COMMON LAMBSQUARTERS RESPONSE TO GLYPHOSATE ACROSS ENVIRONMENTS.
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Glyphosate use has increased dramatically as conservation-tillage practices and the adoption of glyphosate-resistant crops have become widespread. Common lambsquarters is a major problem weed of soybean and corn cropping systems in the upper Midwest. It is highly competitive and control with glyphosate can be inconsistent. We conducted a series of experiments to explore factors that may contribute to this inconsistent control.

Field research was conducted in 2006 and 2007 to determine the response of common lambsquarters to glyphosate under a wide-range of environmental conditions. Glyphosate was applied at 0.84 kg ae ha^{-1} plus 1 kg ha^{-1} ammonium sulfate to 10-cm tall plants on 18 dates in each year and to 20-cm tall plants on 18 dates in 2007. Control was assessed as visual injury relative to nontreated plants 28 days after herbicide treatment. In 2006, control of 10-cm tall plants did not differ among17 of 18 dates, and was 99% or greater. However, control was 0% on one date, and was attributed to 1 mm of rainfall within 1.5 hr of application. In 2007, control of 10-cm tall plants was less on three dates (93, 83, and 71%) relative to other dates. Similarly, control of 20-cm tall plants was less on two dates (88 and 81%) relative to all other dates. Regression analysis did not show any consistent relationships between environmental parameters (relative humidity, temperature at time of treatment, minimum and maximum temperature pre- and post-treatment) and visual injury ratings even though notable variation of environmental conditions existed. For example, the minimum air temperature 24 hr before and after application ranged from 4 to 24 and 0 to 24 C, respectively. The maximum air temperature 24 hr before and after application ranged from 18 to 32 and 12 to 33 C, respectively.

To investigate the effects of growth stage on common lambsquarters response to glyphosate, dose-response experiments were conducted at four sites in 2004 and 2005. Glyphosate was applied at doses ranging from 0.1 to 3.2 kg ha^{-1} to 10- and 20-cm tall plants. Above-ground dry mass (expressed as percentage of nontreated plants) was regressed over dose using a four parameter logistic equation. Doses that reduced mass by 50% (effective dose, ED_{50}) ranged from 0.06 to 0.17 kg ha^{-1} for 10-cm tall plants and 0.05 to 0.49 kg ha^{-1} for 20-cm tall plants across site-years. ED_{50} values were not affected by plant size in two site-years, but were 1.9 to 2.8 times greater for 20- than 10-cm tall plants in two other site-years. We also investigated the effect of rainfall on common lambsquarters response to glyphosate. In field experiments conducted in 2005 and 2006, glyphosate was applied at 0.84 kg ha^{-1} plus 1 kg ha^{-1} ammonium sulfate to common lambsquarters, followed by simulated rainfall 0.5, 1.0, 2.0 and 4.0 hr after treatment. Control was assessed as visual injury as described above. In each year, control increased with greater time between glyphosate application and rainfall.

Glyphosate was highly effective in controlling common lambsquarters under a wide range of environmental conditions in this study with a few exceptions. We were not able to identify environmental parameters that reduced efficacy in all cases. Rainfall following application and common lambsquarters stage of growth may be important contributing factors in certain instances of relatively low glyphosate efficacy. Subtle combinations of biotic and abiotic factors may be responsible for some instances of reduced glyphosate efficacy on common lambsquarters.

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