

GE Crops, Chemicals and the Environment

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Roundup, an herbicide produced by Monsanto that contains the active ingredient glyphosate, has been vigorously applied to crops for years.¹ Most genetically engineered (GE) crops are designed to be tolerant of specially tailored herbicides.² Farmers can spray the herbicide on their fields, killing the weeds without harming the GE crops. With the development of Roundup Ready crops, the application intensity of Roundup has only increased.

Monsanto's herbicide-tolerant corn, soybeans and cotton were planted on 150 million U.S. acres in 2009.³ Glyphosate use on these Roundup Ready crops has grown steadily. Between 2001 and 2007, glyphosate use doubled to 185 million pounds.⁴ Persistent glyphosate use has led to a rampant spread of weed resistance, diminished plant immunity to disease and continues to threaten surrounding wildlife populations.

Glyphosate can pose risks to animals and the environment. A 2010 Chemical Research in Toxicology study found that glyphosate-based herbicides caused highly abnormal deformities and neurological problems in vertebrates.⁵ Another study found that glyphosate caused DNA damage to human cells even at lower exposure levels than recommended by the herbicide's manufacturer.⁶

Spread of Superweeds

Ubiquitous Roundup application has spawned glyphosate-resistant weeds, driving farmers to apply more-toxic herbicides and to reduce conservation tilling, according to a 2010 National Research Council report.⁷ At least 20 weed species worldwide are resistant to glyphosate, including aggressive weeds like ragweed, pigweed and waterhemp.⁸ This resistance can be transferred by pollen, which helps explain the rapid distribution of these weeds.⁹ Already, 12 million acres in the United States are infested with "superweeds," and even biotech company Syngenta predicts that glyphosate-resistant weeds will infest one-fourth of U.S. cropland by 2013.¹⁰

Agricultural experts warn that these superweeds can lower farm yields, increase pollution and raise costs for farmers.¹¹ In 2009, farmers in Georgia were forced to weed half of the state's 1 million acres of cotton due to the spread of pigweed, costing a total of \$11 million.¹² To deal with this spreading problem, biotechnology companies are creating crops that are resistant to a variety of more-toxic chemicals, including 2,4-D (an Agent Orange component) and dicamba.¹³ Not only can 2,4-D drift easily onto neighboring fields and wreak havoc on produce, but it also has associated health risks including endocrine disruption and developmental abnormalities.¹⁴

Penn State University weed scientist Dave Mortenson suggests that efforts to control newly resistant weeds could increase pesticide use 70 percent by 2015.¹⁵ As mixtures of herbicides are used on crops, some weeds are developing multiple resistance to several chemicals with different modes of action. This occurrence could eventually make soybean production an unviable option in parts of the Midwest.¹⁶ And as glyphosate-resistant weeds strangle cropland, farmers have returned to deep tilling for weed management, abandoning tillage practices designed to slow soil erosion.¹⁷ As one Missouri farmer pointed out, "Fortunately weeds haven't developed a resistance to cold steel."¹⁸

Gene Flow

Another environmental risk posed by glyphosate is that crops designed to be tolerant to the chemical have a growth advantage and can transfer that genetic trait to

their weedy relatives. According to Ohio State University ecologist Allison Snow, GE traits (such as tolerance to glyphosate) can make wild plants more like weeds and more difficult to manage.¹⁹

GE gene flow is especially common in crops that have a variety of weedy relatives, such as canola, rice, sunflower, squash and creeping bentgrass.²⁰ In North Dakota, a study of wild roadside populations of canola found that 80 percent of the sampling sites expressed at least one transgene.²¹ Herbicide-tolerant creeping bentgrass and Kentucky bluegrass are of special concern for Oregon State University weed scientist Carol Mallory-Smith, who has traced the movement of the glyphosate-resistant transgene from bentgrass to similar wild species in Oregon.²² The spread of glyphosate-resistant crops to wild relatives could result in an increased need for harsher pesticides as an alternative.

Weakening of Natural Plant Defenses

The Roundup Ready trait lowers the nutritional content of crops by inhibiting the absorption of nutrients including calcium, iron, magnesium and zinc, making plants more susceptible to disease.²³ Bob Kremer, a microbiologist with the U.S. Department of Agriculture, told Reuters that data suggest that glyphosate can cause fungal diseases that negatively affect plant health and production.²⁴ Studies indicate that fusarium, a soil-borne pathogen that infects plant roots, becomes more prevalent when crops are treated with Roundup.²⁵

Effects on Wildlife

Animals may be impacted by glyphosate directly through exposure and inhalation or indirectly through a loss of habitat. Amphibians are at particular risk from pesticide exposure due to their permeable skin, which is very susceptible to chemical contamination.²⁶ The Center for Biological Diversity sued the U.S. Environmental Protection Agency (EPA) and the U.S. Fish and Wildlife Service for the registration of 66 pesticides — including glyphosate — that could harm California's endangered red-legged frog, protected under the federal Endangered Species Act.²⁷ Red-legged frog populations have declined more than 90 percent, and the frogs have disappeared from 70 percent of their former habitat.²⁸

Additionally, scientists fear that glyphosate-tolerant crops are to blame for declining monarch butterfly populations. A 2011 study found that the downward trend in monarch populations is partially due to the loss of habitat for the butterflies, which depend on milkweed.²⁹ From 1999 to 2009, there was a 90 percent reduction in milkweed in Iowa fields, which is likely due to a reliance on glyphosate, which kills the milkweed plant. Monarch butterfly reproduction could be negatively affected by a shrinking critical habitat and food source for its larvae.³⁰



Persistence in the Environment

Glyphosate persists in the environment for as long as a year in soil and on sprayed plants, and for more than six months in water.³¹ In 2011, U.S. Geological Survey (USGS) research observed glyphosate in over 60 percent of air and rain samples during the growing season in Mississippi, Iowa and Indiana. During a dry month, elevated glyphosate concentrations can be sustained, resulting in a longer exposure period.³²

The USGS also released a study showing the persistence of glyphosate in surface waters near agricultural production sites in the Midwest. Researchers found glyphosate in over half of samples in Iowa and in every single stream sample examined in Mississippi over two years.³³ Paul Capel, head of the USGS agricultural chemicals team, told Reuters: "It is out there in significant levels. It is out there consistently." The scientist warned that more research is needed to determine how glyphosate persistence in the environment might affect people and animals over the long term.³⁴

The EPA is gathering data on the safety of glyphosate — the majority of which will come from a task force representing major agribusinesses — and expects to make a final decision on its registration by 2015.³⁵ The potential cumulative, long-term risks of glyphosate

exposure have not been studied. These considerations should be critical in determining the safety of a product prior to approval, and not left to attempt to assess once the product is on the market.

Recommendations

The United States should enact policy that would more rigorously evaluate the potentially harmful effects of GE crops and linked chemicals before commercialization, to ensure the safety of humans and the environment. Until that policy is designed, the United States should enact a moratorium on any new approvals of genetically engineered plants and animals.

Endnotes

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