

Alternative Ways to Control Weeds in a Glyphosate-Dominated World



The image cannot be displayed. Your computer may not have enough memory to open the image, or the image may have been corrupted. Restart your computer, and then open the file again. If the red x still appears, you may have to delete the image and then insert it again.

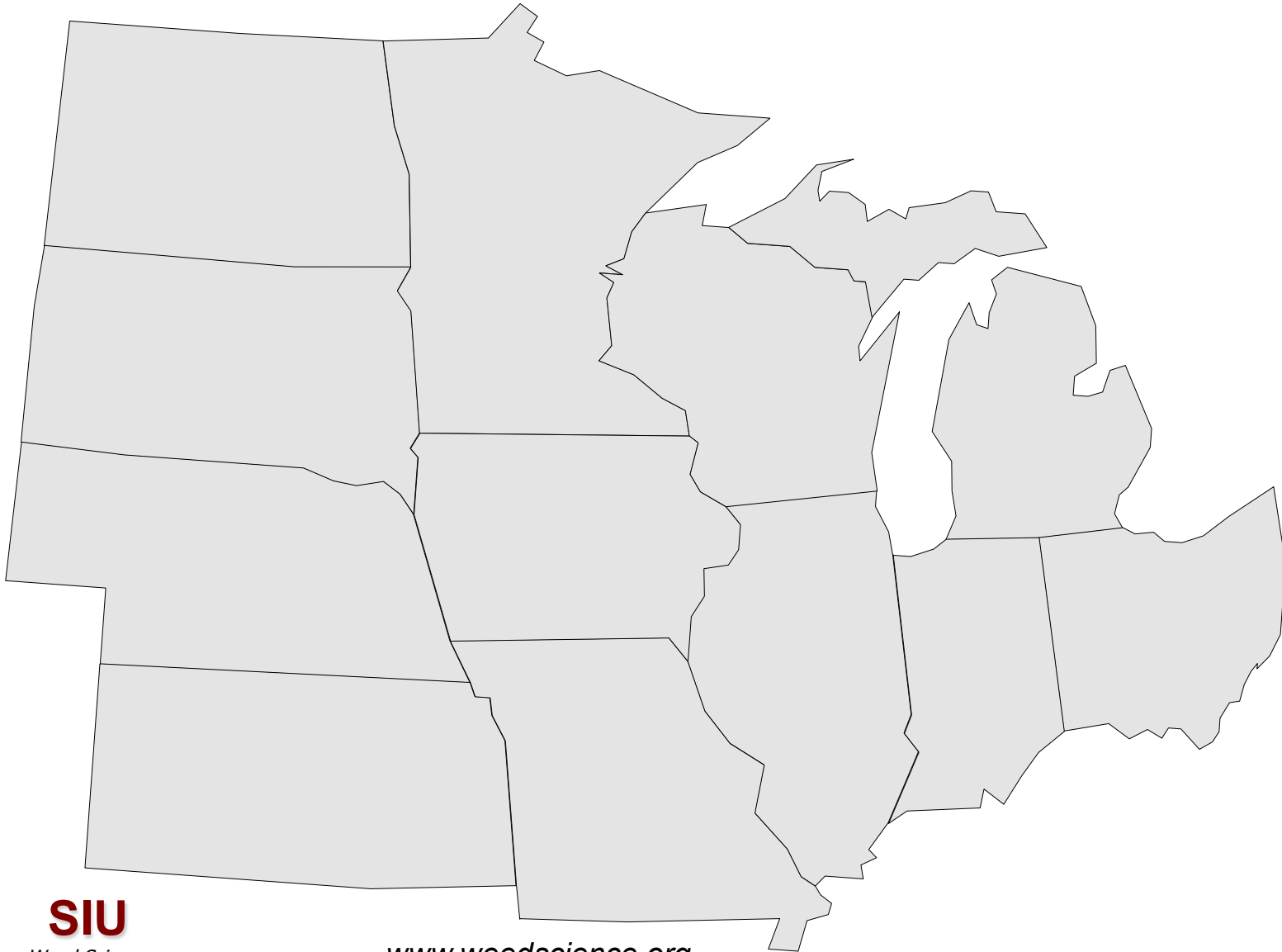


Bryan Young





SIU
Weed Science

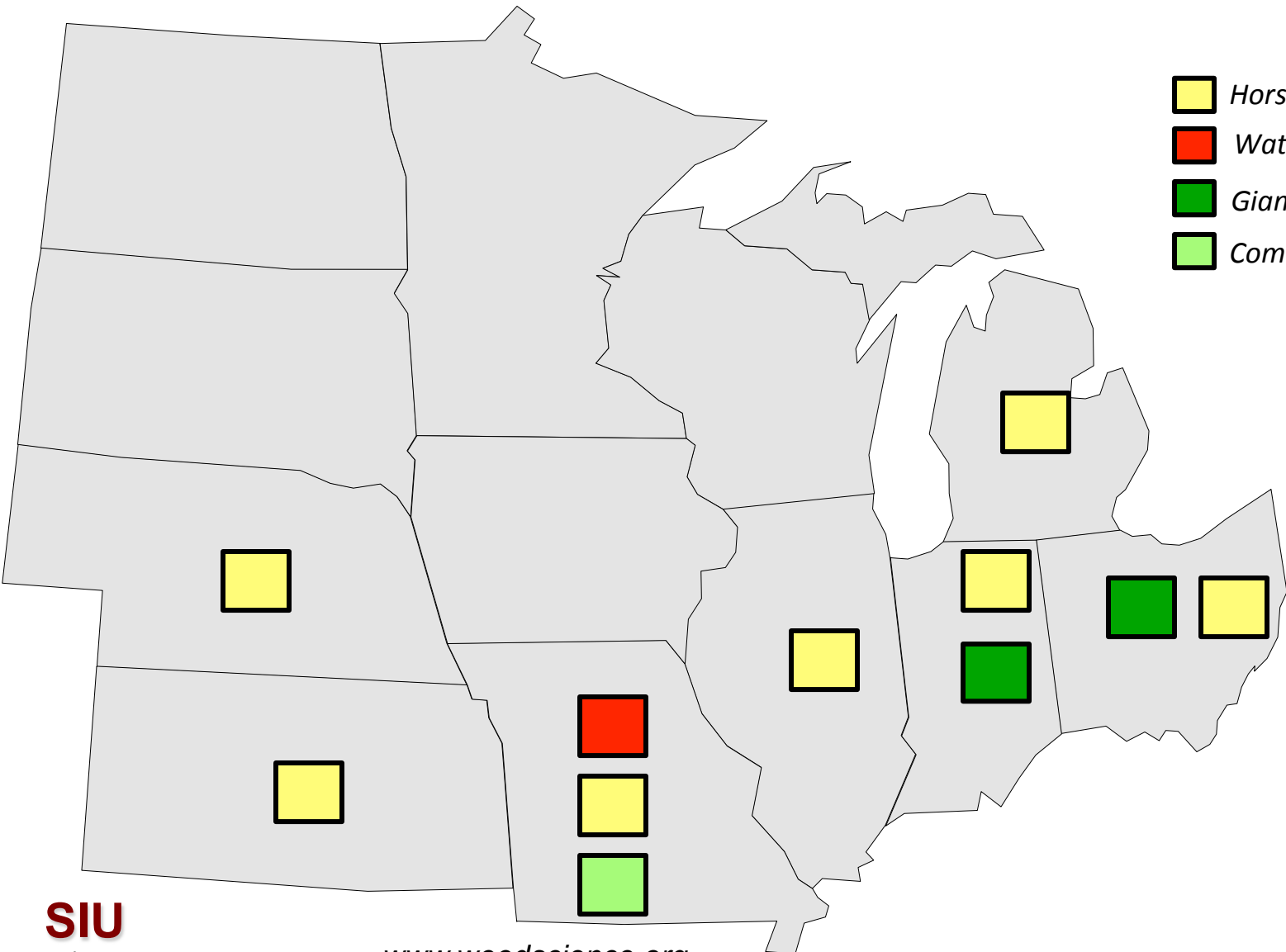


Distribution of Confirmed Glyphosate-Resistant Weed Species in the MidWest

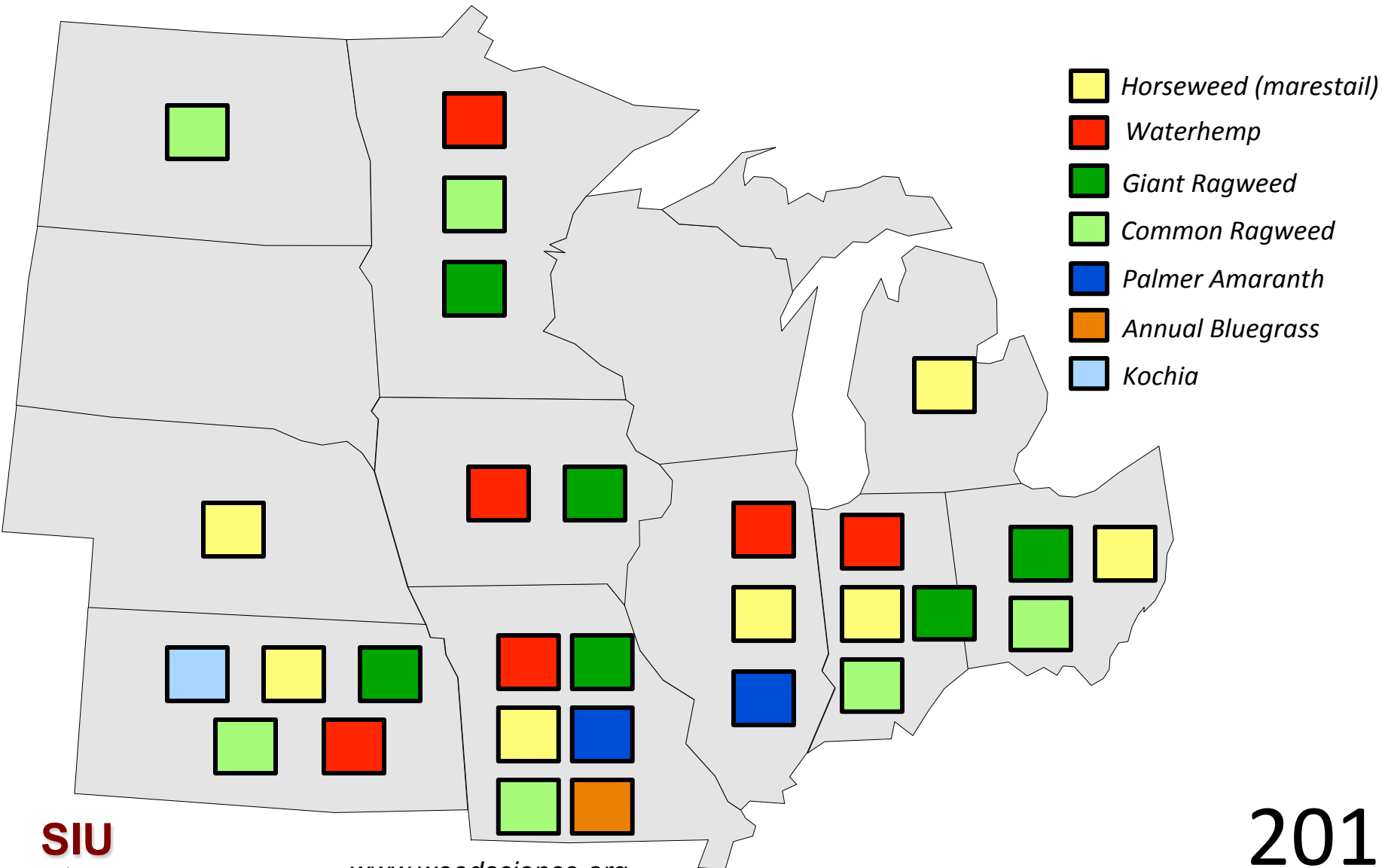


Distribution of Confirmed Glyphosate-Resistant Weed Species in the MidWest

-  *Horseweed (marestail)*
-  *Waterhemp*
-  *Giant Ragweed*
-  *Common Ragweed*



Distribution of Confirmed Glyphosate-Resistant Weed Species in the MidWest



False Impressions of Why You May Not Have Glyphosate-Resistant Weeds

- ◆ I don't cut my herbicide rates.

Glyphosate-Resistant Waterhemp



*Common waterhemp 2008
Jackson Co., IL*

Glyphosate-Resistant Waterhemp



ROUNDUP P-MAX 22 oz
+N-PAK AMS 5%
4-6"WH



ROUNDUP P-MAX 152 oz
+N-PAK AMS 5%
4-6"WH

False Impressions of Why You Don't Have Glyphosate-Resistant Weeds

- ◆ I don't cut my herbicide rates.
- ◆ I spray when weeds are small.
- ◆ I rotate crops in each field annually.
- ◆ I don't farm in Arkansas.
- ◆ ~~I till my fields every other year.~~
- ◆ I'm just that good!

Only credible reason

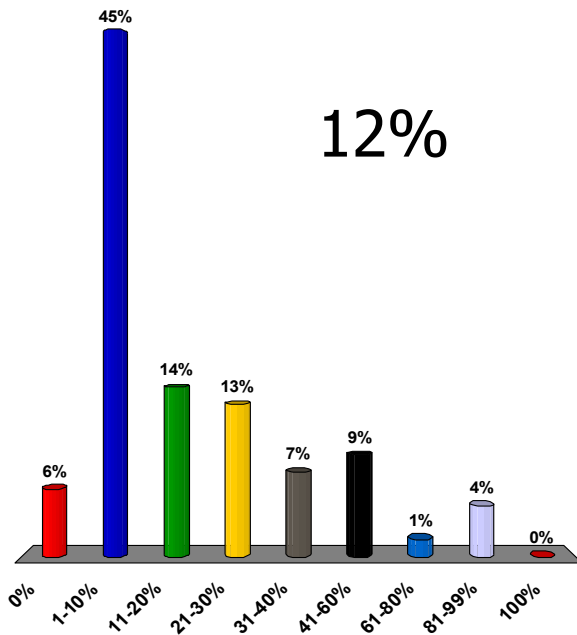
- ◆ Glyphosate is just a *minor* part of my overall weed management plan.

Table 2. Assessment of Resistance Risk by Evaluation of the Cropping System.

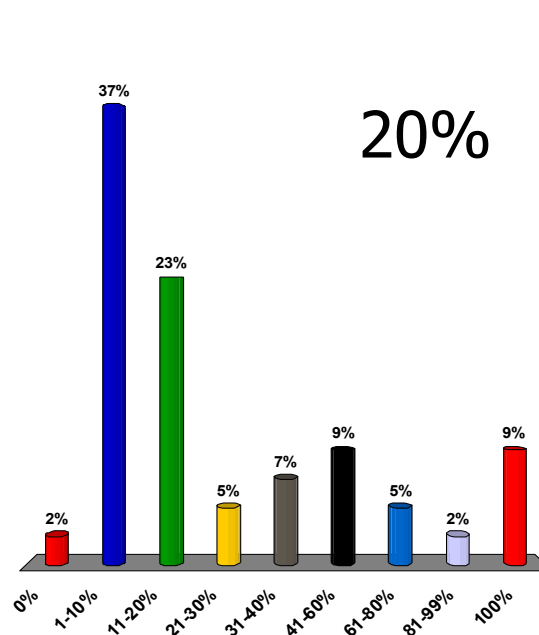
Management Option	Risk of Resistance		
	Low	Moderate	High
Herbicide mix or rotation in cropping system	>2 modes of action	2 modes of action	1 mode of action
Weed control in cropping system	Cultural, mechanical and chemical	Cultural* and chemical	Chemical only
Use of same MOA per season	Once	More than once	Many times
Cropping system	Full rotation	Limited rotation	No rotation
Resistance status to MOA	Unknown	Limited	Common
Weed infestation	Low	Moderate	High
Control in last 3 years	Good	Declining	Poor

*Cultural control can be by using cultivation, stubble burning, competitive crops, stale seedbeds, etc. See HRAC guidelines for more details.

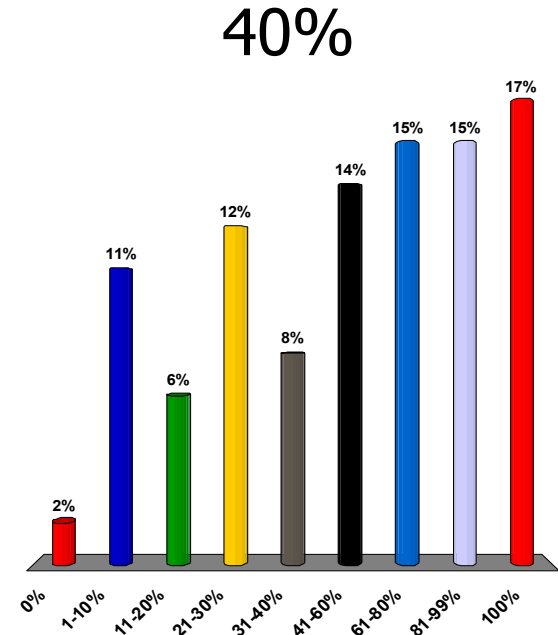
What percentage your territory contains glyphosate-resistant waterhemp?



Fall 2009

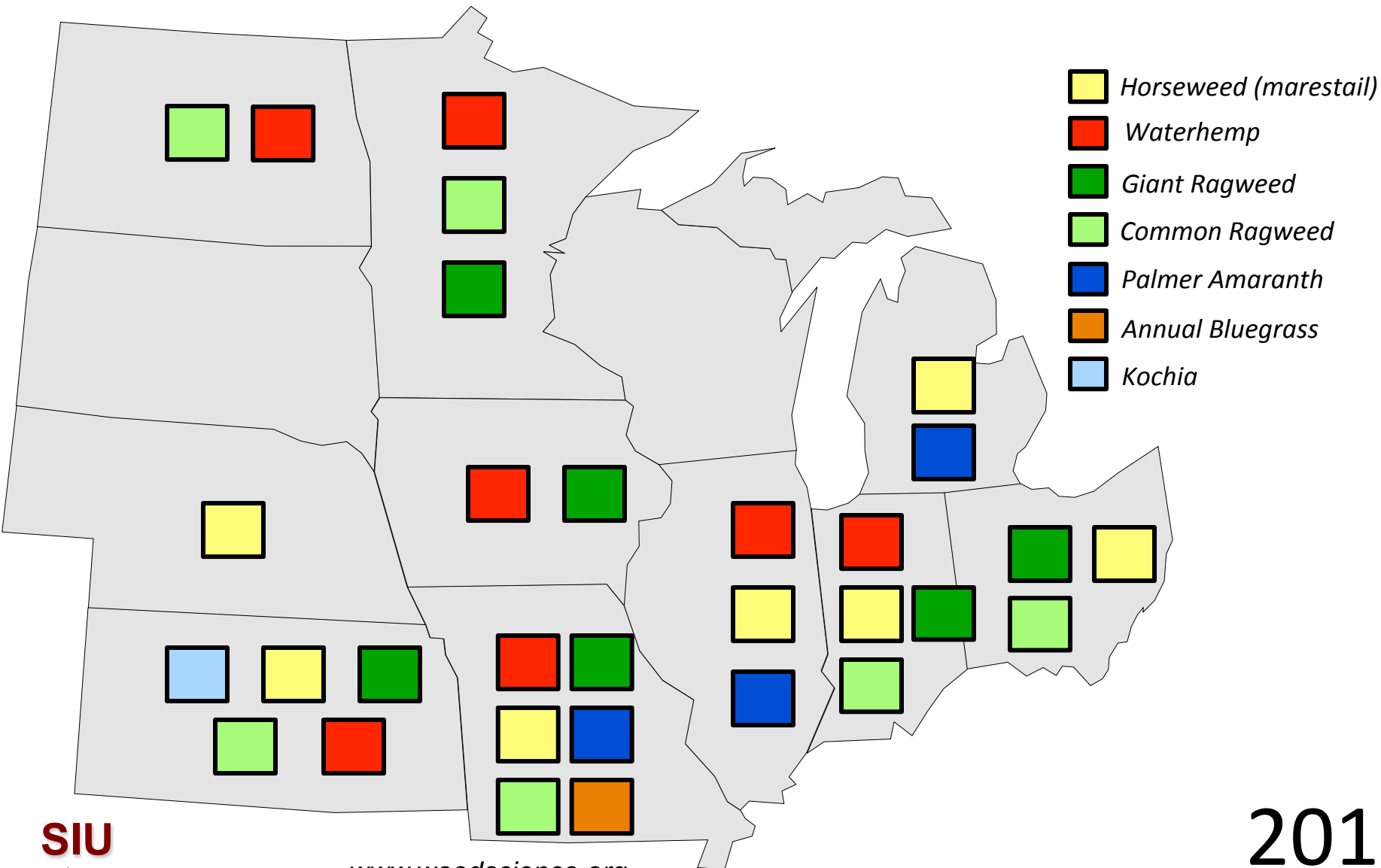


Fall 2010

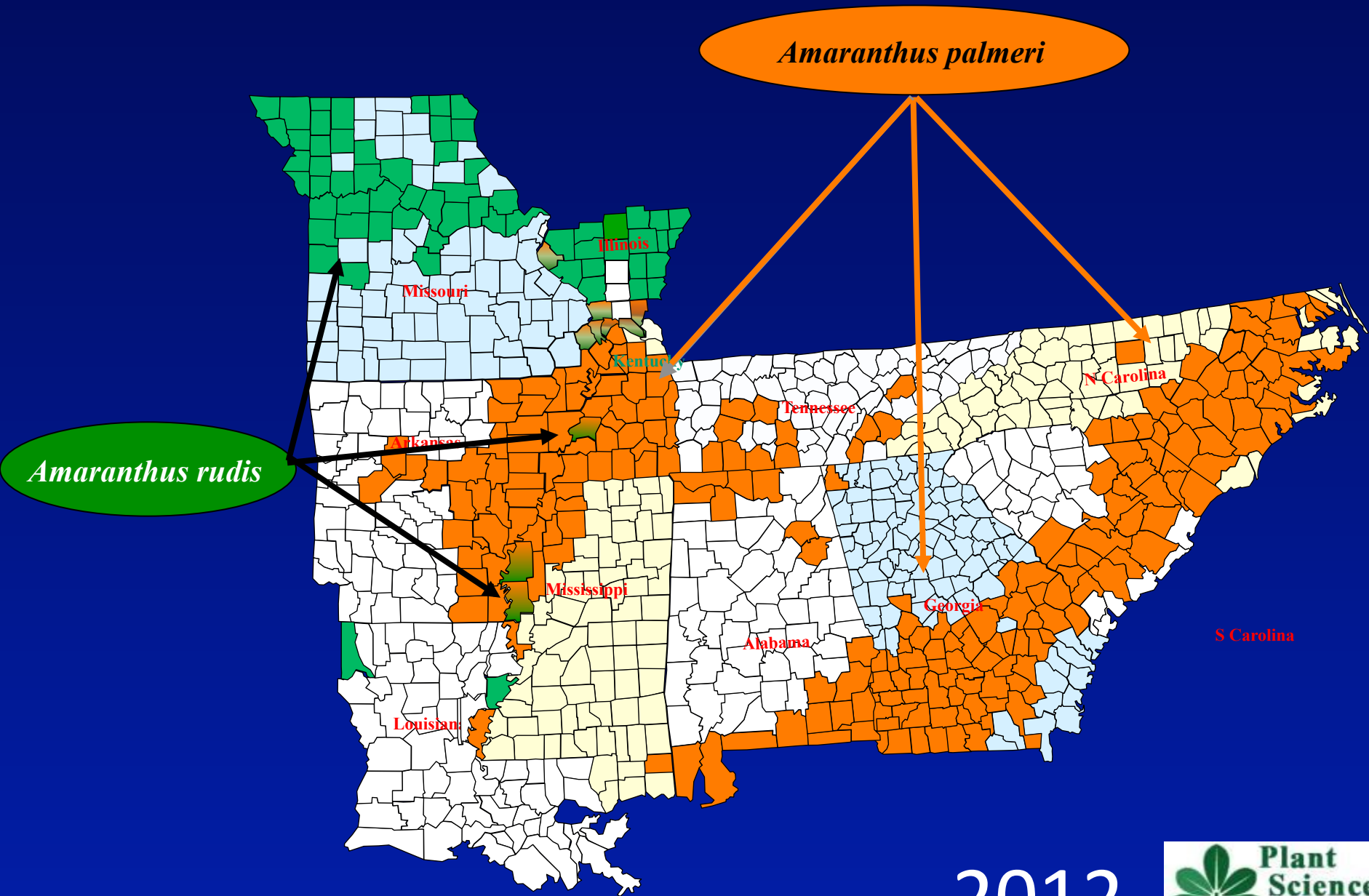


Fall 2011

Distribution of Confirmed Glyphosate-Resistant Weed Species in the MidWest



Glyphosate-Resistant *Amaranthus* Species



2012

Other Problematic Weeds in Glyphosate-Resistant Cropping Systems

- ◆ Morningglory
- ◆ Wild buckwheat
- ◆ Common Lambsquarters
- ◆ Velvetleaf
- ◆ Barnyardgrass
- ◆ Fall panicum



Best Management Practices

Cultural

- ◆ Increase crop rotation diversity
- ◆ Integrate cover crops

Mechanical

- ◆ Use tillage when appropriate

Chemical

- ◆ Integrate diverse herbicide modes-of-action
- ◆ Tank-mixtures in foliar applications
- ◆ Soil residual herbicides – **Preferred!**
 - Full rates of residual if glyphosate efficacy has declined

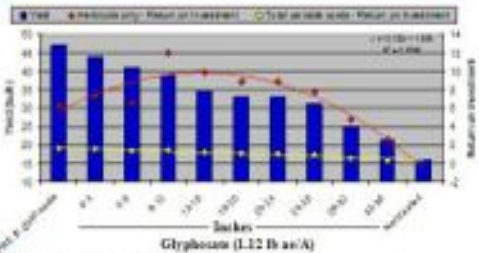
Value of Residual Herbicides



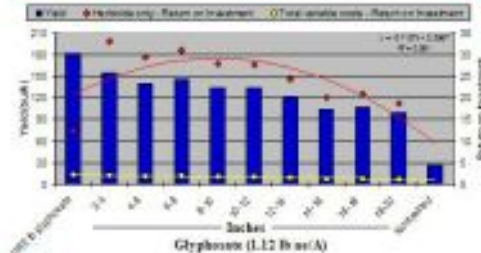
- ◆ Greater and more consistent weed management.
- ◆ Integral component to deter or control glyphosate-resistant weed species.
- ◆ Improve nutrient utilization by the crop.
 - β Don't feed the weeds!
- ◆ Optimize crop protection and yield!



Delayed Applications of Glyphosate in Soybean



Delayed Applications of Glyphosate in Corn



Potential negative:

- ◆ Environment (rainfall) dictates performance

Table 1. Economics of soybean weed management strategies.

Herbicide program	Weed height at application	Soybean yield (bu/A)	Return on all variable input costs
Facult herbicide followed by glyphosate	Prosoybeans 0-4.5"	47	85%
Glyphosate	0-4.5"	41	81%
Glyphosate	0-8"	41	74%
Glyphosate	0-11"	38	69%
Glyphosate	11-16"	34	51%
Glyphosate	16-20"	33	3%
Glyphosate	20-24"	33	2%
Glyphosate	24-28"	31	-9%
Glyphosate	28-31"	31	-46%
Glyphosate	31-36"	31	-70%
No herbicide	—	18	—

Table 2. Economics of corn weed management strategies.

Herbicide program	Weed height at application	Corn yield (bu/A)	Return on all variable input costs
Facult herbicide followed by glyphosate	Prosoybeans 0-4.5"	181	219%
Glyphosate	0-4"	164	202%
Glyphosate	4-8"	168	198%
Glyphosate	8-16"	154	171%
Glyphosate	16-11"	153	169%
Glyphosate	11-14"	151	169%
Glyphosate	14-16"	154	173%
Glyphosate	16-18"	147	178%
Glyphosate	18-20"	99	118%
No herbicide	—	17	—



Residual Herbicide Timing

Early Preplant (EPP) vs. Preemergence (PRE)

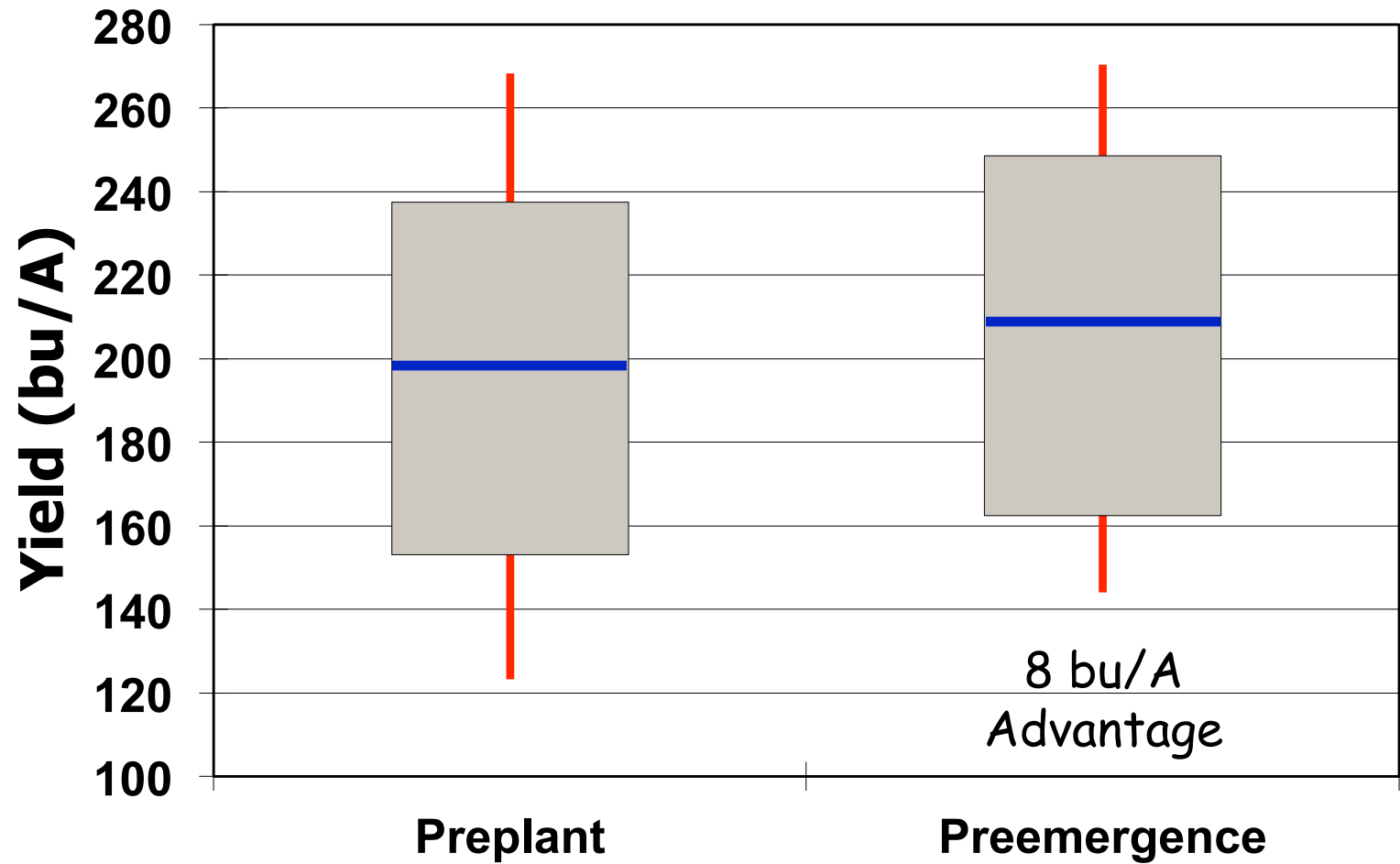
- **An EPP application may provide a wider window for rainfall activation than a PRE.**
- **An EPP can allow for the distribution of labor more evenly throughout the season.**

Excessive rainfall on EPP residuals may lead to:

- **Decreased herbicide persistence.**
- **Reductions in early-season weed control resulting in an earlier postemergence (POST) application.**



Residual Herbicide Timing Effect on Yield





Residual Herbicide Rates

- “Foundation” rates lead to inconsistent weed control even when followed with glyphosate.
- Near full rates reduce inconsistency and manage risk.
- Performance of POST herbicides is crucial.
 - ❖ Are they always going to work?

1/2X Rate



3/4X Rate



1X Rate



Corn Herbicide Options

Residual	POST
Lexar/Lumax	Glyphosate
Degree Xtra/G-Max/Bicep II Mag	Halex GT/ Callisto Xtra
Verdict	Status
Corvus	Ignite
Surestart/Tripleflex	Capreno
Atrazine	Atrazine
Hornet	Impact
Prequel	Realm Q

Basics: Weed Management in Corn

- ◆ Tillage performed on majority of acres
- ◆ Residual weed control at planting
 - Use **three** modes of action
 - Examples: Lexar/Lumax
Corvus + Atrazine
Degree Xtra + Balance Flex
Surestart + Atrazine
- ◆ Early burndown (atrazine + princep) followed by Early POST
 - Same products listed above
 - Halex GT + atrazine
 - Ignite + atrazine (LL corn)
- ◆ Risk increases with greater dependence on POST herbicides
 - Failure to spray timely
 - Potential herbicide-resistant weeds (ex. waterhemp resistant to glyphosate, atrazine, or HPPD herbicides)

Will Side-Dressing Nitrogen in Corn Impair Weed Control?

Grower Program

"Our corn program is 2.5qt of Lumax & 1 qt of atrazine over the top after planting. We do plant RR corn & do side-dress the majority of our acres. Our main weed problems are glories & cockleburs. We've had pretty good luck until this year. Any suggestions?"

My Response

"If the soil disturbance is introducing untreated soil or new weed seeds to the surface another herbicide pass following the side-dress may be justified. A residual herbicide may be used if the weeds have not yet emerged or just a non-residual herbicide if weeds have emerged. Also depends on corn growth stage."



*Waterhemp after paraquat burndown, Late-spring planting 2009
Alexander Co., IL*

Basics: Weed Management in Soybean

- ◆ No-till burndown
 - ↳ small weeds = big success!
 - ↳ Start clean and stay clean!

- ◆ Residual herbicides
 - ↳ Necessary for ALL problematic weeds in soybean
 - ❖ The greater the problem you have the more you should be using full rates of residual herbicides.

- ◆ POST only programs
 - ↳ High risk; can't bring back your lost yield!
 - ↳ Weed size limitations for any glyphosate tank-mixtures

- ◆ Two-pass: Preplant followed by POST
 - ↳ Requires effective herbicides with glyphosate for foliar control and residual herbicides in potentially both applications.

PPO and Glyphosate-Resistant Waterhemp



*Waterhemp 2011
Jackson Co., IL*

Soybean Weed Management

Herbicide Program Template

Burndown: Timing – Depends on geography
(Fall, early spring, at planting)

Ex. Glyphosate

2,4-D

Residual herbicide

Early POST: Target weeds not yet emerged or <4 inches

Ex. Glyphosate

Tank-mix for foliar activity

Residual herbicide

Influence of Residual Herbicide Rate

Waterhemp Control at DeSoto, IL



Authority XL 4 oz/A applied 14 DBP



Authority XL 7.5 oz/A applied 14 DBP



Authority XL 4 oz/A applied 28 DBP



Authority XL 4 oz/A applied 14 DBP



Authority XL 4 oz/A applied at planting

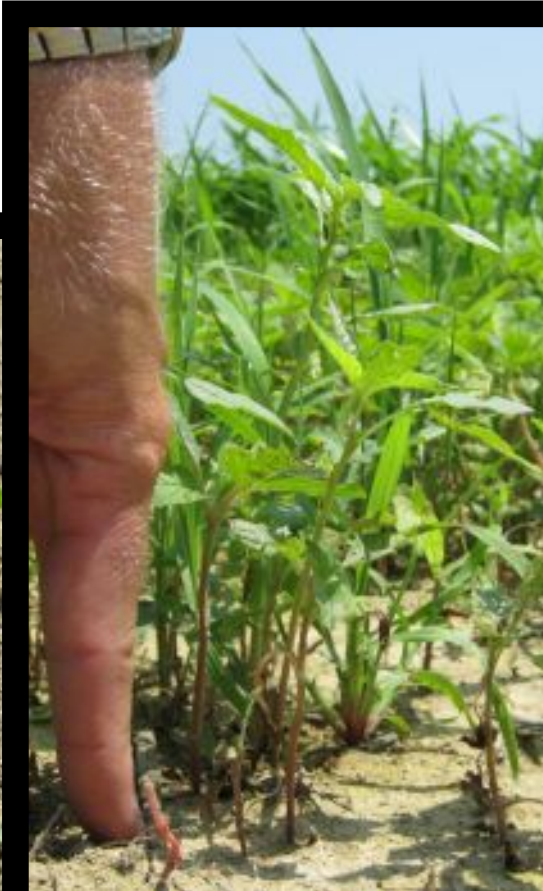
Just Give Weeds The Finger!

**Greater than 6"
Good Luck!**

**2"
Ideal**

**3-4"
Good**

**4-6"
Marginal**



Comparison of Future Soybean Technologies

All require a “program” approach!

Soybean System/ Herbicide	Horseweed (marestail)	Lambsquarters, common	Morningglory, annual	Ragweed, giant	Palmer amaranth	Waterhemp
RR2Y (glyphosate)	8-9	8	7	7-8	9	8-9
Liberty Link (Ignite)	8-9	8	8-9	8-9	6	8
Optimum GAT??	?	?	?	?	?	?
Enlist (2,4-D)	7-8	8-9	9	8-9	8	8
Dicamba	8	8-9	9	9	9	7
HPPD (Isoxaflutole/ Mesotrione)	?	?	?	?	?	?

Non-treated Check



11-YRC-DicambaSoy

Roundup WM 22 oz
Clarity 16 oz
Valor XLT 3 oz
AMS

10-14 EPP



Roundup WM 22 oz
Clarity 16 oz
Warrant 3 pt
AMS

21 DAP



11-YRC-DicambaSoy

Diversify Integrate Rate Timing DIRT

Diversify your weed management tactics so that you don't rely on a single herbicide application, herbicide active ingredient, or herbicide mode of action to control your most problematic weeds.

Diversify Integrate Rate Timing
DIRT

Integrate at least two effective herbicide modes of action for control of your most problematic weeds.

Overreliance on any single MOA will perpetuate resistance evolution.

Diversify Integrate Rate Timing **DIRT**

Using full herbicide Rates is essential to providing consistent control of weeds.

Full rates can reduce inconsistencies for both residual and foliar herbicides.

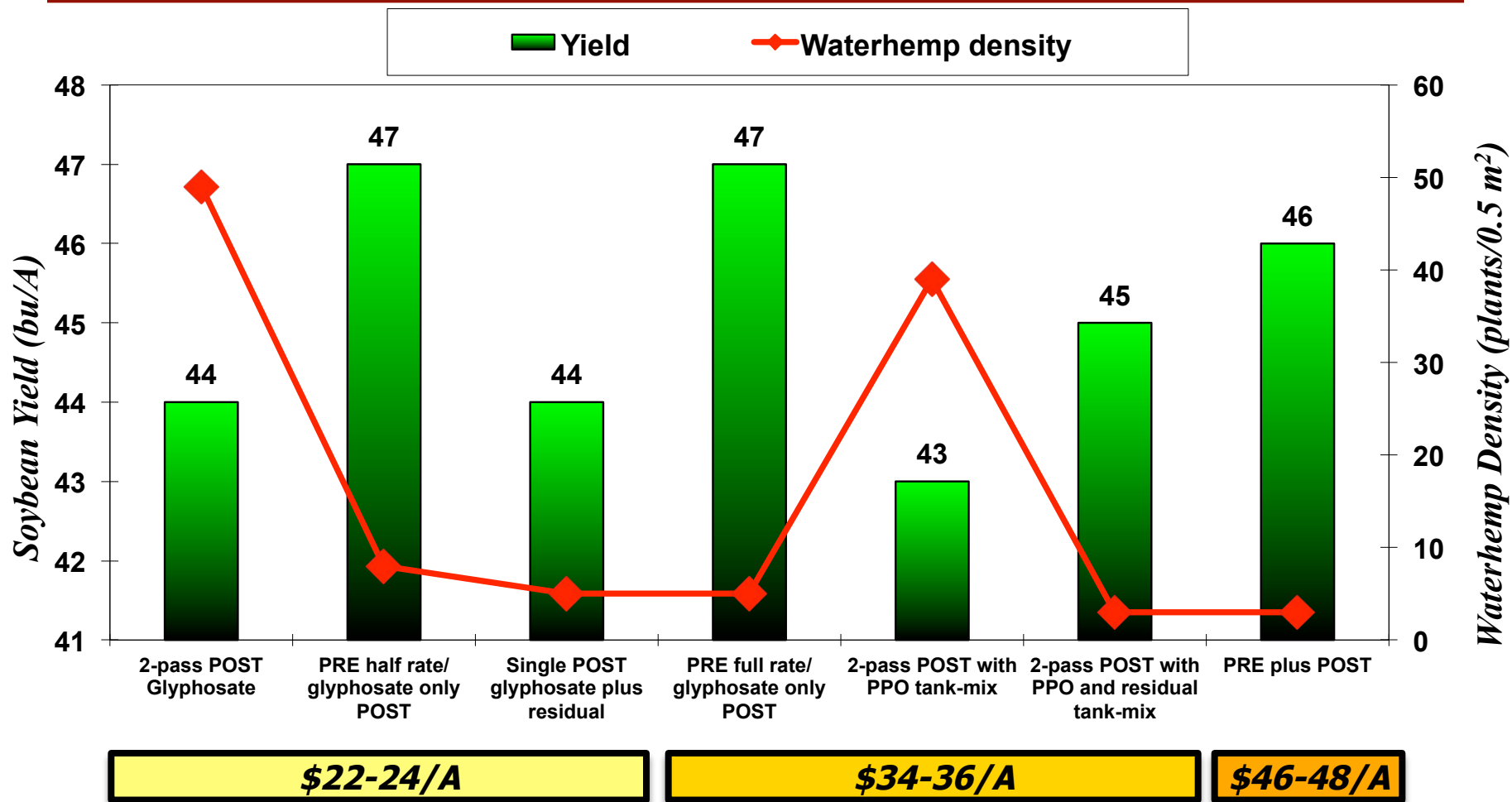
Diversify Integrate Rate Timing DIRT

The Timing of herbicide applications is critical, whether for a residual herbicide or a postemergence herbicide.

Residuals applied just prior to peak emergence period of target weed.

POST herbicides applied to weeds less than 4".

Optimizing Your Weed Management Investment



Grower Sites for Benchmark Study



Benchmark Study

Glyphosate Resistance Management



MISSISSIPPI STATE UNIVERSITY

PURDUE UNIVERSITY



Southern Illinois University Carbondale

NC STATE UNIVERSITY

IOWA STATE UNIVERSITY

UNIVERSITY OF Nebraska

Benchmark Study Summary

- Academic herbicide resistance BMPs
 - Herbicide costs slightly higher
 - No statistical difference in yield
 - No statistical difference in net return
- Under a worst-case scenario (no resistance present), academic herbicide resistance BMPs resulted in similar yields and net returns

Benchmark Study

Glyphosate Resistance Management



 MISSISSIPPI STATE UNIVERSITY

 PURDUE UNIVERSITY



Southern
Illinois University
Carbondale

 NC STATE UNIVERSITY

IOWA STATE
UNIVERSITY

UNIVERSITY OF
Nebraska

Summary

- ◆ Weed shifts to problematic and herbicide-resistant biotypes will continue at a rapid pace.
- ◆ Current/future solutions require **optimal** use of **complimentary** herbicides. Diverse, effective MOAs.
- ◆ Continual weed scouting and adaptive planning will be necessary.
- ◆ Successful weed management programs will be more profitable than poor planning.

QUESTIONS?

Bryan Young
Southern Illinois University MC-4415
1205 Lincoln Dr.
Carbondale, IL 62901

Phone: (618) 453-7679

Fax: (618) 453-7457

E-mail: bgyoung@siu.edu



PRODUCING RESULTS

SIU

Weed Science