

I. National Pesticide Information Center – General Facts

Glyphosate is the active ingredient in the herbicide called Round-Up.

What is Glyphosate?

- Glyphosate is an herbicide, applied to the leaves of plants to kill broadleaf plants & grasses.
- First registered for use in the U.S. in 1974, it is the most widely used herbicide for weed abatement in the U.S. and Europe today.
- Uses:
 - o Agriculture
 - o Residential on lawns & gardens
 - o Industrial Areas

How does Glyphosate work?

- Non-selective, meaning it will kill most plants.
- It inhibits a specific enzyme pathway necessary for plant photosynthesis. Hence, no direct target to animals & humans.
- Prevents plants from making certain proteins that are needed for plant growth

What happens to Glyphosate in the environment?

- Does not vaporize after it is sprayed.
- It can persist in soil for up to 6 months depending on the climate & type of soil it is in.
- It does not likely get into groundwater because it binds tightly to soil. In one study, half the glyphosate in dead leaves broke down in 8-9 days. Another study found that the herbicide was taken up by carrots & lettuce after the soil was treated with it.

Human exposure to Glyphosate that would cause temporary harm:

- Skin contact
- Eyes contact
- Breathing it

Study on rats & link to Cancer:

- When high doses were administered to laboratory animals, some studies suggest that it has carcinogenic potential.
- Studies on cancer rates in people have provided conflicting results on whether the use of glyphosate containing products is associated with cancer.

II. THE CONTROVERSY: Does it cause cancer in humans?

In 1993 the **Environmental Protection Agency** (EPA) considered “glyphosate to be noncarcinogenic and relatively low in dermal and oral acute toxicity. The EPA considered a "worst case" dietary risk model of an individual eating a lifetime of food derived entirely from glyphosate-sprayed fields with residues at their maximum levels. This model indicated that no adverse health effects would be expected under such conditions.”

Glyphosate and formulations such as Roundup have been approved by regulatory bodies worldwide, including the **European Food Safety Authority, Canada’s Pest Management Regulatory Agency, German Federal Institute for Risk Assessment, European Food Safety Authority, the World Health Organization’s Joint Meeting on Pesticide Residues, and the European Chemicals Agency For Risk Assessment (RAC)**, who all concluded, like the EPA, that it does not cause cancer in humans.

In opposition to these agencies, in 2015 the **World Health Organization’s International Agency for Research on Cancer** (IARC) classified glyphosate as a probable cancer agent, citing that there was a particular strong link between the herbicide & non-Hodgkin lymphoma. The scientist leading that review knew of fresh data showing no cancer link – but because the findings were unpublished at the time he was not allowed to include them as the agency can only consider published research. The unpublished research came from the **Agricultural Health Study**, a large and significant study, led by scientists at the **U.S. National Cancer Institute**, of agricultural workers and their families in the U.S. The IARC has no plans to reconsider its assessment of the chemical.

Our research showed this to be the only report to link glyphosate to cancer in humans, which has sparked hefty debate worldwide.

After the IARC report, lawsuits against Roundup, Monsanto's flagship product, began piling in with over 1100 people throughout the U.S. claiming that exposure to the herbicide caused them to develop non-Hodgkin lymphoma. The lawsuits are still pending and under dispute.

EPA's Glyphosate Status Update per its PPDC Meeting, Nov. 1, 2017

Background:

- Since 2009 the EPA has been conducting annual registration reviews through the **Pesticide Program Dialogue Committee** (PPDC)
- Multiple delays in the release of the risk assessments for glyphosate were caused by certain science issues and **IARC's** classification of glyphosate as a "*probable*" cancer agent.
- EPA held a FIFRA (Federal Insecticide Fungicide Rodenticide Act) mtng. in Dec. 2016 in which the agency proposed to classify glyphosate as not likely to cause cancer

Current Status Update:

- On 12/18/17 EPA again concluded that glyphosate is not likely to be carcinogenic to humans when used according to pesticide label but may have potential impact on birds, mammals & terrestrial & aquatic plants.
- EPA current registration review is open for comments until 4/30/18 on their website.
- Once public comments are received, EPA will reassess risk which will include proposed labeling changes & other risk mitigation measures, if necessary.
- EPA plans to complete a Final Decision after an evaluation of risks to pollinators & a complete endangered species assessment.
- EPA will initiate endangered species consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Services by 2020

Recent News:

September 2017: In the wake of the lawsuits against Monsanto, which began in the U.S. as a result of the **IARC** report, five countries – Belgium, Malta, Sri Lanka, The Netherlands & Argentina – have banned glyphosate.

November 2017: After a large careful study on agricultural workers, the **National Cancer Institute** publishes in journal that “Active ingredient in Roundup does not cause cancer”. In summary, among 54,251 pesticide applicators studied, 82.9 % used glyphosate which was not statistically significant in its association with cancer.

November 2017: Glyphosate won a new five-year lease in Europe, authorized by the **European Commission**, closing the most bitterly fought pesticide relicensing battle of recent times.

February 2018: A federal judge on Monday temporarily barred California environmental officials from requiring cancer warnings on food products that contain traces of the herbicide glyphosate. The injunction by U.S. District Judge William Shubb leaves glyphosate on the state's so-called Proposition 65 list as a "chemical known to the state of California to cause cancer," but bars anyone from enforcing a requirement to warn consumers about the presence of the herbicide.

III. Ecological Impact:

Environmental organizations have conducted studies on the use of glyphosate in agricultural areas and have concluded that it is harmful to pollinators like bees and the monarch butterfly.

- In honeybees, exposure to levels of glyphosate interferes with their ability to forage efficiently & return to the hive.
- Glyphosate is responsible for killing milkweed, which the Monarch butterflies use for procreation, contributing to their decline.

IV. Recent Scientific Research, 'The Scientist' 2/7/18

- Glyphosate & Roundup have different, sometimes adverse, effects on the mitochondrial function when tested on zebrafish
- Since Monsanto doesn't reveal the inert ingredients in Roundup, it makes it very difficult for scientists to determine which chemical or surfactant is the most toxic.
- Concentrations of the herbicide generally applied in animal studies way exceeds those that would be normally found in real-world environments & aren't reflective of real-world situations as the herbicide is not being used according to instructions. For instance, the label directs pesticide applicators to use chemical-resistant gloves & protective eyewear when applying Roundup.
- While some scientists say that glyphosate binds to soil particles, damaging to the environment, other experts refute that every soil tested in the world contains bacteria that would eat the herbicide, and that it degrades very rapidly in soil.
- A recent study by a team of researchers in France revealed that Roundup exposure leads to major changes in the gut microbiome of rats

V. Alternative Methods to Roundup for Weed Abatement:

- **Acetic Acid**, commonly known as vinegar:
 - Tried in field and was not successful
 - Not practical on a large scale
- **Phytotoxic Oils** (clove, peppermint, pine or citronella)
 - Phydura
 - Active ingredient is clove oil
 - Tried in field in small area, was successful
- **Salt Based Herbicide**
- **Herbicidal Soaps**
- **Other Organic Products**

SOURCES:

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What is glyphosate?

Glyphosate is an herbicide. It is applied to the leaves of plants to kill both broadleaf plants and grasses. The sodium salt form of glyphosate is used to regulate plant growth and ripen fruit.

Glyphosate was first registered for use in the U.S. in 1974. Glyphosate is one of the most widely used herbicides in the United States. People apply it in agriculture and forestry, on lawns and gardens, and for weeds in industrial areas. Some products containing glyphosate control aquatic plants.



What are some products that contain glyphosate?

Glyphosate comes in many forms, including an acid and several salts. These can be either solids or an amber-colored liquid. There are over 750 products containing glyphosate for sale in the U.S.

Always follow label instructions and take steps to avoid exposure. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 1-800-222-1222. If you wish to discuss a pesticide problem, please call 1-800-858-7378.

How does glyphosate work?

Glyphosate is a non-selective herbicide, meaning it will kill most plants. It prevents the plants from making certain proteins that are needed for plant growth. Glyphosate stops a specific enzyme pathway, the shikimic acid pathway. The shikimic acid pathway is necessary for plants and some microorganisms.



How might I be exposed to glyphosate?

You can be exposed to glyphosate if you get it on your skin, in your eyes or breathe it in when you are using it. You might swallow some glyphosate if you eat or smoke after applying it without washing your hands first. You may also be exposed if you touch plants that are still wet with spray. Glyphosate isn't likely to vaporize after it is sprayed.

NPIC General Fact Sheets are designed to provide scientific information to the general public. This document is intended to promote informed decision-making. Please refer to the Technical Fact Sheet for more information.