

Glyphosate : An herbicide with negative implications

Herbicides are commonly used in agricultural growing practices, with Roundup(R) being the most commonly used herbicide in the United States. (Pesticide, 2001) Roundup(R) was the original glyphosate based herbicide, and was held under patent restrictions by Monsanto until September 2000. (New York University, 2003) Since that time numerous other companies have developed similar herbicides. The active ingredient in these popular herbicides is glyphosate. Working as broad-spectrum herbicide, this glycine-like compound prevents essential amino acid synthesis in growing plants which in turn kills the growing plant. (Rhodes, 2009) Although, herbicides containing glyphosate are extremely effective in eliminating weeds from crops that are genetically resistant to the application of glyphosate, there are drawbacks to the use of these herbicides being uncovered at rapid rates.

It is understood that glyphosate only kills actively growing plants, thus it must be applied every year, sometimes multiple times throughout a growing season. And this compound does not simply disappear into the soil or water system without a trace. Rather, it has been found in wastewater being dumped back into streams from water treatment facilities. (U.S. Geological Survey, 2010) This chemical residual is a foreign component to nearby ecosystems and could have negative, lasting effects on the environment.

Additionally, farmers and scientists are beginning to hypothesize glyphosate is taken in by livestock animals having fed on plants and grain exposed to glyphosate. The active compound, glyphosate, has been present in animal manure, which is commonly used as fertilizer in production agriculture. This presence has shown to be extremely detrimental to farmers using non-genetically modified plants. These plants lack resistance to glyphosate and when growing plants come in contact with glyphosate found in livestock manure the plant does not thrive and can have significantly reduced production rates. These reduced yield rates can also be attributed to the metal chelate characteristics of glyphosate, which restrict nutrient uptake in the plant. (Davidson, 2010)

A recent study published by scientists in South America extends the implications of applying herbicides containing glyphosate to vertebrate health. Commercial based glyphosate herbicides were exposed in varying dilutions to *Xenopus laevis* embryos. (Paganelli, 2010) This is a species of frog found in South America, which is also commonly used in research. (Department of Microbiology, 2010) The embryos exposed to glyphosate were abnormal and had documented developmental abnormalities. In other experiments, similar abnormalities were found when exposing chicken embryos to glyphosate. Furthermore, humans are subject to glyphosate exposure from agricultural practices, and it is possible their offspring could see similar negative impacts. (Paganelli, 2010)

Minimizing both environmental and vertebrate exposure to glyphosate is important in maintaining environmental integrity and vertebrate health. In order to accomplish this task, fewer volumes of genetically modified plants with resistance to glyphosate should be used in agriculture. Having less of these crops would result in decreased use of herbicides containing glyphosate, and subsequently there would be less risk of environmental and human exposure. It is possible to manage weeds in crop fields with mechanical tillage and with less harmful, natural herbicides. Those management practices make decreasing the volume of glyphosate used an attainable national or global possibility.

At the local level, close monitoring of water runoff from agriculture fields and waste water plants would enable waterworks and environmental professionals the ability to detect glyphosate

quickly. By knowing the compound is present, additional measures can be taken so that contaminated water does not enter a drinking water supply or nearby ecosystems. Installation of buffer strips or collection pools could likely catch this runoff before glyphosate could have negative implications on the surrounding environment.

To specifically minimize human exposure to potentially dangerous levels of glyphosate, regulating the amount of genetically modified products one consumes could prevent adverse health affects from herbicide residue. Because certified organic products have not had applications of glyphosate, they would be an ideal addition to a diet that contained a majority of genetically modified food likely treated with glyphosate based herbicides.

Both environmental integrity and human health can be severely impacted by chemicals and other pollutants. And as a readily available chemical with documented adverse affects in a variety of cases, glyphosate based herbicides should be of heightened interest in public health. There are ways to minimize health risks caused by this compound, but with proper attention the risks could be completely alleviated.

References :

Davidson, D. (2010) Glyphosate Induced Hidden Hunger. Retrieved November 16, 2010, from BRT Ag and Turf Website : <http://www.brtagandturf.com/education.php>

Department of Microbiology and Immunology : University of Rochester. (2010) Xenopus Laevis. Retrieved November 16, 2010, from University of Rochester Website : <http://www.urmc.rochester.edu/mbi/resources/Xenopus/>

New York University. (2003) Monsanto's Roundup. Retrieved November 16, 2010, from New York University Website : <http://pages.stern.nyu.edu/~lcabral/teaching/monsanto.pdf>

Paganelli, A., Gnazzo, V., Acosta, H., Lopez, S.L., Carrasco, A.E. (2010) Glyphosate-Based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling. *Chem. Res. Toxicology*, 23(10), 1586-95.

Pesticide Market Estimates 2000-2001. (2001) Retrieved November 16, 2010, from The Environmental Protection Agency Website : http://www.epa.gov/opp00001/pestsales/01pestsales/table_of_contents2001.htm

Rhodes, D. (2009) Amino Acid Biosynthesis [Lecture Notes]. Retrieved from Perdue University Website : <http://www.hort.purdue.edu/rhodcv/hort640c/aromat/ar00007.htm>

U.S. Geological Survey. (2010) Glyphosate Found in Wastewater Discharged to Streams. Retrieved November 16, 2010 from USGS Toxic Substances Hydrology Program Website : http://toxics.usgs.gov/highlights/glyphosate_wastewater.html

Hi Allison,

Are there any alternatives other than glyphosate to protecting crops and keeping the ecosystem in water safe? You mentioned in your research that *"Because certified organic products have not had applications of glyphosate, they would be an ideal addition to a diet that contained a majority of genetically modified food likely treated with glyphosate based herbicides"*.

Other than cost, Why doesn't the USDA require that all farmers use organic methods in farming?

Thanks,

Lee

Prior to the development of glyphosate, farmers were able to control weed populations with herbicides and mechanical measures that did not require a genetically engineered plant for application. The development of glyphosate based herbicides allowed for less crop scouting and made managing crop systems easier because of the reduced need for understanding basic plant pathology. (Schlapkohl, K., personal communication, 22 November 2010)

Identification of one's specific weed population is essential. By knowing what weed species are present a broad spectrum herbicide isn't needed. Species specific herbicides which do not carry over in the soil or plant matter can be applied to control weed populations in row crops. In addition to targeted herbicides there are burn down methods such as Gramoxone(R) which can be used before and after planting. This chemical's active ingredient is paraquat, which only effects the pant area that it touches. There is no threat posed to ground water because its chemical residues are not active in soil or after having dried on a plant. (Paraquat, 2010)

Cocktails of various different chemicals can also be used to control weed populations. By understanding the chemistry of the herbicides that are being used, herbicides can be combined to target various weed species in one application. The use of filtered water in these herbicide cocktails decreases the amount of chemical needed because there are not minerals present in the water hindering the mode of action of the combined herbicides. (Schlapkohl, K., personal communication, 22 November 2010)

There are many positive and negative aspects to both conventional farming and organic farming. Both methods are beginning to be better understood because of scrutinizing research, but until one or the other is scientifically proven to be completely safe or unsafe I do not believe the USDA could mandate those specific farming practices. A combination of techniques from both practices is likely a better compromise for production agriculture.

Paraquat information center. (2010) Retrieved on November 23, 2010, from Paraquat information center website : <http://www.paraquat.com/>