

The glyphosate herbicide in Yucatan, Mexico

Abstract

The state of Yucatan, Mexico is highly vulnerable to pollution, due to its soils and karstic aquifer, contaminant filtration processes are facilitated and degraded the quality of drinking water due to lack of infrastructure in drinking water plants. Several studies have been documented on the pollution of the water of cenotes (sinkholes) with high concentrations of organochlorine pesticides, as well as their bioaccumulation in the blood of women with cancer and in breast milk. The use of glyphosate globally for the production of transgenic crops has increased in the last decade. Transgenic or genetically modified (GM) crops are the result of the application of DNA technology in agriculture with the aim of improving seeds or creating resistance to pests at the genetic level. Transgenic soybeans with the use of glyphosate herbicide are currently a subject of broad discussion, considering the high impacts on public health. The World Health Organization classified glyphosate as a probable carcinogen for humans. In Yucatan, glyphosate is used in the production of soybeans in the East and South of the state. The objective of this short review is to analyze the current status of aquifer contamination with organochlorine pesticides with new information on the use of glyphosate in Yucatan with potential damage to the ecosystem and the aquifer, which is a high risk for water for human consumption.

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Introduction

GM crops have been used in the world since 1996. In 2010, 148 million hectares were planted, cultivated by 15.4 million farmers in 29 countries.¹ The Working Group of the International Agency for Research on Cancer (IARC, 2015)² also reported the herbicide glyphosate as a probable human carcinogen. The company that produces the glyphosate at an international level is Monsanto, and in recent years it has received lawsuits in several countries for the high toxicity of its product. The last trial against Monsanto has been such big news worldwide that not even the corporate media could hide it. For many years it was denied that glyphosate was harmful to the environment or human health, because unfortunately several research groups in the world and the same company described that glyphosate could be used safely, arguing benefits for the production of food and contribute to food security in the world (yes, but at what cost?...), which implies a high lack of ethics for its impact on international public health and of course an outrage for indigenous peoples.³ Now, international society, as well as native peoples, is aware of the potential damage to health, while the official sector must consider international conventions and treaties, as well as regulations, human rights, reparation of damage, and official decrees for the conservation of the environment and human health.

In addition to water contamination, some foods that can be contaminated are tortillas (basic food product in Mexico), cereals, soy milk and soy-based beverages, grain-based products (snacks), textured soybeans, fruits, vegetables, or any crop fumigated with glyphosate. The advice would be to read the label of the products we purchased and see if it contains glyphosate. The ideal is to consume organic food, or consume directly from local producers who produce using agro-ecological techniques.

Information from IARC on glyphosate describes that there are 91 producers in 20 countries, including 53 in China, 9 in India, 5 in the USA, and others in Australia, Canada, Cyprus, Egypt, Germany, Guatemala, Hungary, Israel, Malaysia, Mexico, Singapore, Spain,

Taiwan, Thailand, Turkey, England, and Venezuela, and is registered for use in at least 130 countries. The IARC monograph reported an international production of 720,000 tons in 2012 in more than 750 different products, so current production is very likely to be over one million tons per year.

In this regard, the precautionary principle adopted by European governments should be adopted by the government in Mexico, remember the Rotterdam international agreements on the Prior Informed Consent Procedure (PIC), where governments (including Mexico), have the necessary information on hazardous chemicals, to assess the risks and take informed decisions on their imports, and the Stockholm Convention, for the prohibition /restriction of toxic carcinogenic agrochemicals internationally, and where Mexico is a signatory.

In recent years worldwide, serious damage has been reported on the effects of the use of glyphosate in public health in the USA, Central and South America, the United Kingdom, among others. In Argentina (one of the main exporting countries of transgenic soybean worldwide), in the last 10 years the use of glyphosate has increased in several provinces with intensive agriculture, qualifying as a health catastrophe, due to the high number of cancer cases, reproductive disorders, congenital malformations and spontaneous abortions. Hundreds of localities in these provinces, as well as Santa Fe or Córdoba, have two common denominators: exorbitant rates of illness and proximity to intensive cultivation areas that extend over some 30 million hectares throughout the country. It is necessary to remember that glyphosate is an endocrine disruptor promoter of cancers, as well as organochlorine pesticides (DDT, lindane, heptachlor, endosulfan, aldrin, dieldrin, endrin) studied in water, blood, and breast milk in Yucatan.

The impacts to human health, the environment, and biodiversity of highly toxic agrochemicals and especially glyphosate, of the multinational Monsanto, are due to direct exposure to ground and aerial fumigations with atmospheric transport of pollutants, as well

as exposure indirect through the consumption of contaminated food and water. On the other hand, several transgenic varieties of corn, produced abroad at an industrial level, are arriving for food production in Mexico. Recall that a high percentage (10 million tons) of corn that we import from the US for animal feed, in Mexico is used for the consumption of tortillas.

In the state of Yucatan, farmers maintain the traditional existence of the milpa for the cultivation of corn as a central component and crops such as squash, tomatoes, habanero peppers; however soy is being cultivated in the agricultural and livestock area. Recent studies on farmers in the main agricultural area of southern of Yucatan, 55% of farmers reported using the glyphosate herbicide for the production of transgenic soybeans (Polanco et al., 2018b), and in the livestock area at east of Yucatan, in the municipality of Dzidzantún, 72% of farmers are using glyphosate for their crops (Tamayo-Manrique et al., 2018).

In Mexico, Mexican producers and authorities are currently going through various legal procedures due to the high impact of glyphosate on ecosystems and on public health (Lakhani et al., 2014), with significant human rights violations regarding prior informed and informed procedures to indigenous peoples. Coupled with the use of carcinogenic pesticides such as DDT, lindane, heptachlor, endosulfan, aldrin, endrin, dieldrin (organochlorines), with the high impacts for human health and the environment in Yucatan, glyphosate herbicide (organophosphate herbicide) is now joined of Monsanto.

In the Yucatan Peninsula, Campeche is the main producer of transgenic soy,⁴ increasing its production from 29 to 200 ha in 2013-2014. In 2012, producers requested permission to grow 60,000 ha, with extensive use of the glyphosate herbicide. Soy (Glycine max L. cv.A5403) Faena Solution (or RR) (MON-04032-6), has been introduced in its experimental phase in the State of Campeche since 2001, joining the state of Yucatán from 2003, and Quintana Roo from 2005, covering since then the peninsular level until 2009. In Yucatan, the area was increased to 12,000 ha, including the municipalities of Santa Elena, Ticul, Oxkutzkab, Tekax, Tzucacab, Peto and Tizimin.⁵ The production of soybean in the South and East of Yucatan with application of glyphosate, represents high impacts to aquifer contamination and human health, due to the easy filtration of contaminants in karst soils.⁶ The cultivation of soybean in Yucatan exceeded 25,000tons in 2017, 25% more than in 2016, with around 20,000 tons of soybeans produced. The area planted with soybeans in the state has grown 33% in relation to 2016, since it increased from 8,000hectares cultivated to 12,000hectares. In the month of July 2017, 120 tons of seeds were delivered to 271 farmers from Oxkutzkab and Tekax in the South of Yucatan, an amount that was added to another 130 tons delivered to 13 thousand producers from different municipalities of the state of Yucatan,⁷ including Tizimin. Sagarpa notifies that the intention of sowing soybean in 2018 for the autumn-winter cycle in Yucatán is 1,500hectares.⁴

So in Yucatan there are important factors to consider in the process of water pollution: 1) social factors, such as poverty, low educational levels, a low perception of risk on the use and management of carcinogenic agrochemicals,⁸⁻¹⁴ rates of diseases above the national average related to carcinogenic agrochemicals (cancer, congenital malformations), and 2) natural factors, such as the fragility of our ecosystem, with a high density of cenotes (more than 4,000), which are another route of contamination to the underground aquifer because

they are. The above is serious, since in general, society has the view that the problem of glyphosate and transgenic soy in the peninsula is only in Campeche in the municipality of Hopelchén. These recent studies reveal that glyphosate is used in Yucatán, and adds to the contamination of organochlorine pesticides already detected years ago in groundwater (DDT, heptachlor, lindane, endosulfan, aldrin, endrin, dieldrin), aggravating the toxicity of the aquifer Yucateco and the problems for human health, since studies of bioaccumulation of pesticides in the blood of women with cancer and breast milk have also been carried out (CIR, UADY-Faculty of Chemistry). Likewise, and in direct relation to the high impact of these toxic agrochemicals on bees and the production of honey with export quality to Europe (Germany, Austria, Denmark, among other countries), is that bee populations are drastically decreasing to cause of aerial spraying, contaminating bees and honey with glyphosate and various pesticides, which European importers do not accept, because they affect their export quality, significantly affecting the economy of beekeepers and their families. Beekeepers have also organized themselves with the support of various social organizations that support them. Currently litigation is being carried out at the level of the Supreme Court of the Nation, to protect its natural and economic heritage, the conservation of biodiversity, and the human right to prior and informed consultation of any development in the Mayan communities.

Despite the use of glyphosate for the production of transgenic soy, farmers in Yucatan are applying the herbicide glyphosate almost for any type of crop. This is serious, since glyphosate also represents a high risk for its easy filtration to the underground aquifer, due to the conditions of the highly stony soil in Yucatan, and which has been classified as extreme vulnerability,⁶ which would increase the load of pollutants in the underground aquifer, worsening the water conditions for human consumption.

Conclusion

Due to the above, the official authorities must manage this condition of extreme vulnerability of our Yucatan aquifer as a highly fragile ecosystem for pollution, and therefore, the high risk for water for human consumption and impacts on health. Normally in developed countries with highly stony or karst soil systems like ours, governments pay special attention, with high technology in their drinking water treatment plants, they implement monitoring and surveillance systems for levels of chemical and microbiological contaminants to prevent high levels impacts on human health.¹⁵ Reflecting on the current state of serious environmental damage¹⁶ in the Yucatan Peninsula, on the one hand the Riviera Maya coast in the Caribbean Sea, saturated with sargassum, where this unusual proliferation of algae is related to the excess of nutrients in the water,¹⁷⁻²¹ as is organic matter and fertilizers that flow into the Caribbean coast; on the other hand, the recent news of the mortality of manatees and marine species in rivers and coasts of Tabasco, caused by contamination of heavy metals (lead (Pb), cadmium (Cd), mercury (Hg), arsenic (As), and hydrocarbons.²²⁻²⁶

Good quality water is essential for human health, the conservation of biodiversity, as well as for the social and economic development of any country, so the management of water resources must occupy a strategic place in the agenda of the 3 levels of government.

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Conflict of interest

The author declares there is no conflicts of interest in this work.

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