RESPONSE OF COMMON LAMBSQUARTERS TO GLYPHOSATE IN THE GREENHOUSE AND GROWTH CHAMBER. Mark M. Loux and Jeff M. Stachler, Professor and Program Specialist, Dept. of Horticulture and Crop Science, The Ohio State University, Columbus, OH 43210, and Brad A. Miller and Jeffrey B. Taylor, Technology Development Representatives, Monsanto Company, St. Louis, MO 63167

Over the past several years, some Ohio growers have observed inadequate control of common lambsquarters with postemergence glyphosate treatments in glyphosate-resistant soybean. Weed scientists at The Ohio State University (OSU) collected seed from lambsquarters plants surviving one or glyphosate applications in a number of fields in 2002 through 2004, to determine whether control problems could be due to the presence of biotypes with reduced sensitivity to glyphosate. OSU conducted greenhouse studies between 2003 and 2005 with a number of different populations to determine whether biotypes with reduced sensitivity to glyphosate could be identified. Monsanto conducted additional greenhouse and growth chamber studies in 2005 with selected biotypes provided by OSU.

In OSU greenhouse studies, a commercial formulation of the isopropylamine salt of glyphosate (Roundup UltraMAX®) was applied at rates of 0.84 and 3.36 kg ae/ha with 2% (w/v) ammonium sulfate when lambsquarters plants had 3 to 10 nodes and were 2 to 9 cm tall. A total of 12 lambsquarters biotypes appeared to have reduced sensitivity to glyphosate in one or more studies. However, results of ANOVA indicated that significant differences between a certain suspect biotype and a sensitive biotype were not necessarily observed in every study. Reduced sensitivity was exhibited primarily as less effective control at 0.84 kg/ha, although control was occasionally reduced at 3.36 kg/ha. For one biotype, studies included the initially collected composite sample from a field where glyphosate effectiveness appeared to be reduced, and seed from plants surviving glyphosate in a field or greenhouse study. Plants from the latter were less effectively controlled by glyphosate, compared to those from the original composite sample.

A dose-response study was conducted by OSU to further characterize the response of three of the suspect biotypes. A formulation of the potassium salt of glyphosate was applied at rates ranging from 0.08 to 84 kg/ha. Treatments were applied with 0.25% (v/v) of a proprietary nonionic surfactant blend and 2% (w/v) of ammonium sulfate when lambsquarters plants had 5 to 10 nodes and were 3 to 8 cm tall. The study was conducted twice, and nonlinear, logistic dose-response curves were fit to the combined data to calculate GR_{50} values. The suspect biotypes exhibited GR_{50} values that were 2.5- to 4.4-fold higher than a susceptible biotype on a dry-weight basis.

Monsanto completed two greenhouse studies and one growth chamber study by the time of abstract submission, with two more studies in progress. In these studies, one or two sensitive biotypes were compared to three biotypes identified to be less sensitive in OSU greenhouse studies. A commercial formulation of the potassium salt of glyphosate (Roundup WeatherMAX®) was applied at rates of 0.84, 1.68, and 3.36 kg/ha with 2% (w/v) ammonium sulfate when lambsquarters plants were 10 to 15 cm tall. Results of ANOVA for completed studies showed differences in the response of biotypes to glyphosate, but there was an interaction between biotype and glyphosate rate in the two greenhouse studies. In the growth chamber study, control of all biotypes, averaged over glyphosate rate, ranged from 82 to 94%. Control of the three suspect biotypes was significantly less than the sensitive biotype. Lambsquarters control in the greenhouse studies ranged from 47 to 100%, and differences among biotypes occurred only at the lower two glyphosate rates. In both greenhouse studies, all three suspect biotypes were less sensitive than a sensitive biotype at 0.84 kg/ha, and two of the suspect biotypes were less sensitive than the sensitive biotype at 1.68 kg/ha.

The authors conducted large-plot field studies in 2005 at sites where suspect biotypes were collected, and these are reported in a separate abstract. In addition, OSU conducted a small-plot field

study with one sensitive biotype and 6 suspect biotypes. Seeds of these biotypes were sowed in the experimental area, and each plot consisted of a single row of lambsquarters plants 7.6 m in length. A commercial formulation of the isopropylamine salt of glyphosate (Roundup UltraMAX®) was applied at 0.84 kg/ha with 2% (w/v) ammonium sulfate when lambsquarters plants were 10 to 15 cm tall. Control of individual plants of all biotypes 21 DAT exceeded 95%. A second application of glyphosate at a rate of 1.68 kg/ha 32 days after the first application resulted in 100% control of all plants.

These studies show that lambsquarters biotypes can vary in their response to glyphosate in the growth chamber and greenhouse. There appears be reduced sensitivity of some biotypes to rates of glyphosate up to 3.36 kg/ha, although the expression of this varies among studies. Results of a single field study conducted in 2005 did not corroborate those from greenhouse and growth chamber studies. Reduced sensitivity of some common lambsquarters biotypes to glyphosate may be an evolved response, and could be a contributing factor to poor performance of postemergence glyphosate treatments occasionally observed in growers' fields.