Compilation of Roundup Research

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**Introduction**

This research is a compilation of information found from a variety of sources about the effects of Roundup and its active ingredient glyphosate on the environment. The information is organized below under specific questions, providing answers to each of these questions, and it will include the source where this information is from.

**What is the active ingredient in Roundup, and how long will this ingredient remain in the soil?**

The active ingredient in Roundup is glyphosate, a well-known herbicide. The length of time it remains in the soil is dependent on the quality of the soil. Some glyphosate may be sorbed into the soil and stick to minerals such as aluminum and iron oxides, causing the glyphosate to remain in the soil longer, but decreasing the likelihood of leaching ([Reylea, Rick A.](http://onlinelibrary.wiley.com/doi/10.1002/ps.1512/full)). The half-life of glyphosate in the soil can vary anywhere from 1 to 174 days. (["Glyphosate."](http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html)). High microbial activity in the soil speeds the process of degradation.

**What is the likelihood of leaching or runoff of glyphosate?**

Overall, glyphosate is more likely to be runoff in surface water than to leach to groundwater. For this reason, it is recommended that the product not be used immediately before rainfall is expected. Research is somewhat ambiguous about the likelihood of leaching and surface runoff of glyphosate, however most sources agree that both of these scenarios are unlikely in the absence of heavy rain ([Reylea, Rick A.](http://onlinelibrary.wiley.com/doi/10.1002/ps.1512/full)). Since so much glyphosate is either broken down quickly by microorganisms or sorbed into soil minerals leaching is not expected unless the area experiences heavy rain. The same can be said for runoff into surface water, with some studies indicating that less than 2% of the product is likely to be lost to surface water, assuming any rain is not too heavy (["Glyphosate."](http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html)). The final concern about glyphosate is the potential of soil erosion into surrounding areas and water sources. There are again ambiguous studies about the likelihood of soil erosion, but the Roundup website itself does note this concern and advise individuals to use the product on clear days with little wind (["Are Roundup® Weed & Grass Killer Products Safe?"](http://www.roundup.com/smg/goART3/Howto/Are%2BRoundup%C2%AE%2BWeed%2B%26%2BGrass%2BKiller%2BProducts%2BSafe%3F/44100019)).

**What would happen if glyphosate did infiltrate water sources?**

The biggest concern for glyphosate in water sources is the potential effect on amphibian life. Laboratory tests have determined that glyphosate is lethal to amphibian larvae in high doses. This study was conducted by exposing larvae directly to glyphosate, however, so the actual lethality of small amounts of glyphosate that makes its way to water sources is unknown. However, this is still a concern because at certain doses about 96% of larvae were killed by the chemical ([Reylea, Rick A.](http://onlinelibrary.wiley.com/doi/10.1890/04-1291/full)). The half-life of glyphosate in standing water is 10-12 days (["Glyphosate."](http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html)).

**With the concerns above, how long before rainfall should Roundup be used?**

A variety of sources claim that the product dries incredibly rapidly, so that a mere 30 minutes prior to rainfall is an acceptable amount of time (["Can I Spray Roundup After Rain?"](http://homeguides.sfgate.com/can-spray-roundup-after-rain-91085.html)). However, some sources indicate that for the product to have maximum effectiveness it should remain in the soil for at least an hour before rainfall ([Yelverton, Fred](http://archive.lib.msu.edu/tic/turfx/article/2000nov5.pdf)). The Roundup website itself advises users not to spray the product within 24 hours of expected rain (["Are Roundup® Weed & Grass Killer Products Safe?"](http://www.roundup.com/smg/goART3/Howto/Are%2BRoundup%C2%AE%2BWeed%2B%26%2BGrass%2BKiller%2BProducts%2BSafe%3F/44100019)).

**What are the effects of glyphosate on organisms in the soil?**

There are many studies to suggest that glyphosate has either no effect on bacteria in the soil, or that, if anything, it might have a temporary positive effect on these microorganisms. Microbial communities are responsible for the actual breakdown of glyphosate, thus some studies conducted showed a temporary increase in microbial numbers in soils immediately after the initial use of Roundup. Other studies found that the use of Roundup had no effect at all on microbial communities. The same was true for the amount of fungi and bacterium in the soil (["The Impact of Glyphosate on Soil Health."](https://www.soilassociation.org/media/7202/glyphosate-and-soil-health-full-report.pdf)). The main concern then for the use of glyphosate in the soil is its effect on earthworms. Like the effects of glyphosate on amphibian larvae, several laboratory studies have been conducted showing the potentially lethal effects of glyphosate on earthworm larvae. Juvenile earthworms are also affected by glyphosate, but less likely to die out in large numbers like the larvae (["The Impact of Glyphosate on Soil Health."](https://www.soilassociation.org/media/7202/glyphosate-and-soil-health-full-report.pdf)). It is important to note, however, that the dosage that killed these animals was higher than what is likely to be used for a single usage with subsequent spot treatment.

**What would be the effect of the product on bees?**

Glyphosate has been labeled as “relatively nontoxic” to honeybees. Studies conducted have shown that the oral and dermal LD50 is 0.1mg per bee, however this is an unlikely amount of exposure in a single use of Roundup. If the Roundup were to be used more continuously, then it would become a threat to bees (["Glyphosate."](http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html)).

**What is the difference between using Roundup on the soil once and using it continuously?**

While most of the research above shows Roundup to be a more benign product than many might imagine, it is important to note that there would be more severe risks if the product was used consistently. Most wildlife is not negatively affected by the product in small doses, however the buildup of glyphosate in animals can lead to the deaths of birds, bees, and insects in addition to the harm it would cause to amphibians and earthworms. The more product that is used, the more dangerous it becomes to the surrounding environment, specifically to animals (["Glyphosate."](http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html)).

**What are the effects of glyphosate on humans and other mammals?**

Recently there has been an outbreak in concern over whether or not glyphosate is a carcinogen. Prior to 2005 many organizations including the U.S. Environmental Protection Agency claimed that the compound was not a carcinogen. In 2005, the International Agency for Research on Cancer (IARC) claimed that glyphosate was a “probable carcinogen.” This research, however, was criticized by scientists who claimed that the IARC had run tests and made assumptions based on hypothetical situations that were extremely unlikely to occur, and that their test results were thus compromised. Neither the EPA nor similar organizations in other countries have changed their claims about glyphosate ([Kabat, Geoffrey](https://www.forbes.com/sites/geoffreykabat/2016/11/21/while-unlikely-to-be-carcinogenic-the-herbicide-glyphosate-is-a-symptom-of-a-deep-social-pathology/%22%20%5Cl%20%2258c785082cbb)). Studies on the potential effects of glyphosate on mammals have widely found that the product is neither a carcinogen nor a mutagen (["Glyphosate."](http://pmep.cce.cornell.edu/profiles/extoxnet/dienochlor-glyphosate/glyphosate-ext.html)).

**What does the Roundup website say about all of this?**

The Roundup website is quick to advertise their product by claiming a 40-year history of safe use of the product. It also notes that more than 800 studies have been conducted on the product, the majority of which have been independent studies. The website mentions that the product should be completely harmless for both people and pets, and also notes that if used properly and effectively, Roundup should pose “no unreasonable risk to the environment” (["Are Roundup® Weed & Grass Killer Products Safe?"](http://www.roundup.com/smg/goART3/Howto/Are%2BRoundup%C2%AE%2BWeed%2B%26%2BGrass%2BKiller%2BProducts%2BSafe%3F/44100019)).

**What are the other alternatives?**

One alternative to using Roundup would be to use a “less toxic” herbicide. A list of the least toxic herbicides includes horticulture vinegar or acetic acid (found in products BurnOut II, Avenger, and Phydura), herbicidal soaps (found in Scythe), or iron-based herbicides (found in products Iron-X and Fiesta) (["Least-toxic Control of Weeds."](http://www.beyondpesticides.org/assets/media/documents/alternatives/factsheets/Least%20toxic%20control%20of%20weeds.pdf)). The effectiveness of these alternatives may be relatively low in comparison. Another option would be to continue to manually remove and manage unwanted grass and weeds, however this process would not only use up a lot of time and manual labor, but would also have environmental impacts in the years of car emissions that would be used to transfer helpers on this project to the school and back with all the materials needed.

**Works Cited**

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