Establishing an herbicide resistance monitoring program for Pennsylvania soybean growers

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Research Summary: Herbicide resistant weeds in soybean have become an important consideration when designing a weed control program. One of the pillars of herbicide resistance management is timely detection of resistant populations. The long-term goal of this project is to establish an herbicide resistance monitoring program to provide timely detection of resistant weeds for soybean farmers in Pennsylvania. Once this project is completed, growers would be able to submit leaf samples for herbicide resistance diagnostics with short turnaround time (i.e., days, as opposed to several months with current techniques). Our program could be used to detect herbicide resistance before herbicide application to assist with in-season decision making. As the first step towards this goal, we are assessing the state of resistance distribution in the Commonwealth. In the 2022 growing season, we sampled annual ryegrass, marestail, Palmer amaranth, and waterhemp, the most commonly observed species in fields (Figure 1). After the end of sampling in November 2022, we began greenhouse experiments to test for 17 commonly used herbicides.

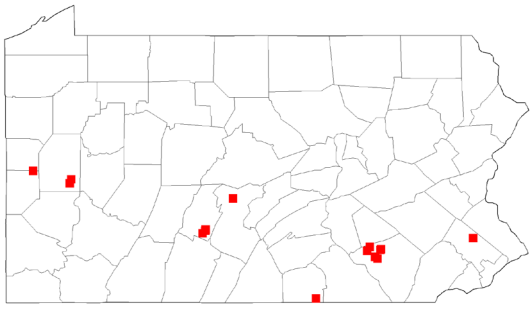

Figure 1. Map of Pennsylvania and locations where weed populations were collected in 2022.

Findings: We observed that resistance to glyphosate, ALS inhibitors (e.g., Pursuit), and atrazine in waterhemp is widespread (Figure 2), but not in all populations. A single population displayed resistance to 2,4-D and dicamba. We also observed that products containing flumioxazin (e.g., Valor), fomesafen (e.g., Reflex), glufosinate (e.g., Liberty), and tiafenacil (Reviton) are still efficient. Populations of Italian ryegrass displayed resistance to fluazifop (e.g., Fusilade) and glyphosate. All marestail populations were resistant to glyphosate and chlorimuron (e.g., Classic), but were controlled by atrazine, 2,4-D, glufosinate, and dicamba. Given weed populations displayed distinct resistance patterns, growers could benefit from a system for quick herbicide resistance diagnosis. In 2023, we considerably expanded our sample size to obtain a better representation of the state of herbicide resistance in PA. Future work will test those populations against key soybean herbicides.

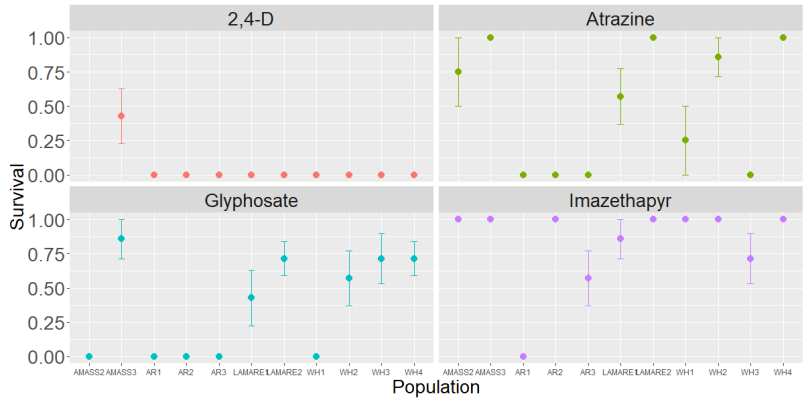

Figure 2. Example of herbicide resistance screening data for waterhemp. Proportion of survivors (Y-axis) and population name (X-axis). Datapoints represent mean response with seven replications.