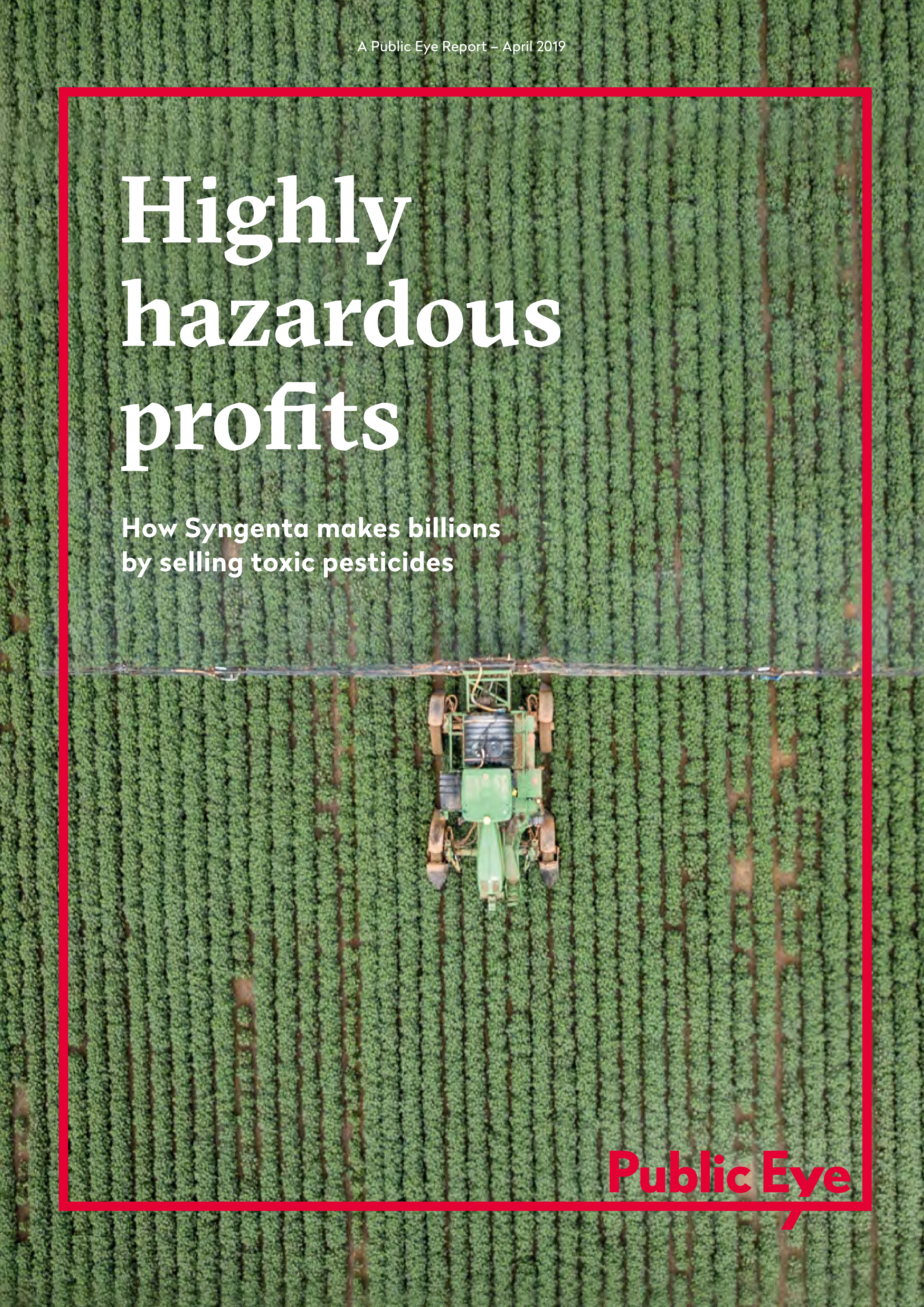
A Public Eye Report – April 2019

Highly hazardous profits

How Syngenta makes billions by selling toxic pesticides



Public Eye

IMPRINT Highly hazardous profits. How Syngenta makes billions by selling toxic pesticides. A Public Eye Report, April 2019, 56 pages | **Authors** Laurent Gaberell and Carla Hoinkes | **Editing** Mary Louise Rapaud | **Contributors** Timo Kollbrunner, Christa Luginbühl and Géraldine Viret | **Acknowledgments** Fernando Bejarano, Medha Chandra, Peter Clausing, Susan Haffmans, Emily Marquez, Lars Neumeister, Fran Paula, Javier Souza, Murilo Souza, Baskut Tuncak, Alan Tygel and Meriel Watts | **Publisher** Raphaël de Riedmatten | **Layout** Karin Hutter, karinhutter.com | **Cover picture** © Fábio Erdos

PUBLIC EYE Avenue Charles-Dickens 4, CH-1006 Lausanne | Phone +41 (0)21 620 03 03
Fax +41 (0)21 620 03 00 | contact@publiceye.ch | www.publiceye.ch | CP 10-10813-5

Executive Summary

Research by Public Eye reveals that the most dangerous pesticides, known as "highly hazardous", are used heavily in low- and middle-income countries (LMICs), despite being – for the most part – banned in Switzerland and the European Union (EU). Public Eye's in-depth probe into the opaque world of highly hazardous pesticides also reveals that the Swiss agrochemical giant, Syngenta, is one of the main responsible for the flood of such products into LMICs. This conclusion is based on our analysis of exclusive industry data, which lifts the lid on a ticking time bomb that dramatically endangers human health and the environment. Our investigation in Brazil, the world's largest user of pesticides, shows that millions are exposed to pesticides that present significant hazards to human health – including through drinking water. Scientists fear this could trigger an epidemic of chronic diseases. The time has come to put an end to this dirty business.

Approximately three million tonnes of pesticides are applied worldwide every year, an amount that has been constantly increasing over the past three decades, especially in LMICs, which now account for over half of pesticide use. Concerns over the health impacts of pesticides are escalating. While farmers and rural residents are exposed most frequently and directly, residues of pesticides are found everywhere: in our food, our drinking water, in the rain and in the air. In short, no one remains untouched by pesticide exposure.

EXPOSURE TO PESTICIDES: A TICKING TIME BOMB

Pesticides are poisons, designed to kill living organisms such as pests and weeds. By their very nature, they can also affect humans and other non-target organisms. UN experts have recently warned that pesticides have a "catastrophic impact" on the environment, human health and society as a whole, including an estimated 25 million cases of acute poisoning resulting in 220,000 deaths a year. They have expressed "grave concern" over the impact of chronic exposure to pesticides, including cancer, Alzheimer's and Parkinson's diseases, hormone disruption, developmental disorders, sterility and neurological health effects.

> Pesticides have a "catastrophic impact" on the environment, human health and society as a whole, including an estimated 25 million cases of acute poisoning resulting in 220,000 deaths a year.

It is now widely accepted that in order to reduce risks, pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or the environment – the "highly hazardous pesticides" (HHPs) – must be taken off the market. This represents a paradigm shift from decades of thinking that all risks associated with pesticides can be well-managed and reduced to an acceptable level, for example through training programmes promoting so-called 'safe use'. In other words the old risk management approach is now seen as not sufficient when pesticides are intrinsically highly hazardous. However, despite progress in recognising the dangers of HHPs, very little is known about the extent of their use and the companies behind this dirty business.

For this reason, Public Eye investigated the opaque business of highly hazardous pesticides over several months. Based on exclusive industry data and using the list of highly hazardous pesticides developed by the Pesticide Action Network (PAN), our report shines a light on the massive use of these dangerous substances in LMICs, and the central role played by Swiss-based agrochemical giant, Syngenta, in promoting their use.

Most – though not all – highly hazardous pesticides are no longer authorized for use in Switzerland and the EU. The situation is completely different in LMICs: our research suggests that about 1.2 million tonnes of highly hazardous pesticides are used in these countries every year, representing a huge market – some USD 13 billion.

WARNING: HIGHLY HAZARDOUS BUSINESS MODEL

Syngenta presents itself as an agricultural company that helps to feed the planet while protecting biodiversity and keeping farmers safe. The company's public ambition is to be at the forefront of the transition towards a more sustainable agriculture. Our research reveals a very different reality: selling highly hazardous pesticides is at the core of Syngenta's business model. About one third of Syngenta's pesticide portfolio – and half of its best sellers – consists of substances listed as "highly hazardous" by PAN.

Based on exclusive data from Phillips McDougall, the leading agribusiness intelligence company, Public Eye estimates that Basel-based Syngenta made some USD 3.9 billion by selling highly hazardous pesticides in 2017 – over 40% of its pesticide sales that year, with a volume of about 400,000 tonnes. About two thirds of those sales were made in LMICs. Brazil is the company's largest market, but it also sells its toxic pesticides in Argentina, China, Paraguay, Mexico, India, Vietnam, Philippines, Ecuador, Colombia, Kenya and Ghana, among others.

SCANDALOUS DOUBLE STANDARDS

While the company boasts of providing "world-class science and innovative crop solutions" to farmers around the globe, the facts do not match the rhetoric. Since 2000, Syngenta has developed only eight new molecules. Some of its toxic blockbusters – such as highly controversial paraquat, atrazine, lambda-cyhalothrin or glyphosate – have been on the market for decades. Fifty-one of the 120 pesticide active ingredients in Syngenta's portfolio are not authorized for use in its home country, Switzerland; sixteen of them were banned because of their impact on human health and the environment. But Syngenta continues selling them in lower income countries, where standards are often weaker and less strictly enforced.

> Our research reveals that selling highly hazardous pesticides is at the core of Syngenta's business model.

Confronted with our findings, Syngenta said it does not agree with the list that PAN has developed. The company indicated its support for regulating pesticides based on risks not hazards, and stressed that it complies with all of the regulatory and safety standards of the countries where its products are registered for sale.

"Even more complete portfolio": Syngenta advert in Rio Verde, Goiás, Brazil. | © Fábio Erdos/Panos

Fernando Bejarano from PAN Mexico does not share that view. He said: "Companies such as Syngenta have chosen to promote profit over people and take advantage of weaker regulations in lower income countries to increase their sales." And he stressed that people living in low and middle income countries "are paying the price, in terms of health and environmental impacts".

In order to better understand the consequences for people in lower income countries, we decided to go to Brazil, the largest user of toxic pesticides and Syngenta's largest growth market.

BRAZIL, SYNGENTA'S LARGEST MARKET FOR TOXIC PESTICIDES

Over the last two decades, Brazil has become an agricultural superpower. The country is now the world's second largest global supplier of food and agricultural products, and the main exporter of soy, coffee, sugarcane and tobacco. Pesticide use has skyrocketed in Brazil over the last thirty years, and the country is now the largest user worldwide, with some 540,000 tonnes of pesticides applied in 2017, for a market value of USD 8.9 billion.

Brazil is also the largest user of the most toxic pesticides. According to our analysis of the official statistics published by the Ministry of the Environment (IBAMA), about 370,000 tonnes of highly hazardous pesticides were sprayed on agricultural fields in the country in 2017 – approximately 20% of the worldwide use.

Syngenta is the main seller of pesticides in Brazil, with an 18% share of the national market, accounting for sales that reached USD 1.6 billion in 2017. Our analysis indicates that most of that total comes from the sale of pesticides listed by PAN as "highly hazardous", which in 2017 amounted to about 100,000 tonnes at a market value we estimate at USD 1 billion.

POISON IN THE WATER

"There is probably not a single citizen in this country without a certain level of pesticide exposure", says Ada Cristina Pontes Aguiar, medical doctor and researcher at the Federal University of Ceará in Brazil. Our dive into Brazilian's drinking water confirms this assessment. Through a freedom of information request, Public Eye accessed a government database of drinking water monitoring from 2014–2017.

Pesticide residues were found in 86% of drinking water samples tested. A total of 454 Brazilian municipalities, with a population of 33 million, detected pesticide residues in their drinking water above the legal limits at least once during the four-year period. Overall, the level of contamination of the drinking water in Brazil is far higher than what is found in the EU or Switzerland. While in the EU only 0.1% of drinking water samples exceed the limit of 0.1 micrograms per litre, in Brazil 12.5% of test results found residues of pesticides above this concentration.

A major concern is that a cocktail of 27 toxic substances is regularly found in the drinking water of Brazilian municipalities. Seven of these substances are currently sold by Syngenta in Brazil. 1,396 municipalities, with a combined population of over 85 million, detected traces of all 27 pesticides in their drinking water during the four-year period. All these substances interact and can have additive – or even synergistic – effects. The unsettling conclusion is that millions of Brazilians are exposed to a cocktail of pesticides in their drinking water that has never been tested, and the effects of which remain largely unknown.

> Millions of Brazilians are exposed to a cocktail of pesticides in their drinking water that has never been tested, and the effects of which remain largely unknown.

AN EPIDEMIC OF CHRONIC DISEASES

Evidence of the link between pesticides and elevated rates of chronic diseases in Brazil is accumulating. Researchers and government agencies are warning that pesticides constitute a major public health concern in the country. Studies are documenting disturbing rates of cancers, birth defects, and other chronic diseases in regions where pesticide use is highest. In 2015, the Brazilian National Cancer Agency (INCA) issued a statement against current practices of pesticide use and warned of the increased risk of chronic diseases. INCA also warned that the health consequences of the rapid increase of pesticide use in Brazil might only be starting to be felt, "as chronic diseases develop sometimes many years after exposure".

TIME TO ACT: OUR DEMANDS

Syngenta, as the leading player on the agrochemical market, must show responsibility **by committing to stop producing and selling highly hazardous pesticides globally.** As Syngenta's host country, Switzerland has a special responsibility. The **Swiss authorities** must adopt binding rules to fight this illegitimate and highly dangerous business, by:

1. **Prohibiting the export of pesticides that have been banned in Switzerland because of their impact on human health and the environment,** as demanded in a motion filed by National Councillor Lisa Mazzone;

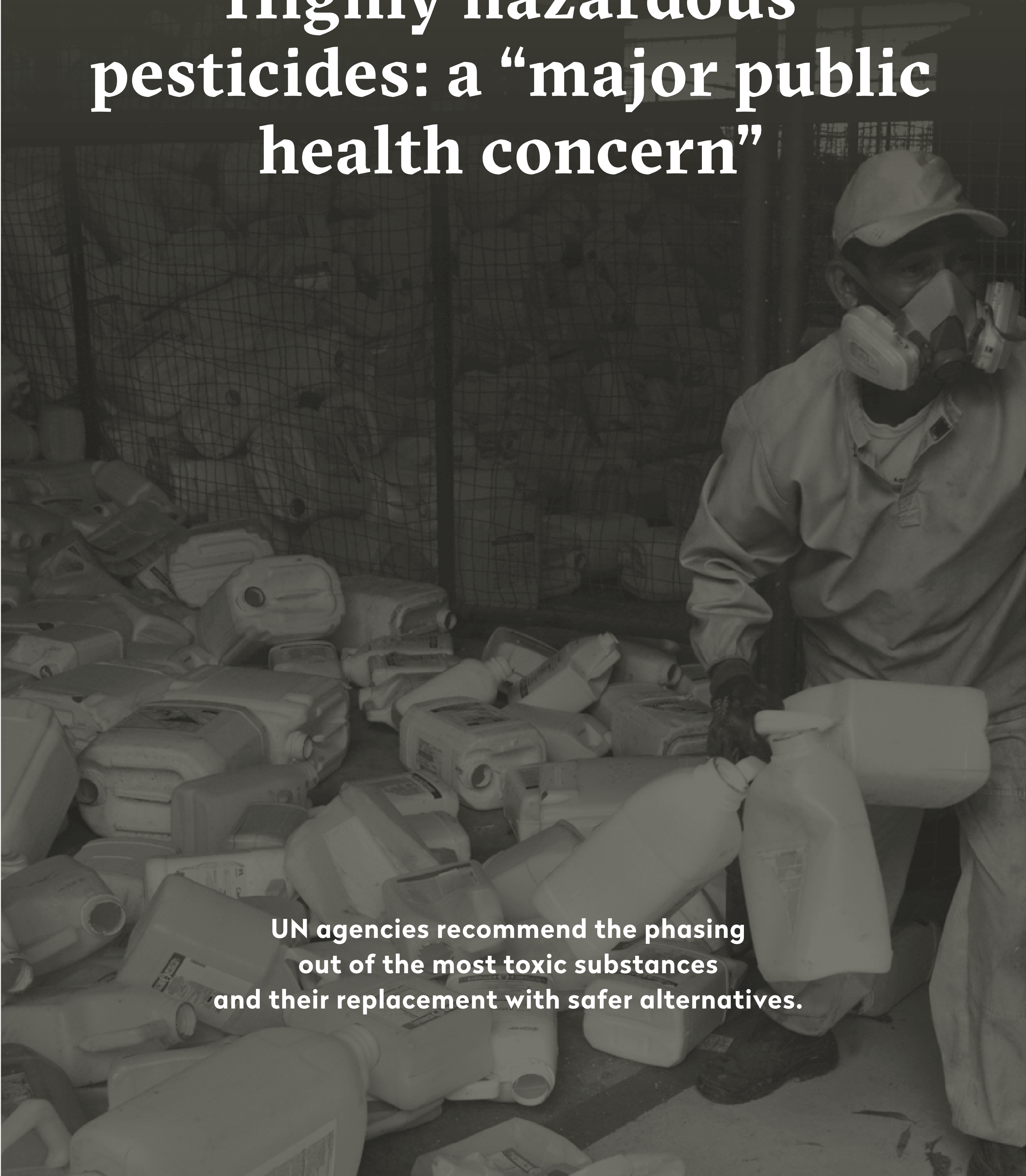
2. **Establishing mandatory human rights due diligence for companies based in Switzerland,** as proposed by the Responsible Business Initiative;

3. **Unequivocally supporting the efforts in favour of an international legally binding treaty to phase out highly hazardous pesticides** and replace them with safer alternatives.

Future generations have to be protected from the damaging consequences of highly hazardous pesticides. It is time to act and regulate the irresponsible global trade in poisons, and end the double standards that have permitted it to flourish.

Pesticide application right next to inhabited areas close to Lucas do Rio Verde, Mato Grosso, Brazil. | © Lunaé Parracho

1
Highly hazardous pesticides: a “major public health concern”



UN agencies recommend the phasing out of the most toxic substances and their replacement with safer alternatives.

1.1 – THE SHIFTING GEOGRAPHY OF PESTICIDE POISONINGS

Every year, the equivalent of twenty-five million bathtubs full of pure chemicals is sprayed on the world's food crops, a quantity that has been constantly increasing over the past three decades. Most of what amounts to three million tonnes of pesticide active ingredients[1] are manufactured by just four companies – Bayer CropScience, Syngenta, DowDupont and BASF – which are responsible for almost two-thirds of the USD 54.219 billion global pesticide market.[2]

There's been a significant shift over the past two decades in where those pesticides are being sold, and who is being impacted by exposure to them. While pesticide use in the rich countries has remained on a slow but steady upward trajectory, the use of pesticides in low- and middle-income countries (LMICs)[3] has skyrocketed.

In 1990, worldwide use was at 1.8 million tonnes, 75% of which was concentrated in high income countries (HICs).[4] The United States share alone reached 24%.[5] Since then, the global use of pesticides has almost doubled to three million tonnes per year. Most of this increase has occurred in LMICs which still have the strongest growth rates today.[6] In Brazil, for example, pesticide use today is nine times higher than it was some thirty years ago.[7]

Over half of the global pesticide use now occurs in LMICs. Brazil, China and Argentina alone account for about 40% of all volumes used in 2017[8] (see Figure 1.1). This reflects the large expansion of the agricultural area that has occurred in many LMICs and the transformation of agriculture as a result of the "Green revolution" and trade liberalization policies.[9]

Pesticides are poisons, designed to kill living organisms such as pests and weeds. The barriers between those organisms and humans, however, are by no means impermeable. Concerns are rising, at the World Health Organization (WHO) and other public health bodies, over the long-term health implications of the dramatic increases in pesticide use.[10] UN human rights experts recently warned that pesticides have catastrophic impacts on the environment, human health and society as a whole, calling them "a global human rights concern".[11]

The situation is particularly worrying in LMICs, where the staggering increase in pesticide use has not been accompanied by the necessary safeguards to control how they are applied. Approximately 25% of LMICs lack effective laws on the distribution and use of pesticides, and about 80% do not have sufficient resources to enforce existing pesticide-related laws.[12]

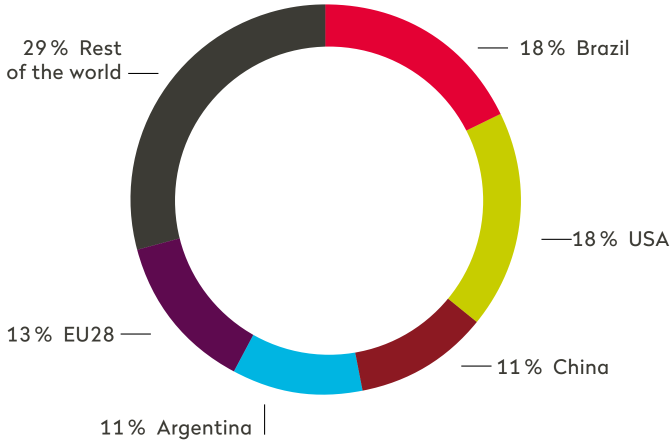
Farmers and agricultural workers are at higher risk because of their direct and repeated exposure to pesticides. People living close to agricultural lands and plantations also face toxic exposure as pesticides are often used close to their homes, schools or workplaces. The wider population is exposed every day through pesticide residues in food, drinking water, air, rain and dust.[13] In short, no one is untouched by pesticide exposure.

There are hundreds of different toxic pesticides suspected to be contributors to a spectrum of health problems. The most direct impact is acute poisoning, i.e. poisoning resulting either from a single or multiple exposures within a short period. Severe cases can result in the loss of eyesight, seizures, unconsciousness, coma and even death. Unfortunately, there are no reliable, global statistics on the number of victims of acute pesticide poisoning.

The most authoritative study on the frequency of such poisonings was published nearly thirty years ago, in 1990, by WHO. Pesticides were then believed to cause 3 million severe acute poisonings every year, resulting in some 220,000 deaths worldwide, with intentional poisonings (suicides) representing about two thirds of cases.[14] Approximately 99% of these deaths occurred in LMICs. As many as 25 million agricultural workers were believed to suffer from an episode of pesticide poisoning every year.[15]

These WHO figures are now outdated and, given the increase in pesticide use in LMICs, most likely reflect only a fraction of the real problem of acute poisoning.[16] In a 2016 report on the burden of diseases from environmental risks, WHO estimated that self-poisonings from pesticides alone account for about one third of the world's 800,000 suicides, i.e about 270,000 deaths

Figure 1.1 – **Share of worldwide pesticide use in 2017**



Source: Public Eye estimate, based on official country statistics and industry data[17]

Women hand weeding in cotton fields near Yavatmal, Maharashtra, India. | © Atul Loke/Panos

per year. [18] But no new estimates were provided regarding the number of cases of unintentional poisonings from pesticides.[19]

The Pesticide Action Network (PAN) indicated in a recent report that pesticide poisoning could affect as many as 41 million people each year, and result in 300,000 deaths in the Asia-Pacific region alone.[20] Whatever the exact numbers, it is clear that we are facing a massive problem, particularly in LMICs, where a large proportion of the population continues to be involved in agriculture or live in areas where pesticides are used, and farmers are often unprotected while handling them. In some countries, pesticide poisonings even exceed fatalities from infectious diseases.[21]

Long-term exposure to pesticides can also result in chronic health effects. Accurately estimating the number of such cases is even more challenging as symptoms may develop only years after exposure, diseases are often multi-causal, and people tend to be exposed to multiple harmful substances throughout their lifetime.

WHO estimates that as much as 22% of all diseases and deaths could be attributed to exposure to environmental factors.[22] While WHO does not provide any figures on the respective share of pesticides, experts consider them as one of the principal environmental risk factors for chronic diseases.[23]

According to a scientific review published in 2013 in the Journal of Toxicology and Applied Pharmacology, "there is a huge body of evidence on the relation between exposure to pesticides and elevated rates of chronic diseases, such as different types of cancer, diabetes, neurodegenerative disorders like Parkinson, Alzheimer, and amyotrophic lateral sclerosis (ALS), birth defects and reproductive disorders".[24]

A recent review by the US National Institutes of Health (NIH) also concluded that "the spectrum of suspected pesticide – chronic human disease associations continues to grow".[25] The NIH scientitsts warned that the heavy and mostly uncontrolled use of pesticides in many LMICs may result in "high exposures to large numbers of people and lead to more severe and widespread health effects".[26]

Chronic low-dose exposure to pesticides is considered one of the significant risk factors for increased rates of cancer.[27] A landmark report by the U.S. President's Cancer Panel in 2010 stated that exposure to pesticides "has been linked to brain/central nervous system (CNS), breast, colon, lung, ovarian (female spouses), pancreatic, kidney, testicular, and stomach cancers, as well as Hodgkin and non-Hodgkin lymphoma, multiple myeloma, and soft tissue sarcoma".[28] The report added that farmers have been found to have elevated rates of prostate cancer, melanoma, other skin cancers, and cancer of the lip.

In addition to cancer, pesticides have also been linked to different forms of endocrine-related diseases.[29] A 2012 report by the United Nations Environment Programme (UNEP) and the Food and Agriculture Organization (FAO) blamed the exposure to endocrine-disrupting pesticides and chemicals for the global rise in endocrine-related disorders, such as low semen quality, genital malformations, adverse pregnancy outcomes, neurobe-

Box 1.1

ENDOCRINE-DISRUPTING CHEMICALS

Endocrine-disrupting chemicals (EDCs) are chemicals that mimic, block, or interfere with hormones in the body's endocrine system. Hormones are substances secreted by glands throughout the body. Together, hormones and glands make up the endocrine system. Hormones act as "chemical messengers" that travel in the bloodstream to tissues or organs, and regulate everything from hunger to reproduction, influencing nearly every cell, organ, and metabolic function. Potential consequences of exposure to EDCs include infertility and male and female reproductive dysfunctions, prostate and breast cancer, birth defects, obesity, diabetes, cardiopulmonary disease, neurobehavioral and learning dysfunctions, and immune dysregulation.[31] Endocrine-disrupting chemicals can have effects at extremely low doses.

Box 1.2

CLASSIFICATION OF PESTICIDES ACCORDING TO THEIR HAZARDS

WHO adopted its Recommended Classification of Pesticides by Hazard in 1975. The document classifies pesticide active ingredients in five hazard classes according to their acute risk to health, from category "extremely hazardous" (category 1a), to "highly hazardous" (category 1b), moderately hazardous (category 2), slightly hazardous (category 3), and "unlikely to present acute hazard" (category U).[37] The latest version was published in 2009[38] and lists about 600 active ingredients, 75 of which are classified in categories 1a (extremely hazardous) and 1b (highly hazardous).

In 2002, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) was adopted under the auspices of the United Nations. [39] In addition to acute toxicity, it provides a classification of chemicals according to their chronic health and environmental hazards. The three chronic health hazards considered by the GHS are: mutagenicity – the induction of permanent and transmissible damage to the genetic material (i.e, gene, DNA); carcinogenicity – the ability of a substance to induce cancer or increases its incidence; and reproductive toxicity – adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on development of the offspring. The GHS is an internationally agreed standard that regulatory agencies can use when classifying specific chemicals and communicating about their hazards. The GHS has now been adopted by a large number of countries.[40]

havioral disorders, endocrine-related cancers, obesity and diabetes (see Box 1.1).[30]

Researchers are particularly worried about exposure of children and pregnant women. UNICEF has warned that children face "exceptional risks" at critical stages in their early development when toxic exposure can cause lasting damage.[32] A report published by UNEP in 2017 cautions that prolonged low-level exposure to pesticides may have chronic effects on children, including birth defects, asthma, cancer and neurological alterations.[33] The American Academy of Pediatrics points to increasing epidemiologic evidence that demonstrates a link between early life exposure to pesticides and a range of pediatric cancers, decreased cognitive function and behavioral problems.[34] Studies find that women's exposure to pesticides during pregnancy is associated with a range of negative impacts on their children's IQ and and neurobehavorial development.[35]

Baskut Tuncak, United Nations Special Rapporteur on human rights and toxics, believes the warnings must be taken seriously. "Communities around the world face a health crisis due to pesticides", he said. "Everyone should enjoy the same human rights, regardless of age, gender or where they live. We must act urgently to prevent impacts on those most at risk from exposure to toxic pesticides."[36]

1.2 – REDUCING RISKS BY PHASING OUT THE MOST TOXIC PESTICIDES

When it comes to reducing the risks and public health problems posed by pesticides, it is important to understand that the toxicity of different substances for human beings vary greatly. And some pesticides are associated more with chronic health hazards, accumulating over time, while others are known as having high acute toxicity, with immediate impact.

These distinctions are reflected in internationally accepted classification systems such as the WHO Recommended Classification of Pesticides by Hazard and the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) (see Box 1.2). These international bodies have come to recognize that some pesticides are in a category of their own, presenting an extremely high level of hazard.

According to FAO and WHO, pesticides "that are acknowledged to present particularly high levels of acute or chronic hazards to health or the environment according to internationally accepted classification systems, such as WHO or GHS, or their listing in relevant binding international agreements or conventions" should be considered "highly hazardous pesticides".[41]

The WHO has called exposure to highly hazardous pesticides "a major public health concern", acknowledging that their widespread use has caused health problems and fatalities in many parts of the world.[42]

And it is now widely recognized, including among UN agencies and international public health institutions, that these "highly hazardous pesticides" should be phased out and replaced with safer alternatives in order to reduce risks for human health and the environment. This represents a significant shift from decades of thinking that risks associated with all pesticides can

Syngenta's popular insecticide Engeo Pleno (left), seen at an agricultural aircraft base in Mato Grosso, Brazil. | © Lunaé Parracho

be well managed and reduced to an acceptable level, including through training programmes promoting so-called "safe use". In other words the old risk management approach is now seen as not sufficient when pesticides are intrinsically highly hazardous (see Box 1.3).

Already in 2006, the FAO Council recommended a progressive ban on highly hazardous pesticides.[43] According to the latest FAO Guidance on Pest and Pesticide Management Policy Development[44] the first two steps to limit pesticide risks are (1) to reduce their use as much as possible and (2) to select products with the lowest risks to human health and the environment.[45] Ensuring the proper use of pesticides, for example through training farmers, is only the third step.[46] As emphasized in the FAO Guidance, "such trainings cannot substitute for step 2 concerning the selection of pesticides […] Highly hazardous products should be regulated and, where possible, be substituted with less hazardous products."

Working with WHO, the food and agriculture body released in 2016 a set of specific guidelines for regulators to deal with highly hazardous pesticides (HHPs). The first mitigation option recommended to governments is to end their use.[47] This approach is also supported by the Code of Conduct on Safety and Health in Agriculture of the International Labour Organization.[48]

Importantly the International Code of Conduct on Pesticide Management, which is supposed to provide a framework for government regulators and the private sector on best practice in managing pesticides, clearly states that not only governments but also pesticide manufacturers have a responsibility to remove the most toxic pesticides from the market.[49] Experts consider this the most important step pesticide producers can take to reduce the adverse effects of pesticides.[50]

Phasing out HHPs is not only necessary but also possible, says Jules Pretty, Professor at the University of Essex in the UK: "There are many alternative compounds, as well as many viable agricultural production systems that either use no pesticides at all, or have cut down use with Integrated Pest Management."[51]

Dr. Meriel Watts, Senior Science and Policy Advisor at PAN Asia Pacific, stresses that "global action is required to help

Box 1.3

RISK VS HAZARD

The hazard of a pesticide is determined by its intrinsic toxicological properties. The risk is a function of hazard and exposure, i.e. how much one might be exposed to the chemical. Risk reduction can thus be achieved either by reduction in hazard or reduction in exposure. While for years the focus has been on the latter, it is now widely accepted that a main element of risk reduction involves opting for the less hazardous alternatives.

"I apply poison" – advert of a pesticide dispenser in Sinop, Mato Grosso, Brazil. | © Lunaé Parracho

farmers get off highly hazardous pesticides and to implement agroecology instead".[52] She states that "over time and under pressure from industry, farmers have become so used to using HHPs that even though these pesticides are killing them they can no longer see any other way of growing crops".

In 2015 , over 100 international health experts and toxicologists issued a joint call to stop the use of HHPs in order "to protect our children and the succeeding generations from an impending toxic tragedy".[53] An appeal for a progressive ban of HHPs and their substitution with eco-system-based alternatives has now been signed by 564 civil society organizations from 111 countries.[54]

As UN Special Rapporteur Baskut Tuncak emphasizes: "This is a global problem, clearly implicating transnational supply chains of both pesticides and agricultural commodities. Therefore, it cannot be solved by bilateral or regional action alone; global action is required. Governments need to move the issue of HHPs to one of a treaty, to force companies to make good on long-standing promises to phase out HHPs."[55]

Proposals for a global mechanism to phase out HHPs were made by the African Group, with the support of many delegates from the Arab region and Latin America, during discussions on the Strategic Approach for International Chemical Management (SAICM) at the 2012 and 2015 meetings of the International Conference on Chemical Management (ICCM). However no decisions could be taken because of strong opposition from countries with a significant presence of pesticide manufacturers, primarily the United States and the EU.[56]

In 2017, UN human rights experts recommended that "the international community must work on a comprehensive, binding treaty to regulate hazardous pesticides throughout their life cycle, taking into account human rights principles".[57] PAN International supported this call and submitted a detailed proposal to the SAICM secretariat in January 2018. The issue is likely to come up again at the next ICCM meeting in 2020. "The time has come for a global, legally binding treaty on highly hazardous pesticides" says Meriel Watts.[58]

Box 1.4

WEAK INTERNATIONAL REGULATION

The overall global governance of pesticides remains weak and inadequate. It relies mainly on the International Code of Conduct on Pesticide Management, which is powerless to take action or implement programmes.[59] The Code is constantly violated by the pesticide industry, with no repercussions.[60] Another non-binding instrument is the Strategic Approach for International Chemical Management (SAICM).[61] SAICM was created in 2006 during the first International Conference on Chemicals Management (ICCM). While its Global Plan of Action included "promoting alternatives to reduce and phase out highly toxic pesticides",[62] SAICM has failed to develop any concrete programme or action in this regard.[63]

The only binding international conventions dealing with pesticides are very specific and do not provide a comprehensive approach to all pesticides. The Stockholm Convention on Persistent Organic Pollutants aims to eliminate the production and use of certain pesticides defined as persistent organic pollutants (POPs)[64] but only a handful of currently used pesticides are eligible for listing.[65] And industry lobbying has managed to water down the Convention by integrating a large number of exemptions. The other important instrument is the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.[66] However, as its name suggests, it does not ban the production, use of or trade in hazardous pesticides: instead, it establishes a prior informed consent procedure that allows countries to control the import of listed substances. And the vast majority of pesticides currently in use are not covered by this convention.[67]

For now, the global governance of pesticides remains weak and inadequate (see Box 1.4). And countries are left to their own devices, with little or no support to phase out highly hazardous pesticides and replace them with safer alternatives. Even worse, while there is growing recognition that highly hazardous pesticides must be phased out, there is still no consensus on what substances should fall under that definition.

1.3 – HIGHLY HAZARDOUS PESTICIDES – A CONTESTED DEFINITION

In 2006, FAO and WHO held a joint meeting of experts and adopted criteria to identify highly hazardous pesticides.[68] They were defined as pesticides having one or more of the following characteristics: being included in WHO categories 1a (extremely hazardous) or 1b (highly hazardous) of acute toxicity; meeting the criteria of carcinogenicity, mutagenicity or reproductive toxicity of the GHS categories 1a (known) or 1b (presumed); being listed in the Montreal, Rotterdam or Stockholm Conventions; or having shown "a high incidence of severe or irreversible adverse effects on human health or the environment".

The meeting ended by recommending that, as a first step – and a priority for risk reduction – FAO and WHO establish a list of HHPs and update it periodically in collaboration with UNEP. The expert meeting also recommended that "FAO, in collaboration with WHO, invite governments and the pesticide industry to develop plans of action for progressively phasing out HHPs".[69] However, more than ten years have passed and FAO and WHO have failed to even start developing a list of pesticides that should be considered "highly hazardous".

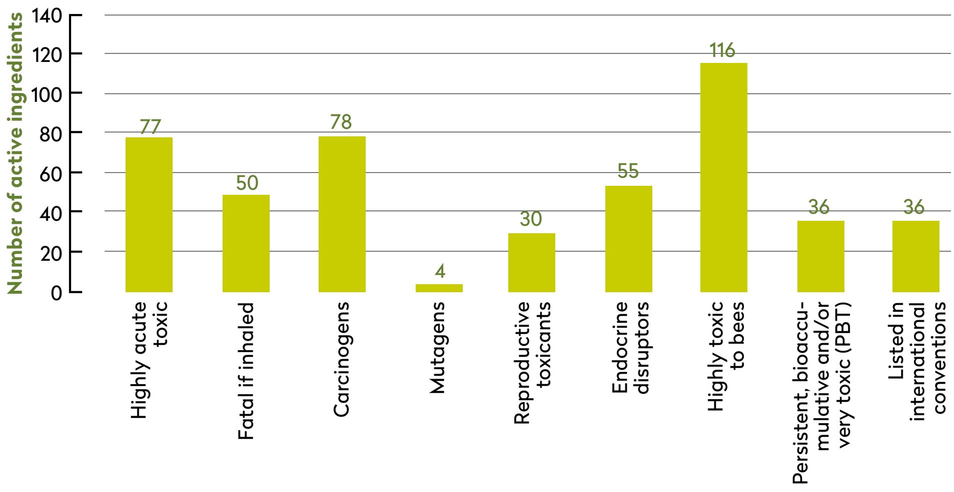
To fill this gap, the Pesticide Action Network (PAN) has developed its own list, using the criteria developed by FAO and WHO while remediating some of their main shortcomings (see Box 1.5).

Box 1.5

CRITERIA USED BY PAN TO ESTABLISH ITS LIST OF THE "HIGHLY HAZARDOUS PESTICIDES"

PAN used the criteria developed by FAO and WHO, but addressed some of their main shortcomings. In terms of acute toxicity, PAN added to the WHO categories 1a and 1b all pesticides listed as "fatal if inhaled" (H330) under the GHS by the European Union (EU). The reason is that the WHO classification does not take into account inhalation toxicity even though exposure via inhalation is very frequent, especially in LMICs – and the oral acute toxicity to rats used by WHO presents in some cases a gross underestimation of the real risk for humans.[70] In terms of chronic health hazards, PAN included all pesticides classified as carcinogens, mutagens or reproductive toxicants in categories 1a and 1b by the EU, the US Environmental Protection Agency (USEPA) or the International Agency for Research on Cancer (IARC). PAN added all pesticides classified as endocrine disruptors by the EU because there is now consensus that endocrine-disrupting chemicals are a major public health concern.[71] Regarding environmental hazards, in addition to pesticides listed in relevant international conventions, PAN added all pesticides considered by the USEPA as "highly toxic to bees", as well as pesticides that are highly persistent, bioaccumulative and/or very toxic to aquatic organisms, according to the tresholds of the Stockholm Convention.

Figure 1.2 – **Number of pesticide active ingredients in each hazard category included in the PAN list of highly hazardous pesticides (HHP)**



Source: PAN 2019 list of HHPs.
Please note: the total exceeds 310 because many active ingredients meet several hazard criteria.

PAN did this by reviewing the official classification of about 1,000 pesticide active ingredients currently on the market. Its first list of highly hazardous pesticides was published in 2009 and last updated in 2019 (see Annex 3). It includes 310 pesticide active ingredients, which is approximately 30% of pesticides currently in use worldwide (see Figure 1.2, page 13).

About one third of all pesticides currently in use worldwide are classified as "highly hazardous" by PAN.

PAN emphasises that the fact a pesticide is not listed does not mean it should be considered safe for use. One reason is that many products have not been evaluated and classified for all their potential hazards. It also takes time to collate evidence of adverse effects and to have such evidence recognized. The list nevertheless provides "a basis for action to implement the progressive ban on highly hazardous pesticides and replace them with safer, agro-ecological and other appropriate non-chemical alternatives".[72]

The efforts made by PAN to develop a list of highly hazardous pesticides represent a first crucial step toward reducing pesticide risks. The next necessary step would be to gain more transparency about the extent of HHP use, the countries where large number of peoples are potentially exposed and the companies marketing the products. As for now, there is very little information publicly available in that regard.

Neither FAO nor WHO provide any information on the sale and use of highly hazardous pesticides worldwide. FAO publishes only very general statistics about pesticide use and nothing on specific substances.[73] Even that information is unreliable because of poor and inconsistent country reporting.[74] Countries tend to publish only general figures about pesticide use on their territory[75] while companies retain information about their specific share in specific markets as confidential business information.

This is why Public Eye decided to investigate the opaque world of highly hazardous pesticides and try to shed some light on the role of one of the major players in the industry, Swiss-based Syngenta.

Lid of a Syngenta pesticide bottle in Mato Grosso, Brazil. | © Lunaé Parracho

2
Syngenta – Making profits with highly hazardous pesticides

Although most highly hazardous pesticides are banned in Switzerland and the European Union but, agro-giant Syngenta continues selling them in LMICs.

2.1 – A MULTIBILLION DOLLAR MARKET

In order to assess the extent of use of highly hazardous pesticides worldwide, Public Eye purchased data on pesticide sales from Phillips McDougall, a private market research firm that presents itself as "the market leader in providing business intelligence for the crop protection & seeds industry".[76] The Phillips McDougall data, considered among the most comprehensive available on pesticide sales and uses, provided a revealing glimpse into the primary users of highly hazardous pesticides, and from whom they are obtained.[77]

Phillips McDougall's data[78] is one of the main sources used by the US EPA to produce its pesticide market estimates, and the company also regularly undertakes consultancies for the agrochemical industry itself.[79] The Phillips McDougall data is sourced from "panel data market research, farmers, trade data, country data and distributor surveys as well as proprietary, in-house databases and company results".[80]

We analysed the data using the 2019 PAN International list of highly hazardous pesticides (HHP).[81] Firstly because this is the only consolidated and credible list available. Secondly, we fully support PAN's approach of both using the FAO and WHO criteria while at the same time considering those critical hazards that were left uncovered – endocrine disruption, inhalation toxicity and environmental hazards.

The pesticides listed by PAN as "highly hazardous" represent about 30% of the 1,000 pesticide active ingredients available worldwide. Their actual share, based on sales – and not just availability – of global pesticides is considerably higher.

Based on our analysis of the Phillips McDougall data, we estimate that the combined sales of all 310 pesticides included in the PAN list represent approximately 40% of the USD 54.2 billion global market, i.e. about USD 22 billion in sales in 2017. In terms of volume, we estimate the share of HHPs in worldwide pesticide use at around 60%, i.e. about 1.8 million tonnes in 2017.

Twelve of the 20 most widely sold pesticides are on PAN's list of the highly hazardous. Altogether, those "top 12" highly hazardous pesticides account for USD 13.6 billion in sales and 1.12 million tonnes in volumes in 2017. This represents over 60% of worldwide HHP use and sales (see Figure 2.1).

The most widely used pesticide overall is also on the PAN list of HHPs – glyphosate, which is a herbicide (it kills weeds). Glyphosate sales reached USD 5.1 billion in 2017, which is approximately 10% of the entire global pesticide market. PAN included glyphosate in its list following its classification by IARC as probably carcinogen to humans in 2015. The EU and the USEPA have reached a counter-conclusion that glyphosate is unlikely to pose a carcinogenic hazard.[82] That was followed by allegations over the unprecedented influence exerted by the industry on those risk assessments.[83]

But even without glyphosate, the use and sales of highly hazardous pesticides remain extremely high and represented about USD 17 billion in sales and one million tonnes in volume in 2017. This is around one third of the global pesticide market.

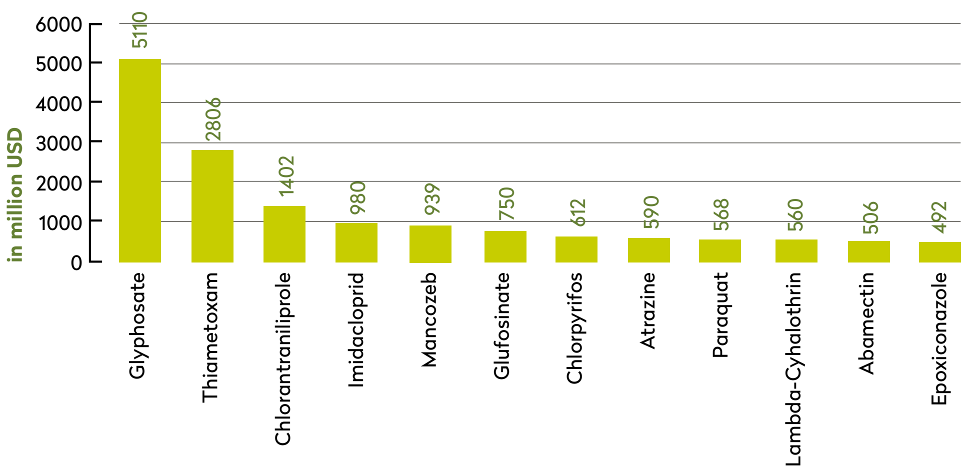
2.2 – LOWER INCOMES, HIGHER TOXICITIES

About three quarters of the pesticides classified by PAN as highly hazardous are not authorized for use in Switzerland or the European Union.[84] This is partly the result of the adoption of new and stricter regulations during the last two decades. The EU's 1991 Directive on the Placing of Plant Protection Products on the Market set higher standards and required companies to re-register their products.[85] As a result, 60% of all pesticide active ingredients previously authorized for use in the EU were taken off the market.[86]

The new legislation that came into force in 2009 in the EU takes for the first time into account the intrinsic hazards of pesticides.[87] According to the so-called hazard-based "cut-off" criteria, pesticide active substances that have been classified as carcinogenic, mutagenic, toxic to reproduction or endocrine disrupting are not authorized in the EU.[88] The idea behind is that some hazards are so severe that the risks associated with them should not be taken, whatever the level of exposure.

In Switzerland over 130 pesticide active substances have been withdrawn from the market since 2005 due to new and

Figure 2.1 – **Top 12 highly hazardous pesticides (HHP) by value of sales in 2017**



Source: Phillips McDougall

stricter regulations.[89] The Swiss legislation now also incorporates hazard-based "cut-off" criteria, similar to those in the EU.[90]

While the EU share of worldwide pesticide use is at 13%,[91] our analysis of the Phillips McDougall data suggests that its share of HHP use is much lower – at 5%, or about 90,000 tonnes of highly hazardous pesticides per year. Accordingly, HHPs account for about 23% of all pesticides used in the EU in terms of volumes. There is no specific data for Switzerland but the figure is likely to be similar (see Box 2.1).

The situation is completely different in low- and middle-income countries (LMICs), where standards are generally weaker and enforced less strictly. Our analysis of the Phillips McDougall data suggests that LMICs constitute 60% of the global market in HHP sales, some USD 13.2 billion in 2017. In terms of volume, our analysis indicates that LMICs account for about 70% of worldwide HHP use, i.e. over 1.2 million tonnes in 2017.[92]

Peter Clausing explains this massive use of highly hazardous pesticides in LMICs as the result of two main components. "One is that innovation by the pesticide industry is stagnating, the other is that growth is the basic ingredient of a capitalist economy. As many HHPs have been banned in the EU and also in the US, the easiest way to grow is to expand markets into new geographic areas with weak legislations."[93]

Our analysis of the Phillips McDougall data suggests that Brazil, China and Argentina alone account for over half of HHP use in LMICs. Those are also the countries with the largest agricultural area. But HHP use is extremely high in most LMICs.[94]

In countries such as Uruguay, Brazil or Colombia HHP use per hectare of arable land is 7–10 times higher than in the EU[95] (see Figure 2.2). The HHP share of all pesticides applied within a specific country is also generally much higher in LMICs than in the EU (see Figure 2.2). In several LMICs such as Paraguay, Brazil or Uruguay, HHPs represent over 80% of volumes applied.[96]

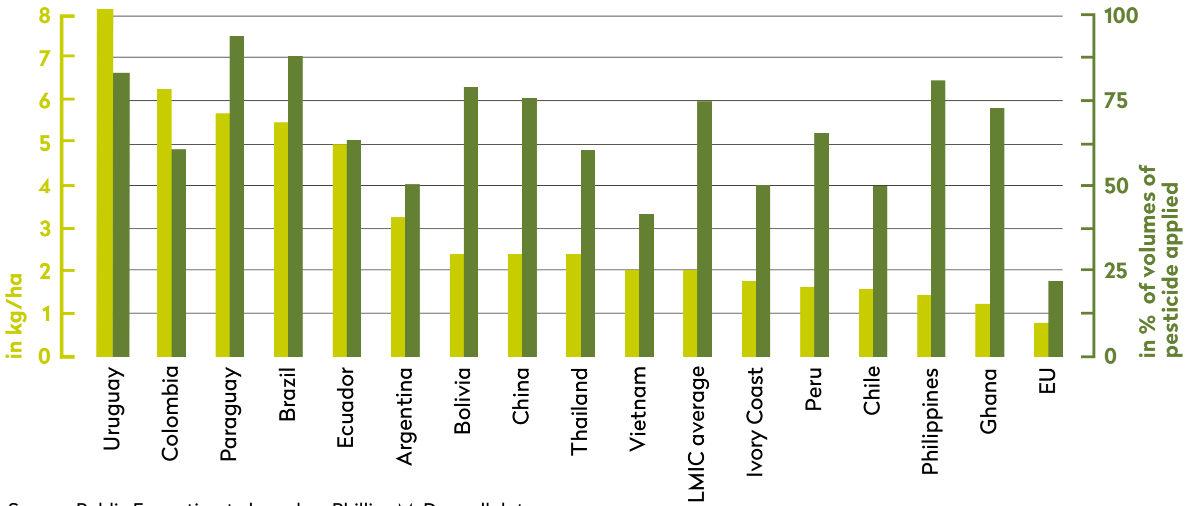
Box 2.1

TOXIC LEFTOVERS

Despite the stricter regulations, there is still a worrying number of highly hazardous pesticides authorized for use in Switzerland and the EU. Sixty-eight pesticides listed by PAN as "highly hazardous" are still authorized in Switzerland and even 100 in the EU. In terms of acute toxicity, twelve pesticides that fall into the WHO class 1a (extremely hazardous) or WHO class 1b (highly hazardous) are still authorized in the EU[97] (two of them are also authorized in Switzerland).[98] In terms of chronic health hazards, there are two pesticides (glyphosate and malathion) classified as "probably carcinogenic to humans" by IARC that are still registered in the EU, and one (glyphosate) is also authorized in Switzerland. In addition, 29 pesticides classified as "likely human carcinogen" by the US EPA (this is the equivalent of category 1B in the GHS and the EU) are authorized in the EU, and 21 are registered in Switzerland.[99] Furthermore, one pesticide classified by the EU as "mutagenic",[100] 14 pesticides it classifies as "reproductive toxicants",[101] and 16 it identifies as "endocrine disruptors"[102] are still allowed in the EU and/or Switzerland. Our research shows that a total of 39 substances classified as carcinogens, reproductive toxicants, mutagens or endocrine disruptors are authorized in Switzerland while they should in principle fall under the hazard-based cut-off criteria.

We showed this data to UN Special Rapporteur Baskut Tuncak. His reaction was unequivocal: "This massive use of highly-

Figure 2.2 – **Highly hazardous pesticides (HHP) use in selected LMICs**



Source: Public Eye estimate based on Phillips McDougall data hazardous pesticides in LMICs is tragically a case of exploitation, a false narrative of development that is a far cry from anything sustainable", he wrote. [103] Dr. Peter Clausing agrees: "These figures are highly alarming", he said. "Highly hazardous pesticides by themselves are particularly dangerous but this is potentiated by marketing them in regions with insufficient protection of farm workers and of the general population." [104]

2.3 – SYNGENTA'S HIGHLY HAZARDOUS GROWTH MARKET

Agrochemical giants like Syngenta, Bayer CropScience, BASF or DowDupont would like us to believe they are responsible companies. CropLife, their international lobby organization, claims that its members are innovating to replace highly hazardous pesticides with newer, less toxic products.[105] CropLife says it shares "a common goal with the FAO, WHO and UN Environment Programme to promote safe, effective and responsible pesticide use around the world".[106] In relation to highly hazardous pesticides (HHPs), Crop Life writes that "the majority of HHPs in the developing world are produced and sold by companies that are not CropLife International members".[107] However, our analysis of the Phillips McDougall data clearly contradicts these statements. We estimate that Crop Life members are responsible for about 60% of sales of pesticides listed by PAN as "extremely hazardous".[108]

We decided to have a closer look at Syngenta's role in the industry of highly hazardous pesticides. As a Swiss corporate watchdog, we focus on Swiss-based companies. The choice to focus on Syngenta is not an arbitrary one, however. Syngenta was the main seller of pesticide worldwide in 2017, reporting USD 9.244 billion in sales, a 17% share of the global market.[109]

The company publicly claims: "Sustainability has always been at the core of our business model, impacting the way we do business on a day-to-day basis." [110] We asked Syngenta how this translates to highly hazardous pesticides. The company responded: "We accept our responsibility to develop safe and sustainable products and steward them carefully." [111] Syngenta also wrote that it had even gone "beyond regulatory requirements" and conducted an individual portfolio review. "We have assessed all of our formulations sold in the market and have made appropriate risk mitigation decisions on the use or sale of any identified highly hazardous pesticide." [112]

The company explained that it follows "stringent product development criteria and while thousands of chemicals are analyzed, those with potential negative side effects are screened out from the very beginning." And it added: "We invest more than USD 1.3 billion in product research and development each year. These investments result in new product introductions (chemical and non-chemical) that are most often lower risk alternatives to existing products."

Our research shows a different picture. We started by identifying all the pesticide active ingredients sold by Syngenta by consulting pesticide registration databases and Syngenta national websites all over the world. Altogether Syngenta produces and/or sells over 120 pesticide active ingredients. Fourty-two are on the PAN list of highly hazardous pesticides (see Annex 2).

SYNGENTA'S TOXIC BLOCKBUSTERS

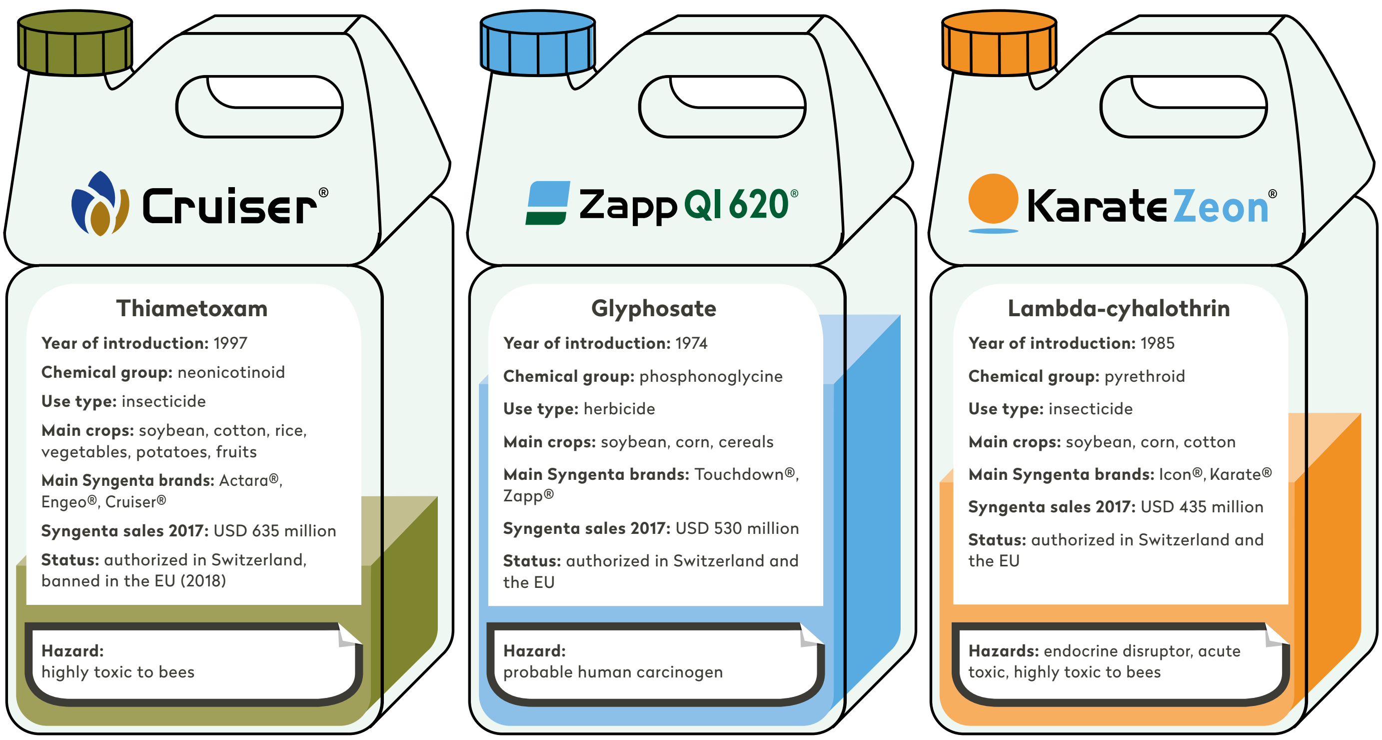
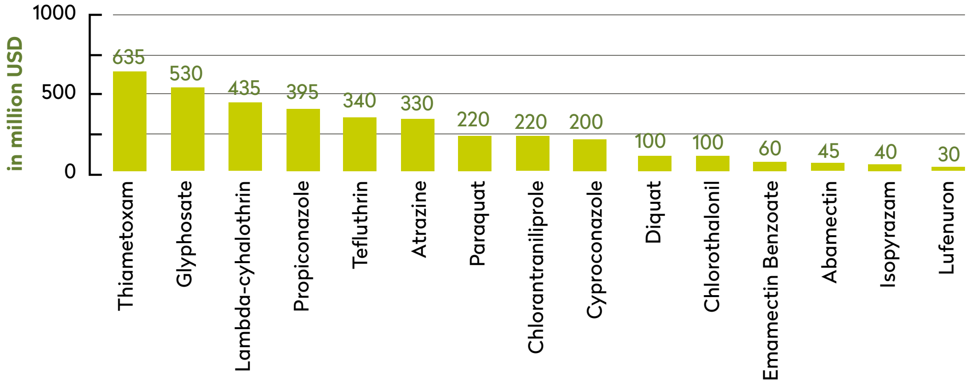


Figure 2.4 – **Syngenta 2017 sales of HHPs used in "key marketed products"**



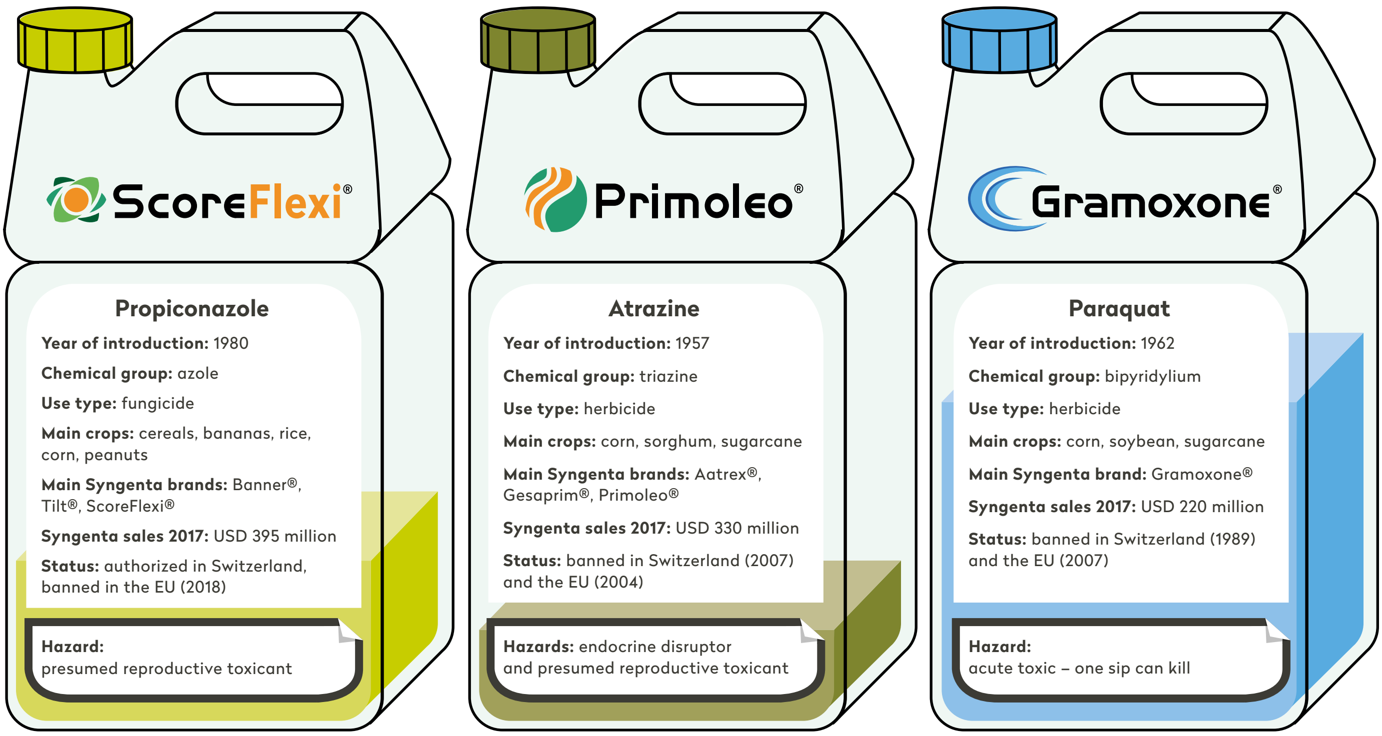
Source: Public Eye estimate, based on Phillips McDougall data

The proportion is even higher when one looks at its most widely sold pesticides: 15 of the 32 pesticide active substances Syngenta uses in its "key marketed products" are listed as "highly hazardous" by PAN.[113] Among the Syngenta bestsellers: three substances considered likely human carcinogens by the USEPA or IARC;[114] two substances classified as presumed reproductive toxicants by the EU;[115] three substances considered endocrine disruptors by the EU;[116] and six that make it in WHO category 1A (highly hazardous) of acute toxicity or are classified as "fatal if inhaled" by the EU.[117]

Selling highly hazardous pesticides seems to be a central part of Syngenta's business model. According to our estimate based on the Phillips McDougall data, the pesticides listed by PAN as "highly hazardous" accounted for over 40% of the company's pesticide sales in 2017.[118] This suggests that Syngenta made some USD 3.9 billion by selling "PAN-HHPs" in 2017 (see Figure 2.4). In terms of volumes, this would represent about 400,000 tonnes of "PAN-HHPs" sold by Syngenta in 2017.

According to this estimate, Syngenta has a share of approximately 18% in the global HHP market by value of sales and 22% by volume.

Contrary to its claim of providing "world class science and innovative crop solutions",[119] Syngenta has developed only eight new active ingredients since 2000. Toxic "blockbusters" such as



atrazine, paraquat, glyphosate or lambda-cyhalothrin have been on the market for 30 to 60 years.

Overall, our database analysis suggests that about two thirds of Syngenta sales of "PAN HHPs" take place in LMICs. According to our estimate, Brazil alone accounts for about one third of the company's global HHP sales. Other main LMIC markets include Argentina, China, Paraguay, Mexico, India, Vietnam, Philippines, Ecuador, Colombia, Kenya and Ghana.[120]

In the view of Meriel Watts, "those massive sales of highly hazardous pesticides by Syngenta are completely incompatible with sustainable agriculture, with environmental integrity, and with human rights. Any company, or country, that wants to claim the moral high-ground must abandon highly hazardous pesticides."[121]

Confronted with our findings, Syngenta responded that it does "not agree with the list that PAN has developed". Furthermore Syngenta indicated it supports "regulating crop protection products based on risk, not hazard".[122] Syngenta illustrated its argument with the example that "everyday chemicals like caffeine, gasoline (benzene), alcohol (ethanol), ibuprofen, and table salt can be hazardous at high doses, but normal uses are considered safe. The same is true of pesticides."[123] "The crucial point is their risk versus benefits under recommended use conditions", Syngenta wrote. And the company indicated it "is committed to ensuring that such risk is appropriately addressed and minimized", emphasizing that since 2014 it has trained more than 25 million people in the "safe use and handling" of its products.

"This sounds like a hoax", says Peter Clausing.[124] "I can imagine that they mention safe working practices during their sales campaigns. But I believe that this rarely results in safer working practice." This is precisely the reason why FAO emphasizes that trainings are only the third step in risk reduction and cannot substitute for the use of less toxic alternatives. As indicated in its 2010 Guidance: "The impact of training in proper pesticide use continues to be questioned and cannot be regarded as a solution for risks associated with the use of highly hazardous products, particularly in developing countries where large numbers of small-scale farmers would have access to these products".[125]

Selling highly hazardous pesticides seems to be at the core of Syngenta's business model.

And while table salt, ibuprofen and coffee are still widely available, our research shows that 51 of the 120 pesticide active ingredients in Syngenta's portfolio are not authorized for use in its home country, Switzerland.[126] Confronted with this fact, Syngenta expresses its disappointment that "the choice [for farmers] is narrowing due to an increasing politicization of the pesticide registration process". [127] The company also denies that these substances have actually been banned and explains that "it is very common for a specific product to be registered in one country but not in another." However, this is clearly not the case for at least sixteen of its pesticides which have been explicitly banned "owing to their effects on human health or on the environment".[128]

Syngenta also claims to "comply with all of the regulatory and safety standards of the countries where [its] products are registered for sale". But the UN Guiding Principles on Business and Human Rights, unanimously adopted by the UN Human Rights Council in 2011 as a "global standard of expected conduct for all business enterprises wherever they operate", leave no doubt that the corporate responsibility to respect human rights "exists over and above compliance with national laws and regulations".[129] This also applies to FAO and WHO guidances on pesticide risk reduction.

In the view of Fernando Bejarano from PAN Mexico (RAPAM): "Companies such as Syngenta have chosen to promote profit over people and take advantage of weaker regulations in lower income countries to increase their sales. Yet we are paying the price, in terms of health and environmental impacts."[130]

In some cases, Syngenta produces its pesticide active ingredients in countries in which their use is banned, and exports them abroad. For example, a Public Eye investigation revealed that in 2017 Syngenta exported 125 tonnes of diafenthiuron from Switzerland to LMICs, a substance banned in Switzerland since 2009. Seventy-five tonnes went to India, where it has been implicated in a wave of poisonings.[131] Another Public Eye research showed that Syngenta exports annually an average of 41,000 tonnes of paraquat from the United Kingdom, where its use has been banned since 2007.[132]

This practice of Switzerland and other high income countries of allowing the export of toxins known to cause major health damage or fatality – and banned for that reason – has been deemed a "clear human rights violation" by UN human rights experts.[133] "A pesticide banned in Switzerland or Europe because it is too toxic is still too toxic for use in other countries", says Meriel Watts. "One of the very first steps in cleaning up the morass of problems in international pesticide management should be the banning of double standards in pesticide manufacture and export."[134]

"People living in high-income countries should be concerned, and ought not be complicit in this exploitation of those more vulnerable", writes UN Special Rapporteur Baskut Tuncak. "High income countries have and continue to externalize the impacts of their own consumption and production on LMICs, such as by unethically exporting pesticides they have forbidden from use in their territory to countries with weaker regulatory systems and limited monitoring capacity. And then, in many cases, high-income countries are importing back agricultural commodities and other products produced with these pesticides. This is an unethical practice, which I would imagine most consumers would not support, if they were made aware."[135]

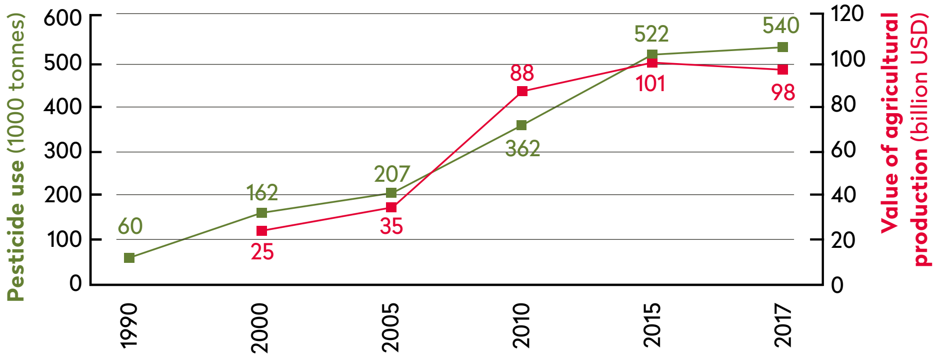
In order to better understand the consequences for people living in low- and middle-income countries, we decided to investigate in Brazil, the country with the highest use of toxic pesticides worldwide – and Syngenta's biggest market.

3
Brazil's pesticide problem

"Our biggest problem was the strong opposition from the pesticide industry. They first tried to disqualify our technical staff, then implemented political pressure through congress and finally filed lawsuits."

Luis Claudio Meirelles, former director of the toxicological department of the Brazilian Health Regulatory Agency

Figure 3.1 – **Total value of agricultural production and pesticide use in volumes in Brazil, 1990–2017**



Source: Public Eye estimate based on IBAMA 2019, Porto and Soares 2011, IBGE 2019[136]

3.1 – THE WORLD'S LARGEST MARKET FOR TOXIC PESTICIDES

Over the last two decades, Brazil has become an agricultural superpower. The country switched from being a net agricultural and food importer in the 1980s,[137] to the world's second largest global supplier of food and agricultural products.[138] Brazil is now the world's leading exporter of soybean, beef, chicken, orange juice, coffee, sugarcane, ethanol and tobacco. Agriculture, food and related industries represent about 25% of the country's total GDP and about half of its exports.[139]

> About 370,000 tonnes of highly hazardous pesticides were applied in the country in 2017.

The value of agricultural production has almost tripled in twenty years, and the total crop area has expanded by 64%, covering 78 million hectares in 2017.[140] This impressive growth has mainly been driven by massive public investment in agricultural research, government promotion of agricultural exports and trade liberalisation, as well as favourable agricultural credit policies, including massive tax exemptions for pesticides and fertilizers.[141]

Three crops – soybean, sugarcane and corn – take up 70% of the agricultural area[142] and represent over 60% of the country's total value of agricultural production.[143] Since 1997, soybean production alone has increased by 400% to reach a record 114 million tonnes in 2017.[144] During the same period, corn production almost tripled and sugarcane production more than doubled.[145] Most of this produce is used for animal feed, biofuels or industrial purposes.

Parallel to this massive expansion in large scale crop monocultures, pesticide use in Brazil has skyrocketed (see Figure 3.1). In 1990, Brazil accounted for only 3% of global volumes.[146] Today, pesticide use is nine times higher[147] and Brazil is considered the largest user worldwide, accounting for about 18% of global use.[148] Pesticide sales were estimated at USD 8.9 billion in 2017, about 16% of the global market.[149]

The bulk of pesticides in Brazil are used on soybean, corn and sugarcane. In 2017, pesticides applied on soybean accounted for 52% of pesticide sales in the country. Pesticides for sugarcane were second with 12% of the sales, followed by corn (10%), cotton (7%) and coffee (3%).[150] While these crops are mainly produced in the south, southeast and central west of the country, industrial fruit production in the northeast and other parts of Brazil also consumes large amounts of pesticides.

A significant part of the pesticides applied in Brazil are "highly hazardous". About 30% of registered pesticides are not authorized in Switzerland and the European Union,[151] and 153 of the 528 active ingredients authorized for use in Brazil are on the PAN list of highly hazardous pesticides.[152] The proportion of HHPs is even higher for the most widely used pesticides in the country: seven of the "top 10" pesticides are on the PAN list of HHPs.[153] Among them, three are classified as likely carcinogens by the USEPA or IARC, two are classified as endocrine disrupters by the EU, and one substance is classified as a presumed reproductive toxicant by the EU.

In terms of volume, our analysis of the official statistics published by the Ministry of Environment (IBAMA) shows that in 2017 about 370,000 tonnes of HHPs were used in the country,[154] which was approximatively 20% of global HHP use that year. This makes Brazil the number one user of HHPs worldwide. And it represents some 4.6 kg of highly hazardous pesticides per hectare of arable land being applied in the country – about six time higher than in the EU.[155]

Considering this massive use of HHPs, it is surprising that Brazil's pesticide legislation includes hazard-based "cut-off" criteria, similar to those in Switzerland and the EU. Accordingly, pesticides classified as carcinogens, reproductive toxicants, mutagens or endocrine disruptors should not be authorized.[156] However our research shows that 77 substances authorized for use in the country have been classified in one of those hazard categories by either the USEPA, the EU or IARC.

The problem is that the regulation has critical flaws. A main issue is that pesticides are not automatically and regularly re-evaluated, as is the case in the EU or Switzerland. Official government agencies can decide to re-evaluate pesticides if there are new findings in one of the hazard-based "cut-off" criteria. But when the Brazilian Health Regulatory Agency (ANVISA), the responsible entity from the Ministry of Health, attempted to re-evaluate several pesticides in 2008, it faced major difficulties. "Our biggest problem was the strong opposition from the pesticide industry", recalls Luis Claudio Meirelles, director of the toxicological department at the time. "They first tried to disqualify our technical staff, then implemented political pressure through congress and finally filed lawsuits."[157]

ANVISA nevertheless succeeded in re-evaluating 15 pesticide active ingredients, which resulted in a ban on 11 – including Syngenta's paraquat which should enter into force in 2020[158] – and restrictions on the use of four; three re-evaluations are still pending.[159] Since Meirelles left ANVISA in 2012 the agency has not initiated any further pesticide re-evaluations. As a consequence, many pesticides remain on the market "even if they have been found to be intrinsically hazardous for human health and other countries have banned them", Marcia Sarpa de Campos Mello from the National Cancer Institute of Brazil (INCA) explains. Atrazine, for example, was approved decades ago and has never been re-evaluated.[160]

Dr. Wanderlei Pignati, a professor at the Federal University of Mato Grosso and leading pesticide expert in Brazil, says: "Who are the ones to enforce the law? Most of the ministries in Brazil and most of the State governors have strong ties to agribusiness, including producers and sellers of commodities, the pesticide and fertilizer industry. They have no interest in regulating their own sectors."[163]

And it might even get worse (see Box 3.1). A controversial bill dubbed the "poison package" is currently being promoted by the so-called *bancada ruralista* (a parliamentary group representing the interests of the agro-industry) in Parliament, which would remove the hazard-based approach altogether and make the Ministry of Agriculture responsible for approving new substances, removing the Health and Environment Ministries from decision-making.[164]

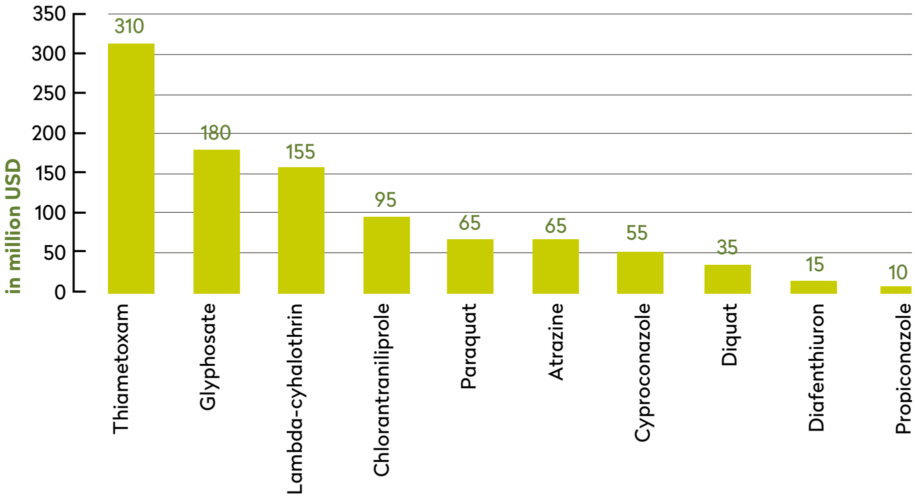
Box 3.1

AGRIBUSINESS IN POWER

As agribusiness has become the mainstay of the Brazilian economy, the political power of the rural land-owning class has grown. The *bancada ruralista* has controlled up to half of Brazil's congress in recent years.[161] With the newly elected President Jair Bolsonaro, the power of agribusiness is reaching unprecedented levels. His new agriculture minister, Tereza Cristina Dias, was the head of the farming lobby and was nicknamed the "Muse of Poison" due to her leadership in pushing for weaker controls on pesticides.[162]

The office of a distributor of Syngenta products in Sinop, Mato Grosso, Brazil. | © Lunaé Parracho

Figure 3.2 – **Syngenta sales of HHPs in Brazil in 2017 (top 10)**



Source: Public Eye estimate based on Phillips McDougall data

One company seems to benefit enormously from this situation – Swiss-based Syngenta. According to data from the National Plant Protection Association (Sindiveg), Syngenta is the leading agrochemical company in Brazil, with sales reaching nearly USD 1.6 billion in 2017 in the country, an 18% share of the market.[165] Accordingly, Brazil accounted for 17% of the company's global pesticide sales in 2017.[166]

While Syngenta claims that it contributes to the sustainability of Brazil's agriculture and to feeding a growing population while respecting the environment and all people involved,[167] the company has played a central role in promoting the "poison package" and weakening the health and environmental safeguards in the regulations.[168]

Syngenta's economic interest in weak regulations is obvious. Our research on Syngenta's website in Brazil shows that the company sells in Brazil 141 different pesticide formulations based on 45 pesticide active substances.[169] Twenty-one of the active substances are listed as "highly hazardous" by PAN. Of these, six are classified as likely carcinogenic by the USEPA or IARC,[170] three as endocrine disruptors by the EU,[171] two as presumed reproductive toxicants by the EU,[172] and five as "fatal if inhaled" by the EU.[173]

Our analysis of Phillips McDougall data suggests that the sales of pesticides listed by PAN as "highly hazardous" represented about 60% of Syngenta pesticide sales in the country in 2017, i.e. approximately USD 1 billion (see Figure 3.2). In terms of volume, we estimate that Syngenta was responsible for a quarter of all "PAN HHPs" sold in the country in 2017, i.e. about 100,000 tonnes.

Nine of the 21 pesticides listed by PAN as "highly hazardous" that Syngenta sells in Brazil have been banned for use in Switzerland and/or the EU for health or environmental reasons.[174] Confronted with these findings, Syngenta claims that the regulatory system of pesticides in Brazil is "one of the most rigorous in the world" and that "all products developed by Syngenta for the Brazilian market are subject to an extremely rigorous assessment and regulation process".

According to the company, "the demand for a certain product varies according to the type of pest, crop and climatic conditions, thus influencing the market".[175]

Public health specialists in Brazil reject that argument. "So what if the needs of crops or soils in Brazil are different?" said Victor Pelaez, a food engineer and economist at the Federal University of Paraná, to Reuters in 2015. "What's toxic in one place is toxic everywhere, including Brazil."[176] Wanderlei Pignati is outraged at this practice of multinational companies like Syngenta taking advantage of those double standards. "I would classify it as an international crime", he said.[177] Ada Cristina Pontes Aguiar, medical doctor and researcher at the Federal Univerity of Ceará, agrees: "If a certain active ingredient is banned in its home country, Switzerland, Syngenta should not be allowed to sell it in Brazil or anywhere else around the world. It is unacceptable that Syngenta makes millions of dollars at the expense of people's suffering in Brazil."[178]

3.2 – DIVING INTO BRAZIL'S CONTAMINATED DRINKING WATER

"There is probably not a single citizen in this country without a certain level of pesticide exposure", says Ada Cristina Pontes Aguiar.[179] Farmers and agricultural workers suffer the highest level of exposure when mixing or spraying pesticides, or working in fields immediately after application. But other people living in rural areas also face toxic exposure through the drift of pesticides applied on fields close to their homes, schools, and workplaces.

According to the Ministry of Health, 26,788 people were poisoned by agricultural pesticides between 2007 and 2017. There were 4,003 cases in 2017 alone[180] – 11 cases of acute pesticide poisoning a day. However, the Ministry of Health itself acknowledges that under-reporting of pesticide poisoning is of concern.[181] Experts in Brazil estimate that for each notified case there are fifty unrecorded cases.[182]

The whole population is exposed to residues of highly hazardous pesticides through the food they eat every day. The official monitoring programme run by ANVISA found pesticide residues in 70% of the 12,000 food samples tested between 2013 and 2015. Twenty percent of the samples showed pesticide residues that either exceeded permitted levels or contained unauthorized pesticides.[183]

Another major potential source of exposure of the whole population is drinking water. The chances that the drinking water is contaminated are high given the massive amounts of pesticides used in the country. And it is a major issue because access to safe water is a fundamental human need and millions of Brazilians rely on it on a daily basis. Yet little is known about the presence of pesticides in the drinking water. So we decided to dive into it and try to find out.

Through a freedom of information request we accessed data from the Brazilian national drinking water monitoring programme (Vigiagua) for 2014–2017.[184] By law, drinking water suppliers in Brazil are responsible for testing 27 pesticides every six months in the systems they manage and reporting the results to the federal government.[185] All the test results are then compiled in a database called Sisagua.

It is clear that only a fraction of the pesticides currently in use in the country are monitored. But according to the Ministry of Health, the 27 monitored pesticides were selected on the basis of their level of use, the likelihood of their ending up in drinking water and their toxicity.[186] This approach of targeting a reduced number of substances is in line with what is recommended by WHO and what is being done in the EU or the US.

Twenty-one of the 27 pesticides are on the PAN list of highly hazardous pesticides; eleven of them are listed because of their proven chronic hazards to human health. Seven pesticides covered by the monitoring programme are no longer authorized for use – some were even banned in the 1990s – but continue to be tested because they are extremely persistent. At least one of these – DDT, a likely human carcinogen and an endocrine disruptor – is a legacy from Syngenta.[187]

Of the 20 pesticides that are still authorized for use and are monitored in drinking water, seven are currently sold by Syngenta in Brazil.[188] Five are listed by PAN as "highly hazardous". Among them are four substances listed for their high chronic hazards to human health; atrazine, a reproductive toxicant and endocrine disruptor according to USEPA and the EU;[189] diuron, a likely human carcinogen according to USEPA;[190] glyphosate, probably carcinogenic to humans according to IARC;[191] and mancozeb, a likely a human carcinogen according to USEPA and an endocrine disruptor according to the EU.[192] Confronted with these facts, Syngenta wrote: "We do not consider the active ingredients mentioned in the question to be highly hazardous".[193]

The Brazilian government has, for each of the 27 substances, set a limit on the maximum concentration permitted in micrograms per litre of drinking water;[194] the water is considered safe for human consumption as long as the residues of a pesticide do not exceed the specific limits. However, concerns have been expressed about the way these limits were established and whether they really protect human health (see Box 3.2).

Box 3.2

SAFE LIMITS?

The starting point for establishing limits for pesticides in drinking water are toxicological studies performed on laboratory animals. The lowest dose at which no adverse effects are observed (the "no-observed-adverse effect" level – NOAEL) is used to derive an "Acceptable Daily Intake" (ADI) for human exposures. The ADI is the total amount of a chemical which – according to the authorities – can be "consumed" daily with the expectation that health will not be harmed. The ADI is derived from the NOAEL by applying some "uncertainty factors" to account for interspecies (animal-to-human) and interindividual (human-to-human) variability in sensitivity.[195] Additional uncertainty factors may be added in case irreversible damage by the chemical (carcinogenicity, mutagenicity, reproductive toxicity, endocrine disruption) cannot be ruled out. Importantly, depending of whether those are applied or not, the ADI – and therefore the limit that is ultimately set for drinking water – can vary considerably (e.g. by a factor 10 to 100 depending on the cases).

The limits in the Brazilian legislation are mostly taken from WHO guidelines for drinking water quality. WHO itself relies entirely on the work of an international "expert" body called the Joint Meeting on Pesticide Residues (JMPR). Of great concern is that the entire process takes place behind closed doors and is heavily influenced by the pesticide industry.[196] Further, the studies the regulators rely on are confidential and typically conducted by, or on behalf of, the pesticide companies. The studies look at the effects of one pesticide at a time, and do not take into account the "cocktail effect", i.e. the fact that people are exposed not to a single substance but to a mixture of pesticides that can interact and have additive or synergistic effects. Also, in many cases "we simply don't know enough about the substances to establish those limits", explains Wanderlei Pignati.[197] This is a main reason why the EU chose to adopt a uniform low limit in drinking water applicable to all pesticides.[198] There is now a growing body of evidence that chemicals – in particular endocrine disrupting ones – can act at very low doses, and that the current methods of assessing these chemicals are out-of-date and grossly inadequate in determining "safe" levels of exposure.[199] It should also be emphasized that the limits for pesticides in drinking water set in Brazil or by the WHO are based on an average adult person, and so do not provide adequate protection for pregnant women and unborn or young children, particularly vulnerable populations facing exceptional risks.

Although consistent with WHO guidelines on drinking water quality, the Brazilian approach contrasts with the EU and Swiss approach of trying to keep drinking water free of pesticide residues by establishing a low limit of 0.1 micrograms per litre for all pesticide residue, while the sum of all individual pesticides is not allowed to exceed 0.5 micrograms per litre.[200] However, Syngenta writes that the EU standard is "neither health-based nor scientifically supported". [201]

A major shortcoming of Brazil's drinking water monitoring programme is the relatively low level of testing. Our analysis shows that despite legal requirements, an average of only 31% of Brazilian municipalities submit drinking water test results each year to the federal government. While there is generally more testing in the states with the highest pesticide use,[202] this is not the case in Mato Grosso, the number one user of pesticides, where only 24% of municipalities submitted at least one test result during the four years.[203] A main reason for this relatively low level of testing in the country are the high costs of monitoring – which are entirely paid for by water providers, municipal and federal authorities, and ultimately the general public (see Box 3.3.).

Box 3.3

THE COSTS OF MONITORING

Monitoring drinking water for pesticide residues is complex and costly. According to Karen Friedrich from the Federal Labour Prosecution Office, "one of the main reasons for the low level of testing is the low number of quality laboratories in the country".[204] The other major problem is the high costs of testing. According to estimates of a laboratory in São Paulo it costs at least USD 200 to test one water sample for the 27 pesticides, as required by law.[205] Extrapolating this to all test results submitted by Brazilian municipalities between 2014 and 2017, we estimate the cost of the completed monitoring process at about USD 2 million per year, paid for by water providers, municipal and federal authorities, and ultimately the general public.[206] However, in other countries the manufacturers of pesticides have been in some instances asked to contribute. For example in the US Syngenta has been requested to conduct and pay for a more intense atrazine water monitoring programme in high risk areas.[207] When asked about whether it contributes to the testing in Brazil, the company did not respond directly: "Syngenta works directly with farmers and communities through its sales teams and allies in expanding its product stewardship programmes to advise them on the best safe and efficient use of our products to ensure safety to human health, the environment and water sources."

Even among the Brazilian municipalities that did submit data, most test results were incomplete. Only 3% tested the 27 pesticides twice a year during the four-year period, as required by law. It therefore appears likely that the monitoring programme misses peak concentrations that generally occur after the pesticide application – especially when surface water is the source of drinking water. Further, in most cases it is difficult to know if the concentrations detected are representative of the average levels of pesticides found in the drinking water throughout the year.

Pesticide residues were found in 86% of the drinking water tests.

However, even this incomplete monitoring system reveals an extensive contamination of Brazil's drinking water. The government dataset, Sisagua, contains information on over 850,000 pesticide tests of drinking water conducted between 2014 and 2017; our analysis shows that pesticide residues were detected in 86% of the tests.

Concentrations of pesticides that exceed the limits allowed under Brazilian law were found in 2,915 drinking water tests (0.35%). This represents 454 municipalities – with a population totalling 33 million – that have detected pesticide residues in their drinking water above the legal limits in Brazil at least once during the four-year period.

Overall, the level of contamination of the drinking water in Brazil is much higher than what is found in the EU or Switzerland. According to the latest report available, only 0.1% of drinking water samples in the EU had concentrations above the limit of 0.1 micrograms per litre.[208] In Brazil 12.5% of test results exceed the maximum concentrations set in the EU.

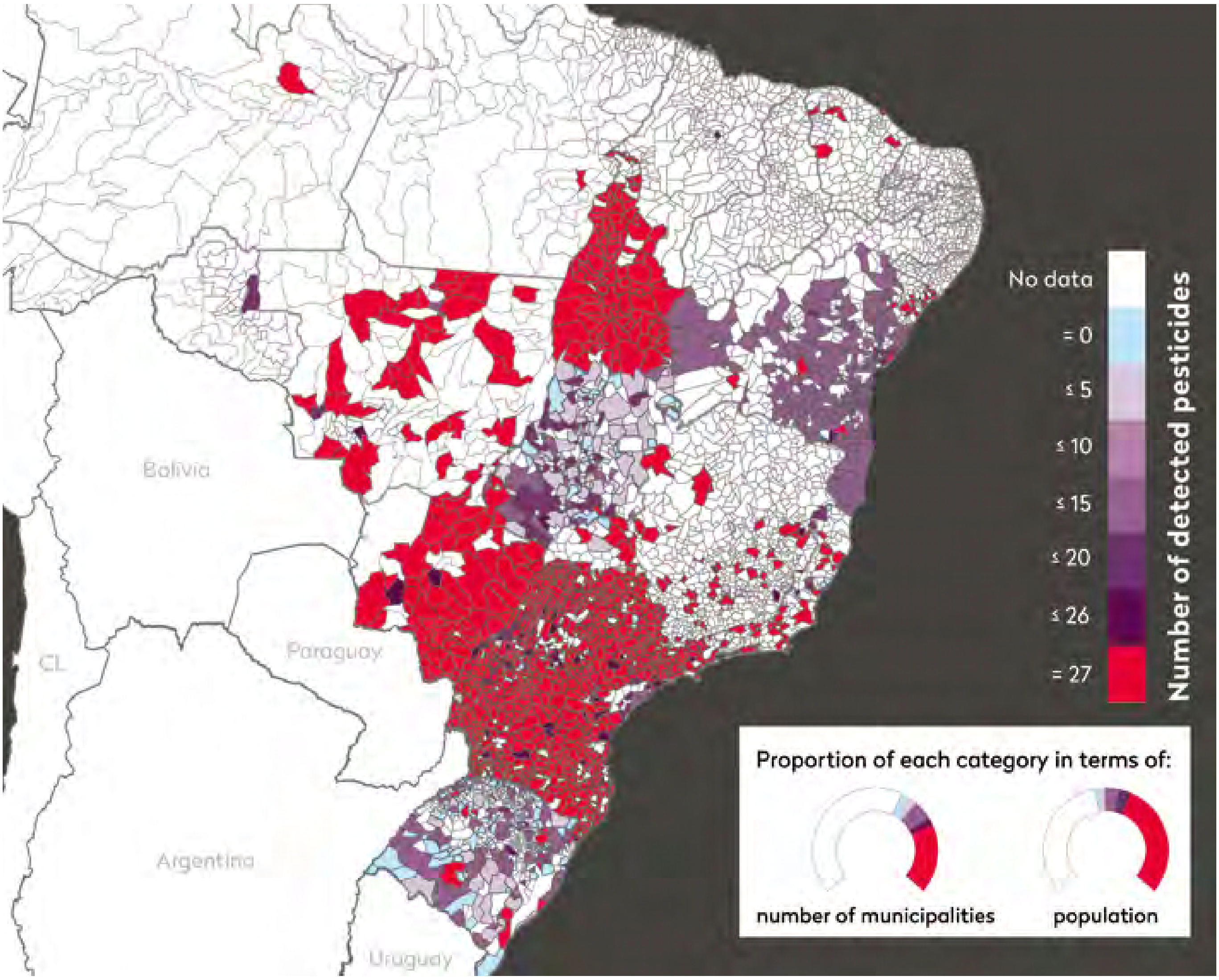
To Ada Cristina Pontes Aguiar this situation is "extremely worrying". "Allowing European companies to expose the Brazilian population to pesticides in their drinking water at levels sometimes 400 times higher than what is allowed in the EU is another form of double standard."[209]

What is especially alarming is the high level of detection for all 27 pesticides: all substances were found in at least 80% of drinking wate samples tested, and all 27 were regularly found at concentrations above the EU limit. Of significant concern is that the 27 pesticides are commonly found together in the drinking water of Brazilian municipalities.

Our analysis of the Sisagua database reveals that 1,396 municipalities – with a combined population of over 85 million – detected traces of all 27 pesticides in their drinking water at least once between 2014 and 2017. Most of those municipalities are located in the agro-industrial corridor of Brazil, extending from the south/southeast to the central west and up to the northeast. On average, Brazilian municipalities detected 20 different pesticides in their drinking water during that period (see Figure 3.3).

Regulatory authorities generally assume that the cocktail is safe as long as the concentration of each substance is below its respective limit. "But how can you consider safe a drin-

Figure 3.3 – **Number of different pesticides detected in Brazilian municipalities during the four-year period**



Source: Public Eye, based on SISAGUA

A cocktail of 27 different pesticides is commonly found in the drinking water of Brazilian municipalities.

king water that contains residues of up to 27 pesticides?" asks Prof. Pignati. All these substances interact and can have additive – or even synergistic – effects. As André Leu explains in his book *The Myths of Safe Pesticides:* "The emerging body of evidence demonstrates that many chemical cocktails can act synergistically, meaning that instead of one plus one equating two, the extra effect of the mixtures can lead to one plus one equaling five of even higher in toxicity and damaging effect."[210]

"Each substance is tested in isolation, but when they mix and people absorb them together, the effect can be very different", says Catarina Hess, Professor at the Federal University of Santa Catarina.[211] The unsettling conclusion is that millions of Brazilians are exposed to a cocktail of pesticides in their drinking water that has never been tested and the effects of which remain largely unknown.

Case study – SYNGENTA'S BLOCKBUSTER ATRAZINE DETECTED IN 4 OUT OF 5 WATER SAMPLES

Atrazine is an endocrine disruptor and a reproductive toxicant. It was banned in Switzerland and the EU because of water contamination, but Syngenta continues selling it in Brazil, where it ends up polluting the drinking-water of millions of Brazilians.

One of the highly hazardous pesticides sold by Syngenta that is most commonly found in Brazil's drinking water is atrazine, which is a weed killer used mainly on corn, and, in smaller volumes, on sorghum and sugarcane. Atrazine was discovered by Geigy, a company that is now part of Syngenta, and first placed on the market in 1958. It was hailed as a milestone in improving chemical weed control and soon became the preferred corn herbicide of farmers in the US and Europe.[212] However, concerns about the safety of atrazine started to emerge in the 1980s and today, it is well recognized as an endocrine disruptor and a reproductive toxicant, qualifying it as a "highly hazardous pesticide".[213]

Atrazine was banned in the EU in 2004[214] and in Switzerland in 2007[215] because of widespread groundwater and drinking water contamination. But due to its high persistence it is still one of the most commonly found pesticides in the water.[216] Atrazine remains one of the most widely used pesticides worldwide and Syngenta its main seller. In the US, where over 30,000 tonnes are applied every year,[217] several epidemiological studies are showing a statistically significant association between exposure to atrazine in drinking water and birth defects or adverse pregnancy outcomes, such as male genital malformations, gastroschisis, limb defects, fetal growth retardations and preterm delivery.[218]

One of the latest studies, published in 2017 by Professor Leslie Stayner and his colleagues at the University of Illinois, reviewed more than 130,000 birth records in four Midwestern states and reported a statistically significant association between the presence of atrazine in drinking water and preterm births.[219]

Brazil is the second largest user of atrazine worldwide. According to IBAMA, 25,000 tonnes of atrazine were applied in Brazil in 2017. Our analysis of Phillips McDougall data suggests that 16,000 tonnes of those were sold by Syngenta for a market value of about USD 65 million.

Our research shows that the drinking water is heavily contaminated with atrazine in Brazil. According to our analysis of the Sisagua governmental dataset, atrazine was detected in 85% of drinking water samples tested in Brazilian municipalities between 2014 and 2017. 1,941 municipalities – with a combined population of about 105 million – detected atrazine residues in their drinking water during the four-year period.

Fourteen municipalities have detected atrazine at concentrations above 2 micrograms per litre – the legal limit in Brazil – at least once during the four-year period, and a further 70 reported atrazine residues at the exact limit. Overall, 826 municipalities – with a population totalling 55 million – had an average concentration of atrazine in their drinking water during the four-year period that exceeded the EU limit of 0.1 micrograms per litre. When we showed the Sisagua data to Professor Leslie Stayner, at the University of Illinois, she said she was "concerned" about the levels of atrazine detected in Brazilian drinking water.[220] Jason Rohr, Professor of Integrative Biology at the University of South Florida and one of the most renowned atrazine experts, said: "My biggest concern would be for developing fetuses and children."[221]

Jennifer Sass, senior scientist at the Natural Resources Defense Council (NRDC) shares those concerns: "Even when the annual average may be low, our experience in the US has demonstrated that the monitoring programme easily misses seasonal spikes of atrazine that can be much higher – into the double and even triple digits – particularly during spring rainy season and can sometimes last for days or weeks. High spiking levels in drinking water, even for short periods of time, may pose a significant risk to people, particularly during vulnerable life stages such as pre-natal development."[222]

An additional concern is that another pesticide sold by Syngenta in Brazil – simazine – is commonly found in those same areas where atrazine is frequently detected, and at similar levels, as our analysis of the Sisagua database reveals. Simazine and atrazine are "chemical cousins", both members of the triazine class of herbicides. The US EPA determined over thirteen years ago that they both share the same mechanism of toxicity and the same toxicity profile, including developmental and reproductive harm.[223] WHO also considers atrazine and simazine have additive toxicity.[224] In other words, when assessing the health risks of drinking water, atrazine and simazine contamination should be added together.

As in the case of atrazine, the maximum level of simazine allowed in Brazil's drinking water is 2 micrograms per litre. Yet, because the limits in Brazil are set for individual substances only, the drinking water will be considered "no risk" if both atrazine and simazine are below their respective limits, despite having combined concentrations exceeding 2 micrograms per liter.

To get an idea of the combined level of atrazine and simazine in the Brazilian drinking water, we matched the levels of both pesticides detected in municipalities on the same day in the four-year period. Our analysis shows that – when accounting for the additive toxicity of atrazine and simazine – the number of municipalities with drinking water samples exceeding 2 micrograms per liter at least once between 2014–17 jumps from 14 to 109. This represents a population of over 23 million people living in municipalities in which "unsafe" levels of atrazine and simazine have been detected in the drinking water.

Figure 3.4 – **Maximum detection of atrazine in drinking water in Brazilian municipalities between 2014–17**

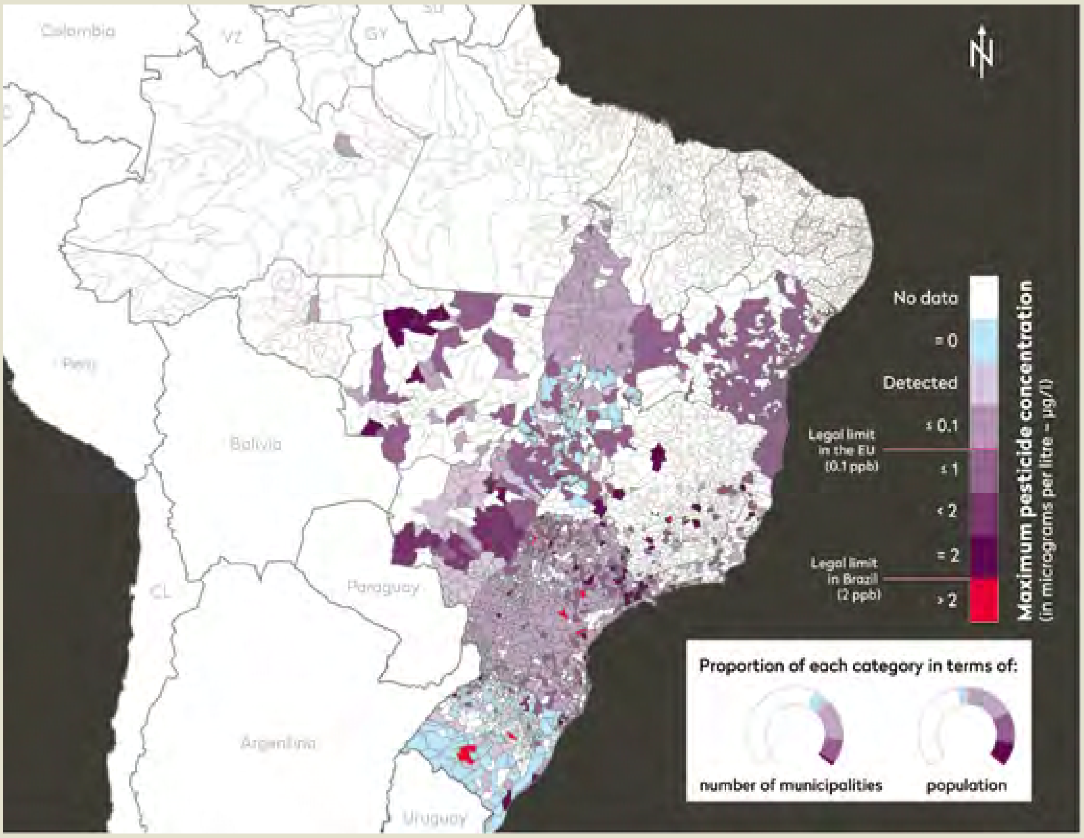
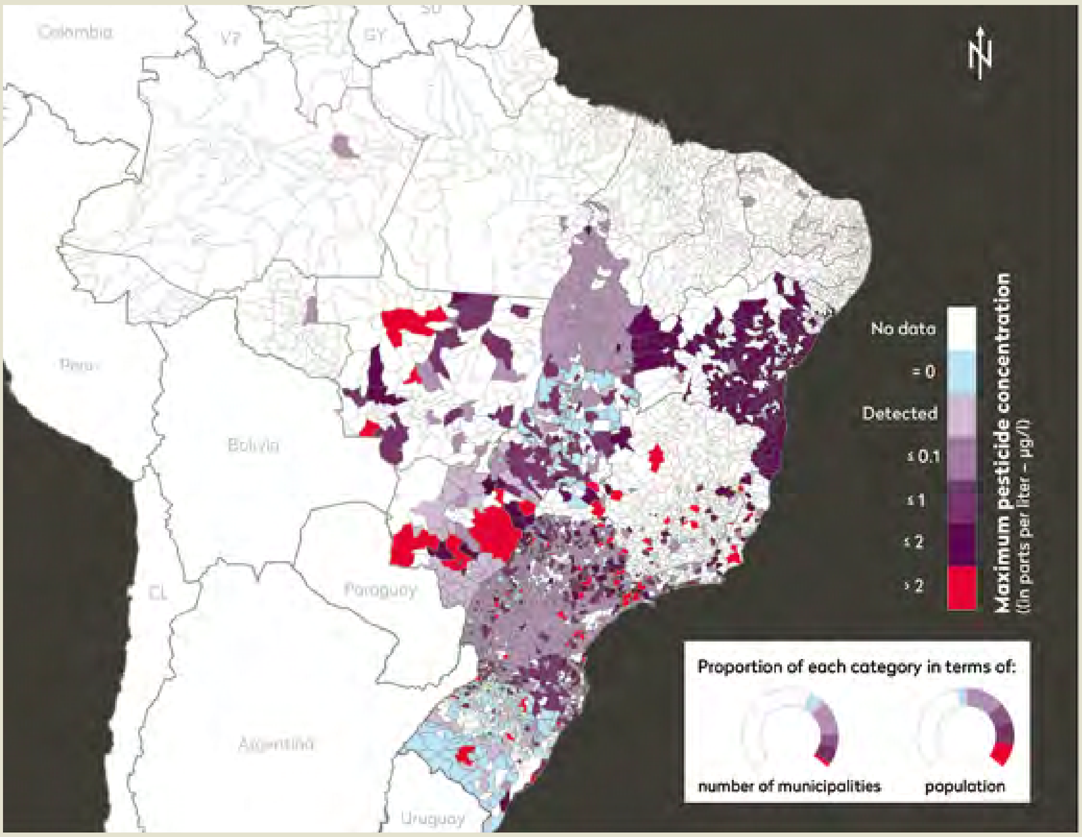


Figure 3.5 – **Maximum detection of sum of atrazine and simazine (same day) in drinking water in Brazilian municipalities between 2014–17**



3.3 – THE CHRONIC HEALTH IMPACTS OF PESTICIDES IN BRAZIL

Researchers and governmental agencies in Brazil are increasingly worried about the long-term health implications of the dramatic increases in pesticide use in the country and warn about an epidemic of chronic diseases, especially in regions where pesticide use is highest.

In 2015, the Brazilian National Cancer Agency (INCA) issued a strong statement warning of the serious health effects caused by massive pesticide use. The Institute, under the direct administration of the Ministry of Health, "marked [its] position against current pesticide use practices" and warned of the increased risk of chronic diseases, in particular infertility, impotence, miscarriages, malformations, neurotoxicity, hormonal deregulation, effects on the immune system and cancer. The INCA warned in particular that long-term exposure to "usually low doses" residues of multiple pesticides in food and the environment "may affect the whole population (…) and may lead to chronic health effects".[225]

Chronic diseases today "constitute the country's greatest health concern" according to the Ministry of Health.[226] Together they account for 72% of the causes of death. In contrast to recent decreases in the incidence of diseases like cardiovascular and chronic respiratory illnesses, "mortality rates related to diabetes and cancer have increased", the Ministry observes. INCA expects some 600,000 new cases of cancer for 2019 – a 75% increase compared to 2000.[227] Cancer is now the second cause of death in Brazil.

Marcia Sarpa de Campos Mello, toxicologist and researcher at INCA, says that the agency "is deeply concerned that pesticide exposure contributes to the growing cancer burden, particularly with regard to specific cancer types like those related to hormonal factors such as breast or prostate cancers".[228]

Prostate and breast cancer are the most common types of cancer in Brazil[229] and both have increased significantly in recent years.[230] In 2018, the Ministry of Health observed that prostate cancer mortality rates were particularly high in Brazil's "agricultural production corridor" where production "strongly relies on the use of chemicals". It also found that breast cancer mortality "stands out" in territories with high levels of exposure to agricultural chemicals.[231] This is supported by several studies conducted in Brazil showing that both breast and prostate cancer are related to pesticides.[232]

But other cancer types have also been associated with pesticide exposure. For example, the Ministry of Health has observed particularly high rates of Non-Hodgkin Lymphoma (NHL) in the agro-industrial territories.[233] In 2018, INCA conducted a control study in its cancer hospital in Rio de Janeiro and found that patients were three times more likely to develop NHL if previously exposed to pesticides.[234]

This finding was supported by another recent study which established that young agricultural workers in the south of Brazil face a twofold increase in the risk of dying from NHL compared to non-agricultural workers.[235] And researchers concluded recently that the "sharp increase" in colon cancer mortality in Brazil from 2000 to 2012 was probably also linked to pesticides. A strong correlation was found between the amount of pesticides sold in the country and colon cancer mortality, suggesting that "pesticide exposure may be a risk factor for colon cancer".[237]

Various findings point to a general increase in cancer among agricultural workers and their families in agro-industrial regions. In 2018, the Ministry of Health claimed that "many studies have shown an excess of cancer among agricultural workers that is possibly related to occupational pesticide exposure".[238]

The southern state of Rio Grande do Sul has the highest rates of cancer in Brazil. While this "epidemy of cancer" can

Box 3.4

"NO DOUBT" THAT CASES OF MALFORMATION AND EARLY PUBERTY ARE RELATED TO PESTICIDES

Researchers from the University of Ceará first began to investigate the association between pesticide exposure and birth defects when they were contacted by citizens of Tomé claiming that the prevalence of children born with congenital malformations and with serious hormonal issues had drastically increased in the municipality. Tomé is a small town of about 2,500 inhabitants that is completely surrounded by industrial plantations producing bananas, melons and other fruits for export. The town had already appeared in a study showing increased cancer mortality rates in main fruticulture regions in 2013. As birth defects are very rare events, the researchers were concerned to find so many cases in a small place like Tomé. "While there was not one single case in more than ten years, suddenly five children were born with birth defects in Tomé within less than two years", explains Ada Cristina Pontes Aguiar, researcher at the medical faculty of the Federal University of Ceará.[236] The researchers decided to investigate the birth defect cases as well as three girls suffering from early puberty, who started to develop breasts before they were even one year old. The researchers found that the fathers of all the children were agricultural workers with a history of significant pesticide exposure. And many mothers reported intense pesti-cide exposure during gestation, for example by experiencing nearby aerial sprayings. The researchers also found pesticides including HHPs in the blood of the children and parents, and residues of pyrethroid insecticides in their urine, substances that are known for their potential endocrine disruption. In six family homes, there were residues of at least one pesticide in the drinking water. Although other factors might have been involved, "there is no doubt that pesticides are related to those cases of malformation and early puberty", concludes Aguiar.

Love in time of monocultures: motel behind transgenic crops in Sinop, Mato Grosso, Brazil. | © Lunaé Parracho

partly be explained by high indices of development and urbanisation, it might also be linked to the elevated use of agrochemicals in the state.[239] In 2010, researchers found that cancer mortality rates were particularly high in the region of Ijuí, a major agro-industrial area of the state. Cancer mortality correlated with cropped areas, the number of farms using pesticides and the proportion of agricultural workers in the municipalities.[240] Fábio Franke, oncologist at the Charity hospital of Ijuí, observed a "high number of agricultural workers among his cancer patients"[241] and a direct relationship between pesticides and those cancer cases.[242]

Of particular concern is the effect of pesticide exposure on the incidence of cancer in children and adolescents. In Mato Grosso, Brazil's top soy producer and pesticide user, two recent studies have found a correlation between pesticide use and cancer mortality and morbidity among children and adolescents.[243] According to Dr. Wanderlei Pignati, who conducted the studies, childhood cancers were four to six times more frequent in regions with intense pesticide use than regions with low pesticide use.[244]

Similar observations were made in the main areas of industrial fruit production in the northeast of Brazil. Local researchers showed that childhood cancer hospitalisation rates in Petrolina and Juazeiro, the two main fruit growing centres of the northeast, increased significantly from 2004 to 2013, reaching 60 cases per one million inhabitants, compared to 44 cases in Brazil and 43 cases in the Northeastern Region.[245] And an extensive case control study carried out in hospitals in 13 Brazilian states from 1999 to 2007 found that children whose mothers were exposed to pesticides during pregnancy were more likely to develop leukemia in their first year of life compared with those whose mothers did not report such exposure.[246]

> The Brazilian National Cancer Agency (INCA) marked its position against pesticide use practices and warned of the increased risk of chronic diseases.

"We are not only concerned with cancer", says Marcia Sarpa de Campos Mellos from INCA. "Several studies indicate that paternal exposure to pesticides can also lead to adverse birth outcomes."[247] Today, between three and five percent of newborns are affected by some form of congenital malformation in Brazil.[248] Researchers found higher rates of birth defects in agricultural areas and among children whose parents were exposed to pesticides.

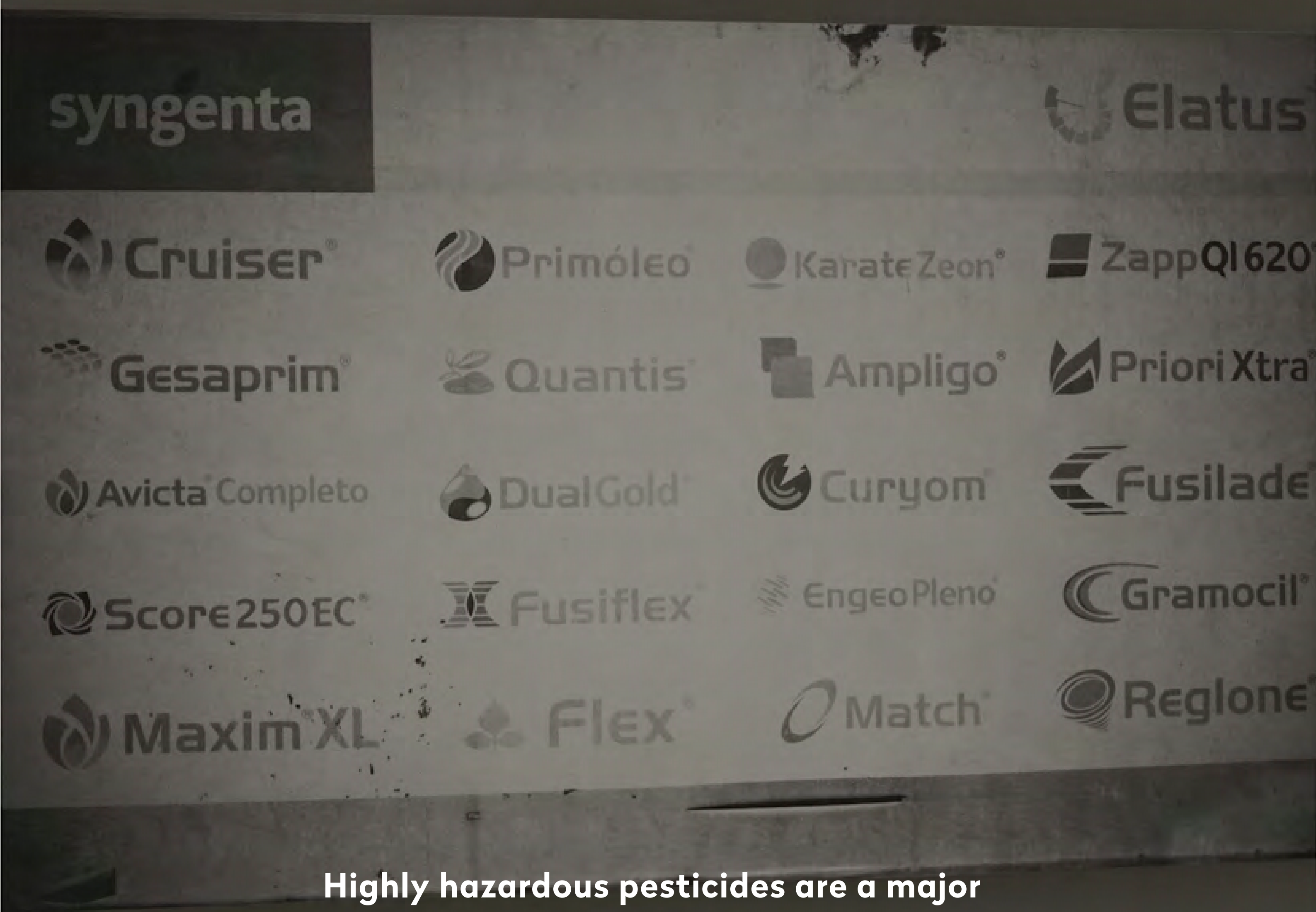
A study from 2016 concluded that children in Mato Grosso had a fourfold risk of birth defects if their parents had both been exposed to pesticides in the past.

A case control study carried out in several hospitals of Mato Grosso in 2014 found double the number of cases of congenital malformation among children whose mothers were exposed to pesticides during the periconceptional period.[249] A study from 2016 concluded that children in Mato Grosso had a fourfold risk of birth defects if their parents had both been exposed to pesticides in the past.[250]

In 2017, researchers found that in the southern state of Paraná, the incidence of congenital malformation was significantly higher between 2004 and 2014 than in the preceding decade. The authors concluded that the increase of specific types of birth defects correlated with the increase of pesticide use in the state and the municipality of Cascável, the state's number one pesticide user[251] (see Box 3.4, page 30).

To Ada Cristina Pontes Aguiar, "pesticides constitute today a major public health concern in the country".[252] Yet, as Karen Friedrich stresses, what is known so far is "probably only the tip of the iceberg". "Scientific research in this field receives very limited public funding in Brazil", explains Karen Friedrich. "Yet, even in this precarious scenario, we already have an alarming number of solid studies showing that pesticide exposure is related to a range of chronic diseases in Brazil". Also INCA warns that the health consequences of the rapid increase of pesticide use in Brazil might only be starting to be felt, "as chronic diseases develop sometimes many years after exposure".[253]

4
Conclusion and recommendations



Highly hazardous pesticides are a major threat to global health. It's time to put an end to this dirty business.

WHO has called exposure to highly hazardous pesticides (HHPs) a major public health concern. And it is widely recognised that these HHPs need to be phased out and replaced with safer alternatives in order to reduce risks to human health and the environment. Yet, as this report has shown, while most HHPs are now banned in Switzerland and the EU, they remain heavily used in low- and middle-income countries (LMICs). According to our estimate based on industry data, about 1.2 million tonnes of pesticides listed by PAN as "highly hazardous" were used in LMICs in 2017, with a market value of about USD 13 billion.

Our research revealed that Swiss-based Syngenta is one of the main player in the industry of highly hazardous pesticides. Syngenta would like to have us believe it is doing business in a responsible and sustainable way. However, our analysis suggests that it made about USD 3.9 billion in 2017 – 40% of its pesticide sales – by selling pesticides listed as "highly hazardous" by PAN, for the most part in LMICs.

Fifty-one of the 120 pesticide active ingredients in Syngenta's portfolio are not authorized for use in its home country, Switzerland; sixteen of them were banned because of their impact on human health or the environment. But Syngenta continues selling them in lower income countries, where standards are often weaker and less strictly enforced.

In Brazil, the world's main user of toxic pesticides and the biggest market for Syngenta, millions of people are exposed on a daily basis to a cocktail of highly hazardous pesticides, including through their drinking water. Government agencies and local researchers are warning that exposure to pesticides is turning into an epidemic of chronic diseases, especially in the "agricultural corridor", where studies show increasing rates of cancers, including among children, as well as disturbing rates of birth abnormalities and adverse reproductive outcomes.

THE TIME HAS COME TO ACT ON HIGHLY HAZARDOUS PESTICIDES.

SYNGENTA should immediately halt the production and sale of highly hazardous pesticides.

If Syngenta is genuinely concerned about sustainability and social responsibility, it should not expose millions of people in low- and middle-income countries to products that are known to be highly hazardous to people's health and the environment. By doing so, Syngenta is in clear contradiction with the International Code of Conduct on Pesticide Management and all other WHO/FAO guidelines on pesticide risk reduction. The company also violates its duty to respect human rights under the UN Guiding Principles on Business and Human Rights (UNGP). Syngenta should present a detailed, time-bound plan on how it will phase out all of its pesticides that are on the PAN list of highly hazardous pesticides.

As home to the leading seller of pesticides worldwide, Switzerland has a major responsibility. As Syngenta has so far shown no willingness to phase out highly hazardous pesticides, the **SWISS GOVERNMENT** needs to step in.

As a **first step**, the Swiss government should "prohibit the export of pesticides whose use has been banned in Switzerland due to their effects on human health or the environment", as demanded in a motion filed by National Councilor Lisa Mazzone.[254] A pesticide that is considered too dangerous for use in Switzerland should also be considered too dangerous for use in other countries.

As a **second effective measure**, the Swiss government should implement mandatory human rights and environmental due diligence requirements for Swiss companies, as proposed by the "Responsible Business Initiative" currently being discussed in the Parliament.[255] Our research on highly hazardous pesticides is just one more example of companies failing to voluntarily comply with their duty to respect human rights under the UNGP. This needs to be made a legal obligation under Swiss law.

As a **third step**, the Swiss government should support a binding international treaty to regulate highly hazardous pesticides. This problem cannot be solved by bilateral or regional action alone; global action is required. A treaty is required to ban HHPs internationally and provide support to LMICs to replace them with safer alternatives. The call for a binding treaty enjoys the support of a broad range of countries, civil society organisations and UN human rights experts. A concrete proposal has already been submitted by PAN in the context of SAICM.[256]

Annex 1

Highly Hazardous Pesticides

Syngenta Responses to Public Eye, 23 January 2019

QUESTION 1

According to the World Health Organization (WHO), exposure to highly hazardous pesticides is "a major public health concern" and they should be phased out and replaced with safer alternatives.

- ***Does your company share this view?***

Syngenta Response

It is important to correctly reference the WHO, its research and the actual recommendations contained in the paper as opposed to selective commentary. The quoted WHO source's is: "Exposure to highly hazardous pesticides: a major public health concern": https://www.who.int/ipcs/features/hazardous_pesticides.pdf

This paper from 2010 concludes with risk mitigation recommendations and we share the WHO's broad look at a comprehensive set of risk mitigation strategies. To reduce exposure to highly hazardous pesticides and their health impacts, WHO recommends four clusters of action:

- Handling, storage and use
- Elimination and replacement of pesticide use
- Education
- Regulation, monitoring and surveillance

The WHO confirms that safe use, training and regulation are effective means to reduce potential risks from pesticides. For the 'elimination and replacement of pesticide use', the WHO specifically refers to persistent highly hazardous pesticides, pesticides regarded as obsolete, and recommends integrated pest and vector management strategies.

QUESTION 2

According to the Food and Agriculture Organization (FAO)'s Guidance on Pest and Pesticide Management Policy Development, the first two steps to mitigate the risks associated with pesticides are to reduce their use as much as possible and to select products with the lowest risk to human health and the environment. Ensuring the proper use of pesticides is only the third step. The International Code of Conduct on Pesticide Management clearly states that pesticide manufacturers have – along with governments – a responsibility to take the most toxic pesticides off the market.

- ***What did your company do in recent years to support the phasing out of highly hazardous pesticides?***
- ***Do you have a concrete plan to phase out highly hazardous pesticides within a determined time frame?***

Syngenta response

The 'pesticide risk reduction' section referred to in the FAO Guidance (page 10) acknowledges both the important role pesticides are playing in pest management and the fact that they pose risks to human health and the environment. The Guidance states that 'pesticide risk reduction and risk management are thus essential to proper and responsible use of pesticides'. On page 12, the Guidance specifies that 'pesticide risk reduction programs generally should contain all three elements simultaneously' viz:-

1) Ask the question to what extent pesticide use is actually needed to protect yields;
2) Carefully select the pesticides;
3) Ensure the proper use of selected products.

In relation to point 1: we have no interest in farmers overusing our products as this may lead to resistance or result in adverse environmental issues. Our life-cycle approach to pesticides includes extension services offered to farmers so that they take agronomic decisions including those relating to pesticide use that are sustainable.

In relation to point 2: the Guidance specifies that "the choice of formulation and mode of application can have significant effects on volume used and risk of exposure". We believe it is important that farmers can choose from a wide range of formulations and modes of application. This choice is however narrowing due to an increasing politicization of the pesticide registration process. Less choice also leads to higher risk of resistance development. We invest more than USD $1.3 billion in product research and development each year. These investments result in new product introductions (chemical and non-chemical) that are most often lower risk alternatives to existing products.

In relation to point 3: the safe use of products is a key commitment Syngenta has made in The Good Growth Plan. Since 2014, we have trained more than 25 million people in the safe use and handling of our products and to promote awareness around the importance of safe handling and use of products. In many parts of the world we partner with Civil Society groups who support this training and engagement and we would welcome the opportunity to sit down with you and explore how we might be able to further extend this training and its reach in key smallholder markets around the world. Smallholders make up some 70 percent of the people we train.

Read more: https://www.syngenta.com/~/media/Files/S/Syngenta/2018/Syngenta-Sustainable-Business-Report-2017.pdf

The International Code of Conduct on Pesticide Management stipulates that "prohibition of the importation, distribution, sale and purchase of highly hazardous pesticides may be considered if, based on risk assessment, risk mitigation measures or good marketing practices are insufficient to ensure that the product can be handled without unacceptable risk to humans and the environment." Syngenta, along with CropLife International, supports this approach to managing highly hazardous pesticides.

Going beyond regulatory requirements to ensure the responsible use of products through their life-cycle, Syngenta, along with the industry has in recent years conducted full portfolio review. We have assessed all our formulations sold in the market and have made appropriate risk mitigation decisions on the use or sale of any identified highly hazardous pesticide.

Read more: https://croplife.org/a-responsible-approach-to-highly-hazardous-pesticides/

QUESTION 3

Fourteen of the 32 active substances that Syngenta uses in its "key marketed products" (see list in 20-F report on page 19) are on the list of highly hazardous pesticides of the Pesticide Action Network. Among them, one WHO Class 1b pesticide (tefluthrin), four classified as likely human carcinogens by the US EPA (chlorothalonil, isopyrazam and sedaxane) and IARC (glyphosate), and two classified as endocrine disruptors by the EU (atrazine and lambda-cyhalothrin). Also, two other active substances (cyproconazole and propiconazole) Syngenta uses in its "key marketed products" have just been classified by the EU as reproductive toxicant category 1B and will make it in the next version of the PAN HHP list.

- ***How is this compatible with the need to phase out highly hazardous pesticides (HHPs) in order to protect human health and the environment?***
- ***Would you be ready to commit to phase out all highly hazardous pesticides in your portfolio?***

Syngenta response

A hazard is the potential of a substance to cause harm. Whether harm from this substance actually occurs depends on the extent of exposure to the hazard (the risk of harm). By way of example: Ultraviolet radiation (sunshine) is inherently hazardous because its energy can burn the skin and cause genetic damage in skin cells. Efficient risk mitigation measures include reducing exposure by staying in the shade, using sun cream, wearing a hat and covering the skin with clothes.

The hazardous nature of crop protection chemicals alone does not make them 'highly hazardous'. The crucial point is their risk versus benefits under recommended use conditions. A specific active ingredient may be considered potentially hazardous but it is the dose that makes the poison. Everyday chemicals like caffeine, gasoline (benzene), alcohol (ethanol), ibuprofen, and table salt can be hazardous at high doses, but normal uses are considered safe. The same is true of pesticides.

Syngenta is committed to ensuring that such risk is appropriately addressed and minimized so a variety of products are available to help protect crops, people and the environment. We follow stringent product development criteria and while thousands of chemicals are analyzed, those with potential negative side effects are screened out from the very beginning. Products are then thoroughly tested according to local regulatory requirements and independently agreed international standards. If they are safe for intended uses, and approved by the competent authorities, they are delivered to the market responsibly.

Going beyond regulatory requirements to ensure the responsible use of products through their life-cycle, Syngenta has in recent years, along with the industry conducted an individual portfolio review. We have assessed all of our formulations sold in the market and have made appropriate risk mitigation decisions on the use or sale of any identified highly hazardous pesticide.

Together with the industry, we support the International Code of Conduct on Pesticide Management, which calls for regulating crop protection products based on risk, not hazard. We do not agree with the list that PAN has developed and we would be happy to meet with you and to discuss our position, explain our decision making criteria and scientific assessment processes.

QUESTION 4

According to our estimates based on industry data, the sales of the 40 Syngenta pesticides listed by PAN as highly hazardous represented about 40% of Syngenta's pesticide sales in 2017. We therefore come to the conclusion that the sale of HHPs is a key part of Syngenta's business model.

- ***Can you confirm this assessment? If not, what is the share of your pesticides listed by PAN as HHPs in your global pesticide sales?***
- ***How is this compatible with Syngenta's commitment to improve the sustainability of agriculture, to help biodiversity flourish and to help people stay safe?***

Syngenta response

Our strategy is to grow through customer-focused innovation. We accept our responsibility to develop safe and sustainable products and steward them carefully, investing approximately 30 percent of the cost of a new active ingredient on product safety.

As noted in the response to Question 3, we have in recent years undertaken a thorough assessment of our portfolio and we have taken appropriate risk mitigation actions where required. We would be happy to meet with you and explain our decision making and assessments in more detail.

Together with industry, we support the International Code of Conduct on Pesticide Management, which calls for regulating crop protection products based on risk, not hazard. With this assessment methodology in mind we do not agree with the list that PAN has developed. A principle point of difference with the position of PAN is that we sell formulations in the marketplace and it is therefore entirely appropriate and indeed to look at formulations, not active ingredients.

The Good Growth Plan is informing the way our products and services contribute to a sustainable agricultural system. Collectively, the Plan's six commitments contribute towards delivering the UN Sustainable Development Goals. The Plan's principles and priorities are deeply embedded in the way we do business. As it has continued, we have begun to assess not only our progress but also the nature and quality of the value we are adding: the impact on people, communities and the environment. As we build what we learn into our commercial offer, we are also compiling the evidence that it delivers real, measurable value for growers and society at large.

The sustainability of agriculture relies on biodiversity – for plant breeding, pollination and food diversity. A key strategy to reverse the loss of species is managing less-productive farmland alongside fields and waterways to reintroduce local species, provide buffers for soil and water, and connect wildlife habitats. This enables sustainable intensification on more productive land.

We have also made the commitment to train 20 million farm workers on labor safety by 2020. We share good agronomy practices, combined with safe-use and environmental stewardship, through initiatives such as locally-tailored Syngenta Learning Centers on demonstration farms.

Read more in our Sustainable Business Report 2017 (the 2018 Sustainable Business Report will be released in late March 2019.)
https://www.syngenta.com/~/media/Files/S/Syngenta/2018/Syngenta-Sustainable-Business-Report-2017.pdf

QUESTION 5

According to our research, your company sells 50 different pesticides that are not authorized for use in your home country, Switzerland. 16 of them are specifically listed in the Swiss PIC Ordinance as having been "banned" for reasons of health or environmental protection. Nevertheless these pesticides are sold in low and middle income countries.

- ***Is it legitimate to sell products that are considered too dangerous in Switzerland to lower income countries, where regulations are weaker and workers less protected?***
- ***Would you be ready to commit to stopping the sale of pesticides that have been banned in Switzerland for reasons of health or environmental protection?***

Syngenta response

The Prior Informed Consent (PIC) procedure is an administrative transparency and control mechanism connected with the international trade of affected products between contracting countries (called parties). It requires each party to decide whether or not it allows the import of affected products. PIC listing does not constitute an international ban, any prohibition of use or recommendation to do so and it is disingenuous to suggest otherwise.

We manufacture active ingredients in a just few countries but we sell these products in more than 90 countries the world over. Monthey is the largest of our six production sites worldwide. It is however nonsensical to suggest that any given industry could or should create production facilities in every country where its products are sold and our industry is no different. We choose locations for manufacture that have the highest standards of quality, safety and environmental performance, including Switzerland. The 90+ countries to which we sell our products then benefit from this world class manufacturing.

In the manufacture of products we comply with all of the regulatory and safety standards required by the manufacturing regulatory authorities of that country. Similarly we comply with all of the regulatory and safety standards of the countries where our products are registered for sale. The decisions of sovereign governments to support and allow product manufacturing are entirely separate from the decisions of sovereign governments to support the sale of products that have been manufactured whether in that country or elsewhere.

Registration and commercialization of a product take into account specific local needs and it is very common for a specific product to be registered in one country but not in another. Different regulatory systems, climatic and agronomic conditions, farming systems and farmers' needs are a reality. From a business perspective, the registration of a product only makes sense if the market potential justifies the expenditures. This explains very clearly why what we produce in Switzerland may not be necessarily registered or sold in this country.

QUESTION 6

On its website, Syngenta Brazil claims: Nós da Syngenta somos orientados para desempenhar uma agricultura capaz de alimentar uma população crescente de uma forma verdadeiramente sustentável – respeitando o meio ambiente e todas as pessoas da cadeia que participamos. Our research shows a different picture. Syngenta is the leading seller of highly hazardous pesticides in Brazil. Syngenta sells 45 pesticides in Brazil, 20 of them are on the list of highly hazardous pesticides of the Pesticide Action Network and nine of them are specifically listed in the Swiss PIC Ordinance as having been "banned" for reasons of health or environmental protection.

- ***How is this compatible with your commitment to promote a "truly sustainable" agriculture that "respects the environment and all the people"?***
- ***By doing so, aren't you violating your obligation and commitment to respect human rights and the environment (that "exists independently of States' abilities and/or willingness to fulfil their own human rights obligations"), as defined by the UN Guiding Principles on Business and Human Rights?***

Syngenta response

We do not agree with the list PAN has developed. Furthermore, the properties of a specific active ingredient should not be confused with the risks of formulated products under actual agronomic conditions of use. Formulated products include active ingredients in diluted form to ensure there are no unacceptable risks from their use. In all the markets where we are present, we sell formulations that have been carefully assessed and approved by the respective regulatory authorities. Syngenta complies with the rule of law and all regulations wherever we operate.

Pesticides undergo extensive health, safety and environmental testing and rigorous regulatory review before gaining market approval. Globally, the industry carries out rigorous studies on the possible effects of products on human and animal health before applying for a pesticide registration. These are further supplemented by the studies of national regulatory agencies. It is also important to emphasize that industry and regulatory authorities regularly monitor developments in the patterns of potential exposures among pesticide users in order to ensure continued safety in use.

All Syngenta crop protection products are thoroughly tested to ensure that there are no unwanted effects on human health, beneficial insects such as bees, the environment, or on water sources.

The Regulatory System for pesticides in Brazil is one of the most rigorous in the world and it takes, approximately 10 years of studies and research before reaching the market as an effective and safe new product. Before a product may be sold, it must comply with all requirements and standards and be classified and approved as safe by the competent regulatory authority (in Brazil, this may be the ministry of Health, the Environment, or Agriculture).

Like any market, all products developed by Syngenta for the Brazilian market are subject to an extremely rigorous assessment and regulation process. The authorities focus on the definition of farmer safety, safe dosages and maximum residue limits in food, the environment, water and crops. To perform their work, they thoroughly look at toxicological and residue studies that follow international standards of quality and meet the legal requirements for registration of pesticides.

It is also very important to acknowledge that agricultural pesticides are produced to combat pests and diseases that affect certain crops. In tropical countries like Brazil, pest pressure can be very intense. Products used in Brazil may not be necessary in countries where low winter temperatures naturally reduce some of the pest pressure. In other words, the demand for a certain product varies according to the type of pest, crop and climatic conditions, thus influencing the market. Countries have different regulatory structures and this characteristic is also valid for the registration of pesticides. Each country presents its own approach to the risk management of these substances.

See more about our commitments made to improve the sustainability of agriculture
https://www.syngenta.com/what-we-do/the-good-growth-plan
https://www.youtube.com/watch?v=ucdMpoSPrGI&feature=youtu.be
https://www.syngenta.com/media/media-releases/yr-2018/30-08-2018

QUESTION 7

According to our analysis of the data from the official drinking water monitoring program of the Brazilian Ministry of Health (Vivagua), seven pesticides sold by Syngenta in Brazil (atrazine, diuron, glyphosate, mancozeb, s-metolachlor, profenofos and simazine) are commonly found in the drinking water of millions of Brazilians at levels sometimes 10-20 times higher than what is permitted in Switzerland and the European Union.

- ***Do you think that it is responsible to expose millions of people to highly hazardous pesticides in their drinking water?***
- ***Are you taking any concrete measures in Brazil to prevent the contamination of drinking water with highly hazardous pesticides? Are you contributing to the water testing in order to identify the risks?***

Syngenta response

Good management practices and the responsible use of pesticides are essential in avoiding point source contamination. Syngenta works directly with farmers and communities through its sales teams and allies in expanding its product stewardship programs to advise them on the best safe and efficient use of our products to ensure safety to human health, the environment and water sources.

Chemical products are tested by regulatory authorities across the world on their impact on water quality before they are approved for commercialization. Residue levels are highly regulated and constantly monitored and the reality is that tolerance levels differ between jurisdictions and some countries may take approaches that are not necessarily based on scientific criteria. For example, the EU general groundwater limit for all pesticides is 0.1 parts per billion (ppb), regardless of toxicity. This standard is neither health-based nor scientifically supported. And, the WHO has raised its recommended safe level of atrazine in drinking water to 100 ppb, which is 33 times higher than the US limit of 3 ppb.

We do not consider the active ingredients mentioned in the question to be ‘highly hazardous’.

Read more: Regulatory limits for pesticide residues in water (IUPAC Technical Report):
http://publications.iupac.org/pac/2003/pdf/7508x1123.pdf

Annex 2

SYNGENTA'S 42 HIGHLY HAZARDOUS PESTICIDES

				Group 1 Acute toxicity				Group 2 Long term effects									Group 3 Environmental toxicity				
	Active ingredient	Use type	Sumo f max = 1 in Groups 1–3	WHO 1a	WHO 1b	H33pl	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	Very bio acc	Very pers water, soil or sediment	Very toxic to aq. organism	Highly toxic bees	max = 1
1	Abamectin	I	2			1	1									0				1	1
2	Acetochlor	H	1				0								1	1					0
3	Atrazine	H	1				0								1	1					0
4	Boric acid	I	1				0							1	1	1					0
5	Brodifacoum	R	2	1		1	1							1		1					0
6	Bromoxynil	H	1			1	1									0					0
7	Chlorantraniliprole	I	1				0									0		1	1		1
8	Chlorothalonil	F	2			1	1					1				1					0
9	Chlorpyrifos	I	1				0									0				1	1
10	Copper hydroxide	F	2			1	1									0		1	1		1
11	Cypermethrin	I	1				0									0				1	1
12	Cyproconazole	F	1				0							1		1					0
13	Diafenthiuron	I	1				0									0				1	1
14	Diazinon	I	2				0				1					1				1	1
15	Diuron	H	1				0				1					1					0
16	Diquat dibromide	H	1			1	1									0					0
17	Emamectin benzoate	I	1				0									0					1
18	Fenoxycarb	I	2				0					1				1				1	1
19	Fentin hydroxide	F	2			1	1					1			1	1					0
20	Flubendiamide	I	1				0									0		1	1		1
21	Glyphosate	H	1				0				1					1					0
22	Hexythiazox	I	1				0					1				1					0
23	Imidacloprid	I	1				0									0				1	1
24	Isopyrazam	F	2				0					1				1		1	1		1
25	Lambda-cyhalothrin	I	3			1	1								1	1				1	1
26	Lufenuron	I	1				0									0	1	1	1		1
27	Mancozeb	F	1				0					1			1	1					0
28	Methidathion	I	2		1		1									0				1	1
29	Metribuzin	H	1				0								1	1					0
30	Monocrotophos	I	2		1	1	1									0				1	1
31	Oxyfluorfen	H	1				0					1				1					0
32	Paraffin/mineral oils	H	1				0			1						1					0
33	Paraquat dichloride	H	1			1	1									0					0
34	Permethrin	I	2				0					1				1				1	1
35	Pirimicarb	I	2				0					1				1		1	1		1
36	Pirimiphos-methyl	I	1				0									0				1	1
37	Profenophos	I	1				0									0				1	1
38	Propiconazole	F	1				0						1			1					0
39	Pymetrozine	I	1				0					1				1					0
40	Tefluthrin	I	2		1		1									0				1	1
41	Terbutryn	H	1				0								1	1					0
42	Thiametoxam	I	1				0									0				1	1

Annex 3

PAN International List of Highly Hazardous Pesticides – March 2019

					Group 1 Acute toxicity				Group 2 Long term effects									Group 3 Environmental toxicity					Group 4 Conventions				
	CAS number	Pesticide	Grouped	Sumo f max = 1 in Groups 1–4	WHO 1a	WHO 1b	H33pl	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	Very bio acc	Very pers water, soil	Very toxic to aq. organism	Highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
					28	49	50	103	1	3	13	7	70	4	30	55	141	22	18	30	116	148	1	32		9	36
1	542-75-6	1,3-dichloropropene		1				0					1				1					0					0
2	94-82-6	2,4-DB		1				0								1	1					0					0
3	71751-41-2	Abamectin		2			1	1									0				1	1					0
4	30560-19-1	Acephate		1				0									0				1	1					0
5	34256-82-1	Acetochlor		1				0								1	1					0					0
6	101007-06-1	Acrinathrin		1				0									0				1	1					0
7	107-02-8	Acrolein		1		1	1	1									0					0					0
8	15972-60-8	Alachlor		2				0								1	1					0		1			1
9	83130-01-2	Alanycarb		1				0									0				1	1					0
10	116-06-3	Aldicarb		3	1		1	1									0				1	1		1			1
11	319-84-6	Alpha-BHC; alpha-HCH		1				0									0					0				1	1
12	96-24-2	Alpha-chlorohydrin		1		1		1									0					0					0
13	20859-73-8	Aluminum phosphide		2			1	1									0				1	1					0
14	348635-87-0	Amisulbrom		1				0									0		1	1		1					0
15	61-82-5	Amitrole		1				0								1	1					0					0
16	90640-80-5	Anthracene oil		1				0			1						1					0					0
17	84-65-1	Anthraquinone		1				0					1		1		1					0					0
18	for CAS number see list of grouped pesticides	Arsen and its compounds	x	1				0	1	1	1						1					0					0
19	1912-24-9	Atrazine		1				0								1	1					0					0
20	68049-83-2	Azafenidin		1				0							1		1					0					0
21	35575-96-3	Azamethiphos		1				0									0				1	1					0
22	2642-71-9	Azinphos-ethyl		2		1		1									0				1	1					0
23	86-50-0	Azinphos-methyl		3		1	1	1									0				1	1		1			1
24	41083-11-8	Azocyclotin		2			1	1									0	1		1		1					0
25	22781-23-3	Bendiocarb		1				0									0				1	1					0
26	82560-54-1	Benfuracarb		1				0									0				1	1					0
27	17804-35-2	Benomyl		2				0						1	1		1					0		1	X		1
28	741-58-2	Bensulide		1				0									0				1	1					0
29	177406-68-7	Benthiavalicarb-isopropyl		1				0					1				1					0					0
30	68359-37-5	Beta-cyfluthrin; cyfluthrin		2		1	1	1									0				1	1					0
31	319-85-7	Beta-HCH; beta-BCH		2				0								1	1					0				1	1
32	82657-04-3	Bifenthrin		2				0								1	1				1	1					0
33	28434-01-7	Bioresmethrin		1				0									0				1	1					0
34	2079-00-7	Blasticidin-S		1		1		1									0					0					0
35	1303-96-4	Borax; borate salts		1				0							1		1					0					0
36	10043-35-3	Boric acid		1				0							1	1	1					0					0
37	56073-10-0	Brodifacoum		2	1		1	1							1		1					0					0
38	28772-56-7	Bromadiolone		2	1		1	1							1		1					0					0

					Group 1 Acute toxicity				Group 2 Long term effects									Group 3 Environmental toxicity					Group 4 Conventions				
	CAS number	**Pesticide**	**Grouped**	**Sumo f max = 1 in Groups 1–4**	WHO 1a	WHO 1b	H33pl	**max = 1**	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	**max = 1**	Very bio acc	Very pers water, soil	Very toxic to aq. organism	Highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
39	63333-35-7	Bromethalin		2	1			**1**									**0**	1		1		**1**					**0**
40	1689-84-5	Bromoxynil		1			1	**1**									**0**					**0**					**0**
41	56634-95-8	Bromoxynil heptanoate		1				**0**									**0**	1		1		**1**					**0**
42	1689-99-2	Bromoxynil octanoate		1				**0**									**0**	1		1		**1**					**0**
43	23184-66-9	Butachlor		1				**0**					1				**1**					**0**					**0**
44	34681-10-2	Butocarboxim		1				**0**									**0**				1	**1**					**0**
45	34681-23-7	Butoxycarboxim		1		1		**1**									**0**					**0**					**0**
46	95465-99-9	Cadusafos		2		1		**1**									**0**		1	1	1	**1**					**0**
47	2425-06-1	Captafol		3	1			**1**			1	1	1				**1**					**0**		**1**			**1**
48	592-01-8	Calcium cyanide		1	1			**1**									**0**					**0**					**0**
49	63-25-2	Carbaryl		2				**0**					1			1	**1**				1	**1**					**0**
50	10605-21-7	Carbendazim		1				**0**						1	1		**1**					**0**					**0**
51	16118-49-3	Carbetamide		2				**0**							1		**1**					**0**		**1**			**1**
52	1563-66-2	Carbofuran		3		1	1	**1**									**0**				1	**1**		**1**	**X**		**1**
53	55285-14-8	Carbosulfan		3			1	**1**									**0**				1	**1**		**1**	**C**PIC		**1**
54	2439-01-2	Chinomethionat; oxythioquinox		1				**0**					1				**1**					**0**					**0**
55	500008-45-7	Chlorantraniliprole		1				**0**									**0**		1	1		**1**					**0**
56	57-74-9	Chlordane		3				**0**					1			1	**1**	1				**1**		**1**		**1**	**1**
57	54593-83-8	Chlorethoxyphos		2	1			**1**									**0**				1	**1**					**0**
58	122453-73-0	Chlorfenapyr		1				**0**									**0**				1	**1**					**0**
59	470-90-6	Chlorfenvinphos		2		1		**1**									**0**				1	**1**					**0**
60	71422-67-8	Chlorfluazuron		1				**0**									**0**	1		1		**1**					**0**
61	24934-91-6	Chlormephos		1	1			**1**									**0**					**0**					**0**
62	67-66-3	Chloroform		1				**0**					1				**1**					**0**					**0**
63	3691-35-8	Chlorophacinone		1	1			**1**									**0**					**0**					**0**
64	120-32-1	Chlorophene; 2-benzyl-4-chlorophenol		1				**0**								1	**1**					**0**					**0**
65	76-06-2	Chloropicrin		1			1	**1**									**0**					**0**					**0**
66	1897-45-6	Chlorothalonil		2			1	**1**					1				**1**					**0**					**0**
67	15545-48-9	Chlorotoluron		1				**0**								1	**1**					**0**					**0**
68	2921-88-2	Chlorpyrifos		1				**0**									**0**				1	**1**					**0**
69	5598-13-0	Chlorpyrifos-methyl		1				**0**									**0**				1	**1**					**0**
70	38083-17-9	Climbazole		1				**0**									**0**				1	**1**					**0**
71	210880-92-5	Clothianidin		1				**0**									**0**				1	**1**					**0**
72	20427-59-2	Copper (II) hydroxide		2			1	**1**									**0**		1	1		**1**					**0**
73	56-72-4	Coumaphos		2		1	1	**1**							1		**1**					**0**					**0**
74	5836-29-3	Coumatetralyl		2		1	1	**1**							1		**1**					**0**					**0**
75	8001-58-9	Creosote		1				**0**			1	1	1				**1**					**0**					**0**
76	420-04-2	Cyanamide; hydrogen cyanamide		1				**0**								1	**1**					**0**					**0**
77	68085-85-8	Cyhalothrin		1				**0**									**0**				1	**1**					**0**
78	76703-62-3	Cyhalothrin, gamma		1				**0**									**0**				1	**1**					**0**
79	13121-70-5	Cyhexatin		1				**0**									**0**	1		1		**1**					**0**
80	52315-07-8	Cypermethrin		1				**0**									**0**				1	**1**					**0**
81	67375-30-8	Cypermethrin, alpha		1				**0**									**0**				1	**1**					**0**
82	65731-84-2	Cypermethrin, beta		1				**0**									**0**				1	**1**					**0**
83	94361-06-5	Cyproconazole		1				**0**							1		**1**					**0**					**0**
84	1596-84-5	Daminozide		1				**0**					1				**1**					**0**					**0**
85	50-29-3	DDT		3				**0**					1			1	**1**		1	1		**1**		**1**		**1**	**1**
86	52918-63-5	Deltamethrin		2				**0**								1	**1**				1	**1**					**0**
87	919-86-8	Demeton-S-methyl		2		1		**1**									**0**				1	**1**					**0**
88	80060-09-9	Diafenthiuron		1				**0**									**0**				1	**1**					**0**
89	333-41-5	Diazinon		2				**0**				1					**1**				1	**1**					**0**
90	62-73-7	Dichlorvos; DDVP		2		1	1	**1**									**0**				1	**1**					**0**

					Group 1 Acute toxicity				Group 2 Long term effects									Group 3 Environmental toxicity					Group 4 Conventions				
	CAS number	Pesticide	Grouped	Sumo f max = 1 in Groups 1–4	WHO 1a	WHO 1b	H33pl	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	Very bio acc	Very pers water, soil	Very toxic to aq. organism	Highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
91	51338-27-3	Diclofop-methyl		1				0					1				1					0					0
92	115-32-2	Dicofol		1				0									0								CPOP	1	1
93	141-66-2	Dicrotophos		2		1		1									0				1	1					0
94	56073-07-5	Difenacoum		2	1			1									0	1				1					0
95	104653-34-1	Difethialone		2	1		1	1							1		1					0					0
96	60-51-5	Dimethoate		1				0									0				1	1					0
97	149961-52-4	Dimoxystrobin		2				0								1	1		1	1		1					0
98	39300-45-3	Dinocap		1				0							1		1					0					0
99	165252-70-0	Dinotefuran		1				0									0				1	1					0
100	1420-07-1	Dinoterb		2		1		1							1		1					0					0
101	82-66-6	Diphacinone		1	1			1									0					0					0
102	85-00-7	Diquat dibromide		1			1	1									0					0					0
103	4032-26-2	Diquat dichloride		1			1	1									0					0					0
104	298-04-4	Disulfoton		1	1			1									0					0					0
105	330-54-1	Diuron		1				0					1				1					0					0
106	for CAS number see list of grouped pesticides	DNOC and its salts	x	2		1	1	1									0					0		1			1
107	17109-49-8	Edifenphos		1		1		1									0					0					0
108	155569-91-8	Emamectin benzoate		1				0									0		1	1	1	1					0
109	115-29-7	Endosulfan		2			1	1									0					0		1		1	1
110	297-99-4	E-Phosphamidon		1	1			1									0					0					0
111	106-89-8	Epichlorohydrin		1				0			1	1	1			1	1					0					0
112	2104-64-5	EPN		2	1			1									0				1	1					0
113	133855-98-8	Epoxiconazole		1				0					1		1	1	1					0					0
114	66230-04-4	Esfenvalerate		1				0									0				1	1					0
115	29973-13-5	Ethiofencarb		1		1		1									0					0					0
116	23947-60-6	Ethirimol		1				0									0				1	1					0
117	13194-48-4	Ethoprophos; Ethoprop		2	1		1	1					1				1					0					0
118	106-93-4	Ethylene dibromide; 1,2-dibromoethane		2				0			1	1	1			1	1					0		1			1
119	107-06-2	Ethylene dichloride; 1,2-dichloroethane		2				0			1		1				1					0		1			1
120	75-21-8	Ethylene oxide		2				0		1	1			1			1					0		1			1
121	96-45-7	Ethylene thiourea		1				0					1		1	1	1					0					0
122	80844-07-1	Etofenprox; Ethofenprox		1				0									0		1	1	1	1					0
123	52-85-7	Famphur		1		1		1									0					0					0
124	22224-92-6	Fenamiphos		2		1	1	1									0				1	1					0
125	60168-88-9	Fenarimol		1				0								1	1					0					0
126	120928-09-8	Fenazaquin		1				0									0				1	1					0
127	13356-08-6	Fenbutatin-oxide		2			1	1									0		1	1		1					0
128	103112-35-2	Fenchlorazole-ethyl		1				0			1						1					0					0
129	122-14-5	Fenitrothion		2				0								1	1				1	1					0
130	72490-01-8	Fenoxycarb		2				0					1				1				1	1					0
131	39515-41-8	Fenpropathrin		2			1	1									0				1	1					0
132	134098-61-6	Fenpyroximate		1			1	1									0					0					0
133	55-38-9	Fenthion/Fenthion >640g/L		2				0									0				1	1		1	CF		1
134	900-95-8	Fentin acetate; Triphenyltin acetate		2			1	1								1	1					0					0
135	76-87-9	Fentin hydroxide; Triphenyltin hydroxide		2			1	1					1			1	1					0					0
136	51630-58-1	Fenvalerate		1				0									0				1	1					0
137	120068-37-3	Fipronil		1				0									0				1	1					0

	CAS number	Pesticide	Grouped	Sumo f max = 1 in Groups 1–4	Group 1 Acute toxicity				Group 2 Long term effects									Group 3 Environmental toxicity					Group 4 Conventions				
					WHO 1a	WHO 1b	H33pl	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	Very bio acc	Very pers water, soil	Very toxic to aq. organism	Highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
138	90035-08-8	Flocoumafen		2	1		1	1							1		1					0					0
139	69806-50-4	Fluazifop-butyl		1				0							1		1					0					0
140	174514-07-9	Fluazolate		1				0									0	1		1		1					0
141	272451-65-7	Flubendiamide		1				0									0		1	1		1					0
142	70124-77-5	Flucythrinate		2		1		1									0				1	1					0
143	101463-69-8	Flufenoxuron		1				0									0	1		1		1					0
144	62924-70-3	Flumetralin		1				0									0	1		1		1					0
145	103361-09-7	Flumioxazin		1				0							1		1					0					0
146	640-19-7	Fluoroacetamide		2		1		1									0					0		1			1
147	951659-40-8	Flupyradifurone		1				0									0				1	1					
148	85509-19-9	Flusilazole		1				0							1		1					0					0
149	117337-19-6	Fluthiacet-methyl		1				0					1				1					0					0
150	133-07-3	Folpet		1				0					1				1					0					0
151	50-00-0	Formaldehyde		1				0		1			1				1					0					0
152	22259-30-9	Formetanate		2		1	1	1									0				1	1					0
153	98886-44-3	Fosthiazate		1				0									0				1	1					0
154	65907-30-4	Furathiocarb		1		1	1	1									0					0					0
155	121776-33-8	Furilazole		1				0					1				1					0					0
156	77182-82-2	Glufosinate-ammonium		1				0							1		1					0					0
157	for CAS number see list of grouped pesticides	Glyphosate	x	1				0				1					1					0					0
158	111872-58-3	Halfenprox		1				0									0	1		1		1					0
159	69806-40-2	Haloxyfop-methyl (unstated stereochemistry)		1				0					1				1					0					0
160	23560-59-0	Heptenophos		2		1		1									0				1	1					0
161	118-74-1	Hexachlorobenzene		4	1			1			1		1			1	1	1				1		1		1	1
162	86479-06-3	Hexaflumuron		1				0									0				1	1					0
163	608-73-1	Hexchlorocyclohexane; BHC mixed isomers		2				0					1			1	1					0		1			1
164	78587-05-0	Hexythiazox		1				0					1				1					0					0
165	74-90-8	Hydrogen cyanide		1			1	1									0					0					0
166	35554-44-0	Imazalil		1				0					1				1					0					0
167	138261-41-3	Imidacloprid		1				0									0				1	1					0
168	72963-72-5	Imiprothrin		1				0									0				1	1					0
169	173584-44-6	Indoxacarb		1				0									0				1	1					0
170	1689-83-4	Ioxynil		1				0								1	1					0					0
171	36734-19-7	Iprodione		1				0					1				1					0					0
172	140923-17-7	Iprovalicarb		1				0					1				1					0					0
173	881685-58-1	Isopyrazam		2				0					1				1		1	1		1					0
174	141112-29-0	Isoxaflutole		1				0					1				1					0					0
175	18854-01-8	Isoxathion		2		1		1									0				1	1					0
176	143390-89-0	Kresoxim-methyl		1				0					1				1					0					0
177	91465-08-6	Lambda-cyhalothrin		3			1	1								1	1				1	1					0
178	58-89-9	Lindane		3				0								1	1				1	1		1		1	1
179	330-55-2	Linuron		1				0							1	1	1					0					0
180	103055-07-8	Lufenuron		1				0									0	1	1	1		1					0
181	12057-74-8	Magnesium phosphide		1			1	1									0					0					0
182	121-75-5	Malathion		2				0				1					1				1	1					0
183	8018-01-7	Mancozeb		1				0					1			1	1					0					0
184	12427-38-2	Maneb		1				0					1			1	1					0					0
185	2595-54-2	Mecarbam		1		1		1									0					0					0
186	110235-47-7	Mepanipyrim		1				0					1				1					0					0

					Group 1 Acute toxicity				Group 2 Long term effects									Group 3 Environmental toxicity					Group 4 Conventions				
	CAS number	**Pesticide**	**Grouped**	**Sumo f max = 1 in Groups 1–4**	WHO 1a	WHO 1b	H33pl	**max = 1**	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	**max = 1**	Very bio acc	Very pers water, soil	Very toxic to aq. organism	Highly toxic bees	**max = 1**	Montr Prot	PIC	See note below the table	POP	**max = 1**
187	for CAS number see list of grouped pesticides	Mercury and its compounds	x	2			1	**1**									**0**					**0**		**1**			**1**
188	139968-49-3	Metaflumizone		1				**0**									**0**	1	1		1	**1**					**0**
189	137-41-7	Metam-potassium		1				**0**					1				**1**					**0**					**0**
190	137-42-8	Metam-sodium		1				**0**					1			1	**1**					**0**					**0**
191	18691-97-9	Methabenzthiazuron		1				**0**									**0**				1	**1**					**0**
192	10265-92-6	Methamidophos		3		1	1	**1**									**0**				1	**1**		**1**	**X**		**1**
193	950-37-8	Methidathion		2		1		**1**									**0**				1	**1**					**0**
194	2032-65-7	Methiocarb		2		1		**1**									**0**				1	**1**					**0**
195	16752-77-5	Methomyl		2		1		**1**									**0**				1	**1**					**0**
196	72-43-5	Methoxychlor		1				**0**								1	**1**					**0**					**0**
197	74-83-9	Methyl bromide		1				**0**									**0**					**0**	**1**				**1**
198	9006-42-2	Metiram		1				**0**					1			1	**1**					**0**					**0**
199	21087-64-9	Metribuzin		1				**0**								1	**1**					**0**					**0**
200	7786-34-7	Mevinphos		2	1			**1**									**0**				1	**1**					**0**
201	51596-10-2	Milbemectin		1				**0**									**0**				1	**1**					**0**
202	2212-67-1	Molinate		1				**0**								1	**1**					**0**					**0**
203	71526-07-3	MON 4660; AD 67		1				**0**					1				**1**					**0**					**0**
204	6923-22-4	Monocrotophos		3		1	1	**1**									**0**				1	**1**		**1**			**1**
205	300-76-5	Naled		1				**0**									**0**				1	**1**					**0**
206	54-11-5	Nicotine		1		1	1	**1**									**0**					**0**					**0**
207	150824-47-8	Nitenpyram		1				**0**									**0**				1	**1**					**0**
208	98-95-3	Nitrobenzene		1				**0**							1	1	**1**					**0**					**0**
209	121451-02-3	Noviflumuron		1				**0**					1				**1**					**0**					**0**
210	1113-02-6	Omethoate		3		1		**1**								1	**1**				1	**1**					**0**
211	19044-88-3	Oryzalin		1				**0**					1				**1**					**0**					**0**
212	19666-30-9	Oxadiazon		1				**0**					1				**1**					**0**					**0**
213	23135-22-0	Oxamyl		2		1	1	**1**									**0**				1	**1**					**0**
214	301-12-2	Oxydemeton-methyl		2		1		**1**									**0**				1	**1**					**0**
215	42874-03-3	Oxyfluorfen		1				**0**					1				**1**					**0**					**0**
216	64741-88-4	Paraffin oils; mineral oils	x	1				**0**			1						**1**					**0**					**0**
217	1910-42-5	Paraquat dichloride/Paraquat dichloride >276g/l		2			1	**1**									**0**					**0**		**1**	**CF**		**1**
218	56-38-2	Parathion		3	1			**1**									**0**				1	**1**		**1**			**1**
219	298-00-0	Parathion-methyl		2	1		1	**1**									**0**					**0**		**1**	**X**		**1**
220	87-86-5	PCP; Pentachlorphenol		3		1	1	**1**					1			1	**1**					**0**		**1**			**1**
221	40487-42-1	Pendimethalin		1				**0**									**0**	1	1			**1**					**0**
222	52645-53-1	Permethrin		2				**0**					1				**1**				1	**1**					**0**
223	2597-03-7	Phenthoate		1				**0**									**0**				1	**1**					**0**
224	298-02-2	Phorate		2	1			**1**									**0**				1	**1**					**0**
225	732-11-6	Phosmet		1				**0**									**0**				1	**1**					**0**
226	13171-21-6	Phosphamidon		3	1			**1**									**0**				1	**1**		**1**	**X**		**1**
227	7803-51-2	Phosphine		1			1	**1**									**0**					**0**					**0**
228	1918-02-1	Picloram		1				**0**								1	**1**					**0**					**0**
229	23103-98-2	Pirimicarb		2				**0**					1				**1**		1	1		**1**					**0**
230	29232-93-7	Pirimiphos-methyl		1				**0**									**0**				1	**1**					**0**
231	299-45-6	Potasan		1			1	**1**									**0**					**0**					**0**
232	23031-36-9	Prallethrin		1				**0**									**0**				1	**1**					**0**
233	32809-16-8	Procymidone		1				**0**					1			1	**1**					**0**					**0**
234	41198-08-7	Profenofos		1				**0**									**0**				1	**1**					**0**
235	139001-49-3	Profoxydim		1				**0**								1	**1**					**0**					**0**

	CAS number	Pesticide	Grouped	Sumo f max = 1 in Groups 1–4	Group 1 Acute toxicity: WHO 1a	WHO 1b	H33pl	max = 1	Group 2 Long term effects: EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	Group 3 Environmental toxicity: Very bio acc	Very pers water, soil	Very toxic to aq. organism	Highly toxic bees	max = 1	Group 4 Conventions: Montr Prot	PIC	See note below the table	POP	max = 1
236	1918-16-7	Propachlor		1				**0**					1				**1**					**0**					**0**
237	2312-35-8	Propargite		2				**0**					1				**1**	1		1		**1**					**0**
238	31218-83-4	Propetamphos		1		1		**1**									**0**					**0**					**0**
239	60207-90-1	Propiconazole		1				**0**							1		**1**					**0**					**0**
240	12071-83-9	Propineb		1				**0**					1				**1**					**0**					**0**
241	114-26-1	Propoxur		2				**0**					1				**1**				1	**1**					**0**
242	75-56-9	Propylene oxide, Oxirane		1				**0**			1		1	1			**1**					**0**					**0**
243	34643-46-4	Prothiofos		1				**0**									**0**	1		1		**1**					**0**
244	123312-89-0	Pymetrozine		1				**0**					1				**1**					**0**					**0**
245	77458-01-6	Pyraclofos		1				**0**									**0**				1	**1**					**0**
246	129630-19-9	Pyraflufen-ethyl		1				**0**					1				**1**					**0**					**0**
247	6814-58-0	Pyrazachlor		1				**0**					1				**1**					**0**					**0**
248	13457-18-6	Pyrazophos		1				**0**									**0**				1	**1**					**0**
249	108-34-9	Pyrazoxon		1			1	**1**									**0**					**0**					**0**
250	96489-71-3	Pyridaben		1				**0**									**0**				1	**1**					**0**
251	179101-81-6	Pyridalyl		1				**0**									**0**	1	1	1		**1**					**0**
252	119-12-0	Pyridiphenthion		1				**0**									**0**				1	**1**					**0**
253	13593-03-8	Quinalphos		2				**0**								1	**1**				1	**1**					**0**
254	2797-51-5	Quinoclamine		1				**0**									**0**				1	**1**					**0**
255	148-24-3	Quinolin-8-ol; 8-hydroxy-quinoline		1				**0**							1		**1**					**0**					**0**
256	124495-18-7	Quinoxyfen		1				**0**									**0**	1		1		**1**					**0**
257	119738-06-6	Quizalofop-p-tefuryl		1				**0**								1	**1**					**0**					**0**
258	10453-86-8	Resmethrin		2				**0**					1			1	**1**				1	**1**					**0**
259	83-79-4	Rotenone		1				**0**									**0**				1	**1**					**0**
260	105024-66-6	Silafluofen		2				**0**							1		**1**				1	**1**					**0**
261	143-33-9	Sodium cyanide		1		1		**1**									**0**					**0**					**0**
262	62-74-8	Sodium fluoroacetate (1080)		1	1		1	**1**									**0**					**0**					**0**
263	187166-15-0	Spinetoram		1				**0**									**0**				1	**1**					**0**
264	168316-95-8	Spinosad		1				**0**									**0**				1	**1**					**0**
265	148477-71-8	Spirodiclofen		1				**0**			1		1				**1**					**0**					**0**
266	57-24-9	Strychnine		1		1		**1**									**0**					**0**					**0**
267	4151-50-2	Sulfluramid		1				**0**									**0**					**0**		1		1*	**1**
268	3689-24-5	Sulfotep		1	1			**1**									**0**					**0**					**0**
269	946578-00-3	Sulfoxaflor		1				**0**									**0**				1	**1**					**0**
270	21564-17-0	TCMTB		1			1	**1**									**0**					**0**					**0**
271	96182-53-5	Tebupirimifos		2	1			**1**									**0**		1	1		**1**					**0**
272	79538-32-2	Tefluthrin		2		1	1	**1**									**0**				1	**1**					**0**
273	3383-96-8	Temephos		1				**0**									**0**				1	**1**					**0**
274	149979-41-9	Tepraloxydim		1				**0**								1	**1**					**0**					**0**
275	13071-79-9	Terbufos		1	1			**1**									**0**					**0**					**0**
276	886-50-0	Terbutryn		1				**0**								1	**1**					**0**					**0**
277	2593-15-9	Terrazole; Etridiazole		1				**0**					1				**1**					**0**					**0**
278	22248-79-9	Tetrachlorvinphos		2				**0**					1				**1**				1	**1**					**0**
279	112281-77-3	Tetraconazole		1				**0**					1				**1**					**0**					**0**
280	7696-12-0	Tetramethrin		1				**0**									**0**				1	**1**					**0**
281	111988-49-9	Thiacloprid		1				**0**					1		1		**1**					**0**					**0**
282	153719-23-4	Thiametoxam		1				**0**									**0**				1	**1**					**0**
283	59669-26-0	Thiodicarb		2				**0**					1				**1**				1	**1**					**0**
284	39196-18-4	Thiofanox		2		1		**1**									**0**				1	**1**					**0**

					Group 1 Acute toxicity				Group 2 Long term effects									Group 3 Environmental toxicity					Group 4 Conventions				
	CAS number	Pesticide	Grouped	Sumo f max = 1 in Groups 1–4	WHO 1a	WHO 1b	H33pl	max = 1	EPA carc	IARC carc	EU GHS carc (1A, 1B)	IARC prob carc	EPA likel carc	EU GHS muta (1A, 1B)	EU GHS repro (1A, 1B)	EU EDC (1) or C2 & R2 GHS	max = 1	Very bio acc	Very pers water, soil	Very toxic to aq. organism	Highly toxic bees	max = 1	Montr Prot	PIC	See note below the table	POP	max = 1
285	640-15-3	Thiometon		2		1		**1**									**0**				1	**1**					**0**
286	23564-05-8	Thiophanate-methyl		1				**0**					1				**1**					**0**					**0**
287	62-56-6	Thiourea		1				**0**								1	**1**					**0**					**0**
288	137-26-8	Thiram in formulations with benomyl and carbofuran		2				**0**								1	**1**					**0**		**1**	**X**		**1**
289	330459-31-9	Tioxazafen		1				**0**					1				**1**					**0**					**0**
290	129558-76-5	Tolfenpyrad		1				**0**									**0**	1		1		**1**					**0**
291	731-27-1	Tolylfluanid		2			1	**1**					1				**1**					**0**					**0**
292	66841-25-6	Tralomethrin		1				**0**									**0**				1	**1**					**0**
293	55219-65-3	Triadimenol		1				**0**							1		**1**					**0**					**0**
294	2303-17-5	Tri-allate		1				**0**									**0**		1	1		**1**					**0**
295	24017-47-8	Triazophos		1		1		**1**									**0**					**0**					**0**
296	for CAS number see list of grouped pesticides	Tributyltin compounds	x	2				**0**								1	**1**					**0**		**1**			**1**
297	52-68-6	Trichlorfon		3				**0**								1	**1**				1	**1**		**1**			**1**
298	81412-43-3	Tridemorph		1				**0**							1		**1**					**0**					**0**
299	99387-89-0	Triflumizole		1				**0**							1		**1**					**0**					**0**
300	1582-09-8	Trifluralin		2				**0**								1	**1**	1				**1**					**0**
301	37248-47-8	Validamycin		1				**0**									**0**				1	**1**					**0**
302	2275-23-2	Vamidothion		2		1		**1**									**0**				1	**1**					**0**
303	50471-44-8	Vinclozolin		1				**0**							1	1	**1**					**0**					**0**
304	81-81-2	Warfarin		2		1	1	**1**							1		**1**					**0**					**0**
305	2655-14-3	XMC		1				**0**									**0**				1	**1**					**0**
306	52315-07-8z	zeta-Cypermethrin		2		1		**1**									**0**				1	**1**					**0**
307	1314-84-7	Zinc phosphide		1		1		**1**									**0**					**0**					**0**
308	12122-67-7	Zineb		1				**0**								1	**1**					**0**					**0**
309	137-30-4	Ziram		1			1	**1**									**0**					**0**					**0**
310	23783-98-4	Z-Phosphamidon		0	1			**0**									**0**					**0**					**0**

X: Annex III of the Rotterdam Convention includes certain specific formulations.
CF: Formulations at or above the specified concentration have been agreed by the Rotterdam COP to meet the criteria for listing, but are not yet formally listed
CPIC: agreed by the PIC Convention's Chemical Review Committee and the Conference of the Parties as meeting the criteria of the Convention but yet not formally listed
CPOP: agreed by the POPs Chemical Review Committee and the Conference of the Parties as meeting the criteria of the Stockholm Convention but yet not formally listed

* Although sulfluramid is not specially listed under the Stockholm Convention it is regarded by the Stockholm COP as being listed because it is derived from and breaks down into substances that are listed (PFOS and salts).

Endnotes

1 Active ingredients are the chemicals in pesticides that kill, control or repel pests. They represent only a portion of the whole formulated pesticide. Active ingredients are generally mixed with solvents, adjuvants or surfactants in order to make them work more effectively. All volumes mentioned in this report refer to pesticide active ingredients. For the source of the three million tonnes, see US EPA, 2017, "Pesticides Industry Sales and Usage 2008–2012 Market Estimates", Ag Professional, 2018, Study shows global pesticide market to reach USD 81 billion in five years, Phillips McDougall, 2017, Growing importance of China and India in the global crop protection market

2 The figure of the share of the top 4 companies is based on 2017 sales – at a time Bayer had not yet completed its acquisition of Monsanto. Yet it can be assumed that the joint share of the top 4 will be about the same as the share of the top 5 in 2017 since most divestments Bayer was requested to make as part of its acquisition of Monsanto were sold to BASF. See Agrow, 2018, Top 20 and Agrow, 2018, Global crop protection market up 3 percent in 2017.

3 We are using the World Bank classification, which assigns the world's economies into four income groups – high, upper-middle, lower-middle, and low – based on GNI per capita. 137 countries make up the category of low and middle income countries (LMICs) according to the World Bank. See World Bank Country and Lending Groups.

4 81 countries are currently classified by the World Bank as high-income countries. See World Bank Country and Lending Groups. For the source of the 75% of use in high income countries in 1990 see for example World Health Organization, 1990, Public health impact of pesticides used in agriculture, p. 30

5 US EPA, 1992, "Pesticides Industry Sales and Usage – 1990 and 1991 Market Estimates"

6 See Phillips McDougall, 2017, "The Global Agrochemical Market Trends by Crop", Kleffmann Group, 2016, "Crop Protection Market & Trends – APAC", or Pretty and Bharucha, 2015, "Integrated Pest Management for Sustainable Intensification of Agriculture in Asia and Africa"

7 Pesticide use was about 60,000 tonnes in 1990 and 540,000 tonnes in 2017. See Porto and Soares, 2011, "Development model, pesticides, and health: a panorama of the Brazilian agricultural reality and proposals for an innovative research agenda" and IBAMA, 2017, "Boletins anuais de produção, importação, exportação e vendas de agrotóxicos no Brasil"

8 This is an estimate based on the best official country statistics and industry data available today. Brazil used 540,000 tonnes of active ingredients in 2017. See IBAMA, 2017, "Boletins anuais de produção, importação, exportação e vendas de agrotóxicos no Brasil". There are no official statistics about pesticide use in Argentina but industry sources place it at over 300,000 tonnes in 2016. See Agronews, 2016, "Market Insights in Argentine Agriculture". In China, the National Bureau of Statistics only publishes statistics in terms of volume of formulated product. But industry sources place annual consumption at over 300,000 tonnes of active ingredients in 2017. See Agronews, 2018, "ATESC total pesticide demand in 2018 will be stable and decline a little in China"

9 The Green Revolution was an effort to increase agricultural production via a package of industrial agriculture technologies, such as hybrid seeds, fertilizers, pesticides and irrigation.

10 This report primarily focuses on the adverse health effects of pesticides on humans. But it is clear that pesticides also affect the environment.

11 See 2017, UNHRC, Report of the Special Rapporteur on the Right to Food, p. 3–4

12 See 2017, UNHRC, Report of the Special Rapporteur on the Right to Food, p. 16

13 Many foods contain low levels of residue of multiple pesticides. Pesticide residues were detected in 85% of food samples tested by the USDA in 2015. One sample of strawberries contained residues of 20 pesticides. In the EU pesticide residues were detected in 47 % of food samples tested in 2015. The Swiss Federal Institute of Aquatic Science and Technology found that Swiss watercourses were contaminated with 128 different agricultural chemicals. A 2014 US Geological Survey found pesticides in 75% of air and rain samples. Another study showed that much of the precipitation in Europe contains such high levels of dissolved pesticides that it would be illegal to supply it as drinking water. On pesticides in dust see for instance EU Commission, 2008, Indoor dust poses significant endocrine disruptor risk or Quiros-Alcala et al., 2011, Pesticides in house dust from urban and farmworker households in California: an observational measurement study

14 World Health Organization, 1990, Public health impact of pesticides used in agriculture.

15 Jeyaratnam, 1990, Acute pesticide poisoning: a major global health problem.

16 As the authors of the WHO/UNEP study warned, p. 89: "If, as expected, the use of chemical pesticides doubles in the next ten years in developing countries, and if agricultural practices continue to develop, it is likely that the number of cases of intentional and unintentional acute poisoning will increase accordingly".

17 The sources for Brazil, Argentina and China have already been provided. For the US the source is US EPA, 2017, "Pesticides Industry Sales and Usage 2008–2012 Market Estimates". The figure for the US is for 2012 because this is the latest official estimate available. However looking at trends during the early 2000s, pesticide use should have remained stable in the US since 2012. For the EU the source is Eurostat 2016.

18 WHO, 2016, "Preventing Disease Through Healthy Environment"

19 WHO said that chemicals, including pesticides, cause an estimated 193'000 death from unintentional poisoning annually, but did not provide any specific figures for pesticides only. Similarly, according to the International Labour Organization (ILO), at least 170'000 agricultural workers are killed each year and exposure to pesticides represents one of the major risks they face. But no figures are provided for the share of pesticides. See ILO, "Agriculture: A Hazardous Work"

20 PAN, 2015, "Communities in Peril"

21 See 2017, UNHRC, Report of the Special Rapporteur on the Right to Food, p. 4

22 WHO, 2016, "Preventing Disease Through Healthy Environment"

23 Landrigan et al., 2016, Health Consequences of Environmental Exposures: Changing Global Patterns of Exposure and Disease.

24 Mostafalou et al., 2013, Pesticides and human chronic diseases: evidences, mechanisms, and perspectives

25 Blair et al., 2015, Pesticides and Human Health, p. 1

26 Blair et al., 2015, Pesticides and Human Health, p. 2

27 Alavanja et al., 2004, Health effects of chronic pesticide exposure: cancer and neurotoxicity

28 U.S. President's Cancer Panel, 2010, Reducing Cancer Environmental Risk – What We Can Do, p. 45

29 See Trasande et al., 2016, Burden of disease and costs of exposure to endocrine disrupting chemicals in the European Union: an updated analysis

30 WHO and UNEP, 2012, State of the science of endocrine disrupting chemicals

31 See Trasande et al., 2016, Burden of disease and costs of exposure to endocrine disrupting chemicals in the European Union: an updated analysis

32 UNICEF, 2018, Understanding the Impacts of Pesticides on Children, p. 10

33 UNEP, 2017, Towards a Pollution-Free Planet

34 American Academy of Pediatrics, 2012, Pesticide Exposure in Children

35 Gillam, 2017, Whitewash, p. 70

36 Baskut Tuncak, interviewed by Public Eye on January 25, 2019.

37 The WHO classification is based primarily on the acute oral and dermal toxicity of a pesticide to rats and the so-called "LD50 value". The LD50 value is a statistical estimate of the number of mg of toxicant per kg of bodyweight required to kill 50% of a large population of test animals.

38 WHO, 2009, The WHO recommended classification of pesticides by hazard and guidelines to classification

39 United Nations, 2011, Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

40 See UNECE, GHS Implementation

41 WHO and FAO, 2016, Guidelines on Highly Hazardous Pesticides, p. vi

42 WHO, 2010, "Exposure to Highly Hazardous

Pesticides: A Major Public Health Concern"
43 FAO, 2006, Report of the Hundred and Thirty-first Session of the FAO Council, p. 13
44 FAO, 2006, Report of the Hundred and Thirty-first Session of the FAO Council, p. 13
45 See FAO, 2010, "Guidance on Pest and Pesticide Management Policy Development", p. 10
46 The reason is that, as FAO explains in the Guidance: "The impact of training in proper pesticide use continues to be questioned and can not be regarded as a solution for risks associated with the use of highly hazardous products, particularly in developing countries where large numbers of small-scale farmers would have access to these products. Poor small-scale farmers in particular, generally fail to adopt the use of necessary protective gear after training because of unavailability, costs or discomfort of its use in hot and humid climates. Furthermore, it often proves impossible to reach all potential pesticide users with training, or to restrict pesticide use to only those farmers trained in their use."
47 WHO and FAO, 2016, Guidelines on Highly Hazardous Pesticides, p. 15
48 ILO, 2010, Code of Practice on Safety and Health in Agriculture. See article 4.3.2: "Preventive and protective measures should be implemented in the following order of priority: eliminate or substitute the hazardous agent with a less hazardous one, such as a less hazardous chemical, or non-hazardous one."
49 See FAO and WHO, 2014, The International Code of Conduct on Pesticide Management. Among others, the Code requests the pesticide industry to make every reasonable effort to reduce risks posed by pesticides by making less toxic formulations available (article 5.2.4.1).
50 See Pretty, 2005, The Pesticide Detox– Towards a More Sustainable Agriculture, p. xiv.
51 Jules Pretty, interviewed by Public Eye on January 22, 2019.
52 Meriel Watts, interviewed by Public Eye on January 21, 2019.
53 See PAN International, 2015, Over 100 international health experts and toxicologists call for an end to the use of HHPs
54 PAN International, 2019, Appeal for a ban of highly hazardous pesticides
55 Baskut Tuncak, interviewed by Public Eye on January 25, 2019.
56 PAN International, 2015, PAN welcomes the ICCM resolution on highly hazardous pesticides
57 See 2017, UNHRC, Report of the Special Rapporteur on the Right to Food, p. 22
58 Meriel Watts, interviewed by Public Eye on January 21, 2019.
59 PAN International, 2018, Global Governance of Highly Hazardous Pesticides
60 For example, after Public Eye, ECCHR and PAN submitted a complaint providing evidence that Syngenta and Bayer were violating the International Code of Conduct on Pesticide Management when distributing highly hazardous pesticides in Punjab, India, the FAO/WHO Joint Meeting on Pesticide Management was unable to do anything to redress the situation, other than to "take note of the report", "support collaborating" and "encourage multi-stakeholder dialogue". See Public Eye, 2017, UN Experts fail to deliver assessment of Bayer and Syngenta compliance with the International Code of Conduct on Pesticide Management
61 UNEP, Strategic Approach to International Chemicals Management
62 See UNEP, Strategic Approach to International Chemicals Management, Global Plan of Action, p. 29
63 PAN International, 2018, Global Governance of Highly Hazardous Pesticides
64 See Stockholm Convention on Persistent Organic Pollutants (POPs) as amended in 2009
65 Nine pesticides were initially included in the Convention and seven new pesticides have been included subsequently
66 See Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, as amended in 2017.
67 There are currently a total of 50 chemicals listed in the Convention, including 34 pesticides.
68 FAO and WHO, 2007, Report of the 2007 Joint Meeting on Pesticide Management, p. 27
69 FAO and WHO, 2007, Report of the 2007 Joint Meeting on Pesticide Management, p. 28
70 PAN International, 2019, PAN International List of Highly Hazardous Pesticides, p. 13. See Annex 3.
71 See WHO and UNEP, 2012, State of the Science on Endocrine Disrupting Chemicals
72 PAN International, 2019, PAN International List of Highly Hazardous Pesticides. See Annex 3.
73 See FAO stats, Pesticide use.
74 For some countries pesticide use is reported in volumes of active ingredients and for others in volumes of formulated products. For instance for China FAO statistics indicate 1.77 million tonnes for 2016: these figures come from the Chinese Bureau of Statistics that publishes the statistic only in volumes of formulated products, while according to industry sources the volumes of active ingredients is about 300,000 tonnes. For some countries the data presented by FAO does not correspond to what the country itself indicates in its annual reports. For instance the US EPA indicates pesticide use was at 536,000 tonnes in 2012 but FAO statistics indicate 407,000 tonnes. For Brazil FAO statistics indicate 377,000 tonnes for 2016 while the official governmental agency in Brazil reports 540,000 tonnes.
75 In Switzerland, the Federal Office for Agriculture (FOA) has recently started publishing aggregated data on pesticide use in the country, share use by type (herbicides, fungicides and insecticides) and volumes for the ten most widely used substances. See FOA, 2018, Verkaufsstatistik von Pflanzenschutzmitteln in der Schweiz (Letzte Änderung 25.07.2018).
76 Phillips McDougall, AgrAspire Methodology Document
77 The Phillips McDougall data is not fully comprehensive in terms of its coverage of the global market. Yet it is considered the best data available today. The main markets are covered and the sample is considered representative of the entire market so that estimates on global sales by substances, volumes used in countries and the share of main companies can be derived.
78 Ibidem.
79 See US EPA, 2017, Pesticide Industry Sales and Usage; Phillips McDougall, 2018, Evolution of the Crop Protection Industry since 1960; or Phillips McDougall, 2016, The Cost of New Agrochemical Product Discovery
80 Phillips McDougall, AgrAspire Methodology Document
81 PAN International, 2019, PAN International List of Highly Hazardous Pesticides. See Annex 3.
82 See IARC, 2015, Glyphosate monograph; EFSA, 2015, Conclusion on the peer review of the pesticide risk assessment of the active substance glyphosate; and USEPA, 2017, EPA Releases Draft Risk Assessments for Glyphosate
83 It was revealed that dozens of pages of the risk assessment report used by European Food Safety Authority (EFSA) had been copied and pasted from a Monsanto study. Also, documents from a lawsuit against Monsanto in the US revealed that the company had been aware for decades of the carcinogenic risks of glyphosate. The "Monsanto papers" also showed the close links between Monsanto and the EU and US regulators, and how the company had tried to influence science by including ghost-written academic articles. On November 2017 EU member states voted to renew the approval of glyphosate for a shortened time period of five years.
84 See the Pflanzenschutzmittelverzeichnis for the active substance authorized for use in Switzerland and EU pesticide database for the substance authorized for use in the European Union.
85 Council Directive of 15 July 1991 on the Placing of Plant Protection Products on the Market
86 Pretty and Hine, 2005, "Pesticide Use and the Environment" in The Pesticide Detox – Towards a More Sustainable Agriculture
87 See Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market.
88 The cut-off criteria in the only apply to pesticides classified in categories 1A (known) or 1B (presumed).
89 See OFAG, 2017, Substances actives retirées de l'annexe 1 de l'OPPh
90 See CF, 2010, Ordonnance 916.161 sur la mise en circulation des produits phytosanitaires
91 About 400,000 tonnes are applied in the EU while worldwide use is about 3 million tonnes. See chapter 1.1.
92 Sale figures underestimate the share of HHP used in LMICs because the same products tend to be sold cheaper there than in HICs.
93 Peter Clausing, interviewed by Public Eye on January 22, 2019.
94 The Phillips McDougall data provides detailed information about pesticide sales by active ingredients and manufacturers for "only" 57 countries, including 35 low- and middle-income countries (LMICs). We are therefore not able to provide data for each and every LMIC. Yet the main pesticide markets in LMICs are covered.
95 We used FAO statistics on arable land and related it to HHP use in each country covered by the Phillips McDougall data. As the Phillips McDougall data does not provide the complete picture of pesticide use within countries – and the coverage might be better in some countries than in others – the figures provided in this graph for the intensity of HHP use should not be taken as exact estimates but rather as indicators of a common trend within LMICs as compared to the EU.
96 To calculate this share we related HHP use with pesticide use by volumes in all 57 countries covered by the Phillips McDougall data.
97 Bromadiolone, Cyfluthrin, Difenacoum, Ethoprophos, Fenamiphos, Formetanate, Methiocarb, Methomyl, Oxamyl, Tefluthrin, zeta-Cypermethrin, Zinc phosphide
98 Methomyl andTefluthrin
99 The following substances are authorized in both Switzerland and the EU: Chlorothalonil, Daminozide, Diuron, Epoxocinazole, Folpet, Haloxyfop-methyl, Hexythiazox, Imazalil, Iprovalicarb, Isoxaflutole, Kresoxim-methyl, Mancozeb, Mepanipyrim, Oryzalin, Pirimicarb, Pyraflufen-ethyl, Spirodiclofen, Thiacloprid, Thiophanate-methyl; the following are authorized only in the EU: Benthiavalicarbisopropyl, Diclofop-Methyl, Ethoprophos,

Etridiazole, Isopyrazam, Metam-potassium, Metam-sodium, Metiram, Oxyfluorfen, Tetraconazole; and the following only in Switzerland: Iprodione, Pymetrozine.
100 Carbendazim (authorized in Switzerland, but not in the EU).
101 The following substances are authorized in both Switzerland and the EU: Carbetamide, Cyproconazole, Epoxiconazole, Fluazifop-butyl, Flumioxazin, Thiacloprid, Triadimenol; the following only in the EU: 8-Hydroxyquinoline, Bromadiolone, Quizalofop-p-tefuryl, Triflumizole; the following only in Switzerland: Carbendazim, Glufosinate-ammonium and Propiconazole.
102 The following substances are authorized in both Switzerland and the EU: Bifenthrin, Chlorotoluron, Deltamethrin, Epoxiconazole, Lambda-cyhalothrin, Mancozeb, Metribuzin, Picloram; the following only in the EU: 2,4-DB, Dimoxystrobin, Metam-sodium, Metiram, Profoxydim; the following only in Switzerland: Ioxynil, Tepraloxydim, Thiram.
103 Baskut Tuncak, interviewed by Public Eye on January 25, 2019.
104 Peter Clausing, interviewed by Public Eye on January 22, 2019.
105 See Neumann, 2017, A Responsible Approach to Highly Hazardous Pesticides
106 See CropLife international webpage on Highly Hazardous Pesticides (HHPs)
107 CropLife international members consist of Syngenta, Bayer CropScience, Monsanto (now Bayer CropScience), BASF and Corteva (the Agriculture Division of DowDupont). See Crop Life's position on highly hazardous pesticides.
108 It is clear from the 2017 Phillips McDougall data that by then Syngenta was the leading seller of HHPs followed by Monsanto and Bayer CropScience. Yet we cannot provide an exact figure for their current respective share since Bayer acquired Monsanto in 2018. What is clear however is that the joint share of the CrobLife companies will not be affected by the mergers since most divestments Bayer was requested to make by regulators were sold to BASF.
109 See Syngenta, 2018, Financial report 2017.
110 See Syngenta, Annual report 2016, Chairman's statement.
111 Syngenta, written answer to our questions on January 23, 2019. See Annex 1.
112 Syngenta, written answer to our questions on January 23, 2019. See Annex 1.
113 For the list of active ingredients in Syngenta's "key marketed products", see Syngenta 2016 Annual Report on Form 20-F, p. 36. The HHPs are: abamectin, atrazine, chlorantraniliprole, chlorothalonil, cyproconazole, diquat, emamectin-benzoate, glyphosate, isopyrazam, lambda-cyhalothrin, lufenuron, paraquat, propiconazole, tefluthrin and thiametoxam.
114 Chlorothalonil, Isopyrazam and Glyphosate. See US EPA, 2017, Chemicals Evaluated for Carcinogenic Potential and 2015, IARC, Glyphosate monograph
115 Cyproconazole and Propiconazole. For the EU classification of cyproconazole as a reproductive toxicant category 1b, see EU pesticide database, for propiconazole, see here.
116 Atrazine-lambda-cyhalothrin and mancozeb. See EU Commission, 2000, List of 66 substances with classification high, medium or low exposure concern; and EU Commission, 2004, Commission staff working document on implementation of the Community strategy for endocrine disrupters
117 Abamectin, chlorothalonil, diquat, lambda-cyhalothrin, paraquat and tefluthrin. The last one is in category 1A of WHO, all others classified as fatal if inhaled by the EU. See WHO, 2009, The WHO recommended classification of pesticides by hazard and guidelines to classification and EU pesticide database.
118 As with the data on global sales of pesticides, the Phillips McDougall data on Syngenta sales is not fully comprehensive and covers "only" about 60% of Syngenta sales in 2017. Yet the main markets and substances are covered. And the sample is considered representative of the entire company's sales, so that sales of specific actives in determined countries can be extrapolated. When it comes to the sales by specific manufacturers the Phillips McDougall data is only available by formulated products. As one product can contain several different active ingredients, and one might be "highly hazardous" and the other not, we had to look at the specific concentrations in each product and split the value for each active in a mixture product by concentration; i. e. if a brand contains 60% one active and 40% of another, the value of sales is splitted accordingly. This is the methodology Phillips McDougall is using and recommending to use. That way we were able to estimate the Syngenta sales of highly hazardous pesticides only, without including sales of other active ingredients that are not classified as "highly hazardous" and that are sometimes included in the same products.
119 Syngenta at a glance
120 Again it should be recalled that the Phillips McDougal data only provides specicific information on Syngenta sales for 57 countries, including 35 low and middle income countries (LMICs). While the main pesticide – and presumably Syngenta – markets are covered, this limitation of the data does not allow us to be fully comprehensive in terms of Syngenta country sales.
121 Meriel Watts, interviewed by Public Eye on January 21, 2019.
122 Syngenta, written answer to our questions on 23 January, 2019. See Annex 1.
123 Syngenta, written answer to our questions on 23 January, 2019. See Annex 1.
124 Peter Clausing, interviewed by Public Eye on January 22, 2019.
125 See FAO, 2010, "Guidance on Pest and Pesticide Management Policy Development", p. 12. FAO explains that the knowledge gained during training is often not subsequently applied because workers have no access to protective clothing, or they cannot afford it, or because wearing protective clothing in warm and humid climates is unacceptable. In addition, it is impossible to train all workers, just as it is impossible to limit the use of pesticides to only those workers who have been trained.
126 See the Pflanzenschutzmittelverzeichnis for the active substance authorized for use in Switzerland.
127 Syngenta, written answer to our questions on 23 January, 2019. See Annex 1.
128 Those are: acetochlor, ametryn, atrazine, butafenacil, diafenthiuron, diazinon, hexaconazole, methidathion, monocrotophos, paraquat, pebulate, permethrin, profenofos, prometryn, terbutryn and simazine. See Swiss Ordinance on the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Chemicals in International Trade (ChemPICO, 814.82). The Ordinance establi- shes a notification and information system for the import and export of certain substances and preparations, "the use of which is banned or subject to severe restrictions owing to their effects on human health or on the environment". All sixteen substances listed above are not authorized in Switzerland, meaning they fall in the category of the substances "the use of which is banned".
129 UNHR, 2011, UN Guiding Principles on Business and Human Rights, p. 13
130 Fernando Bejarano, Director of Red de Acción sobre Plaguicidas y Alternativas en México (RAPAM), interviewed by Public Eye on December 12, 2018.
131 See 2018, Public Eye, A Syngenta pesticide produced in Switzerland is implicated in deadly poisonings in India
132 The Guardian, 2017, UK condemned over "shocking" export of deadly weedkiller to poorer countries
133 See 2017, UNHRC, Report of the Special Rapporteur on the Right to Food, p. 17
134 Meriel Watts, interviewed by Public Eye on January 21, 2019.
135 Baskut Tuncak, interviewed by Public Eye on January 25, 2019.
136 See IBAMA, 2019, "Boletins anuais de produção, importação, exportação e vendas de agrotóxicos no Brasil"; Porto and Soares, 2011, "Development model, pesticides, and health: a panorama of the Brazilian agricultural reality and proposals for an innovative research agenda"; and IBGE, 2019, Sistema IBGE de Recuperação Automática
137 Bojanic, 2017, The Rapid Agricultural Development of Brazil in the Last 20 Years
138 OECD and FAO, 2015, Agricultural Outlook 2015–2014.
139 Agroberichtenbuitenland, 2017, Agribusiness 46% of Brazil's exports in 2016
140 See IBGE 2019, Sistema IBGE de Recuperação Automática – SIDRA. The value of agriculture production was converted from Brazilian Real to US Dollars, using the exchange rates of January 1 of the respective year.
141 World Bank, 2017, Agriculture productivity growth in Brazil: recent trends and future prospects
142 See Global Yield Gap Atlas
143 IBGE, 2017, CensoAgro 2017
144 GRO, 2017, The Future of Brazilian Agriculture
145 IBGE, 2019, Sistema IBGE de Recuperação Automática – SIDRA
146 See Porto and Soares, 2011, "Development model, pesticides, and health: a panorama of the Brazilian agricultural reality and proposals for an innovative research agenda".
147 See IBAMA, 2019, "Boletins anuais de produção, importação, exportação e vendas de agrotóxicos no Brasil"
148 Worldwide use was at 1.8 million tons according to the US EPA. See US EPA, 1992, "Pesticides Industry Sales and Usage – 1990 and 1991 Market Estimates"
149 Agropages, 2018, "Top 20 Brazilian agrochem companies in 2017: Mergers will increase market concentration in the future"
150 Agropages, 2018, "Top 20 Brazilian agrochem companies in 2017: Mergers will increase market concentration in the future
151 Gonzales, 2018, Brazil's fundamental pesticide law under attack
152 See PAN International, 2019, PAN International List of Highly Hazardous Pesticides and ANVISA list of authorized active ingredients
153 Those are glyphosate (IARC- probably carcinogen), mancozeb (EPA likely carcinogen and EU EDC), acephate (EPA highly toxic to bees), mineral oil (EU presumed carcinogen), atrazine (EU EDC), paraquat (EU fatal if inhaled) and imidacloprid (EPA highly toxic to bees).
154 IBAMA, 2019, "Boletins anuais de produção, importação, exportação e vendas de agrotóxicos no Brasil"

155 The estimate for HHP use per hectare based on IBAMA data is slightly lower than the estimate based on Phillips McDougall data provided in the previous chapter. However it is important to emphasize that IBAMA statistics likely underestimate the actual HHP use in the country since the Ministry only publishes data on a specific pesticide when there are at least three manufacturers in order to preserve business secrecy.
156 Federal Law No 7.802 of June 11, 1989
157 Luis Claudio Meirelles, interviewed by Public Eye on December 11, 2018.
158 See Public Eye, 2017, Brazil bans paraquat and the agribusiness lobby is gearing up for action
159 The calculation was made by crossing the PAN International list of HHPs with the data provided by the Ministry of Environment (IBAMA), which contains details on volumes applied for the 88 most widely used substances. See ANVISA, 2019, "Reavaliação de Agrotóxicos"
160 Marcia Sarpa de Campos Mello, interviewed by Public Eye on December 19, 2018
161 2017, FT, A fight for Brazil's Amazon forest
162 2018, The Guardian, Brazil's new foreign minister believes climate change is a Marxist plot
163 Wanderlei Pignati, interviewed by Public Eye on December 12, 2018
164 Gonzales, 2018, Brazil's fundamental pesticide law under attack.
165 Agropages, 2018, Top 20 Brazilian agrochem companies in 2017: Mergers will increase market concentration in the future
166 Syngenta reported USD 9.2 bn pesticide sales for 2017. See Syngenta 2017 Financial Report
167 See Syngenta's website in Brazil. *Nós da Syngenta somos orientados para desempenhar uma agricultura capaz de alimentar uma população crescente de uma forma verdadeiramente sustentável – respeitando o meio ambiente e todas as pessoas da cadeia que participamos.*
168 Syngenta has positioned itself in favour of the draft bill – see "Syngenta se posiciona publicamente sobre o projeto de lei que propõe mudanças na regulamentação de agrotóxicos no Brasil"– and actively promotes it through their social media channels.
169 See crop protection products offered for sales on Syngenta's website in Brazil
170 Chlorothalonil (EPA likely carcinogenic; example of Syngenta product containing the HHP: Bravonil), Diuron (EPA likely carcinogenic; Gramocil), Fentin hydroxide (EPA likely carcinogenic, EU fatal if inhaled; Mertin 400), Mancozeb (EPA likely carcinogenic; Ridomil Gold) and Pymetrozine (EPA likely carcinogenic; Bedane). Glyphosate (IARC probably carcinogenic; Zapp QI). See US EPA, 2017, Chemicals Evaluated for Carcinogenic Potential and 2015, IARC, Glyphosate monograph.
171 Atrazine (Primoleo), Lambda-cyhalothrin (Engeo Pleno) and mancozeb (Ridomil Gold). See EU Commission, 2000, List of 66 substances with classification high, medium or low exposure concern
172 Cyproconazole (Priori Xtra) and Propiconazole (Tilt). For the EU classification of cyproconazole as a reproductive toxicant category 1b see EU pesticide database, for propiconazole see here.
173 Abamectin (Vermitec), Diquat (Reglone), Fentin hydroxide (Mertin 400), Lambda-cyhalothrin (Engeo Pleno), Paraquat (Gramoxone). All of them are classified as "fatal if inhaled" (H330) by the EU. See EU pesticide database.
174 Atrazine, Diafenthiuron, Diquat, Fentin hydroxide, Paraquat, Profenofos, Pymetrozine, Propiconazole, Thiametoxam. Diquat,Pymetrozine and Thiametoxam have just been banned in 2018 in the EU and Switzerland will likely follow soon. See EU pesticide database for the pesticides approved in the EU and Pflanzenschutzmittelverzeichnis for the active substance authorized for use in Switzerland.
175 Syngenta, written answer to our questions on January 23, 2019. See Annex 1.
176 Reuters, 2015, "Why Brazil has a big appetite for risky pesticides".
177 Wanderlei Pignati, interviewed by Public Eye on December 12, 2018.
178 Ada Cristina Pontes Aguiar, interviewed by Public Eye on December 13, 2018.
179 Ada Cristina Pontes Aguiar, interviewed by Public Eye on December 13, 2018.
180 Not published yet by Ministry of Health. Agência Pública, 2018, 26 mil brasileiros foram intoxicados por agrotóxicos desde 2007
181 Ministry of Health, 2018, Relatório Nacional de Vigilância em Saúde de Populações Expostas a Agrotóxicos
182 Agência Pública, 2018, 26 mil brasileiros foram intoxicados por agrotóxicos desde 2007
183 Agência Nacional de Vigilância Sanitária, 2016, Programa de análise de resíduos de agrotóxicos em alimentos PARA – Relatório das análises de amostras monitoradas no período de 2013 a 2015
184 Ministry of Health, 2019, "Vigiagua"
185 Ordinance No. 2914/11. The 27 substances are the following: 2,4 D + 2, 4, 5 , Alachlor, Aldicarb , Aldrin + Dieldrin, Atrazine, Carbendazim, Carbofuran, Chlordane, Chlorpyrifos, DDT +DDD + DDE, Diuron, Endosulfan, Endrin, Glyphosate + AMPA, Lindane, Mancozeb, Methamidophos, Metolachlor, Molinate, Parathion-methyl, Pendimenthalin, Permethrin, Profenofos, Simazine, Tebuconazol, Terbufos, Trifluralin.
186 Secretaria de Vigilância em Saúde – Ministério da Saúde, 2013, Monitoramento de agrotóxicos na água para consumo humano. The approach of targeting a reduced number of pesticides follows WHO recommendations and EU practice. 12 of the 20 most widely used pesticides are not covered by the monitoring program: acephate, paraquat, imidacloprid, malathion, chlorothalonil, clomazone, tetraconazol, sodium benzenesulfonate, tebutiuron, methomil, cypermehtrin and picloram. But none of those substances is listed by WHO as a substance of concern in drinking water, generally because they are considered "unlikely to occur in drinking water" or to occur "at concentrations well below those of health concern". See WHO, 2017, Guidelines for drinking-water quality.
187 DDT was discovered by Syngenta (at that time Geigy) in 1939 and quickly became the most widely used pesticide worlwide. Syngenta sold it for agricultural use in Brazil under the brand Gerasol until it was banned in 1985. DDT is classified as a likely human carcinogen by the USEPA and an endocrine disruptor by the EU. See USEPA, 2017, Chemicals Evaluated for Carcinogenic Potential and EU Commission, 2000, List of 66 substances with classification high, medium or low exposure concern.
188 Atrazine (example of Syngenta product sold in Brazil: Primoleo), diuron (Gramocil), glyphosate (Zapp QI), profenofos (Cuyrom), mancozeb (Ridomil Gold), metolachlor (Dua Gold) and simazine (Primatop).
189 See USEPA, 2003, Interim Reregistration Eligibility Decision (IRED) for the herbicide atrazine and USEPA, 2015, Endocrine disruptor screening program. See also USEPA, 2018, Draft human health atrazine risk assessment. And see EU Commission, 2000, List of 66 substances with classification high, medium or low exposure concern.
190 USEPA, 2017, Chemicals Evaluated for Carcinogenic Potential.
191 2015, IARC, Glyphosate monograph.
192 See USEPA, 2017, Chemicals Evaluated for Carcinogenic Potential and EU Commission, 2004, Commission staff working document on implementation of the Community strategy for endocrine disrupters
193 Syngenta, written answer to our questions on January 23, 2019. See Annex 1.
194 The specific limit for each substance can be found in Annex VII of Decree 2914. Limits are largely based on the guideline values established by WHO. See WHO, 2017, Guidelines for drinking-water quality.
195 The standard approach is to divide the NOAEL by 100 to calculate the ADI. This approach combines a factor 10 allowance for intra-species variation in sensitivity with a factor 10 allowance for interspecies variation.
196 See for example the case of JMPR glyphosate assessment. The Guardian, 2016, UN/WHO panel in conflict of interest row over glyphosate cancer risk or, NRDC 2015, Open letter to WHO
197 Wanderlei Pignati, interviewed by Public Eye on December 12, 2018.
198 See Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption. One reason the Directive advocates for adopting the approach of a uniform limit applicable to all pesticides is the "insufficient evidence on which to base parametric values for endocrine-disrupting chemicals at a community level".
199 See Leu, 2014, The Myth of Safe Pesticides or WHO and UNEP, 2012, State of the science of endocrine disrupting chemicals. The current model of toxicology works on the assumption that "the dose makes the poison"; in other words, toxic effects decrease following a linear progression until the compound is no longer toxic. However this concept was proven incorrect in the case of endocrine disrupting chemicals, which can be more toxic at low doses.
200 Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption. The stated objective of the Directive is "to protect human health from the adverse effects of any contamination of water intended for human consumption by ensuring that it is wholesome and clean".
201 Syngenta, written answer to our questions on January 23, 2019. See Annex 1.
202 The percentage of municipalities that submitted at least one test result during the four years is quite high in Parana (97%, second in pesticide use), Mato Grosso do Sul (90%, seventh), São Paulo (88%, third), Santa Catarina (80%, ninth), Goiais (76%, fifth), Bahia (65%, eighth) and Rio Grande do Sul (56%, fourth).
203 The percentage is also low in Minas Gerais (33%), sixth in pesticide use, and extremely low in Maranhão (0.9%) and Pará (0.7%), respectively tenth and eleventh in pesticide use.
204 Karen Friedrich, interviewed by Public Eye on December 13, 2018.
205 Estimation for testing the 27 pesticides with a chromatography method, provided by Quimi Quali Laboratory Campinas, São Paulo.
206 We looked at the real number of measurements done by Brazilian municipial during the four-year period and assumed that each time one municipality measured the 27 pesticides one same day, the cost was USD 200.
207 See USEPA, 2004, Memorandum of Agreement with Registrants
208 See EU Commission, 2016, Synthesis Report on the Quality of Drinking Water
209 Ada Cristina Pontes Aguiar, interviewed by Public Eye on December 13, 2018.

210 See Leu, 2014, The Myth of Safe Pesticides.
211 Catarina Hess, interviewed by Public Eye in August 2018.
212 Le Baron et al., 2008, The Triazine Herbicides – 50 Years Revolutionizing Agriculture
213 See USEPA, 2003, Interim Reregistration Eligibility Decision (IRED) for the herbicide atrazine. "EPA has determined that the triazine pesticides (with a common mechanism group of atrazine, propazine, simazine and their chlorometabolites) have a common mechanism of suppression of LH surge and consequent developmental and reproductive effects." Atrazine targets the hypothalamic-pituitary-gonadal (HPG) axis which is involved in the development of the reproductive system, and its maintenance and functioning in adulthood. In 2015, after conducting its endocrine disruptor screening program the USEPA concluded: "atrazine has the potential to interact with the estrogen and androgen pathways in mammals and other wildlife". In a USEPA 2018 draft human health atrazine risk assessment it was concluded that exposure to atrazine results "in reproductive and developmental effects in laboratory animals that are considered relevant to humans". It is believed that the toxicity mode of action of atrazine involves "perturbation of the hypothalamic-pituitary-gonadal axis (HPG) axis resulting in suppression of the LH (luteinizing hormone) surge leading to a number of neuroendocrine effects. The perturbation of the neuroendocrine system – in particular the HPG axis – is "the hallmark of atrazine toxicity", the USEPA stated in 2018. The Agency considers "the disruption of the LH surge as "the key event of the cascade of changes leading to the adverse reproductive outcomes following atrazine exposure". Atrazine is also listed in California under Proposition 65 as a chemical that causes reproductive toxicity. Atrazine is in the EU list of endocrine disruptors. See EU Commission, 2000, List of 66 substances with classification high, medium or low exposure concern.
214 See EU Commission, 2014, Commission Decision of 10 March 2004 concerning the non-inclusion of atrazine in Annex 1 to Council Directive 91/414/EEC
215 See OFAG, atrazine. The decision was taken in 2007 but the ban entered into force in 2012.
216 See EU Commission, 2016, Synthesis Report on the Quality of Drinking Water in the Union
217 In the US, atrazine was allowed to remain on the market but Syngenta was requested to conduct a more intense water monitoring programme in high risk areas. And having been sued by water provider companies, Syngenta agreed to pay over USD 100 million to compensate them for the cost of removing atrazine from the drinking water below the legal limit. According to the US EPA, over 30,000 tons of atrazine are applied every year in the country. US EPA, 2017, Pesticides Industry Sales and Usage 2008–2012 Market Estimates
218 A 2014 review of epidemiological studies sponsored by Syngenta (Goodman et al., 2014, Atrazine and pregnancy outcomes: a systematic review of epidemiologic evidence) listed 28 statistically significant odds ratios and/or significant correlations from a total of 7 publications for an association between exposure to atrazine/triazine herbicides and birth defects. It should be noted that all 7 studies were performed in the U.S. Birth defects with statistically significant associations listed in this review article included male genital malformations, gastroschisis (intestines extending outside the body through a hole in the abdominal wall) and limb defects. In addition Goodman et al. (2014) identified 10 studies investigating adverse pregnancy outcomes other than birth defects. Statistically significant associations with atrazine exposure were identified in particular for fetal growth retardations and preterm delivery. See also Wirbisky and Freeman, 2015, Atrazine Exposure and Reproductive Dysfunction through the Hypothalamus-Pituitary-Gonadal (HPG) Axis
219 Stayner et al., 2017, Atrazine and nitrate in drinking water and the risk of preterm delivery and low birth weight in four Midwestern states.
220 Leslie Stayner, interviewed by Public Eye, July 19, 2018.
221 Jason Rohr, interviewed by Public Eye, July 17, 2018.
222 Jennifer Sass, interviewed by Public Eye, February 2, 2019.
223 See USEPA, 2006, Triazine Cumulative Risk Assessment
224 See WHO, 2017, Guidelines for drinking-water quality
225 INCA, 2015, Posicionamento do Instituto Nacional de Câncer: José Alencar Gomes da Silva acerca dos agrotóxicos
226 Ministry of Health, 2011, Strategic Action Plan to Tackle Noncommunicable Diseases (NCD) in Brazil, 2011–2022
227 INCA, 2000, Estimates of cancer incidence and mortality in Brazil – 2000
228 Marcia Sarpa de Campos Mello, interviewed by Public Eye on December 19, 2018.
229 See INCA, 2018, Estimativa 2018: incidência de câncer no Brasil. According to WHO, prostate cancer mortality rates roughly doubled and breast cancer mortality increased by approximately 30% from 1980 to 2015 (see age-standardized cancer rates according to the Global Cancer Observatory).
230 According to WHO, age adjusted prostate cancer mortality rates roughly doubled and breast cancer mortality increased by approximately 30% from 1980 to 2015 in Brazil (see Global Cancer Observatory)
231 Brazilian Ministry of Health, 2018, Atlas do câncer relacionado ao trabalho no Brasil
232 In 2015, researchers established a strong statistical correlation between areas of soy production and prostate cancer mortality. In regions with intense agricultural activity and pesticide use, prostate cancer rates were higher compared to other regions (see Santos da Silva Ageo et al., 2015, Correlação entre produção agrícola, variáveis clínicas-demográficas e câncer de próstata: um estudo ecológico). A study from 2012 showed that living in a rural area, among other factors, increased the risk of women developing breast cancer in the State of Goiás, one of the main soy and corn producers of the country (see Inumaru et al., 2012, Risk and Protective Factors for Breast Cancer in Midwest of Brazil). Similarly, a study from 2010 found that young women in Rio de Janeiro had a higher risk of developing breast cancer if they had been exposed to residential pesticide use during adulthood (Guillermo Patricio, 2010, Environmental Exposure and Breast Cancer Among Young Women in Rio de Janeiro, Brazil).
233 Brazilian Ministry of Health, 2018, Atlas do câncer relacionado ao trabalho no Brasil
234 Marcia Sarpas de Mello, interviewed by Public Eye, on December 19, 2018.
235 Boccolini et al., 2016, Non-Hodgkin lymphoma among Brazilian agricultural workers: A death certificate case-control study)
236 Ada Cristina Pontes Aguiar, interviewed by Public Eye on December 13, 2018.
237 Martin et al., 2018, Increased exposure to pesticides and colon cancer: Early evidence in Brazil
238 Brazilian Ministry of Health, 2018, Atlas do câncer relacionado ao trabalho no Brasil
239 BBC, 2016, Epidemia de câncer? Alto indice de agricultores gaúchos doentes põe agrotóxicos em xeque
240 Jobimi et al., 2010, Existe uma associação entre mortalidade por câncer e uso de agrotóxicos? Uma contribuição ao debate
241 Extraclasse, 2018, Pesquisas associam câncer ao uso intensivo de agrotóxicos nas lavouras
242 BBC, 2016, Epidemia de câncer? Alto índice de agricultores gaúchos doentes põe agrotóxicos em xeque
243 Pignati et al., 2017, Spatial distribution of pesticides in Brasil: a strategy for Health Surveillance and Pignati et al., 2017, Morbidity and mortality from cancer children and adolescents associated with the agricultural use of pesticides in the state of Mato Grosso, Brazil
244 Wanderlei Pignati, interviewed by Public Eye on December 12, 2018.
245 Pinheiro Silva, 2018, Trends in morbidity and mortality due to child and adolescent cancer in a center of irrigated fruiticulture
246 Ferreira et al., 2013, In Utero Pesticide Exposure and Leukemia in Brazilian Children <2 Years of Age
247 Marcia Sarpa de Campos Mello, interviewed by Public Eye on December 19, 2018
248 See Dutra & Ferreira, 2017, Associação entre malformações congênitas e a utilização de agrotóxicos em monoculturas no Paraná, Brasil
249 Oliveira et al., 2014, Malformações congênitas em municipios de grande utilização de agrotóxicos em Mato Grosso
250 Ueker et al., 2016, Parenteral exposure to pesticides and occurence of congenital malformations: hospital-based case–control study
251 Dutra & Ferreira, 2017, Associação entre malformações congênitas e a utilização de agrotóxicos em monoculturas no Paraná, Brasil
252 Ada Cristina Pontes Aguiar, interviewed by Public Eye on December 13, 2018.
253 Karen Friedrich, interviewed by Public Eye on December 13, 2018.
254 Motion 17.4094
255 Responsible business initiative
256 According to a proposal by UN human rights experts, such an instrument should: "(a) Aim to remove existing double standards among countries that are particularly detrimental to countries with weaker regulatory systems; (b) Generate policies to reduce pesticide use worldwide and develop a framework for the banning and phasing-out of highly hazardous pesticides; (c) Promote agroecology; (d) Place strict liability on pesticide producers." See 2017, UNHRC, Report of the Special Rapporteur on the Right to Food, p. 22.

Research by Public Eye reveals that the most dangerous pesticides, known as “highly hazardous”, are used heavily in low- and middle-income countries (LMICs), despite being – for the most part – banned in Switzerland and the EU. Public Eye’s in-depth probe into the opaque world of highly hazardous pesticides also reveals that the Swiss agrochemical giant, Syngenta, is one of the main responsible for the flood of such products into LMICs. This conclusion is based on our analysis of exclusive industry data, which lifts the lid on a ticking time bomb that dramatically endangers human health and the environment. Our investigation in Brazil, the world’s largest user of pesticides, shows that millions of people are exposed to pesticides that present significant hazards to human health – including through exposure to drinking water. Scientists fear this could trigger an epidemic of chronic diseases. The time has come to put an end to this dirty business.

PUBLIC EYE (formerly Berne Declaration) is a non-profit, independent Swiss organisation with around 25,000 members. Public Eye has been campaigning for more equitable relations between Switzerland and underprivileged countries for fifty years. Among its most important concerns are the global safeguarding of human rights, the socially and ecologically responsible conduct of business enterprises and the promotion of fair economic relations. **www.publiceye.ch**

Dienerstrasse 12
Postfach | CH-8021 Zürich
Tel. +41 (0)44 2 777 999
Fax +41 (0)44 2 777 991
kontakt@publiceye.ch

Avenue Charles-Dickens 4
CH-1006 Lausanne
Tél. +41 (0)21 620 03 03
Fax +41 (0)21 620 03 00
contact@publiceye.ch

www.publiceye.ch | @publiceye.ch | @publiceye_ch | @publiceye_ch

Public Eye
Berne Declaration