

# **Environmental Effects and Biodegradation Processes of Glyphosate**

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## **ABSTRACT**

The ecological effects and biodegradation processes of the herbicide glyphosate are becoming a topic of concern as the use Roundup Ready Technology continues to increase. Because the use of glyphosate has increased dramatically in only the past decade, researchers are investigating the potential harmful effects the chemical may have on humans and the environment. So far, studies have shown that glyphosate is not toxic to animals, plants, or humans at concentration levels found in the environment (Monsanto, 2003b). The primary reason for glyphosate's low toxicity in the environment is because of its ability to bind tightly to soil and be easily degraded in the environment. It has been shown that microorganisms are capable of using glyphosate as a source of carbon, nitrogen, and phosphorus (Haney et al., 2000 and Forlani et al., 1999). These facts provide support for the continued use of glyphosate as an effective herbicide, as it has been shown not to be harmful when exposed to the environment. However, glyphosate may have other negative impacts; the most important of which is the possibility that it could lead to the evolution of glyphosate resistant weeds.

**KEYWORDS:** Glyphosate, Roundup, biodegradation, herbicide resistant weeds

## **INTRODUCTION**

Glyphosate [N-(phosphonomethyl)glycine] is a broad-spectrum, non-selective, post-emergence herbicide. It is the active ingredient in Roundup, a glyphosate-based herbicide produced by Monsanto (St. Louis, Missouri). The use of Roundup has increased dramatically since the introduction of Roundup Ready (RR) crops. RR Technology refers to genetically engineered (GE) crops, primarily soybeans for now, that are resistant to glyphosate.

Because it is only a relatively recent development that glyphosate is being applied in such large quantities, concerns regarding the environmental effects of the herbicide are rising. Many studies have been done to show that glyphosate is not harmful to the environment at the concentrations used in farming, primarily because of its ability to be degraded easily in the environment. There are also rising concerns that the heavy dependence on a specific herbicide such as Roundup will lead to the evolution of herbicide resistant weeds, requiring the use of additional herbicides that may potentially be harmful to the environment.

The widespread use of glyphosate has resulted in a number of concerns from around the world. This paper will focus on the biodegradation processes glyphosate experiences, the potential ecological effects of glyphosate, and the future of glyphosate use and how it may be affected by the evolution of glyphosate resistant weeds.

## **ROUNDUP AND GLYPHOSATE INFORMATION**

Roundup is used to control weeds in numerous locations and situations. It can be used on farm fields, golf courses, or in home gardens. It can also be used to control unwanted vegetation in aquatic environments, restore wildlife habitats, or to control roadside vegetation. The primary use of glyphosate however, is to control weeds in soybean fields. It is effective controlling nearly all types of weeds, including grasses, broadleaves, and perennials. According to a report by the United States Geological Survey, glyphosate application in 11 midwestern states more than tripled from 11.3 to 37.5 million pounds between 1997 and 2000 (Glyphosate Reconnaissance, 2002). This corresponds to the increasing use of Roundup Ready crops, as seen in Figure 5.1. Roundup Ready corn technology is also being developed, and its use has increased as well. However, it has not achieved the same status as RR soybeans, as only 8-9% of corn acres in the U.S. were planted with RR corn (Fernandez-Cornejo and McBride, 2002).

