

WEED SCIENCE
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Scientists Say Herbicide Resistance Predates Genetically Engineered Crops by 40 Years

LAWRENCE, Kansas – July 12, 2016 – You may think weeds resistant to herbicides are a new phenomenon linked to the overuse of glyphosate in genetically engineered crops, but nothing could be further from the truth. Next year will mark the 60th anniversary of the first reports of herbicide-resistant weeds, while this year marks only the 20th anniversary of glyphosate-resistant crops.

The first known report of herbicide-resistance came in 1957 when a [spreading dayflower](#) (*Commelina diffusa*) growing in a Hawaiian sugarcane field was found to be resistant to a synthetic auxin herbicide. One biotype of spreading dayflower was able to withstand five times the normal treatment dosage. That same year [wild carrot](#) (*Daucus carota*) growing on roadsides in Ontario, Canada was found to be resistant to some of the same synthetic auxin herbicides.

Since then, 250 species of weeds have evolved resistance to 160 different herbicides that span 23 of the 26 known herbicide mechanisms of action. They are found in 86 crops in 66 countries, making herbicide resistance a truly global problem.

“Given all the media attention paid to glyphosate, you would think it would have the greatest number of resistant weed species,” says David Shaw, Ph.D., a Mississippi State University weed scientist. “Though there are currently 35 weed species resistant to the amino acid synthesis inhibitor glyphosate, there are four times as many weed species resistant to ALS inhibitors and three times as many resistant to PS II inhibitors.”

Scientists say what is unique about glyphosate resistance is the severity of selection pressure for resistance development. More than 90 percent of soybean, corn, cotton and sugar beet acres in the U.S. are glyphosate tolerant and receive glyphosate treatments – often multiple times per year.

“The sheer size of the crop acreage impacted by glyphosate-resistant weeds has made glyphosate the public face for the pervasive problem of resistance,” says Shaw. “But resistance issues are far broader than a single herbicide and were around long before glyphosate-resistant, genetically engineered crops were even introduced.”

Research shows that resistant weeds can evolve *whenever* a single approach to weed management is used repeatedly to the exclusion of other chemical and cultural controls – making a diverse, integrated approach to weed management the first line of defense. Many growers have had great success fighting resistance by adopting a broader range of controls.

One example is found in the [experiences of U.S. cotton growers](#) in the southern U.S. After years of relying on glyphosate for weed control, resistant Palmer amaranth (*Amaranthus palmeri*) began to overrun crops and caused yields to plummet. Today integrated weed management programs that use a diverse range of controls have become commonplace in cotton, despite the higher cost. Growers are using cover crops, hand-weeding, tillage, weed seed removal and herbicides with different mechanisms of action in order to keep Palmer amaranth at bay.

There have been tradeoffs. Additional herbicides, labor and fuel have tripled the cost of weed control in cotton. In addition, increased tillage has raised concerns about soil erosion from water and wind. But for now, the crop has been preserved.

“Although diversification is critical to crop sustainability, it can be difficult to make a decision to spend more on integrated weed control strategies,” says Stanley Culpepper, Ph.D., a weed scientist at the University of Georgia. “As a result, many of the most successful diversification efforts can be found in crops like cotton where change became an imperative.”

Culpepper says that in addition to costs, another barrier to adoption of integrated weed management is the belief by some that new types of herbicides will be invented to take the place of those no longer effective on resistant weeds. But the HPPD-inhibitors discovered in the late 1980s for use in corn crops are the last new mechanism of action to make its way out of the lab and into the market.

“It would be naïve to think we are going to spray our way out of resistance problems,” Culpepper says. “Although herbicides are a critical component for large-scale weed management, it is paramount that we surround these herbicides with diverse weed control methods in order to preserve their usefulness – not sit back and wait for something better to come along.”

About the Weed Science Society of America

The Weed Science Society of America, a nonprofit scientific society, was founded in 1956 to encourage and promote the development of knowledge concerning weeds and their impact on the environment. The Society promotes research, education and extension outreach activities related to weeds, provides science-based information to the public and policy makers, fosters awareness of weeds and their impact on managed and natural ecosystems, and promotes

cooperation among weed science organizations across the nation and around the world. For more information, visit www.wssa.net.