

## Summary of Dangers of Glyphosate/Roundup

Roundup, whose main and best-known ingredient is glyphosate, is one of the most-used herbicides ever; it's also one of the most dangerous.

U.S. farmers apply nearly 300 million pounds of Roundup on more than a billion acres of their fields annually, according to data from the U.S. geological survey (1,2). This doesn't count the amount used in non-agricultural applications such as forestry, parks, playing fields, and on private lawns and gardens. A stunning 3.5 billion pounds of Roundup have been used in the U.S. since 1974 and 18.9 billion pounds worldwide (3,4). No pesticide in history has been sprayed so widely.

In addition to being used in conjunction with "Roundup ready" crops since 1996, i.e., crops that have been genetically modified to resist its effects, Roundup has been used since 1999 directly on non-GE crops, such as grains, sugar cane, peanuts and potatoes, as a desiccant just before harvest (5).

Glyphosate has been linked to a wide range of diseases and conditions in humans including birth defects, liver damage, Alzheimer's disease, Parkinson's disease, ADHD, various cancers, and celiac disease. It has also been shown to cause cancers, other mutations or death in amphibians, fish, rats, poultry and cattle. (6, 7, 8, 9)

Additionally, Monsanto has patented glyphosate as an antibiotic, raising concerns that it is fueling antibiotic resistance in bacteria. Its antibiotic properties may also destroy beneficial bacteria in the digestive tract leading to diseases in humans and other animals that consume glyphosate-tainted grains. (10, 11)

Worldwide, countries are becoming increasingly suspicious of glyphosate-based herbicides/pesticides. In 2015, glyphosate was deemed a probable human carcinogen by the World Health Organization's International Agency for Research on Cancer. (12,13) The entire formulation of Roundup, including the supposedly "inert" ingredients, may be even more dangerous, since the "inert" ingredients are added to enhance Roundup's toxicity (14). In reaction to concerns raised by glyphosate, 29 countries have restricted or banned glyphosate-based herbicides (15).

In the U.S., the public's awareness of the devastating effect that Roundup has on human health, especially the connection between Roundup and non-Hodgkin's lymphoma has increased in recent months. In California, three major legal cases have been won and hundreds of millions of dollars awarded to people who used Roundup and are now dying of non-Hodgkin's lymphoma (16).

Less widely known (and what our group is focusing on) is the deleterious effects that Roundup has on living things in the soil, thus severely compromising overall soil health (17). Roundup is deadly to nitrogen-fixing bacteria (18), mycorrhizae (19), plant growth-promoting bacteria (PGPR organisms), as well as larger organisms in the soil such as

earthworms. Additionally, Roundup is harmful to pollinators, stimulates soil-borne diseases, compromises plants' ability to resist these diseases and reduces plants' ability to take up nutrients (20, 21). Thus, the use of Roundup adversely affects the complex interaction between plants and the soil microbiome, undercutting and hampering the processes of photosynthesis and carbon sequestration.

There are currently two strong glyphosate-related bills in the Massachusetts legislature:

- H792 would mean a total ban of glyphosate in Massachusetts.
- S447 would empower municipalities to regulate pesticides at the local level. (The regulation of herbicides/pesticides resides in the Massachusetts Pesticide Board.)

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