

Micronutrients and Glyphosate

Micronutrients, including manganese (Mn) and zinc (Zn) are important for crop development. Soil application of these micronutrients is not as effective as foliar application, as availability of manganese can be reduced by factors such as high soil pH, presence of other metals, and high organic matter.

Glyphosate applied to soil

The favorable environmental fate characteristics of glyphosate, the active ingredient in Roundup brand agricultural herbicides, are well researched and established (Giesy et al, 2000). Glyphosate binds tightly to most types of soil. This tight binding means that it is not available for uptake by roots from soil. This binding also results in an extremely low potential for glyphosate to move into groundwater. Over time, glyphosate undergoes microbial degradation in soil, sediment and natural waters, under both aerobic and anaerobic conditions. The major metabolite formed is aminomethylphosphonic acid (AMPA), which also binds tightly to most soils and is degraded by microbial processes over time. Glyphosate and AMPA are ultimately degraded to carbon dioxide, inorganic phosphate, and other naturally occurring compounds. There is no credible evidence that the presence of glyphosate in soil at expected environmental concentrations causes extended adverse effects to microbial processes in soil. In the event that glyphosate reaches surface water, it dissipates by two primary mechanisms. It quickly partitions from water into sediment, and then is microbially degraded over time in both the water and the sediment. In flowing waters, factors such as tributary dilution and dispersion contribute to the dissipation of glyphosate. The dissipation of glyphosate in sterile and non-sterile water has been extensively studied.

Glyphosate and root exudation

There is limited evidence that glyphosate is exuded from plant roots. Most of the earlier studies were conducted on wild type plants which are injured by glyphosate. These results are therefore inconclusive since any root exudation could have resulted from the effects of injury or contamination by root tissues containing glyphosate. A study by USDA scientists in 2005 (Kremer et al) reported root exudation of glyphosate in GT (glyphosate tolerant) soybeans under hydroponic conditions. Using an ELISA assay, they reported extremely low levels of exudation of glyphosate at 200 and 1500 nanograms/plant after 2 days and 16 days, respectively. Even if some glyphosate is exuded, the extremely minute concentration from the roots is not likely to impact the bioavailability of Zn and Mn. The soil next to the roots contains a complex mixture of other metal ions besides Zn and Mn, along with organic acids exuded by plants that

effectively bind to metals. Furthermore, soil adsorption of glyphosate will further reduce the potential for glyphosate to impact the bioavailability of soil micronutrients.

Summary

Roundup® brand agricultural herbicides have been widely used for weed control in crops for over 30 years. Growers' experiences with Roundup agricultural herbicides have been extremely positive, including excellent weed control and profit potential.

- The theory of glyphosate affecting micronutrient availability has received attention but no causal relationship with glyphosate has been made.
- No data exist to show micronutrient chelating from glyphosate *inside crop plants* as a result of direct application to Roundup Ready® crops.
- The minute concentration of root-exuded glyphosate is not likely to impact the bioavailability of Zn and Mn. Additionally, soil adsorption of glyphosate will further reduce the potential for glyphosate to impact the bioavailability of soil micronutrients.
- It appears highly unlikely that glyphosate uptake from soil applications of Roundup brand herbicides applied at label rates for weed control can occur to the extent necessary to impact micronutrient availability.

Sources

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