

Current status of glyphosate resistant weeds in the US

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Introduction

- Acceptance of glyphosate resistant crops is unprecedented in agriculture and represents, with the concomitant use of glyphosate, the primary tactic in corn/soybean/cotton weed management
- The evolution of herbicide resistant weed populations and shifts in weed populations are inevitable
- Consider the cropping systems – what are the options?
 - Row crops have more tactics than small grain systems
 - Corn and soybeans have many options for weed management
- How do growers assess the problem?
- What should grower perspective be – short term or long term?

Introduction

- Selection pressure imposed by the wide-spread adoption of glyphosate-based systems has resulted in changes in weed communities
- The temporal occurrence of glyphosate resistant weeds is similar resistance to other herbicides
- The number of weeds that have evolved glyphosate resistance and the speed of appearance seems to be increasing
- Weed population shifts attributable to glyphosate selection pressure are also observed

Introduction

- Weed adaptation to glyphosate demonstrates some similarities to other herbicides
- Genetic basis of glyphosate resistance is varied
 - Single semi-dominant gene – horseweed
 - Polygenic trait – waterhemp
- Mechanism of glyphosate resistance is varied
 - Differential translocation – horseweed
 - Altered target site – goosegrass
 - Putative multiple mechanisms – waterhemp
 - Unknown – rigid ryegrass

Glyphosate resistant weeds

- Nine weed species have evolved resistance to glyphosate – six in the US
- Horseweed (marestail) populations resistant to glyphosate continue to spread rapidly
- New reports include:
 - Palmer amaranth (GA, NC, TN)
 - Common waterhemp (MO)
 - Common ragweed (MO)
- Suspected glyphosate resistant biotypes
 - Giant ragweed (OH, IN, ?)
 - Common lambsquarters (IN, OH, ?)

Glyphosate Resistance Horseweed



Source: H. Wilson, VPI

Glyphosate resistant horseweed

- Originally reported 3 years after grower adoption of glyphosate-based soybean production systems
- Rapidly spread (multiple founding events) across the east/south/Midwest US
 - Serious problem in soybeans and cotton
 - Impacted major economic changes in cotton production
- “Perfect” weed for resistance to evolve
- Multiple resistance to several herbicides

Palmer amaranth

Male

Female

G. Hager

Palmer pigweed resistance to glyphosate

- Press releases from the University of Georgia, University of Tennessee, and North Carolina State University
- Simultaneous multiple founding events
- Thus far, only efficacy information is available – more information needed
- Previous reports of evolved resistance to ALS and PPO inhibitor herbicides
- Palmer pigweed represents a significant economic problem

Everly, IA 1999



Two weeks after glyphosate (2.2 kg /ha)

Common Waterhemp resistant to glyphosate

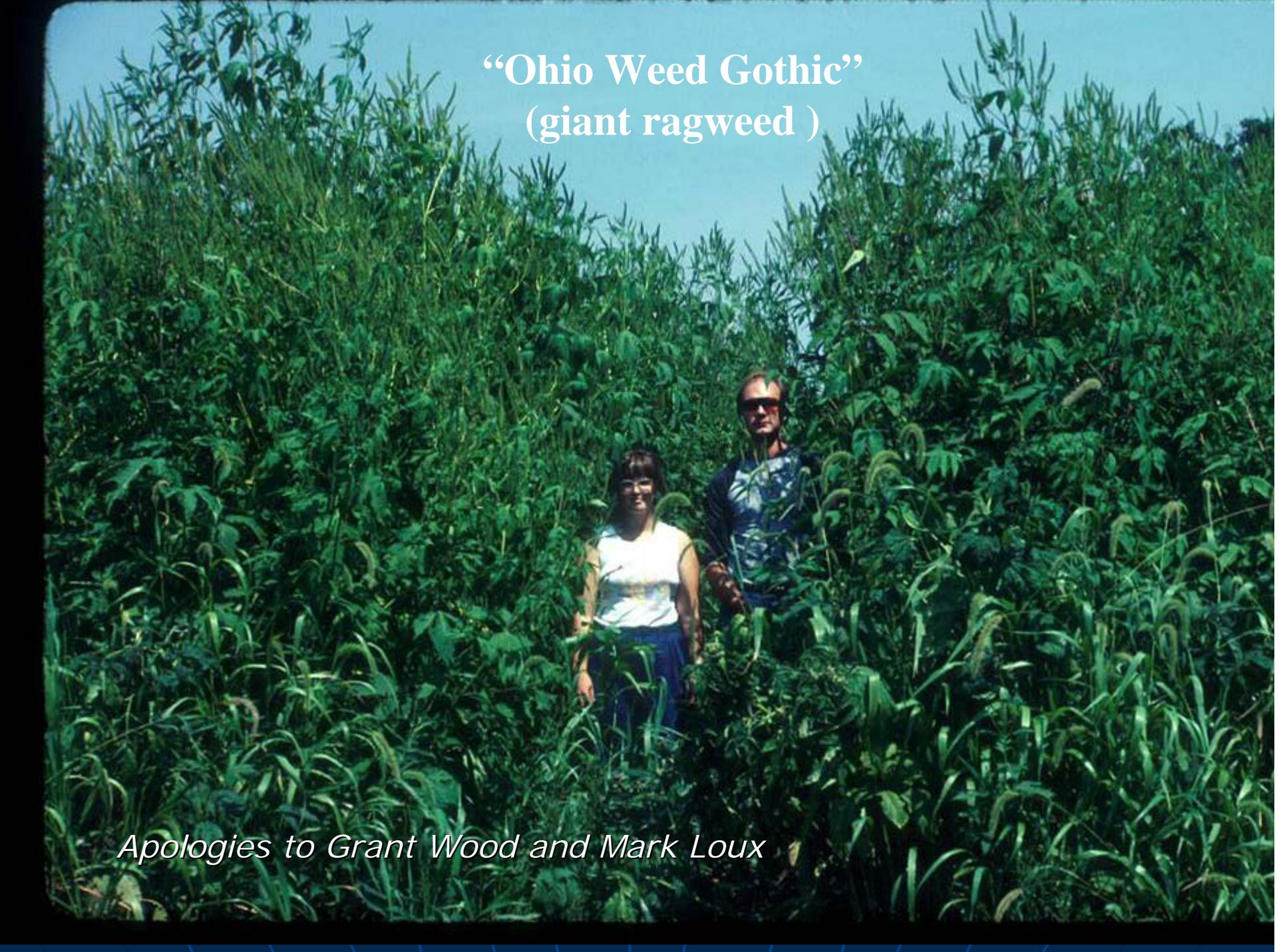
- Early reports and publications from Iowa State University on glyphosate resistance in common waterhemp
- Press release in September 2005 from the University of Missouri reporting glyphosate resistance
- Two fields in NW Missouri
 - Continuous soybeans
 - 9 recurrent selections with glyphosate (multiple applications per season)
- Only efficacy data available (~6x fold resistance)
- Field views appear similar to most Iowa/Midwest soybean fields

Glyphosate resistant common ragweed



Glyphosate resistant common ragweed

- Press release from the University of Missouri in 2004
- A small portion of one field has a historic population of common ragweed that resists 10x levels of glyphosate
- Press release from the University of Arkansas in 2005 describes 2x levels of glyphosate resistance (6 recurrent selections)



“Ohio Weed Gothic”
(giant ragweed)

Apologies to Grant Wood and Mark Loux

Ohio common lambsquarters



Untreated

1X

4X



Untreated

1X

4X

Glyphosate 1X = 0.75 lb ae/A



Even at low population (10 plants/m²) Asiatic dayflower reduces soybean yield (Mishra *et al* 2002)

Conclusions

- Glyphosate-based production systems will predominate many/most production systems in the foreseeable future
- Evolved glyphosate resistance and/or weed population shifts will likely increase at an increasing rate
- Bigger concerns than glyphosate resistance:
 - Economics (loss of yield due to poor application timing)
 - Decline in IWM (spray and spray again)
 - Decline in IPM (as long as you are in the field)