Alfalfa Weevil Management and Insecticide Resistance

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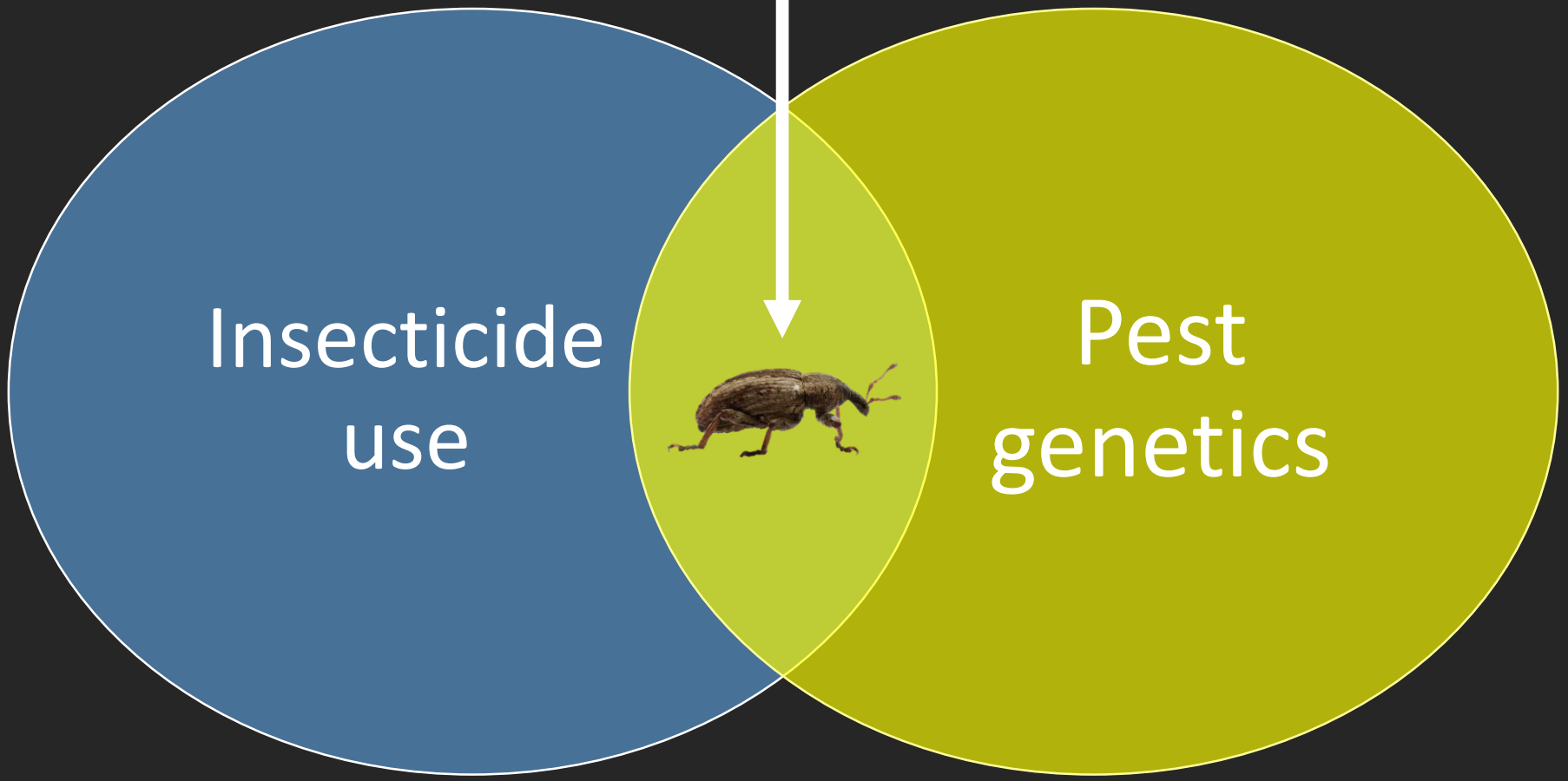
Managing alfalfa weevils: resistance

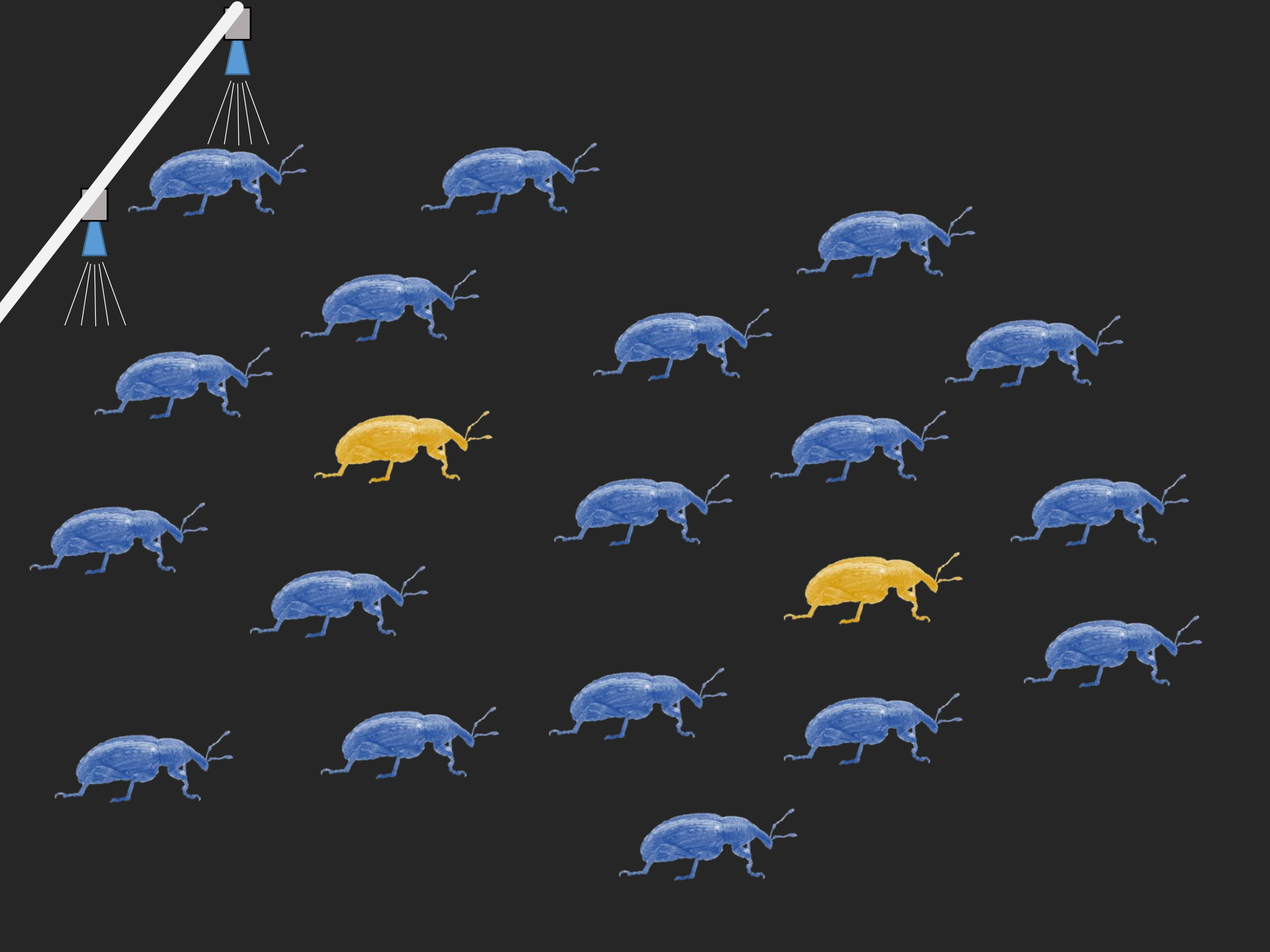
How does insecticide resistance develop?

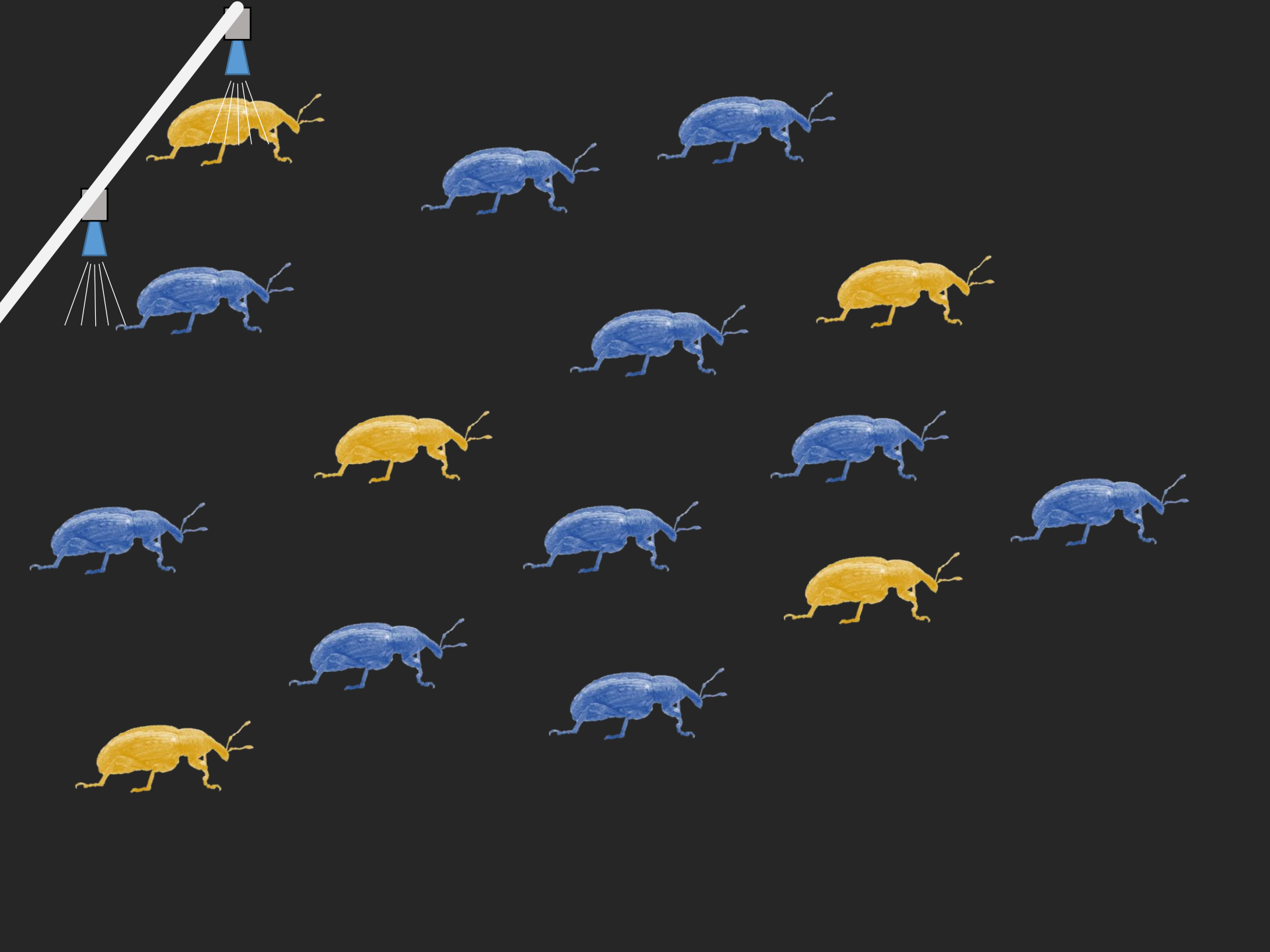
OCF Realty


TITAN
FITNESS
5 Litres
WARRIOR
TITAN
FITNESS
5 Litres
WARRIOR

Insecticide resistance



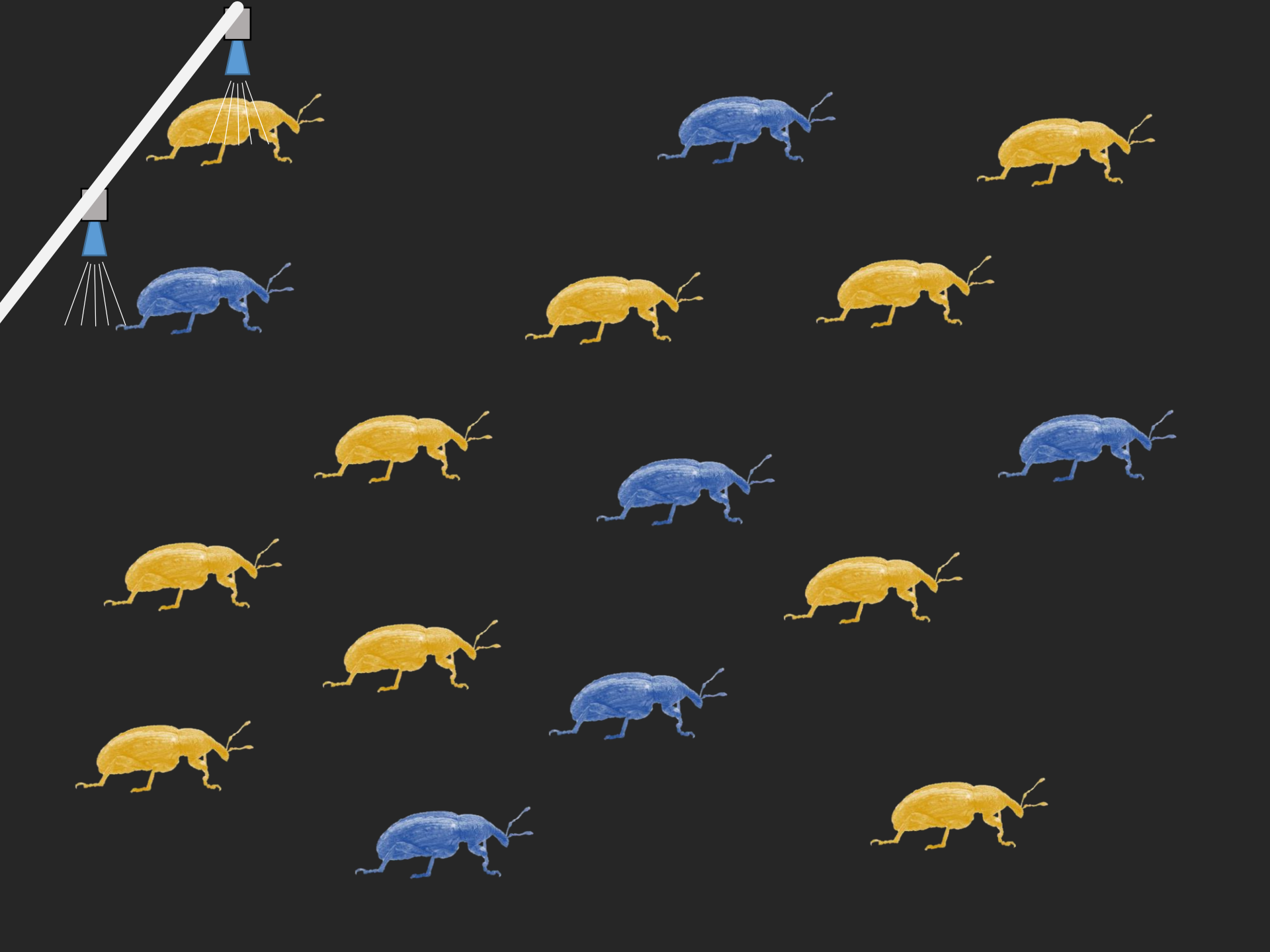


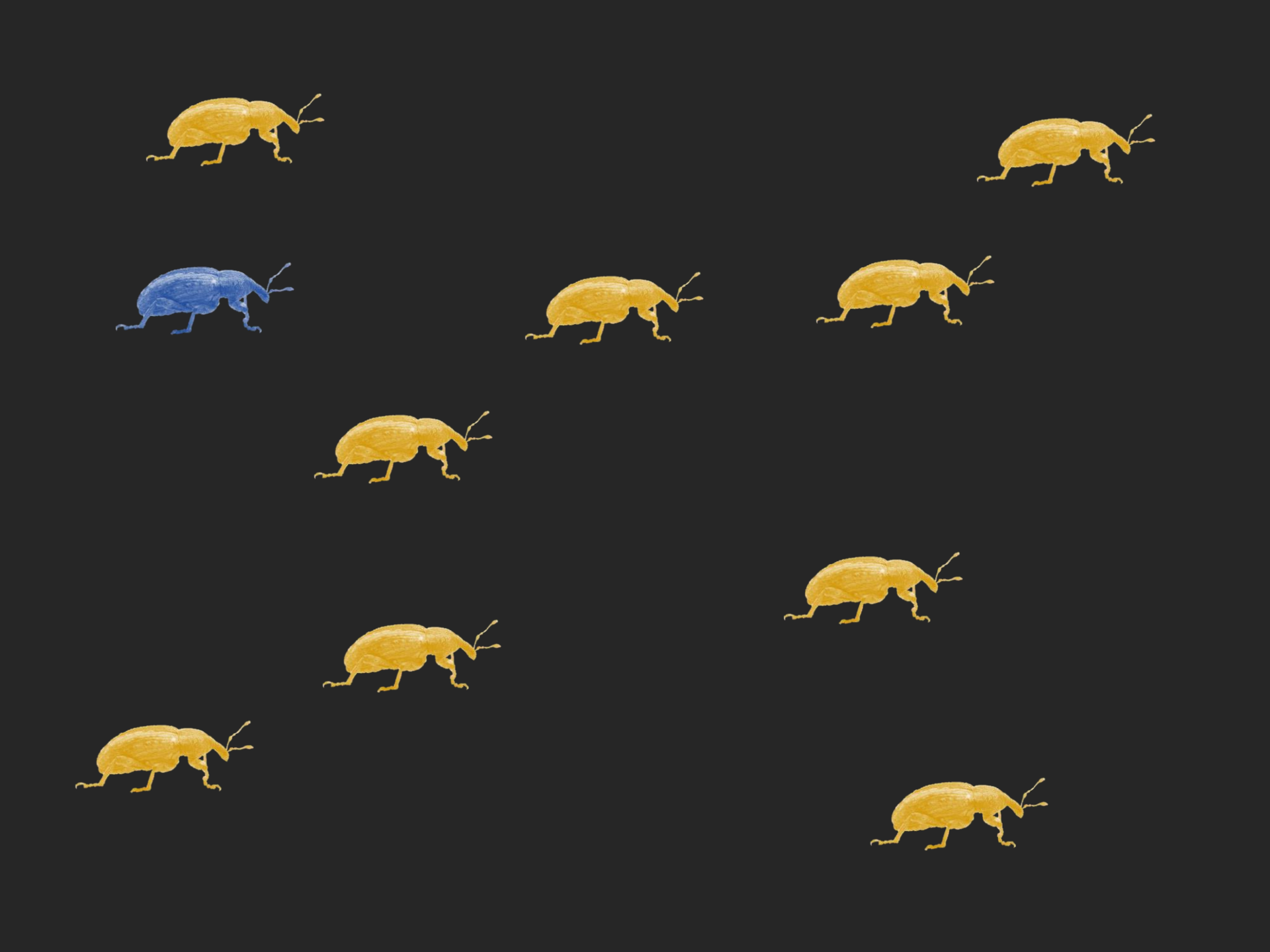


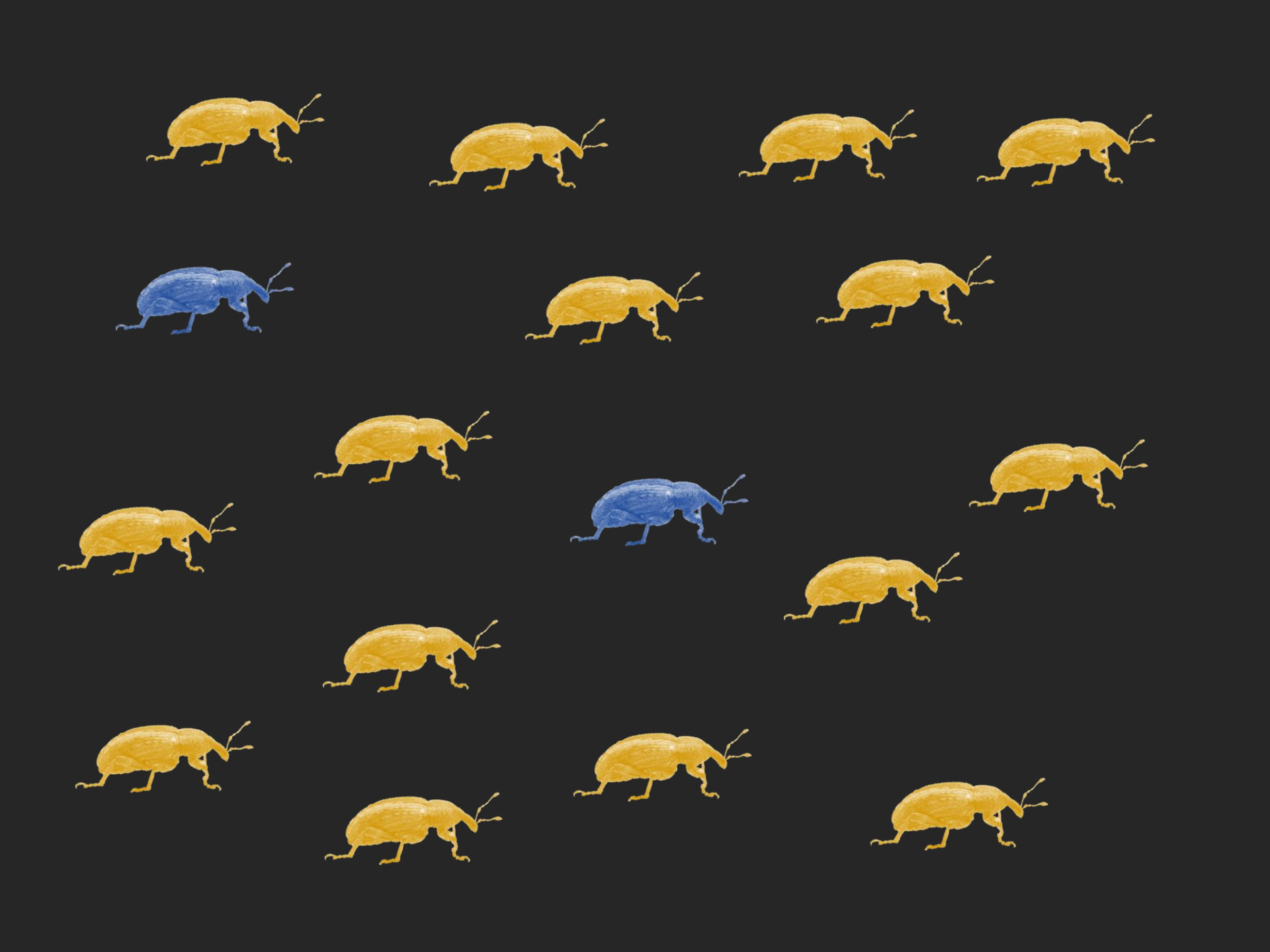




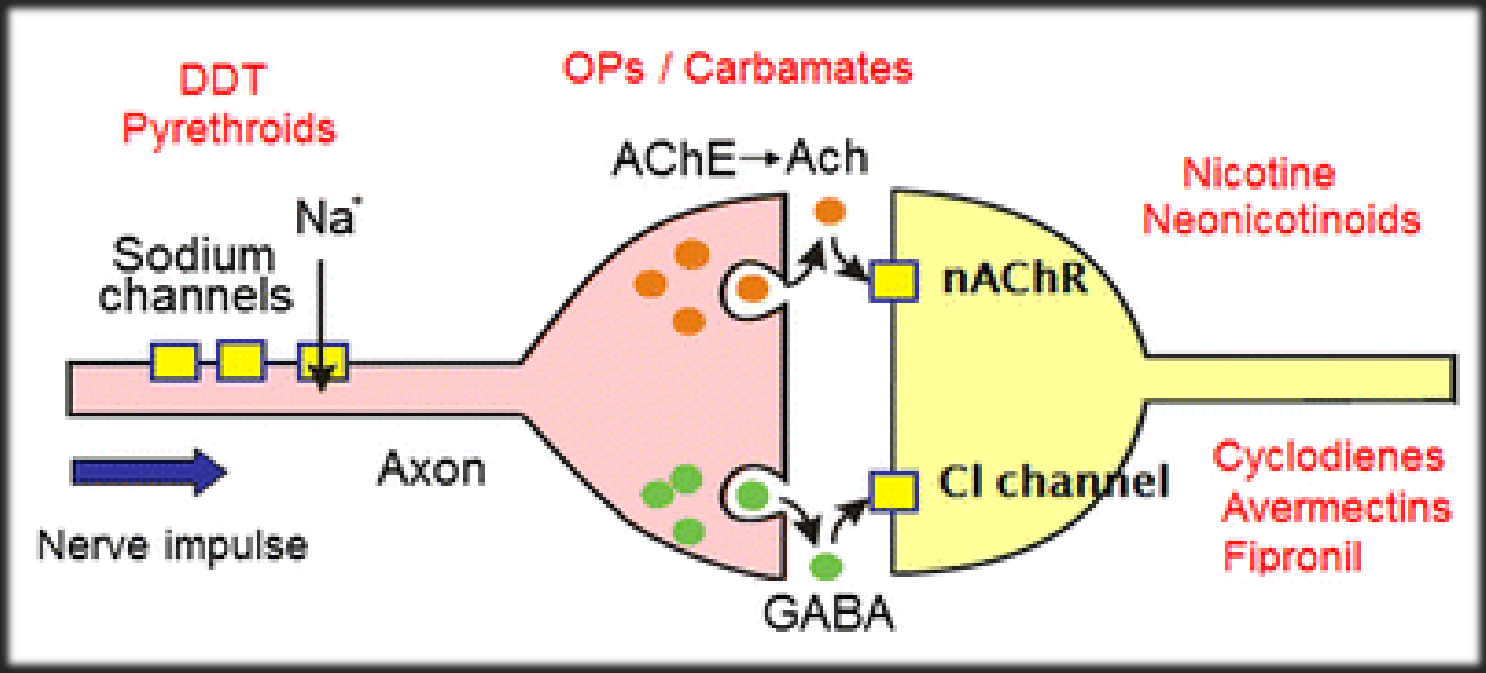






Insecticide Resistance Action Committee created mode of action groupings



Fields et al. 2017

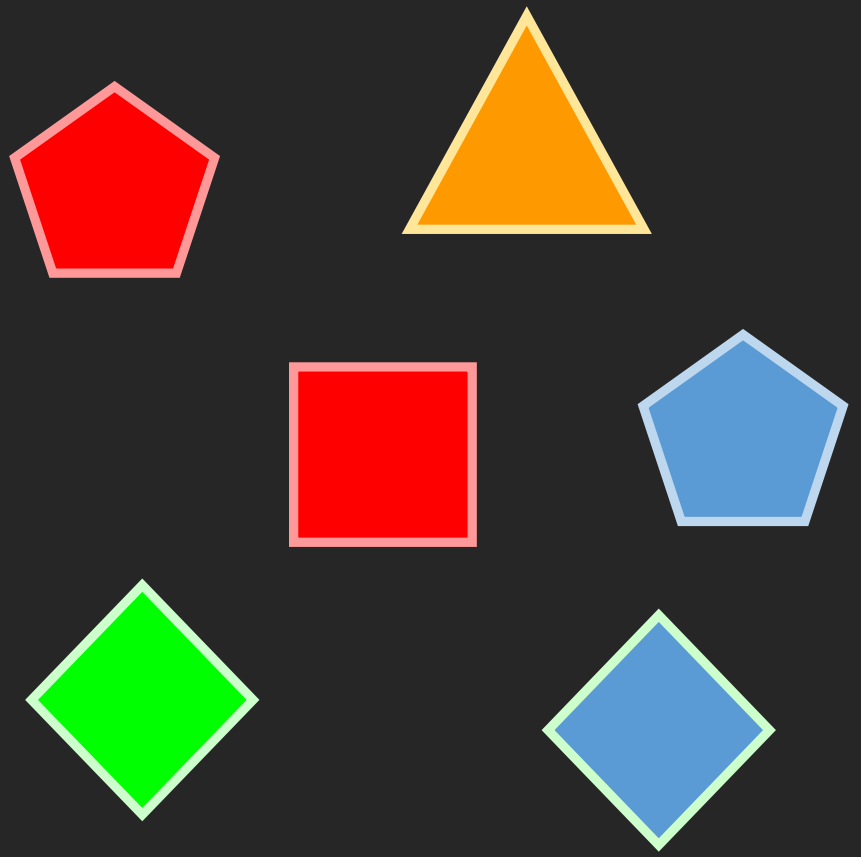

3
SODIUM CHANNEL MODULATORS
GROUP 3 INSECTICIDE
A
PYRETHROIDS, PYRETHRINS
B
DDT, METHOXYCHLOR
4
NICOTINIC ACETYLCHOLINE RECEPTOR (NACHR) COMPETITIVE MODULATORS
A
NEONICOTINOIDS
Acetamiprid, Clothianidin, Dinotefuran, Imidacloprid, Nitenpyram, Thiacloprid, Thiamethoxam
B
NICOTINE
C
SULFOXIMINES
D
BUTENOLIDES
E
MESOIONICS
Cross resistance

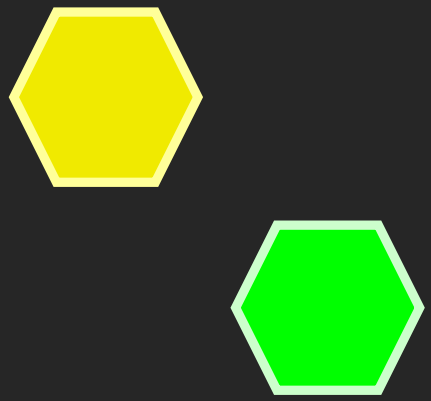
Insecticides are grouped by their mode of action (MoA)

How resistance develops

How we can prevent resistance from developing

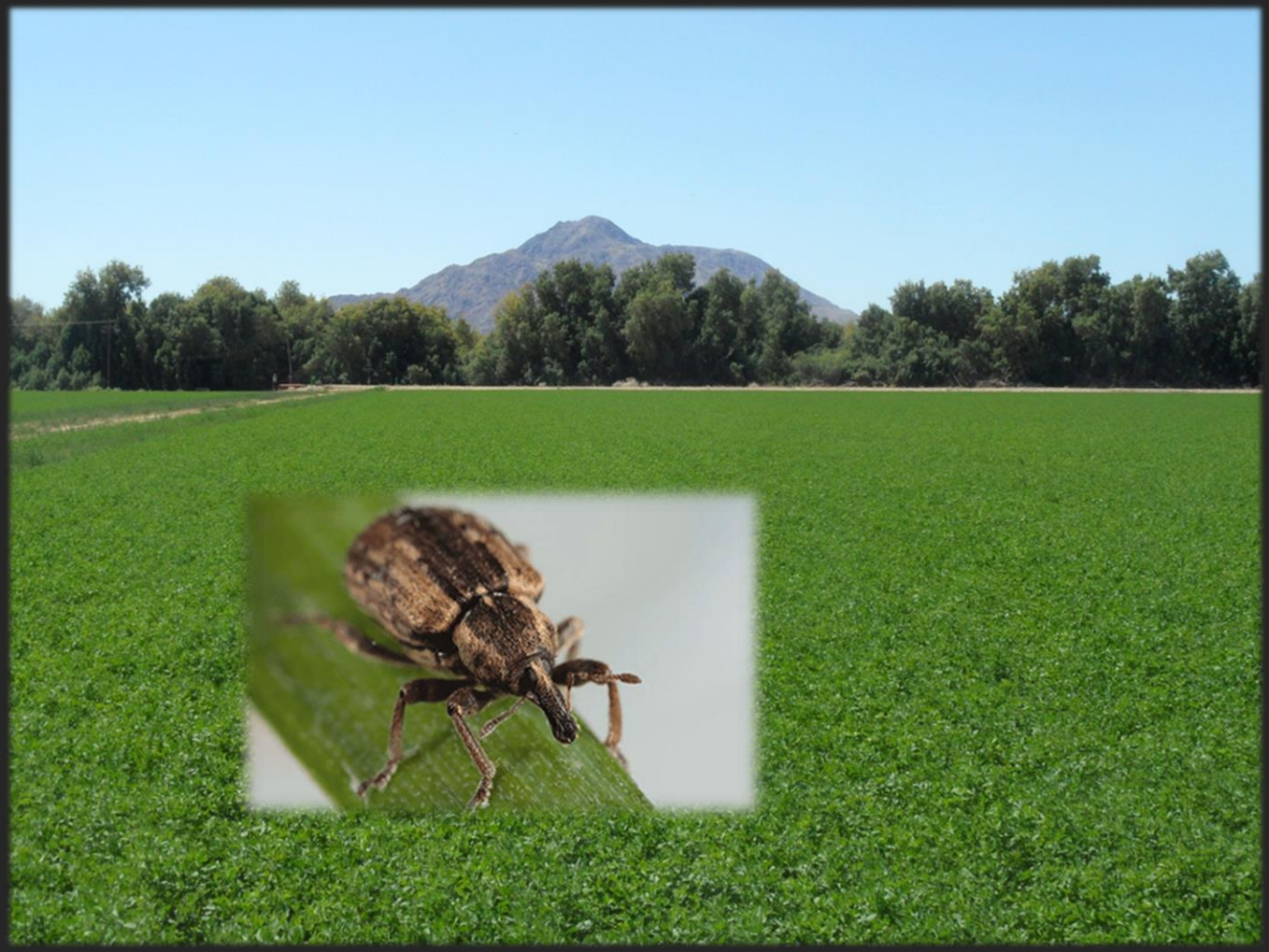
Loss of AIs puts pressure on remaining ones and any *possible* new ones






CHALLENGES
AHEAD

Insecticide resistance in weevils in CA and across the Western US



Nothing new: see 1960's Utah

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;

Resistance can disrupt weevil management

A. INDOXACARB
(Steward EC) 6.7–11.3 fl oz
MODE-OF-ACTION GROUP NUMBER[1]: 22A

B. LAMBDA-CYHALOTHRIN*
(Warrior II with Zeon) 1.28–1.92 fl oz
MODE-OF-ACTION GROUP NUMBER[1]: 3A

C. BETA-CYFLUTHRIN*
(Baythroid XL) 1.6–2.8 fl oz
MODE-OF-ACTION GROUP NUMBER[1]: 3A

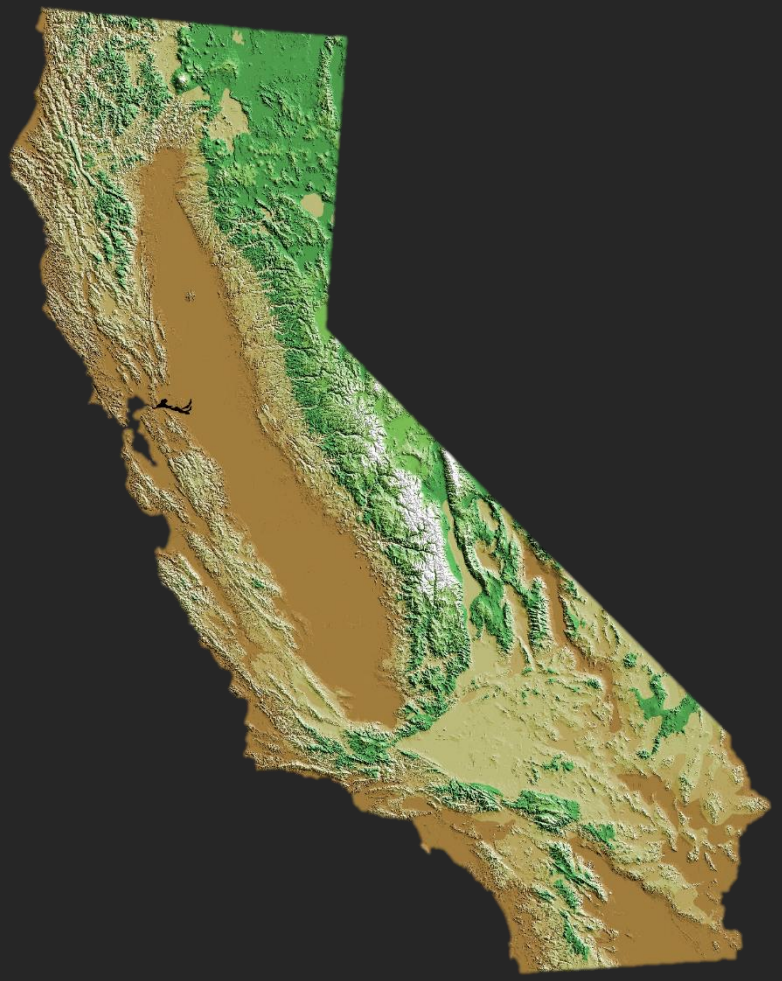
D. CHLORPYRIFOS*
(Lorsban Advanced) 1–2 pt
MODE-OF-ACTION GROUP NUMBER[1]: 1B

E. MALATHION
(Malathion 8-E) 1–1.25 pt
MODE-OF-ACTION GROUP NUMBER[1]: 1B

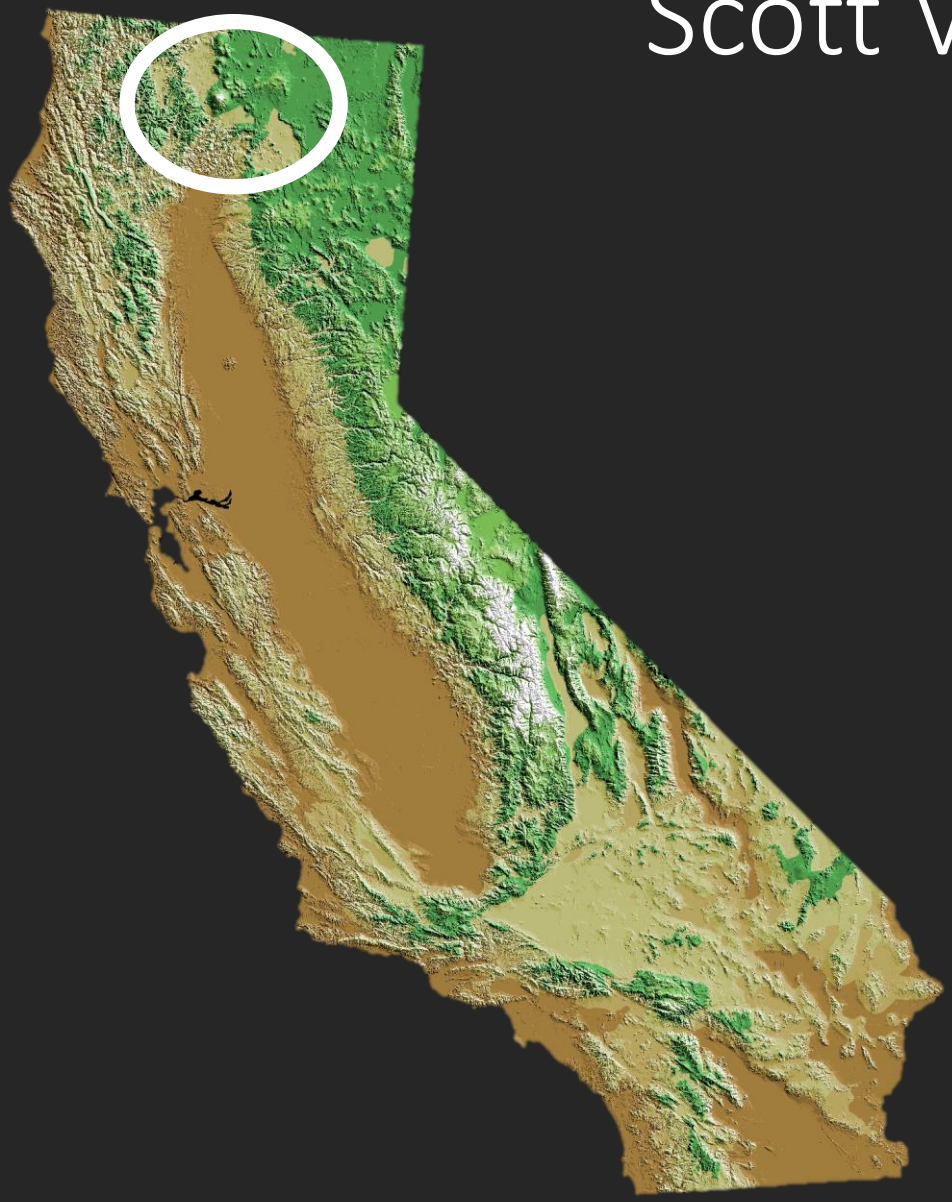
F. SPINOSAD
(Entrust SC)# 2–4 fl oz
MODE-OF-ACTION GROUP NUMBER[1]: 5

Unfortunately, few new insecticides in the pipeline for alfalfa [weevil]

In California, insecticide resistance in weevils is clearly an issue and may be growing worse



Scott Valley: 2016



ALFALFA & FORAGE NEWS
News and information from UC Cooperative Extension about alfalfa and forage production.

Alfalfa Weevil Resistance to Pyrethroid Insecticides found in Intermountain Alfalfa Fields

Author: Steve Orloff
Author: Larry Godfrey
Author: Kevin Goding
Author: Laurie Askew
Author: Daniel H Putnam

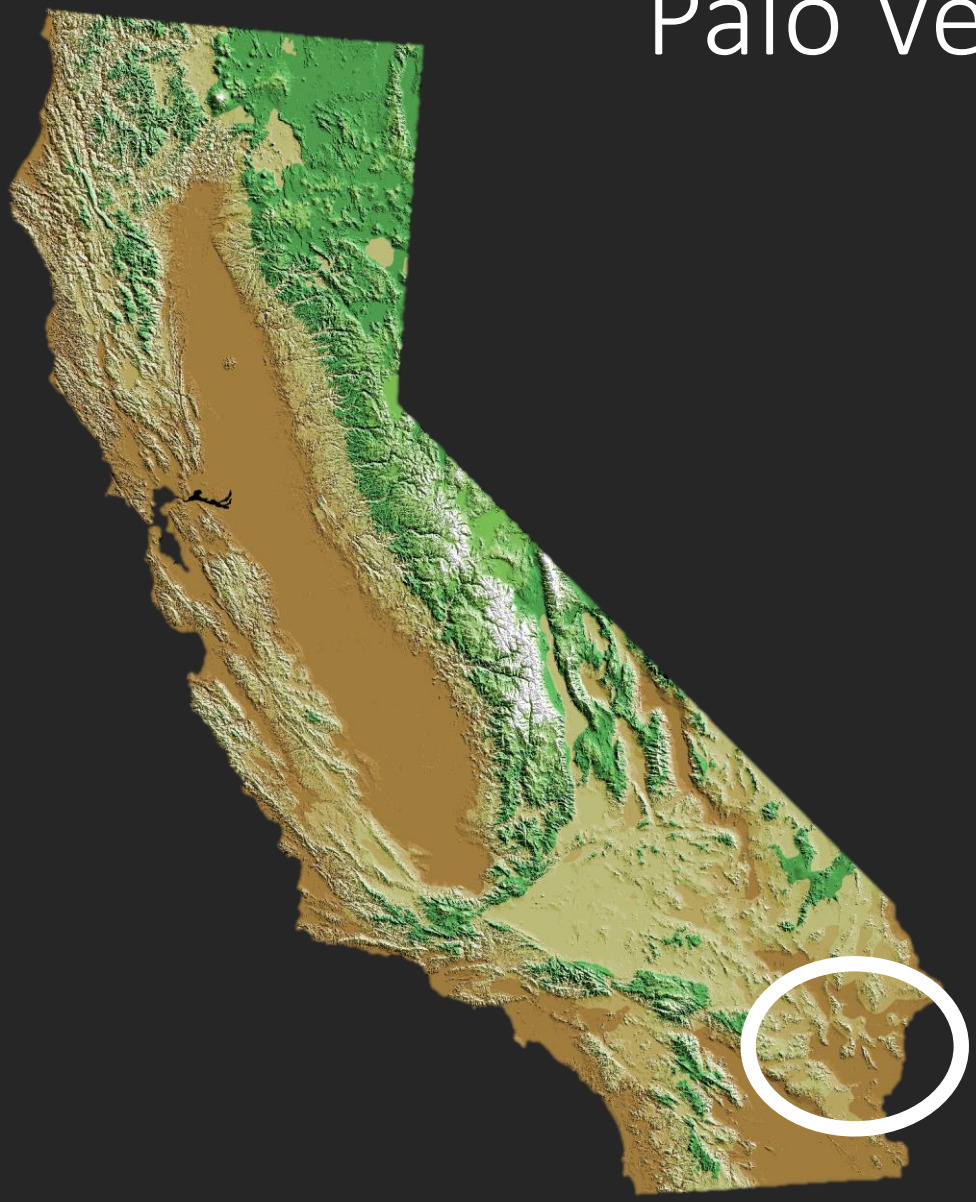
Published on: May 12, 2016

"May you live in interesting times..."

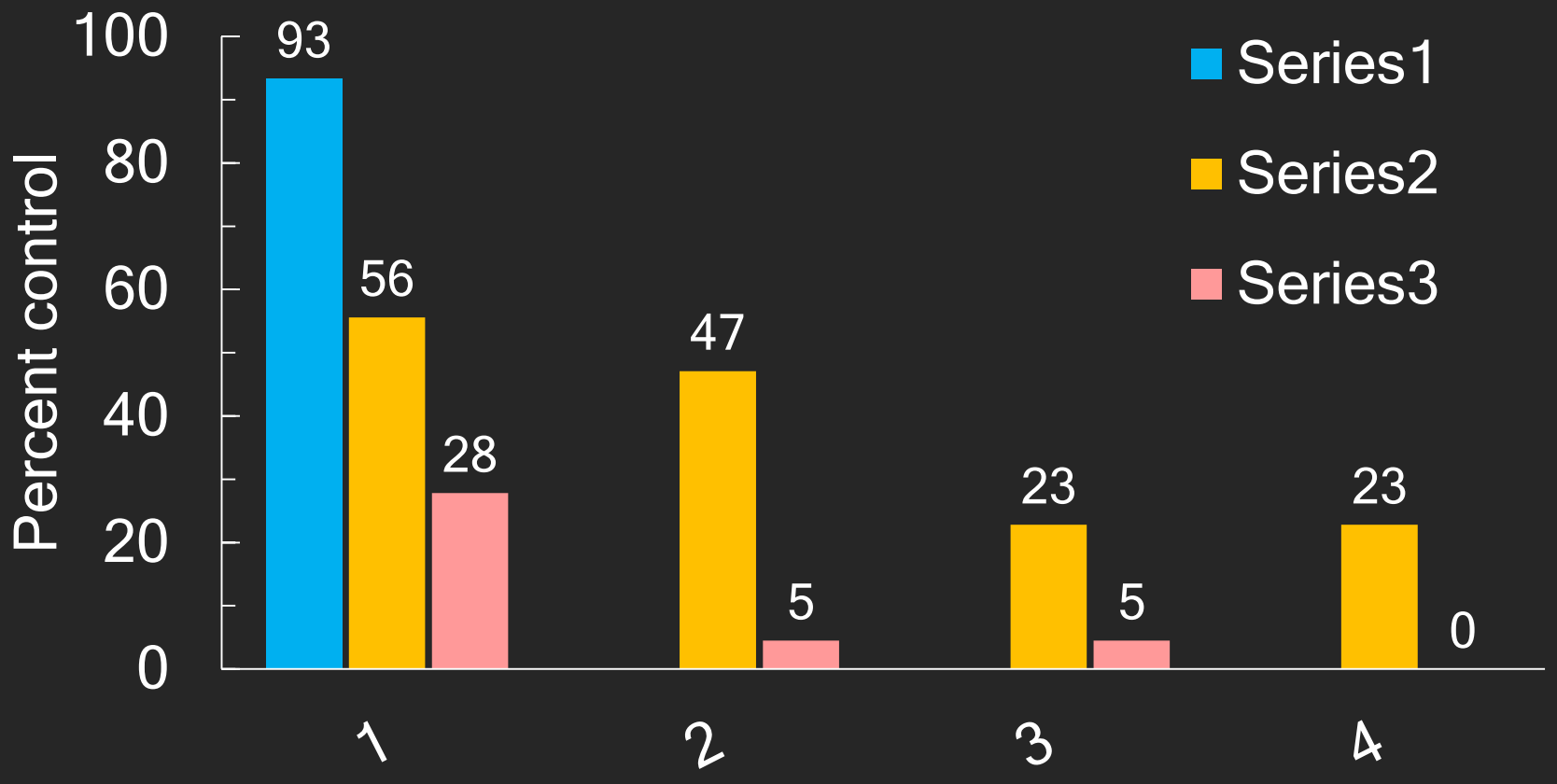
-Reported to be a Chinese curse

Field	Insecticide rate				
	0.25×	0.5×	Recommended (1×)	2×	4×
	% Mortality				
Conventional field 1	5%	8%	5%	10%	23%
Conventional field 2	0%	5%	10%	13%	23%
Conventional field 3	23%	3%	3%	10%	35%
Conventional field 4	0%	0%	15%	8%	23%
Conventional average	**7%**	**4%**	**8%**	**10%**	**26%**

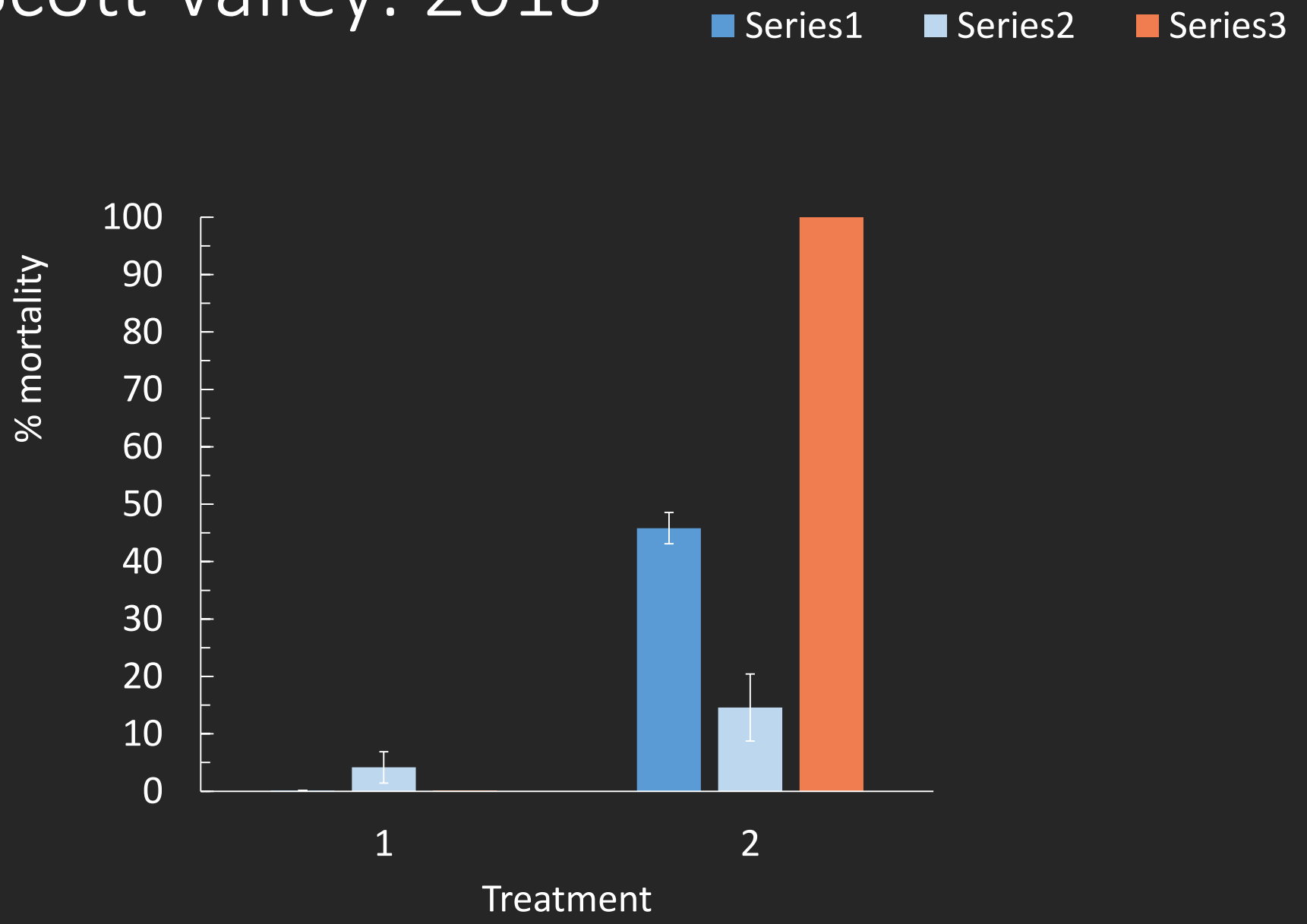
Palo Verde Valley: 2018



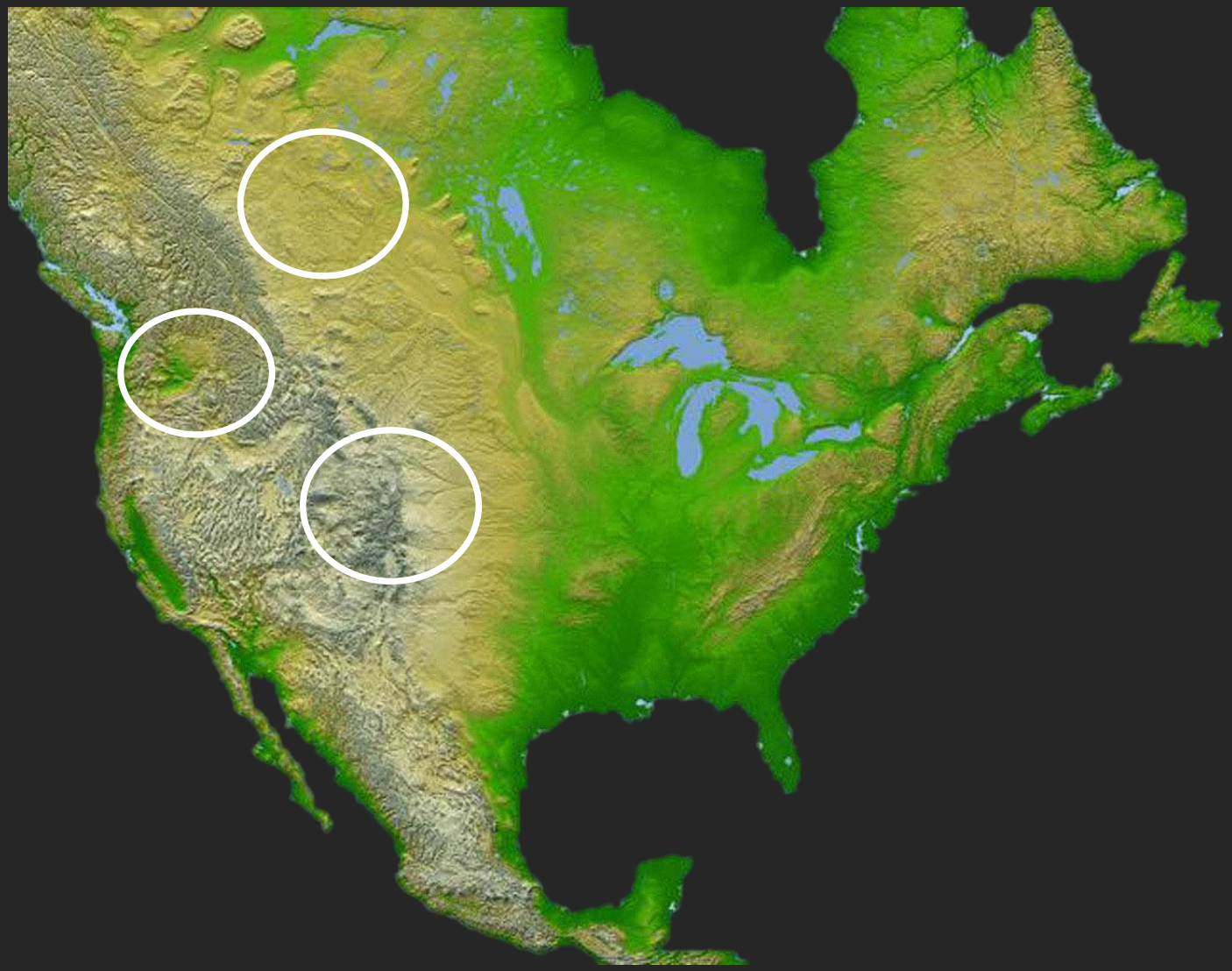
History of greater pyrethroid use → poorer control with pyrethroids



Scott Valley: 2018



“We’ve had to learn to live with higher levels”



Do not appear to be substantial issues with resistance for other alfalfa pests, *thus far*

How can we reduce the likelihood that insecticide resistance will develop?

IPM

- Without insecticides, no selection pressure
- Alternative tactics

Good basic agronomic practices + cultural practices targeting key pests

Good basic agronomic practices + cultural methods

- Goal: Vigorous crop
  - Good variety
  - Proper irrigation
  - Good nutrient management
  - Proper cutting schedule
  - Good weed management
  - Avoid herbicide injury

- Cultural controls
  - Early cutting (?)
  - Delayed cutting/regrowth (?)

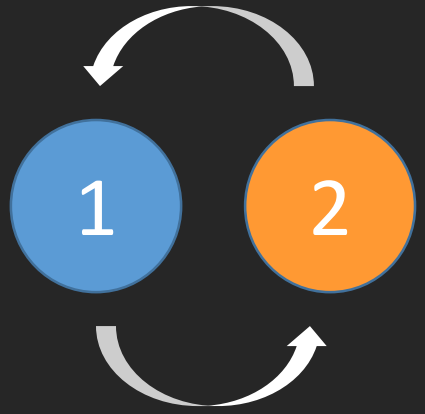
With insecticides, follow the principles of IPM

- Monitor pests
- Use action thresholds

ONLY NECESSARY APPLICATIONS

- Follow best practices for applications
- Follow label recommendations for rates
- Monitoring to detect issues + communication

How to best use insecticides with different MoAs to manage resistance?

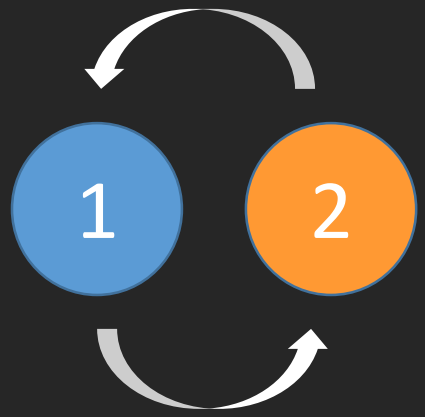


What about mixtures of MoAs?

- Generally not recommended
- Rely on “redundant killing”
- In practice, risk of selecting for resistance to BOTH
- Issues with dispersing pests where single insecticides and mixtures are used across landscape
- OK for: treatments following thresholds AND IF each insecticide has activity against only one pest

Rotating MoAs is most favored

- Rotate between insecticides with different group #s
- Try to target different generations of the pest with materials with different group #s



- Very limited options
- Pyrethroid → pyrethroid → pyrethroid → pyrethroid → pyrethroid = BAD
- Rotate between groups
- Ideally, follow a plan at the farm/landscape level (dispersal)
  - Same material in adjacent fields, different materials across the landscape

A.	INDOXACARB (Steward EC) MODE-OF-ACTION GROUP NUMBER[1]: 22A	6.7–11.3 fl oz
B.	LAMBDA-CYHALOTHRIN* (Warrior II with Zeon) MODE-OF-ACTION GROUP NUMBER[1]: 3A	1.28–1.92 fl oz
C.	BETA-CYFLUTHRIN* (Baythroid XL) MODE-OF-ACTION GROUP NUMBER[1]: 3A	1.6–2.8 fl oz
D.	CHLORPYRIFOS* (Lorsban Advanced) MODE-OF-ACTION GROUP NUMBER[1]: 1B	1–2 pt
E.	MALATHION (Malathion 8-E) MODE-OF-ACTION GROUP NUMBER[1]: 1B	1–1.25 pt
F.	SPINOSAD (Entrust SC)# MODE-OF-ACTION GROUP NUMBER[1]: 5	2–4 fl oz

Conclusions

- Keep tools in the toolbox
- Start with good agronomic practices
- Follow basics of IPM
- Rotate MoAs, pay attention to group #s
- We CAN delay resistance

Acknowledgements

- Rachael Long (UC ANR – Yolo, Solano, Sacramento)
- Dan Putnam (UC Davis)
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- Giuliano Galdi (Siskiyou)
- Michael Rethwisch (Imperial)
- Jasmin Ramirez Bonilla (UCD)
- Kevin Goding (UCD)
- Treanna Pierce (UCD)

New Project!

USDA

RAW (Resistant Alfalfa Weevils)

MONTANA STATE UNIVERSITY

UCDAVIS UNIVERSITY OF CALIFORNIA

Questions?