

This research represents the first instance of a weed species having glyphosate resistance in bermudagrass turf.

bluegrass biotypes.

Alternative modes of action need to be used in regular rotation to guard against resistance development. This will involve using different chemistries at both pre- and postemergent timings. A list of herbicidal modes of action with activity against annual bluegrass is presented in Table 1 (pg. 40). In addition to rotating herbicides annually, tank-mixing active ingredients varying in mode of action can help mitigate the onset of herbicide resistance. However, modes of action included in these tank mixtures should also be rotated regularly.

Weed management programs focused on preventing the onset of herbicide resistance may be more costly than historical maintenance practices of applying the same product year after year. However, the investment in a rotation program will pay off in the long

run as weed management costs have been shown to increase dramatically in crop production due to the evolution of herbicide-resistant weeds (Norsworthy et al. 2012).

Future research will evaluate programs for managing herbicide-susceptible annual bluegrass and other weeds in turf with alternative chemistries in rotation to prevent the evolution of new herbicide-resistant biotypes.

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References

- Anonymous. 2010. Roundup ProMax herbicide label. Monsanto Company. St. Louis, MO. pp 1-11.
- Binkholder, K. M., B. S. Fresenburg, T. C. Teuton, X. Xiong, and R. J. Smeda. 2011. Selection of glyphosate resistant annual bluegrass (*Poa annua* L.) on a golf course. *Weed Sci.* 59: 286-289.
- Duke, S. O. and S. B. Powles. 2009. Glyphosate resistant crops and weeds: now and in the future. *AgBio Forum.* 12:346-357.
- Ellis, W. M. 1973. The breeding system and variation in populations of *Poa annua* L. *Evolution.* 27:656-662.
- Heap, I. 2013. International survey of herbicide resistant weeds. <http://www.weedscience.org>. Accessed: 1 January 2013.
- Hutto, K. C., J. M. Taylor, and J. D. Byrd. 2008. Soil temperature as an application indicator for perennial ryegrass control. *Weed Technol.* 22: 245-248.
- Lycan, D. W. and S. E. Hart. 2006. Seasonal effects on annual bluegrass (*Poa annua* L.) in creeping bentgrass with bispyribac-sodium. *Weed Technol.* 20: 722-727.
- Ng, C. H., W. Ratnam and B. S. Ismail. 2004. Inheritance of glyphosate resistance in goosegrass (*Eleusine indica*). *Weed Sci.* 52:564-570.
- Norsworthy, J.K., S.M. Ward, D.R. Shaw, R.S. Llewellyn, R.L. Nichols, T.M. Webster, K.W. Bradley, G. Frisvold, S.B. Powles, N.R. Burgos, W.W. Witt, and M. Barrett. 2012. Reducing the risks of herbicide resistance: best management practices and recommendations. *Weed Sci.* 60(sp1): 31-62.
- Roberts, H. A. and P. A. Feast. 1973. Emergence and longevity of seeds of annual weeds in cultivated and undisturbed soil. *J. Appl. Ecol.* 10:133-143.
- Sweeney, P. M. and T. K. Danneberger. 1995. RAPD characterization of *Poa annua* L. populations on golf course greens and fairways. *Crop Sci.* 35:1676-1680.
- Willis, J.B. 2008. Impact of sulfonylurea herbicides on seeded bermudagrass establishment and cold temperature influence on perennial ryegrass response to foramsulfuron. Ph.D. dissertation. Blacksburg, VA: Virginia Polytechnical Institute. p. 74-84.

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