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## ECO-SOCIAL AND ECONOMIC PROFILE OF THE HERBICIDE GLYPHOSATE

### Abstract

By overview of scientific, political, and economic arguments, the structure and profile of glyphosate, the most important agrochemical compound in the world, has been portrayed. Toxicological, ecological and market objections of the opponents of glyphosate are in opposition with the financial and political support to that herbicide which, according to its advocates, enables the protection of crops, higher yields, and postpones the problem of world hunger. The conflict surrounding glyphosate surpasses the narrow scientific and social frames and is a good example of the need to think through and of decision making which involves connection and the totality of reality.

**Key words:** glyphosate, GMO, IARC, EFSA, FDA, cancer, endocrine disruptors

## **Introduction**

The herbicide glyphosate is currently the most controversial chemical compound in the world (Cuhra, 2016: 1-28). Its destiny on the market is the subject of intense scientific, media, and political conflicts. The main institutions in charge of food security are involved in the discussions surrounding its harmfulness, the American Food and Drug Administration (FDA) and the European Food Safety Agency (EFSA), International Agency for Research on Cancer of the United Nations (IARC), European Chemicals Agency (ECHA), the representatives of the agricultural industry (Monsanto, Bayer), agriculture workers, medicinal and scientific institutions, ecological associations, associations for the protection of consumer rights, beer and bread producers; in the USA, there is a series of court processes opened due to glyphosate and the European Parliament is voting to decide on the final ban on the use of that herbicide. There is almost no serious media outlet in the world that has not presented the topic of glyphosate to the general public.

Discussions on glyphosate discover a global profile of a chemical (Duke, 2008: 319-325). The entire civilization has become dependent on a phosphorus-methyl derivate of glycine because global agriculture is based on that herbicide.

## **Glyphosate and GM crops**

Glyphosate is a wide spectrum herbicide which was first produced by the company “Monsanto” under the trade name “Roundup”. The same company is the owner of a large number of patented genetically modified (GM) crops. Glyphosate is the chemical basis of many GM seed sowings, which means that the farmers who decided to sow the Monsanto GM corn or soy are dependent on the purchase and usage of the Monsanto glyphosate. The sowing of GM crops without the application of glyphosate makes no sense because GM crops are designed precisely in conjunction with that chemical additive. GM crops endure the effects of glyphosate while all other plants turn into “still life” (Silva, 2018: 1352-1359). Glyphosate is a non-selective herbicide which efficiently destroys the flora of an ecosystem. On the label of the “Roundup” product it literally states the following – “Glyphosate – killer of weeds and grass.” Glyphosate is like a chemical weapon in a fight against biodiversity.

In the fields sown with GM crops, glyphosate, therefore, creates the “scorched earth” effect on which only a plant with the modified genes to create an enzyme which can dissolve the structure of glyphosate can grow. That is why glyphosate

is massively used. Completely opposite to the announcements of the agriculture industry that the appearance of GM crops will reduce the need to use aggressive chemical compounds, the expenditure of herbicides has significantly increased. In the time from 1975 to 1984, 26 million kilograms of glyphosate were used in the US and, in the era after the appearance of GM crops (after 1996), in the time from 2005 to 2014, more than a billion kilograms of glyphosate were used (Benbrook, 2016: 3).

### **MRL values for glyphosate**

Glyphosate is the most sold and used herbicide in the world so many grains and food products contain it in measurable traces or even in unallowed amounts (bread, beer, pasta...). Therefore, the maximum remains level (MRL) of glyphosate has been determined for many grains and cultures in agriculture. For instance, for wheat and peas, the MRL is 10 milligrams per a kilogram. For comparison, a kilogram of wheat contains less than 10 milligrams of vitamin E. The MRL values for soy and sugar beet are 20 mg/kg. It is also known that for years the values of allowed glyphosate contamination have been increased, only because of a simple reason of a greater usage of glyphosate. That is how, for instance, the EFSA increased the MRL values for soy in 2012 from 5 mg/kg (from 1997) to the 20 mg/kg of today. According to the official statement by the German government from 2011, “the changes in MRL values for glyphosate are based on the changes in agriculture practice.”

### **Glyphosate in food**

Glyphosate is amassed in leaves, seeds, and fruits and it cannot be washed out with water nor eliminated by cooking. Such plants, like corn, soy or sugar beet become a transport vehicle for glyphosate on its way to the consumer. Food contains glyphosate for months regardless of the way it is processed. That means that each consumption of GM corn and other GM products supposes a contamination by glyphosate. Glyphosate has become an omnipresent chemical so the American Ministry of Agriculture published in 2011 that glyphosate is in 90% of soy samples in doses higher than 2 ppm and then, in 2012, the British Food Safety Agency (FSA) discovered that 25% of bread on the market is polluted by more than 0.2 ppm of glyphosate, while the Bavarian Institute for Environment published in 2016 that glyphosate exists in almost every beer and some brands of beer have the concentration of glyphosate up to 300 times that of the officially allowed amounts for water.

The FDA recently performed the first systematic testing of the presence of glyphosate in honey. The results are crushing because that poisonous pesticide has been discovered in every honey sample. The collected samples of honey originate from many American federal states and not a single one was clean. Narong Chamkasem, an FDA chemical analyst states: "It is impossible to find a blind test, a sample of honey without glyphosate. I have collected the samples of products on the market and they all contain glyphosate, even the organic products of mountain honey." That is how honey from Florida contains 22 ppb, the one from Iowa 41, and the one from Louisiana as much as 107 ppb. That is double the amount allowed by the regulations in the European Union.

The supervisory institutions in the US have for decades been examining and measuring the traces of pesticides in food products but, for some reason, glyphosate was not on the tested substances list for years. Only in February of this year has the regular testing of food begun, including honey, for the presence of glyphosate. Until now, the data on glyphosate in food has publicly been shown only by university scientists or independent analytic laboratories (Rubio, 2014: 1-8).

### **Glyphosate in humans**

Considering this data, it is not unexpected that most people are contaminated with glyphosate and its by-product (amino-methyl-phosphonic acid, AMPA) (Mills, 2017, 1610-1611). In 2013, German scientists from Bremen and Leipzig lead a research and measured the presence of glyphosate and AMPA in the urine of Europeans. Over 40% of citizens of the European Union, including Croats, have measurable amounts of glyphosate in their urine. Later on, the results were published in a publication for analytic toxicology in which they proved that humans and animals, fed by products gained with traditional growth, have higher doses of glyphosate than those who frequently use ecological food products (Krüger, 2014, 210). With the increase use of GM products, the doses of glyphosate in the human organism are increased (Conrad, 2017: 8-16). Therefore, the institutions of authority, apart from monitoring GM in market products, should also conduct a regular monitoring of the remains of glyphosate. In Croatia, there is currently no legal demand to check for glyphosate in food.

According to the latest scientific results, glyphosate is also in the blood of pregnant women and it is carried over to the foetus with the bloodstream. In other words, the placenta is a weak protective barrier for the child in the body

of its mother, at least when talking about the exposure to and the effects of glyphosate. Among the first to measure and prove the presence of glyphosate in pregnant women is Paul Winchester, professor of medicine at the University of Indianapolis (Winchester, 2016: e107-e115). He connected the exposure of pregnant women to glyphosate with the increased frequency of premature birth and lower birth weight. Premature birth is connected to other developmental disorders and cognitive abilities of the child so, therefore, it is important to understand the effect of glyphosate and other pesticides to the health of the mother and her foetus. Professor Winchester also discovered that glyphosate is present in more than 90% of pregnant women.

### **ADI value for glyphosate**

In 2012, the European Union officially determined the allowed daily intake (ADI) for glyphosate and it is 0,3 milligrams per kilogram of body weight. That means that a 20-kilogram child can eat 6 milligrams of glyphosate each day. The ADI value determined by the Health and Agriculture Organization is even larger and it is 1 milligram per kilogram of body weight. On the other hand, a group of independent scientists under the leadership of Robinson and Fagan considers that the ADI value for glyphosate should be much lower - 0,025 milligrams per kilogram of body weight, which is about a dozen times less than the official EU value.

### **Glyphosate is a “probable carcinogen”**

In many scientific circles a consensus has been reached according to which the health and ecological damage of glyphosate is bigger than the benefit of its application (Eriksson, 2008: 1657-1663). Such scientific complaints converged into the official statement of the World Health Organization, according to which glyphosate has been categorized into group 2A i.e. the group of probable cancer causes. Glyphosate is genotoxic and reprotoxic, belongs to a group of hormonal poisons (endocrine disruptors) and is especially harmful for children and pregnant women. A large number of studies of harmfulness of glyphosate warns that the herbicide does not belong on the field nor the table (Antoniou, 2012: S4:006). In accordance with the precautionary principle, this chemical should be banned.

With the categorization of “probable carcinogen”, defined by the WHO, the most popular pesticide in the world became an unwanted product among farmers, gardeners and tradesmen. Many commercial chains and garden centres are throwing glyphosate-based products out of their catalogue. The German REWE group, numbering 15 thousand stores all over the European Union, announced that starting from September 30<sup>th</sup> 2017 it is ceasing its sale of all products for the protection of plants which contain the active substance glyphosate, even though such products make up 60% of their current offer. These marketing moves also have political backing. Christian Meyer, the Saxon minister of consumer protection stated: “The pesticide glyphosate should not be used in gardens, parks, or children’s playgrounds. I also find it inappropriate to use glyphosate near houses. The sale and use of glyphosate should be banned based on the precautionary principle.”

Ségolène Royal, a former French minister of environment protection, announced the introduction of new limitations and prohibitions for the use of glyphosate and many garden centres in the UK gave up the purchase of glyphosate concoctions. In that country, in the last 20 years, the sale of glyphosate has grown 400% but, under the pressure of consumers, the tradesmen, it seems, are giving up a portion of their profits. The Soil Association warns that, due to the treatment of wheat, a third of bakery products is polluted with glyphosate remains and that 70% of the island population has that pesticide in their urine. The association started a national petition “Not in our bread” which demands the large trade chains, like Hovis, Warburtons and Allied Bakery to stop offering food products made from glyphosate-polluted wheat.

### **The pressure of science and the public**

Many scientists, consumer protection associations and public media are putting pressure on the institutions to ban glyphosate as a chemical ingredient used in protecting plants. The agrochemical industry has given up the production of DDT and atrazine, neonicotinoid insecticides have recently been banned, and a similar fate threatens the most used herbicide in the world – glyphosate. The ban of glyphosate would put the GM crop sowing under question because it supposes the use of glyphosate. There is no chemical replacement for glyphosate – no other herbicides can be used instead.

It is interesting that half of the total amount of glyphosate in the world is produced in China. Therefore, that country would have the greatest economic

fallout from the ban. “The chemical warfare” of the US versus China, as it is called by William Engdahl, will become a complex toxicological-trade crossword puzzle if the European Union activates its precautionary principle and bans glyphosate.

The current status of glyphosate in the European Union has been defined by the compromise decision which prolongs the authorization to only 5 years. This new postponement is simply a concession to the agrochemical industry but also to farmers who have been “gifted” the next five years like an adjustment period. According to the words of Albert Alamann, French law professor in the Paris business school HEC, glyphosate is “living on borrowed time”. “This small industrial victory will soon be exposed as a Pyrrhus’ victory. The limited duration of the reauthorization will strengthen the stigmatization of glyphosate in the public and force the industry to search for alternative solutions. In other words, glyphosate is living on borrowed time.”

### **Conclusion**

There are literally political and scientific conflicts being led concerning one “simple” chemical. The role of glyphosate is actually a big one because it is what the American and European agriculture is based on. That is a crushing fact which reveals that contemporary farmers and agriculture workers do not know (or do not want to) how to grow crops without glyphosate. It is a chemical addiction fed by convenience and profit. Handling glyphosate is simple, demands no additional land processing (“no till”), and a regular application ensures larger yield per hectare.

The lesson of this convoluted story is that the stands of experts and politicians are not a necessary product of arguments or care for the greater good, but are often conditioned by interests, concessions and compromise. The political and regulatory permits for the use of glyphosate are not a guarantee for the health of people or the environment, nor are they proof of the security of such products on the market.

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## EKO-SOCIJALNI I GOSPODARSKI PROFIL HERBICIDA GLIFOZATA

### Sažetak

Pregledom znanstvenih, političkih i gospodarskih argumenata prikazana je struktura i profil glifozata, najvažnije agrokemikalije na svijetu. Toksikološki, ekološki i tržišni prigovori protivnika glifozata u oprjeci su s financijskom i političkom podrškom tom herbicidu, koji, prema zagovarateljima, omogućuje zaštitu usjeva, veće prinose i odgađa problem gladi u svijetu. Sukob oko glifozata nadilazi uske znanstvene i društvene okvire, te je dobar primjer potrebe promišljanja i odluka koje uključuju povezanost i cjelokupnost stvarnosti.

**Ključne riječi:** glifozat, GMO, IARC, EFSA, FDA, rak, endokrini disruptori