



Glyphosate, the active ingredient in Roundup® agricultural herbicides<sup>1</sup>, is degraded over time by soil microbes into naturally-occurring substances. The intention of this Backgrounder is to explain the terminology relating to half lives and its relevance to field conditions.

The authors of a comprehensive ecotoxicological assessment of glyphosate (Giesy *et al.*, 2000) concluded the following: “Field studies indicate that glyphosate typically dissipates rapidly from both simple ecosystems, such as agricultural, and more complex ecosystems, such as forestry, regardless of the diverse edaphic [soil] and climatic conditions.” The authors also concluded that field studies conducted in agricultural and forest soils (13 studies, five countries, 47 different sites) indicated an average half-life of 32 days. In 2002, the European Commission completed an assessment of fate and behavior of glyphosate in environment (European Commission 2002). Under a wide range of climatic conditions found in the U.S., Canada, and Europe, the mean half-life for glyphosate degradation in field soil was reported to be 30 days, with a range from 1 to 130 days.

The half-life of glyphosate (the time required for half of the compound to dissipate or degrade) varies, depending on conditions. For example, a Monsanto study conducted at eight sites across the U.S. in 1992-1993 produced a range of half lives, some short (1.7, 7.3, 8.3 days) and some longer, up to 141.9 days at one site in Iowa (Oppenhuizen 1993). Anti-pesticide activist groups often cite the latter result. . The average half-life of glyphosate at the eight study sites was about 40 days, a moderately rapid rate compared with degradation of other compounds. The variability in rates of glyphosate degradation is believed to be due to the varying microbial activity and extent of soil-binding at the different study sites.

Half-life is related to soil persistence, but the two terms are not interchangeable. A half-life of 32 days means that half of the residues initially present will have dissipated or degraded in 32 days. However, this does not mean that all of the compound will be gone in 64 days. Detectable levels can be present even after 3 to 4 half-lives, but the concentration in soil will be very low and the residues will be tightly bound to soil particles. Detection of glyphosate at very low levels 3 years after application has been reported in a study conducted in subarctic forest soils in Sweden (Torstensson *et al.*, 1989), but was attributed to the lack of microbial activity during winter months and to the gradual release of small amounts of adsorbed glyphosate from treated vegetation residues, rather than an insufficient capacity of the soils to degrade glyphosate. Microbes, even if frozen for several months a year, eventually will degrade the glyphosate in soil.

The detection of glyphosate residues in soil does not mean that these residues are bioavailable. Indeed, the laboratory methods for extracting glyphosate from soil involve harsh conditions (extraction with 0.1-0.5 M KOH) which release residues that, under normal conditions, would be bound to the soil and not be available.

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<sup>1</sup> “Roundup agricultural herbicides” refers to Monsanto’s Roundup-branded agricultural herbicides with glyphosate as the sole active ingredient.

Glyphosate is widely used prior to planting of the crop or even post-planting before crop emergence, indicating that residues in soil shortly after application at the recommended rates do not affect crop growth. Similarly weeds can germinate and grow in treated areas. Furthermore, studies have demonstrated that glyphosate, when applied according to instructions, is not harmful to soil insects, earthworms or microscopic soil organisms. The latter in fact degrade the glyphosate (U.S. EPA, 1993).

## References

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