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
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 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
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

[Images of plants treated with different concentrations of Glyphosate]

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)