

WEED RESISTANCE IN THE MID-SOUTH AND FUTURE WEED CONTROL OPTIONS

Darrin M. Dodds
Mississippi State University
Mississippi State, MS

Abstract

The introduction of glyphosate-resistant cotton in 1997 revolutionized weed control in cotton. Prior to the introduction of this technology, weed control in cotton depended upon soil applied herbicides, cultivation, and herbicides applied layby or postemergence-directed. However, over reliance on glyphosate-resistant technology has resulted in several weed species that have developed resistance to glyphosate.

Horseweed (*Conyza canadensis*) was the first Mid-South weed in which resistance to glyphosate was confirmed. Resistance in this species was first reported in Tennessee in 2001, followed by Missouri in 2002, and Arkansas and Mississippi in 2003. Currently, Louisiana has no documented cases of glyphosate resistance in horseweed. Glyphosate resistance in giant ragweed (*Ambrosia trifida*) was documented in Arkansas and Tennessee in 2004 and 2005, respectively. In addition, glyphosate resistant common ragweed (*Ambrosia artemisiifolia*) was reported in Arkansas and Missouri in 2004. Italian ryegrass (*Lolium multiflorum*) was reported resistant to glyphosate in Mississippi in 2005. Weed species that have most recently developed resistance to glyphosate include Palmer amaranth (*Amaranthus palmeri*) and johnsongrass (*Sorghum halepense*). Palmer amaranth population in Arkansas and Tennessee were confirmed to be resistant to glyphosate in 2006 followed by populations in Mississippi in 2008. Some Mississippi populations have also demonstrated multiple resistance to glyphosate and acetolactate synthase inhibiting herbicides. The first report of johnsongrass resistance in the Mid-South was in Arkansas in 2007 followed by Mississippi in 2008. Currently, no documented cases of resistance to glyphosate have been reported in Louisiana; however, several different species including johnsongrass, Palmer amaranth, and common waterhemp (*Amaranthus rudis*) are under investigation.

A significant reduction in the development of new herbicides, modes of action, and/or transgenic technologies was observed in the years following the introduction of glyphosate resistant cropping systems. However, as more weed species have developed resistance to glyphosate, renewed interest has been placed upon development of weed management tools. For the foreseeable future, development of weed management tools will focus on expanding the use of currently available herbicides through the use of transgenic technology as well as an expansion in use of currently available herbicide resistance traits.

Glytol® technology is being developed by Bayer CropScience and offers glyphosate resistance similar to that of Roundup Ready Flex® cotton; however, Glytol® technology utilizes a different resistance gene and promoter than that of Roundup Ready Flex®. Glytol® is scheduled to be released in 2009; however, no insect resistance traits will be included in the initial introduction. Glytol® technology will be combined with Liberty Link® technology and offered as H2®. H2® is scheduled to be released in 2010; however, similar to Glytol®, the initial offering of H2® will not include insect resistance traits. H2® will be offered with Bollgard II® technology in 2011 and with Twinlink® technology in 2012.

Dow AgroSciences Herbicide Tolerance Trait (DHT®) is under development from Dow AgroSciences. DHT® technology will provide resistance to the phenoxy herbicide 2,4-D and the aryloxyphenoxypropionate family of graminicides. In addition, DHT2® will offer resistance to these herbicides as well as triclopyr. The DHT® herbicide tolerance package is scheduled to be released in cotton in 2013 in conjunction with glyphosate resistance. The utilization of this technology will require a tremendous amount of education on product selection as well as stewardship in regard to product use and off-site movement. DHT® cotton will not be resistant to other auxin like herbicides including the benzoic acids. In addition, insertion of this technology into corn will require a greater knowledge of herbicides and herbicide families. The DHT® package confers resistance to the aryloxyphenoxypropionate family of herbicides (Assure, Fusilade, etc.); however, it does not confer resistance to the cyclohexanedione family of herbicides (Select, Poast, etc.). Both families contain commonly used graminicides; however, use of the DHT® technology in corn hybrids will not allow use of herbicides from both families. Use of cyclohexanedione herbicides will result in severe injury or death of corn hybrids containing DHT® technology. Off-site movement, either through volatilization or drift, will be of concern in areas where crops are grown that are sensitive to herbicides used in this system. Expanding postemergence use of 2,4-D to cotton and other crops could

potentially create an environment in which crop injury occurs more frequently due to non-resistant crops being grown in close proximity to resistant crops.

University testing of dicamba tolerant cotton began on a very limited basis in 2008. Commercial release of this technology is scheduled for 2013. Dicamba tolerance is achieved through the use of the dicamba monooxygenase gene (DMO). This gene was discovered by researchers at the University of Nebraska at a dicamba manufacturing plant and has been licensed to Monsanto. Dicamba/glufosinate tolerant cotton is currently under development by Monsanto; however, no timetable for release is currently available. Similar to DHT®, dicamba tolerant cotton will not be resistant to 2,4-D or other herbicides that provide similar injury symptoms. This will require education on product selection as will be the case with DHT® technology.

Resistance to the 4-hydroxyphenyl pyruvate dioxygenase (HPPD) class of herbicides is being developed for soybeans and is scheduled to be released in conjunction with glyphosate resistance in 2014 in that crop. The potential for development of this technology in cotton exists; however, the current and future status is unclear.

In conclusion, several new herbicide tolerance traits are under development and are scheduled for release in the next two to five years. However, these traits only expand the use of currently available herbicides and/or traits. Private industry herbicide discovery programs are investigating new herbicides and modes of action; however, the time and expense required for discovery, development, and release of a new herbicide and/or mode of action is immense and could prove to be a significant financial risk for a given company. Although the search is underway for the next revolutionary herbicide, most herbicides introduced in the foreseeable future will be integrated into currently existing weed management programs and will not provide the basis for these weed management programs.