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.
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 its body of a toxin, or break a toxin down quicker than other insects

• Target-site
  – The insecticide can no longer connect at its 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

<table>
<thead>
<tr>
<th>Common name</th>
<th>Type of herbicide</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>ALS inhibitors</td>
</tr>
<tr>
<td>Common cocklebur</td>
<td>X</td>
</tr>
<tr>
<td>Common lambsquarters</td>
<td></td>
</tr>
<tr>
<td>Common sunflower</td>
<td>X</td>
</tr>
<tr>
<td>Common waterhemp</td>
<td>X</td>
</tr>
<tr>
<td>Giant foxtail</td>
<td></td>
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<tr>
<td>Giant ragweed</td>
<td>X</td>
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<tr>
<td>Marestail</td>
<td>X</td>
</tr>
<tr>
<td>Shattercane</td>
<td>X</td>
</tr>
</tbody>
</table>
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.