PALMER AMARANTH: IT COMES HERBICIDE PROOF AND ADAPTS WELL TO WISCONSIN

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Palmer amaranth is ranked as the most troublesome weed species in the southern US. In recent years, Palmer amaranth has become more predominant in the southern part of the Midwest, further increasing the complexity of weed management in corn and soybean production systems in the region. Having similar biological characteristics as waterhemp (male and female plants, prolific seed producer, wide emergence window, and vigorous growth), Palmer amaranth can be difficult to control and capable of rapidly evolving resistance to herbicides. Populations from across the US have been documented to have evolved resistance to 8 herbicide sites of action (SOAs) including groups 2 (ALS-inhibitors), 3 (Microtubule inhibitors), 4 (synthetic auxins), 5 (PSII-inhibitors), 9 (EPSPS-inhibitors), 14 (PPO-inhibitors), 15 (VLCFA-inhibitors), and/or 27 (HPPD-inhibitors). Of these, populations identified in Wisconsin have been confirmed resistant to groups 2, 9, and/or 27 (Heap, 2019). Separate individual populations from Kansas and Arkansas have been documented to have evolved resistance to 5 different SOAs.

Greenhouse experiments were conducted to determine herbicide-resistance level of a Palmer amaranth population from southern Wisconsin identified in August of 2018. Two Palmer amaranth populations from Nebraska were included for comparison. The populations were screened to preemergence (PRE) and postemergence (POST) herbicides commonly used in corn and soybean production. PRE treatments included atrazine, mesotrione, metribuzin, sulfentrazone, and S-metolachlor at 0.5x, 1x, and 3x label rate. POST treatments included glyphosate, imazethapyr, atrazine, lactofen, mesotrione, glufosinate, and dicamba at 1x and 3x label rates. PRE treatments were applied at planting of Palmer amaranth and POST treatments were applied when plants reached 2-4 inches tall. For the PRE experiment, number of established plants was determined at 25 days after treatment (DAT). For the POST experiment, a visual evaluation was taken on a scale from 1 (dead) to 10 (healthy) at 21 DAT. Palmer amaranth populations were considered resistant to each POST treatment if more than 50% of treated plants across both experimental runs had VE $\geq$ 7. Atrazine did not provide satisfactory control in PRE emergence applications. Reduced PRE rates (0.5X) resulted in lower Palmer amaranth control for some herbicides. All populations tested in the POST emergence screenings were found to be resistant to imazethapyr (1x and 3x), two populations to glyphosate and atrazine (1x), and one population to atrazine (3x). The Wisconsin population was resistant to these three herbicides. Glufosinate resulted in the most satisfactory POST control. The results from these studies indicate that novel infestations of Palmer amaranth are likely to be resistant to herbicides.

Research investigating Palmer amaranth adaptation across a range of US Midwest climates was conducted in 2018 and 2019 in Wisconsin (1 location), Nebraska (3 locations), and Illinois (1 location) to evaluate the adaptation of Palmer amaranth to different cropping systems (corn, soybeans, and fallow). At each location a block of corn and soybean on 30 in row spacing were planted in May and a fallow block was established as well. Palmer amaranth plants were transplanted to the field at the 2-3 leaf stage at two timings (early June and early July). Palmer amaranth growth was influenced by location, crop emergence time

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and crop canopy type. Overall, Palmer amaranth plants transplanted in June produced higher biomass in fallow compared to corn and soybeans. When growing in corn and soybeans, Palmer amaranth produced higher biomass if transplanted in June compared to July. Palmer amaranth produced more biomass at the two westernmost Nebraska locations, center of origin of the population used herein, but it was also able to reach reproductive stages and produce a significant amount of biomass in the northernmost site (Arlington, Wis.). Results of this study indicate that if seeds are introduced and proper management is not adopted immediately, Palmer amaranth will likely establish and thrive in the upper Midwest cropping systems.

Reference

Heap, I. 2019. International Survey of Herbicide Resistant Weeds. Weed Science Society of America. http://www.weedscience.org/