Introduction and Objective

Glyphosate-resistant weeds, confirmed in 32 states, continue to be a major threat to corn and soybean production across the Nation. In January 2012, a population of giant ragweed (Ambrosia trifida) from southern Wisconsin was announced as the first confirmed case of glyphosate resistance in the state. A pro-active survey of late-season weed escapes in corn and soybean fields was conducted throughout Wisconsin during late-July through early-September of 2012. One objective of the survey was to identify areas where additional populations of glyphosate-resistant weeds may exist.

Methods

- An on-line survey was distributed to Wisconsin producers in June 2012 to generate contact information, field history information, and permission for in-field sampling
- 153 fields (91 corn and 62 soybean) were sampled for late-season weed escapes in 2012.
- While conducting the in-field sampling, seed heads from 30-40 mature plants that escaped postemergence glyphosate applications were collected
- Seed heads were threshed and seedlings were grown in the greenhouse for preliminary glyphosate screening
- Glyphosate was applied to seven to ten putative susceptible and putative resistant plants at rates of 0, 0.43, and 0.87 kg ae ha⁻¹ for numerous populations of horseweed, giant ragweed, waterhemp, velvetleaf, redroot pigweed, and Powell amaranth.
- Preliminary screens warranted a dose response experiment for a population of horseweed (Conyza canadensis) from Jefferson County.
- Glyphosate was applied to the putative resistant population from Jefferson County and a putative susceptible population from Grant County at rates of 0, 0.22, 0.43, 0.87, 1.74, and 3.48 kg ae ha⁻¹. Treatments were replicated eight times and the experiment was repeated once.
- Data from the two dose response experiments were combined and analyzed in R statistical freeware.

Results

The population of horseweed from Jefferson County was confirmed resistant. The effective dose of glyphosate needed to reduce dry horseweed biomass by 50% (ED₅₀) was estimated to be 1.59 kg ae ha⁻¹ and 0.28 kg ae ha⁻¹ for the putative resistant and putative susceptible population, respectively (Figure 2). Therefore, the plants from Jefferson County were confirmed glyphosate-resistant with nearly six-fold difference in response from the susceptible plants.

Conclusions

The identification of this glyphosate-resistant horseweed population demonstrates the effective approach of the pro-active late-season weed escape survey. This approach was particularly successful because farmers do not usually recognize herbicide-resistant weed problems until the frequency of the resistance in a field is fairly high. However in this case, the accession of glyphosate-resistant horseweed occurred in two small patches of about 20 plants per patch. Furthermore, these were the only horseweed plants found throughout the entire late-season weed escape survey. With the early identification of this glyphosate-resistant horseweed population, hopefully future control of glyphosate-resistant horseweed through diversified weed management strategies can still be successful, and other farmers without glyphosate-resistant horseweed will adopt diversified management to augment the threat of this weed in Wisconsin.

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Figure 1. Horseweed plants (glyphosate-resistant) grown from the seed collected in Jefferson County, Wisconsin compared to a glyphosate-susceptible population from Grant County and their response to postemergence glyphosate in the greenhouse at rates ranging from 0 to 4x with 1x being 0.87 kg ae ha⁻¹ (22 fl oz product ac⁻¹). Plants were sprayed when horseweed rosettes measured 2.5 to 5 cm (1 to 2 inches) in diameter.

Figure 2. Shoot dry biomass of Jefferson County horseweed and susceptible horseweed following treatment with glyphosate at doses up to 3.48 kg ae ha⁻¹ as estimated by a four-parameter log-logistic regression function.