Why Is a 4-Decade-Old Pesticide Back in the News? The Story of Glyphosate.

A look at glyphosate and cancer risk

June 5, 2018 By Danielle Penick

When the International Agency for Research on Cancer (IARC) classifies a new product as a "probable carcinogen," it makes the news. Recent items include hot coffee and bacon. But a seemingly more obscure item made the news in 2015—glyphosate. Glyphosate is the primary ingredient in the herbicide Roundup®, which is the most widely used herbicide in the world. The new classification of glyphosate as a probable carcinogen has raised global concerns for the public. But what is the evidence behind the change?

Unlike many pesticides that make the news, glyphosate has been in use for a long time. Glyphosate was first synthesized in 1950, and its potential as an herbicide (a pesticide that kills weeds) was discovered by an American chemist in 1970. Farmers quickly adopted glyphosate when it was put on the market in 1974 as a replacement for other, harsher herbicides.

The reason glyphosate is so effective and considered safe is that it targets an enzyme pathway primarily found in plants, fungi, and bacteria. For this reason, glyphosate is ideal for killing weeds but has little-known toxicity to humans or other animals at doses regularly applied to crops.

"What the IARC is reporting to the public is very confusing," says Alison Bernstein, PhD, a neuroscientist with an emphasis in toxicology at Michigan State University. Bernstein does not study glyphosate specifically, but she has written a lot about it through her work with SciMoms, a science advocacy group that helps consumers make science-based decisions. Bernstein believes that the classification of glyphosate as a probable carcinogen by the IARC has caused more harm than good. "I think people think it's the scariest pesticide out there and as someone who studies pesticides it's definitely not the scariest one. It's frustrating for me that the public conversation about pesticides is so far removed from what the actual science says."

The public debate over glyphosate is highly charged, and there are sound reasons to be concerned about pesticides and the safety of our food. But should we be concerned about glyphosate? And if so, what are the alternatives?

Pesticides: A brief history

To understand the current debate over glyphosate, it's helpful to know the history of pesticide use in agriculture in general. We often think of pesticides as a modern invention, but they have been used since at least 2000 BC when ancient Sumerians treated their crops with sulfur to control insects and mites. Many early pesticides were compounds that would terrify us if we heard they were being used today—arsenic, mercury, and lead were some of the most common. In fact, arsenic-based pesticides were the most commonly used pesticides in the United States until the 1950s.

The dawn of modern pesticides began during World War II with the introduction of DDT. A year before the war, a Swiss chemist discovered that DDT could be used as an insecticide. When an outbreak of typhus spread through Italy in 1943, the United States government issued DDT powder to all troops to control lice that were spreading the disease. American troops treated nearly 1.3 million civilians with DDT over three weeks, and the cases of typhus were halved during the first week alone.

DDT was so successful that typhus was nearly eliminated in Europe by the end of the war. The Swiss chemist who discovered the insecticidal properties of DDT was awarded a Nobel Prize in physiology and medicine, and at the ceremony, the committee remarked, "For the first time in history, a typhus outbreak was brought under control in winter. DDT had passed its ordeal by fire with flying colors." The future of modern pesticides looked bright.

But in 1962, Rachel Carson would forever change the way we think about pesticides with the publication of her book Silent Spring. In Silent Spring, Carson described the alarming effects of DDT on bird populations in North America. DDT was causing the eggshells of birds to thin, particularly the shells of bald eagles. These findings alarmed those who were part of the growing environmental movement and led a call to action for pesticide regulation.

Prior to the publication of Silent Spring, some pesticide regulations did exist in the United States. The first regulations were introduced in 1947, but these had little to do with the effects of pesticides on the environment or human health. Instead, regulations focused on how well a pesticide accomplished its designated task—killing pests. Farmers wanted to know whether the pesticides they were purchasing actually worked and that they had not been adulterated or diluted.

It would take over ten years after the publication Silent Spring for new pesticide regulations to emerge. During that time, Carson was diagnosed with breast cancer—a condition she hid from the public because she thought it might be used to discredit her—and she ultimately died before she was able to see lawmakers enact stronger pesticide regulations. But in 1970, President Richard Nixon created the Environmental Protection Agency (EPA) and provided the new agency with the power to regulate pesticides.

Within two years of the creation of the EPA, DDT was banned in the United States, and regulations were put in place to vet all new pesticides. Glyphosate was one of the earliest pesticides subject to these new rules. Pesticides in the United States must now be registered with the EPA in a process

that usually takes 6-9 years, and all registered pesticides are reviewed every 15 years to ensure that they meet proper standards.

Current regulations have helped remove some of the most damaging pesticides from the market, like DDT and lead arsenate. But wouldn't using no pesticides be better than relying on even the best pesticides available today?

Going organic

"In college, I was buying everything organic," says Iida Ruishalme, a science writer at Thoughtscapism, where she writes about health, the environment, and agriculture. "I was interested in environmentalism and nature, so I wanted to make environmentally-conscious decisions." But Ruishalme was caught off guard one day when a friend told her organic agriculture required a lot more land compared with conventional methods. "I was like, No, that's not true!," says Ruishalme. But when she started reading about organic agriculture to see if her friend was right, she realized that she didn't know much about agricultural practices at all. "I had just assumed organic must be better," says Ruishalme.

What Ruishalme soon found out was that organic didn't necessarily mean pesticide-free. There are many natural and synthetic pesticides approved for use in organic crops. For example, copper sulfate, a natural pesticide, is approved for use on organic crops and is one of the top two most commonly used organic pesticides.

Copper sulfateBy H. Zell (CC BY-SA 3.0)

While organic pesticides generally come from natural sources, that does not mean they are safer than conventional pesticides. Studies on copper sulfate have found that it is highly toxic to fish

and moderately toxic to birds even at recommended doses of application. Copper sulfate is also moderately toxic to humans and is readily absorbed through the skin. Like DDT, copper sulfate accumulates in the environment and there is no practical way to remove it. Because of this, some French wine producers have given up the organic label because they believe accumulation of copper sulfate in the soil is more damaging to their vineyards than some conventional methods.

Glyphosate, in contrast, has little-known toxicity to humans or other animals when used at approved doses. Glyphosate breaks down relatively quickly in the soil and does not accumulate like DDT or copper sulfate. In humans, glyphosate does not easily pass through skin, and if ingested or absorbed, it's excreted through urine and does not remain in the body.

By most measures, glyphosate appears to be safer and more environmentally friendly than organic-approved copper sulfate, but comparing the two pesticides is not completely fair. Copper sulfate is primarily used as a fungicide while glyphosate is an herbicide. There are few economically viable herbicides approved for organic farming, so farmers primarily use non-chemical methods to prevent the growth of weeds. One of the most common methods is tilling. While tilling has a long history in agriculture, it turns out it can increase soil erosion, reduce soil biodiversity, and lead to reduced soil fertility.

So even some pesticide-free farming methods can have negative impacts on the environment. What Ruishalme learned while she was researching organic agriculture is that glyphosate may be less damaging to the environment than tilling. "Glyphosate helps with farming methods that avoid tilling," says Ruishalme, "so the use of glyphosate can be beneficial over some organic farming practices."

Roundup, the commercial product containing glyphosate By Mike Mozart of TheToyChannel and JeepersMedia on YouTube (CC BY 2.0)

Ruishalme has come a long way since she first started investigating organic and conventional farming practices. She first heard about glyphosate while reading websites advocating for organic agriculture. “Glyphosate came up again and again, so I thought maybe this was a real concern,” says Ruishalme. But when Ruishalme started digging into the scientific literature, she found a different story. “It’s easy for someone to understand a webpage that says glyphosate is dangerous and that you should avoid it, but the science was starkly different.”

Ruishalme conducted one of the most extensive surveys of glyphosate and its associated risks, which she published as a series titled 17 Questions on Glyphosate. Her experience researching glyphosate has given her a new perspective on conventional agriculture practices in general. “If you are afraid of something, the best remedy is to understand it better. If you have a good understanding of the facts, then you have less to fear,” Ruishalme says.

The takeaway

The debate over glyphosate remains highly controversial among the public, and there are still good reasons to regulate pesticides. “Clearly, I do toxicology research,” says Bernstein, “and I think it’s important to characterize the risks pesticides pose to human health. I just believe we should focus on things that are actually a problem.” Bernstein cautions that glyphosate is safe

because of the current guidelines. “We should make sure we keep these regulations strong, because if we weaken these regulations, then glyphosate might actually become a concern.”

Bernstein also points out that if you take glyphosate off the market, then you have to consider what the replacement would be. “When BPA was removed from plastics, it was initially replaced with BPS, which was worse.” Right now, there do not seem to be clear alternatives to glyphosate.

It’s also important to point out that while consumers are not generally exposed to high doses of glyphosate under current regulations, farmers and their families face higher exposure. But a recent study of 89,000 American farmers and their spouses—the largest study of its kind—found that glyphosate exposure was not associated with any higher cancer risks, including solid tumors, lymphoid malignancies, and Non-Hodgkins Lymphoma and it’s subtypes. These findings support the conclusion that glyphosate exposure does not increase cancer risks when used at approved doses.

It is important that studies continue to assess the health risks of glyphosate for humans and the environment, not least because glyphosate is the most widely used pesticide in the world. In addition to testing for new or unconsidered risks of glyphosate, continuing research can also build confidence that glyphosate is safe, as was the case with the study on American farmers described above.

About the IARC position on glyphosate, Ruishalme says “The most important fact to understand is that the public is not at risk, especially because the IARC does not look at cancer risk. They look at whether there is any potential for risk.” Overall, Ruishalme believes the decision to list glyphosate as a probable carcinogen makes the IARC appear less trustworthy as they did not provide any new evidence. As a result, the IARC has been criticized by many scientists and governing bodies.

And inflating the risks of glyphosate can have serious negative health consequences for the public as well. Fear of pesticide exposure can increase anxiety over food and cause people to eat less produce. While people may debate the health risks of certain pesticides, there is broad consensus that we should eat more fruits and vegetables, not fewer.

When Bernstein first got into the field of toxicology, she says, “I thought I was learning more about products to avoid.” But in the end, her research made her more relaxed. “Now I try to focus on the big picture—like getting my kids to eat vegetables and cutting down on sugar. That’s huge for me,” says Bernstein.

Likewise, Ruishalme says, “My kids are learning that produce is not something scary. Let’s focus on what’s more important—eating lots of fruits and vegetables.”

While no synthetic or natural pesticide is entirely safe, glyphosate appears to be among the safest pesticides we have developed based on current research. Many criticisms of synthetic pesticides can also be applied to natural pesticides, so natural is not necessarily a better option. Overall, eating more fruits and vegetables—regardless of production method—is the best option for improving our health.

This piece was co-authored by myself, Danielle Penick, RD, of Survivors' Table, and my husband, Clint Penick, a biologist at Arizona State University. We both have no conflicts of interest to declare and received no funding for this piece.

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