AWI Breech Strike R&D Technical Update
Maritime Museum, Sydney
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Resistance to flystrike preventative insecticides

HISTORY OF RESISTANCE DEVELOPMENT:

- **Organochlorine** — 1958 – f(R) – (frequency of resistant larvae) = 70%; banned because of residues in meat
- **Organophosphate** — 1965 - f(R) 98%; protection reduced to 2-4 weeks; flystrike dressings failed
- **Carbamate** — 1967 - augmented OP resistance; later cross-resistance to BPUs
- **Benzoylphenyl urea** (diflubenzuron) — 1998 - low-level resistance; protection less than label
  2002 - high-level resistance; no protection/flystrike claims removed from product labels

RELIANCE NOW ON:

CYROMAZINE[Jet+BL] and **DICYCLANIL**[BL]

IVERMECTIN[Jet]

α-CYPERMETHRIN[BL]**

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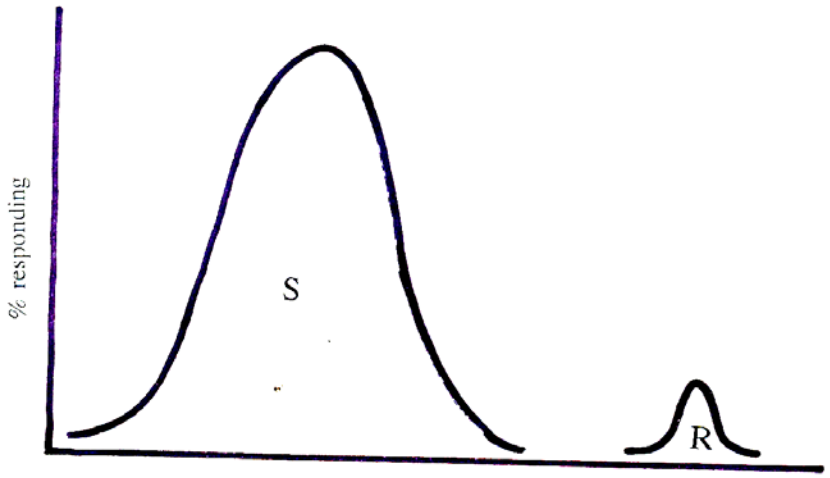
- **Cyromazine resistance screen**

(1 mg kg^{-1}) (SDC)

(Susceptible Discriminating Concentration)



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DECEMBER 2010 – REPORTED FIELD FAILURE at NIMMITABEL:

- **10-15 week old unmulesed, weaner ewes treated with 19 mL cyromazine spray-on (ProGuard®).**
- **Wether weaners treated with the label-recommended doses of dicyclanil spray-on (CLiK®).**
- **Four weeks later 10 % of the cyromazine-treated ewes struck in urine stain.**
- **No breech or body strikes observed in the dicyclanil-treated wethers which were unaffected by urine stain.**

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LABORATORY INVESTIGATION:

- f**(R) = 4% mortality at SDC**
- **Multi-concentration bioassays with cyromazine and dicyclanil.**
- **Nimmitabel strain compared with 'susceptible' field strain.**
- **Mortality measured as failure of larvae to pupate.**

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1. Larval mortality in the 'field susceptible' and Nimmitabel strains after feeding on cyromazine or dicyclanil treated homogenate.

INSECTICIDE	STRAIN	LC50*	RF_{50} **	LC95	RF_{95}	100 % mortality (mg kg^{-1})
Cyromazine	'Field susceptible'	0.26	-	0.43	-	0.5
	Nimmitabel	0.60	2.3	1.44	3.3	4
Dicyclanil	'Field susceptible'	0.02	-	0.04	-	0.05
	Nimmitabel	0.03	1.3	0.08	2.1	0.1

* LC50/95 – concentration lethal to 50/95% of the population sample

** RF – Resistance Factor (LC50 of Resistant strain/LC50 of Susceptible strain)

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Insecticide	Blowfly strain	LC50 (mg kg^{-1})	RF	100% mortality (mg kg^{-1})
CYROMAZINE	Field (susceptible)	0.26	-	0.5
	Nimmitabel (original)	0.60	2.3x	4
	Nimmitabel (selected)**	2.14	8.1x	8
DICYCLANIL	Field (susceptible)	0.02	-	0.05
	Nimmitabel (original)	0.03	1.3x	0.1
	Nimmitabel (selected)**	0.06	2.8x	0.125

** Nimmitabel (selected) – a strain comprised only of the original 4% resistant larvae

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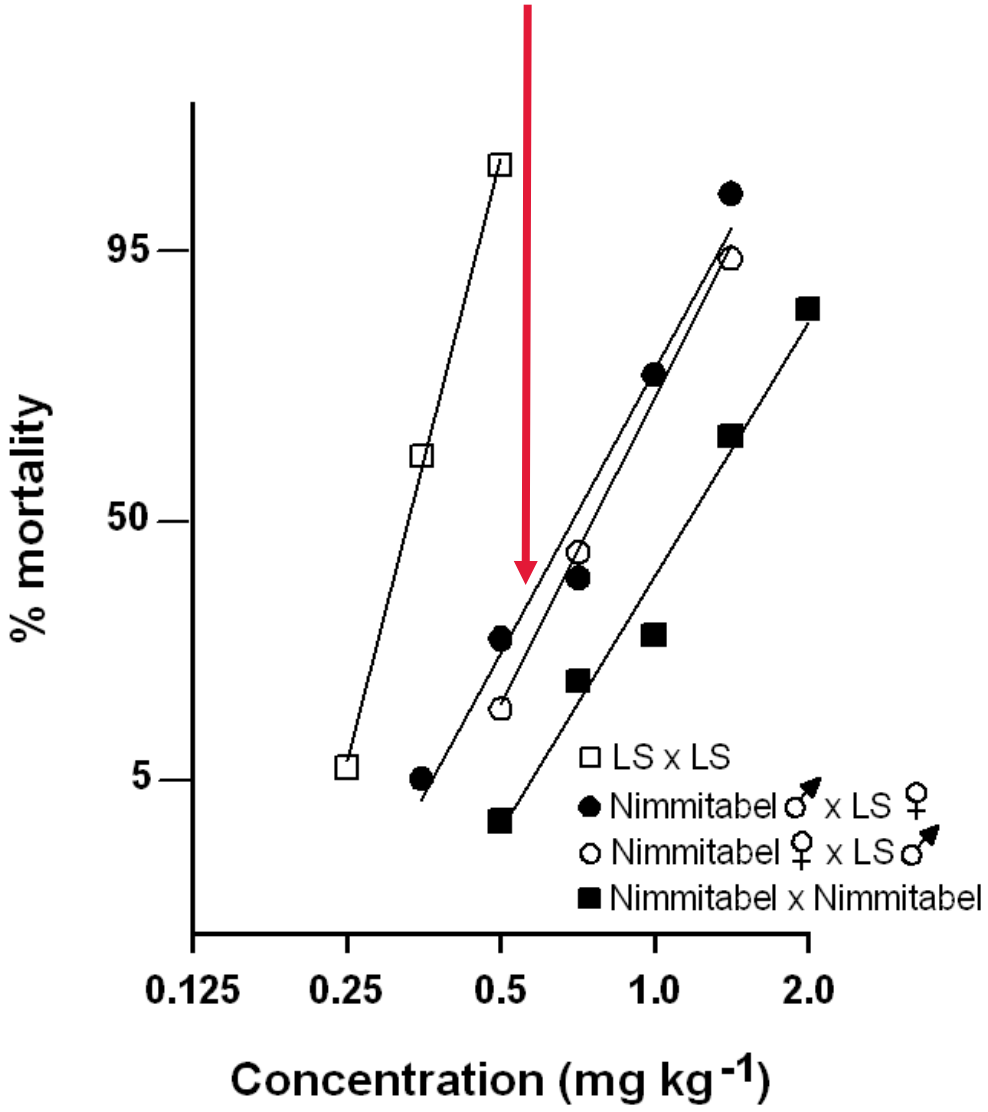

CYROMAZINE TESTING:

- **Crossed the 'selected' Nimmitabel strain with the susceptible strain (LS).**

- **Hybrid's susceptibility to cyromazine intermediate between parental strains.**

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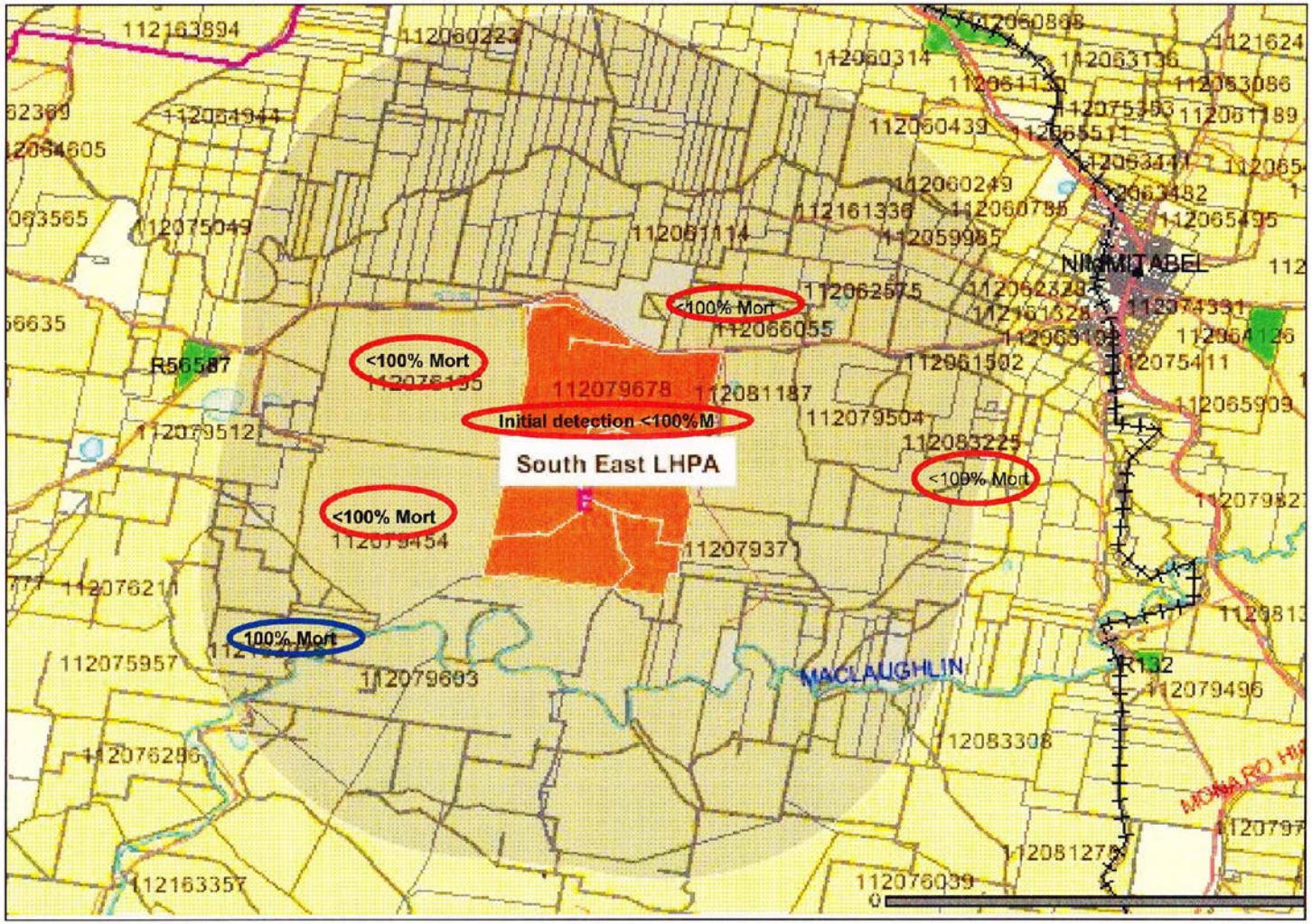
Back in Nimmitabel ..... other properties with cyromazine resistant larvae



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AWI FUNDED SURVEY PROJECT 2012-2014:

1. CYROMAZINE:

- 58 samples (NSW 28; WA 17; Vic 6; SA 2; Tas 5)
- Low-level resistance only (in 36 out of 58 (62%) populations)
- No high-level resistance (nothing survived 8 mg kg^{-1})
- 40% of larvae in one NSW central west sample were resistant
- All samples tested from NSW contained some resistant larvae (fewer in SA (1/2), WA (5/17) and Vic (1/7)
- All Tasmanian samples were susceptible to cyromazine

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2. DICYCLANIL:

- **Eight of the 36 (22%) samples that displayed low-level cyromazine resistance were also resistant to dicyclanil**
- **All of these samples came from NSW**
- **No high level resistance**

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LARVAL IMPLANT TRIAL

1. Injury inflicted to skin for larval implant

2. Wetting out the fleece around the implant site

Sheep treated with :

- **Vetrazin® Liquid**
- **Vetrazin® Spray-On or CLiK® Spray-On**

'*SUSCEPTIBLE*' ■ and '*RESISTANT*'■ strains implanted side by side for up to 29 weeks

3. First instar maggots on damp dental plug

4. Implant plug with maggots *in-situ*

5. Completed larval implant

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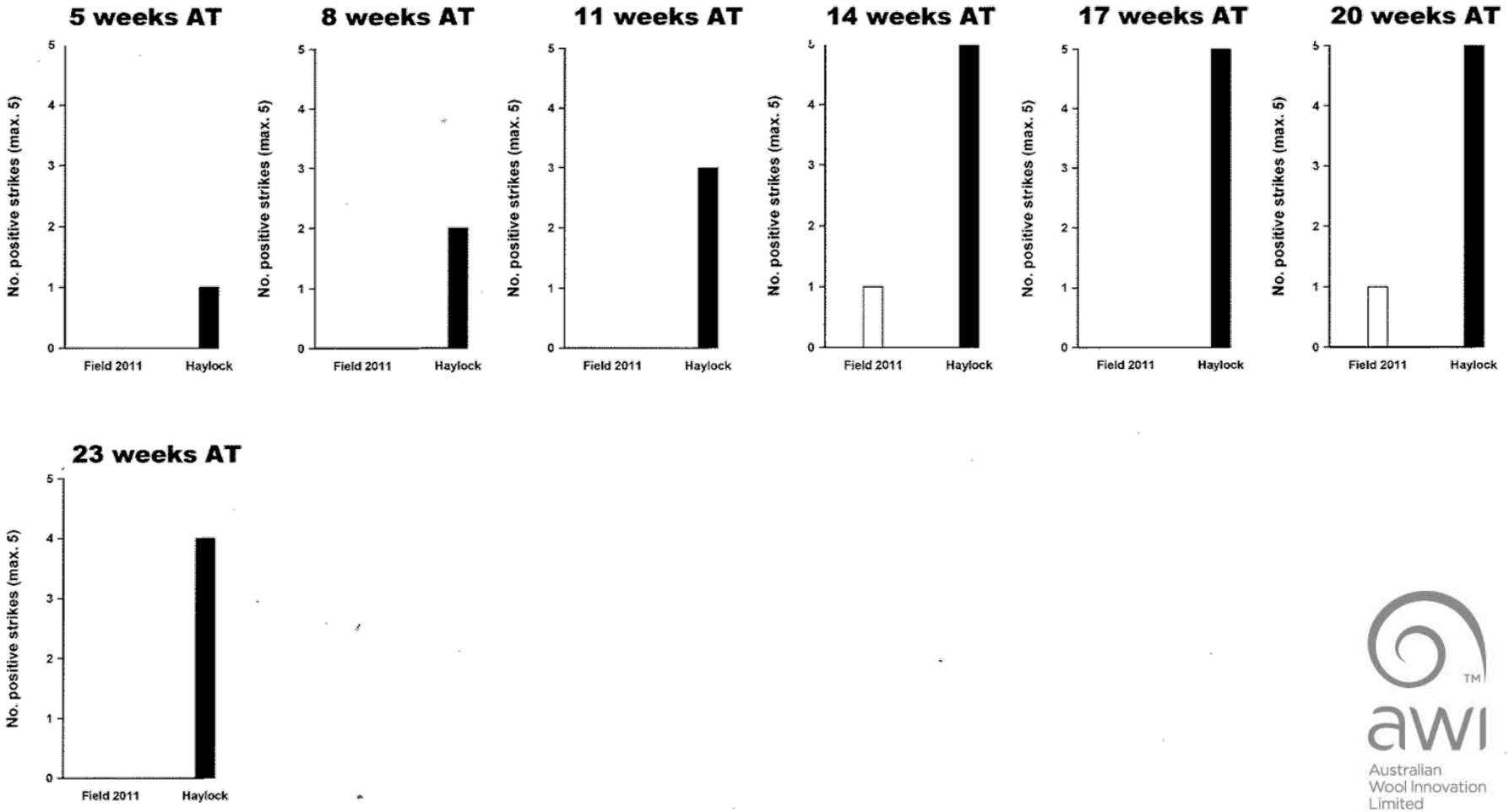
Vetrazin® Liquid (cyromazine)



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Implant sites 72 h after implant initiation, on a sheep treated 11 weeks earlier with Vetrazin® Liquid (LHS – *susceptible* strain; RHS – *resistant* strain).

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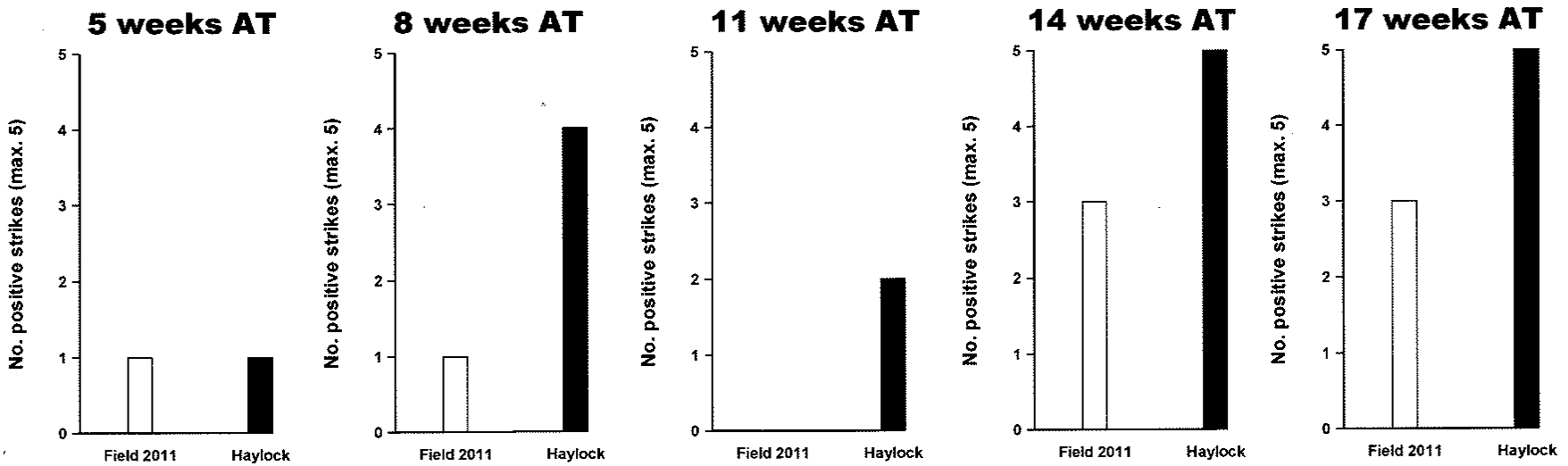
Vetrazin Spray-on® (cyromazine)



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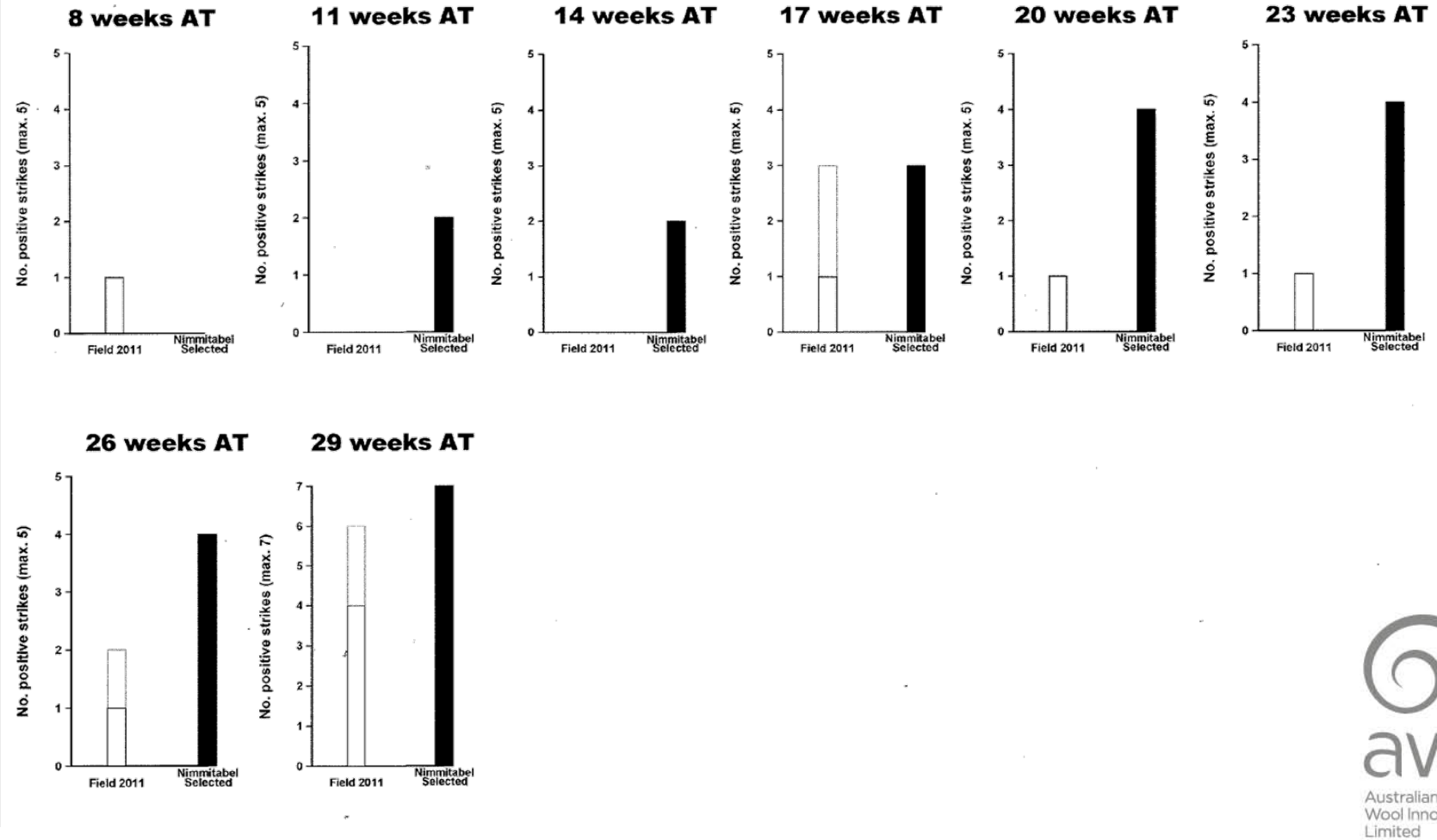
CLiK® (dicyclanil)



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Implant sites 72 h after implant initiation, on a sheep treated 20 weeks earlier with CLiK® (LHS – *susceptible*; RHS – *resistant* strain).

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- **Sheep treated with Vetrazin® Liquid, Vetrazin® Spray-on or CLiK® were protected from flystrike by the cyromazine-susceptible strain for periods consistent with the registered product label claims.**

- **Resistance, even in the laboratory bred pure-breeding resistant strain, was not so severe as to cause control failure with registered cyromazine or dicyclanil products.**

- **The laboratory bred resistant strain had sufficient survival advantage to reduce the protection period provided by registered cyromazine or dicyclanil products.**

Will it matter?

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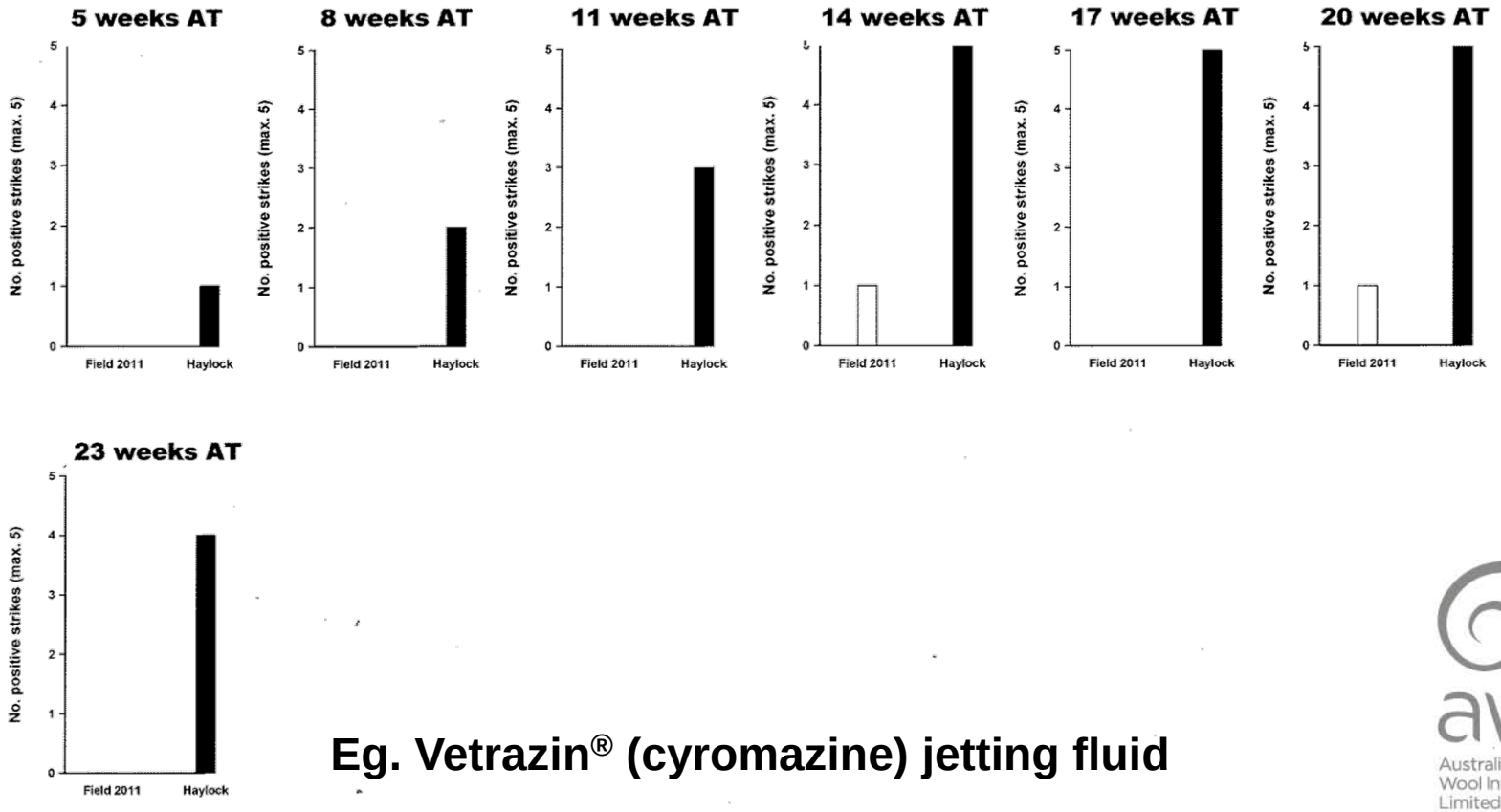
Only if conditions favouring flystrike coincide with the periods after treatment when resistant larvae have a survival advantage over susceptible larvae.



Eg. Vetrazin® (cyromazine) jetting fluid

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