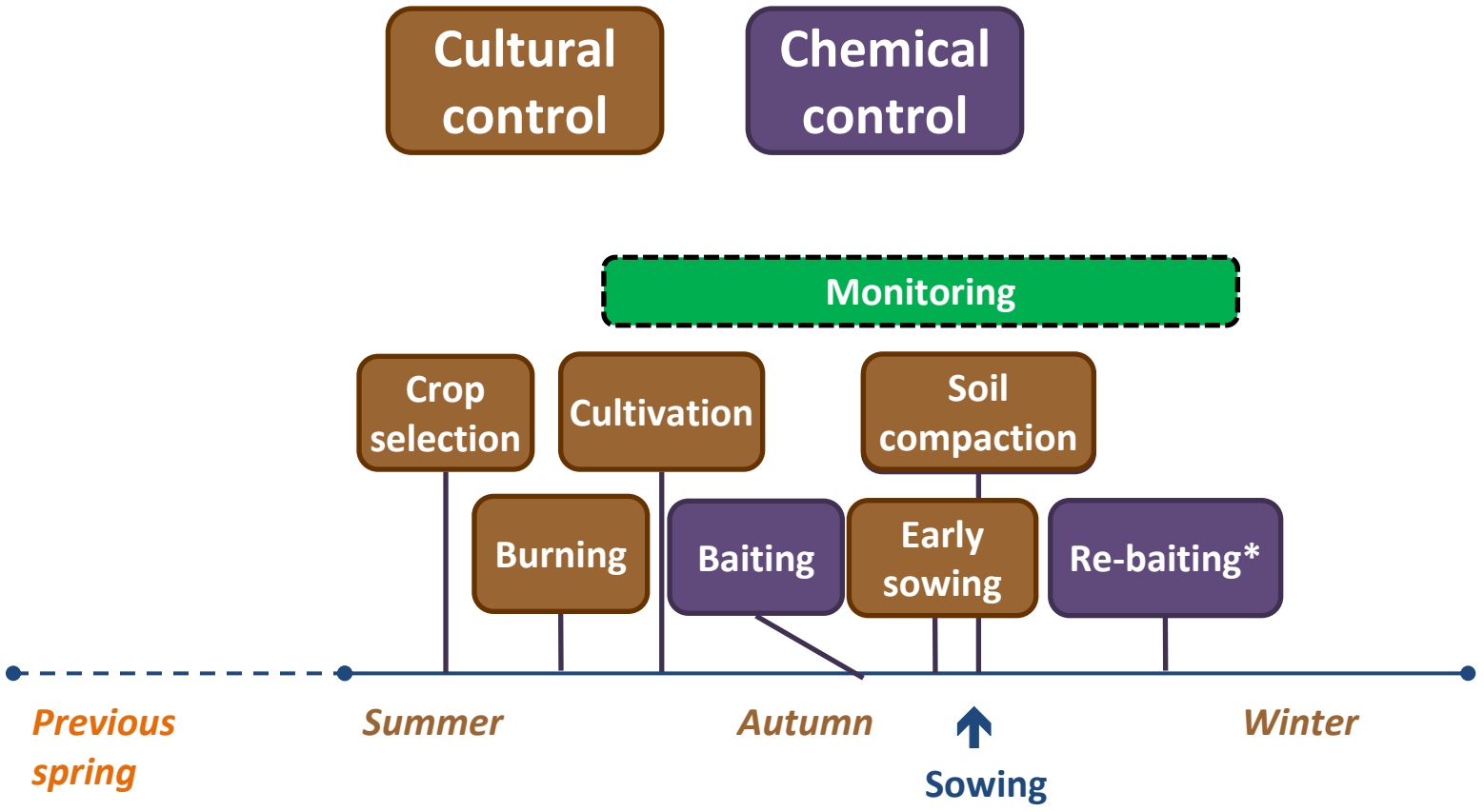
Consider predators (eg carabid beetles) in use of sprays

Integrate: no one tactic is enough!

Chemical

- Bait at/after sowing prior to emergence
- 25-30 baits /m^2 gives 80% chance encounter (don't skimp!)
- Budget for at least two applications of bait in Canola
- When to bait? No good if dry. No good if crop up either.

Decision timeline for slugs



* *Pending monitoring results*

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Establishment pests ‘Best Bet’ IPM strategy

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‘Best Bet’ example: Earth mites and lucerne flea

Pre-season (previous spring/summer)	Pre-sowing	Emergence	Crop establishment
<u>Assess risk</u> High risk when: • History of high mite pressure • Pasture going into crop • Susceptible crop being planted (eg. canola, pasture) • Seasonal forecast is for dry or cool, wet conditions that slow crop growth. If risk is high: • Ensure accurate ID • Use Timerite (RLEM) • Heavily graze pastures in early-mid spring	If high risk: • Use seed dressing on susceptible crops • Plan to monitor more frequently until crop establishment • Use higher sowing rate to compensate for seedling loss • Consider scheduling a post-emergent insecticide treatment If low risk: • Avoid seed dressings (esp. cereals/pulses) & plan to monitor until crop establishment	• Monitor susceptible crops through to establishment (direct visual searches) • Be aware of edge effects; mites move in from weeds around paddock edges If spraying: • Ensure accurate ID before deciding on chemical • Consider border sprays (mites) and ‘spot’ sprays (lucerne flea) • Spray prior to the production of winter eggs to suppress populations and reduce risk in the following season	• As the crop grows, it becomes less susceptible unless growth is slowed by dry or cool, wet conditions

Full ‘Best Bet’ table in printed resources

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Take home messages

- Crops most **vulnerable** at establishment, esp. canola and medics
- Planning **pre-season** is important (time constraints to monitor sufficiently at establishment period)
- We have the ability to foresee many establishment pest issues before they happen… as they are '**residents**'
- **Monitoring & Pest ID** are vital (eg. mites, weevils, scarabs)
- **Early planting**, **stubble management, increasing sowing density** and **seedbed rolling** are common cultural strategies
- **Beneficial species** often only play a support role at crop establishment (difference b/w crops & pastures)