

HERBICIDE RESISTANCE UPDATE

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OUTLINE

- 1 NEW PRODUCTS AND LABEL UPDATES
- 2 MORE HERBICIDE RESISTANCE
- 3 RESIDUAL PROGRAMS THAT WORK

XTEND CHALLENGES

- US District Court in AZ ruled the EPA violated FIFRA notice and comment mandates
 - Court did NOT find ESA violations
- The labels for XtendiMax, Engenia, and Tavium were vacated
- EPA issued cancellation order allowing sale and use of products already in the distribution system
 - Sell by May 31 (soy) or June 30 (cotton)
 - Apply by June 30 (soy) or July 30 (cotton)

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Storen Syngenta

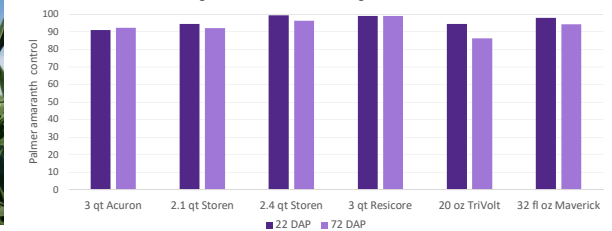
Bicyclopyrone + mesotrione + pyroxasulfone + S-metolachlor

Preplant (up to 28 days before planting) or preemergence

Postemergence (up to V8 corn or 3" weeds)

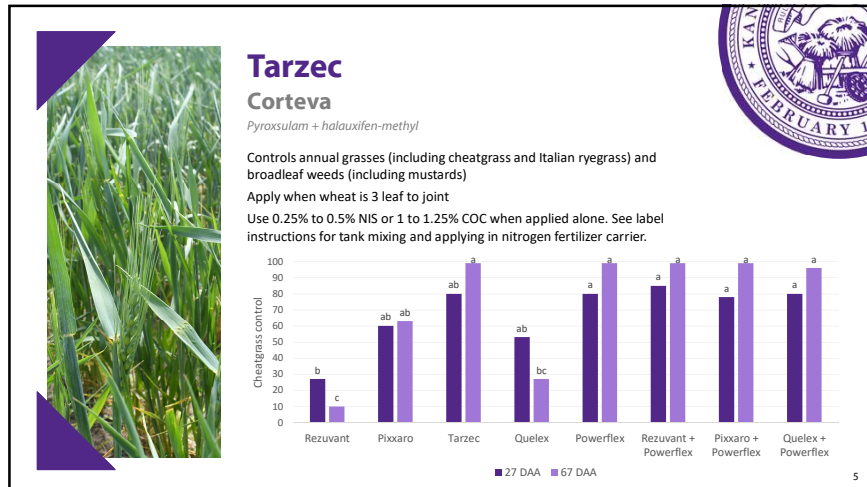
Split application

COC or MSO before corn emergence; NIS after corn emergence



All except Acuron applied with 0.75 lbs atrazine. No statistical differences among treatments ($\alpha = 0.05$)

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ATRAZINE LABEL CHANGES

Section 24(c) – Special Local Needs labels not renewed
Wheat-Fallow rotations only labeled non-crop use

AATREX 4L ALONE – CHEMICAL FALLOW

Do not apply more than 2.25 lb ai/A for any application and do not apply more than one application per year. Users must only apply to fallow land in the following states according to the prescribed rotation pattern in the table below:

Fallow Rotation Pattern	Fallow Use Authorized in these States only
Wheat-Corn-Fallow	CO, KS, ND, NE, SD & WY
Wheat-Fallow-Wheat	CO, KS, ND, NE, SD & WY
Wheat-Sorghum-Fallow	AR, CO, GA, IL, KS, LA, MS, MO, NE, NM, NC, OK, SD & TX

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WHAT IS THE ESA?

Enacted in the 1973

- Protects listed species and their habitats

~1,800 listed species & 900 habitats

- Determined by FWS and National Marine Fisheries Service

~Half plants
40 % in Hawaii



Mead's milkweed

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ESA COMPLIANCE REQUIRES COOPERATION FROM SEVERAL ENTITIES



Agrichemical Companies
Seek registration



EPA, USDA
Evaluate risk;
Approve registration




FWS, NOAA
Ensure no jeopardy
from action



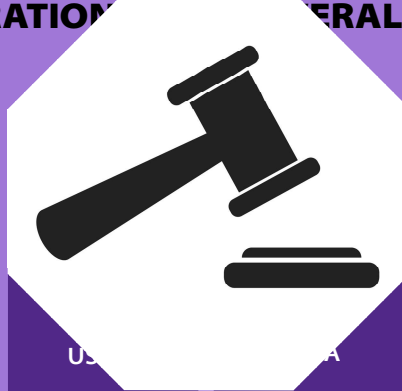
End Users
Judicious
applications

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ESA COMPLIANCE REQUIRES COOPERATION FROM SEVERAL ENTITIES



Agrichemical Companies




U.S. EPA



End Users

THE CURRENT DILEMMA

Court removal of tools



Additional regulations

IS THERE PRECEDENT?

Management of Rural Land


On rural land, the owner must consider the potential impact of the use of the land on the environment. The owner must consider the potential impact of the use of the land on the environment. The owner must consider the potential impact of the use of the land on the environment.

Endangered Species

Bulletins Live! Two

Protection of Sensitive Areas

Applicator must maintain a 30 foot downwind buffer (in the direction in which the wind is blowing) from any area except:



American burying beetle

HERBICIDE STRATEGY

Focused on agricultural uses of conventional herbicides

Goals

- Reduce the likelihood of "jeopardy" or "adverse modification" findings
- Increase the efficiency of consultations with FWS

Final version should come out in August 2024

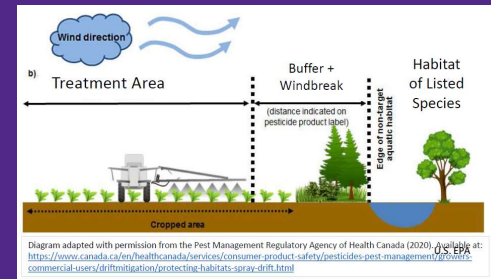
- Labels could start changing in 2025

Exemption from Mitigation

1. Follow recommendations from conservation specialist or certified expert to reduce runoff/erosion.
 - Characteristics of these recommendations or programs are currently under development
2. Field is more than 1,000 feet away from a terrestrial or aquatic habitat for listed species
3. Field has subsurface drainage or tile drains installed – runoff must be controlled

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SPRAY DRIFT MITIGATION



Buffers

Additional mitigations

- Windbreak
- Hooded sprayer
- Coarse droplet size
- Using the minimum effective rate
- Lower %RH and wind speed

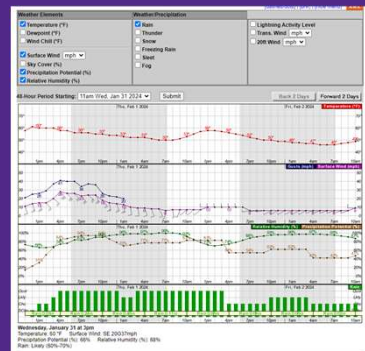
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RUNOFF/EROSION MITIGATION

All labels:

- Do not spray if soil is saturated
- Do not spray if >50% chance of >1 inch rainfall within 48 hours

<https://www.weather.gov/>



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RUNOFF/EROSION MITIGATION

Mitigation Menu of Options

Herbicides will require different mitigation points based on environment and use

Will use NRCS standards

Mitigations proposed in Draft Herbicide Strategy

Field Characteristics	Application	Field management	Adjacent to field	Other
West of I-35	Use lowest effective rate	Contour farming	Riparian area	Water retention
Sandy soil	Incorporation	Cover crop	Vegetated ditch	
Slope <2%		Filter strip	Filter strips	
		Reduced tillage		
		Terraces		

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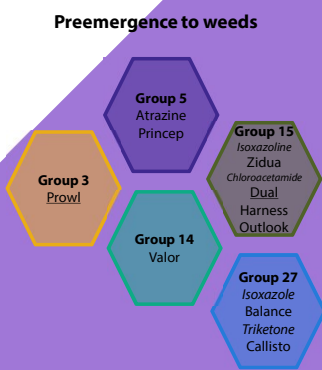
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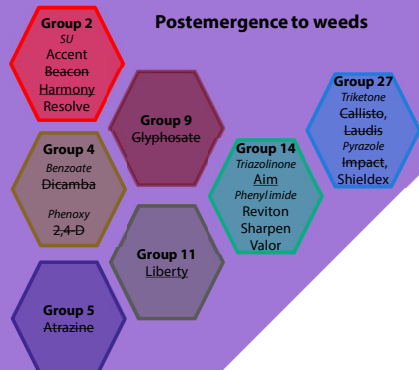
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HERBICIDES FOR PALMER AMARANTH CONTROL IN CORN

Preemergence to weeds



Postemergence to weeds



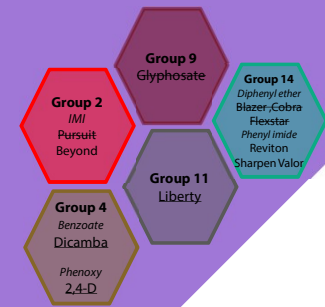
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HERBICIDES FOR PALMER AMARANTH CONTROL IN SOYBEAN

Preemergence to weeds



Postemergence to weeds



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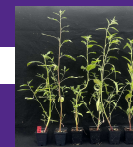
HERBICIDE RESISTANCE IN WATERHEMP

Herbicide group (example herbicide)	Number of cases	Year (and state) of first report	Year of first report in KS
9, EPSPS inhibitor (glyphosate)	27	2005 (MO)	2006
2, ALS inhibitors (Beyond, Harmony, Glean, Pursuit)	27	1993 (IL, IA)	1995
5, PSII inhibitors (atrazine, metribuzin)	15	1994 (MO)	1995
14, PPO inhibitors (Reflex, Cobra)	12	2001 (KS)	2001
27, HPPD inhibitors (Callisto, Laudis, Impact)	6	2009 (IL)	Not yet
4, Growth regulators (2,4-D, dicamba)	3	2009 (NE)	Not yet
15, VLCFA inhibitors (Dual, Harness, Outlook, Zidua)	1	2016 (IL)	Not yet
10, Glutamine synthetase inhibitor (Liberty)			??

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WATERHEMP 21 DAA



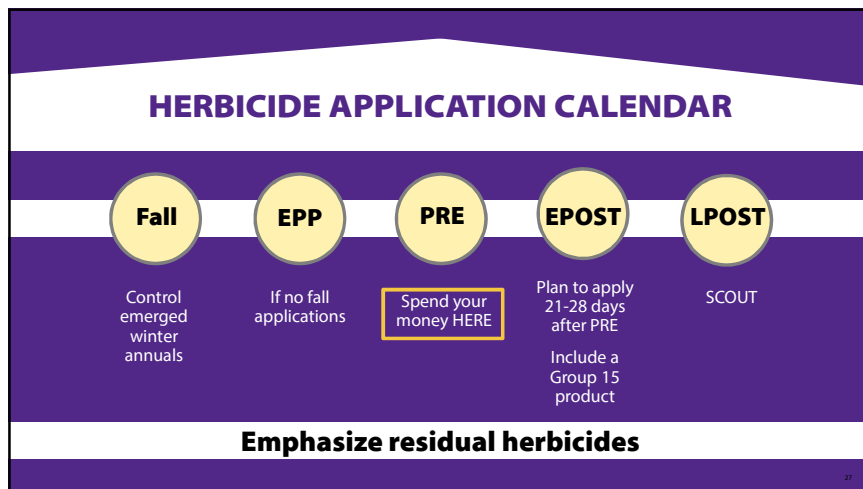
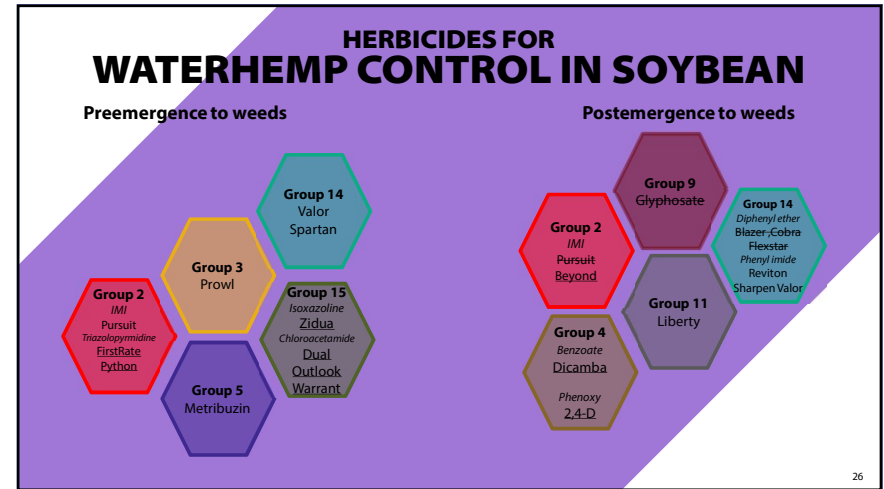
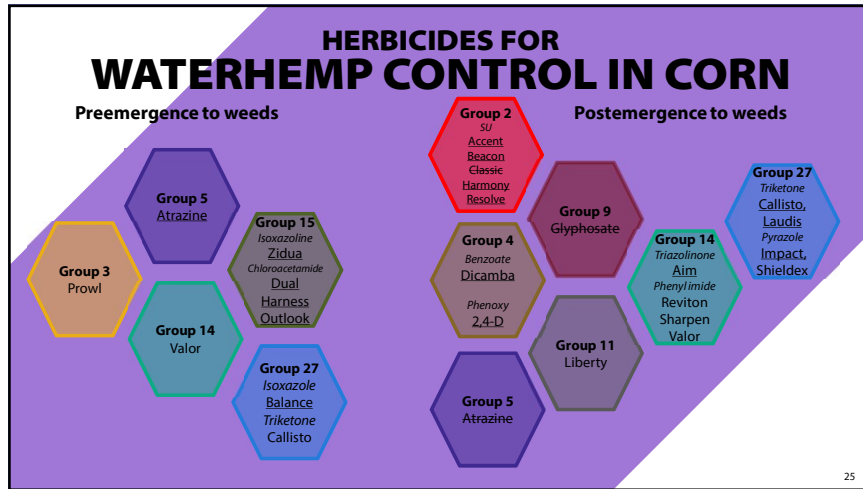
Nontreated



64 fl oz Liberty



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PREEMERGENCE HERBICIDE OPTIONS IN CORN

Herbicide (Product)	Group	Rate	Rating*	Comments
Atrazine	5	0.75 to 2 lbs	Better	
Pyroxasulfone (Zidua)	15	2.5 to 6.5 fl oz	Best	0.5" rain
S-metolachlor (Dual)	15	1 to 2 pts	Good	0.5 to 1" rain
Acetochlor (Harness)	15	1.25 to 3 pts	Good	0.25 to 0.75" rain
Dimethenamid-P (Outlook)	15	12 to 21 fl oz	Good	
Mesotrione (Callisto)	27	3 to 7.7 fl oz	Better	
Isoxaflutole (Balance Flexx)	27	3 to 6 fl oz	Best	Applied with atrazine

*Assuming a susceptible population

Basic formula: Group 15 + atrazine + Group 27 (or other)

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PREEMERGENCE HERBICIDE OPTIONS IN SOYBEAN

Herbicide (Product)	Group	Rate	Rating*	Comments
Metribuzin	5	0.5 to 1 lb	Better	
Pyroxasulfone (Zidua)	15	2.5 to 6.5 fl oz	Better	0.5" rain
S-metolachlor (Dual)	15	1 to 2 pts	Good	0.5 to 1" rain
Acetochlor (Warrant)	15	1.25 to 3 pts	Good	0.25 to 0.75" rain
Dimethenamid-P (Outlook)	15	12 to 21 fl oz	Good	
Flumioxazin (Valor)	14	2 to 3 fl oz	Best	
Sulfentrazone	14	4.5 to 12 fl oz	Best	

*Assuming a susceptible population

Basic formula: Group 15 + Group 14 + metribuzin (or other)

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HERBICIDE MIXTURES ARE THE KEY!

Diggle et al. 2003

"A second major conclusion is that rotation of herbicides...is markedly inferior to the use of herbicides in combination, and is not superior to the "expend and swap" approach ..."

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HERBICIDE MIXTURES ARE THE KEY?

Diggle et al. 2003

"A second major conclusion is that rotation of herbicides...is markedly inferior to the use of herbicides in combination, and is not superior to the "expend and swap" approach ..."

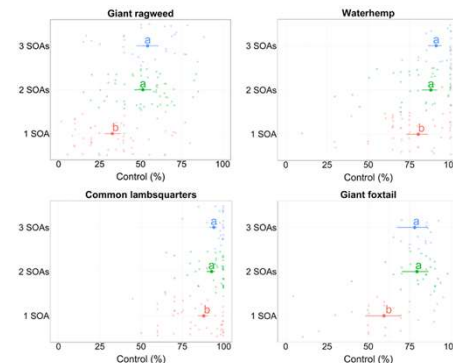
"This conclusion is contingent... on the assumptions... that both herbicides achieve efficacy that is high enough to ensure "redundant kill"...and have different modes of action..."

"For large population size there is very little effect of pattern of herbicide application."

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ARE 3 AI'S REALLY NECESSARY FOR A PREEMERGENCE APPLICATION??

Weed control in corn 4 or 6 WAT at 1 or 2 site/years in Wisconsin



Silva et al. 2023

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TAKE HOME MESSAGE

- 1 FEW HERBICIDES, MANY REGULATIONS
- 2 HERBICIDE RESISTANCE CONTINUES TO SPREAD
- 3 MIXING HERBICIDES IS OUR BEST DEFENSE

LET'S CONNECT

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- 🎙 War Against Weeds podcast