

CHARACTERIZATION AND MANAGEMENT OF A HORSEWEED BIOTYPE WITH RESISTANCE TO GLYPHOSATE AND ALS-INHIBITORS. Jeff M. Stachler, Mark M. Loux, and S. K. Harrison, Weed Science Extension Program Specialist, Professor, Department of Horticulture and Crop Science, The Ohio State University, Columbus, OH 43210.

Greenhouse and field studies were conducted in 2003 and 2004 to characterize and manage a horseweed biotype with resistance to acetolactate synthase (ALS) inhibitors and glyphosate. In 2003, initial screening of 34 horseweed populations from Ohio resulted in the identification of one population from Montgomery County with resistance to cloransulam and glyphosate. A dose response study was subsequently conducted in the greenhouse to further characterize the response of this biotype to cloransulam and glyphosate, in comparison to three other biotypes that were ALS-resistant, glyphosate-resistant, or ALS- and glyphosate-sensitive. Cloransulam and glyphosate were applied alone and in combination at rates ranging from 0.001 to 100 times the recommended rate, which was 18 and 840 g ae/ha, respectively. The R/S (resistant to sensitive) ratio for the biotypes with ALS or glyphosate resistance was 105 and 25, respectively. The R/S ratio for the biotype with multiple resistance was 47 for cloransulam, 16 for glyphosate, and 21 when treated with a combination of cloransulam and glyphosate.

A field dose response study was conducted with the multiple-resistant biotype in the spring of 2004. Cloransulam and glyphosate were applied alone and in combination at 1, 2, or 4 times the recommended rate at two stages of horseweed growth, corresponding to plant stem heights of 1 and 10 cm. Horseweed control 28 DAT (fall germination at time of application), averaged across herbicide treatments and growth stages, was 58, 66, and 79% at 1X, 2X, and 4X, respectively, and decreased to 39, 51, and 60% at 42 DAT (fall and spring germination before and after application). When averaged across herbicide rates and treatments, control 28 DAT was 70% and 66% for the 1 and 10 cm horseweed stages, respectively, and decreased to 44% and 56% at 42 DAT. At 42 DAT, 95 to 100% of the plants were ALS-resistant in cloransulam treatments. For treatments containing glyphosate or cloransulam plus glyphosate, 55 to 75% of the plants were resistant to 1X rates, and 5 to 20% of the plants were resistant to 4X rates, when averaged over horseweed growth stage.

A field study was conducted to determine proper management of this multiple resistant biotype. The study included four main treatments, glyphosate (840 g ae/ha), glyphosate (3370 g ae/ha), glyphosate (840 g ae/ha) plus cloransulam (18 g ai/ha), and paraquat (548 g ai/ha to 885 g ai/ha) plus metribuzin (420 g ai/ha). Additionally, 2,4-D ester (560 g ai/ha and 1120 g ai/ha) was included with each of these main treatments. All treatment combinations were applied to three different stages of fall-germinated horseweed plants, 1, 10, and 23 cm stem length. Control was evaluated 28 DAT and 42 DAT after last application. Fall-germinated horseweed control averaged across all herbicides was 100, 94, and 94% for the 1, 10, and 23 cm timing, respectively. However, total (fall and spring-germinated) horseweed control at 42 DAT after last treatment was 61, 90, and 91%, respectively, due to germination after herbicide treatment. Glyphosate (840 g ae/ha) plus 2,4-D ester (560 g ai/ha) applied at the 10 cm timing provided only 87% control of fall-germinated horseweed at 28 DAT while glyphosate (3370 g ae/ha) plus 2,4-D ester (1120 g ai/ha) provided 100% control. Glyphosate (840 g ae/ha), plus cloransulam (18 g ai/ha), plus 2,4-D ester (560 g ai/ha) provided 87% fall-germinated horseweed control at the 23 cm timing at 28 DAT.

Results of these studies confirmed the presence of resistance to ALS inhibitors and glyphosate in a single horseweed biotype. The level of resistance to ALS inhibitors and glyphosate in this biotype was similar to that of other biotypes that were either ALS- or glyphosate-resistant. The high rate of glyphosate (3370 g ae/ha) in combination with 2,4-D ester and application to horseweed plants 10 to 23 cm tall were necessary to provide 93 to 100% control of the glyphosate and ALS-resistant horseweed biotype.