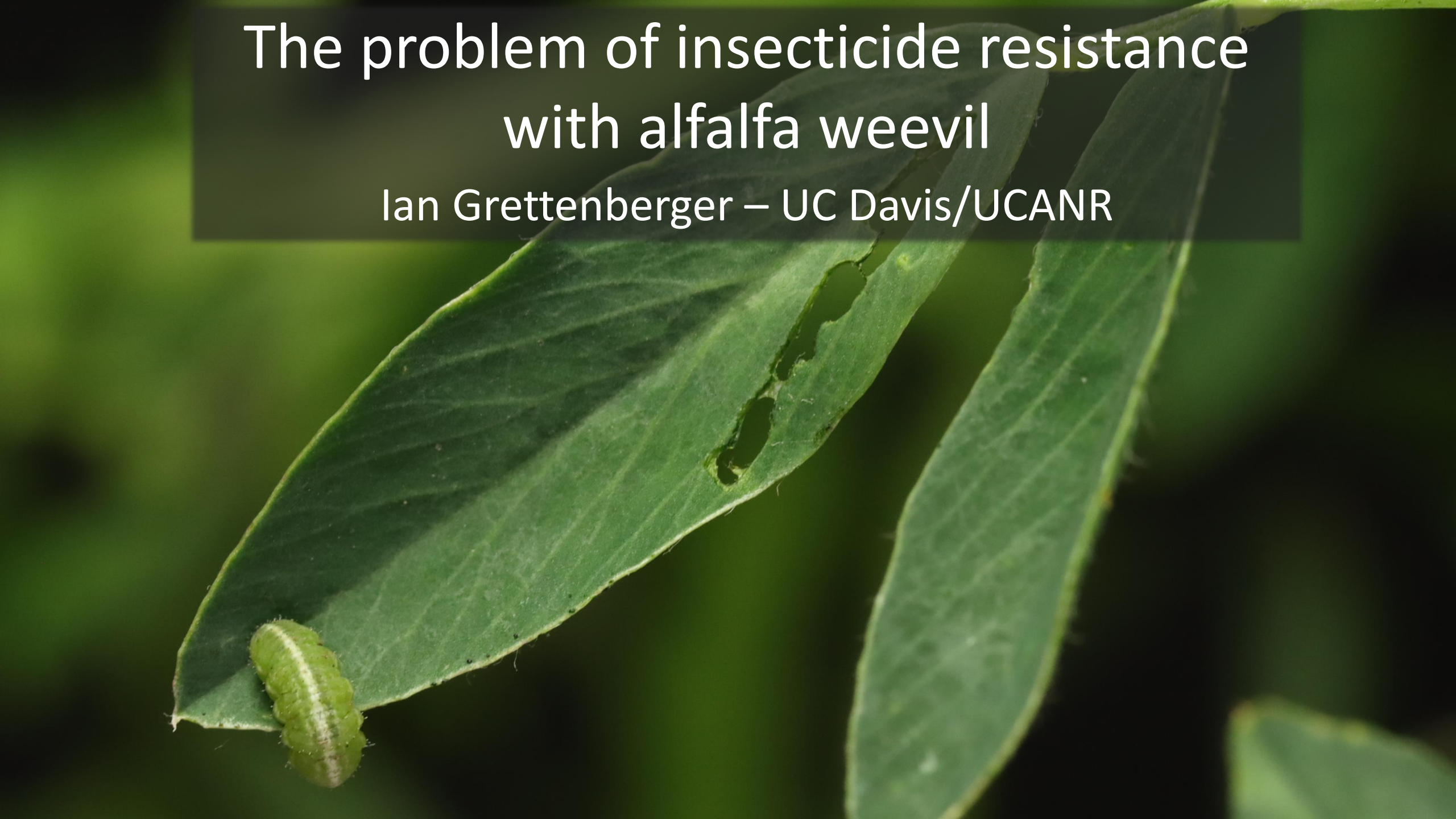
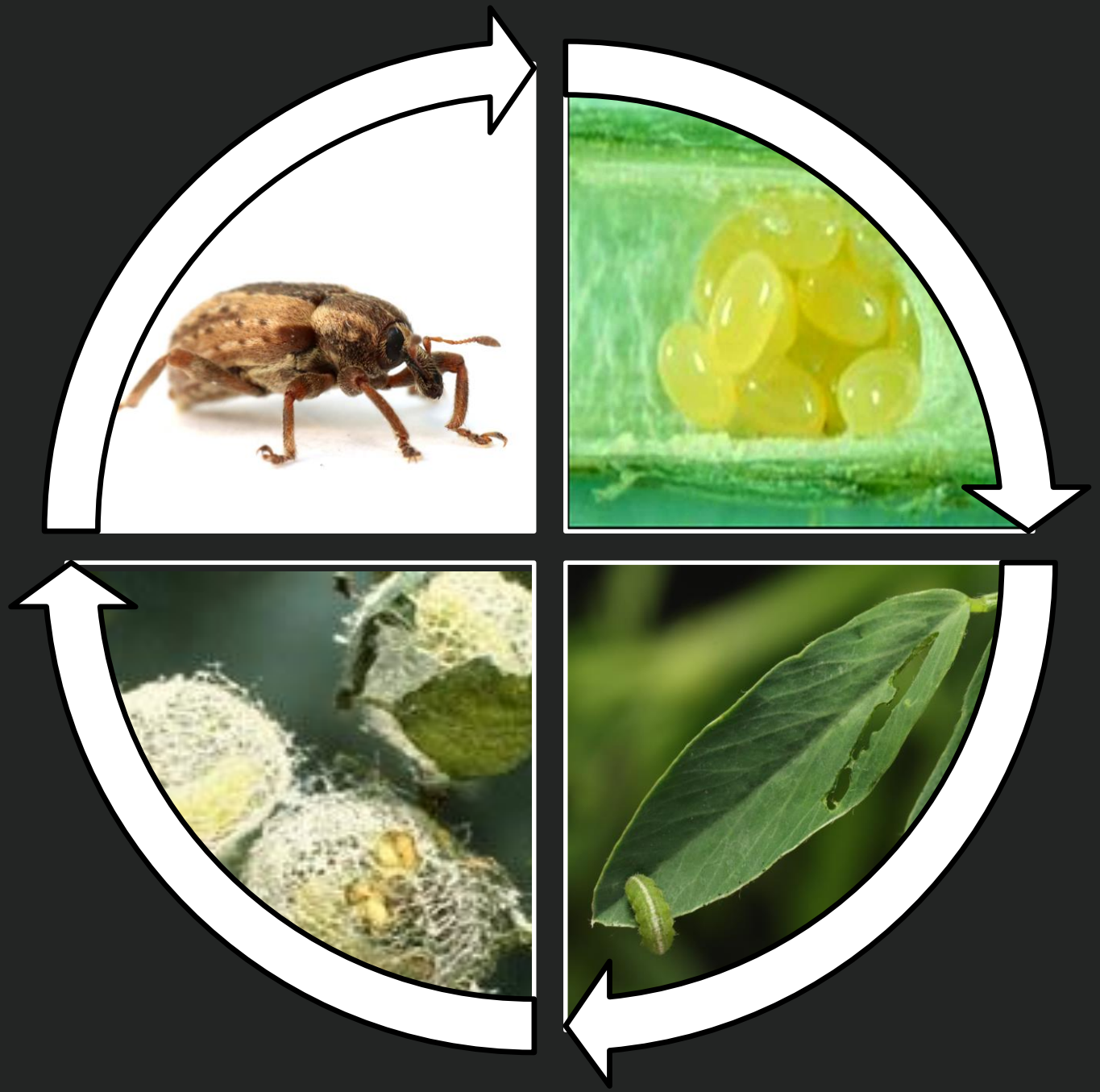
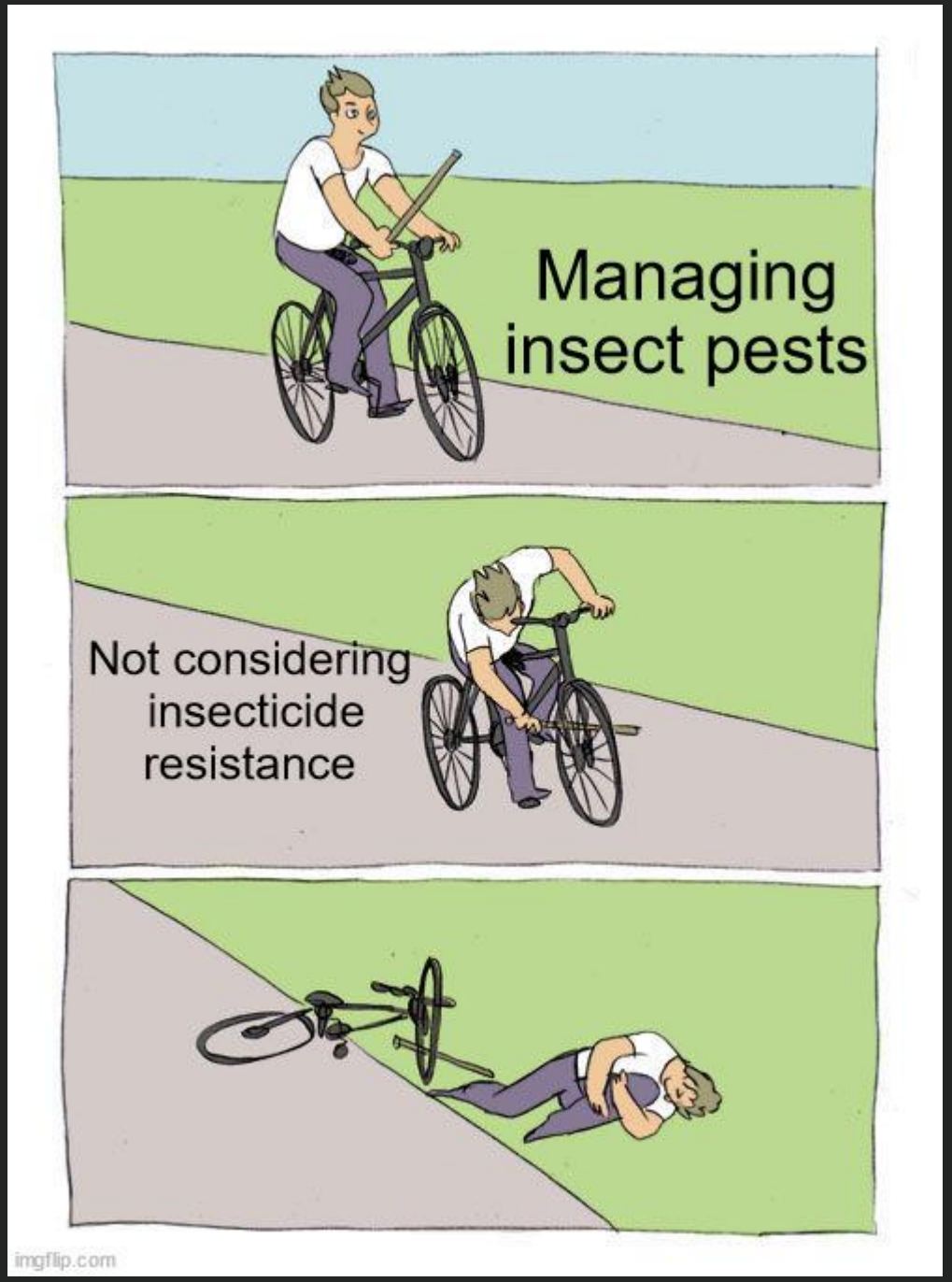
The problem of insecticide resistance with alfalfa weevil

Ian Grettenberger – UC Davis/UCANR





Why care about resistance?

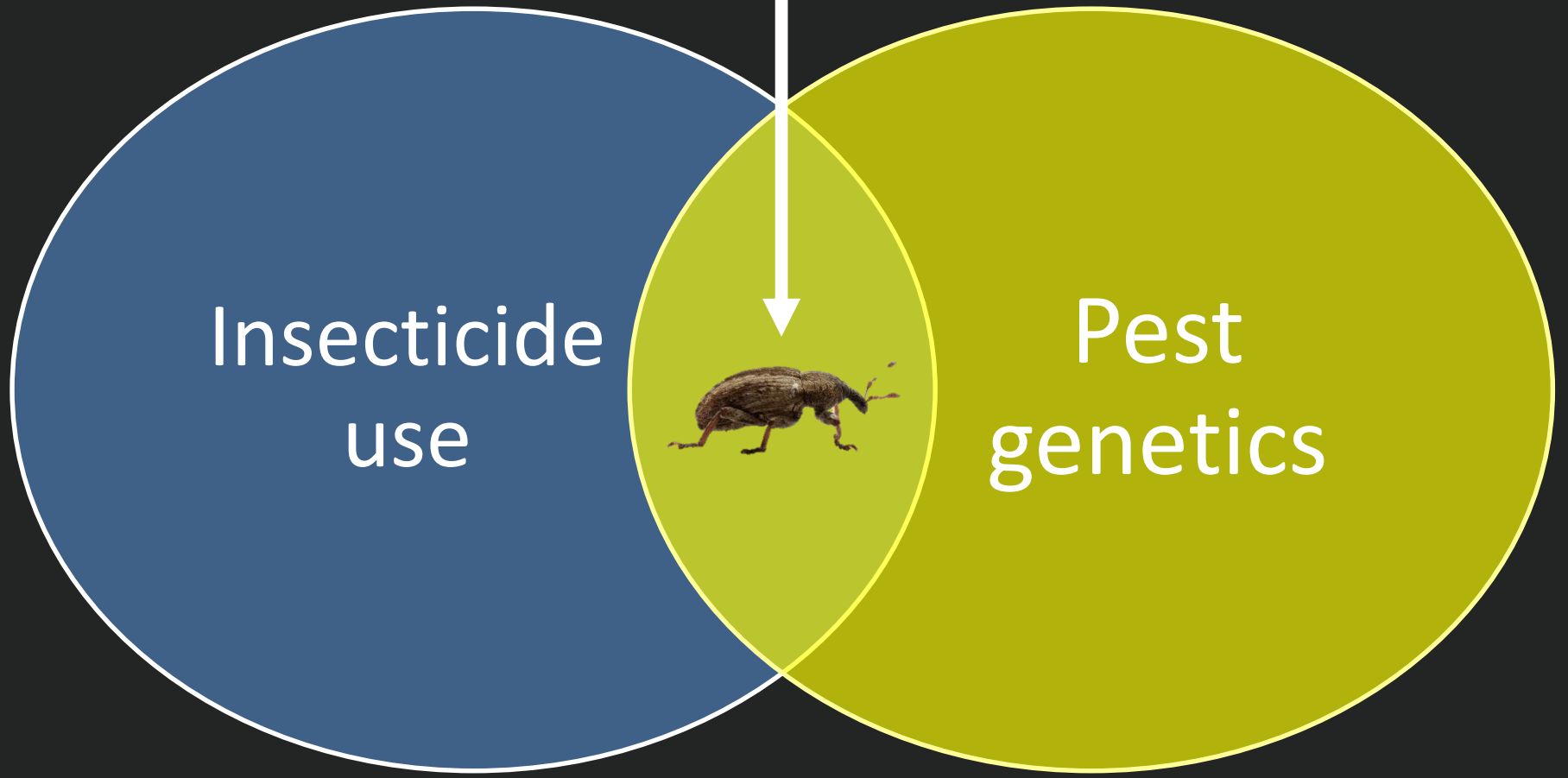


How does insecticide resistance develop?

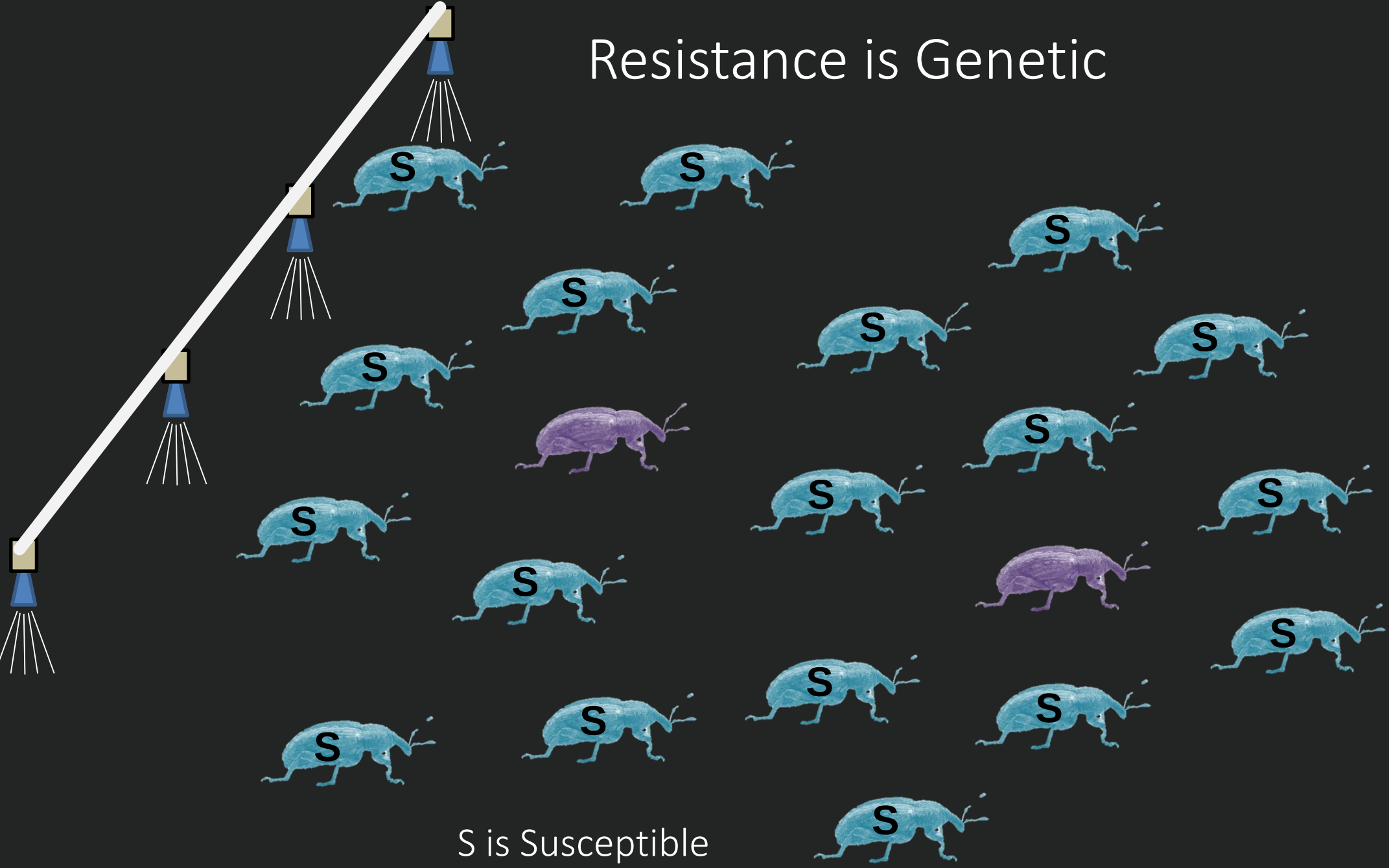
Pest genetics

Insecticide use

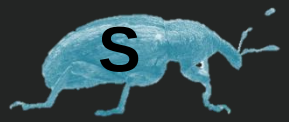
Insecticide resistance



Resistance is Genetic

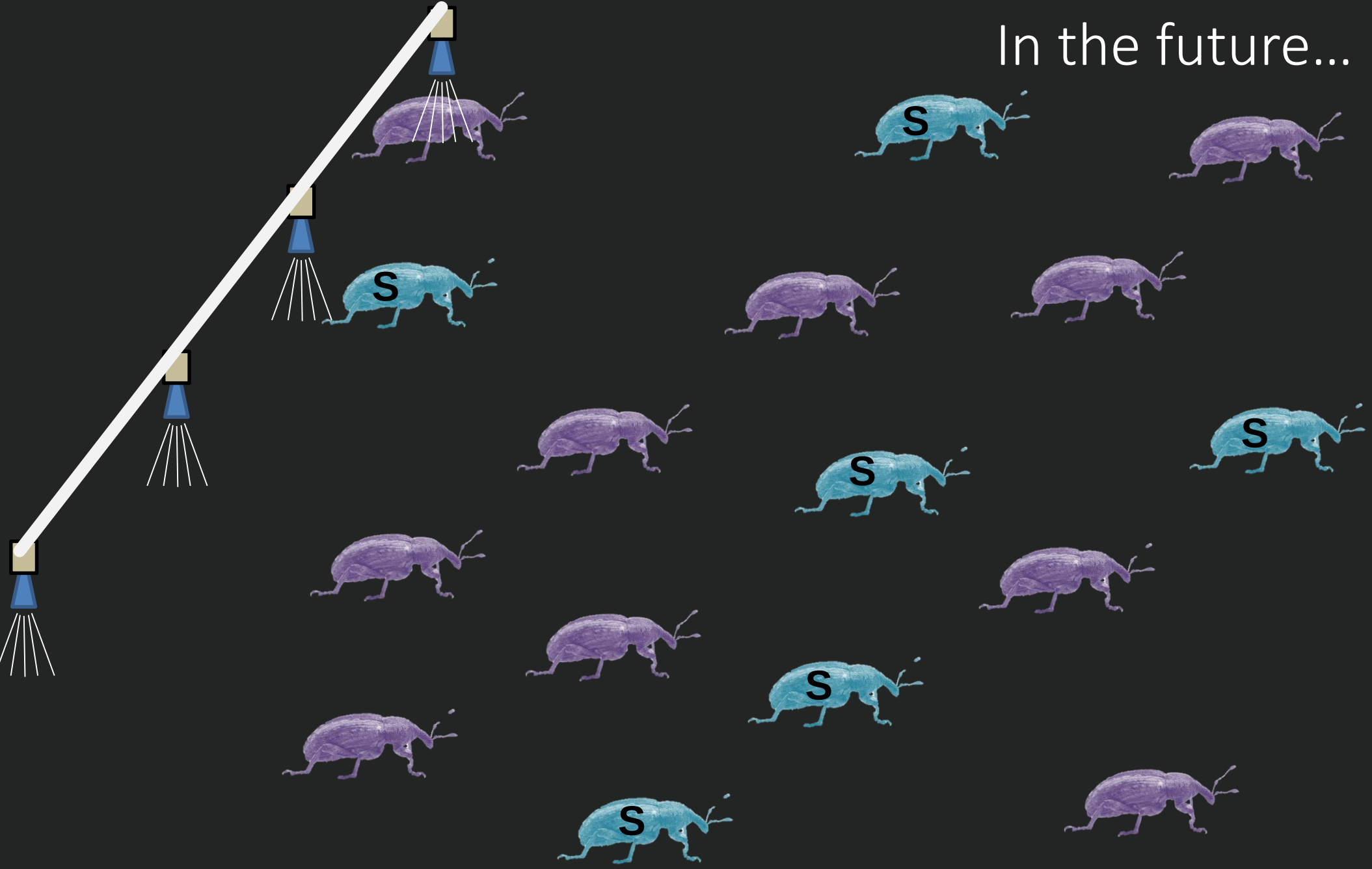


S is Susceptible



Mating

In the future…



Resistance is Now Common

Problem: Pyrethroid-resistant alfalfa weevils

"We've had to learn to live with higher levels"

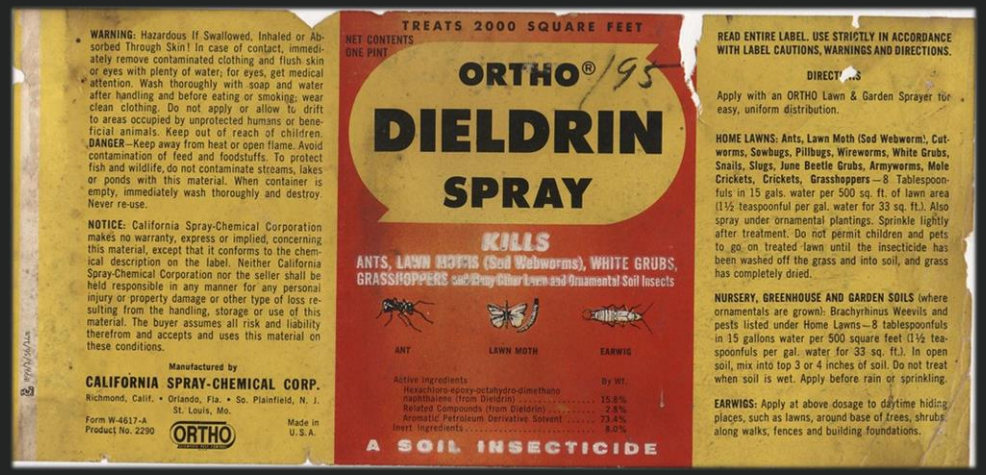
"Once it's here, it's basically like a new pest … really we effectively don't have anything to control it …"

Insecticide resistance is not a new issue

Resistance of the Alfalfa Weevil to Heptachlor[1]

V. E. Adler and C. C. Blickenstaff
Entomology Research Division, Agr. Res. Serv.,
USDA., Beltsville, Md.

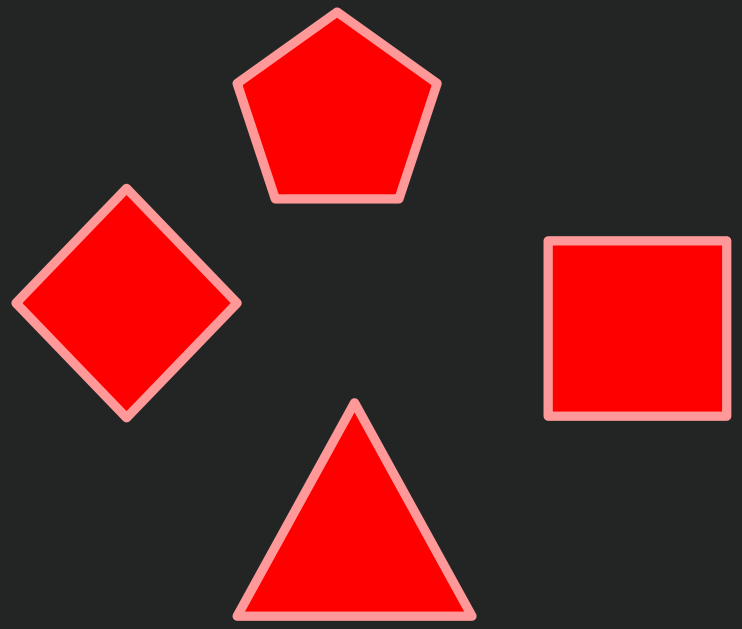
Reports (USDA 1962, 1963; Bissell and Harding 1963; Powell 1969) and personal correspondence indicate that in many



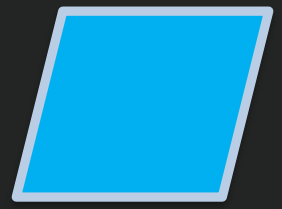
Problem: Limited modes of actions

Spinosyns-Spinosad (5)

Pyrethroids (3A)



Oxadiazines – Indoxacarb (22A)



Organophosphates – malathion (1B)

GROUP 3 INSECTICIDE

Warrior II
with Zeon Technology®

Insecticide

Active Ingredient:	
Lambda-cyhalothrin[1,2]	22.8%
Other Ingredients:	77.2%
Total:	100.0%

Warrior II with Zeon Technology contains 2.08 lbs. of active ingredient per gal. and is a capsule suspension.

[1]*CAS No. 91465-08-6* [2]*Synthetic pyrethroid*

Contains petroleum distillate.

KEEP OUT OF REACH OF CHILDREN.

WARNING / AVISO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

See additional precautionary statements and directions for use in booklet.

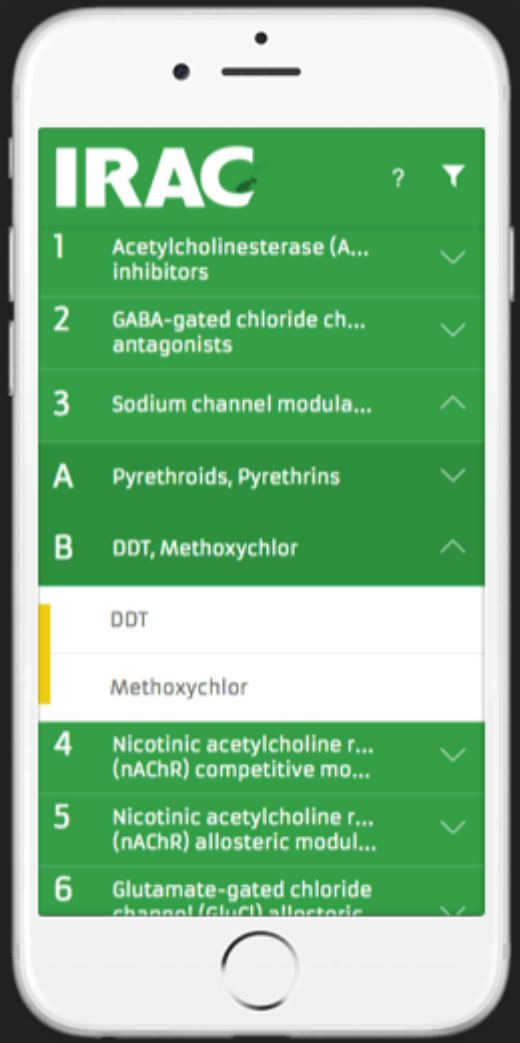
EPA Reg. No. 100-1295 *EPA Est. 39578-TX-1*

Product of the United Kingdom
Formulated in the USA

SCP 1295A-L2B 0709
304012

1 gallon
Net Contents

syngenta®



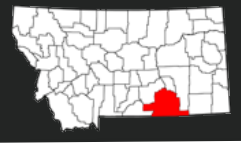
3 SODIUM CHANNEL MODULATORS

- A PYRETHROIDS, PYRETHRINS
- B DDT, METHOXYCHLOR

4 NICOTINIC ACETYLCHOLINE RECEPTOR (NACHR) COMPETITIVE MODULATORS

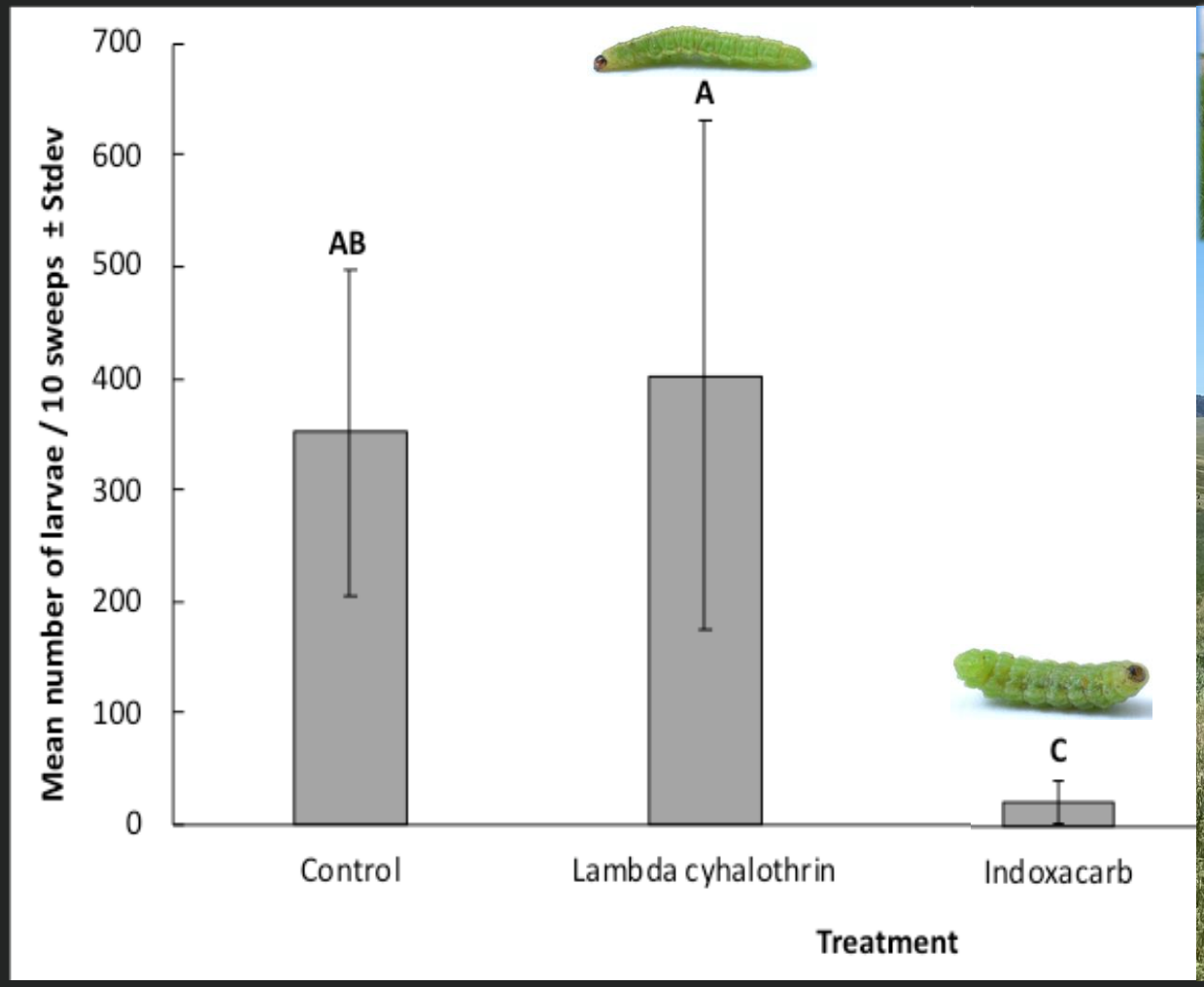
- A NEONICOTINOIDS
  - *Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Nitenpyram, Thiacloprid, Thiamethoxam*
- B NICOTINE
- C SULFOXIMINES
  - *Sulfoxaflor*
- D BUTENOLIDES
- E MESOIONICS

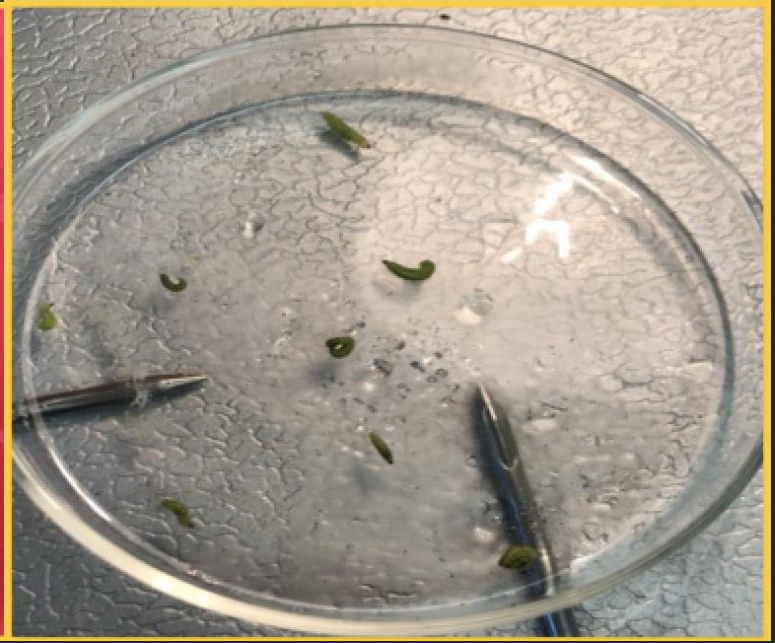
Cross resistance



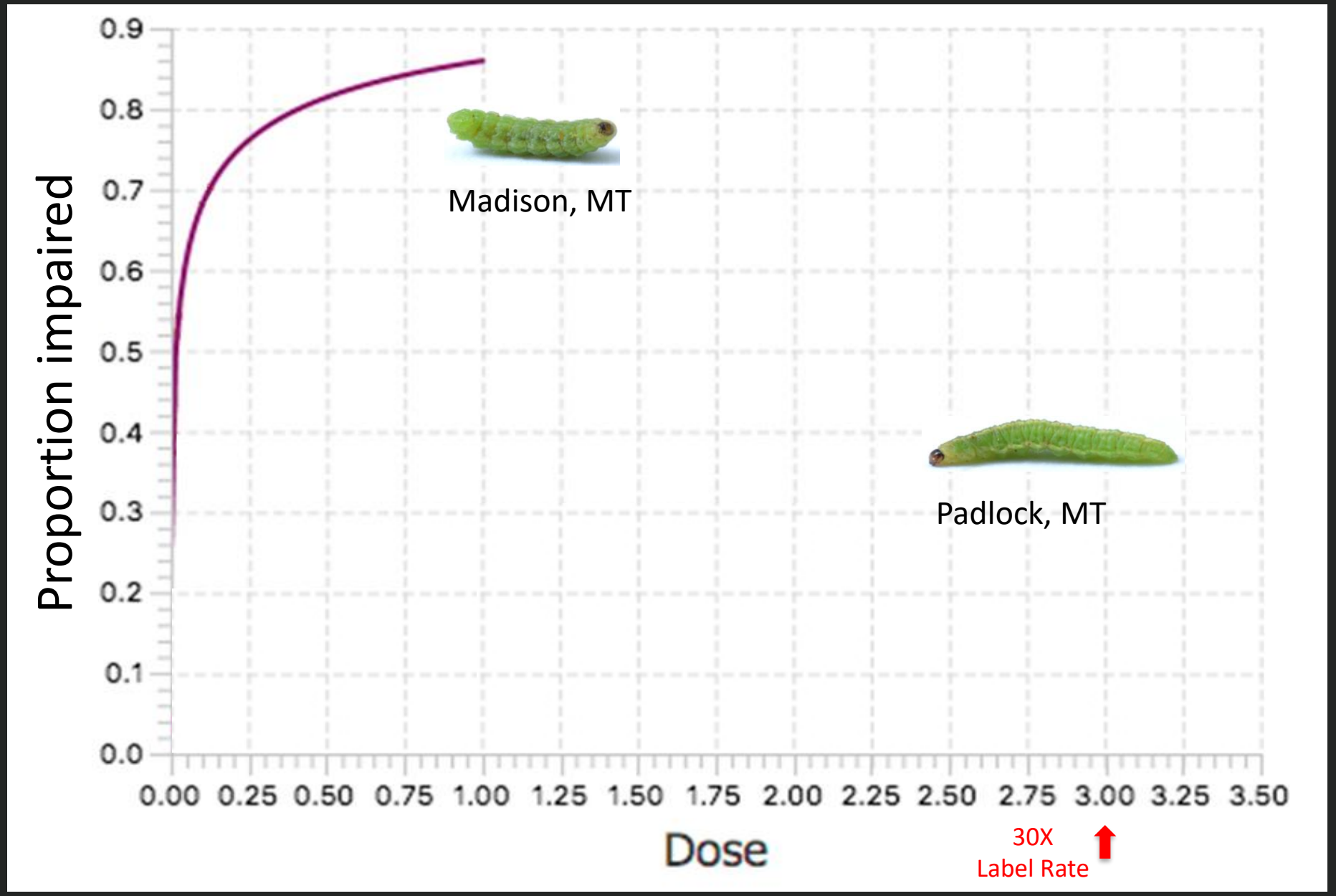
Field Results – Resistant Population

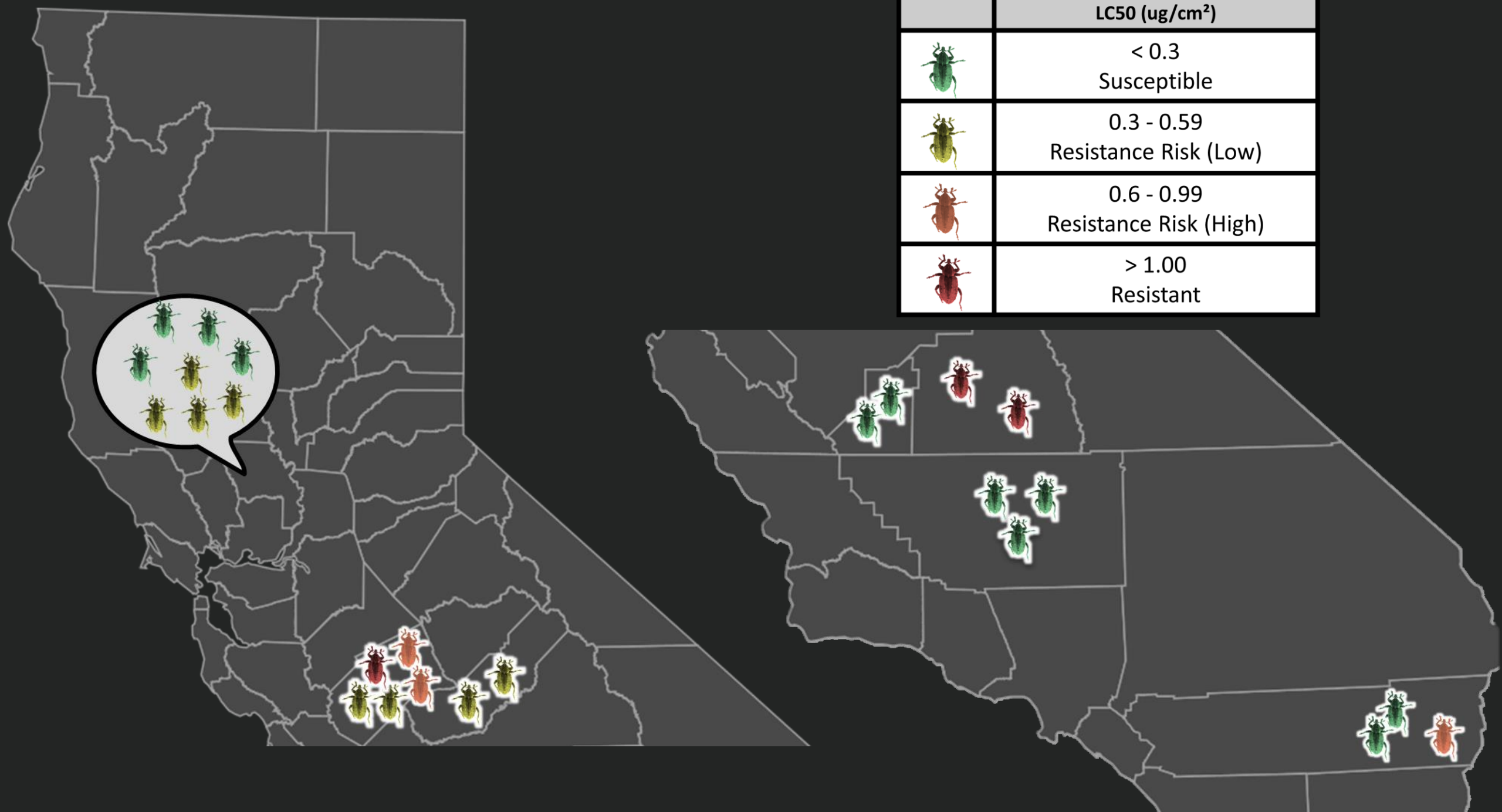
- Warrior II (lambda-cyhalothrin, MoA 3A) useless against resistant population
- Steward (indoxacarb, MoA 22A) worked well



Ten 3rd to 4th instar larvae placed in treated glass vials	Five vials per dose maintained at 21°C for 24 hours	Exposed treated larvae to 43-50°C to determine # dead
		

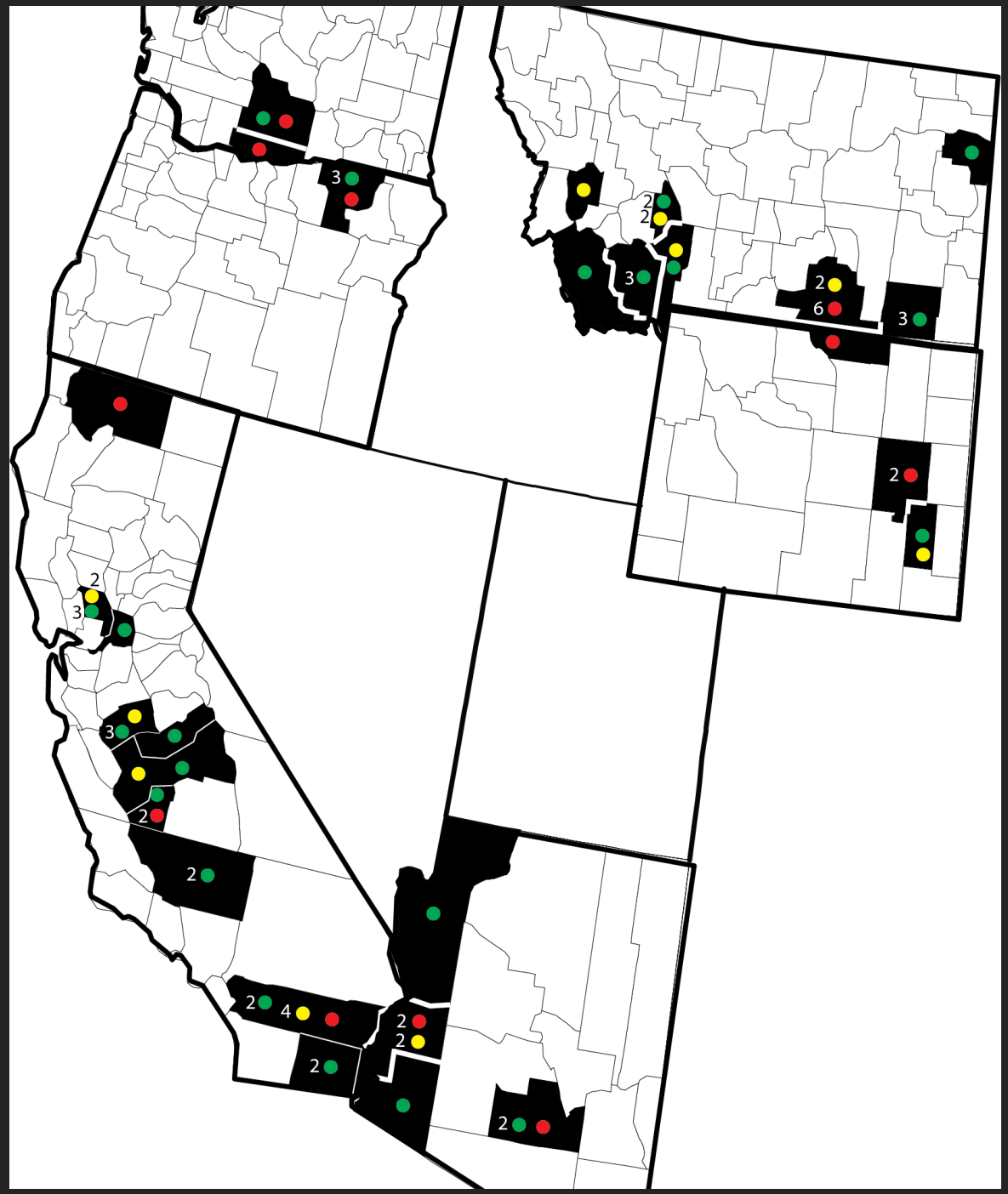
Resistant vs. susceptible populations



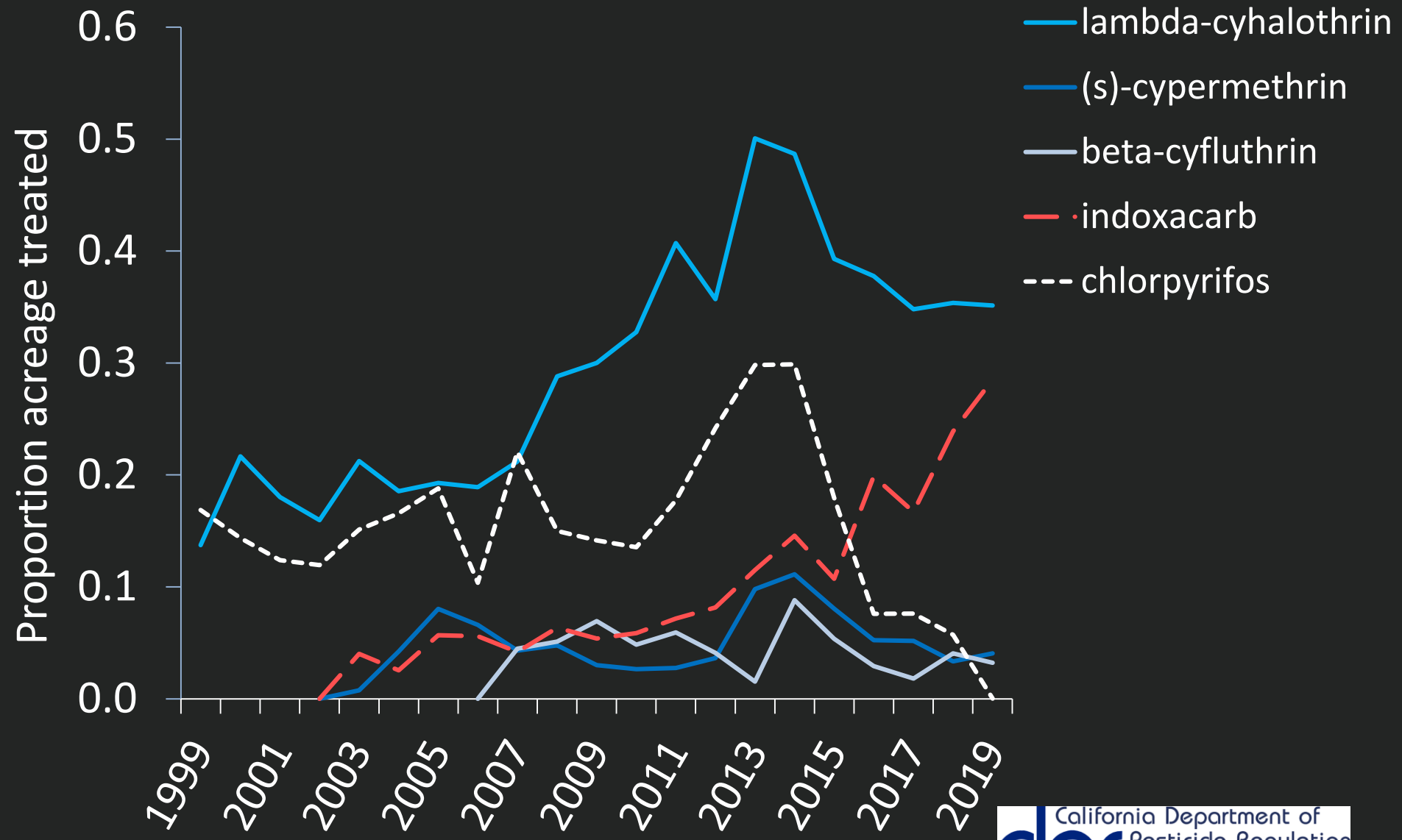

LC50 (ug/cm²)
< 0.3
Susceptible
0.3 - 0.59
Resistance Risk (Low)
0.6 - 0.99
Resistance Risk (High)
> 1.00
Resistant

- Susceptible
- Moderately Resistant
- Highly Resistant

- Every western state tested has a highly resistant population of alfalfa weevil
- Cross-resistance between pyrethroid active ingredients (MoA 3A)
- Every state has susceptible populations; an opportunity to mitigate resistance and extend the use of pyrethroids

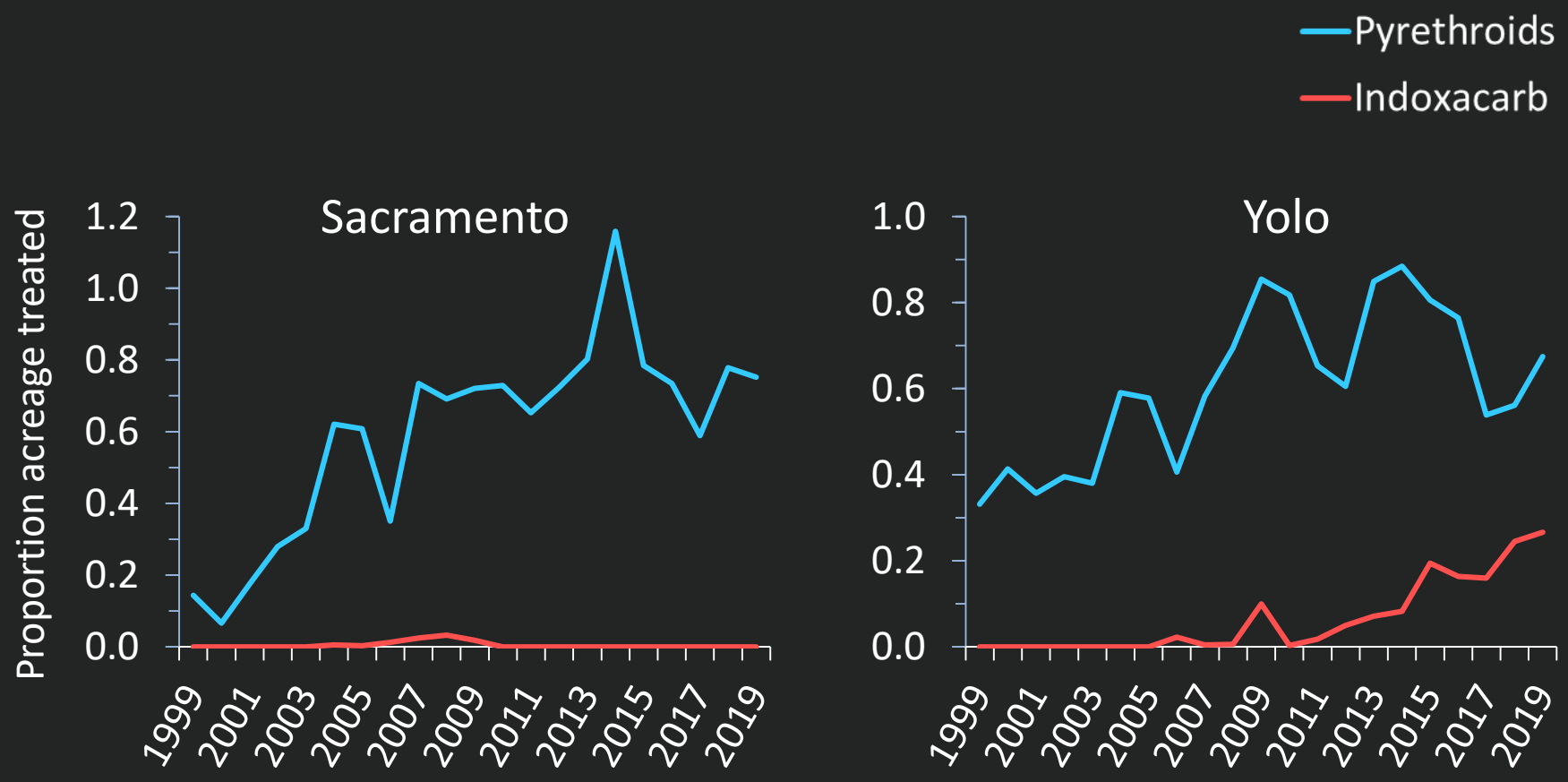


What have we seen in CA?

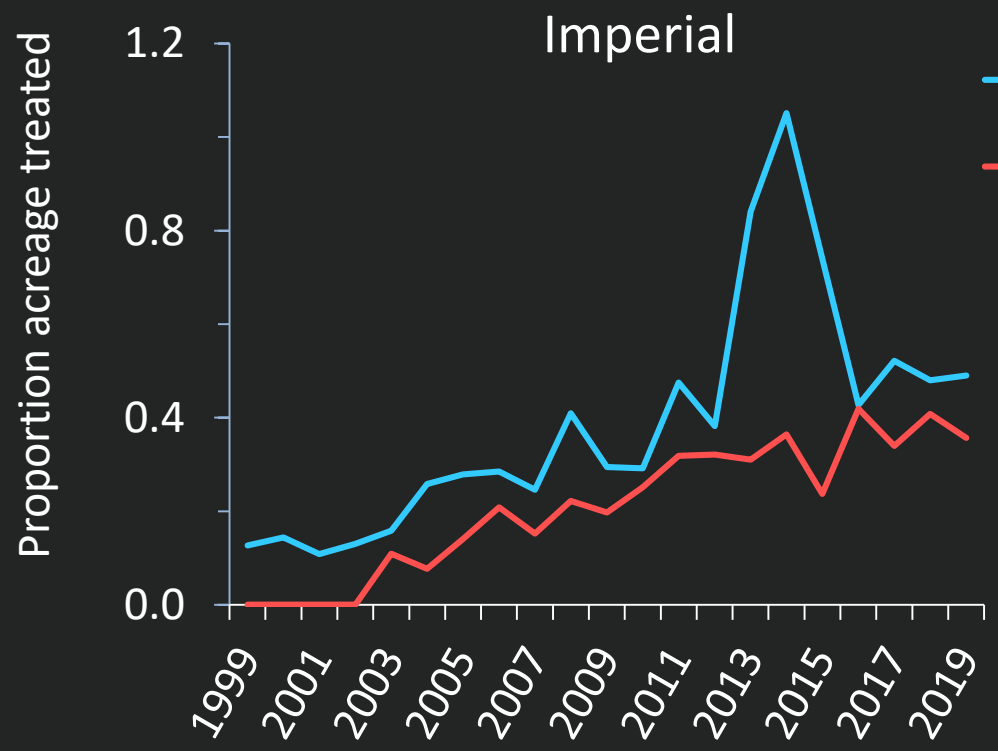


California Department of Pesticide Regulation

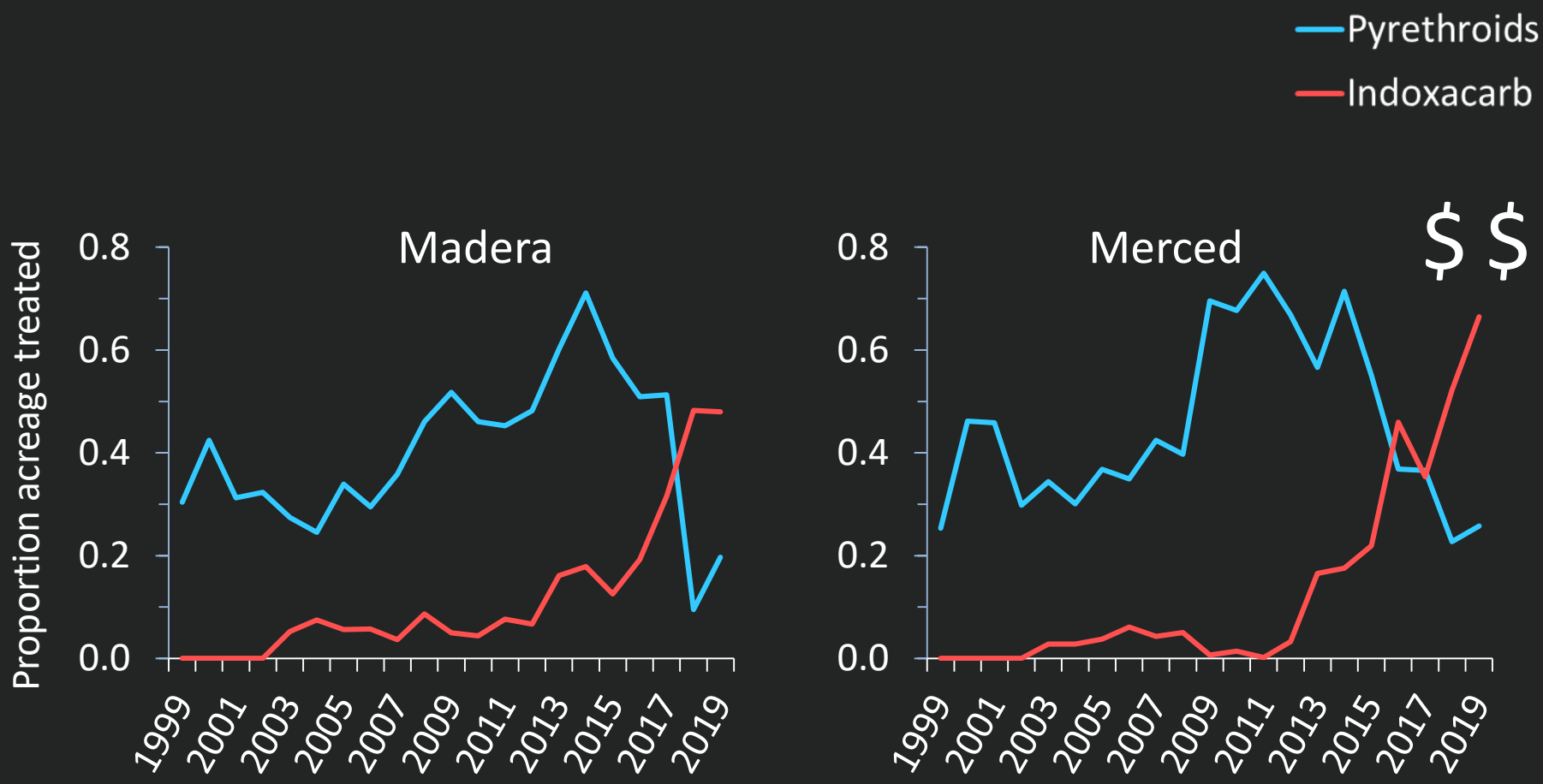
Generally sustained pyrethroid use



Use of both pyrethroids and indoxacarb

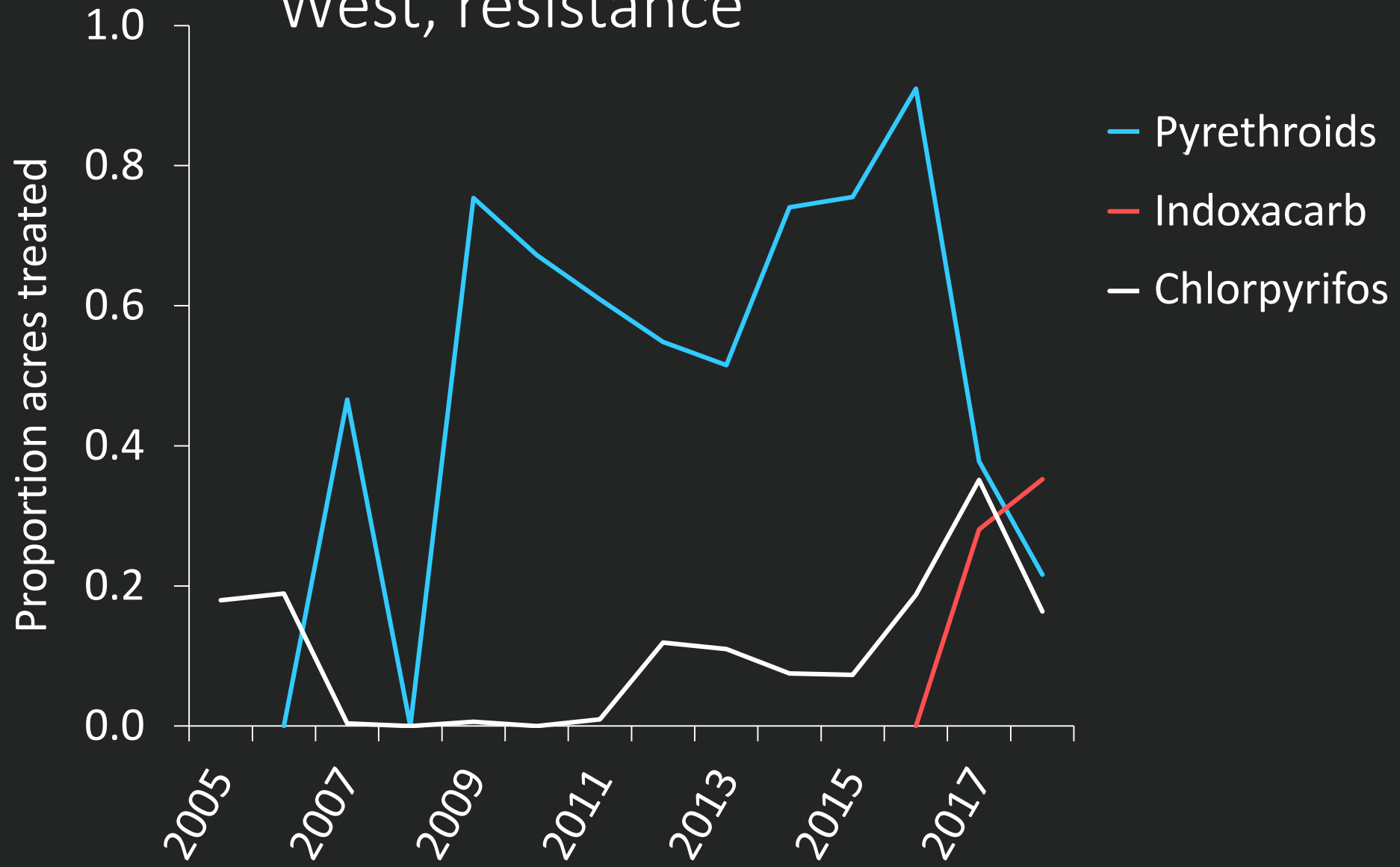


“Swapping” – proactive or reactive



Siskiyou: a tale of two regions: East, no resistance

Siskiyou: a tale of two regions: West, resistance

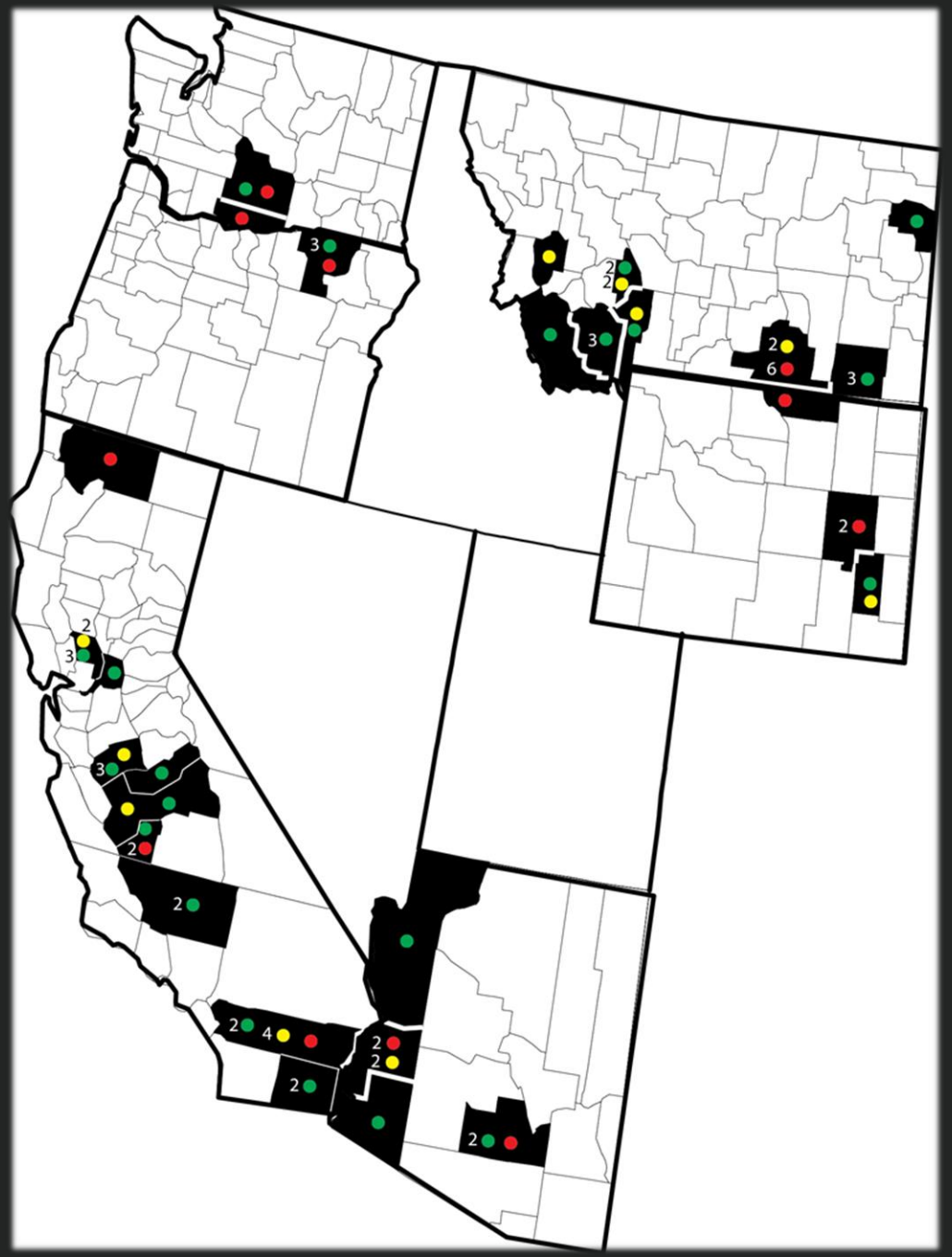


How does resistance spread… how far, how quickly?

- Plenty of uncertainty
- In intensive alfalfa areas + smaller scales: rapidly
- Otherwise, appear to be strong local effects…initially

What do we have to look forward to?

- Clearly have resistance across the landscape
- Likely not a lot of future chemicals
- Still DO have susceptibility in the landscape
- Make BEST use of current tools

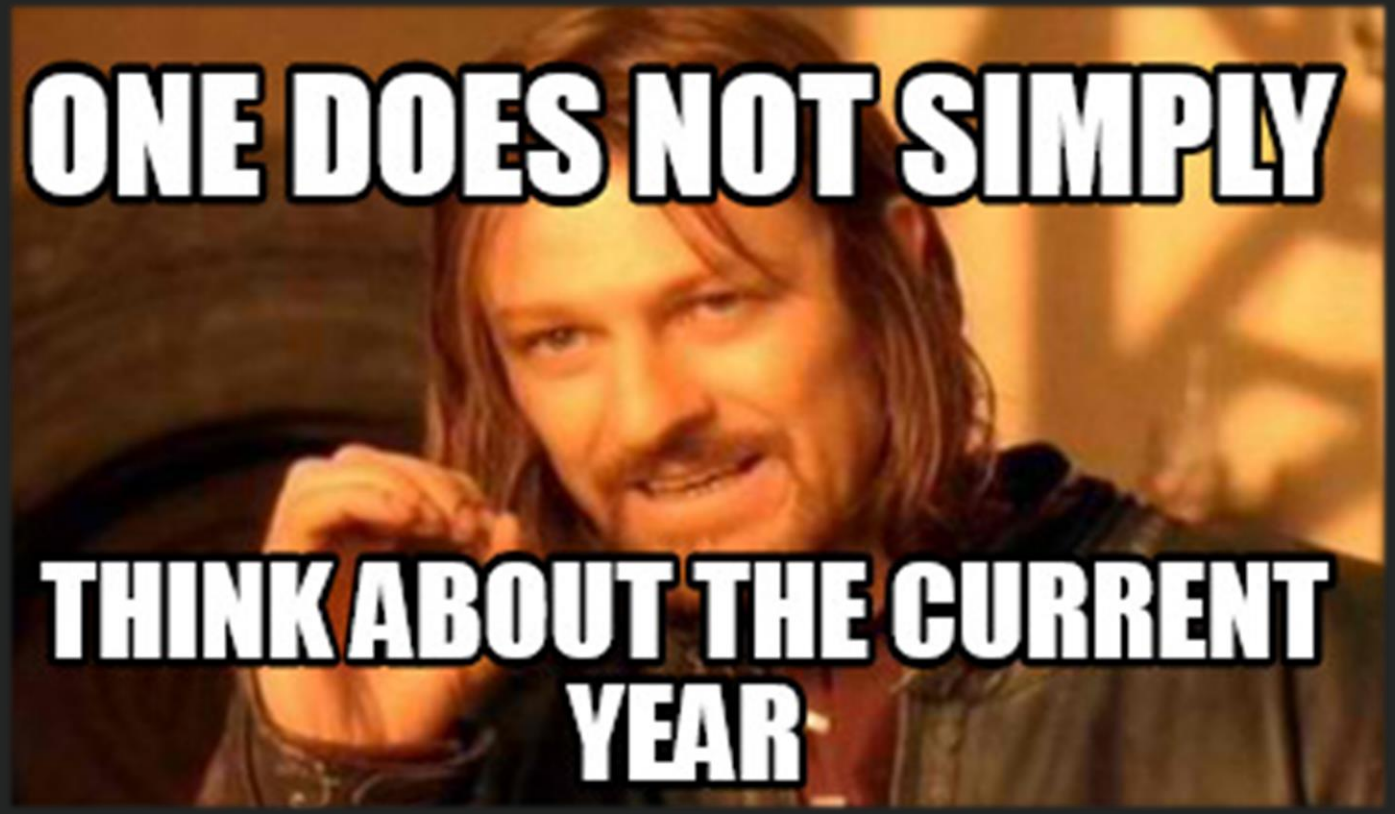


What can we do?

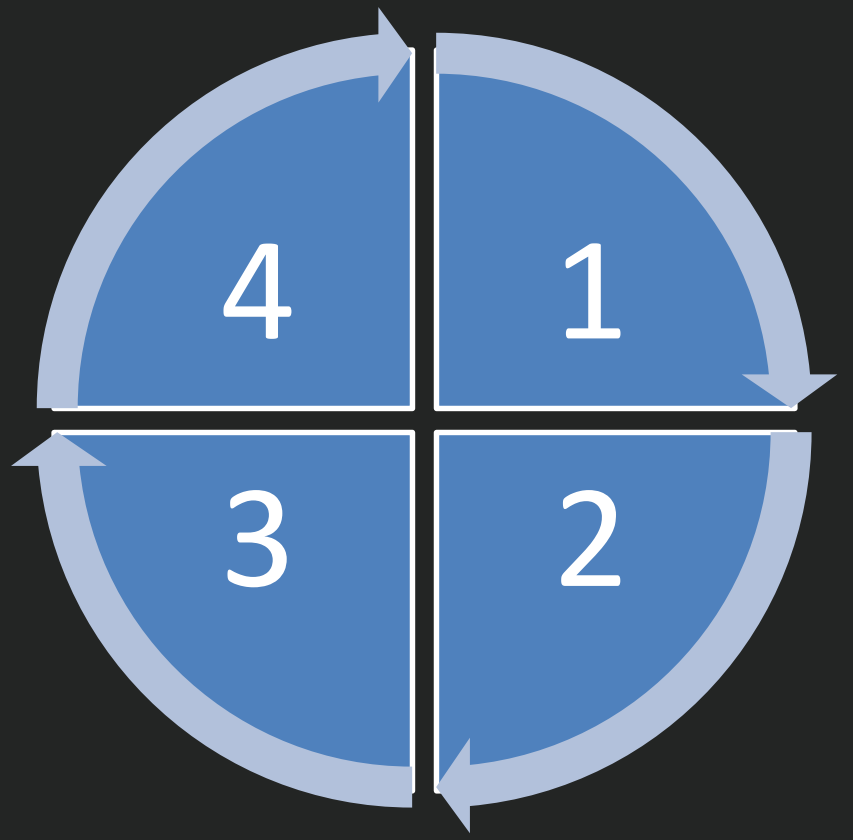
- Vigorous crop
- Cultural controls
- Monitoring/thresholds
  - No spray, no selection

- Best practices for applications
- Rotate modes of actions

What can we do?



Rotation is necessary



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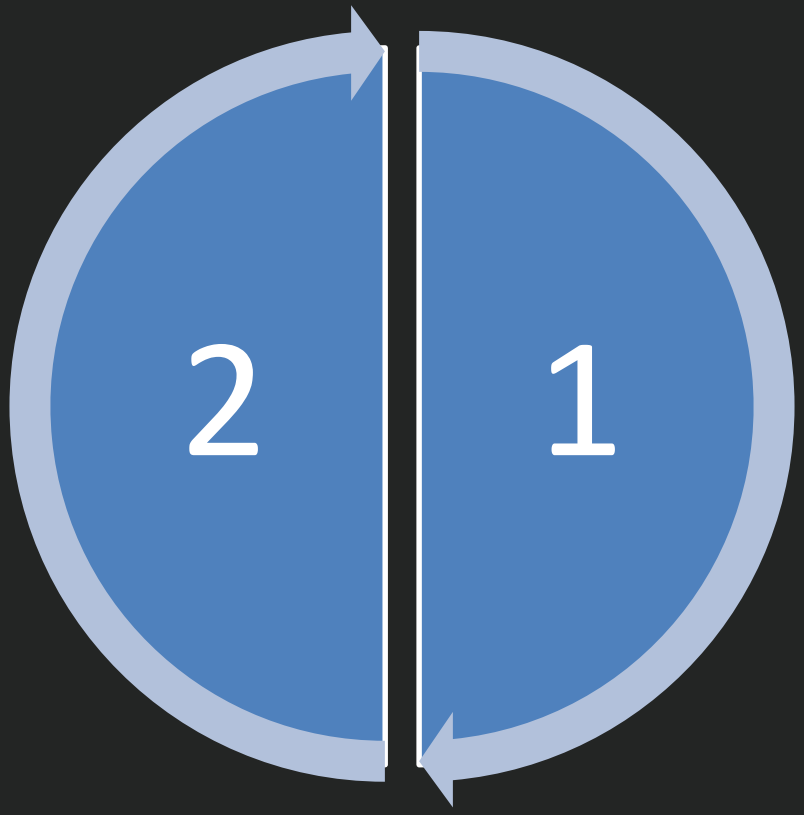

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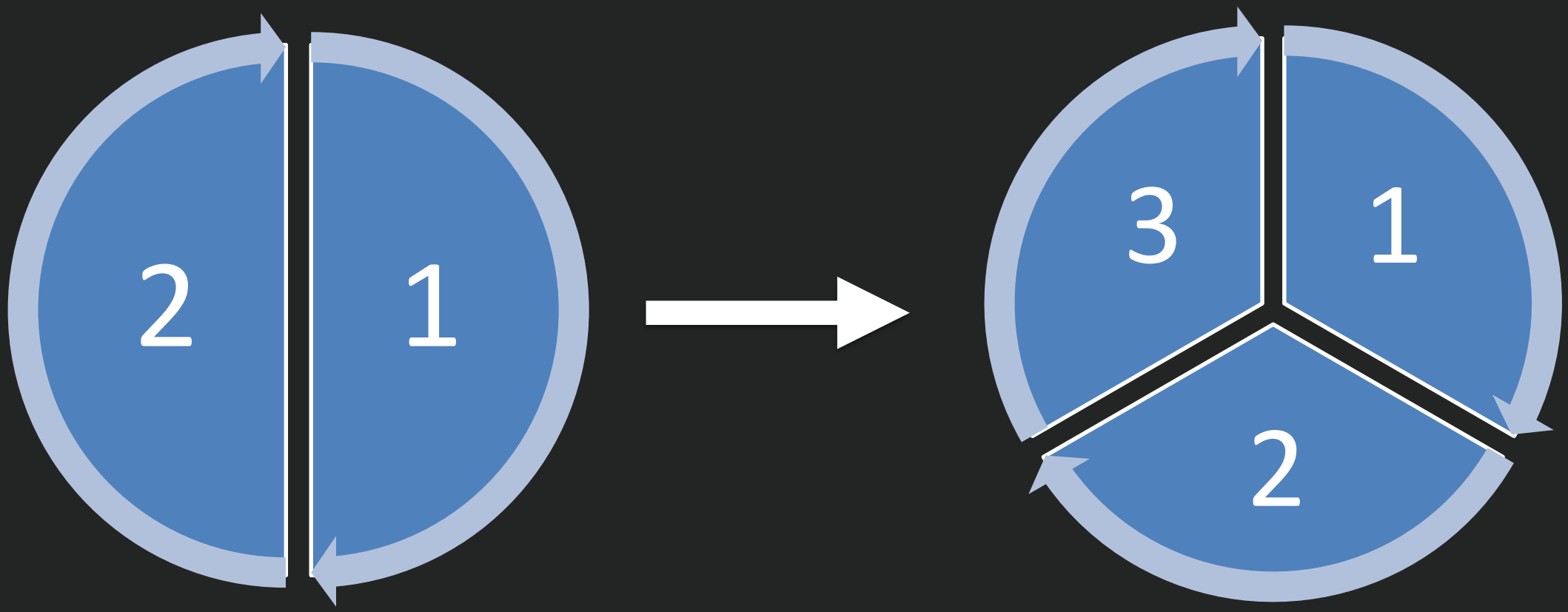

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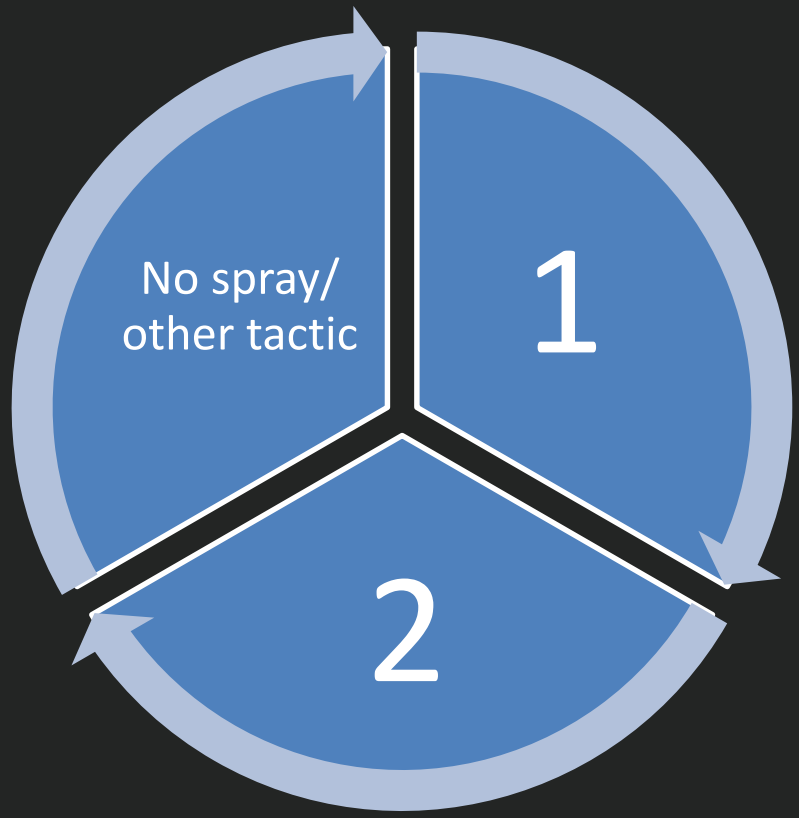
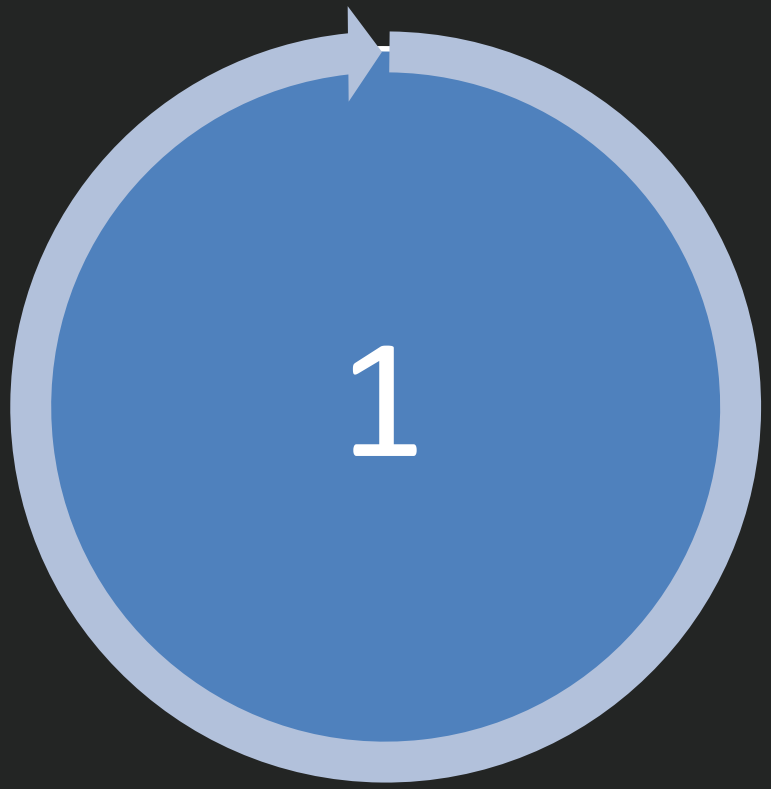


Rotation is necessary




Reactive
Proactive
trendlineinteractive.com

Acknowledgements

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RAW
RESISTANT ALFALFA WEEVIL

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Questions?