



How to Resist Resistance

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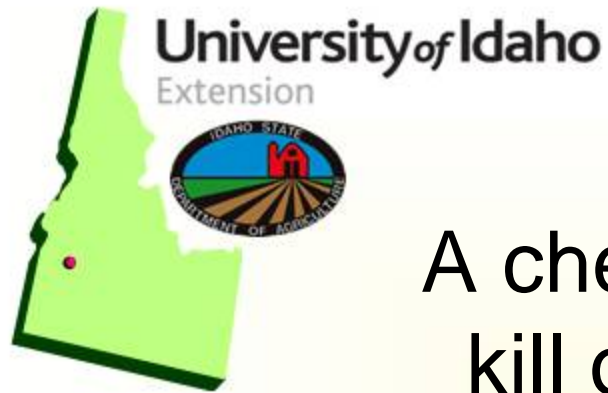
What are we covering today?

- Insecticides
- Fungicides
- Herbicides
- Pest Management tactics to help you avoid resistance
 1. IPM
 2. Pesticide recordkeeping



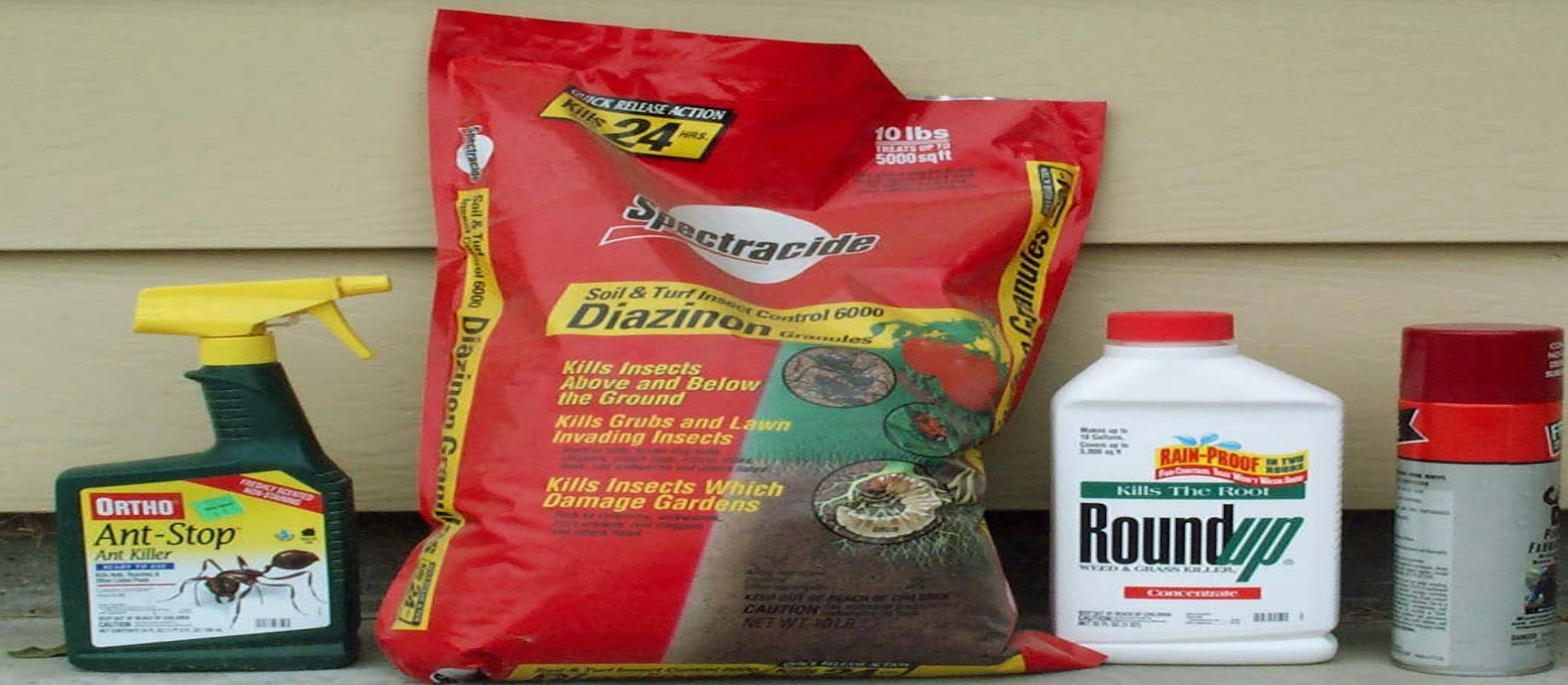
Thanks to:

- Dr. Pamela Hutchinson
- Dr. Don Morishita



What is a pesticide?

A chemical or other agent used to kill or control pests or to protect something from a pest





What is pesticide resistance?

- The inherited change in an organism's (weed, insect, pathogen) susceptibility to the pesticides applied.

“SUPER BUG”



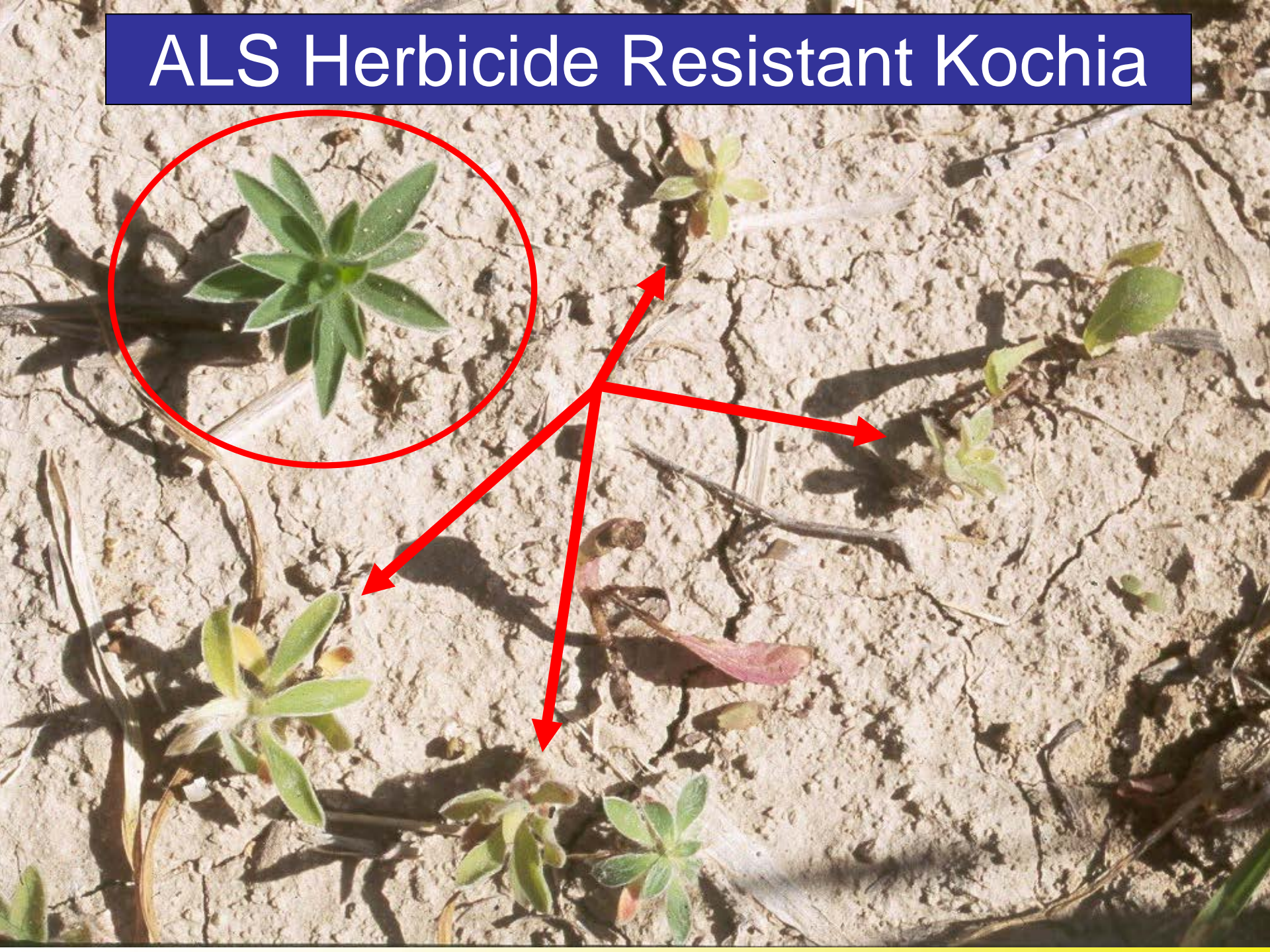


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Late blight of potato caused by *Phytophthora infestans* shows severely diseased plants with no fungicide treatment compared with an effective fungicide treatment. It's not hard to guess which is which.

ALS Herbicide Resistant Kochia





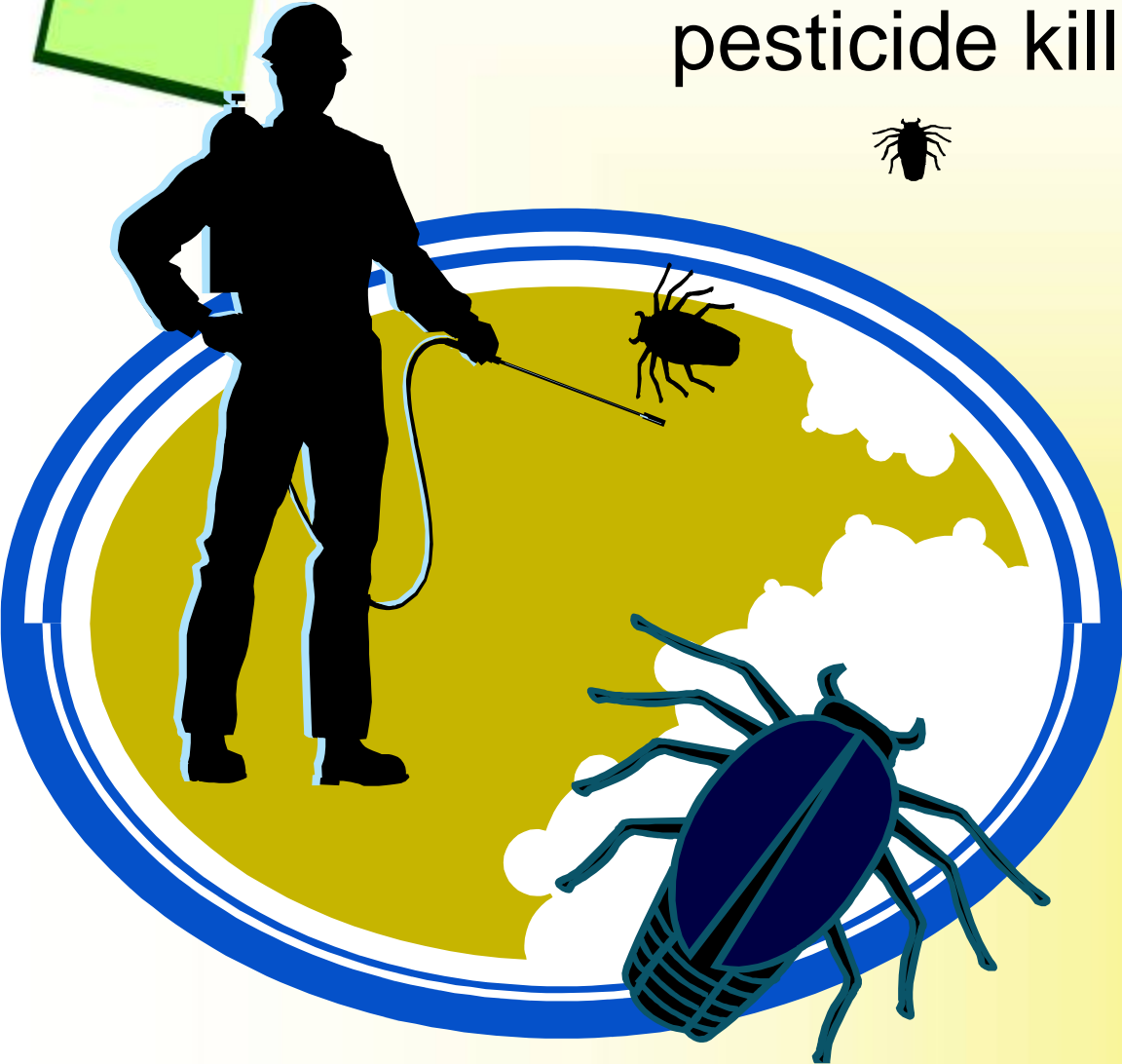
FACTORS FOR RESISTANCE

- Heavy pesticide use or misuse
- Mode of Action (MOA) of pesticide
- Reliance on pesticides for pest control
- **Pesticide Treadmill**



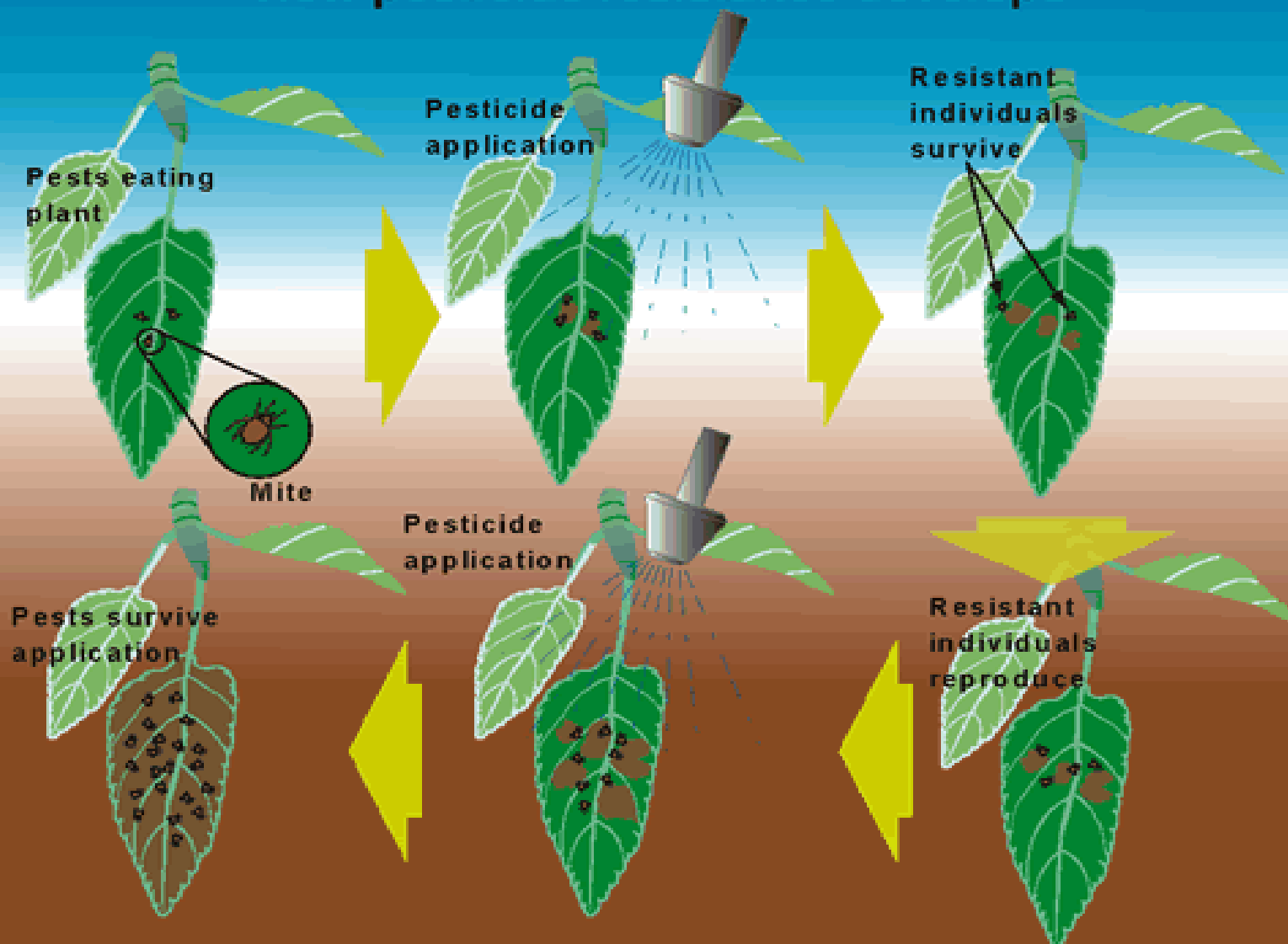


Mode of Action: The sequence of events in which a pesticide kills the pest





How pesticide resistance develops





INSECTICIDES



Insecticide Resistance

- 1947 – houseflies resistant to DDT
- 1991 – Colorado potato beetle resistance caused a \$16 million crop loss to Michigan potato producers
- Cotton and the cotton bollworm
- When new insecticides were introduced after DDT resistance was recorded to every new class within 2-20 years



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Insecticide Resistance

“Survival of the Fittest”

- Random mutation occurs with surviving insects
- Can break up poisons in their guts
- Avoid ingesting poisons

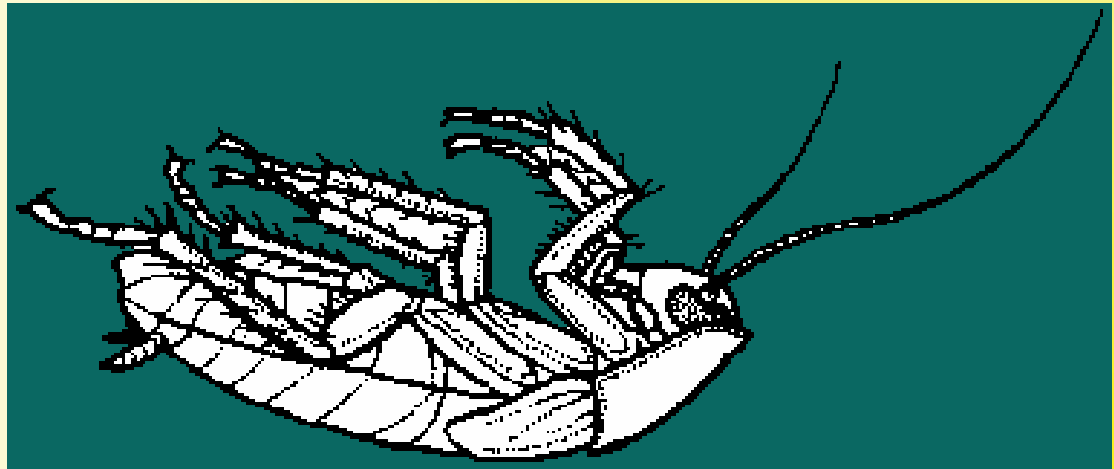


Photo courtesy of University of Minnesota Extension



MODE OF ACTION INSECTICIDES

- Nervous System - most insecticides
- Energy Inhibitors
- Growth Regulators - prevent maturity
- Chitin Inhibitors - prevent maturity and molting
- Water Balance - desiccation





Insecticide Groups

Group #	Mode of Action	Chemical Class
1	Acetylcholine esterase inhibitors	Carbamates and Organophosphates
2	GABA-gated chloride channel antagonists	Organochlorines
3	Sodium channel modulators	Pyrethroids, Pyrethrins
4	Nicotinic Acetylcholine receptor agonists	Neonicotinoids
11	Microbial disruptors	<i>Bacillus</i> spp.
15	Chitin synthesis inhibitor	Rimon



ADMIRE[®] PRO[™]

SYSTEMIC PROTECTANT

Net Contents:

1 GAL. 12 OZ. (140 FL. OZ.)

GROUP 4A INSECTICIDE

For uses in pest management and maintenance of plant health.

ACTIVE INGREDIENT:

Imidacloprid, 1-[(6-Chloro-3-pyridinyl)methyl]-
N-nitro-2-imidazolidinimine 42.8%

OTHER INGREDIENTS: 57.2%
100.0%

EPA Reg. No. 264-827

Contains 4.6 pounds of active ingredient per gallon or 550 grams AI/liter.

SHAKE WELL BEFORE USING

STOP - Read the label before use

**KEEP OUT OF REACH
OF CHILDREN
CAUTION**

FOR ADDITIONAL PRECAUTIONARY
STATEMENTS: See inside Booklet.

For **PRODUCT USE** Information Call
1-866-99BAYER (1-866-992-2937)

For **MEDICAL** And **TRANSPORTATION** Emergencies
ONLY Call 24 Hours A Day 1-800-334-7577

Produced for:

Bayer CropScience LP
P.O. Box 12014, 2 T.W. Alexander Drive
Research Triangle Park, North Carolina 27709
ADMIRE is a registered trademark of Bayer.
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Product of Germany

110421A 05/11

US80246897A

GROUP**4A****INSECTICIDE**

BELAY[®]

INSECTICIDE

FOR USE ON POTATO AND TOBACCO

Active Ingredient	By Wt.
*Clothianidin	23.60%
Other Ingredients	76.40%
Total	100.00%
*(E)-1-(2-chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine	

Contains 2.13 lbs active ingredient per gallon

EPA Reg. No. 59639-150 EPA Est. 39578-TX-01

KEEP OUT OF REACH OF CHILDREN

CAUTION

**SEE BELOW FOR ADDITIONAL
PRECAUTIONARY STATEMENTS.**

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS & DOMESTIC ANIMALS

CAUTION

Harmful if swallowed.

If**swallowed:**

FIRST AID

Call a poison control center or doctor immediately for treatment advice.

Have person sip a glass of water if able to swallow.

Do not induce vomiting unless told to do so by a poison control center or doctor.

Do not give anything by mouth to an unconscious person.

HOT LINE NUMBER

Applicators and other handlers must wear: long-sleeved shirt and long pants, shoes plus socks and chemical-resistant gloves made of any waterproof material.

Follow the manufacturer's instructions for cleaning/maintaining PPE. If no instructions for washables are available, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is toxic to aquatic invertebrates. Do not apply when weather conditions favor drift from treated areas. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment washwaters or rinsate.

This product is toxic to bees exposed to treatment and for more than 5 days following treatment. Do not apply this product to blooming, pollen-shedding or nectar-producing parts of plants if bees may forage on the plants during this time period.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

READ ENTIRE LABEL USE STRICTLY IN ACCORDANCE WITH PRECAUTIONARY STATEMENTS AND DIRECTIONS AND WITH APPLICABLE STATE AND FEDERAL REGULATIONS.



FUNGICIDES



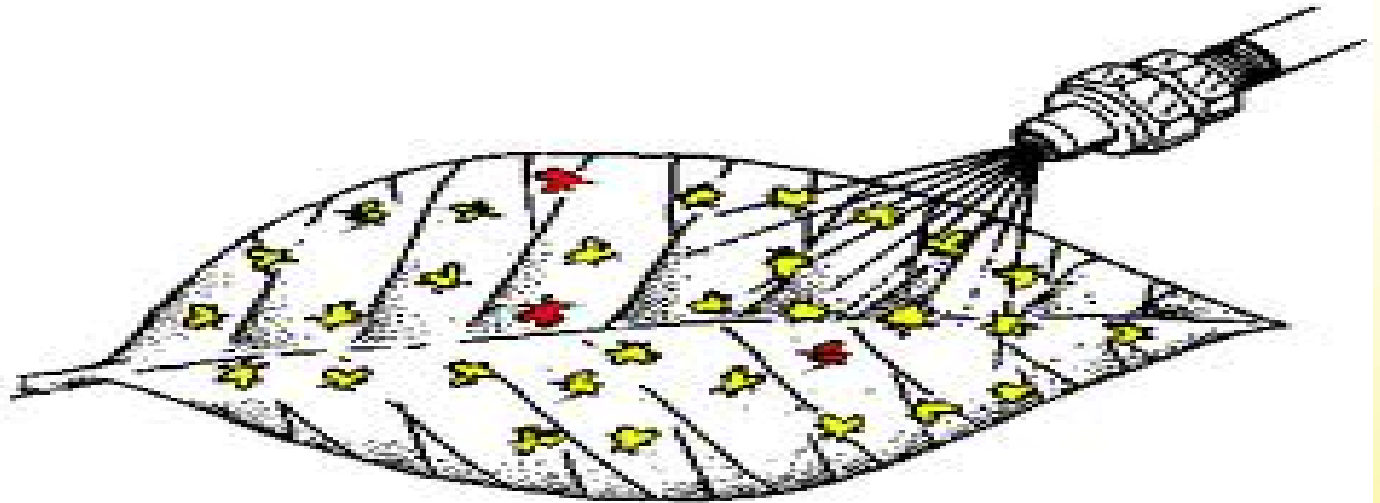
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Sugar Beets Case Study

- Powdery mildew: a pathogen in Idaho with great potential for developing resistance
- Bayleton was used extensively beginning in 1982
- 1987 had to increase Bayleton rates and control only lasted three weeks
- 2000 Idaho had a severe infestation of powdery mildew; only sulfur managed the disease



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FUNGICIDE RESISTANCE

Fungicide Groups

Group Code	Target Site of Action	Product names (examples)
1	Mitosis	Mertect, Topsin
2	Cytochrome reductase in lipid peroxidation	Rovral
4	RNS polymerase	Ridomil, Ridomil Gold
7	Complex II of fungal respiration	boscalid/Endura, Moncut
11	Complex III of fungal respiration: Q0I site	Strobilurins/Quadris, Headline
M	Multi-site contact	Copper hydroxide/Kocide, Champ

SPECIMEN

Cabrio[®]

EG fungicide

For use in disease control and plant health in the following crops:

Berries, brassica, bulb vegetables, cherry, cucurbit vegetables, filberts, fruiting vegetables, leafy vegetables, leaves of root and tuber vegetables, pistachio, root vegetables, and strawberries

Active Ingredient:

pyraclostrobin: (carbamic acid, [2-[[[1-(4-chlorophenyl)-1H-pyrazol-3-yl]oxy]methyl]phenyl]methoxy-, methyl ester) 20.0%

Other Ingredients: 80.0%

Total: 100.0%

EPA Reg. No. 7969-187

EPA Est. No.

KEEP OUT OF REACH OF CHILDREN



HERBICIDES



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Herbicide Resistance

- Most common pesticide-type resistance in Idaho
- Inherited ability to survive a herbicide treatment
- Multiple resistance to 2 or more herbicides with different MOA
- Kochia resistant to *Express and Banvel*
- Wild oat resistant to *Assert and Fargo*



Herbicide Factors Contributing to Resistance

- Highly effective herbicides - the more effective, the greater the selection pressure
- **Single site of action herbicides, e.g. ALS Inhibitors**
- Duration of effect (persistence or residual effect)

Herbicide Classes

- Group 1: Acetyl CoA carboxylase (ACCase) inhibitors
 - Achieve, Assure II, Axial, Discover, Select, Poast, Puma
- Group 2: Acetolactate synthase (ALS) inhibitors
 - Imi's- Assert, Raptor, Arsenal
 - S.U.'s- Matrix, Express, Harmony Ex., UpBeet, Maverick, Oust
- Group 3: Microtubule assembly inhibitors –
 - Dinitroanilines (DNA's)- Prowl, Sonalan, Treflan, Balan



Herbicide Classes

- Group 4: Synthetic Auxins
 - Phenoxy- 2,4-D, 2,4-DB, MCPA
 - Benzoic acid- Banvel, Clarity
 - Carboxylic acid- Curtail, Starane, Stinger, Tordon
 - Quinaline carboxylic acid- Paramount
- Group 5: Photosystem II inhibitors (binding site A)
 - Triazine- metribuzin, Velpar
 - Uracils- Hyvar, Sinbar
 - Phenyl carbamate- Betamix,
 - Pyradazinone- Pyramin



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Herbicide Classes

❖ Group 9: EPSP synthase inhibitors

➤ *Roundup*

❖ Group 10: Glutamine synthetase inhibition

➤ Liberty, Rely

❖ Group 14: Protoporphyrinogen Oxidase (PPO) Inhibitors

➤ Chateau, Aim



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Herbicide Classes

- ❖ **Group 15: Inhibit formation of VLCFA - chloroacetamides**

- **Dual Magnum, Micro-Tech, Outlook**

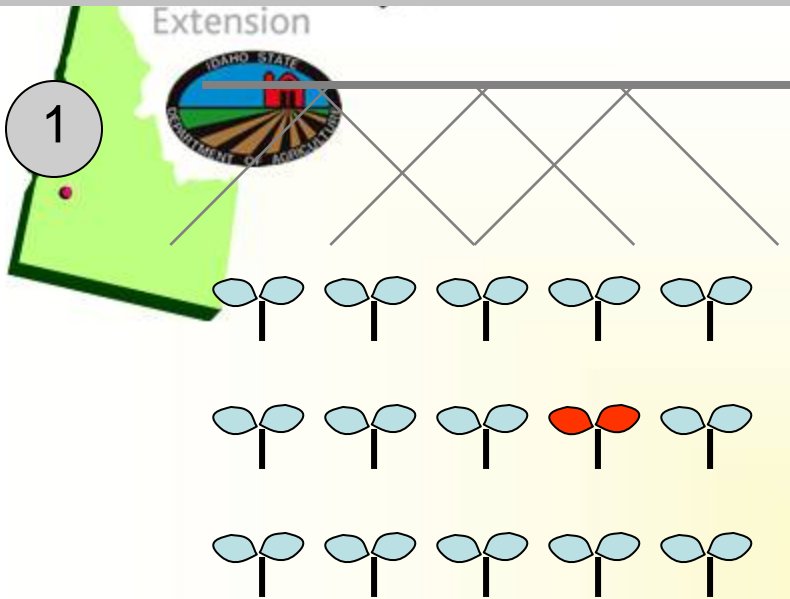
- ❖ **Group 16: Unknown site of action**

- **Benzofuran- Nortron**

- ❖ **Group 22: Photosystem I electron diverters**

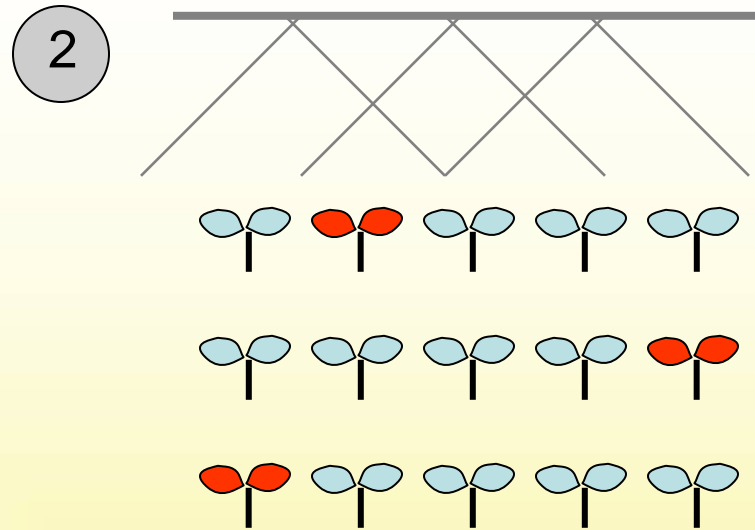
- **Bipyridiliums- Gramoxone Inteon, Diquat, Reglone**

Development of a resistant weed population through herbicide selection



Herbicide sprayed on a weed population in a field

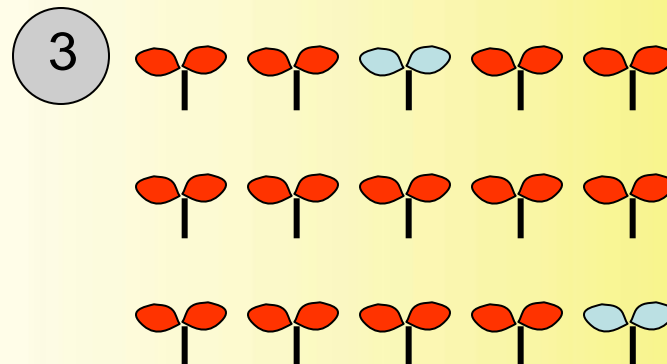
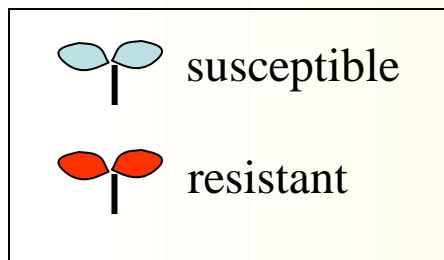
Some resistant plants of a given species already exist in that species population



Repeat use of same

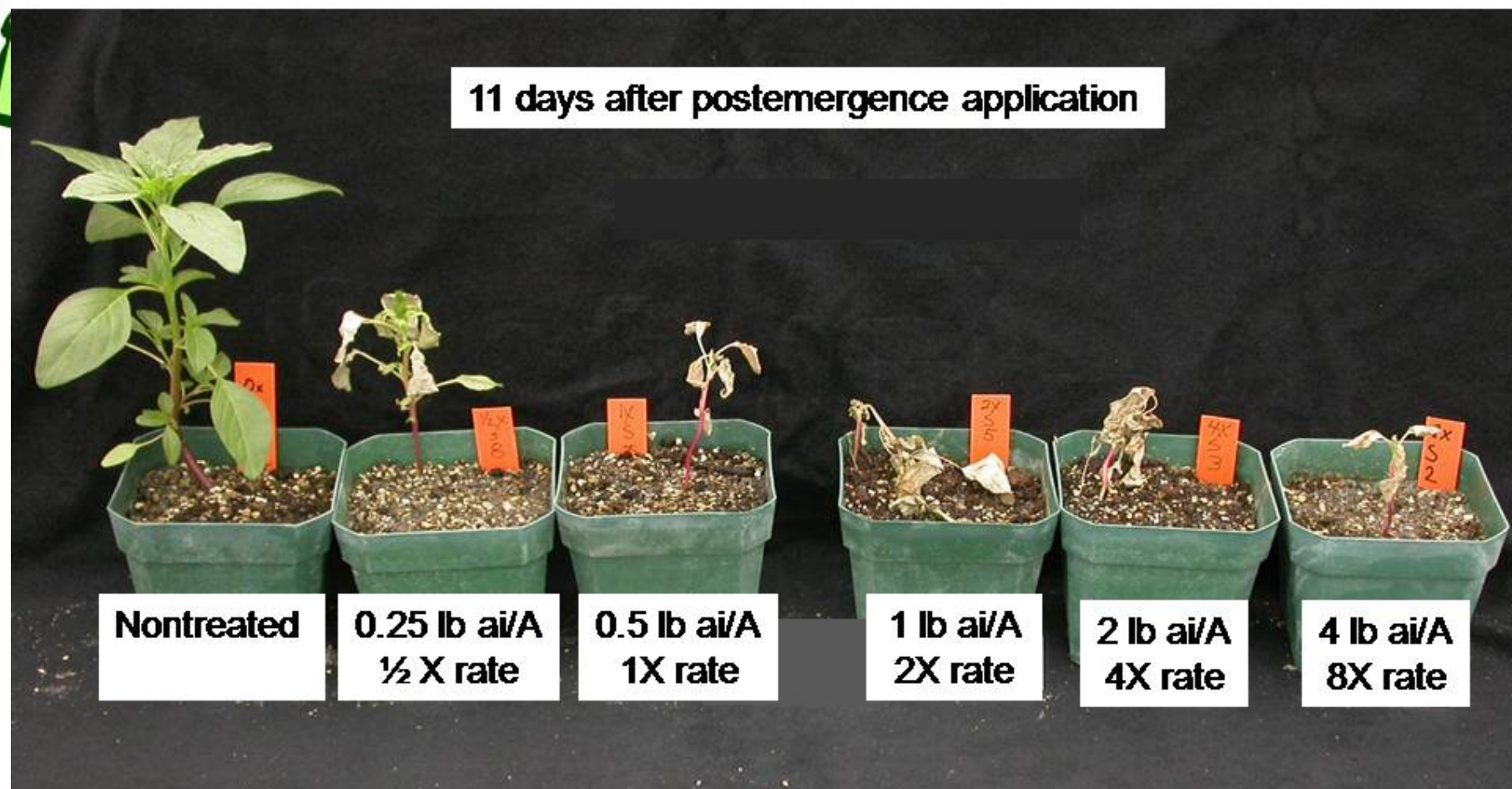
herbicide and/or mode of action

Resistant weed plants of a given species survive and produce seed, susceptible plants of that species do not survive



After repeated use of the same herbicide and/or mode of action, the resistant weed plants have survived and now dominate the population

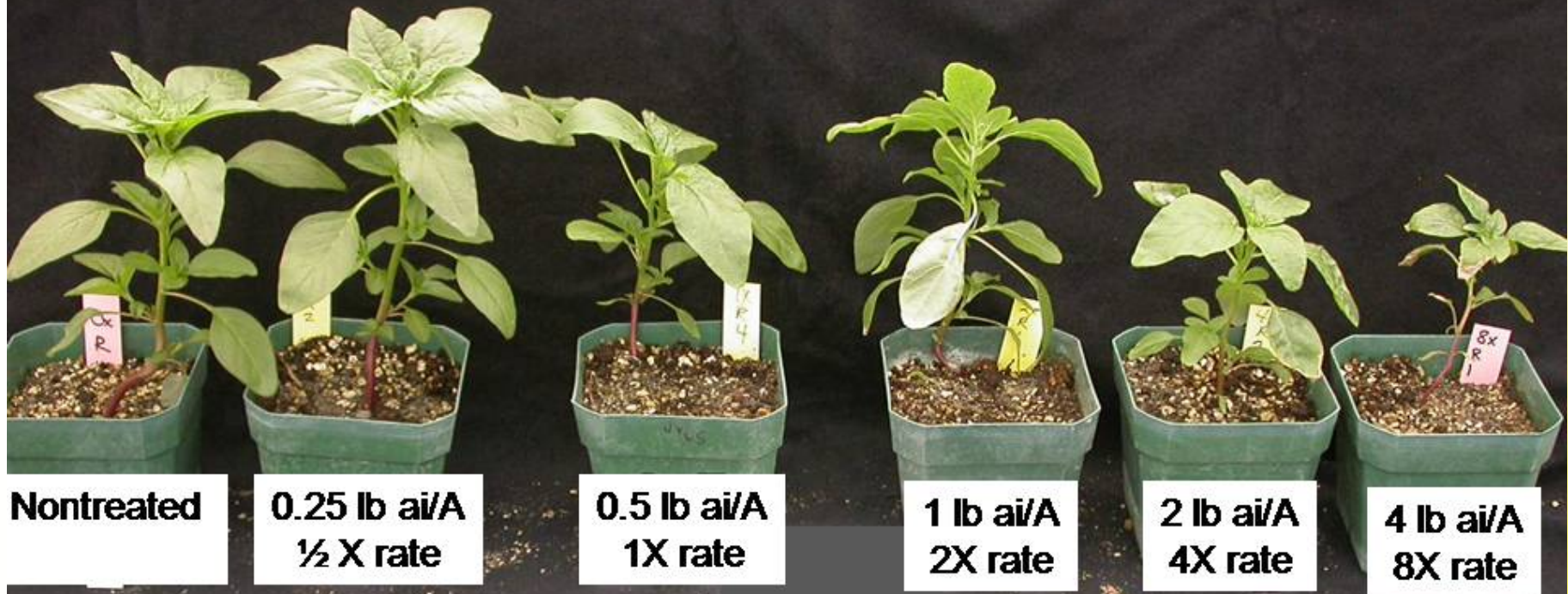
Metribuzin applied POST to susceptible redroot pigweed



Redroot pigweed plants grown from seeds collected in a metribuzin-susceptible population

Metribuzin applied POST to resistant redroot pigweed

11 days after postemergence application



Redroot pigweed plants grown from seeds collected in a metribuzin-resistant population



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DuPont™ Matrix®

herbicide

DRY FLOWABLE

*For Weed Control In Potatoes, Potatoes
grown for seed and field grown Tomatoes*

<i>Active Ingredients</i>	<i>By Weight</i>
Rimsulfuron	
N-((4,6-dimethoxypyrimidin-2-yl) aminocarbonyl)-3-(ethylsulfonyl)- 2-pyridinesulfonamide	25.0%
<i>Inert Ingredients</i>	75.0%
TOTAL	100.0%

EPA REG. NO. 352-556

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID

IF IN EYES:

- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor for treatment advice.

IF ON SKIN OR CLOTHING:

- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20

PRECAUTIONARY STATEMENTS

HAZARD TO HUMANS AND DOMESTIC ANIMALS

CAUTION! Causes moderate eye irritation. Harmful if absorbed through skin. Avoid contact with skin, eyes, or clothing. Avoid breathing dust or spray mist.

PERSONAL PROTECTIVE EQUIPMENT

Some of the materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category A on an EPA chemical-resistant category selection chart.

Applicators and other handlers must wear:

Long-sleeve shirt and long pants.

Chemical resistant gloves made of any water proof material such as polyethylene or polyvinylchloride. Shoes plus socks.

Discard clothing and other absorbent material that have been drenched or heavily contaminated with this product.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

ENGINEERING CONTROL STATEMENTS

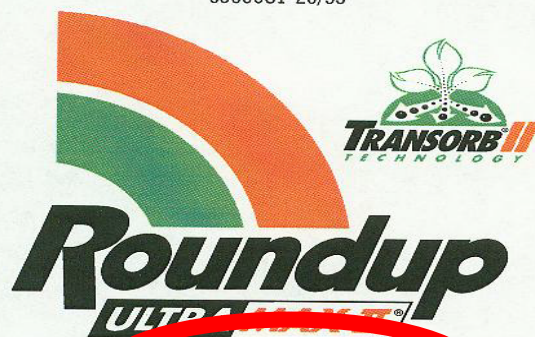
When handlers use closed systems, enclosed cabs or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR part 170 Section 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.



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- Although this label may appear similar to the label on a product you are now using, it has important differences. You must have the EPA-approved labeling with you at the time of use and must read and follow all label directions.
- You should not base any use of a similar product on the precautions, instructions for use or other information you find here.
- Always follow the precautions and instructions for use on the label of the pesticide you are using.

63006C1-20/53



HERBICIDE

GROUP 9 HERBICIDE

Complete Directions for Use

For control of annual and perennial weeds in Colorado, Idaho, Kansas*, Minnesota*, Montana, Nebraska*, Nevada, New Mexico*, North Dakota, Oklahoma*, Oregon, South Dakota, Texas*, Utah, Washington and Wyoming.

EPA Reg. No. 524-537

2004-2

AVOID CONTACT OF HERBICIDE WITH FOLIAGE, GREEN STEMS, EXPOSED NON-WOODY ROOTS OR FRUIT OF CROPS (EXCEPT AS SPECIFIED FOR INDIVIDUAL ROUNDUP READY® CROPS), DESIRABLE PLANTS AND TREES, BECAUSE SEVERE INJURY OR DESTRUCTION MAY RESULT.

Herbicide for Roundup Ready Crops.

Selective broad-spectrum weed control in Roundup Ready crops.
Non-selective, broad-spectrum weed control for many agricultural systems and farmsteads.

For control of annual and perennial weeds in Colorado, Idaho, Kansas*, Minnesota*, Montana, Nebraska*, Nevada, New Mexico*, North Dakota, Oklahoma*, Oregon, South Dakota, Texas*, Utah, Washington and Wyoming.

*COUNTY DISTRIBUTION

In KANSAS, MINNESOTA, NEBRASKA, NEW MEXICO, OKLAHOMA and TEXAS, this product can be used **ONLY** in those counties listed below:

KANSAS:

Barber, Barton, Butler, Chautauqua, Cheyenne, Clark, Cloud, Comanche, Cowley, Decatur, Edwards, Elk, Ellis, Ellsworth, Finney, Ford, Gove, Graham, Grant, Gray, Greeley, Greenwood, Hamilton, Harper, Harvey, Haskell, Hodgeman, Jewell, Kearny, Kingman, Kiowa, Lane, Lincoln, Logan, McPherson, Meade, Mitchell, Morton, Ness, Norton, Osborne, Ottawa, Pawnee, Phillips, Pratt, Rawlins, Reno, Republic, Rice, Rooks, Rush, Russell, Saline, Scott, Sedgwick, Seward, Sheridan, Sherman, Smith, Stafford, Stanton, Stevens, Sumner, Thomas, Trego, Wallace, Wichita

MINNESOTA:

Becker, Clay, Douglas, Kittson, Lake Of The Woods, Mahanomen, Marshall, Norman, Otter Tail, Pennington, Polk, Red Lake, Roseau, Wilkin

NEBRASKA:

Arthur, Banner, Box Butte, Chase, Cheyenne, Custer, Dawes, Dawson, Deuel, Dundee, Frontier, Furnas, Garden, Gosper, Grant, Hayes, Hitchcock, Hooker, Keith, Kimball, Lincoln, Logan, McPherson, Morrill, Perkins, Red Willow, Scotts Bluff, Sheridan, Sioux, Thomas

NEW MEXICO:

Colfax, Rio Arriba, San Juan, Taos, Union

Read the entire label before using this product.

Use only according to label instructions.

Read the "LIMIT OF WARRANTY AND LIABILITY" statement at the end of the label before buying or using. If terms are not acceptable, return at once unopened.

THIS IS AN END-USE PRODUCT. MONSANTO DOES NOT INTEND AND HAS NOT REGISTERED IT FOR REFORMULATION. SEE INDIVIDUAL CONTAINER LABEL FOR REPACKAGING LIMITATIONS.

1.0 INGREDIENTS

ACTIVE INGREDIENT:

*Glyphosate, N-(phosphonomethyl)glycine, in the form of its potassium salt	48.8%
OTHER INGREDIENTS:	51.2%
	100.0%

Contains 660 grams per liter or 5.5 pounds per U.S. gallon of the active ingredient glyphosate, in the form of its potassium salt. Equivalent to 540 grams per liter or 4.5 pounds per U.S. gallon.

This product is protected by U.S. Patent No's. 5,668,085 and 6,365,551. Other Patents Pending. No license granted under any non-U.S. patent(s).

2.0 IMPORTANT PHONE NUMBERS

1. FOR PRODUCT INFORMATION OR ASSISTANCE IN USING THIS PRODUCT, CALL TOLL-FREE.

1-800-332-3111

2. IN CASE OF AN EMERGENCY INVOLVING THIS HERBICIDE PRODUCT, OR FOR MEDICAL ASSISTANCE, CALL COLLECT, DAY OR NIGHT.

(314)-694-4000

3.0 PRECAUTIONARY STATEMENTS

3.1 Hazards to Humans and Domestic Animals

Keep out of reach of children.

CAUTION!

CAUSES MODERATE EYE IRRITATION.

HARMFUL IF INHALED.

Avoid contact with eyes, skin, or clothing.

Avoid breathing vapor or spray mist.

FIRST AID: Call a poison control center or doctor for treatment advice.	
IF IN EYES	<ul style="list-style-type: none">• Hold eye open and rinse slowly and gently with water for 15 to 20 minutes.• Remove contact lenses if present after the first 5 minutes then continue rinsing eye.
IF ON SKIN	<ul style="list-style-type: none">• Take off contaminated clothing.• Rinse skin immediately with plenty of water for 15 to 20 minutes.
IF INHALED	<ul style="list-style-type: none">• Move person to fresh air.• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth, if possible.

- Have the product container or label with you when calling a poison control center or doctor, or going for treatment.
- This product is identified as **Roundup UltraMAX II® herbicide, EPA Registration No. 524-537.**
- You may also contact (314) 694-4000, collect day or night, for emergency medical treatment information.

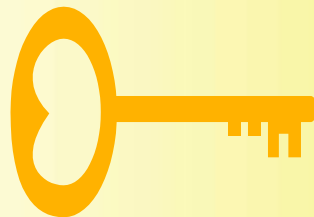
DOMESTIC ANIMALS: This product is considered to be relatively non-toxic to dogs and other domestic animals, however, ingestion of this product is



**Can you manage to prevent
herbicide resistant weeds?**



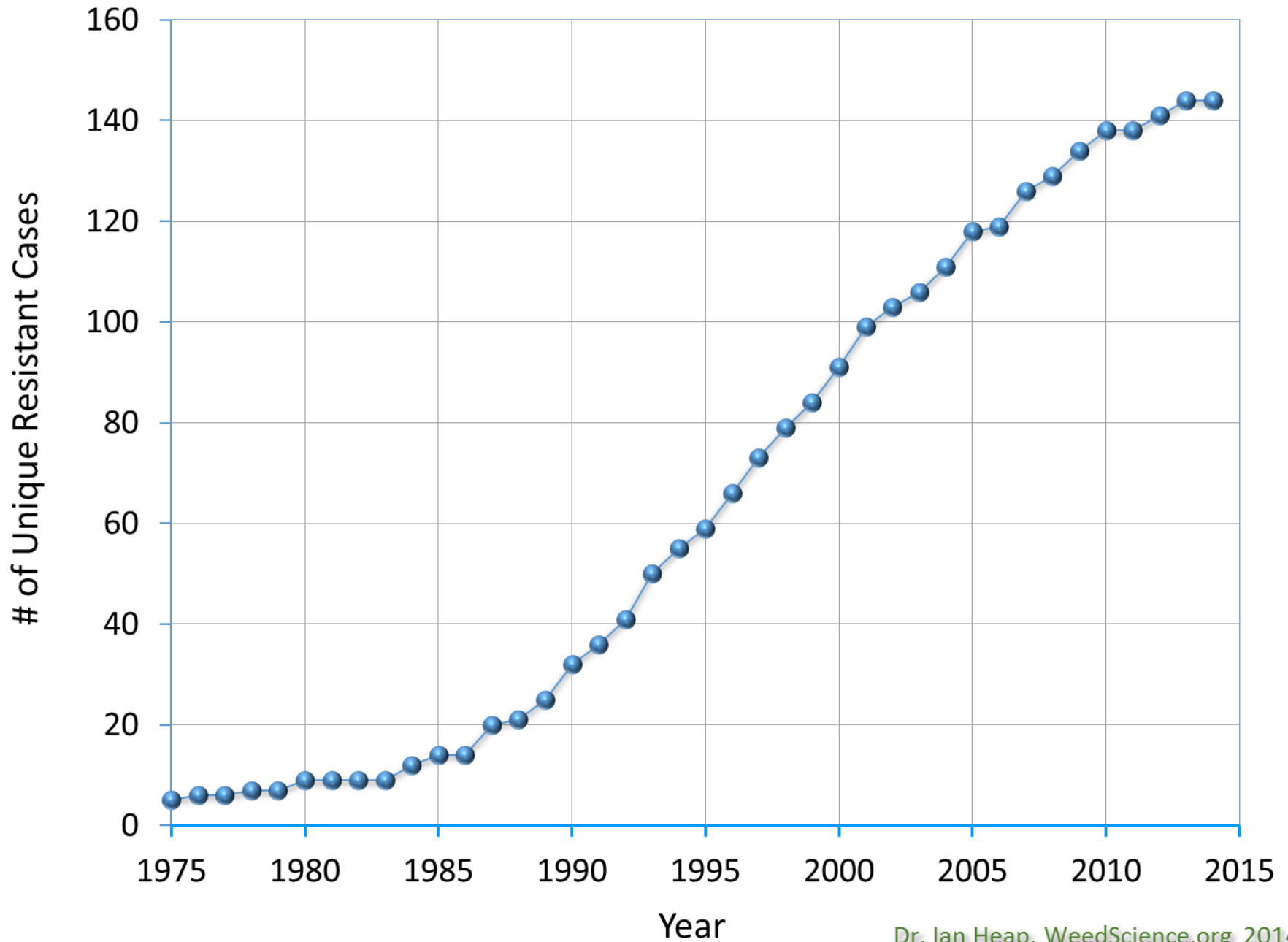
*Knowing the mode of action/
pesticide class is the key to
planning a management strategy to
reduce the potential for developing
resistant pest populations*



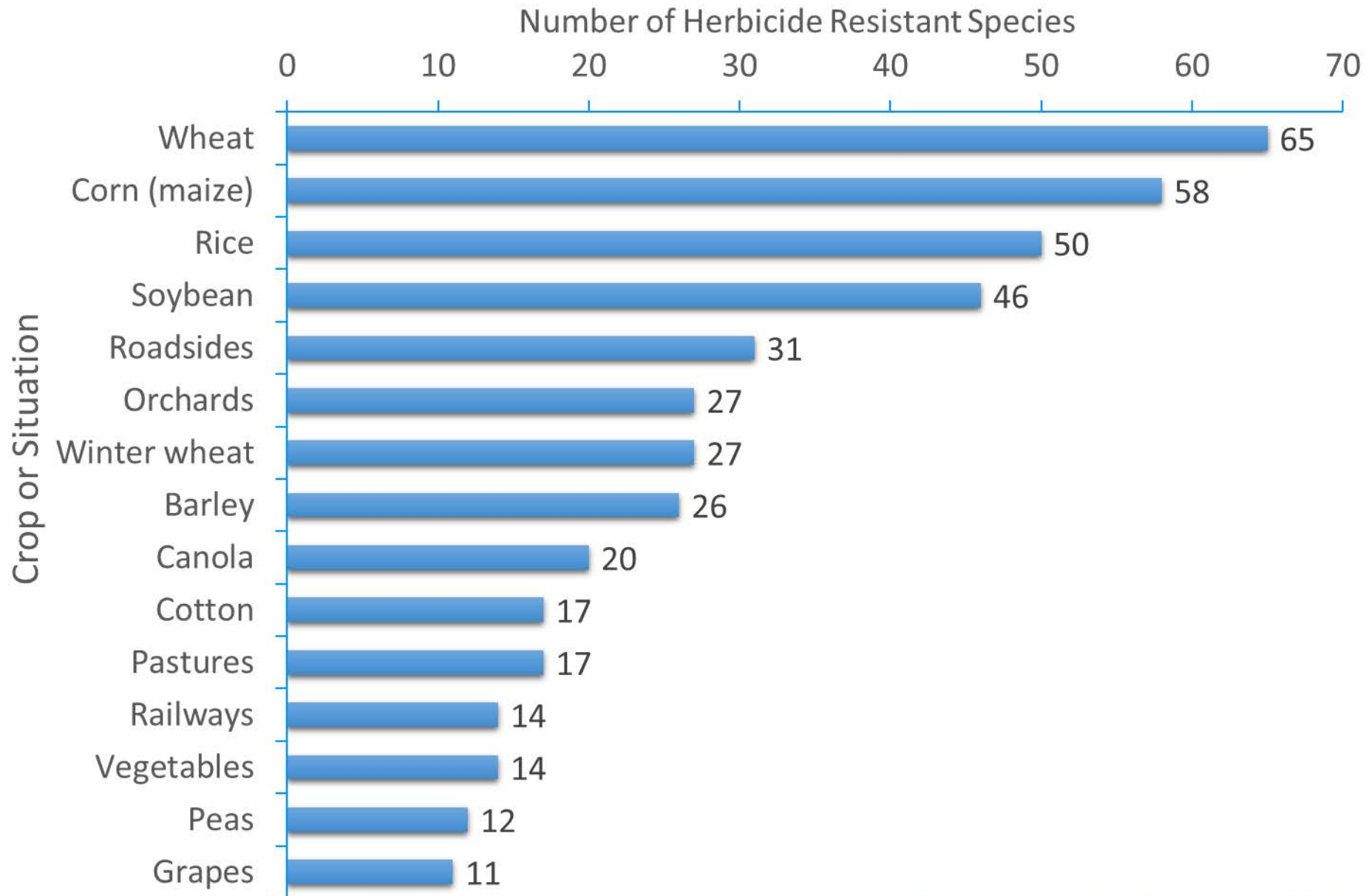


WEED RESISTANCE—A HORROR STORY

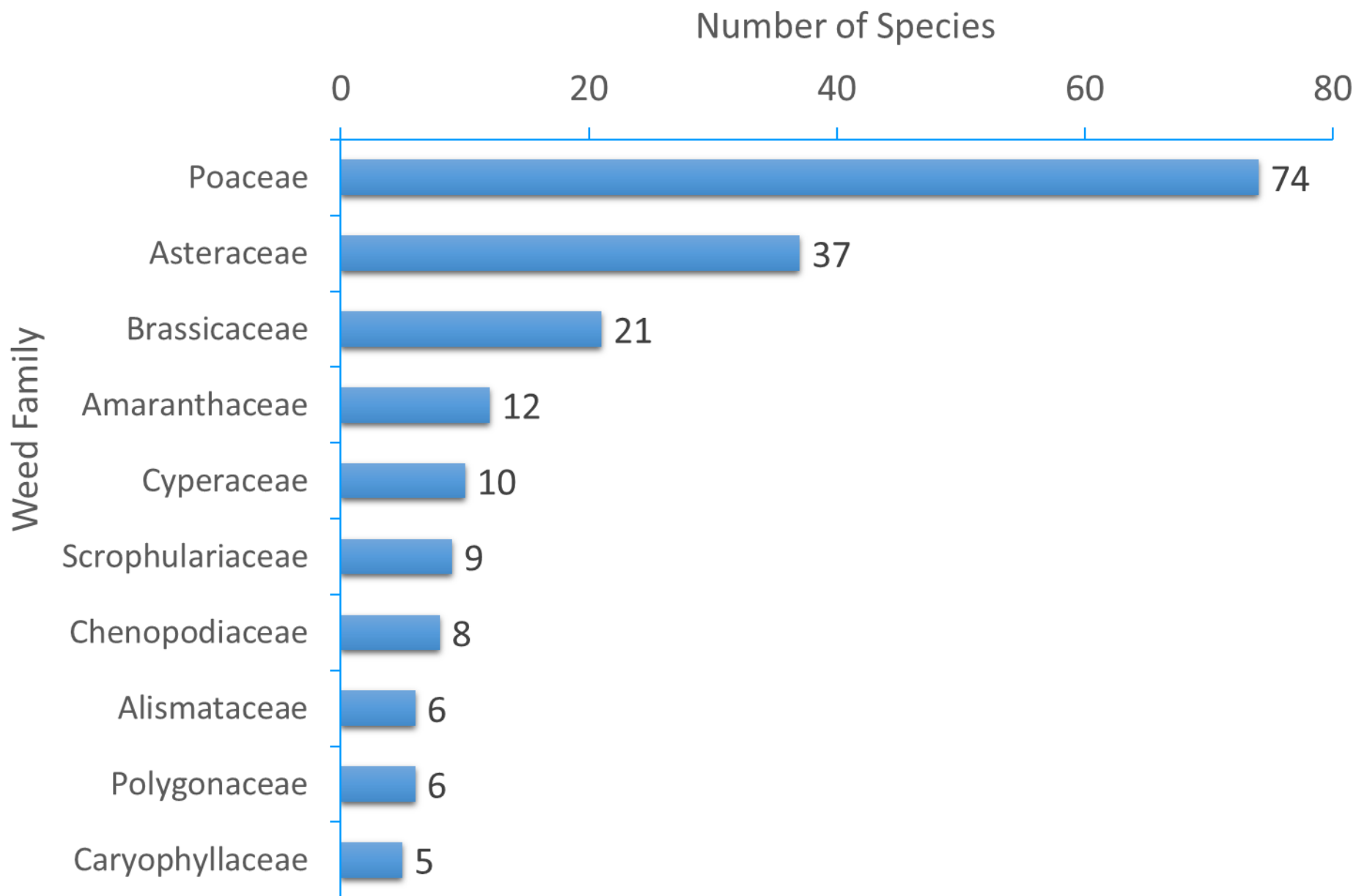
Increase in Unique Herbicide Resistant Weed Cases in the USA



Number of Herbicide-Resistant Weed Species by Crop



Herbicide Resistant Weed Species by Weed Family (Top 10)





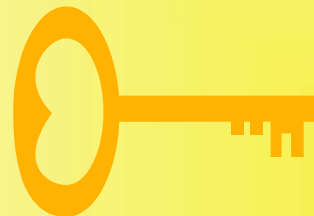
Herbicide Resistance Management Strategies

- Know your herbicide classes
- Maintain herbicide/weed control histories
- Use integrated weed management
 - rotate crops/herbicides, use different cultural practices, competitive healthy crop
- Tank-mix herbicides with different MOA's
 - overlapping spectrum
 - economics
- Use short residual herbicides if possible
 - reduces selection of resistant weeds



Herbicide Resistance Management Strategies

- **Scout - before and after application**
 - Use appropriate pesticides, as necessary
 - Do something about weed escapes/shifts
- **Accurate pesticide application**
- **Sanitation - prevent spread**
 - Clean equipment before moving
 - Screen irrigation water

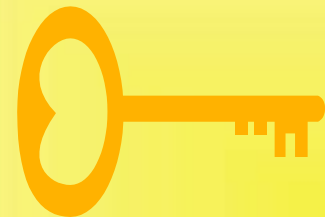




Herbicide Resistance Management Strategies

Plan your herbicide rotations and tank mixtures carefully and make herbicide resistance management a key part of those plans – *as important as your choices for*

- **weed control**
- **crop safety**
- **follow crop concerns**
- **economics**





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Grower “IF” Questions

- If the same herbicide or class of herbicides has been used in the field for sequential/several years
- If the suspected resistant weed species has been controlled effectively in the past
- If weed control is good on all the other labeled weed species

***If the answers are “Yes”
then maybe resistance is involved***



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What to do...

If you suspect herbicide resistance:

- Do not re-spray the field with the same herbicide or herbicide class - control the weed with another means
- do not allow seed to mature
- Report your suspicion to university research/extension personnel/extension educator/crop advisor
- Collect plants or seed that can be used to confirm resistance has developed



BEST MANAGEMENT PRACTICES

- Use a diversified approach to weed management focused on reducing weed seed production
- Scout fields routinely
- Use multiple effective MOAs against the most troublesome weeds
- Use mechanical and biological management where appropriate



BEST MANAGEMENT PRACTICES

- Apply the labeled herbicide rate at recommended weed sizes
- Use cultural management techniques that suppress weeds by using crop competitiveness
 - Seeding rates, fertilizer placement, planting dates



Glyphosate Resistance Management

- Glyphosate is not a substitute for integrated weed management practices
- Do not use the same MOA more than once in three years
- Rotation away from glyphosate for 1 year is a weak resistance management strategy



Glyphosate Resistance Management

- Avoid planting other RR crops (corn, alfalfa) and using glyphosate in consecutive years
- Avoid using glyphosate as a “clean sweep” application in other rotational crops



Roundup PowerMax	✓
Roundup Ultra	
Makaze (Loveland)	
Glyfos X-Tra (Cheminova)	
Cornerstone Plus (Agrisolutions)	
Cornerstone 5 Plus (Agrisolutions)	✓
Touchdown CT2 (Syngenta)	
Touchdown HiTech (Syngenta)	✓



Recommendations

- Use integrated weed management practices
 - Chemical, cultural, and mechanical
- Rotate herbicide modes/mechanisms of action
- Apply the labeled herbicide rate at recommended weed sizes
- Rotate crops and herbicides
- ***Keep accurate records of herbicide use***



OnePlan Pesticide Application Recordkeeping



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What is OnePlan PAR?

- Easy to use way to keep required pesticide application records
- Electronic and permanent record keeping
- Site specific to each application
- Secure record keeping
- Records sorting features
- Soil Fumigant Management Plans



www.OnePlan.org/PAR

- Computerized Web Application
 - Calculations made easy
 - Enter data once
 - Everything in one place
- Complete Records
 - ISDA Records
 - 1.WPS Requirements
 - 2.RUP Application Records



Locate and Describe each Field on Your Operation



Field 2	Potato	08/15/2009	1/18/2011	Edit	In use
Field 2	Wheat, winter	07/1/2008	8/15/2009	Edit	In use
Field 2	Wheat, winter	07/1/2007	7/1/2008	Edit	In use
Field 2	Alfalfa, seed	07/1/2006	7/1/2007	Edit	Del
Field 2	Beans, seed or dry	09/1/2005	7/1/2006	Edit	Del
Field 3	Alfalfa	09/30/2010	Current	Edit	Del
Field 3	Alfalfa, grass mix	09/1/2008	9/30/2010	Edit	In use
Field 3	Beans, seed or dry	08/1/2007	7/1/2008	Edit	In use
Field 3	Wheat, winter	07/1/2006	8/1/2007	Edit	Del
Field 3	Alfalfa, seed	09/1/2005	7/1/2006	Edit	Del
Field 4	Potato	08/15/2010	Current	Edit	Del
Field 4	Wheat, winter	11/15/2009	8/15/2010	Edit	Del
Field 4	Potato	07/1/2008	11/15/2009	Edit	In use
Field 4	Wheat, winter	07/1/2007	7/1/2008	Edit	In use
Field 4	Alfalfa, seed	07/1/2006	7/1/2007	Edit	Del
Field 4	Alfalfa, seed	09/1/2005	7/1/2006	Edit	Del
Field 5	Potato	01/18/2011	Current	Edit	Del
Field 5	Potato	07/15/2009	1/18/2011	Edit	In use
Field 5	Wheat, winter	07/1/2008	7/15/2009	Edit	In use
Field 5	Wheat, winter	07/1/2007	7/1/2008	Edit	In use
Field 5	Beans, seed or dry	07/1/2006	7/1/2007	Edit	Del
Field 5	Wheat, winter	09/1/2005	7/1/2006	Edit	Del
Field 6	Wheat, winter	11/30/2010	Current	Edit	Del

Fill in crop history for each field



Initiate a Work Order

Enter Date and Time of Application

Workorder number: 1111280

1. Scheduled start, finish, and Applicator

Scheduled start

Scheduled finish:

Applicator:

◀ November 2011 ▶

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

2. Specify Crop:

3. Specify Field:

4. Specify Type:

Zone of application:

Mode of application:



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Specify the target crop from your drop
down list

2. Specify Crop:

Potato

3. Specify Fields

4. Specify Type of

Zone of application

Mode of application:

Select...

Alfalfa, grass mix

Alfalfa, seed

Potato

Sugarbeet

Wheat, winter

☐ Band ☐ Spot

☒ Spray (liquid) ☐ Dry (granular)



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Select the fields of that crop for
this application

2. Specify Crop: Potato

3. Specify Fields

<input checked="" type="checkbox"/>	Field	Acres	Area to treat	Applic. area
<input checked="" type="checkbox"/>	Field 3	12	12	12.00
<input checked="" type="checkbox"/>	Field 10	13.93	13.93	13.93
			Total acres:	25.93

6. Specify pests targeted by this application (optional):

Target pests	
Aphids	Delete
Select a pest... ▼	Add

Select a pest...
Weeds
Aphids
Cabbage looper
Colorado Potato Beetle
Potato Leafhopper
Spider mite
Tuberworms
Wireworms
Nematodes
Bacterial Soft Rot
Common Scab

ply: [\(edit Products\)](#)

Rate/acre		Total product		
	oz ▼		oz ▼	Add

clude: [\(edit adjuvants\)](#)

Rate/acre		Total adjuvant		
	oz ▼		oz ▼	Add

Select the
target
pests from
your list

7. Specify Product(s) to apply: [\(edit Products\)](#)

Product name	Rate/acre	Total product		
Dimethoate 4EC	2.0 pt	11.28 gal	Edit	Del
Endosulfan 3EC	1.0 pt	5.64 gal	Edit	Del
Select a product...	<input type="text"/> fl oz	<input type="text"/> fl oz	Add	

Select a product...

638 Herbicide
 Acramite
 Admire 2F
 Admire Pro
 Agree
 Agri-Mek
 Apron
 Asana
 Assail 30 SG
 Buctril 2EC
 Carbaryl 4L
 Carbaryl 4L
 Comite
 Di-Syston
 Dibrom
 Diox

t(s) to include: [\(edit adjuvants\)](#)

	Rate/acre	Rate/100 gal	Total adjuvant		
	0.4 fl oz	2.0 fl oz	1.13 pt	Edit	Del
	0.2 fl oz	1.0 fl oz	9.03 fl oz	Edit	Del
	6.4 fl oz	2.0 pt	2.26 gal	Edit	Del
<input type="text"/>	<input type="text"/> fl oz	<input type="text"/> fl oz	<input type="text"/> fl oz	Add	

otes:

8. Specify adjuvant(s) to include: [\(edit adjuvants\)](#)

Adjuvant name	Rate/acre	Rate/100 gal	Total adjuvant		
Ballast	0.4 fl oz	2.0 fl oz	1.13 pt	Edit	Del
Fighter F	0.2 fl oz	1.0 fl oz	9.03 fl oz	Edit	Del
Class Act	6.4 fl oz	2.0 pt	2.26 gal	Edit	Del
Select an adjuvant... ▼	<input type="text"/>	fl oz ▼	<input type="text"/>	fl oz ▼	<input type="text"/> fl oz ▼
					Add

- Select an adjuvant..
- 17% Concentrate
- Activator 90
- AMS
- Class Act
- Destiny
- Dyne-Amic
- Fast Break
- Herbimax
- UAN 32

es:

When required data are entered, [Review](#) the completed workorder before issuing.

You can [Save](#) what you've entered and continue editing later, or [Discard](#) this entry.

Application Type and Equipment

Zone: Full coverage

Mode: Spray (liquid)

Applicator Equipment: Broadcast Sprayer

Speed (mph): 6

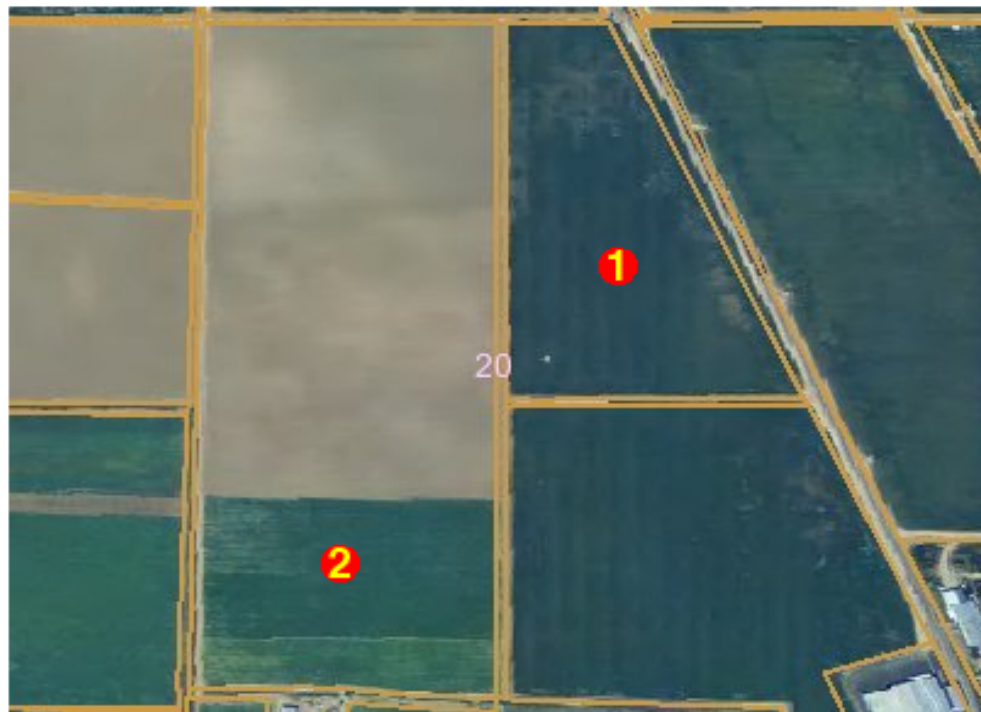
Mix per acre (gal): 20.0

Tank capacity (gal): 300

Nozzles/settings: 8004 Nozzles on 20 inch centers

Nozzle pressure (psi): 35

Notes



Application Site Information

Wind speed:

Temperature:

Wind direction:

Rel. humidity:

Weather:

Soil condition:

Applicator notes

	Field	Acres	Area to treat	Applic. area	Lat/Lon
1	Field 10 T4N R2W S20	13.93	13.93	13.93	43.66791, -116.60188
2	Field 3 T4N R2W S20	12.0	12.0	12.0	43.66516, -116.60439
			Total acres:	25.93	

Finished Work Order

Workorder number: 1011170

Issued: Wednesday November 17, 2010

Crop: Potato

What did I
actually do?

1. Application start, finish, and Applicator

Specified

Actual

Start: Nov. 17, 2010 9:00 AM ☒ AM ☐ PM

Finish: Nov. 17, 2010 1:00 PM ☐ AM ☒ PM

Applicator: Wayne Newbill

▼

≤	November 2010						≥
Su	Mo	Tu	We	Th	Fr	Sa	
<u>31</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	
<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	
<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	
<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	
<u>28</u>	<u>29</u>	<u>30</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	

2. Fields

Specified

Field	Area (ac)	Applic. area
Field 1	22.83	11.415
Field 2	30.67	15.335
Field 5	19.98	9.99
HQ2	16.78	8.39
	Total acres:	45.13

Actual

<input checked="" type="checkbox"/>	Field	Area (ac)	Applic. area
<input checked="" type="checkbox"/>	Field 1	22.83	11.42
<input checked="" type="checkbox"/>	Field 2	30.67	15.34
<input checked="" type="checkbox"/>	Field 5	19.98	9.99
<input checked="" type="checkbox"/>	HQ2	16.78	8.39
		Total acres:	45.13

3. Type of Application

Specified

Zone: Band application

Actual

Zone of application: ☐ Full coverage ☒ Band ☐ Spot

Band width: in. Row width: in. O.C.

Application Reports

[Home](#)

You are logged
in as Wayne
Newbill

[Operation summary](#)[Workorder reports](#)Product Application Records *Operator: Wayne Newbill*
☒ Show all ☐ Restricted Use only
Select by Farm Unit: Select...
 Select by year: Select... Select by field: Select... Select by crop: Select...

Select...

 Alfalfa, seed
 Beans, seed or dry
 Garden Beans
 Potato
 Sugarbeet
 Wheat, winter

All application records for all farm units of the operation

Date	W.O. Num.	Product	RU	EPA Reg. #	Rate/ac.	Total			Crop	Zone
7/17/2008	8071740	Phorate 20G	<input checked="" type="checkbox"/>	2749-521	2.0 lb	45.66 lb			Wheat, winter	Full
7/31/2008	807310	Admire Pro	<input type="checkbox"/>	264-827	6.0 oz	1.07 gal	Field 1	22.8	Wheat, winter	Full
		Dimethoate 4EC	<input type="checkbox"/>	5905-493	2.0 pt	5.71 gal	Field 1	22.8	Wheat, winter	Full
7/17/2008	8071740	Furadan	<input checked="" type="checkbox"/>	279-2876	1.75 pt	4.99 gal	Field 1	22.8	Wheat, winter	Full
8/1/2008	8071516	Admire Pro	<input type="checkbox"/>	264-827	6.0 oz	1.07 gal	Field 1	22.8	Wheat, winter	Full
		Agri-Mek	<input checked="" type="checkbox"/>	100-898-618	4.0 oz	5.71 pt	Field 1	22.8	Wheat, winter	Full
		Furadan	<input checked="" type="checkbox"/>	279-2876	2.18 pt	6.21 gal	Field 1	22.8	Wheat, winter	Full
6/25/2008	806240	Lannate SP	<input checked="" type="checkbox"/>	352-342	2.0 pt	5.71 gal	Field 1	22.8	Wheat, winter	Full
5/1/2008	806104	Admire Pro	<input type="checkbox"/>	264-827	6.0 oz	1.71 pt	Field 1	4.6	Wheat, winter	Band
		Dimethoate 4EC	<input type="checkbox"/>	5905-493	2.18 pt	1.24 gal	Field 1	4.6	Wheat, winter	Band
6/25/2008	806240	Dimethoate 4EC	<input type="checkbox"/>	5905-493	2.0 oz	2.85 pt	Field 1	22.8	Wheat, winter	Full
		Admire Pro	<input type="checkbox"/>	264-827	6.0 oz	1.07 gal	Field 1	22.8	Wheat, winter	Full
		Furadan	<input checked="" type="checkbox"/>	279-2876	2.0 pt	5.71 gal	Field 1	22.8	Wheat, winter	Full
		Torrent 2F	<input type="checkbox"/>	60063-31	1.0 pt	2.85 gal	Field 1	22.8	Wheat, winter	Full
5/1/2008	806104	Admire Pro	<input type="checkbox"/>	264-827	6.0 oz	2.3 pt	Field 2	6.1	Wheat, winter	Band

**Sort
records:**
RUP
Field
Date
Crop



Keep detailed records on field by field basis

- Maintaining detailed and accurate pesticide records helps with the farm's management and operational plans
 - ✓ **Pest problems**
 - ✓ **Crop rotations**
 - ✓ **Pesticide classes/MOA**





What Herbicides Are You Using???

Potato

Poast 1
Matrix 2
Prowl, Treflan 3
Metribuzin 5
Eptam 8
Dual, Outlook 15
Chateau 14

Other crops?

Herbicide Mode of
Action (color code or
numerical code)



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Factors that increase likelihood of resistance

- ✓ Little or no cultivation or tillage for weed control
- ✓ Failing to eliminate “escaped” weeds
- ✓ Continuous or repeated use of single herbicide OR several with same mode of action
- ✓ High herbicide dose
- ✓ Perennial cropping systems/no crop rotation



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Resistance Management

- Use “*integrated pest management*”
- Scout fields routinely
- Rotate pesticides/use multiple MOAs
- Keep accurate pesticide records on a regular basis





QUESTIONS?