

Herbicide Fundamentals

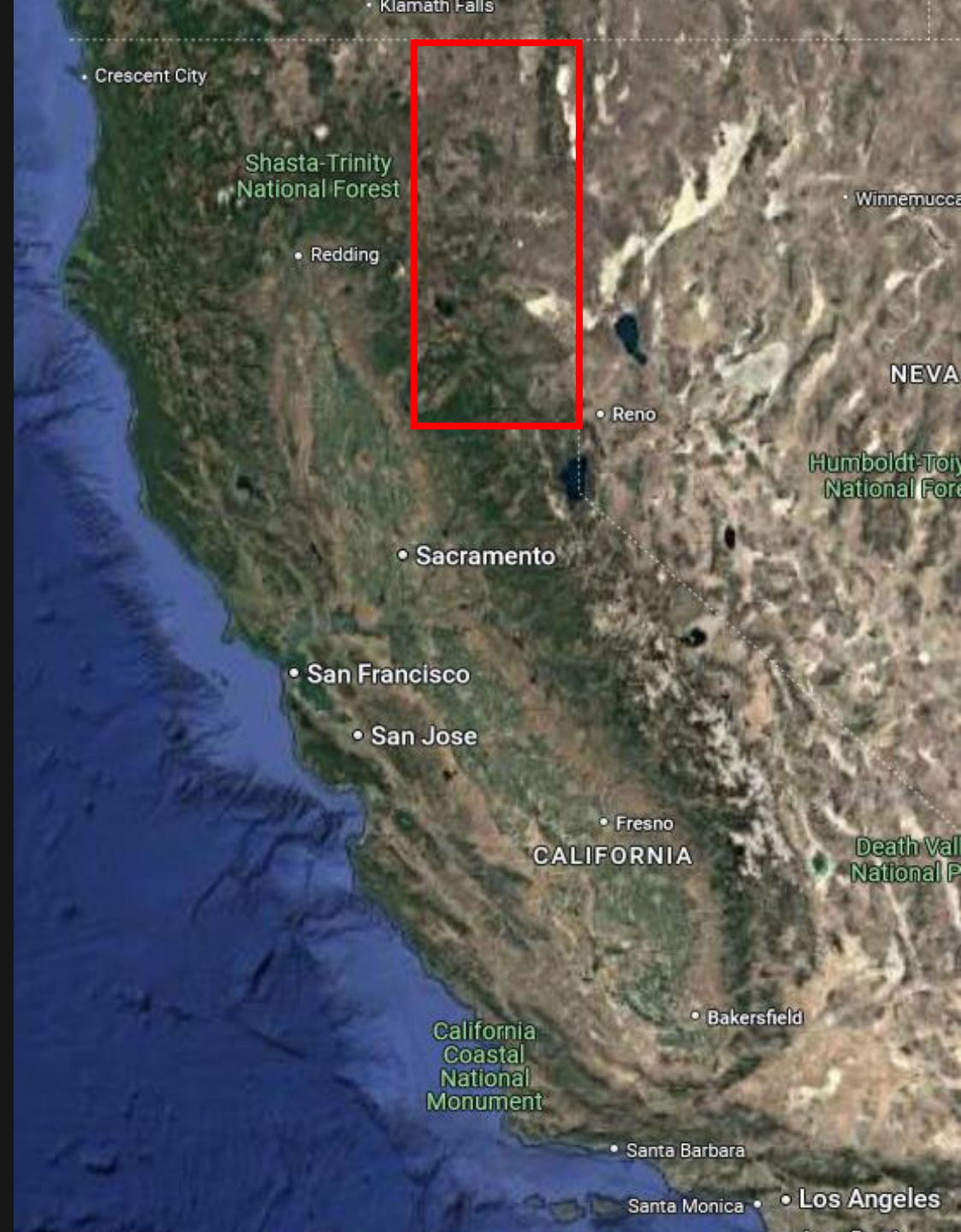
UCCE Farm Advisor: Tom Getts

Lassen, Modoc, Sierra, and Plumas Counties



Tom Getts

- UC Extension
- Weed Ecology and Cropping Systems Advisor
 - Lassen
 - Modoc
 - Sierra
 - Plumas
- Invasive Weeds
- Agronomic Pests



Outline

- Definitions
- Basics
 - Selectivity
 - Pre vs Post
 - Contact Vs Systemic
- Modes of Action
- Resistance

What are herbicides?

- Products used to kill Plants

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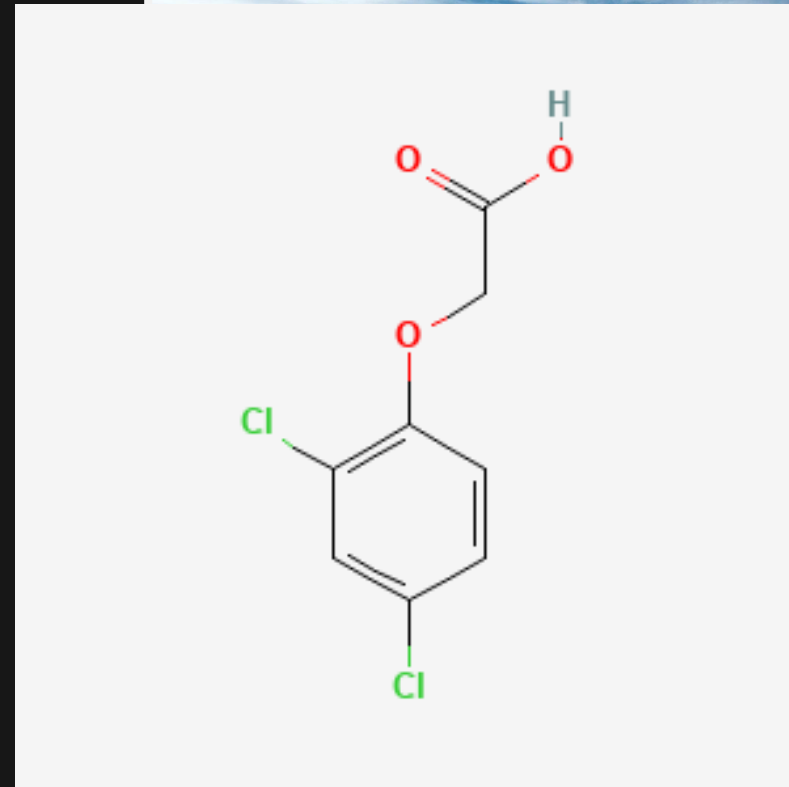
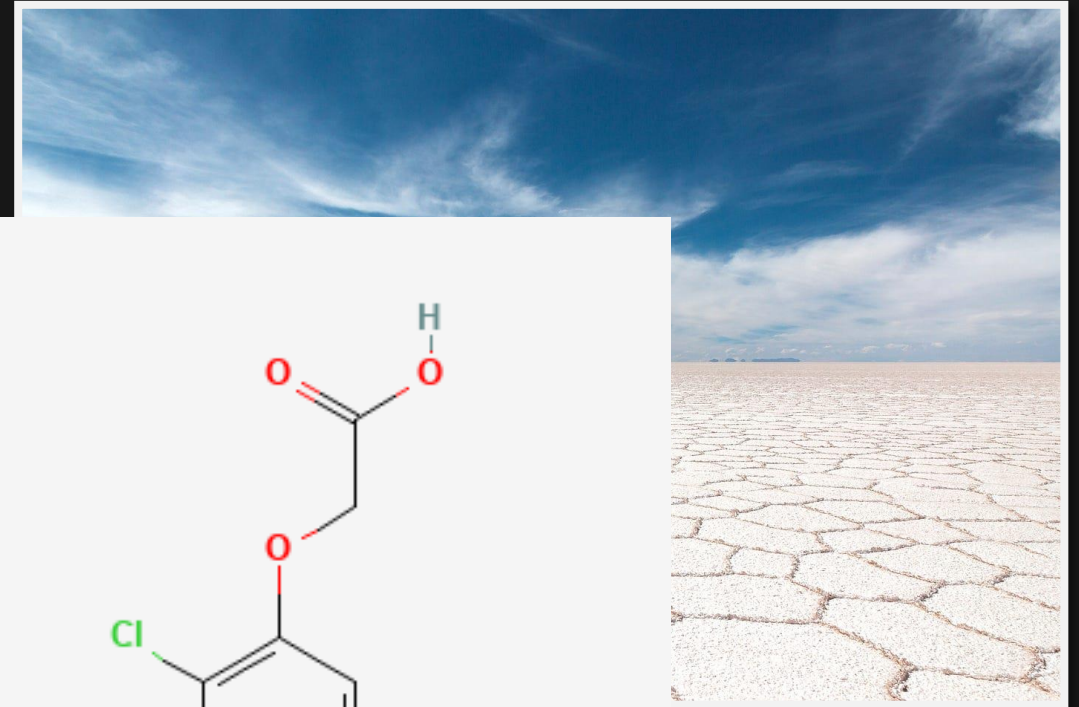
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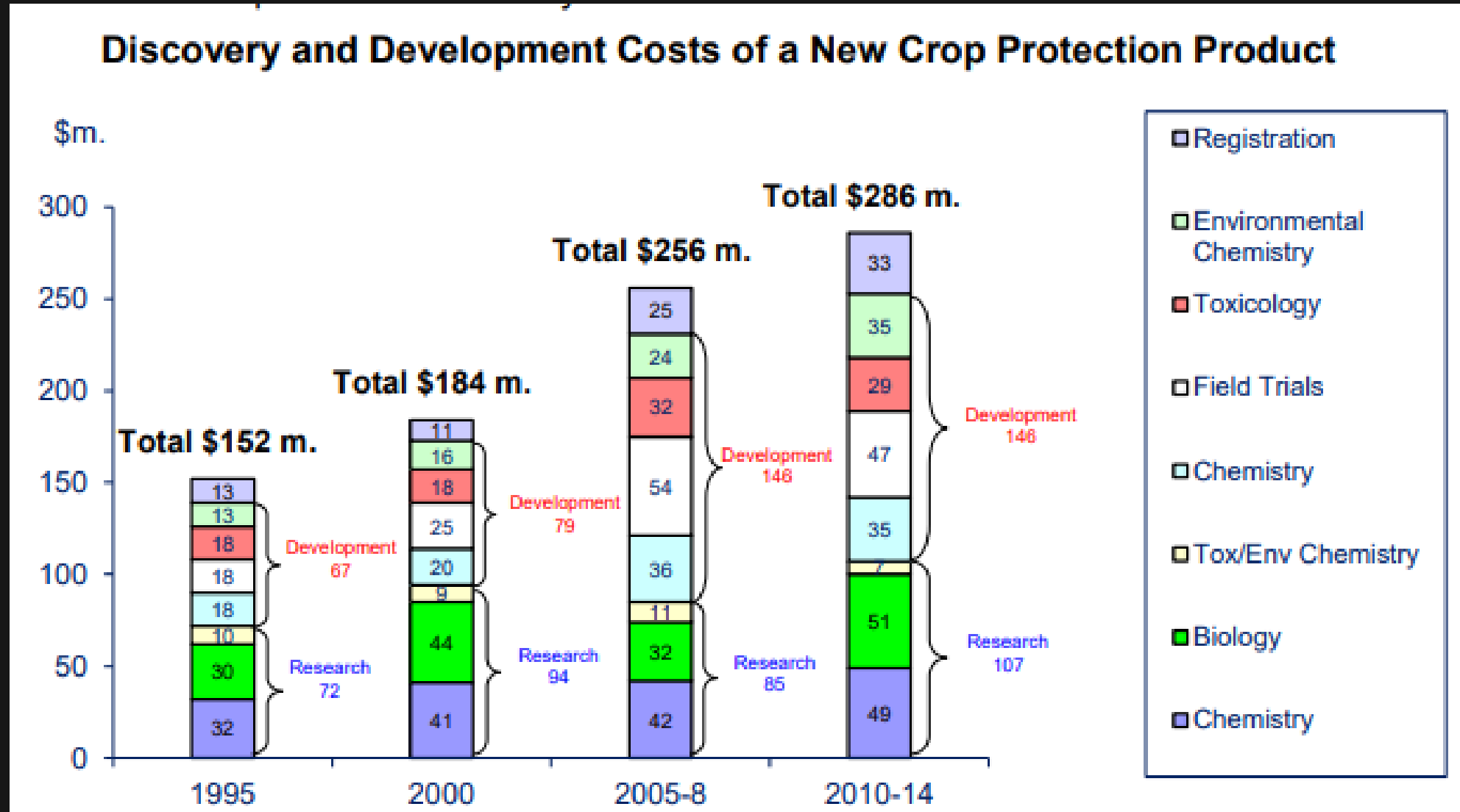
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- 2,4-D- WW2
- 258ish Synthetic herbicides today



Pesticides are Regulated Materials!

- Early Laws- Products that Work
- Later Laws- Environmental Protection
- Extensive Registration Process
 - EPA
 - DPR



Label is the Law!

- Federal Crime to use a pesticide Off Label
- Follow the Label
- Millions Dollars Research into Labels
 - Protect users
 - Protect the environment
 - All based on science
 - EPA is typically considered conservative

Choosing an herbicide?

- Target Species
 - Growth stage
 - Seed bank
- Desirable Species?
- Site
 - Park vs Roadside vs Grazed area
- Management Objective?
- IPM



Herbicide Selectivity

Not all Herbicides kill all Plants!

Affected by

- Plant species
- Herbicide
- Application timing
- Growth stage (dormant applications)
- Etc.



Image courtesy of : gmandchemicalindustry9.wordpress.com

Soil Activity

- Pre-Emergence
 - Seeds
 - Root uptake
- Post-Emergence
- Both!



Contact vs. Systemic

Contact —

- Does not move through plant (Ex - Vinegar, Shark, Gramoxone)
- Coverage matters
- Only kills top growth
- Does not kill root!



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Contact vs. Systemic

Systemic –

- Can move through plant (Ex – Roundup, Telar, Arsenal, 2,4-D)
- Absorbed through leaf/stem/roots
- Can kill roots



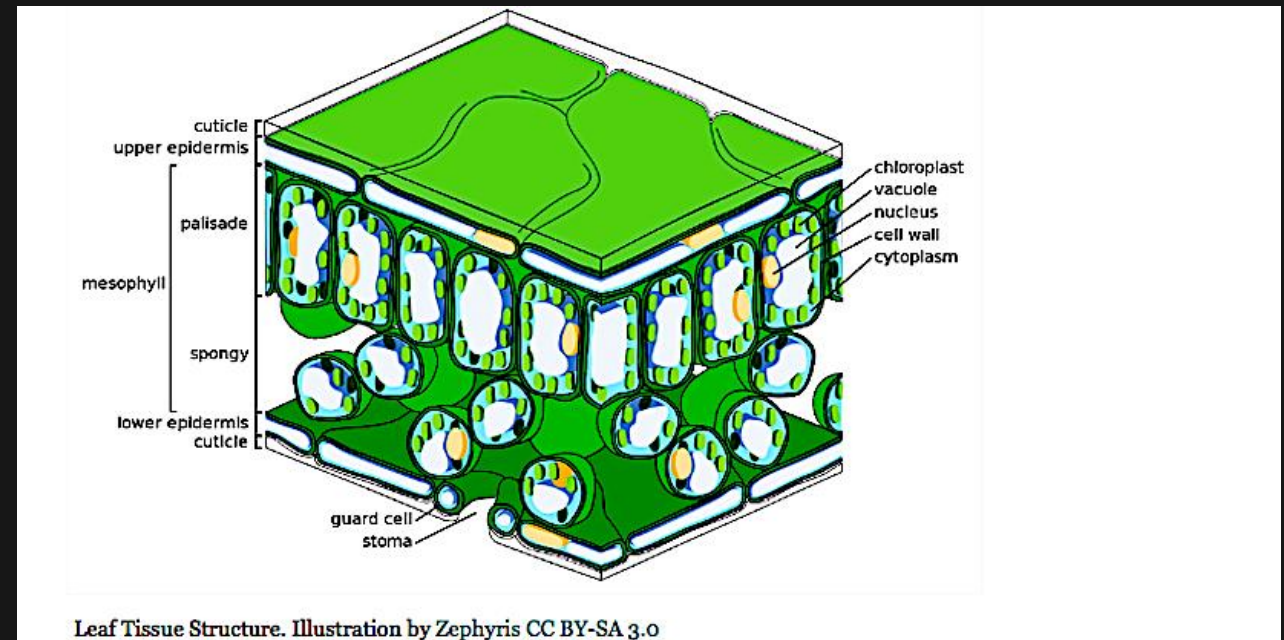
Pre Emergent Herbicides

- Generally, kill seeds/keep them from germinating
- Need good coverage
 - Like “Blanket” over the soil
- Need incorporation
 - Rained into soil, or mixed-in with equipment.
 - Applied fall or spring
 - Mid summer lack of rain limits effectiveness
- Some specific, some not specific
- Some stay in top of soil, some move....



Post Emergent Herbicides

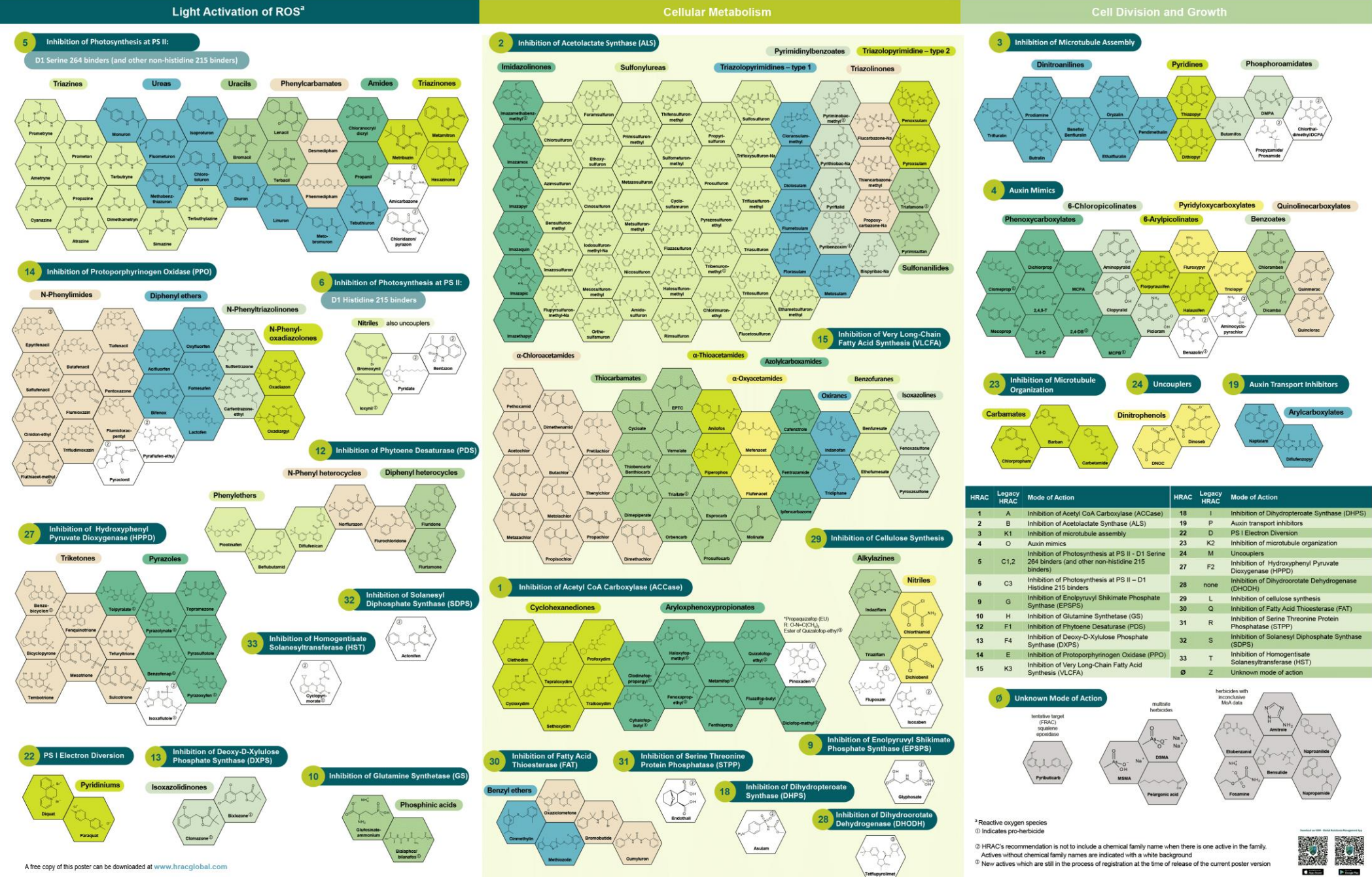
- Need green material
- Need to get through cuticle
- Coverage?
 - Systemic vs Contact
- Can be affected by weather
- Needs active growth
- Surfactants important
- Plant growth stage!



Mode of Action (MOA)

• How an herbicide physiologically works in the plant to kill the weed

• Approx 33 MOA's



* Reactive oxygen species
 ① Indicates pro-herbicide
 ② HRAC's recommendation is not to include a chemical family name when there is one active in the family. Actives without chemical family names are indicated with a white background
 ③ New actives which are still in the process of registration at the time of release of the current poster version

Imazamox 120SL

Imazamox Group 2 Herbicide

For use on alfalfa, beans (dry), chicory, clover grown for seed, edamame, lima bean (succulent), peas (dry), pea (English), snap bean, and soybean.

ACTIVE INGREDIENT:

ammonium salt of imazamox: 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-(methoxymethyl)-3-pyridinecarboxylic acid* 12.1%

OTHER INGREDIENTS: 87.9%

TOTAL: 100.0%

*Equivalent to 11.4% 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-methoxymethyl)-3-pyridinecarboxylic acid

1 gallon contains 1.0 pound of active ingredient as the free acid.

EPA Reg. No. 66222-269 EPA Est. No. 37429-GA-001^{III};
37429-GA-002^{II}; 37429-GA-003^{IV}
Letter(s) in lot number correspond(s)
to superscript in EPA Est. No.

KEEP OUT OF REACH OF CHILDREN CAUTION / PRECAUCION

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

See inside for complete Precautionary Statements and Directions For Use

How can we help? 1-866-406-6262



HERBICIDE

ADAMA

Highlighted Modes of Action!

- Synthetic Auxin Herbicides
 - “Mimic” the plant hormone Auxin
 - Broadleaf killers!
 - Examples
 - 2,4-D
 - Post
 - Aminopyralid
 - Pre and Post
 - Triclopyr
 - Post



Highlighted Modes of Action!

- ACCace Herbicides
 - Inhibit formation of long chain fatty acid's
 - Grass killers!
 - Post activity
 - Examples
 - Clethodim
 - Sethoxydim
 - Fluazifop



Highlighted Modes of Action!

- ALS Inhibitors
 - Prevent formation of acetolactate synthases
 - Variability selectivity
 - Some kill everything
 - Some only kill certain species
 - Chlorsulfuron
 - Pre and Post
 - Rimsulfuron
 - Pre and early Post
 - Imazapyr
 - Pre and Post



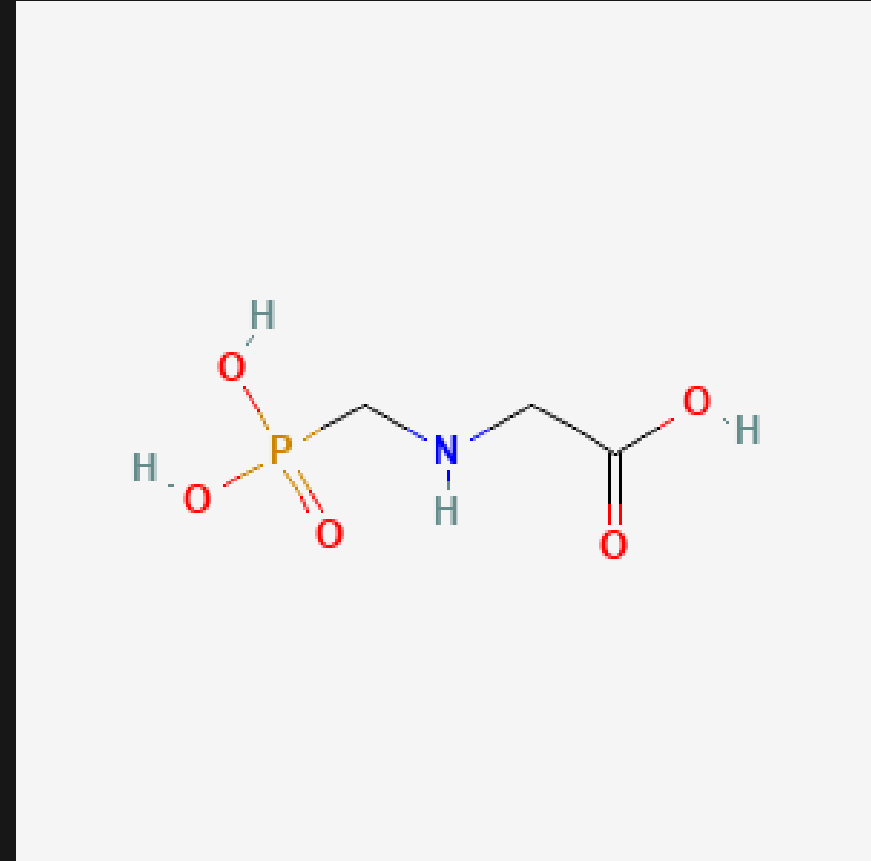
Seedling Growth Inhibitors

- Multiple modes of action
- Pre's
- Microtubular inhibitors
 - Pendimethalin
 - Trifluralin
- Cellulose Biosynthesis inhibitors
 - Indaziflam
 - Isoxaben



EPSPS Synthase Inhibition

- Glyphosate
 - Excellent post activity
- Broad spectrum systemic
 - Grasses
 - Broadleaves
 - Trees
- NO RESIDUAL
 - No soil activity
 - Bound to soil
- Plant after spraying
- Short term bare ground
 - Recolonized by weeds



Tank Mixes?

- What is the goal
- Multiple species
- Pre and Post activity
- Delay/Prevent resistance



Calibration

- Most important factor!
- How much are you applying?
 - Herbicide effectiveness
 - Off target impacts
 - Residual activities
- Amount product spread over amount of area
- Spot
 - % v/v solution

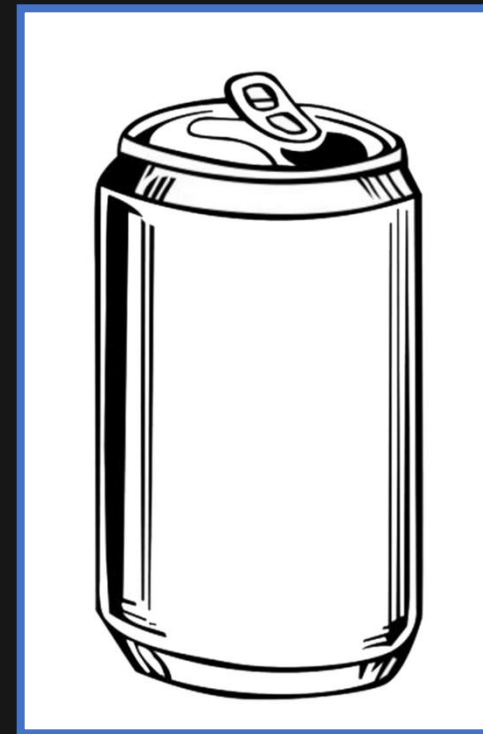


Image courtesy of : www.Clipartbest.com

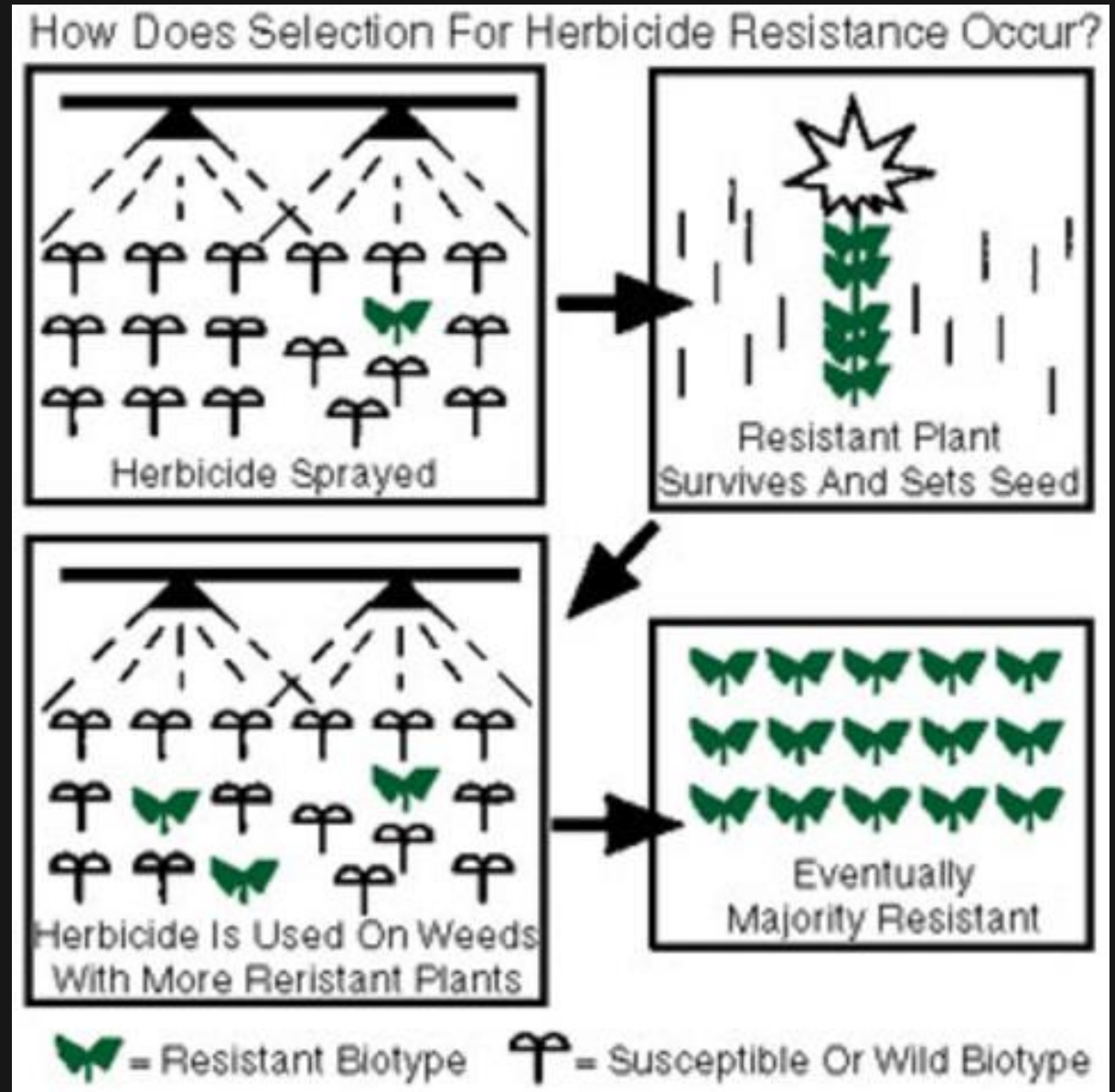


Image Courtesy of: Illinois Extension

Off Target Impacts?

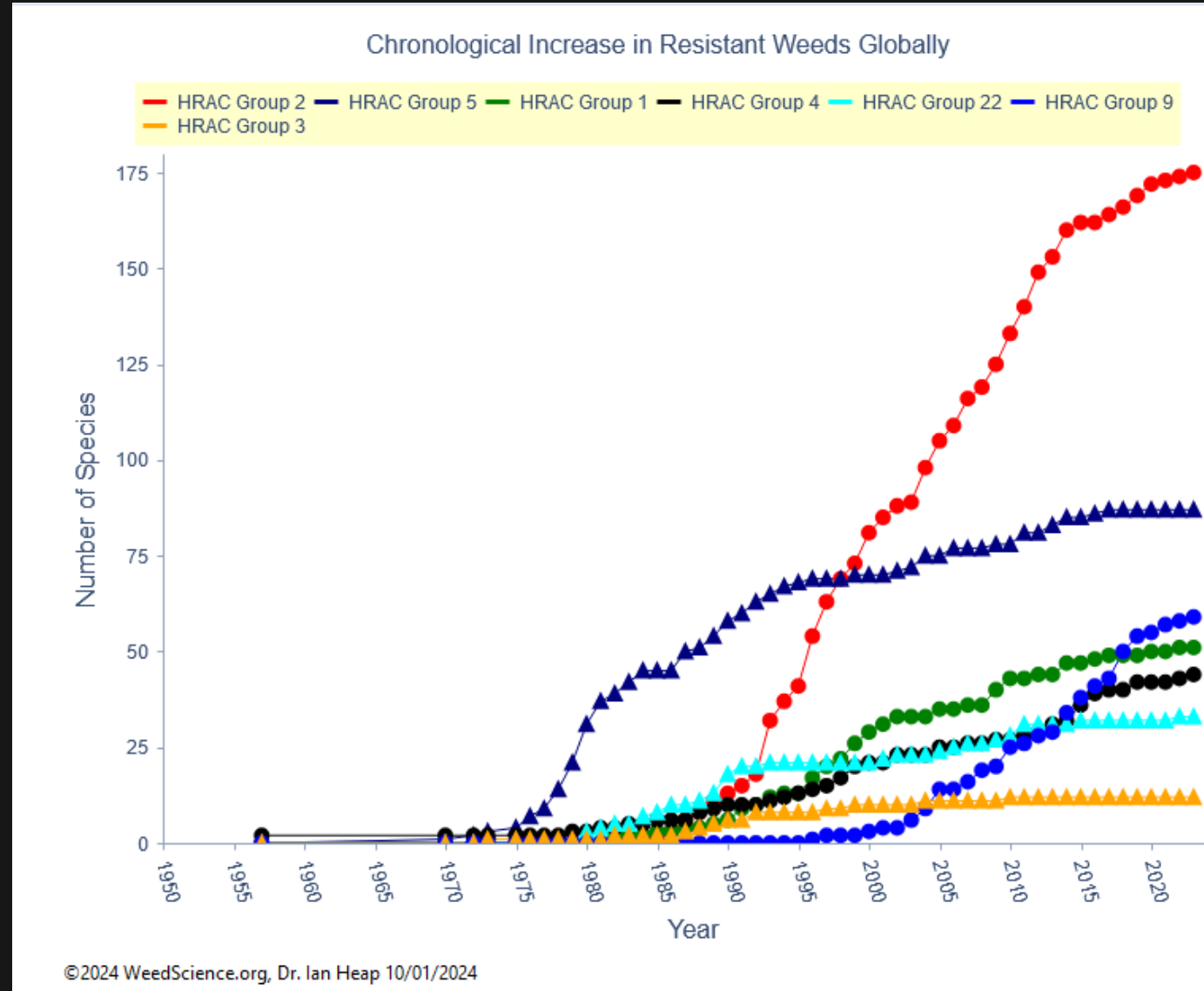
- Desirable vegetation
- Drift
- Volatility
- Soil movement
- Water movement

Herbicide Resistance



Resistance world wide!

- 515 Cases Since 2020



Herbicide site of action (WSSA Group)	Active ingredient	Weed species
Acetolactate synthase (ALS) inhibitors (WSSA 2)	bensulfuron-methyl bensulfuron-methyl bensulfuron-methyl sulfometuron-methyl bensulfuron-methyl bensulfuron-methyl sulfometuron-methyl	<i>Ammannia auriculata</i> (eared redstem) <i>Ammannia coccinea</i> (redstem) <i>Cyperus difformis</i> (smallflower umbrella sedge) <i>Lolium perenne</i> (perennial ryegrass) <i>Sagittaria/montevicensis</i> (California arrowhead) <i>Schoenplectus mucronatus</i> (ricefield bulrush) <i>Salsola tragus</i> (Russian thistle)
5-enol-pyruvyl-shikimate-3-phosphate synthase (EPSPS) inhibitor (WSSA 9)	glyphosate glyphosate glyphosate glyphosate glyphosate glyphosate glyphosate	<i>Amaranthus palmeri</i> (Palmer amaranth) <i>Conyza bonariensis</i> (hairy fleabane) <i>Conyza canadensis</i> (horseweed) <i>Echinochloa colona</i> (junglerice) <i>Lolium perenne ssp. multiflorum</i> (Italian ryegrass) <i>Lolium rigidum</i> (rigid ryegrass) <i>Poa annua</i> (Annual bluegrass)
Acetyl-CoA carboxylase (ACCase) inhibitors (WSSA 1)	fenoxaprop-p-ethyl clethodim fenoxaprop-p-ethyl fluazifop-p-butyl sethoxydim	<i>Echinochloa phyllopogon</i> (late watergrass) <i>Phalaris minor</i> (littleseed canary grass)
Photosystem II (PS II) inhibitors (WSSA 7)	propanil propanil atrazine	<i>Cyperus difformis</i> (smallflower umbrella sedge) <i>Schoenplectus mucronatus</i> (ricefield bulrush) <i>Senecio vulgaris</i> (common groundsel)
Lipid synthesis inhibitors (WSSA 8)	difenzoquat thiobencarb thiobencarb	<i>Avena fatua</i> (wild oats) <i>Echinochloa phyllopogon</i> (late watergrass) <i>Echinochloa oryzoides</i> (early watergrass)
Synthetic auxins (WSSA 4)	quinclorac	<i>Digitaria ischaemum</i> (smooth crabgrass)
Glutamine synthase inhibitors (WSSA 10)	glufosinate	<i>Lolium perenne ssp. multiflorum</i> (Italian ryegrass)

Minimize resistance!

- Integrate IPM
 - Cultural
 - Physical
 - Biological
- Combine multiple effective modes of action
 - Rotation?
- Not common to develop in non-crop, but in crops and rights of ways common.

Choosing an Herbicide

- Situational
- Weed species
- Desirable species
 - Roots!
- Off target impacts
 - Water
- Type of land
 - Wheat Field vs. Garden Vs Roadside
 - Plant back
- Cost



Questions?

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