

Pesticides in agriculture: why?

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In 2018, controversies about pesticides hit the headlines. In the United States, the pesticide firm Monsanto was found guilty of causing cancer in a school groundskeeper that used its glyphosate-based herbicide for many years, and was ordered to pay him \$289 million. In the European Union (EU), debates arose concerning the ban of glyphosate herbicides as well as neonicotinoid insecticides. Why? Pesticides have been generally used in the agriculture of “developed” countries following World War II. They have been a symbol of agriculture modernization, along with improved seeds, fertilizers, and machines. Their adoption has not been without opposition; however, governments’ pro-pesticide campaigns finally convinced people to employ them.

But why do we use pesticides? Further, why do we have to stop using them? Moreover, why is it so difficult to stop using them and ban selling them? Solutions to farming without pesticides exist. Yet, abandoning them means changing the way we produce, buy and consume food - a good opportunity to question our way of living and build a new relationship with our environment.



Pesticide spraying on cereals in Belgium (2017)

Why do we use pesticides?

Pesticides are used in agricultural fields to control pests. Pests are those organisms that are harmful for plants. Certain insects are considered pests because they consume plants - they are insect herbivores. Others transmit viruses when stinging plants, like aphids (aphids sting plants in order to feed on plant liquids, like mosquitoes on animals). Hence, insecticides are used to suppress them. Fungi are considered pests because they parasitize plants. Parasitized plants become weaker and produce less grains, vegetables or fruits than expected. Therefore, fungicides are applied to protect them. Finally, other plants growing besides those that are cultivated are also seen as pests. They are weeds, and are often unwanted because they are seen as competitors for resources, such as nutrients, water, sun, and space. Weeds are eliminated with herbicides.

Pesticides (insecticides, fungicides, herbicides) are used in high quantity on cultivated plants. Japan has been ranked the third highest consumer of pesticides among the Organization for Economic Cooperation and Development (OECD) countries with 12.75 kg/ha (average calculated between 2004 and 2013), well ahead the United-States (ranked 18th with 2.43 kg/ha) (1). Pesticides are used in such a high quantity because they are formidably efficient. Spraying them allows for controlling damaging insects, diseases or competitive plants without much in the way of physical effort and a relatively low price. Unfortunately, they are also poisonous for us and our environment.

Why do we have to stop using pesticides?

Already in the 1960s, Rachel Carson wrote in the book, *Silent Spring*, which became famous worldwide, that “synthetic pesticides have been so thoroughly distributed throughout the animate and inanimate world that they occur virtually everywhere” and, as a result, “every human is now subjected to contact with dangerous chemicals, from the moment of conception until death” (2). The environmental threat of pesticide use was symbolized by springs becoming silent because singing birds, which eat insects, are disappearing with the elimination of their food sources. More recently,

insecticide use, and, more generally, conventional agricultural practice, is considered to be responsible for the disappearance of pollinators, especially bees.

In parallel to species extinction, targeted pests adapt to pesticides as evolutionary processes tend to select resistant organisms, and these resistant pests become even more problematic for farmers. In the United States, certain farm lands cannot be cultivated any longer because they are invaded by herbicide-resistant “super weeds”, like the pigweed Palmer amaranth which is so deeply rooted that even uprooting it mechanically is difficult.

The generalization of pesticide use in agriculture has contaminated our entire environment: air, soil, water, food... hence, also our own bodies. Research has evaluated risks for human health. Among other scientific works, a general synthesis carried out by the French *Institut National de la Santé Et de la Recherche Médicale* (INSERM; institute for health and medical research) notably concluded that the rise of significant risks for various pathologies have been linked to exposure to pesticides (3). Regarding the specific case of glyphosate-based herbicides (the most widely used type of herbicide worldwide), the International Agency for Research on Cancer (IARC), a World Health Organization agency, classified them as “probably carcinogenic to humans” (4).



Demonstration against pesticides in Brussels, Belgium (2015)

Why is it so difficult to stop using pesticides?

There is clear scientific evidence that pesticides are poisonous for our health and environment. Policy makers in certain countries have acknowledged these risks and began to push towards a reduction in use. In France, the “Ecophyto 2018” plan was launched in 2008 with the objective of reducing pesticide use by 50% in 10 years (calculated by a complex indicator referred to as NODU – number of unit doses – that takes into account the quantity but also the intensity of the products) (5). After eight years, the government acknowledged that pesticide use has not decreased and planned “Ecophyto 2”. The efforts of the French government to diminish pesticide use are promising, but its difficulty to significantly decrease dependency on pesticides is worrying. Several factors can explain why is it so difficult to stop using them.

Pesticides are easy-to-use solutions that are colorless and often odorless. Despite knowing that they are dangerous, the temptation to use them is high when crops are infested by insects or when weeds are out of control. Invisible and diluted into water, it is easy to deny their harmful effects on our health and the environment. Furthermore, a problem often calls for quick solutions, and using pesticides is among the fastest way to solve a pest infestation. Pesticides are even being deployed in a preventive way, in an absence of pests, to be certain to avoid any problems.

Fears of damages, or the simple presence of insects on fresh products, are high among farmers. State-regulated quality standards, which include products’ physical appearance, demand an absence of damages caused by insects or diseases on fruits and vegetables when they arrive on market stalls. Consequently, they compel farmers to spray pesticides. For instance, apples are sprayed about 35 times per season in France (about two-thirds of treatments against fungus and bacteria, one-third against insects, and a very small amount being against weeds and regulate growth). Another example

is lettuce, upon which no aphids must be found when they are sold, inducing farmers to spray extra insecticides to guarantee their “cleanliness”.

Beside damages, farmers fear losses of production, and a high yield is often an objective. Yield (quantity produced per surface unit) is the main indicator of performance for agriculture. This quantitative indicator reflects the priority of the market to produce large amounts of food, with relatively less interest in nutritional quality or the potential side effects to the environment. Efforts are through a diversity of economic agents (input sellers, commodity buyers) to convince farmers to always produce more based on the argument that they will earn more. However, high-yielding agriculture necessitates important economic investments in machineries and inputs, moving towards specialization of farms within a limited range of production. The optimization of production systems reduces a farm’s ability to change. Economic profitability of specialized farms depends on high yield, partially achievable thanks to the use of pesticides. The long-term debt incurred to buy machines prevents farmers taking on the risk of changing their manner of farming and losing money. In the end, farmers are locked into a whole technical and economic system, impelling them to continue using pesticides.

However, unfortunately for farmers, high yield does not always guarantee sufficient incomes and their major level of debts easily leads them to bankruptcy when commodity prices crash. As a result, the number of farmers inexorably decreases and farmers’ suicide rate increases, which is already much higher than other socio-professional groups in most countries. For example, roughly one-third of French farmers earn less than 350 € (45 000 ¥) a month, France lost 20% of its farmers between 2000 and 2010 and farmers’ suicide rate is 20-30% higher than the population average. In the United States, the suicide rate is up to five times more than the average population.

Another argument for higher yield farming is that farmers must feed the world and its increasing population estimated to reach 9 billion in 2050. Such an objective likely gives meaning to farmers with respect to growing plants and animals. However, it should not be forgotten that agriculture represents major economic interests. Increasing production with pesticides would benefit companies selling machines and products, while major-producing countries will benefit from higher exports that, however, rarely (if not never) benefit farmers.



*Latest generation harvester (left);
Syngenta (pesticide company) advertisement in Brussels, Belgium (2015) (right)*

Why is it so difficult to ban selling pesticides?

Major economic interests put pressure on policy makers when debating banning pesticides. Recently, the EU discussed two specific cases: the ban of glyphosate-based herbicides and the ban of neonicotinoid-based insecticides. As already mentioned, glyphosate has been labeled “probably carcinogenic to humans” and neonicotinoids are accused of killing bees.

EU member states voted at the end of 2017 to renew the authorization of selling glyphosate herbicides for five more years. It would not have been possible without a last-minute decisive swing of Germany’s Minister of Agriculture, Christian Schmidt, in favor of the renewal despite his own government’s position requesting he abstains. Since then, the German chemical company, Bayer, acquired

Monsanto, and with it, its “Round Up” herbicide. This rose concerns surrounding Mr. Schmidt’s potential conflict of interests when voting for the re-authorization of glyphosate herbicides. Moreover, pesticide companies refused to adhere to the conclusions of the IARC on the carcinogenic risk of glyphosate. Instead, they relied on another official report ordered by the EU and published by the German *Bundesinstitut für Risikobewertung* (BfR; institute for risk evaluation), that did not conclude glyphosate causes cancer. The conclusion of this last report was the main argument for countries supporting the re-authorization of this herbicide. However, it was revealed that large parts of this report were copy-pasted or plagiarized from chemical companies’ own studies, casting doubts on its neutrality and overall conclusions (6).

Similarly, the United States Environmental Protection Agency (US EPA) concluded in a report that glyphosate poses no significant cancer risks. However, it was recently shown (7) that approximately half of the studies used in the US EPA report were those administered by chemical companies when applying for commercial authorization, and these studies almost never concluded that glyphosate is carcinogenic. Conversely, the IARC report excluded most of the company-produced studies and considered mainly investigations published in independent scientific journals, and most of these studies indicated carcinogenic risk of glyphosate.

These disputes highlight how those selling pesticides interfere with science and influence the regulatory processes with which their authorization or banning depends. It was also uncovered by the “Monsanto papers” (the publications of Monsanto’s internal documents and emails) how the company convinced renowned scientists by paying them to publish studies that were in line the company’s own conclusions.



“March Against Monsanto” in Brussels, Belgium (2015)

Conversely to glyphosate, EU member states have voted to ban neonicotinoid-based insecticides in fields (but they are still authorized in greenhouses). This was a victory for environmentalists who supported their ban for many years. It shows that policy makers can vote against company interests. Nevertheless, it does not mean that bees are saved from insecticides and that insecticide use will cease. Indeed, the ban of specific pesticide molecules has always led to the development and the promotion of new ones by firms that will not stop selling chemicals for agriculture. Already, sulfoxaflor-based insecticides are being promoted as alternatives to neonicotinoids. The EU authorized these insecticides in 2015 for 10 years. However, one study has already demonstrated their harmful effects on pollinator reproduction (8).

How to exist without pesticides?

Despite the difficulties in abandoning pesticides, solutions exist. At the technical level, an array of farming practices can help limit pests. They concern plants themselves and the way they are cultivated, as well as the manner by which the farm environment is managed. Regarding plants, the date of sowing can be crucial: delaying sowing by a number of weeks can help plants avoid the occurrence of certain pests. Also, local varieties should be used because they have likely developed resistances to local pests over time. Plant species that are sensitive to different insects and diseases can be mixed, a practice known as intercropping, to prevent the spread of pests from plant to plant. Finally organic, and

not mineral, fertilization by, for instance, using compost improves plant health and limits its sensitivity to pests.

With respect to farm management, laying straw or sowing particular grasses that cover the soil (for example, clover before sowing cereals) prevents weed growth. Weeds can also be mechanically removed instead of with chemicals. Managing natural habitats near fields, such as planting hedgerows or sowing flowers, can favor populations of predators and parasites of insects (for example, ladybeetles that are well-known predators) (see next issue). Finally, limiting soil ploughing also saves ground-dwelling predators, such as carabids and parasitizing insects that spend the winter in the soil.



Straw laying and vegetable intercropping, France (left); Flower strip in a field of cereals, Belgium (right)

It is generally acknowledged that small cultivated parcels, harboring a diversity of plants, are less sensitive to pests than large and very homogeneous fields. This is because more diversified ecosystems favor the development of multiple organisms that interact with one another, and, finally, regulate each other. This holistic approach of farming highlights that there is not only one practical solution to control pests, but instead, an array of practices that should be used together and adapted to specific environmental conditions of each farm. It demands radical change in farming compared to the use of pesticides that is a simple solution applicable everywhere in the same fashion. Abandoning pesticides also means spending time in fields observing plants growing: Are they growing properly? If not, what is the reason they are not growing properly? Are the insects walking or flying around? Do insects represent risks for plants? Hence, farming without pesticides is knowledge-intensive. As such, it represents progress.



Community Supported Agriculture with consumers helping at farming in Belgium (left); Farmers' market in France (right)

Abandoning pesticides also calls for changing the economic dimensions of agriculture. The main marketing system, where the final step is deployment in the supermarket, dictates strict quality standards (example: no damage) and very low prices to farmers. Despite the rise of certified organic products in supermarkets, developing alternatives to this retail system is needed to shift to ecological farming. The Japanese system of *teikei* (提携), developed in the late 1960s, is a good example of

such alternatives. In teikei groups, farmers directly provide organic products to consumers. Consumers in return are engaged in buying the products over the long term, guaranteeing an outlet and stable income for farmers, even in the case of disasters. Consumers are also engaged in regularly helping farming and organizational aspects, such as product delivery, which bonds farmers and consumers and allows consumers to understand the issues related to organic farming. Hence, in such a system, risks of unstable production or damages because of pests are understood and accepted by consumers who support pesticide-free agriculture. The Japanese system of teikei has inspired similar initiatives in other countries, like Community Supportive Agriculture in the United States and the *Association pour le Maintien d'une Agriculture Paysanne* (AMAP; organization to maintain peasant farming) in France. In Japan, certain co-ops have also built close bonds with farmers and support their move to organic farming. Farmers' markets or farmer-led retail shops are other means for farmers to explain to consumers how they produce food while improving their incomes by retaining the entire margin (instead of sharing it with various intermediaries, like wholesalers and supermarkets).

There are many reasons to explain why pesticides are so heavily used in agriculture worldwide, and why it is so difficult to stop utilizing them and ban their use. It appears that on the one hand, farmers are locked in a socio-economic and technical system from which it is difficult to escape. On the other hand, any step towards banning them completely faces obstacles that aim at protecting the huge economic interests that represent pesticides. Nevertheless, people have never stopped criticizing their widespread use. Despite they often represent the minority in society, people have kept and developed farming practices allowing the production of pesticide-free food, inventing alternative ways to connect farmers and consumers. These innovative ideas are still niche, but could rise in popularity with increasing awareness that humanity will only survive in a safe environment.

- (1) Original source: FAO. <https://www.fraserinstitute.org/sites/default/files/environmental-ranking-for-canada-and-the-OECD.pdf>
- (2) Rachel Carson (1962). *Silent Spring*. Houghton Mifflin, USA.
- (3) Inserm (dir.). *Pesticides : Effets sur la santé*. Rapport. Paris: Inserm, 2013, XII-1001 p.
- (4) International Agency for Research on Cancer (2015). IARC Monographs Volume 112: evaluation of five organophosphate insecticides and herbicides. <https://www.iarc.fr/wp-content/uploads/2018/07/MonographVolume112-1.pdf>
- (5) Baschet, J-F., Pingault, N. (2009). Reducing pesticide uses: The Ecophyto 2018 plan - The role of usage indicators in evaluating the achievement of targets. *Centre d'Etudes et de Prospectives*, 4, 1-4. http://agreste.agriculture.gouv.fr/IMG/pdf_analyse40902anglais.pdf
- (6) Weber, S., Burtscher-Schaden, H. (2019). Detailed Expert Report on Plagiarism and Superordinated Copy Paste in the Renewal Assessment Report (RAR) on Glyphosate. <https://bartstaes.be/nl-BE/artikel/dossier/glyphosate-files-the-copy-paste-study/27200>
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