



Monsanto Company

Glyphosate has been the subject of hundreds of toxicological and environmental studies during the nearly 30 years of use. Because glyphosate products are used in so many different ways (agriculture, ornamental, aquatics, wildlife habitat, residential etc.), glyphosate is perhaps the most studied of any herbicide molecule. Many scientists – from industry, governmental agencies, universities and independent institutions – have conducted experiments, laboratory studies and field research with glyphosate herbicides.

To get a clear picture of the environmental and toxicological characteristics of the products, it is important to consider the total weight of evidence provided by this extensive body of research. The U.S. Environmental Protection Agency (EPA), Health Canada, the European Commission (EC) and many other regulatory bodies and science organizations, such as the World Health Organization (WHO) have reviewed this data. Their overwhelming consensus is that glyphosate, when used according to label directions, poses no unreasonable risk to people, wildlife or the environment.

The most recent review was conducted by the European Commission's Health and Consumer Protection Directorate-General, after which glyphosate was re-registered for use in Europe (Jan. 21, 2002). The EC review, like others around the world, concluded that glyphosate is not carcinogenic and has favorable toxicological properties, which are listed in tables for public access at http://ec.europa.eu/food/plant/protection/evaluation/existactive/list1_glyphosate_en.pdf.

The EPA and WHO have published two authoritative documents. In addition, two international panels of independent experts published peer-reviewed safety evaluations of glyphosate. Another summary report was compiled by EXTOWNET, a cooperative effort of extension toxicologists from several universities. All these summaries conclude that the weight of evidence shows very low risk to human health and the environment when the product is used properly.

Here are some quotations from four major works that assess the overall glyphosate weight of evidence:

EPA Reregistration Eligibility Decision: Glyphosate (September 1993):

Fact Sheet: <http://www.epa.gov/oppsrrd1/REDs/factsheets/0178fact.pdf>

Full RED: http://www.epa.gov/oppsrrd1/REDs/old_reds/glyphosate.pdf

- “Glyphosate is of relatively low oral and dermal acute toxicity.”
- “Exposure to workers and other applicators generally is not expected to pose undue risks, due to glyphosate's low acute toxicity.”
- “Several chronic toxicity/carcinogenicity studies...resulted in no effects...or resulted in findings that glyphosate was not carcinogenic in the study. In June 1991, EPA classified glyphosate as a Group E oncogen--one that shows evidence of non-carcinogenicity for humans.”
- “Glyphosate does not cause mutations.”

- “Human dietary exposure and risk are minimal.”
- “Glyphosate adsorbs strongly to soil...residues are expected to be immobile in soil.”
- “Glyphosate is readily degraded by soil microbes to AMPA, which is degraded to carbon dioxide.”
- “Based on current data, EPA has determined that the effects of glyphosate on birds, mammals, fish and invertebrates are minimal.”

WHO Environmental Health Criteria 159: Glyphosate (1994):

<http://www.inchem.org/documents/ehc/ehc/ehc159.htm>

- "Long-term toxicity was studied in mice and rats. Few effects were observed and, in almost all cases, at relatively high dose levels only."
- "Glyphosate, administered by oral and dermal routes, has a very low acute toxicity."
- "Animal studies show that glyphosate is not carcinogenic, teratogenic or mutagenic."
- "Possible hazard for most aquatic organisms is small or negligible. Fish and aquatic invertebrates would not be affected by glyphosate use."
- "Test data show low toxicity of glyphosate and its formulations to honey-bees, earthworms, birds and mammals."

“Ecological Risk Assessment for Roundup Herbicide” (Giesy, et al., 2000): *

- “Field studies indicate that glyphosate typically dissipates rapidly from both simple ecosystems, such as agricultural, and more complex ecosystems, such as forestry.”
- “Glyphosate does not bioconcentrate in fish or other animals.”
- “... minimal risk...would be expected for sediment dwelling organisms.”
- “...Roundup poses minimal risk to aquatic organisms.”
- “...the literature supports the conclusion that non-target arthropods (insects, spiders, mites) are at minimal risk from glyphosate and its formulations.”
- “Several comprehensive field studies have observed birds in forest plots treated with Roundup... In no case was there evidence of direct toxicity of Roundup or glyphosate to birds.”
- “It has been concluded that there is minimal risk to small mammals from the application of glyphosate products.”

[Click here for a summary of the Giesy review.](#)

“Safety Evaluation and Risk Assessment of the Herbicide Roundup and Its Active Ingredient, Glyphosate, for Humans” (Williams et al., 2000): **

URL: <http://dx.doi.org/10.1006/rtp.1999.1371>

- “Roundup is placed in U.S. EPA’s least toxic category (IV) for acute oral, dermal and inhalation toxicity. Thus, the Roundup formulation is considered to be practically nontoxic by all these routes of exposure.”
- “Results from several studies have established that glyphosate is not a reproductive or developmental toxicant.”
- “There is no evidence that...Roundup adversely impacts reproductive function.”
- “There was no suggestion of increased severity of effect in infants or children or of increased potency or unusual toxic properties of glyphosate in infants and children.”

- “The use of Roundup herbicide has no potential to produce adverse effects on endocrine systems in humans nor in other mammals.”

[Click here for a summary of the Williams review.](#)

Another excellent resource is EXTOKNET, a cooperative effort of University of California-Davis, Oregon State University, Michigan State University, Cornell University, and the University of Idaho. A glyphosate summary is available on-line at <http://ace.ace.orst.edu/info/extoknet/pips/ghindex.html>.

* Review by John P. Giesy, Stuart Dobson and Keith R. Solomon, published in *Reviews of Environmental Contamination and Toxicology*, (2000) Vol. 167, pp. 35-120. The publication was based on their review of more than 250 documents.

** Review by Gary M. Williams, Robert Kroes and Ian C. Munro, published in *Regulatory Toxicology and Pharmacology*, (2000) Vol. 31, pp. 117-165. The publication was based on their review of nearly 200 documents.