

# Biotech

## In focus



Cooperative Extension Service  
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## Glyphosate and Human Health II: Long-Term Effects of Exposure

In our last bulletin, we discussed some of the properties of glyphosate, which is among the most popular herbicides worldwide. Factors that have contributed to this popularity include low levels of short-term toxicity—animals must consume large amounts of glyphosate to actually become ill—and the development of genetically modified soy, corn, and other crops that tolerate glyphosate, allowing farmers to control weeds more easily after the crop is planted. This practice reduces the need for cultivating the soil, reducing the loss of topsoil and fuel.

In this bulletin, we will consider two recent assessments of glyphosate's potential to cause long-term health effects, including cancer. Each assessment was produced by groups of scientists who evaluated dozens of research studies. The International Agency for Research on Cancer (IARC), part of the World Health Organization, released the finding in 2015 that glyphosate is “probably carcinogenic to humans.” Also in 2015, Germany's Federal Institute for Risk Assessment (German acronym: BfR) reported to the European Food Safety Authority (EFSA) that available data do not show that glyphosate has cancer-causing or DNA-damaging properties, nor do data indicate that glyphosate is toxic to fertility, reproduction, or fetal development in laboratory animals. On this basis, EFSA concluded that “glyphosate is unlikely to pose a carcinogenic hazard to humans.”

What should we make of this contradiction? First, let's consider what the term “carcinogenic hazard” means. Hazard is the potential to cause harm. The IARC's answer to the question “Can glyphosate cause cancer?” is “Probably yes.” Other exposures that IARC has assigned to the same hazard category as glyphosate (probable human carcinogens, or Group 2A) are red meat (beef, lamb, and pork), acrylamide (present in starchy foods cooked at high temperatures, such as potato chips), work as a hairdresser, and shift work that disturbs sleep patterns.



Group 2A agents like glyphosate are characterized by IARC as showing “limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals.” Evidence is limited when an association between the agent and cancer has been observed, but other causes for the association cannot be ruled out. Group 1 agents, for which evidence of carcinogenicity in humans is sufficient, include tobacco products, alcoholic beverages, ultraviolet light, and processed meats.



**Ania Wiczorek, PhD**

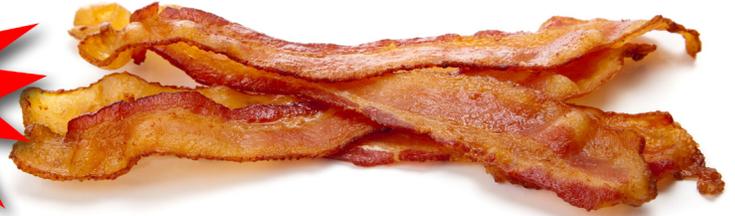
Professor  
Department of Tropical Plant  
and Soil Sciences  
College of Tropical Agriculture  
and Human Resources  
University of Hawai'i at Manoa  
Honolulu, HI 96822  
ania@hawaii.edu

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# ASSESSING RISK

Not included in the IARC analysis is the question of risk: “How likely is glyphosate to cause cancer?” Hazard identification is an important step in risk assessment, but it is only the first step. Risk assessment requires additional information, such as the level of exposure (dose) associated with harm (response), and the level of exposure likely to occur in particular populations at particular times.

We can illustrate the difference between hazard and risk using two agents that carry the same Group 1 IARC hazard rating: tobacco and processed meats. Scientists estimated in 2011 that, in Great Britain, 19% of all cancers were caused by tobacco use, whereas 3% of cancers were caused by eating too much processed and red meat. Thus, while both activities are hazardous, eating a diet high in bacon carries a lower risk of cancer than does smoking.



## Opposing Conclusions

Setting aside the question of risk, why do the IARC and BfR assessments disagree on whether glyphosate represents a cancer hazard? These opposing conclusions are less surprising when we consider that the assessments are drawn from different sets of research studies. IARC excluded unpublished results and used only data that was (or would soon be) published and publically available in the scientific literature or government reports. The BfR assessment included both published and unpublished data but required that all studies conform to Good Laboratory Practices.



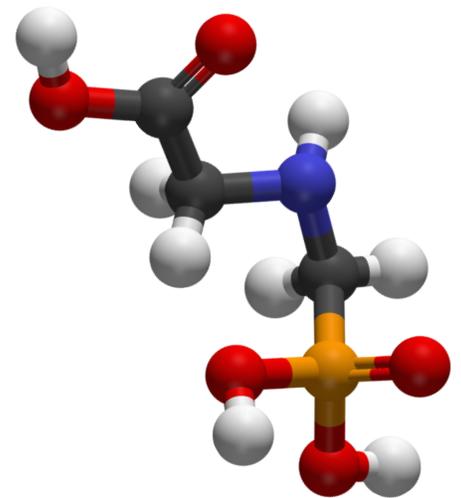
## Forms Studied



Another significant difference is based on which forms of glyphosate were studied. The IARC report evaluated laboratory research not only on glyphosate, but also on herbicide formulations that contain glyphosate plus other ingredients, including surfactants (detergents) that help droplets of herbicide cling to plant leaves.

## Alone vs Multiple

The BfR report excluded laboratory research on glyphosate formulations, basing this decision on how multiple ingredients could make it more difficult to assess the toxicity of glyphosate alone. In evaluating why the IARC and BfR reports had reached different conclusions, EFSA recommended that the potential health effects of the surfactant POE-tallowamine be evaluated.



In our final bulletin on the health effects of glyphosate, we will consider the herbicide in terms of its relative risks and benefits.