

# Roundup Weed Killer Called Out as a Bee Killer

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✓ Fact Checked

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## STORY AT-A-GLANCE

- › According to researchers at the University of Texas at Austin, glyphosate may kill bees by altering the bacterial composition in the bees' guts, making them more prone to fatal infections
- › Researchers call for improved guidelines for glyphosate use, as current guidelines assume bees are not harmed by glyphosate-based herbicides
- › Roundup reduces beneficial bacteria in the colon of female rats. Regardless of the dose – 0.1 ppb, 400 ppm or 5,000 ppm – the animals' gut bacteria underwent significant changes
- › Glyphosate's primary mode of action is that it shuts down amino acid synthesis, followed by inhibition of protein synthesis necessary for plant growth. This also causes the plant to be more susceptible to soil microbes, including pathogens
- › Roundup, dicamba and 2,4-D promote antibiotic resistance by priming pathogens to more readily become resistant to antibiotics; all three herbicides increase antibiotic-resistance of E. coli and salmonella specifically

***Editor's Note: This article is a reprint. It was originally published October 9, 2018.***

Use of glyphosate, a weed killer registered in 130 countries, has risen exponentially since the introduction of genetically engineered (GE) glyphosate-resistant crops. Between 1974 – the year glyphosate entered the U.S. market – and 2014, glyphosate

use increased more than 250fold in the U.S. alone. Today, an estimated 300 million pounds are applied on U.S. farmland annually.

In 2018, globally, nearly 5 billion pounds (over 2 billion kilograms) of glyphosate were applied to farm crops each year.<sup>1</sup> While GE crops were the catalyst for this tremendous surge in usage (since they were specifically designed to encourage farmers' use of glyphosate), the chemical has also become a popular tool for desiccating non-GE grains and legumes, and that has also spurred its use.

About 70 different commonly consumed food crops are sprayed with glyphosate, so just because a food is not genetically engineered does not mean it's free of glyphosate. As previously discussed in many articles, glyphosate and glyphosate-based weed killer formulations such as Roundup have been linked to a wide variety of human health consequences, including:

Non-Hodgkin lymphoma<sup>2</sup>

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Impairing your body's ability to produce fully functioning proteins<sup>3</sup>

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Inhibiting the shikimate pathway (found in gut bacteria)

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Interfering with the function of cytochrome P450 enzymes, required for activation of vitamin D and the creation of nitric oxide

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Chelating important minerals<sup>4</sup>

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Disrupting sulfate synthesis and transport<sup>5</sup>

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Interfering with the synthesis of aromatic amino acids and methionine, resulting in folate and neurotransmitter shortages<sup>6</sup>

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Disrupting your microbiome by acting as an antibiotic<sup>7</sup>

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Impairing methylation pathways<sup>8</sup>

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Inhibiting pituitary release of thyroid stimulating hormone, which can lead to hypothyroidism<sup>9,10</sup>

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Alas, humans are not the only species suffering the effects of this widespread use of glyphosate. According to researchers at the University of Texas at Austin, glyphosate may also kill bees by altering the bacterial composition in the bees' guts, making them more prone to fatal infections.<sup>11,12,13,14,15,16,17</sup>

## **Glyphosate Implicated in Bee Die-Offs**

For years, researchers have struggled to pinpoint the reasons behind dramatically dwindling bee populations. This certainly isn't the first time a pesticide has been implicated. Previous findings have shown neonicotinoid pesticides are particularly harmful to bees and other valuable insects such as butterflies.

In April 2018, the European Union banned the use of neonicotinoids as a result of such findings.<sup>18</sup> Glyphosate, however, has long been considered harmless by U.S. regulators. This misconception is now crumbling in the face of mounting evidence to the contrary. Not only is glyphosate harmful to humans and mammals; insects, microbes and even the plants themselves are harmed in various ways.

According to the authors of this study,<sup>19</sup> "bees rely on a specialized gut microbiota that benefits growth and provides defense against pathogens," and "Exposing bees to glyphosate alters the bee gut community and increases susceptibility to infection by opportunistic pathogens." Erick Motta, a graduate student at University of Texas at Austin and lead author told Science Daily:<sup>20</sup>

*"We need better guidelines for glyphosate use, especially regarding bee exposure, because right now the guidelines assume bees are not harmed by the herbicide. Our study shows that's not true ... It's not the only thing causing all these bee deaths, but it is definitely something people should worry about because glyphosate is used everywhere."*

## How Glyphosate Kills Bees

Glyphosate works by targeting an enzyme called 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) in the shikimate pathway, found in plants and certain microorganisms. This EPSPS enzyme is found in most of the gut bacteria in bees, which is how they become susceptible to the toxic effects of the weed killer. The researchers explain:

*“The honey bee gut microbiota is dominated by eight bacterial species that promote weight gain and reduce pathogen susceptibility. The gene encoding EPSPS is present in almost all sequenced genomes of bee gut bacteria, indicating that they are potentially susceptible to glyphosate.*

*We demonstrated that the relative and absolute abundances of dominant gut microbiota species are decreased in bees exposed to glyphosate at concentrations documented in the environment. Glyphosate exposure of young workers increased mortality of bees subsequently exposed to the opportunistic pathogen *Serratia marcescens*.*

*Members of the bee gut microbiota varied in susceptibility to glyphosate, largely corresponding to whether they possessed an EPSPS of class I (sensitive to glyphosate) or class II (insensitive to glyphosate) ...*

*All strains of the core bee gut species, *Snodgrassella alvi*, encode a sensitive class I EPSPS ... Thus, exposure of bees to glyphosate can perturb their beneficial gut microbiota, potentially affecting bee health and their effectiveness as pollinators.”*

## Bayer Dismisses Findings

As you’d expect, Bayer — which now owns Roundup after acquiring Monsanto earlier this year — issued a statement<sup>21</sup> dismissing the findings, saying “No large-scale study has

ever found a link between glyphosate and honey bee health issues,” and Motta’s paper “does not change that.”

*“The paper does not provide any evidence that the purported effects could have a negative impact on bee health under realistic field conditions.*

*It is also questionable whether the concentrations of the substance tested could at all be absorbed by bee populations in the open over a relevant period of time ... Furthermore, the paper relied on a relatively small number of individual bees which were tested.”*

## **Glyphosate Shown to Affect Microbiome in Rats**

Other research<sup>22</sup> has shown the glyphosate-based herbicide Roundup reduces beneficial bacteria in the colon of female rats. In fact, regardless of the dose – 0.1 part per billion (ppb), 400 parts per million (ppm) or 5,000 ppm – the animals’ gut bacteria underwent significant changes.

The study was conducted by Gilles-Éric Séralini, a French molecular biologist who has spent years researching GE food and the impact glyphosate has on human health.<sup>23</sup>

He is perhaps best known for his 2012 lifetime feeding study linking GE corn and Roundup to cancer. While pressure from Monsanto initially led to the retraction of Séralini’s study in November 2013, it was later republished in the Environmental Sciences Europe journal.<sup>24</sup>

In this rat study, some species of bacteria were found to be highly resistant to Roundup and the reason for this turned out to be because they do not have the EPSPS gene that glyphosate targets.

They also found that “these gut microbiome disturbances showed a substantial overlap with those associated with liver dysfunction in other studies.” According to Séralini, “The acceptable levels of glyphosate residues in food and drinks should be divided immediately by a factor of at least 1,000 because of these hidden poisons.”<sup>25</sup>

## **Glyphosate Also Impacts Plant Nutrition**

Glyphosate's primary mode of action is that it shuts down amino acid synthesis, followed by inhibition of protein synthesis necessary for plant growth. As a result, the plant dies. However, this also causes the plant to be more susceptible to soil microbes, including pathogens.

The reason for this is because the amino acids are also building blocks for other compounds that have defensive functions against soil pathogens. As a result, the plant becomes more susceptible to attack and infection by microorganisms in the soil.

Glyphosate also acts as a mineral chelator, and minerals such as zinc, copper and manganese, which are essential cofactors in many plant enzymes. Chelating or removing these minerals from the plants is largely responsible for impairing their protein synthesis as the enzymes involved in syntheses require the minerals to function. This then opens the plant up to attack.

Now, since glyphosate becomes systemic when applied to the plant, meaning the chemical is integrated into every cell of the plant, it also ends up passing through the roots into the soil. That's in addition to that coming into contact with the soil surface during application. Once the glyphosate is in the soil, it acts as an antibiotic and a chelator, making valuable minerals unavailable to the plant.

While that's bad enough, as this affects the nutrient content of the food, nutrients also become unavailable to the beneficial microorganisms living in the rhizosphere. What's more, if the minerals are bound to glyphosate in the plant, there's no way for your body to dissociate that bond to make the nutrients available when you eat it. Instead, those minerals will simply be excreted back out, or stored in your body right along with the glyphosate.

## **Roundup Creates Antibiotic Resistance**

In 2015, researchers also discovered that commonly used herbicides promote antibiotic resistance by priming pathogens to more readily become resistant to antibiotics.<sup>26</sup> Roundup, dicamba and 2,4-D were all found to increase the antibiotic-resistant prowess of E. coli and salmonella specifically.

The researchers speculate that this effect is caused by turning on a set of genes in the bacteria that activate porins, proteins that create toxic compounds that essentially “immunize” the bacteria to the antibiotic, thereby rendering it more resistant to the drug. Importantly, this change was found to occur at concentrations commonly found on farm fields, lawns, gardens and public parks.

A 2017 study<sup>27</sup> published in the journal Microbiology set out to determine which of the ingredients in the commercial formulations were the cause of this effect, and results showed it’s the active ingredients – including glyphosate – that are to blame.

*"Active ingredients induced changes in antibiotic responses similar to those caused by complete formulations. This occurred at or below recommended application concentrations,"* the researchers write.

While the concentration of glyphosate necessary to induce antibiotic resistance is lower than that typically found as residue on food, adults could probably reach the level that causes antibiotic resistance by eating large amounts of food with low levels of residue, while children could also be at risk, according to the researchers.<sup>28</sup>

Heather Hendrickson, senior lecturer in molecular bioscience at Massey University, told the Genetic Literacy Project, "The message from the paper is clear, we need to reconsider our use of herbicides in light of the effect that they are having on the microbial world."<sup>29</sup>

## **Monsanto Sued for Misleading Consumers**

Monsanto’s main argument for Roundup’s safety has been that glyphosate (the active ingredient) works by targeting the EPSPS enzyme, found in plants but not people or animals. Alas, researchers have clearly demonstrated that glyphosate affects more than

just plants, and the reason for this is because this enzyme also exists in microbes, including bacteria found in soil and the intestines of not only humans but also animals and even some insects.

*“Aside from a probable cancer link, Roundup’s effect on gut bacteria also suggests the chemical may play a significant role in digestive issues, obesity, autism, Alzheimer’s disease, depression, Parkinson’s disease, liver diseases and many other chronic health problems. And, as revealed in the featured bee study, the chemical may also play a role in the bee die-offs experienced around the globe over the past decade.”*

Since the company has refused to set the record straight, the Organic Consumers Association and Beyond Pesticides have sued Monsanto for false and misleading labeling.<sup>30</sup> The lawsuit was filed in April 2017. Monsanto filed a motion to have the case dismissed, saying the label is accurate because “the enzyme targeted is not produced by the human body or found in human cells,” but U.S. District Judge Timothy Kelly rejected the motion.

In his May 1, 2018, ruling, Kelly stated, “The court concludes that Plaintiffs have adequately pleaded a claim that the statement at issue was false or misleading,” and that “defendants cannot dispute that the label’s statement that the enzyme at issue is ‘found in plants, but not in people’ is, at least on one reading, literally false.”

## **Avoid Glyphosate by Buying Organic Foods**

Time will tell the final outcome of that lawsuit. In the meantime, it’s up to you to take whatever precautions necessary to protect yourself and your family – and our all-important soils and pollinators – from this pernicious toxin.

One of the best ways to avoid it and discourage its continued use is to buy certified organic produce and grass fed animal foods whenever possible, as organics and grass fed standards do not permit the use of synthetic pesticides.



While many grocery stores now carry organic foods, it's preferable to source yours from local growers whenever possible, as many organic foods sold in grocery stores are imported.<sup>31</sup> If you live in the U.S., the following organizations can help you locate farm-fresh foods:

**Demeter USA** – [Demeter-USA.org](http://Demeter-USA.org) provides a directory of certified Biodynamic farms and brands. This directory can also be found on [BiodynamicFood.org](http://BiodynamicFood.org).

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**American Grassfed Association** – The goal of the American Grassfed Association is to promote the grass fed industry through government relations, research, concept marketing and public education.

Their website also allows you to search for AGA approved producers certified according to strict standards that include being raised on a diet of 100% forage; raised on pasture and never confined to a feedlot; never treated with antibiotics or hormones; and born and raised on American family farms.

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**EatWild.com** – [EatWild.com](http://EatWild.com) provides lists of farmers known to produce raw dairy products as well as grass fed beef and other farm-fresh produce (although not all are certified organic). Here you can also find information about local farmers markets, as well as local stores and restaurants that sell grass fed products.

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**Weston A. Price Foundation** – Weston A. Price has local chapters in most states, and many of them are connected with buying clubs in which you can easily purchase organic foods, including grass fed raw dairy products like milk and butter.

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**Grassfed Exchange** – The Grassfed Exchange has a listing of producers selling organic and grass fed meats across the U.S.

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**Local Harvest** – This website will help you find farmers markets, family farms and other sources of sustainably grown food in your area where you can buy produce, grass fed meats and many other goodies.

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**Farmers Markets** – A national listing of farmers markets.

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**Eat Well Guide: Wholesome Food from Healthy Animals** – The Eat Well Guide is a free online directory of sustainably raised meat, poultry, dairy and eggs from farms, stores, restaurants, inns, hotels and online outlets in the United States and Canada.

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**Community Involved in Sustaining Agriculture (CISA)** – CISA is dedicated to sustaining agriculture and promoting the products of small farms.

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**The Cornucopia Institute** – The Cornucopia Institute maintains web-based tools rating all certified organic brands of eggs, dairy products and other commodities, based on their ethical sourcing and authentic farming practices separating CAFO "organic" production from authentic organic practices.

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**RealMilk.com** – If you're still unsure of where to find raw milk, check out Raw-Milk-Facts.com and RealMilk.com. They can tell you what the status is for legality in your state, and provide a listing of raw dairy farms in your area. The Farm to Consumer Legal Defense Fund<sup>32</sup> also provides a state-by-state review of raw milk laws.<sup>33</sup> California residents can also find raw milk retailers using the store locator available at [www.OrganicPastures.com](http://www.OrganicPastures.com).

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## Sources and References

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