WHAT WE KNOW (AND DON'T KNOW) ABOUT GLYPHOSATE RESISTANCE IN WATERHEMP. Patrick J. Tranel, Ryan M. Lee, Michael S. Bell, Sukhvinder Singh, Jared R. Walter, and Kevin W. Bradley, Associate Professor, Postdoctoral Research Assistant, Graduate Research Assistant, Graduate Research Assistant, and Undergraduate Research Assistant, Department of Crop Sciences, University of Illinois, Urbana, IL 61801 and Assistant Professor, Division of Plant Sciences, University of Missouri, Columbia, MO 65211.

Much previous research has shown that waterhemp populations can be highly variable in their responses to glyphosate. However, until recently, no waterhemp population has been generally considered to be glyphosate "resistant" because: 1) the difference in glyphosate sensitivity was small and/or 2) a clear genetic basis for the resistance had not been demonstrated.

Two research groups independently conducted recurrent selection for glyphosate resistance, starting with waterhemp populations that were inadequately controlled by glyphosate in the field. Both groups succeeded in generating synthetic waterhemp populations with glyphosate resistance. However, even after several cycles of selection, populations continued to segregate for glyphosate response, i.e., no populations were obtained that were uniformly resistant. One explanation for this finding is that glyphosate resistance in waterhemp may be a multigenic trait.

More recently, a bona fide glyphosate-resistant waterhemp population was identified in Missouri. This population evolved in a field that had been continuously planted to glyphosate-resistant soybean since 1996 with concomitant use of glyphosate as the primary weed-control tool. A key question is whether resistance in this population is mediated by a single gene, or if the resistance is multigenic and like that observed in the recurrent selection experiments. Crossing experiments are ongoing to determine the genetic inheritance of glyphosate resistance in the Missouri population.

Results from genomic Southern-blot analysis indicate that waterhemp has two genes encoding EPSPS, the target enzyme of glyphosate. Preliminary analysis, however, has identified a transcript from only one of these two genes. Numerous polymorphisms were identified among EPSPS genes from resistant and sensitive waterhemp plants; however, no polymorphism was found that would be predicted to confer a glyphosate-resistant enzyme. A leaf-disc assay demonstrates that glyphosate resistance in plants from the Missouri population occurs at the level of leaf tissue, suggesting that resistance cannot be due solely to reduced shoot-to-bud or shoot-to-root glyphosate transport. Possibly, glyphosate resistance in waterhemp is due to exclusion of the herbicide from the active site, as has been suggested for other instances of evolved glyphosate resistance.

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