Herbicide-Resistant Pigweeds (*Amaranthus spp.*) are in Wisconsin, How Serious is it?

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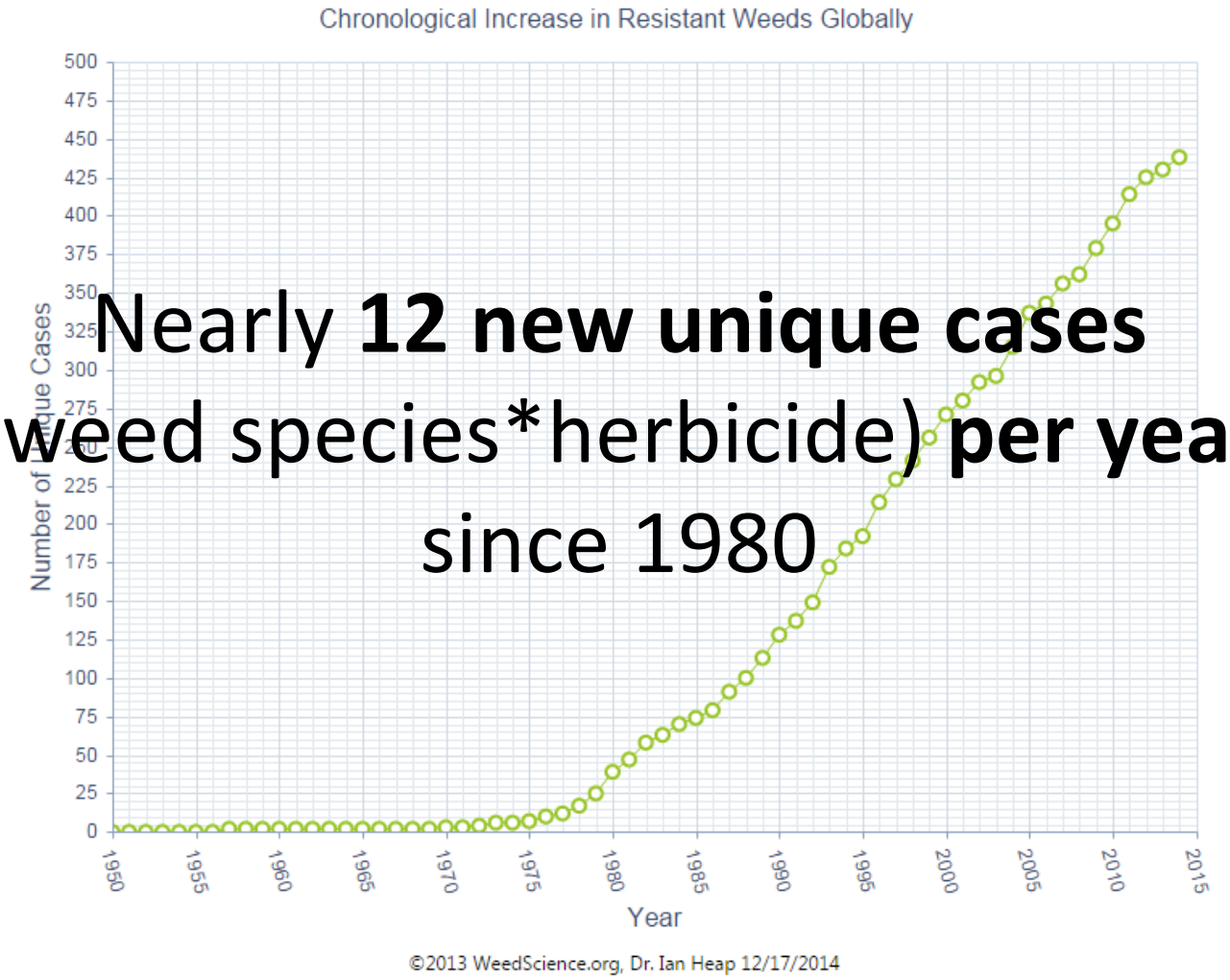
2015 Wisconsin Crop Management Conference

Herbicide Resistance



Nearly **12 new unique cases** (weed species*herbicide) **per year** since 1980

Pigweed Herbicide Resistance

United States:

- Common waterhemp:
  - Six sites-of-action
  - 17 states
- Palmer amaranth:
  - Five sites-of-action
  - 25* states

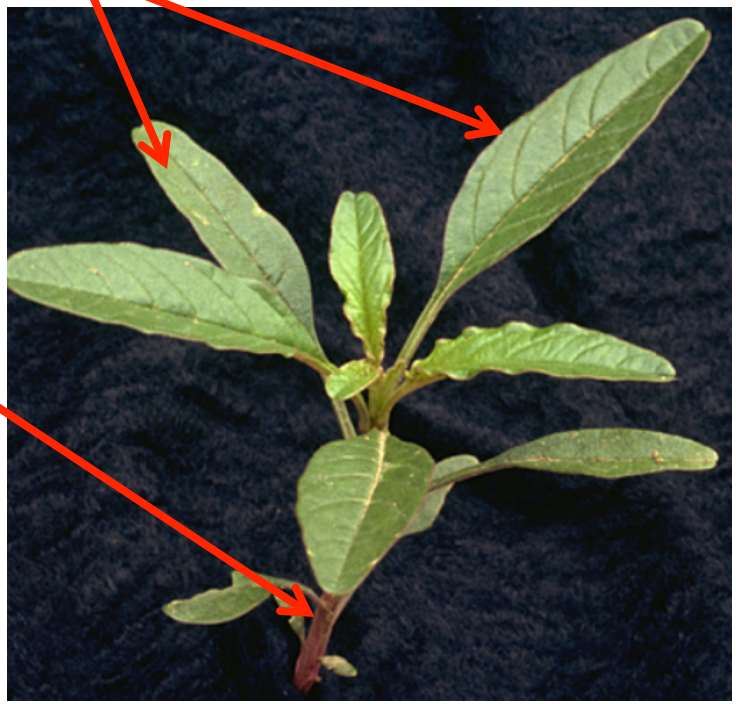
Wisconsin:

- ALS-resistant common waterhemp biotype (1999)

Common Waterhemp

Elongated, narrow leaves

Hairless stems



Seed head measured in “inches”

Images courtesy of Michael S. DeFelice, Weeds of the South

Palmer Amaranth

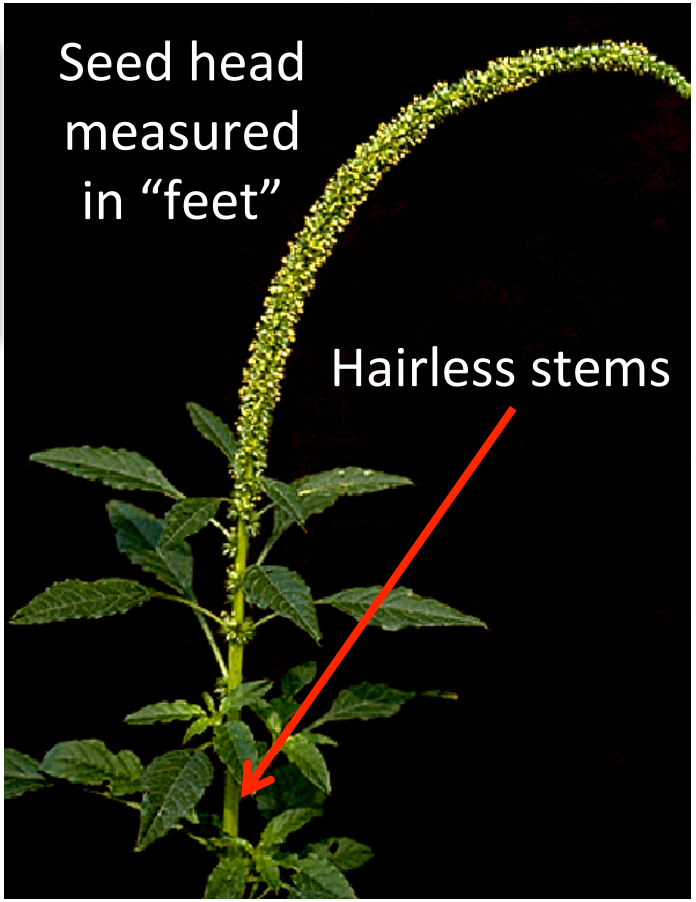
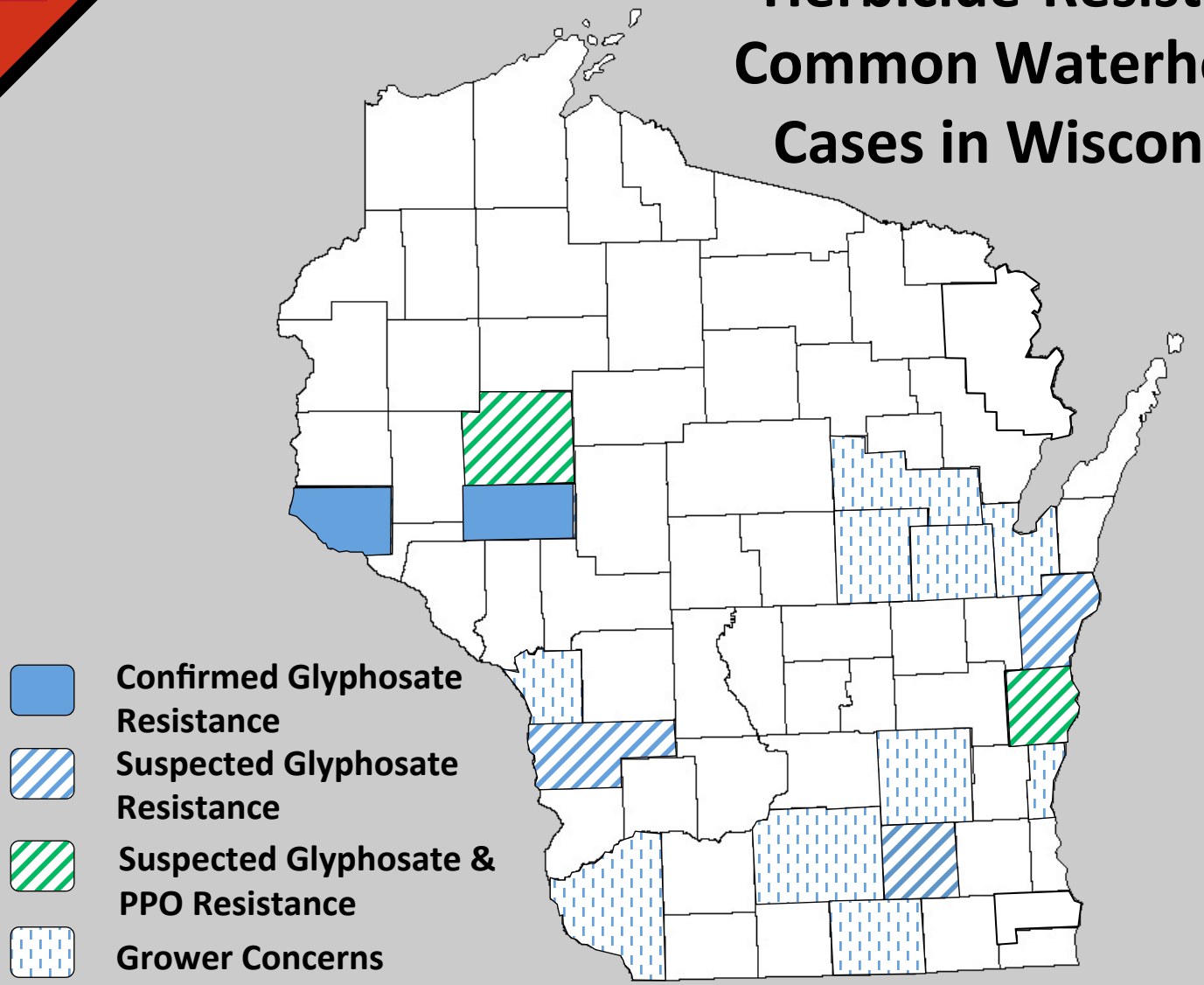


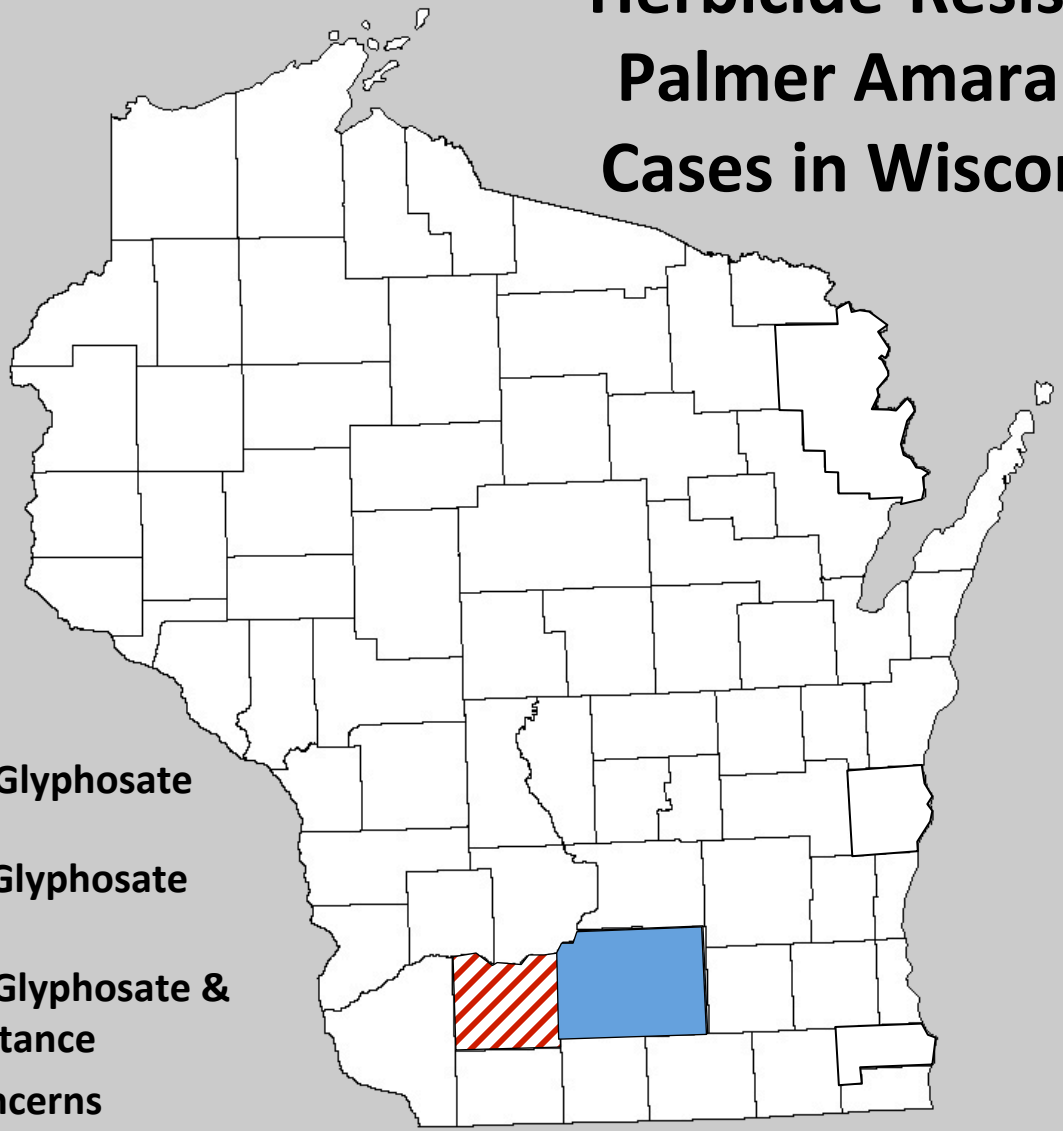
Image courtesy of Michael S. DeFelice, Weeds of the South

Late-Season Weed Escape Survey

Herbicide-Resistant Common Waterhemp Cases in Wisconsin



Herbicide-Resistant Palmer Amaranth Cases in Wisconsin



- Confirmed Glyphosate Resistance
- Suspected Glyphosate Resistance
- Suspected Glyphosate & HPPD Resistance
- Grower Concerns

Procedure

Procedure

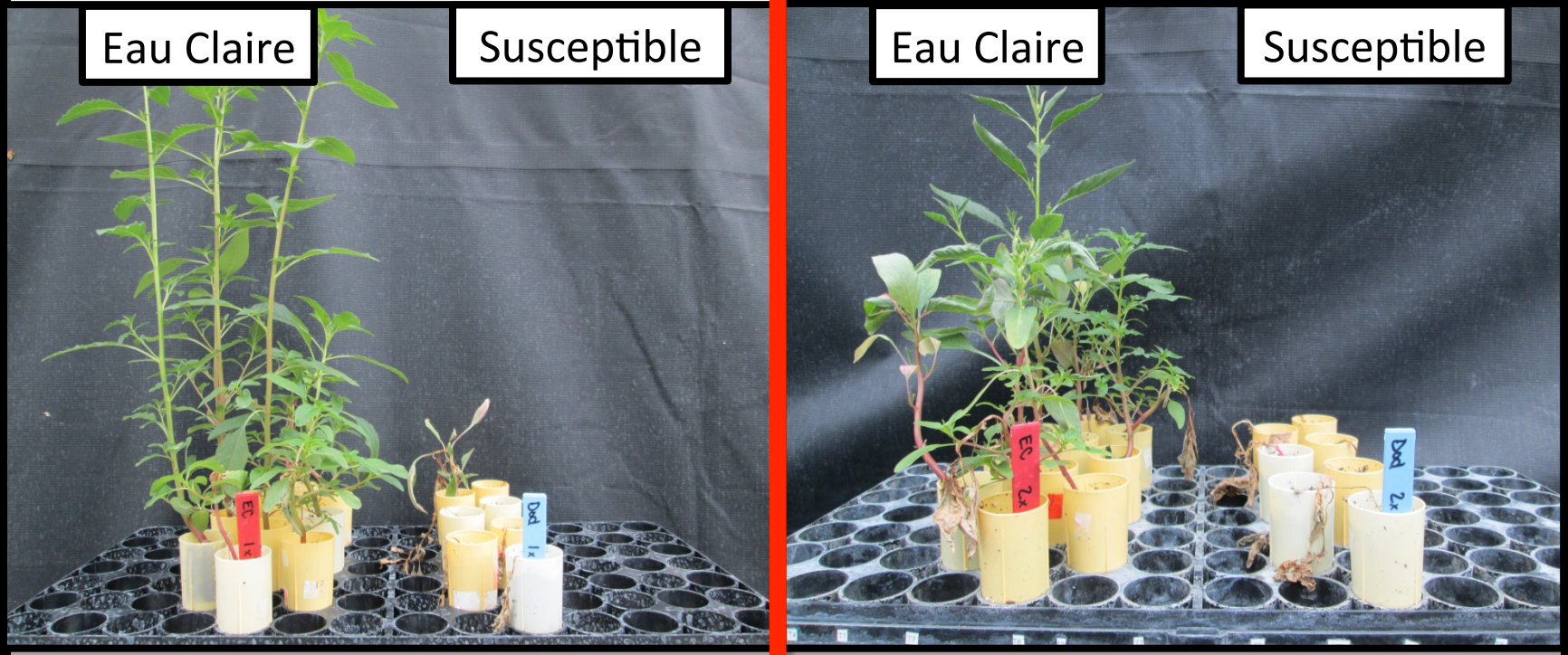
- Plant Dry Biomass collected 28 days after application
- Data analyzed using dose response model package in R statistical software
- Comparisons based on estimated effective doses to reduce plant biomass 90% (ED_{90}) and 50% (ED_{50}) for common waterhemp and Palmer amaranth, respectively

Herbicide Rates

Weed	Herbicide	Rate						
		1	2	3	4	5	6	7
		kg ai (ae) ha^{-1}						
AMATA[a]	glyphosate	0	0.22	0.43	0.87	1.74	3.48	6.96
AMAPA[b]	glyphosate	0	0.0087	0.087	0.87	8.7	___	___
AMAPA	tembotrione	0	0.023	0.046	0.092	0.184	0.368	0.736

[a]Abbreviation: AMATA, *Amaranthus rudis,* common waterhemp
[b]Abbreviation: AMAPA, *Amaranthus palmeri,* Palmer amaranth

Eau Claire County Population

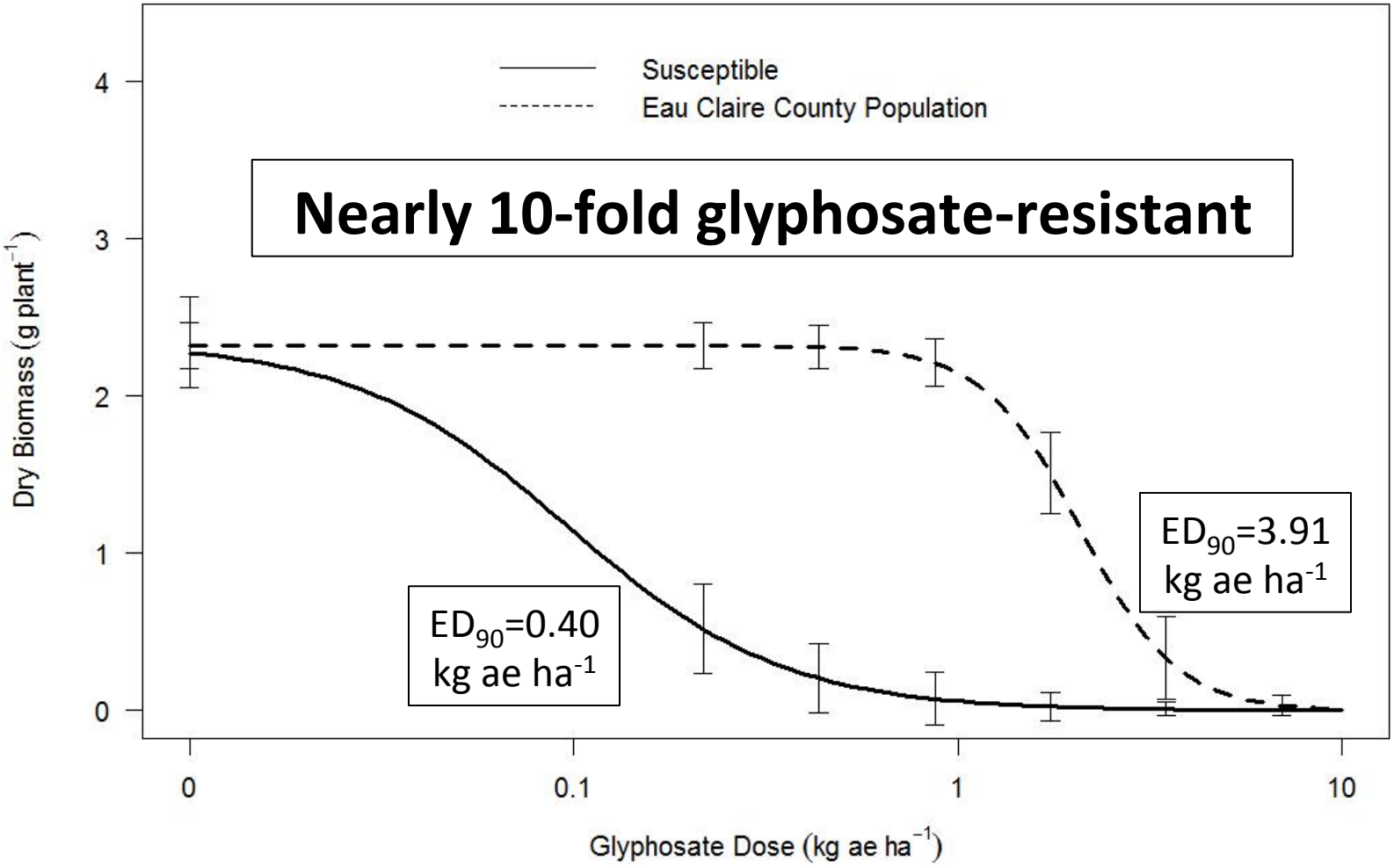


1x rate (22 fl. oz. ac^{-1})

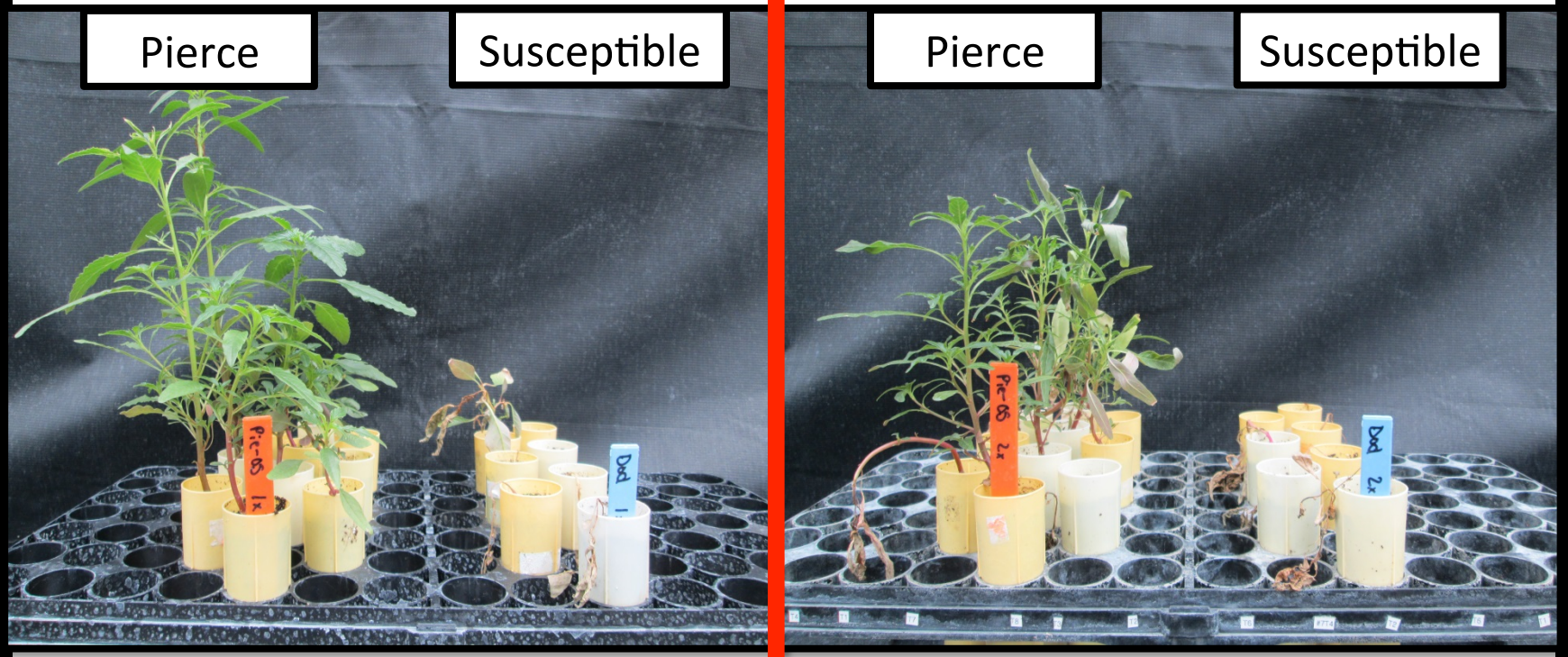
2x rate (44 fl. oz. ac^{-1})

Pictures taken at 14 days after application.

Eau Claire County Population



Pierce County Population

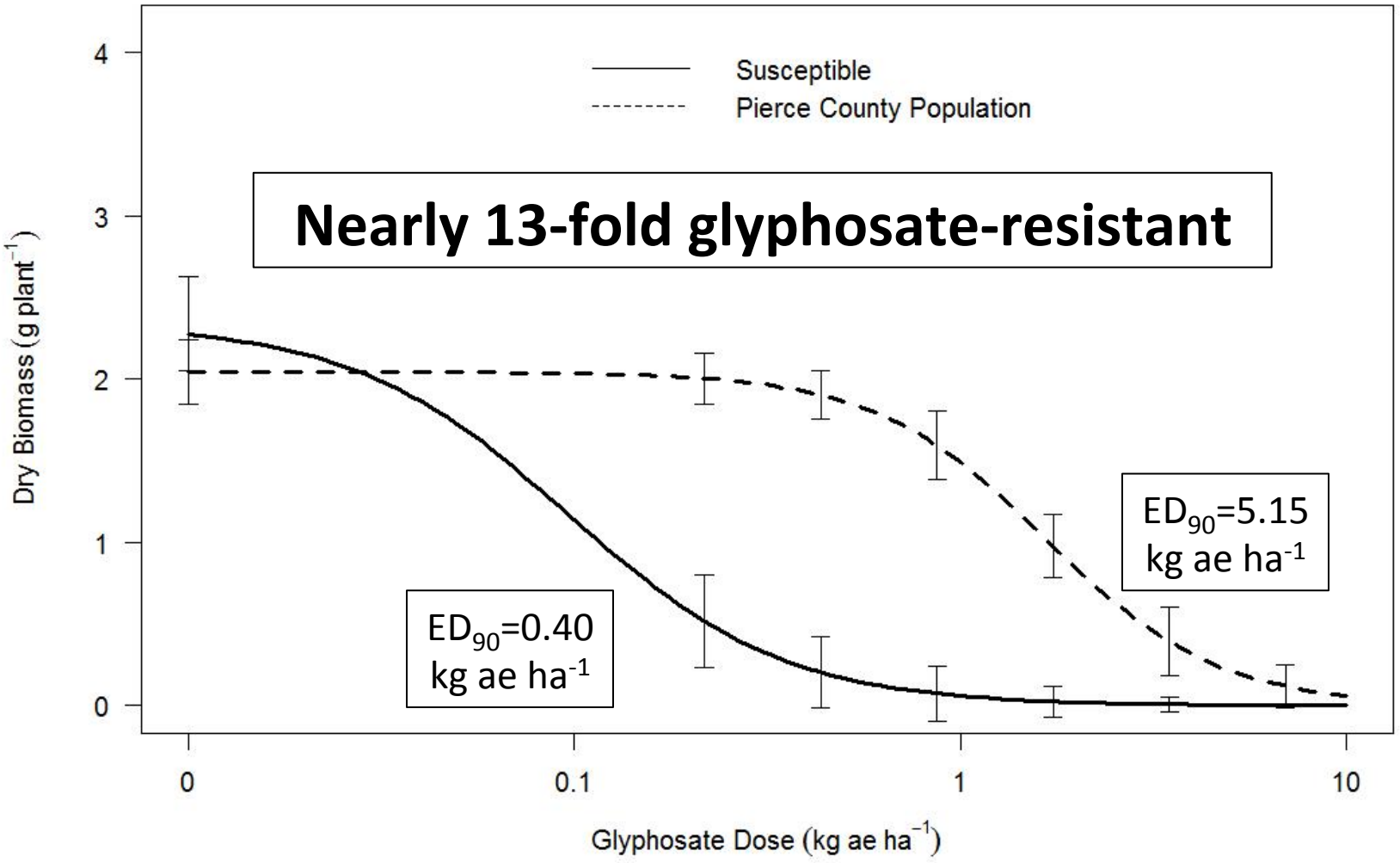


1x rate (22 fl. oz. ac^{-1})

2x rate (44 fl. oz. ac^{-1})

Pictures taken at 14 days after application.

Pierce County Population



Dane County Population

3 – 20x amplification of the Dane County Population EPSPS target site gene

Proc Natl Acad Sci U S A. Jan 19, 2010; 107(3): 1029–1034.
PMCID: PMC2824275
Published online Dec 14, 2009. doi: 10.1073/pnas.0906649107
Agricultural Sciences

Gene amplification confers glyphosate resistance in *Amaranthus palmeri*

Todd A. Gaines,[a,1] Wenli Zhang,[b] Dafu Wang,[c] Bekir Bukun,[a] Stephen T. Chisholm,[a] Dale L. Shaner,[d] Scott J. Nissen,[a] William L. Patzoldt,[e] Patrick J. Tranel,[e] A. Stanley Culpepper,[f] Timothy L. Grey,[f] Theodore M. Webster,[g] William K. Vencill,[h] R. Douglas Sammons,[c] Jiming Jiang,[b] Christopher Preston,[i] Jan E. Leach,[a] and Philip Westra[a,2]

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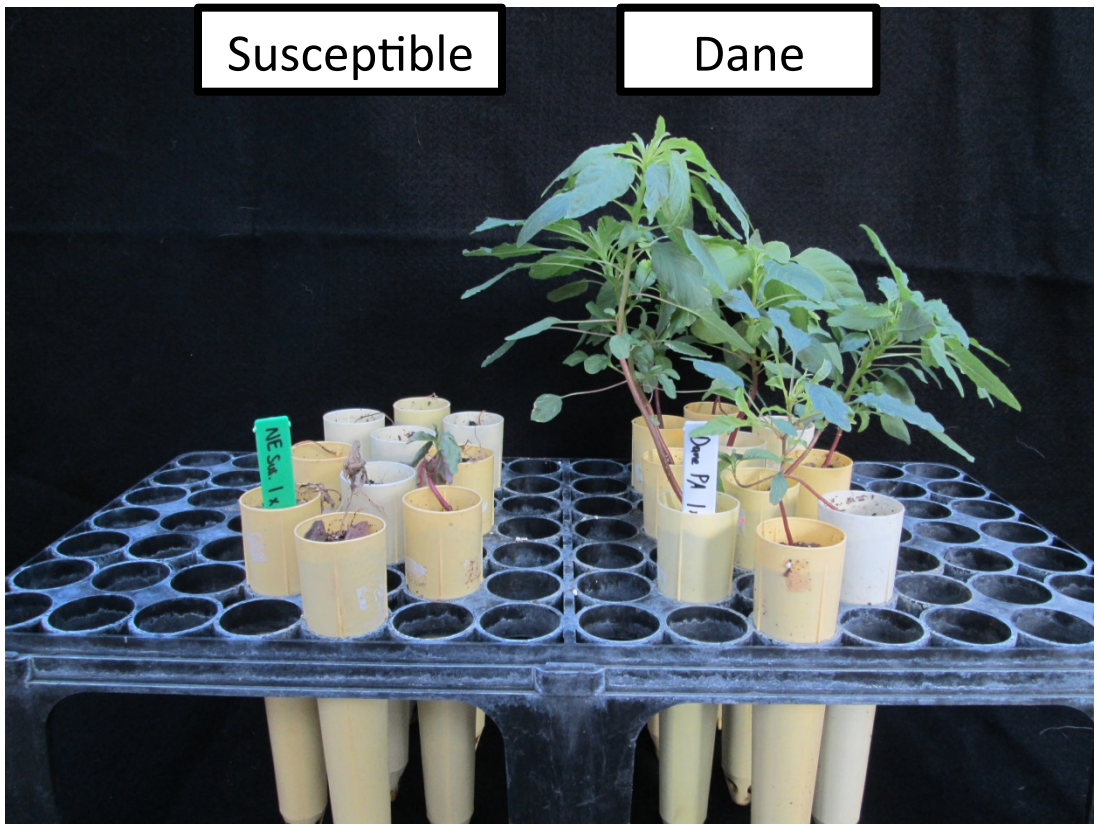
See commentary "Gene amplification delivers glyphosate-resistant weed evolution" on page 955.

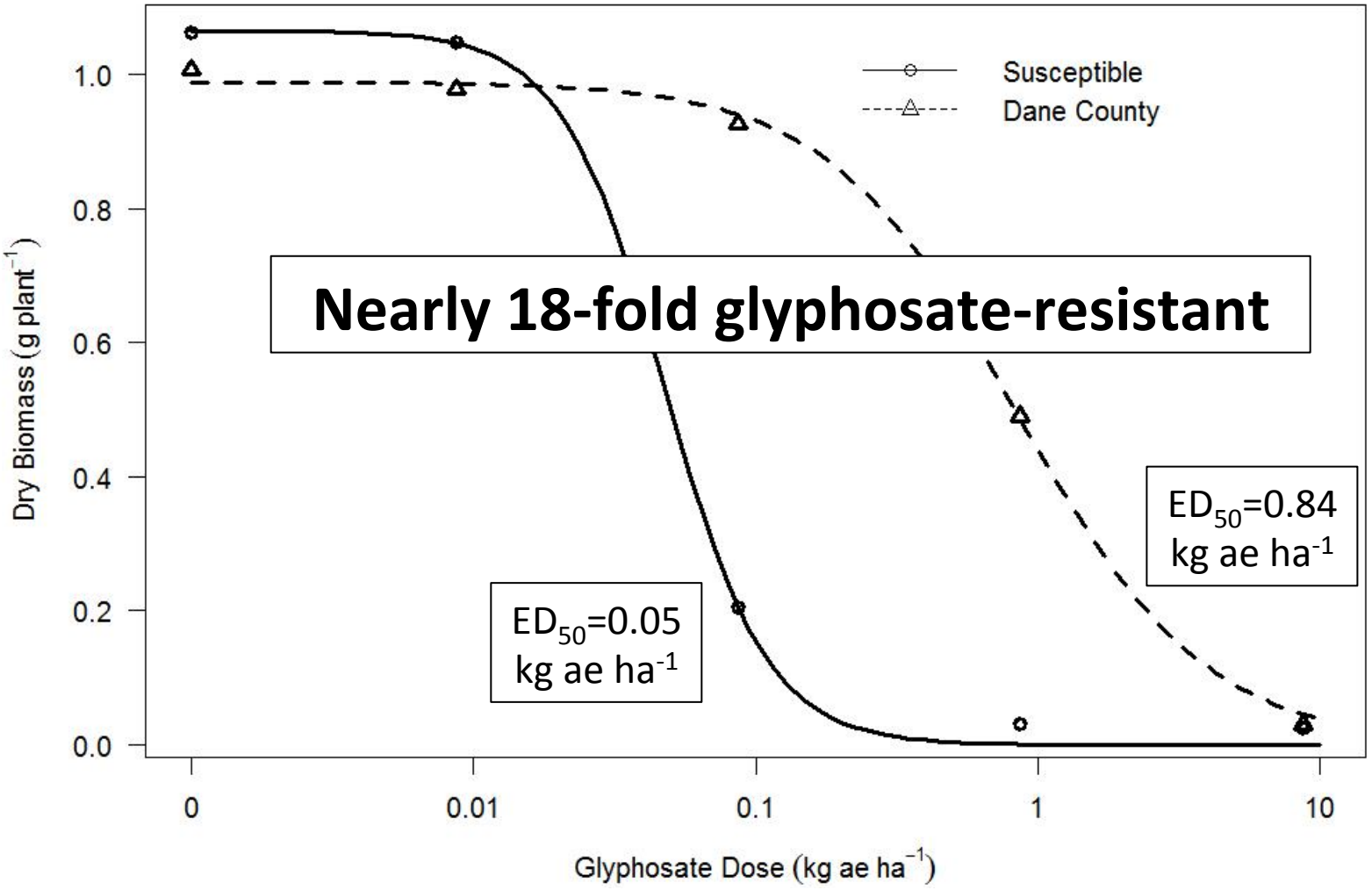
Dane County Population



1x rate (22 fl. oz. ac^{-1})

Picture taken at 21 days after application.

Dane County Population



Dane County Population

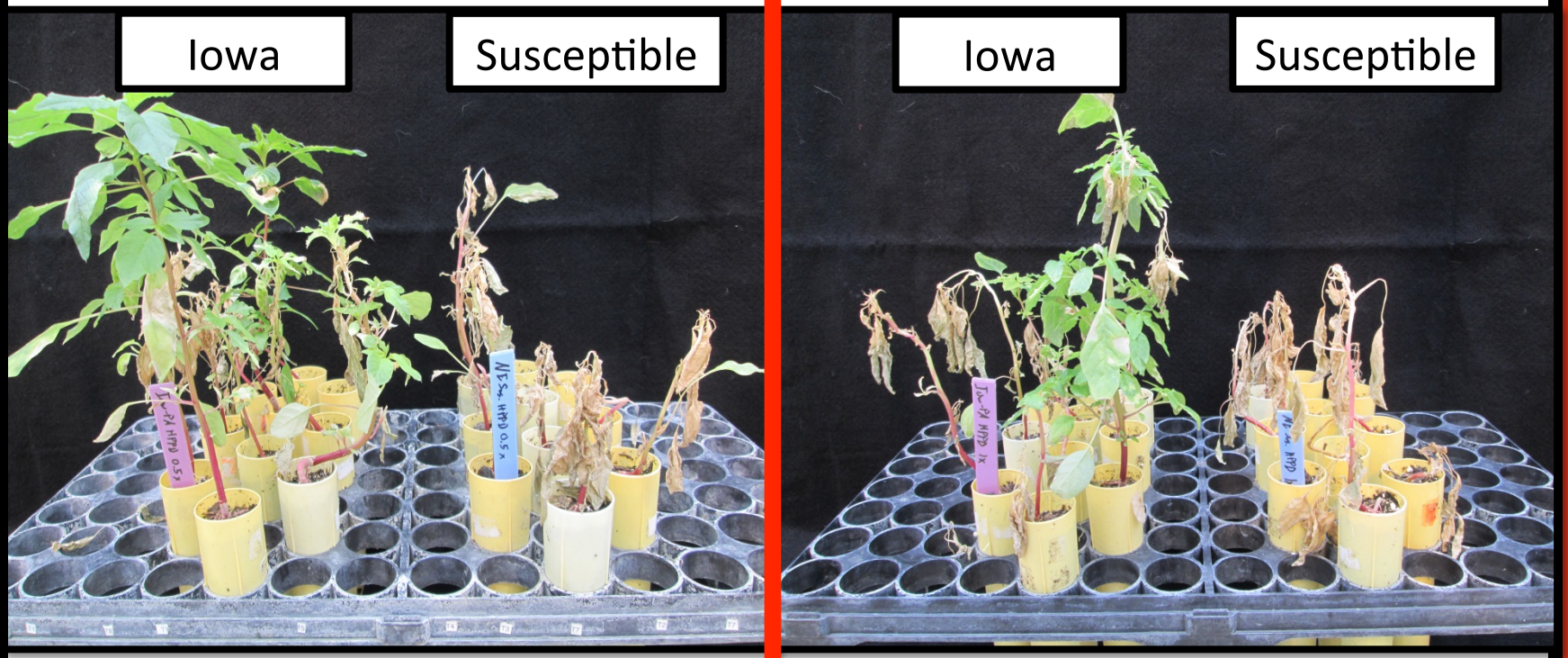
Table 1. Comparison of plant dry biomass 28 days after application between the Dane County and susceptible Palmer amaranth populations at each glyphosate rate.

	Glyphosate Rate (kg ae ha^{-1})				
	0	0.0087	**0.087**	**0.87**	8.7
Significance	NS	NS	**	**	NS

*Significant at the *P*=0.05 probability level.
**Significant at the *P*=0.01 probability level.
***Significant at the *P*=0.001 probability level.

Iowa County Population

Tembotrione (Laudis®)

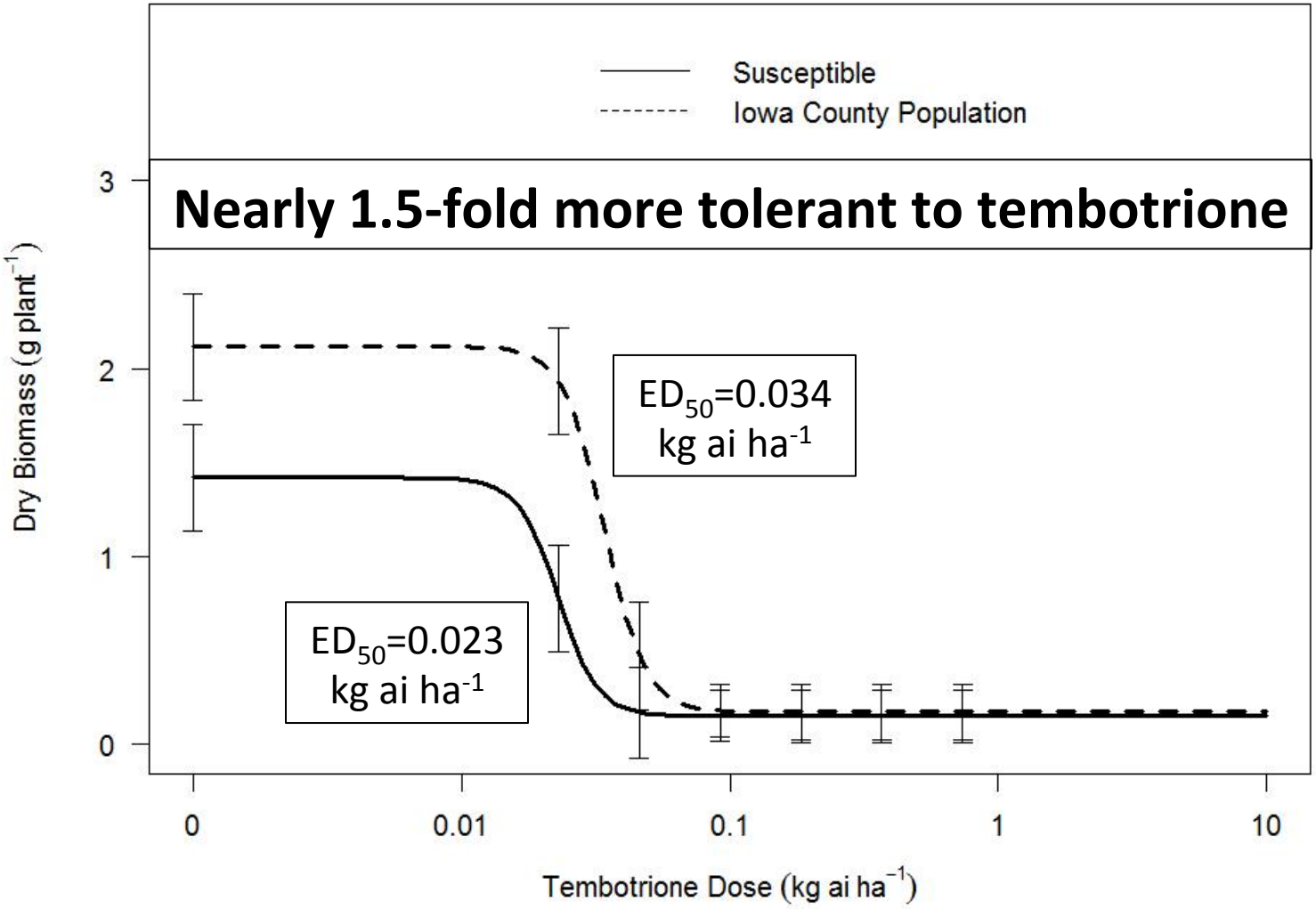


0.5x rate (1.5 fl. oz. ac^{-1})

1x rate (3 fl. oz. ac^{-1})

Pictures taken at 21 days after application.

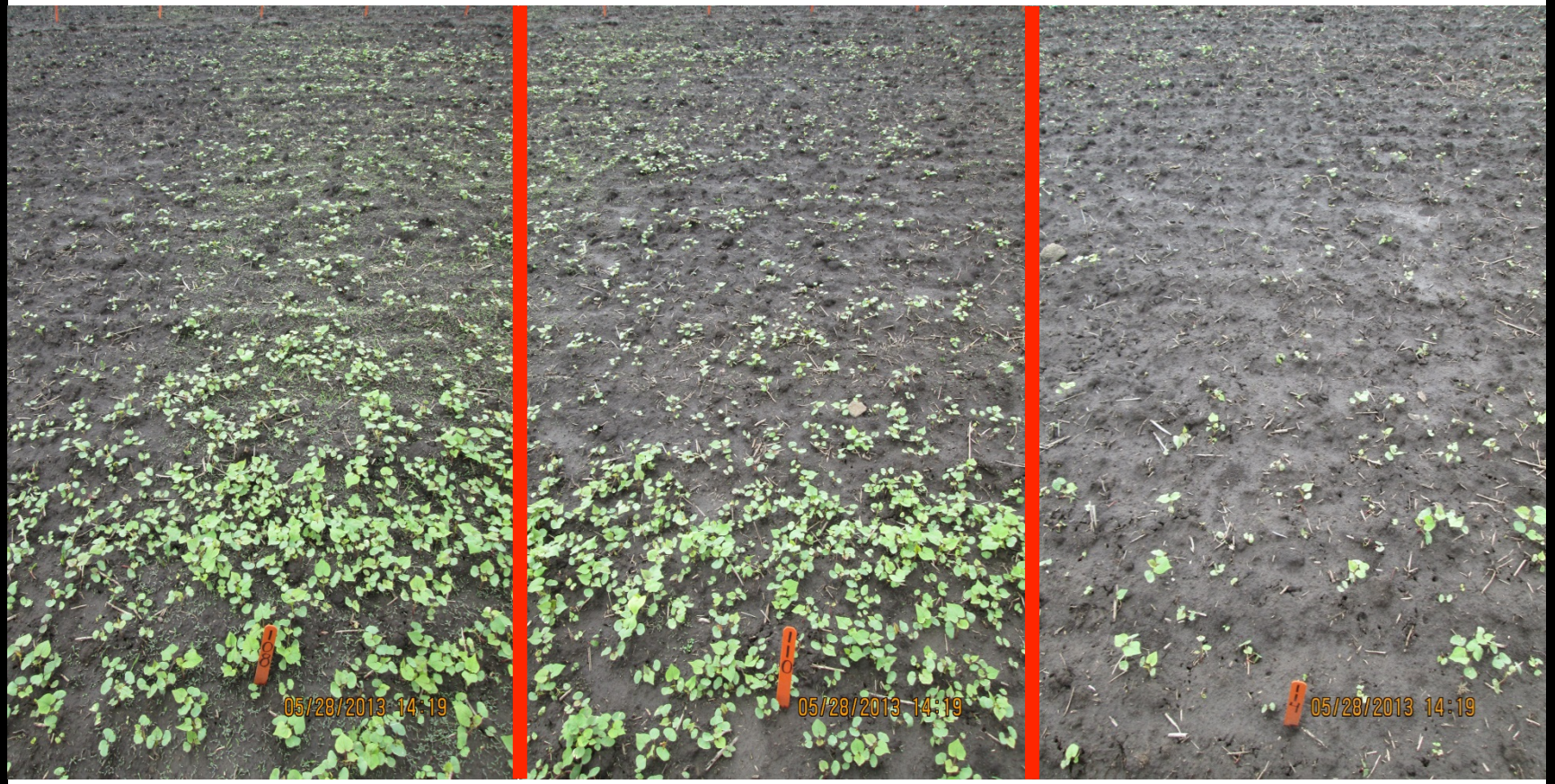
Iowa County Population



Is there current research investigating alternative control strategies for herbicide-resistant pigweeds?

USB Soybean Row Width x Seeding Rate Study

USB New Soybean Residual Evaluations



Pictures taken 20 days after application.

USB New Soybean Herbicide Program Evaluations

Pictures taken 21 DA LPOST (42 DA EPOST, 63 DA PRE).

USB At-Harvest Seed Retention of Common Waterhemp

Conclusions

Herbicide-resistant pigweeds are here!

- Two common waterhemp populations confirmed glyphosate-resistant (Eau Claire and Pierce Counties)
- One Palmer amaranth population confirmed glyphosate-resistant (Dane County)
- Preliminary indications of elevated tembotrione tolerance in another Palmer amaranth population (Iowa County)

Conclusions

What can we do?

- Multiple, diverse weed management strategies
- Multiple, effective modes-of-action/tank-mixing
- Clean tillage/harvest equipment
- Use labeled rates, appropriate adjuvants, and apply at correct timings

Thank you!

Thank you to the graduate and undergraduate research assistants who aided in this project.

For More Information…

Wisconsin Weeds:
http://wcws.cals.wisc.edu/

Herbicide-Resistant Weed Management:
http://takeactiononweeds.com/

Questions?