

Bluestem Breezes  
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## Weed resistance to glyphosate

This week's column is an excerpt from *Glyphosate Stewardship: Optimizing and Preserving Glyphosate Performance*, a new K-State Research and Extension publication, MF-2767. This publication is available online at: <http://www.ksre.ksu.edu/bookstore/pubs/MF2767.pdf/> If you haven't visited the K-State Research and Extension website lately, please do so. There is a wealth of knowledge at your fingertips: [www.ksre.ksu.edu](http://www.ksre.ksu.edu).

Weed resistance is defined by the Weed Science Society of America as "the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal to the native wild type." Even though glyphosate has been used for many years, development of glyphosate-resistant weeds was not an issue during its first 20 years.

However, a number of glyphosate-resistant weed species have been documented, including six species in Kansas (Marestail (horseweed), Common ragweed, Giant ragweed, Palmer amaranth, Common waterhemp, Kochia). Increased occurrence of glyphosate-resistant weeds probably relates mostly to increased reliance on glyphosate during the last two decades, especially when used exclusively in Roundup Ready crops or in burndown treatments ahead of planting in no-till or reduced-till systems. Selection pressure for herbicide resistance increases as the frequency of use increases.

Glyphosate-resistant weeds seem to be somewhat different than most other examples of herbicide resistance. ALS and triazine resistance is often regulated by a single gene, which results in an altered site of action with a high degree of resistance. Glyphosate resistance generally occurs at a lower level, is slower to develop, and may be a result of multiple genes, rather than a single dominant gene. It is harder to identify and quantify glyphosate-resistant weeds compared to ALS- or triazine-resistant weeds. The degree of glyphosate resistance is highly variable and seems to increase over time with continued selection pressure.

Poor weed control does not mean weeds are resistant, as several other factors can affect herbicide performance. However, glyphosate resistance may be possible if the following criteria exist.

- Glyphosate normally provides good control of the weed species in question.
- Other glyphosate-susceptible weeds were controlled as usual.
- Environmental conditions were favorable for glyphosate performance.
- The rate was correct for the species being controlled and there were no application errors.
- Glyphosate has been used frequently and often exclusively in the field.

If resistance is suspected in common ragweed, giant ragweed, or Palmer amaranth, contact your local K-State Research and Extension agent or weed researcher for further examination. Weeds of greatest concern for developing glyphosate resistance in Kansas include Palmer amaranth, common waterhemp, kochia, horseweed (marestail), lambsquarters, giant ragweed, and Russian

thistle. These species have a history of developing resistance to glyphosate and other classes of herbicides, and glyphosate has become a primary tool to control them in Kansas croplands. A key factor in the development of resistant weeds appears to be frequent and exclusive use of glyphosate for weed control. Consequently, a key practice to prevent development of glyphosate resistance is to avoid exclusive use of glyphosate. Management practices that diversify cropping systems and weed-control programs help reduce the risk of developing herbicide resistance, including:

- Rotation of competitive crops, including glyphosate-resistant and conventional crop varieties.
- Using herbicides with different modes of action in sequence or in tank mixes where practical.
- Using residual herbicides in the weed-control program, especially preemergence treatments.
- Using tillage occasionally when it fits into the cropping system.
- Applying glyphosate with appropriate adjuvants, at the proper rate and application stage, and under optimal conditions to maximize performance.

Evidence is building that use of lower glyphosate rates may increase the risk of weed shifts and selection for glyphosate-resistant weeds. With low glyphosate prices, it is not worth sacrificing performance by cutting the glyphosate rate.

Glyphosate has been an extremely valuable tool for weed control and has even helped shape current cropping systems. It is important to use glyphosate wisely to maintain its value for the future. Scout and monitor fields regularly for evolving weed problems and address them accordingly.

Further information on weed management is available by visiting the Extension Office (215 Kansas, Courthouse, Alma; [kamayer@ksu.edu](mailto:kamayer@ksu.edu); 765-3821). For Bluestem Breezes archives, check out [wabaunsee.ksu.edu](http://wabaunsee.ksu.edu).