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Weed Management—Major Crops

Influence of Water Quality and Coapplied Agrochemicals on Efficacy of Glyphosate

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Experiments were conducted in 2008, 2009, and 2010 to determine the influence of water source as carrier and other agrochemicals on glyphosate efficacy and physicochemical compatibility. Glyphosate efficacy was not affected by most water sources, when compared with deionized water, although response was not consistent across all weed species, including cereal rye, common lambsquarters, common ragweed, goosegrass, Italian ryegrass, large crabgrass, Palmer amaranth, tall morningglory, and wheat. Control by glyphosate was not negatively affected when coapplied with cloransulam-methyl, dicamba, flumioxazin, pyrithiobac-sodium, thifensulfuron-methyl plus tribenuron-methyl, trifloxysulfuron-sodium, and 2,4-D but was affected by acifluorfen and glufosinate. Calcium, manganese, and zinc solutions consistently reduced weed control by glyphosate, whereas boron seldom affected efficacy. Compared with deionized water, Italian ryegrass control was affected by water sources when applied at seedling and jointing stages more so than at tillering and heading growth stages. Calcium, manganese, and zinc reduced control regardless of growth stage. Precipitates were not produced when glyphosate was applied with the water sources or fertilizer solutions. However, transient precipitates developed when glyphosate was coapplied with cloransulam-methyl, flumioxazin, thifensulfuron-methyl plus tribenuron-methyl, and trifloxysulfuron-sodium but not when coapplied with acifluorfen, dicamba, glufosinate, pyrithiobac-sodium, and 2,4-D. Solution pH ranged from 4.11 to 5.60 after glyphosate was added, regardless of solution pH before glyphosate addition.
Nomenclature: 2,4-D; acifluorfen; boron; calcium; cloransulam-methyl; dicamba; flumioxazin; glufosinate; glyphosate; manganese; pyrithiobac-sodium; thifensulfuron-methyl plus tribenuron-methyl; trifloxysulfuron-sodium; zinc; cereal rye, *Secale cereale* L.; common lambsquarters, *Chenopodium album* L.; common ragweed, *Ambrosia artemisiifolia* L.; goosegrass, *Eleusine indica* (L.) Gaertn.; Italian ryegrass, *Lolium perenne* L. ssp. *multiflorum* (Lam.) Husnot.; large crabgrass, *Digitaria sanguinalis* (L.) Scop.; Palmer amaranth, *Amaranthus palmeri* (L.) S. Wats.; tall morningglory, *Ipomoea purpurea* (L.) Roth; wheat, *Triticum aestivum* L.
Key words: Agrochemical compatibility, fertilizer solutions, solution pH, water sources.

En 2008, 2009 y 2010 se realizaron experimentos para determinar la influencia del tipo de agua utilizado como agente transportador y otros agroquímicos en la eficacia del glifosato y la compatibilidad físico-química. La eficacia del glifosato no se afectó por la mayoría de los tipos de agua, en comparación con el agua des-ionizada, aunque la respuesta no fue consistente para todas las especies de malezas, incluyendo, *Secale cereale*, *Chenopodium album*, *Ambrosia artemisiifolia*, *Eleusine indica*, *Lolium multiflorum*, *Digitaria sanguinalis*, *Amaranthus palmeri*, *Ipomoea purpurea* y *Triticum aestivum.* El control con glifosato no fue afectado negativamente cuando se aplicó en conjunto con cloransulam-methyl, dicamba, flumioxazin, pyrithiobac-sodium, thifensulfuron-methyl más tribenuron-methyl, trifloxysulfuron-sodium, y 2,4-D, pero sí fue afectado por acifluorfen y glufosinate. Las soluciones de calcio, manganeso, y zinc redujeron consistentemente el control de malezas con glifosato mientras que el boro rara vez afectó la eficacia. En comparación con el agua des-ionizada, el control de *Lolium multiflorum* fue afectado por los tipos de agua utilizada cuando esta se aplicó en estado de plántula y en la etapa de ramificación, en mayor grado que en las etapas de macollamiento y floración. El calcio, manganeso y zinc redujeron el control sin importar la etapa de crecimiento. No se produjeron precipitados cuando el glifosato fue aplicado con agua o soluciones de fertilizante. Sin embargo, se desarrollaron precipitados transitorios cuando el glifosato se aplicó con cloransulam-methyl, flumioxazin, thifensulfuron-methyl más tribenuron-methyl, y trifloxysulfuron-sodium, pero no así con acifluorfen, dicamba, glufosinate, pyrithiobac-sodium, y 2,4-D. El pH de la solución varió de 4.11 a 5.60 después de que se agregó el glifosato sin importar el pH anterior a la adición de glifosato.

Glyphosate and its salts were first described as herbicides in 1971 (Baird et al. 1971). Glyphosate is a broad-spectrum and systemic herbicide used to control weeds before planting or directly in glyphosate-resistant crops. It is foliar applied, and its efficacy depends on retention, cuticular penetration, and subsequent translocation to plant meristems (Mueller et al. 2006; Woodburn 2000).

Quality of water used in spray tanks can greatly affect the efficacy of herbicides. Various water sources have different characteristics, including different cations and pH, the presence of calcium carbonate responsible for water hardness, and carbonate and bicarbonate levels that determine alkalinity. Some suspended matter can also lead to turbidity in water. Polyvalent cations, including aluminum, calcium, iron, magnesium, and zinc, in the spray solution can reduce

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