

Pesticide Resistance



Outline

- What is pesticide resistance?
- How does it occur?
- Resistance to:
 - Insecticides
 - Fungicides
 - Herbicides
- How to delay resistance



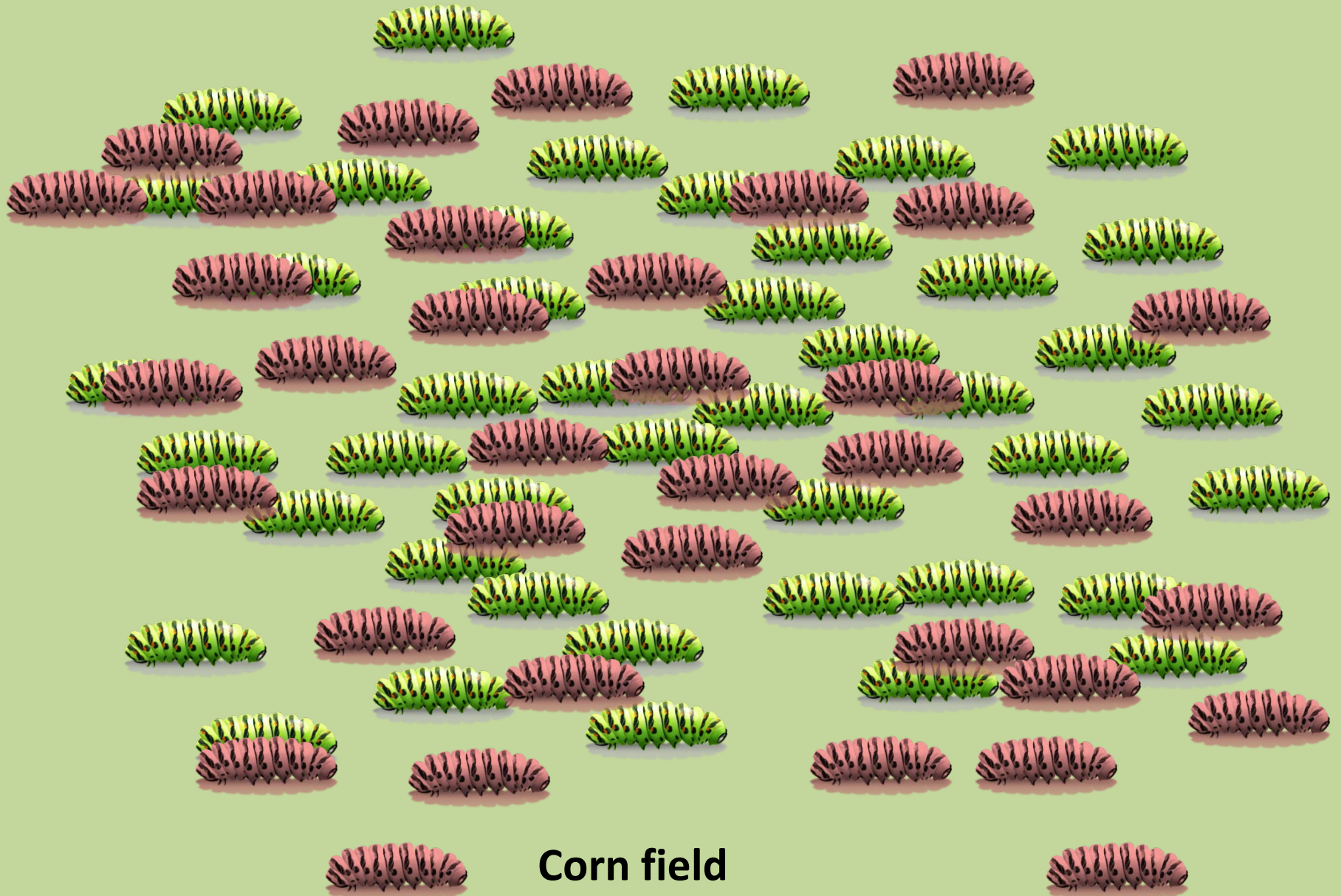
What is pesticide resistance?

- The population of a single kind of pest is made up of biotypes of that organism.
- A biotype is the same organism, but has genetic differences (e.g., dogs come in many variations such as lab, husky, poodle, and bulldog, but all are dogs)
- **Pesticide resistance is the natural ability of a biotype of an organism to survive exposure to a pesticide that would normally kill an individual of that species.**

How does resistance occur?

- This resistant biotype survives the repeated pesticide exposure and reproduces.
- The pest organism's population may then become dominated by the resistant biotype.
- At this point, the pesticide is no longer useful and other management options must be used, if they exist.
- If resistance is managed effectively, the pesticide remains useful to growers.

How resistance works



Insect resistance

- Insecticides are used to control insects
- Insect resistance to the synthetic insecticide DDT was documented in 1947.
- Since that time, within 2-20 years of the release of a new insecticide, key pests have been found with resistance!
- This causes more frequent applications of the insecticide.
- Growers must ultimately switch pesticides as insect control diminishes.
- Even “in-plant” insecticides such as Bt can be overcome by insects.



How insects become resistant

- Metabolic
 - The insect can clear it's body of a toxin, or break a toxin down quicker than other insects
- Target-site
 - The insecticide can no longer connect at it's target-site at a molecular level in the insect
- Penetration
 - The insects shell more slowly absorbs an insecticide
- Behavioral
 - Certain insects can sense or steer clear of insecticide dangers

Fungicide resistance

- Fungicides are used to manage plant diseases caused by fungi
- Older fungicides were less prone to resistance than newer products, but were not as safe or effective as new fungicides
- It is important to manage resistance to keep new products useful for crop protection

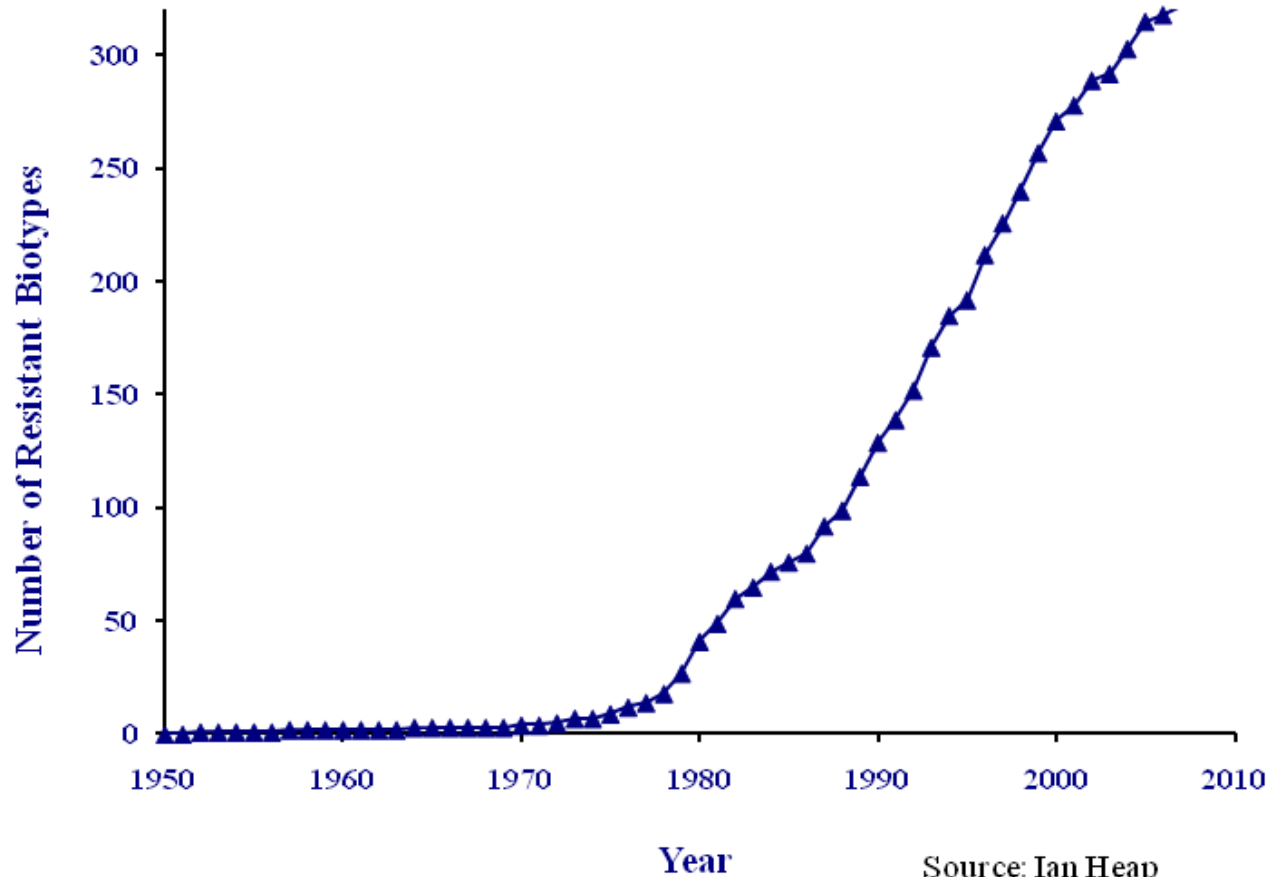


Weed resistance

- Herbicides are used to control weed pests
- First resistant weeds found in the 1950s
- Since then, many other weeds have been found to show resistance to herbicides
- Only a few products used today for weed control
- Because of this, weed resistance is expected to become an increasing problem



Weed resistance



Source: Ian Heap
<http://WeedScience.com>

Herbicide resistant weeds in Iowa

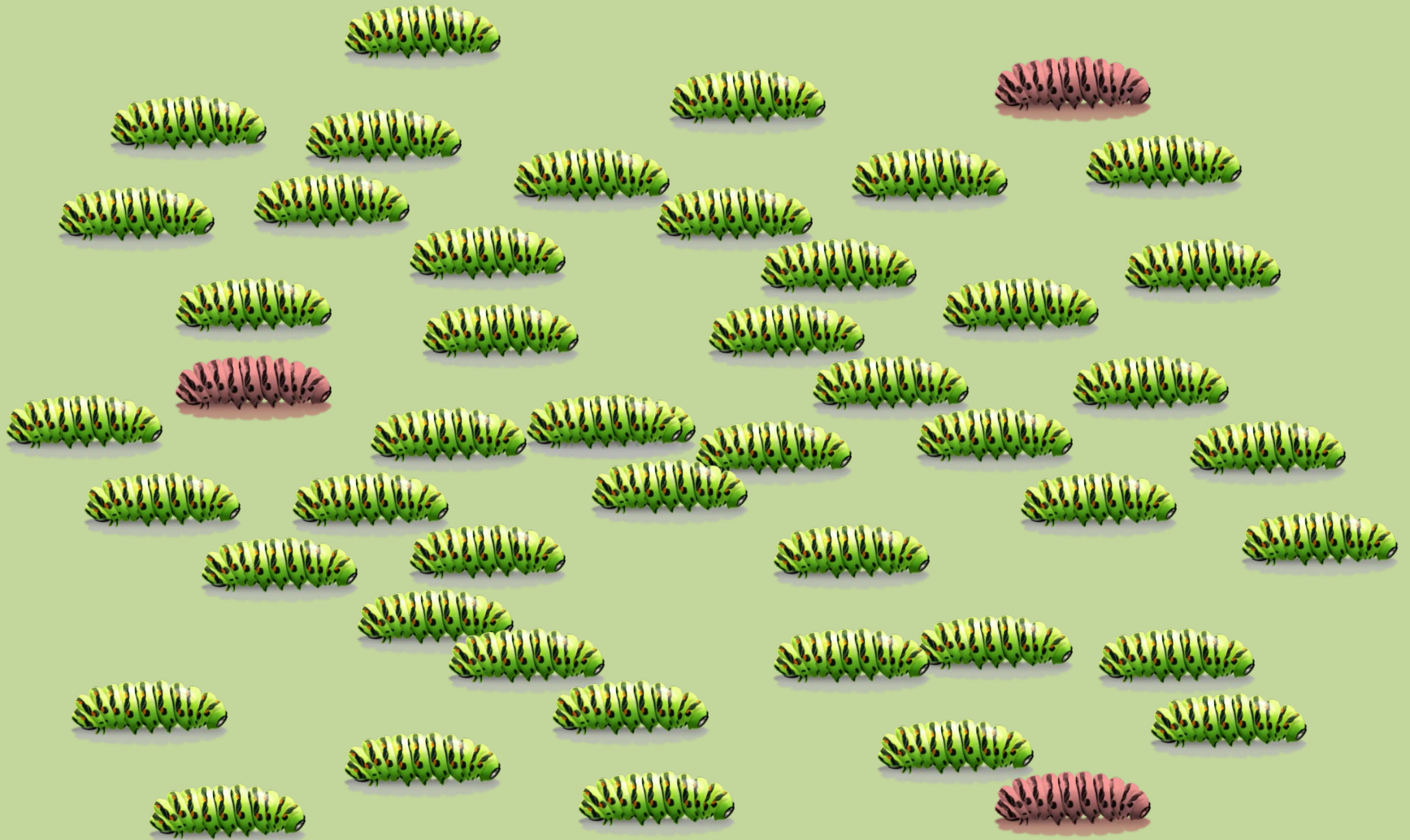
Common name	Type of herbicide				
	ALS inhibitors	EPSPS inhibitors	Photosystem II inhibitors	PPO inhibitors	ACCase inhibitors
Common cocklebur	X				
Common lambsquarters			X		
Common sunflower	X				
Common waterhemp	X	X	X	X	
Giant foxtail					X
Giant ragweed	X	X			
Marestail	X	X			
Shattercane	X				

Managing pesticide resistance

- Apply pesticides only when needed
 - Scout fields to determine pest populations
 - Use when thresholds are met
- Follow label directions
- Rotation of different types of pesticides during the year and from year to year
- Use alternative management options
 - Tillage
 - Natural enemies
 - Crop resistance
 - Crop rotation
- Resistant pests can develop using other management techniques as well.



Rotating pesticides



Corn field

Conclusions

- Pesticide resistance in pest organisms results from using the same pesticide repeatedly, selecting for organisms able to survive exposure.
- Resistant weeds, insects, and fungi can limit the available management options for crop growers.
- Resistance can be managed in several ways so that pesticides remain a useful way of controlling pest organisms now and in the future.