

2008 CMDC

Resistant Weed &

Insect Management –

Lowell Sandell

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Resistance vs. Tolerance vs. Avoidance

Herbicide resistance

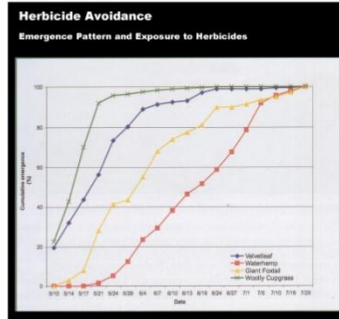
• The evolved capacity of a previously herbicide-susceptible weed population to withstand a herbicide and complete its life cycle when the herbicide is used at its normal rate in an agricultural situation (Heap and Lebaron, 2001)

• Nebraska example: ALS-resistant common waterhemp

Herbicide Tolerance

• The native capacity of a weed population to withstand a herbicide and complete its life cycle when first exposed to that herbicide at its normal use rate in an agricultural setting

• Nebraska example: Foxtails and 2,4-D



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Factors Influencing Resistance Selection

PLANT

1. Plant lifecycle and growth
2. Fecundity
3. Plasticity
4. Genetic diversity



SELECTION AGENT (herbicide)

1. Frequency
2. Dose

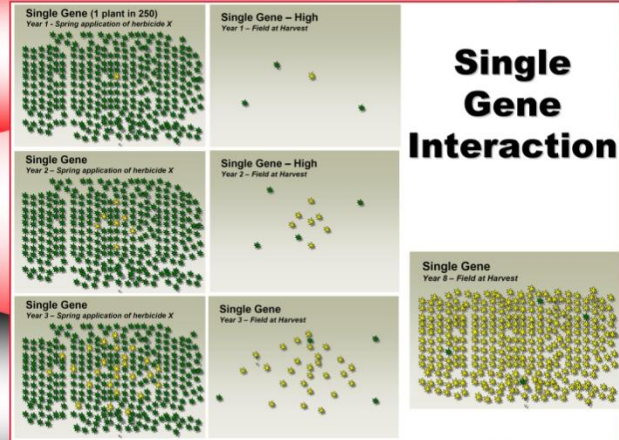
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Mechanisms of Resistance

1. Target site mutation/increased expression
 - ALS & triazine resistance
2. Metabolism/detoxification of herbicide
 - ACCase resistance
3. Reduced movement (translocation) to active site/sequestration
 - Glyphosate resistance

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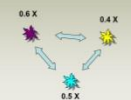
Single Gene Interaction



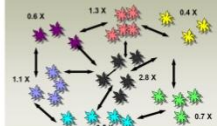
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Multiple Gene Interaction

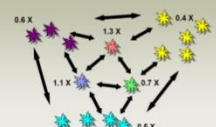
Multi-gene resistance - Genetic Poker
Using a 0.5X rate - Year 1



Multi-gene resistance - Genetic Poker
0.5 X rate - Year 3



Multi-gene resistance - Genetic Poker
0.5 X rate - Year 2



Multi-gene resistance - Genetic Poker
1.0 X rate - Year 4



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Herbicide combinations for resistance management

| Herbicide | Weed | | | |
|-----------|------|----|----|----|
| | A | B | C | D |
| 1 | ++ | ++ | 0 | 0 |
| 2 | 0 | 0 | ++ | ++ |
| 3 | ++ | + | ++ | 0 |
| 4 | 0 | + | 0 | ++ |

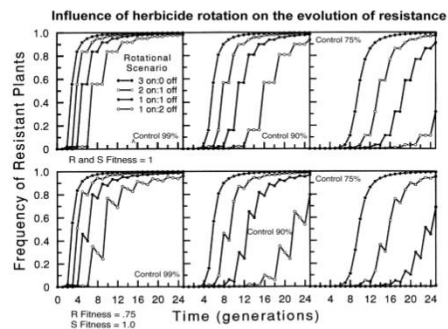
++ = highly effective, 0 = no effect

Each herbicide has a different mode of action.

Combination(s) of which two herbicides would provide the best treatment to counter herbicide resistance.

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Herbicide rotation for resistance



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