Pesticide Action Network Europe

ENDOCRINE DISRUPTING PESTICIDES IN EUROPEAN FOOD

Brussels 2017

Contents

Preface

This report was written during a critical moment in Europe concerning the Regulation of Endocrine Disrupting Chemicals (EDCs). The majority of EU Member States in the European Commission's Standing Committee of Plants, Animals, Food and Feed -which deals with the authorization of pesticides- have approved a set of 'scientific' criteria whose aim is to identify pesticides that are EDCs, which however are unfit for the requirements of the European Pesticide Regulation (Plant Protection Products Reg. EU 1107/2009).

The criteria have received criticism from experts in the field of endocrinology and endocrine disruption for demanding 'too high a burden of proof', and consequently may fail to identify all pesticides that are EDCs and fail to protect people and the environment from the adverse effects of these substances (as required by the Pesticides Regulation). Further, the criteria include an exception for non-target organisms which not only was not within the Commission's mandate, but also contradicts the European Regulation: namely, not to ban the use of substances designed to "manage" pests via their endocrine system, even if they are in fact endocrine disruptors to other non-target invertebrate organisms. The Commission has therefore exceeded its implementing power by composing a set of criteria that are incompatible with the aim of the regulation to provide a high level of protection for humans, animals, the environment and its ecosystems.

Now it is in the hands of the European Parliament to exert its legislative power and object to the criteria proposal, not only because it neglects to protect invertebrate species, which form the 95% of the animal kingdom and have a key role in the balance of ecosystems and biodiversity, but also because it may be putting at risk the health of humans and other animals (vertebrates). Since the burden of proof is too high to identify a substance as an EDC, particularly the ones that may cause adverse effects to humans, we would need to develop new research methods and it may take several years before we see any pesticide substance getting removed from the market because it causes endocrine disruption. And in the meantime, due to the new exception, pesticides that are designed to be endocrine disruptors for pests and could potentially cause endocrine disruption in humans, will be allowed in the market.

This report aims to inform European Regulators, as well as to raise public awareness, on the presence of certain pesticides, which have been identified to have endocrine disrupting properties in scientific literature, in European food. Endocrine Disrupting Pesticides (EDPs) may be putting the current European population and its future generations at risk. It is of utmost importance that these chemicals are properly regulated and Europeans be able to trust that their food is safe, for them and their children.

Introduction

Endocrine Disrupting Pesticides – An issue of great concern

The use of synthetic pesticides in agriculture might have helped to increase food production but not without great costs to human health, the environment and its resources. The 2017 UN report of the Special Rapporteur on the right to food highlights the adverse impact of pesticide use on human rights, human health (workers, their families, bystanders, residents and consumers) and the environment. The report also reveals that intensive agriculture based on pesticide use has not contributed to reduce world hunger but rather it has helped to increase the consumption of food and food waste in industrialized countries[1].

The fact that pesticides end up being toxic towards wildlife and human health shouldn't come as a surprise since these chemicals are deliberately made to be biologically active and kill living organisms (e.g. fungi, insects, weeds etc). In many cases, the interaction of pesticides with the hormonal (endocrine) system of wildlife has led to the impaired reproduction and gradual population decline of certain species (IPCS/WHO, 2002)[2]. The biologist Rachel Carson was the first to bring public attention to this problem in the 60s with her book *Silent Spring*, where she documented the decline in bird species due to the use of pesticides focusing on the insecticide DDT[3].

In the following years, scientific research revealed that certain environmental contaminants can mimic, block or interfere with the action of organisms' natural hormones and cause alterations in the function of the endocrine (hormone) system leading to adverse effects in reproduction, fertility, development, growth, metabolism and behaviour, among others (IPCS/WHO, 2002)[2]. These chemicals are known as endocrine disrupting chemicals (EDCs or EDs for endocrine disruptors) and several cases of endocrine disruption in wildlife have been due to pesticides.

In 2013, the World Health Organization highlighted that exposure to these chemicals is an issue of concern not only for wildlife but also for humans, and that decision-makers need to take action to regulate human and environmental exposure to these chemicals[4]. Decreased fertility in humans, the increasing incidents of endocrine-related cancers, low sperm quality, obesity, cognition deficit and neurodegenerative diseases have all been linked to chemical exposure[5]. Studies have also shown that exposure to EDCs may cause dysfunction of the immune system that may lead to immunodeficiency or hyperactivity of immune responses (allergies and autoimmune diseases)[4]. In all cases, sensitivity to exposure increases at certain

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[1] United Nations, 2017. Report of the Special Rapporteur on the right to food.
[2] International Program on Chemical Safety, World Health Organization, 2002. Global Assessment of the State of the science for endocrine disruptors.
[3] Rachel Carson, 1962. Silent Spring, Houghton Mifflin, USA
[4] United Nations Environment Programme and the World Health Organization, 2013. State of the science of endocrine disrupting chemicals-2012.
[5] Trasande L, Zoeller RT, et al 2015. Estimating burden and disease costs of exposure to endocrine-disrupting chemicals in the EU. J Clin Endocrinol Metab 100:1245-55

periods of lifetime, for example during early-life when the organism is still under development and all biological processes and organs are still forming. In humans, this makes pregnant women and their unborn babies, babies in general and young children the most vulnerable to EDC exposure. These impacts come with enormous economic costs. Scientists have estimated that the health costs from exposure to EDCs may reach up to 157 billion euros or more per year (Trasande et al.).

The finding that certain pesticides are endocrine disruptors is of great concern, since these chemicals are applied on open fields all around the world and end up as residues in our food. Farmers, their families, residents and consumers are all at risk.

European Regulation of EDCs is failing due to lobbying by pesticide industry

The impact of pesticides on human health and wildlife has been documented extensively in scientific literature and has led to demands for stricter regulation of their use in Europe and other parts of the world. Pesticide manufacturers must test their products before receiving approval for market use. These tests can be perceived as models that aim to predict real-life conditions and protect first the people and then the environment and its ecosystems. Following the latest scientific developments, these models have to be continually updated with more sensitive methods that provide a higher level of protection and correspond to real-life situations.

The Pesticide Regulation, known as Plant Protection Products Regulation 1107/2009, in force since 2009, clearly states that pesticide active substances (the active ingredients of pesticides that trigger pest toxicity), pesticide products and pesticide residues should have no harmful effects to humans, animals, the environment and its ecosystems[6]. For this, the Regulation recognizes specific classes of chemicals as hazards that cannot be authorized for pesticide use: mutagens, carcinogens, chemicals that are toxic to reproduction and endocrine disruptors as well as PBTs (persistent, biocumulative and toxic). The Regulation also mentions neurotoxic (causing neurological toxicity) and immunotoxic (toxic for the immune system) substances. If pesticide active substances fulfil the criteria of any of these hazard classes, they must be removed from the market (or not authorized), unless exposure is negligible (except for mutagens, where zero exposure is permitted). These criteria are called "cut-off", and aim to speed up the authorization procedure.

The Pesticide Regulation was the first to specifically address EDCs as hazards, and therefore called on the European Commission to establish a set of scientific criteria to identify which chemicals have endocrine disrupting properties by December 2013 and to remove them from the market. The European Commission's Environment Directorate General, which had already been working on establishing a strategy on endocrine disruptors since 1999, worked

[6] OJ L 309, 24.11.2009, p. 1–50

together with scientific experts from Member States on the field of endocrine disruption research and produced a draft proposal of scientific criteria. But the proposal triggered a strong reaction from the industry and trade sector as well as the other Commission directories, and thus never got approved[7].

The pesticide industry is a very profitable business - with enormous influence over the European Commission's decisions- that didn't want to see any of its products getting removed from the market despite the harm that they may cause. And it succeeded. Two and a half years past its deadline, and with a verdict from the European Court of Justice for not presenting the criteria on time[8], the European Commission, this time through the industry-friendly Health Directorate DG SANTE, presented a set of criteria that were criticized by the scientific community for not being in line with our current knowledge of endocrinology and for failing to properly identify EDCs[9,10]. In a way, the criteria still follow the "old approach" (i.e. the dose makes the poison), which totally overlooks the fact that natural hormones are biologically active at very low levels, and the same is true for endocrine disruptors. As a result, until our knowledge of endocrinology advances even further and the models of chemicals' toxicity assessment are updated, people and the environment will keep being exposed to these chemicals that risk jeopardising their health.

Endocrine Disrupting Pesticides in our food

The fact that ED pesticides (EDPs) are still used without restrictions in agriculture means that they end up as residues in our food, and that people are exposed to them on a daily basis. This is of great concern considering that low doses of these chemicals may potentially disrupt the normal function of the hormone system, particularly of young ones, and may lead to serious adverse effects and disease later in life. A future mother eating a fresh fruit salad from conventional agriculture may think that she is providing healthy vitamins to her future baby, but in fact she might be exposing it to a cocktail of EDCs. What's more, pesticides are not the only chemicals we're exposed to in our daily lives - and neither are they the only EDCs.

In its annual reports, the European Food Safety Authority (EFSA) is proud to announce that food residues in European food are below the Maximum Residues Level (the highest level of a pesticide residue that is legally tolerated in our food)[11]. However, it fails to report that almost half of European food contains residues from at least one pesticide and about a third

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[7] PAN Europe reconstruction of the downfall of the EU endocrine policy, 2015

[8] Case T-521/14, Luxembourg, December 2015. By failing to adopt measures concerning the specification of scientific criteria for the determination of endocrine-disrupting properties, the Commission has breached EU law. https://goo.gl/VvsuhA

[9] Bourguignon JP, et al. 2015. Endocrine Society calls for stricter European regulation of EDCs *Lancet Diabetes Endocrinol*; doi:10.1016/s2213-8587(16)30121-8.

[10] Endocrine experts united in disappointment with European Commission's proposed criteria on EDCs, July 2017. https://goo.gl/guUCjC

[11] EFSA Journal 2017;15(4):4791 [134 pp.]. The 2015 European Union report on pesticide residues in food

contains multiple pesticide residues. This means that certain types of fruit and vegetables may contain much higher amounts, as is the case for grapes, where pesticides were detected in 77.3 % of the samples and 58.3 % contained multiple residues in 2015. What EFSA doesn't say is that the evaluation of pesticide safety does not consider the effects of pesticide cocktails, neither does it consider the endocrine disruption potential of individual pesticides or mixtures. And no one will be held accountable if EFSA concludes that the safe levels (MRLs) are not so safe after all, even if this has put human population at risk.

In a previous work in 2015, Pesticide Action Network Europe conducted an extensive scientific analysis to find which of the pesticides authorized in Europe (around 500 today) should be identified as endocrine disruptors according to the published scientific literature and the Regulatory Assessment dossiers of pesticides- the latter include the summary results of the unpublished industry-sponsored studies[12]. In its research, PAN Europe identified 31 pesticide active substances that are endocrine disruptors for humans that may cause harm. This list has currently grown to 37 pesticides, but in the meantime, a small number of these pesticides haven't been submitted for re-authorization (and/or their authorization period has expired) mainly due to lack of use or they have been banned due to general toxicity.

This report aims to raise awareness about the fact that residues of certain pesticides, reported to interfere with the normal function of the endocrine system of laboratory animals and which may affect humans as well, are found in European food. Hence, we are exposed to these pesticides on a daily basis.

Objectives

This report aims to investigate the presence of pesticide residues that are EDCs in European food and it answers the following questions (for the purpose of this report and for convenience, pesticides that have been identified as endocrine disruptors will be called Endocrine Disrupting Pesticides, hence EDPs):

1) What percentage of EU food products contain pesticides and specifically EDPs?
2) How many EDPs are found in fruit and vegetables produced in Europe?
3) How many EDPs are found in fruit and vegetables consumed in Europe?
4) Which EDPs are most frequently detected in fruit and vegetables?

[12] PAN Europe, 2015. Impact Assessment of the Criteria for Endocrine Disrupting Pesticides. https://goo.gl/52beuW

Method

Regulation (EC) No 396/2005 on maximum residue levels of pesticides in food[13] imposes on Member States the obligation to carry out controls to ensure that food placed on the market is compliant with the legal limits. This regulation establishes both EU and national control programmes. EU-coordinated control programmes define the food products and pesticides that should be monitored by all Member States according to Commission Implementing Regulation (EU) No 400/2014[14]. In addition, Member States also implement national control programmes, which are usually focused on certain products expected to contain residues in concentrations exceeding the legal limits, or on products that are more likely to pose risks for consumers (Article 30 of Reg. (EC) 396/2005). According to Article 31, Member States are requested to share the results of the official controls and other relevant information with the European Food Safety Authority (EFSA). Based on these results, EFSA prepares an Annual Report on pesticide residues, analysing the data in view of the MRL compliance and the exposure of European consumers to pesticide residues[15].

Following a public access to documents request Regulation (EC) No 1049/2001 (PAD)[16] to EFSA, Pesticide Action Network Europe (PANE) received full access to the monitoring data sent to EFSA from Member States concerning pesticide residues in their food (fruit, vegetables and animal origin) for the year 2015. Among others, these data contain information about which pesticide residues were detected in which food, in which country the food was produced and in which country it was sampled.

To determine the frequency of EDPs in our food, PANE used its list of 37 pesticide active ingredients previously identified as having endocrine disrupting properties out of approximately 480 that were on the market in 2015. Most of these pesticides (32 in total) are also included in the US TEDX List of Potential Endocrine Disruptors[17] as well as in the first preliminary screening results of the Joint Research Centre and DG SANTE of the European Commission[18](31 in total), before the EDC criteria were modified and presented to Member States for voting. These EDPs have been linked to 50 pesticide active ingredients and their metabolites in the EFSA database. We decided to exclude two EDPs of the dithiocarbamate class (maneb and mancozeb) from our calculations as they are measured as a group together with other pesticides of the same class that are not EDPs, thus the result would be misleading). Hence, we only used 35 EDPs in the analysis of the results. Full details are given in Annex 1.

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[13] OJ L 70, 16.3.2005, p. 1–16
[14] OJ L 119, 23.4.2014, p. 44–56
[15] https://www.efsa.europa.eu/en/efsajournal/pub/4791, page 7
[16] OJ L 145, 31.5.2001, p. 43–48
[17] https://endocrinedisruption.org/
[18] DG SANTE, 2016. Screening of available evidence on chemical substances for the identification of endocrine disruptors according to different options in the context of an Impact Assessment. Publications Office of the European Union, 2016

Next, an overview was created for the products analysed, their country of origin and the EDPs that were detected the most. Finally, in order to conduct an objective analysis, only the measurements from unprocessed and objectively sampled foods were selected.

For each overview, the following key indicators have been calculated:

- Samples taken
- %Samples with residues
- %Samples with multiple residues
- %Samples with EDPs
- %Samples with multiple EDPs
- %EDPs of residues (% of residues that are EDPs)
- Maximum EDPs found in one sample
- Sum of EDPs found in each category

The results were used to answer our key questions set in the objectives.

Limitations:

This is a preliminary screening analysis of the data gathered by all Member States that unfortunately did not carry out the analysis in a similar manner. For example, the number of samples, types of food sampled and pesticides tested in each Member State show great variation, which makes the comparison of EDP usage per country more difficult. Furthermore, Member States are obliged to provide an evaluation in relation to the safety limits (MRLs) but not the exact values of the pesticide residues (in mg/kg). Therefore, it can only be determined whether the measurement was below or above the legal limit (already performed by EFSA, see introduction), and hence it has not been possible to calculate the overall quantity of pesticide residues (in mg/kg) in the samples.

Question 1: What percentage of EU food products contain pesticides and specifically EDPs?

Overall, 45,889 food samples were analysed in 2015 (Table 1). Out of these samples, 46.8% contained at least one type of pesticide residues and up to 19% contained one or more EDP residues; 4.8% even contained two or more EDPs per sample - an EDP cocktail- with a maximum of 8 different EDPs per sample! Out of the total pesticide residues detected, 1 in 5 was an EDP (21,3%).

In total, 31 out of the 35 EDPs on PAN Europe's list were detected. Out of those not detected, one was not in use and its manufactures did not apply to renew its license (triasulfuron) and one was only used in 3 Member states due to general toxicity and is now banned (amitrole).

TABLE 1. OVERVIEW OF OCCURRENCE OF EDPS PER PRODUCT CATEGORY AND PRODUCT TYPE

Product category	Product type	Samples	%Samples with residues	%Samples with multiple residues	%EDPs of residues	%Samples with EDPs	%Samples with multiple EDPs	Max. EDPs / sample	EDPs detected
Plants	Fruit	14,895	68.1%	49.6%	23.7%	34.3%	9.9%	8	27
	Other	347	53.0%	37.8%	25.9%	23.9%	10.4%	5	10
	Herbs	1,294	53.1%	31.2%	18.0%	18.9%	7.9%	5	26
	Fungi	498	44.8%	23.9%	17.7%	16.7%	0.8%	2	5
	Vegetables	18,739	41.2%	21.6%	18.5%	13.6%	2.6%	6	26
	Spices	118	31.4%	13.6%	22.8%	12.7%	4.2%	6	11
	Legumes	1,557	32.7%	12.9%	25.4%	12.5%	2.0%	6	19
	Cereals	2,940	33.1%	13.2%	22.7%	11.0%	1.5%	4	16
	Seeds	399	32.6%	7.0%	9.6%	3.8%	0.5%	2	6
	Nuts	153	45.1%	2.0%	6.4%	3.3%	0.0%	1	3
	Potatoes	1,305	33.2%	9.9%	3.3%	1.5%	0.0%	1	6
	Total	42,239	50.0%	30.4%	21.5%	20.5%	5.2%	8	32
Animal products	Animal products	3,615	10.4%	4.1%	7.3%	1.3%	0.1%	2	3
	Total	3,615	10.4%	4.1%	7.3%	1.3%	0.1%	2	3
Other	Other	36	33.3%	5.6%	75.0%	27.8%	5.6%	2	4
	Total	36	33.3%	5.6%	75.0%	27.8%	5.6%	2	4
Grand Total		45,889	46.8%	28.3%	21.3%	19.0%	4.8%	8	32

Most samples taken were fruit and vegetables. Out of these, fruit contained by far the highest percentage of EDPs (34.3% of fruit samples had EDP residues), while 9.9% of the fruit contained 2 or more EDPs per sample. Out of the total number of pesticide residues, 1 in 4 (23.7%) was an EDP. Overall 27 EDPs were detected.

Herbs also showed a high amount of total pesticide residues (53.1%) and a high amount of EDPs (18.9%). In total, 26 pesticides were detected in herbs, with a maximum of 5 EDPs found in just one sample. Vegetables were generally less contaminated, but still 41.2% of the samples had pesticide residues, and 13.6% had EDPs. Up to 26 EDPs were detected in all vegetables and up to 6 EDPs were detected in a simple sample.

The "Other" product category consists largely of grapes used for wine (not table grapes), and has a very high EDP contamination. Additional products in this category are also products that are not consumed directly or do not fit in one of the other categories, like animal feed, sugar beet roots, tea and cacao beans.

Because EDPs are mostly found in fruit and vegetables, this report focuses only on these products.

Fruit and vegetables with EDPs

The figures below present an overview EDPs detected in fruit (Figure 1) and vegetables (Figure 2). Note that the grand total percentages of the different product categories are less than in Table 1, because in the figures below only products with 50 or more samples were included. In annexes 2 to 5 more details are presented.

The most notable conclusions are:

- Citrus fruits (mandarins, oranges, grapefruits, lemons, limes et cetera) are among the fruit with highest percentages of EDPs detected, ranging between 38% and 57%

- Out of the fruit that is consumed fresh and whole (without peeling), the most contaminated are currants and especially peaches and apricots (40%-45%), but also cherries, table grapes, strawberries, pears and apples to a considerable extent (27%-39%).
- Mandarins and currants most often have multiple EDPs per sample (1 in 5), but other fruit also regularly contains multiple EDPs; on average 1 in 10.
- The vegetables celery and rocket, together with some root vegetables (celeriac and turnip), Chinese cabbage and parsley roots contain the highest percentage of EDPs (30%-40%) out of all vegetables.
- In vegetables that are consumed on a daily basis such as lettuce, tomatoes, carrots and sweet peppers EDPs were also frequently detected but to a lower extent (16-18% of fruit analysed).

The details of these results are presented in the tables of Annex 2 and Annex 3.

FIGURE 1. OVERVIEW OF FRUIT MOST CONTAMINATED WITH ENDOCRINE DISRUPTING PESTICIDES (EDPS). *(max: maximum number of different EDPs found on one sample; sum: the number of different EDPs found in all samples; n: total number of samples taken).*

No.	Product	Max	Sum	n	%Samples with multiple EDPs	%Samples with EDPs	%Samples with residues
1	Mandarins	6	18	1.011	23%	57%	78%
2	Currants	3	12	73	21%	55%	75%
3	Pineapples	2	5	235	7%	47%	58%
4	Oranges	4	13	1.026	16%	47%	72%
5	Grapefruits	5	15	398	15%	46%	76%
6	Peaches	5	15	1.021	16%	45%	72%
7	Lemons	3	10	547	14%	45%	61%
8	Apricots	5	16	523	13%	40%	75%
9	Cherries	4	11	384	13%	39%	68%
10	Limes	3	7	50	10%	38%	88%
11	Mangoes	3	10	372	3%	37%	74%
12	Table grapes	8	21	1.681	11%	35%	79%
13	Strawberries	5	15	869	9%	34%	75%
14	Pears	6	15	1.328	10%	32%	74%
15	Apples	5	17	2.040	6%	27%	66%
16	Raspberries	3	10	81	11%	26%	64%
17	Plums	3	12	485	5%	22%	39%
18	Bananas	3	11	1.461	2%	20%	70%
19	Avocados	1	1	85	0%	15%	27%
20	Blueberries	2	6	159	3%	15%	43%
21	Kiwi fruits	3	5	436	1%	14%	34%
22	Granate apples	3	8	170	4%	12%	37%
23	Kaki	1	1	74	0%	3%	15%
24	Figs	0	0	51	0%		14%
Grand Total					10%	34%	68%

FIGURE 2. OVERVIEW OF VEGETABLES MOST CONTAMINATED WITH ENDOCRINE DISRUPTING PESTICIDES (EDPS). (*max: maximum number of different EDPs found on one sample; sum: the number of different EDPs found in all samples; n: total number of samples taken*).

No.	Product	Max	Sum	n	%Samples with multiple EDPs	%Samples with EDPs	%Samples with residues
1	Celeries	4	11	199	12%	40%	69%
2	Roman rocket/rucola	3	11	284	9%	35%	90%
3	Celeriacs/turnip rooted celeries	6	11	281	11%	33%	78%
4	Chinese cabbages/pe-tsai	2	10	117	9%	31%	46%
5	Parsley roots/Hamburg roots parsley	3	6	119	7%	30%	45%
6	Okra (lady's fingers)	2	7	110	3%	21%	48%
7	Spinaches	4	7	317	5%	20%	41%
8	Lettuces	3	17	1.047	4%	18%	55%
9	Tomatoes	3	19	1.539	4%	18%	45%
10	Carrots	2	6	714	1%	17%	40%
11	Chards/beet leaves	1	7	96	0%	17%	41%
12	Sweet peppers/bell peppers	4	23	5.337	3%	16%	44%
13	Kales	2	5	50	2%	16%	34%
14	Spring onions/green onions and Welsh onions	4	10	120	3%	16%	34%
15	Leeks	2	6	205	2%	13%	29%
16	Florence fennels	2	8	114	4%	13%	41%
17	Escaroles/broad-leaved endives	3	9	184	1%	13%	47%
18	Melons	2	14	550	1%	13%	55%
19	Cucumbers	3	18	989	2%	11%	51%
20	Aubergines/eggplants	4	16	1.235	1%	8%	34%
21	Radishes	3	8	365	2%	7%	43%
22	Broccoli	3	10	1.057	1%	7%	46%
23	Courgettes	1	11	608	0%	7%	25%
24	Globe artichokes	2	4	78	1%	6%	19%
25	Head cabbages	3	9	387	2%	6%	22%
26	Kohlrabies	1	4	94	0%	5%	33%
27	Turnips	1	4	79	0%	5%	16%
28	Brussels sprouts	1	2	102	0%	5%	48%
29	Witloofs/Belgian endives	1	5	128	0%	5%	25%
30	Pumpkins	2	3	75	1%	4%	17%
31	Cauliflowers	2	5	517	0%	2%	17%
32	Onions	2	4	437	0%	2%	10%
33	Beetroots	2	2	59	2%	8%	
34	Asparagus	1	2	133	0%	2%	2%
35	Cassava roots/manioc	1	1	73	0%	1%	22%
36	Watermelons	1	1	162	0%	1%	10%
37	Cresses and other sprouts and shoots	0	0	52	0%		40%
38	Sweet potatoes	0	0	125	0%		18%
39	Yams	0	0	104	0%		
Grand Total					3%	14%	41%

%Samples with multiple EDPs
%Samples with EDPs
%Samples with residues

Question 2: How many EDPs are found in fruit and vegetables produced in Europe?

The overview in Figure 3 contains the list of European countries which produce highest of fruit and vegetable with EDPs. Only countries were at least 200 samples have been taken are shown.

In Europe, most EDPs residues are detected in fruit and vegetables produced in Spain, Greece and Italy (23-31%). In these countries between 19 and 26 different EDPs were detected, with up to 4-5 EDPs per product sample. The number of EDPs detected in products from Germany, Romania and The Netherlands was lower (12%-15%), while the products with less EDPs were the ones from Denmark, with only 3% EDPs and just 4 different EDPs were found in one sample.

FIGURE 3. OVERVIEW OF ENDOCRINE DISRUPTING PESTICIDES (EDPS) DETECTED IN FRUIT AND VEGETABLES PRODUCED ACROSS DIFFERENT EUROPEAN COUNTRIES (EDPS).
(*max: maximum number of different EDPs found on one sample; sum: the number of different EDPs found in all samples; n: total number of samples taken*).

No.	Country of origin	Max	Sum	n	%Samples with multiple EDPs	%Samples with EDPs	%Samples with residues
1	Spain	5	26	4.441	10%	31%	65%
2	Greece	4	19	1.811	6%	25%	44%
3	Italy	5	26	5.819	5%	23%	54%
4	Poland	3	18	1.088	6%	21%	51%
5	Portugal	6	15	457	4%	21%	55%
6	Belgium	4	15	288	6%	20%	70%
7	Hungary	4	21	964	4%	20%	57%
8	France	5	19	1.540	5%	16%	54%
9	Germany	6	12	833	3%	15%	62%
10	Romania	5	13	1.189	3%	14%	31%
11	Netherlands	3	18	1.458	2%	12%	50%
12	Austria	2	8	245	1%	10%	49%
13	Finland	2	8	227	1%	9%	23%
14	United Kingdom	3	11	386	2%	9%	48%
15	Denmark	2	4	344	1%	3%	30%
Grand Total					6%	22%	53%

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Question 3: How many EDPs are found in fruit and vegetables consumed in Europe?

Figure 4 shows the countries where EDPs are found most often in fruit and vegetables bought in the wholesale and retail market and where at least 200 samples per country have been taken.

Ireland, Sweden and The Netherlands are the countries where most EDPs were detected in fruit and vegetables (32-42% of samples). In these countries between 21 and 23 different EDPs were found, with up to a maximum of 4-6 EDPs per product sample. The number of EDPs detected in products consumed in the Czech Republic, Slovakia, Poland and Germany were somehow lower (28%-32% contaminated), but varied in the maximum number of EDPs detected per sample (4-8). Portugal and Denmark were the countries with the least EDPs pesticides detected in their market products (12-15%).

FIGURE 4. OVERVIEW OF ENDOCRINE DISRUPTING PESTICIDES (EDPS) DETECTED FRUIT AND VEGETABLES SOLD IN THE MARKET OF DIFFERENT EUROPEAN COUNTRIES. (*max: maximum number of different EDPs found on one sample; sum: the number of different EDPs found in all samples; n: total number of samples taken*).

No.	Country of samp..	Max	Sum	n	%Samples with multiple EDPs	%Samples with EDPs	%Samples with residues
1	Ireland	6	21	506	19%	42%	75%
2	Sweden	4	22	1.391	11%	34%	68%
3	Netherlands	6	23	1.029	11%	32%	65%
4	Czech Republic	8	22	555	10%	32%	73%
5	Slovakia	4	17	238	8%	31%	71%
6	Poland	4	18	1.345	7%	29%	61%
7	Germany	6	21	2.247	8%	28%	75%
8	Austria	4	20	814	7%	28%	70%
9	Hungary	5	23	1.226	8%	27%	67%
10	Greece	4	18	1.494	5%	24%	40%
11	Italy	4	24	3.764	5%	23%	49%
12	Slovenia	3	14	231	4%	23%	58%
13	France	4	23	2.015	7%	21%	47%
14	Spain	4	15	510	4%	19%	40%
15	Bulgaria	2	12	213	5%	19%	41%
16	Romania	5	17	2.676	4%	19%	33%
17	United Kingdom	4	19	1.304	3%	17%	60%
18	Denmark	3	17	997	4%	15%	51%
19	Portugal	3	12	499	2%	12%	46%
Grand Total					**6%**	**24%**	**55%**

Question 4: Which EDPs are most frequently detected in fruit and vegetables?

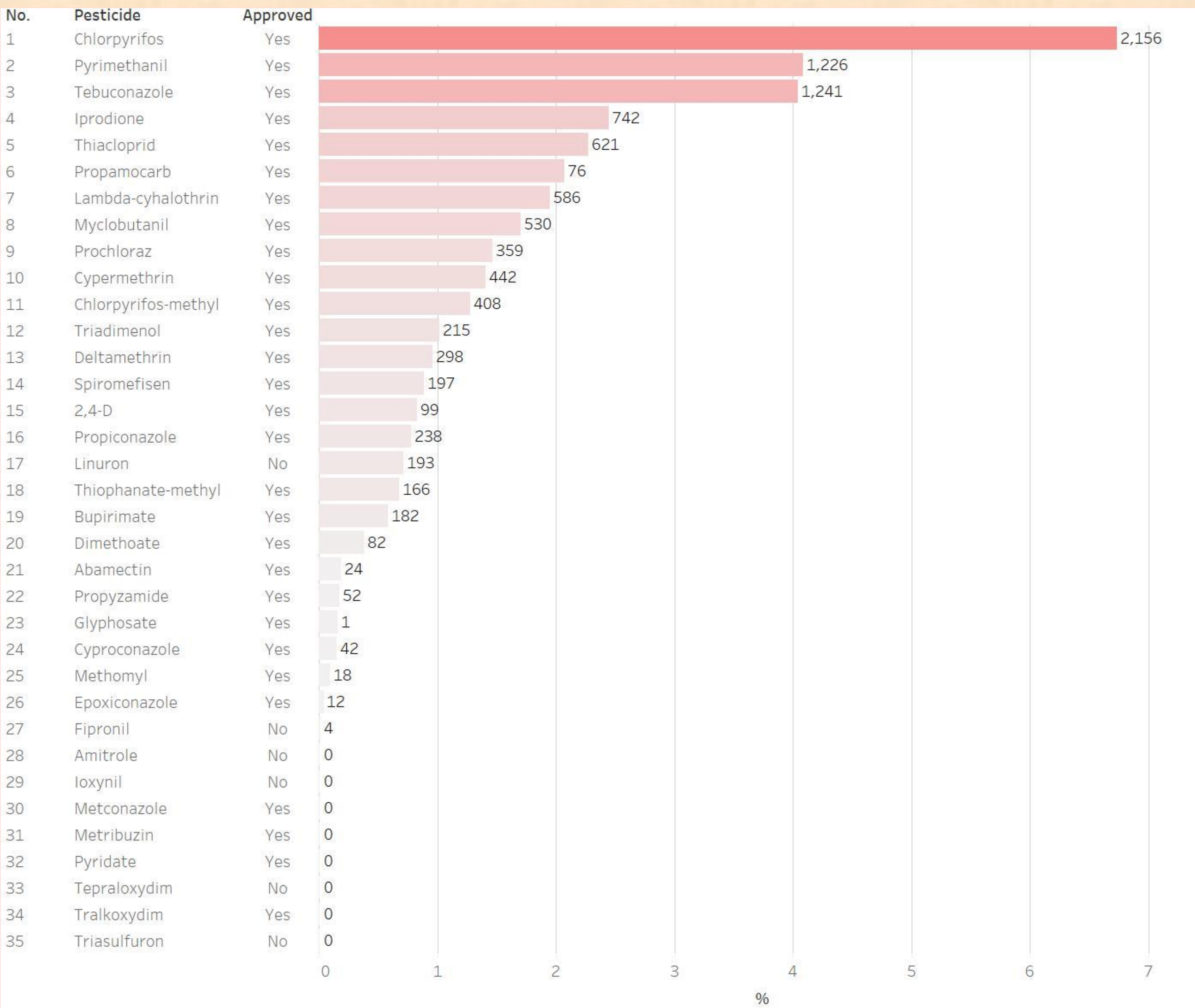
Figure 5 illustrates how frequently EDPs were detected in the samples of fruit and vegetables analysed in Europe (from market wholesale and retailers). Detailed values are given in Annex 4.

Most interesting conclusions:

- The insecticide chlorpyrifos and the fungicides pyrimethanil and tebuconazole are the most widely detected EDPs in fruit and vegetables in Europe.
- The fungicide iprodione and the insecticides Thiacloprid and lambda-cyhalothrin are also detected frequently in consumers' food
- Almost all EDPs detected are approved in the EU, except linuron.
- Fe Member States tested fruit and vegetables for glyphosate.

FIGURE 5. FREQUENCY OF EDPS DETECTED IN SAMPLES ANALYSED (FRUITS AND VEGETABLES)

(number of samples with detected EDPs is given at the end of the bar)



Discussion

The amount of European food products contaminated with endocrine disruptors is of alarming concern, considering that low doses of these chemicals have been reported to alter the function of the hormonal system in wildlife and laboratory animals, leading to adverse effects[19]. Endocrine-related diseases and disorders have also been observed in human population and we know that endocrine-related cancers, such as breast and prostate cancer are on the rise[20]. EDCs have been detected in human tissue, including amniotic fluid and mothers' milk, confirming that exposure is taking place during the sensitive stages of early lifetime[21,22]. In fact, studies on human population have found an association between pre-natal low-level exposure to EDCs and the development of endocrine-related diseases, such as male genital malformations[23,24], precautious puberty[25], obesity [26] and neurotoxicty (brain damage)[27]. These diseases have a great impact on society with enormous health costs (figure XX), and as we can see from the graph most of the costs are attributed to pesticide exposure.

Europeans exposed to endocrine disrupting pesticides

Surprisingly, almost all pesticides classified as endocrine disruptors by PAN Europe were detected in European food products, showing that these chemicals are not regulated at the EU level as they should be. Our study shows that fruit had the highest number of detectable endocrine disrupting pesticide (EDP) residues, with citrus fruit such as mandarins, oranges, grapefruit and lemons being on the top of the list (about half contained EDPs). But also, other common fruit such as peaches, apricots, cherries, table grapes, strawberries and pears were also contaminated with EDPs (about one third contained EDPs). On the other hand, despite having less detectable EDPs (13.6%), a third of certain vegetables like celery, rocket, Chinese cabbage, and some root vegetables, were also found with EDPs. But also, daily vegetables such as lettuce, tomatoes and carrots, were high on the rank. These results are scandalous.

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[19] United Nations Environment Programme and the World Health Organization, 2013. State of the science of endocrine disrupting chemicals-2012

[20] http://globocan.iarc.fr/Pages/fact_sheets_cancer.aspx

[21] Schlumpf M et al., 2010. Exposure patterns of UV filters, fragrances, parabens, phthalates, organochlor pesticides, PBDEs, and PCBs in human milk: Correlation of UV filters with use of cosmetics Chemosphere 81,1171–1183

[22] Foster et al., 2000. Detection of endocrine disrupting chemicals in samples of second trimester human amniotic fluid. J Clin Endocrinol Metab. 85:2954-7.

[23] Fernandez MF et al., 2007. Human Exposure to Endocrine-Disrupting Chemicals and Prenatal Risk Factors for Cryptorchidism and Hypospadias: A Nested Case–Control Study. Environ Health Perspect. 115(Sup1): 8–14.

[24] Haraux E et al., 2016. Maternal Exposure to Domestic Hair Cosmetics and Occupational Endocrine Disruptors Is Associated with a Higher Risk of Hypospadias in the Offspring. Int J Environ Res Public Health,14(1)

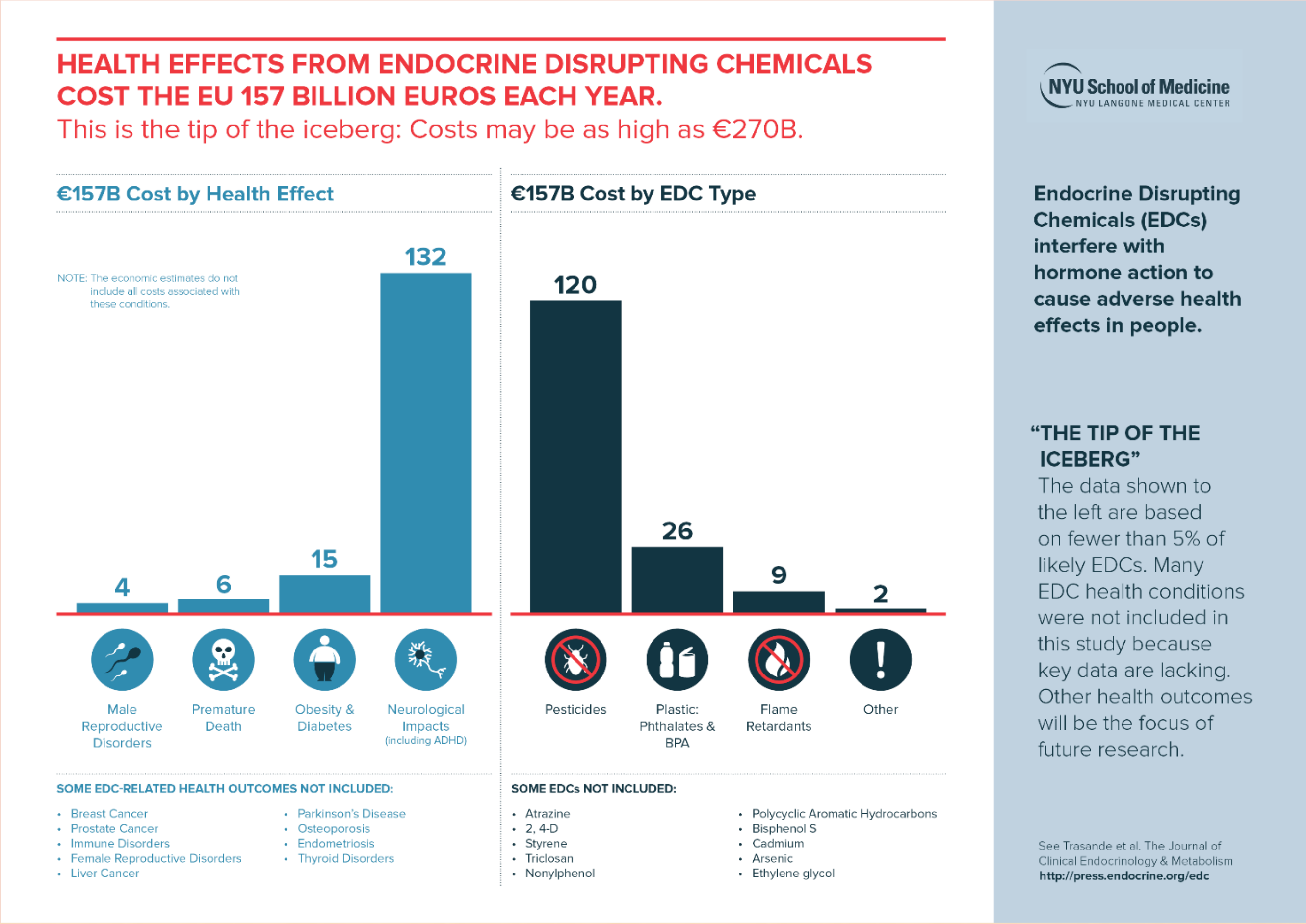
[25] Deng et al., 2010. Effects of growth environments and two environmental endocrine disruptors on children with idiopathic precocious puberty. Eur J Endocrinol.,166:803-9.

[26] Elobeid MA, Allison DB

[27] Gilbert ME et al. 2012. Developmental thyroid hormone disruption: prevalence, environmental contaminants and neurodevelopmental consequences. Neurotoxicology.33:842-52.

Fruit and vegetables are an important part of the daily diet of Europeans, and due to their high nutritional value, they are consumed for their health benefits. Ironically these are also contaminated with pesticides that may cause harm -especially to the most vulnerable parts of the population, namely pregnant women, babies in the womb, new-born babies and children.

TABLE 2 ESTIMATED COSTS OF ENDOCRINE-DISRUPTING CHEMICAL EXPOSURE IN EU



No country left unaffected

The report shows that fruit and vegetables produced in the Southern European countries of Spain, Greece and Italy were the ones with the highest amount of EDPs detected (23-31%) but it was the Northern countries of Ireland, Sweden and the Netherlands that consumed products with most EDPs (32-42%). Therefore, all EU countries are affected from the use of EDPs in agriculture, whether they produce or they consume the food.

Pesticides detected may be toxic at low doses

It is of utmost concern that some of the pesticides (insecticides and fungicides) detected most frequently in European, as well as imported food (such as chlorpyrifos, pyrimethanil, tebuconazole, iprodione, thiacloprid, and lamda-cyhalothrin), have been reported in the scientific literature[28]to cause serious endocrine-related adverse effects. Iprodione and Tebuconazole were even identified as known/presumed endocrine disruptors for humans by European Commission's exercise in 2015. However, with the new EDC criteria and the exception it remains unclear if their use will be regulated at all[29]. Furthermore, the insecticide chlorpyrifos, which acts on the nervous system of insects, is at the top of the list and has been reported to cause neurodevelopmental (brain) toxicity in humans, affecting infants and children[30]. Chlorpyrifos also causes brain damage in laboratory animals[31], and reproductive toxicity[32]. It is clear that these substances are not assessed for their endocrine disrupting potential by regulatory authorities, and since endocrine disruptors may cause adverse effects at low levels of exposure, their safety levels right now may in fact be too high. It is unacceptable and against Europeans' rights to allow commercial unprocessed food to be contaminated with these chemicals.

Mixture effects

It is of particular concern that European food contains not only mixtures of pesticides but also mixtures of EDPs – EDP cocktails! Despite the mandate of both PPPR 1107/2009 and MRL Regulations, mixtures of pesticides are still present in our food without any restriction. It has been proven that certain chemicals combined may have additive effects, or even magnifying effects- i.e. increase the toxicity that one pesticide could have alone[33]. The only restriction currently in place is that individual pesticides have to be below the MRL, and there is no restriction at all on how many of them or up to how much can be present in food, with the result that all kinds of pesticides, herbicides, fungicides, and insecticides can be present in one sample. One fifth (20%) of mandarins and currants had multiple residues of EDPs, followed by oranges and peaches, and up to 8 EDPs were found in table grapes, which

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[28] PAN Europe, 2015. Impact Assessment of the Criteria for Endocrine Disrupting Pesticides. https://goo.gl/52beuW

[29] DG SANTE, 2016. Screening of available evidence on chemical substances for the identification of endocrine disruptors according to different options in the context of an Impact Assessment. Publications Office of the European Union, 2016. https://ec.europa.eu/health/endocrine_disruptors/impact_assessment_en

[30] Burke RD et al., 2017. Developmental neurotoxicity of the organophosphorus insecticide chlorpyrifos: from clinical findings to preclinical models and potential mechanisms. J Neurochem., 142:162-177

[31] Lee I et al, 2015. Developmental neurotoxic effects of two pesticides: Behavior and biomolecular studies on chlorpyrifos and carbaryl. Toxicol Appl Pharmacol.,288:429-38

[32] Nishi K, Hundal SS, 2013. Chlorpyrifos induced toxicity in reproductive organs of female Wistar rats. Food Chem Toxicol.62:732-8.

[33] PAN Europe, 2014. A Poisonous Injection https://goo.gl/S38XD8

could result in a silent toxic 'fruit salad'. Unfortunately, no country remains unaffected from these products.

Final remarks

It is against human rights, and should be illegal, to be exposed to chemicals that may cause harm through food bought in the supermarkets. EDCs may cause serious disorders and diseases in humans and should not be used in the production of our food; alternatively, their use should be strictly regulated (used in closed systems, excluding contact with humans and leaving non-detectable residues in our food). If regulators fail to provide a set of scientific criteria that will successfully identify all pesticides which may cause harm to humans and animals, then it is down to Member States to do this. Governments should put consumers' health and the protection of the environment before the profit of the pesticide industry, which will always push to use more pesticides in agriculture, even though the Sustainable Use of Pesticides Directive 2009/128/EC[34] calls all Member States to use synthetic pesticides only as a last resource, after (and provided that) all non-chemical methods have failed. We have the knowledge to carry out pest management without the use of toxic chemicals, and governments should focus on further developing these techniques, rather than using the public resources in the approval of chemicals that cause harm to humans, the environment and its ecosystems.

Pesticide Action Network Europe

Pesticides Action Netwrok Europe
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Tel. (+32) 2 318 62 55
http://www.pan-europe.info

[34] OJ L 309, 24.11.2009, p. 71–86

Annexes

Annex 1. List of the Endocrine Disrupting Pesticides (EDPs) identified by PANE

PAN Europe – Identified EDPs	Type[a]	TEDX [b]	Commission's Impact Assessment Classification Categories[c]	EFSA pesticide name
2,4-D	HB/PGR	✓	1	2,4-D
				2,4-D (sum of 2,4-D and its esters expressed as 2,4-D)
Abamectin	IN/	✓	2	Abamectin (sum of Avermectin B1a, AvermectinB1b and delta-8,9 isomer of Avermectin B1a)
Amitrole (banned in 2016)	HB	✓	1	Amitrole
Bupirimate	FU	✓	3	Bupirimate
Chlorpyrifos	IN	✓	2	Chlorpyrifos
Chlorpyrifos-methyl	IN	✓	2	Chlorpyrifos-methyl
Cypermethrin	IN	✓	1	Cypermethrin
				Cypermethrin (Cypermethrin including other mixtures of constituent isomers (sum of isomers))
Cyproconazole	FU	✓	2	Cyproconazole
Deltamethrin	IN	✓	2	Deltamethrin
				Deltamethrin (cis-deltamethrin)
Dimethoate	IN	✓	2	Dimethoate
Epoxiconazole	FU	✓	1	Epoxiconazole
Fipronil	IN	✓	2	Fipronil
				Fipronil (sum Fipronil and sulfone metabolite (MB46136) expressed as Fipronil)
Glyphosate	HB	✓	2	Glyphosate
Ioxynil (expired 2015)	HB	✓	-	Ioxynil
				Ioxynil (sum of Ioxynil, its salts and its esters, expressed as ioxynil)

PAN Europe – Identified EDPs	Type[a]	TEDX [b]	Commission's Impact Assessment Classification Categories[c]	EFSA pesticide name
Iprodione	FU	√	1	Iprodione
Lambda-cyhalothrin	IN	√	2	Lambda-Cyhalothrin
				Lambda-cyhalothrin, including other mixed isomeric consituents (sum of isomers)
Linuron (banned in 2016)	HB	√	1	Linuron
Mancozeb[d]	FU	√	1	Measured as sum of total Dithiocarbamates - excluded
Maneb[d] (expired 2017)	FU	√	1	Measured as sum of total Dithiocarbamates - excluded
Metconazole	FU/PGR	X	0	Metconazole (sum of isomers)
Methomyl	IN	√	0	Methomyl
Metribuzin	HB	√	0	Metribuzin
Myclobutanil	FU	√	3	Myclobutanil
Prochloraz	FU	√	2	Prochloraz
				Prochloraz (sum of prochloraz and its metabolites containing the 2,4,6-Trichlorophenol moiety expressed as prochloraz)
Propamocarb	FU		3	Propamocarb
Propiconazole	FU		3	Propiconazole (sum of isomers)
Propyzamide	HB	√	1	Propyzamide
				Propyzamide (sum of propyzamide and all metabolites containing the 3,5-dichlorobenzoic acid fraction expressed as propyzamide)
Pyridate	HB	√	0	Pyridate
				Pyridate (sum of pyridate, its hydrolysis product CL 9673 (6-chloro-4-hydroxy-3-phenylpyridazin) and hydrolysable conjugates of CL 9673 expressed as pyridate)
Pyrimethanil	FU	√	3	Pyrimethanil
				Sum of pyrimethanil and 2-(4-hydroxyanilino)-4.6-dimethylpyrimidine, expressed as pyrimethanil
Spiromefisen	IN	X	2	Spiromesifen

PAN Europe – Identified EDPs	Type[a]	TEDX [b]	Commission's Impact Assessment Classification Categories[c]	EFSA pesticide name
Tebuconazole	FU	✓	1	Tebuconazole
				Tebuconazole (sum of tebuconazole, hydroxy-tebuconazole, and their conjugates, expressed as tebuconazole)
Tepraloxydim (expired in 2015)	HB	X	1	Tepraloxydim
				Tepraloxydim (sum of tepraloxydim and its metabolites that can be hydrolysed either to the moiety 3-(tetrahydro-pyran-4-yl)-glutaric acid or to the moiety 3-hydroxy-(tetrahydro-pyran-4-yl)-glutaric acid, expressed as tepraloxydim)
Thiacloprid	IN	✓	2	Thiacloprid
Thiophanate-methyl	FU	X	1	Thiophanate-methyl
Tralkoxydim	HB	X	1	Tralkoxydim
Triadimenol	FU	✓	2	Triadimenol
Triasulfuron (banned in 2016)	HB	✓	0	Triasulfuron
Total: 37 but 35 selected[d]				**Total: 49 (47 were selected for further analysis)**

[a]HB: herbicide, IN: insecticide, FU: fungicide, PGR: Plant Growth Regulator

[b]US TEDX List of Potential Endocrine Disruptors. https://endocrinedisruption.org/

[c]Preliminary non-legally binding exercise of DG Sante on different criteria options. Category 1: Presumed to cause endocrine disruption; Category 2: Suspected to cause endocrine disruption; Category 3: endocrine active substances; (-) not evaluated, 0 (unclassified)[35]

[d]Maneb and Mancozeb were excluded from the calculations because they are measured as a sum of dithiocarbamates, which correspond to a group of pesticides (maneb, mancozeb, metiram, propineb, thiram and ziram) that are not all endocrine disruptors

[35] DG SANTE, 2016. Screening of available evidence on chemical substances for the identification of endocrine disruptors according to different options in the context of an Impact Assessment. Publications Office of the European Union, 2016. https://ec.europa.eu/health/endocrine_disruptors/impact_assessment_en

Annex 2. Overview of fruit with most EDPs

Product type	Product	Samples	%Samples with residues	%Samples with multiple residues	%EDPs of residues	%Samples with EDPs	%Samples with multiple EDPs	Max. EDPs / sample	EDPs detected
Fruit	Mandarins	1,011	77.6%	60.6%	35.3%	57.1%	22.7%	6	18
	Currants	73	75.3%	69.9%	21.0%	54.8%	20.5%	3	12
	Pineapples	235	57.9%	45.5%	33.2%	46.8%	7.2%	2	5
	Oranges	1,026	72.0%	53.2%	32.1%	46.7%	16.0%	4	13
	Grapefruits	398	75.6%	60.1%	27.8%	45.7%	15.3%	5	15
	Peaches	1,021	71.7%	51.0%	34.9%	45.4%	16.5%	5	15
	Lemons	547	61.2%	44.4%	37.2%	45.2%	13.5%	3	10
	Apricots	523	75.1%	50.3%	27.4%	40.2%	12.8%	5	16
	Cherries	384	68.0%	44.5%	27.7%	38.5%	13.0%	4	11
	Limes	50	88.0%	82.0%	18.4%	38.0%	10.0%	3	7
	Mangoes	372	73.9%	38.7%	26.3%	37.1%	3.0%	3	10
	Table grapes	1,681	79.5%	61.6%	17.5%	34.8%	10.9%	8	21
	Strawberries	869	75.5%	58.3%	17.8%	34.4%	8.5%	5	15
	Pears	1,328	74.5%	57.8%	19.4%	32.3%	9.9%	6	15
	Apples	2,040	66.5%	47.5%	18.2%	26.6%	6.2%	5	17
	Raspberries	81	64.2%	45.7%	20.1%	25.9%	11.1%	3	10
	Plums	485	39.4%	19.4%	37.8%	21.6%	4.9%	3	12
	Bananas	1,461	69.6%	55.8%	12.6%	19.9%	1.7%	3	11
	Avocados	85	27.1%	4.7%	43.3%	15.3%	0.0%	1	1
	Blueberries	159	43.4%	30.8%	15.3%	15.1%	2.5%	2	6
	Kiwi fruits	436	33.9%	9.4%	33.5%	14.4%	1.1%	3	5
	Granate apples	170	37.1%	12.9%	26.9%	12.4%	3.5%	3	8
	Kaki	74	14.9%	0.0%	18.2%	2.7%	0.0%	1	1
	Figs	51	13.7%	2.0%	0.0%	0.0%	0.0%	0	0
	Total	14,558	68.5%	50.0%	23.6%	34.4%	10.0%	8	25

Annex 3. Overview of vegetables most contaminated with EDP

Product type	Product	Samples	%Samples with residues	%Samples with multiple residues	%EDPs of residues	%Samples with EDPs	%Samples with multiple EDPs	Max. EDPs / sample	EDPs detected
Vegetables	Celeries	199	69.3%	49.7%	29.7%	39.7%	11.6%	4	11
	Roman rocket/rucola	284	90.5%	78.9%	12.0%	34.9%	8.8%	3	11
	Celeriacs/turnip rooted celeries	281	77.9%	57.7%	19.4%	32.7%	10.7%	6	11
	Chinese cabbages/pe-tsai	117	46.2%	18.8%	45.5%	30.8%	8.5%	2	10
	Parsley roots/Hamburg roots parsley	119	45.4%	21.0%	45.9%	30.3%	6.7%	3	6
	Okra (lady's fingers)	110	48.2%	20.9%	27.7%	20.9%	2.7%	2	7
	Spinaches	317	41.3%	21.8%	32.4%	20.2%	5.0%	4	7
	Lettuces	1,047	54.7%	35.7%	16.0%	18.4%	4.2%	3	17
	Tomatoes	1,539	45.3%	25.7%	21.4%	17.9%	3.7%	3	19
	Carrots	714	40.3%	14.7%	28.2%	16.8%	1.1%	2	6
	Chards/beet leaves	96	40.6%	22.9%	18.6%	16.7%	0.0%	1	7
	Sweet peppers/bell peppers	5,337	43.9%	23.3%	21.8%	16.4%	3.2%	4	23
	Kales	50	34.0%	24.0%	23.7%	16.0%	2.0%	2	5
	Spring onions/green onions and Welsh ..	120	34.2%	16.7%	27.5%	15.8%	2.5%	4	10
	Leeks	205	28.8%	13.2%	29.1%	13.2%	2.4%	2	6
	Florence fennels	114	41.2%	23.7%	22.4%	13.2%	3.5%	2	8
	Escaroles/broad-leaved endives	184	46.7%	27.7%	13.5%	13.0%	1.1%	3	9
	Melons	550	54.5%	33.8%	9.1%	12.7%	1.1%	2	14
	Cucumbers	989	51.0%	28.7%	11.2%	11.2%	1.6%	3	18
	Aubergines/eggplants	1,235	33.7%	12.8%	15.1%	7.8%	1.1%	4	16
	Radishes	365	43.0%	15.9%	11.9%	7.1%	2.5%	3	8
	Broccoli	1,057	46.4%	18.1%	10.2%	6.7%	0.9%	3	10
	Courgettes	608	24.5%	9.7%	17.5%	6.6%	0.0%	1	11
	Globe artichokes	78	19.2%	7.7%	18.8%	6.4%	1.3%	2	4
	Head cabbages	387	21.7%	7.8%	19.0%	5.7%	1.6%	3	9
	Kohlrabies	94	33.0%	10.6%	11.9%	5.3%	0.0%	1	4
	Turnips	79	16.5%	6.3%	17.4%	5.1%	0.0%	1	4
	Brussels sprouts	102	48.0%	14.7%	6.8%	4.9%	0.0%	1	2
	Witloofs/Belgian endives	128	25.0%	12.5%	10.9%	4.7%	0.0%	1	5
	Pumpkins	75	17.3%	5.3%	22.2%	4.0%	1.3%	2	3
	Cauliflowers	517	16.8%	3.1%	11.6%	2.3%	0.2%	2	5
	Onions	437	9.6%	1.6%	21.2%	2.3%	0.2%	2	4
	Beetroots	59	8.5%	5.1%	20.0%	1.7%	1.7%	2	2
	Asparagus	133	2.3%	0.0%	66.7%	1.5%	0.0%	1	2
	Cassava roots/manioc	73	21.9%	1.4%	5.9%	1.4%	0.0%	1	1
	Watermelons	162	9.9%	3.1%	4.3%	0.6%	0.0%	1	1
	Cresses and other sprouts and shoots	52	40.4%	36.5%	0.0%	0.0%	0.0%	0	0
	Sweet potatoes	125	17.6%	1.6%	0.0%	0.0%	0.0%	0	0
	Yams	104	0.0%	0.0%	0.0%	0.0%	0.0%	0	0
	Total	18,239	41.4%	21.8%	18.5%	13.7%	2.6%	6	26

Annex 4. Overview of pesticides most frequently detected in European fruit and vegetables.

Pesticide	Approved	Fruit	Vegetables	Total
Chlorpyrifos	Yes	12.2% (1,746 of 14,330)	2.3% (410 of 17,670)	6.7% (2,156 of 31,994)
Pyrimethanil	Yes	7.7% (1,008 of 13,123)	1.3% (218 of 16,894)	4.1% (1,226 of 30,011)
Tebuconazole	Yes	5.7% (777 of 13,676)	2.7% (464 of 16,997)	4.0% (1,241 of 30,667)
Iprodione	Yes	3.6% (480 of 13,283)	1.5% (262 of 17,002)	2.5% (742 of 30,283)
Thiacloprid	Yes	4.1% (489 of 11,824)	0.9% (132 of 15,527)	2.3% (621 of 27,345)
Propamocarb	Yes	0.0% (1 of 2,138)	4.9% (75 of 1,532)	2.1% (76 of 3,670)
Lambda-cyhalothrin	Yes	2.6% (350 of 13,286)	1.4% (236 of 16,736)	2.0% (586 of 30,016)
Myclobutanil	Yes	3.2% (445 of 13,775)	0.5% (85 of 17,273)	1.7% (530 of 31,042)
Prochloraz	Yes	2.9% (472 of 12,044)	0.1% (14 of 12,486)	1.5% (486 of 24,524)
Cypermethrin	Yes	1.7% (293 of 13,918)	1.2% (212 of 17,476)	1.4% (505 of 31,388)
Chlorpyrifos-methyl	Yes	1.9% (264 of 14,266)	0.8% (144 of 17,659)	1.3% (408 of 31,919)
Triadimenol	Yes	1.1% (123 of 10,915)	0.9% (92 of 10,252)	1.0% (215 of 21,161)
Deltamethrin	Yes	1.3% (174 of 13,732)	0.7% (124 of 17,242)	1.0% (298 of 30,968)
Spiromefisen	Yes	0.2% (14 of 9,137)	1.4% (183 of 13,138)	0.9% (197 of 22,269)
2,4-D	Yes	1.7% (108 of 5,780)	0.0% (2 of 6,133)	0.8% (110 of 11,907)
Propiconazole	Yes	1.6% (212 of 13,588)	0.2% (26 of 17,063)	0.8% (238 of 30,645)
Linuron	No	0.0% (1 of 11,623)	1.3% (192 of 15,354)	0.7% (193 of 26,971)
Thiophanate-methyl	Yes	0.9% (94 of 10,511)	0.5% (72 of 14,041)	0.7% (166 of 24,546)
Bupirimate	Yes	0.8% (116 of 13,926)	0.4% (66 of 17,323)	0.6% (182 of 31,243)
Dimethoate	Yes	0.6% (63 of 11,133)	0.2% (19 of 10,440)	0.4% (82 of 21,567)
Abamectin	Yes	0.2% (12 of 6,445)	0.2% (12 of 6,435)	0.2% (24 of 12,874)
Propyzamide	Yes	0.0% (2 of 13,441)	0.3% (50 of 17,055)	0.2% (52 of 30,490)
Glyphosate	Yes	0.4% (1 of 274)	0.0% (of 362)	0.2% (1 of 636)
Cyproconazole	Yes	0.3% (32 of 12,100)	0.1% (10 of 15,952)	0.1% (42 of 28,046)
Methomyl	Yes	0.1% (5 of 9,869)	0.1% (13 of 9,534)	0.1% (18 of 19,403)
Epoxiconazole	Yes	0.0% (5 of 12,420)	0.0% (7 of 16,205)	0.0% (12 of 28,619)
Fipronil	No	0.0% (1 of 11,671)	0.0% (4 of 14,976)	0.0% (5 of 26,641)
Amitrole	No	0.0% (of 571)	0.0% (of 611)	0.0% (of 1,182)
Ioxynil	No	0.0% (of 4,710)	0.0% (of 4,992)	0.0% (of 9,696)
Metconazole	Yes	0.0% (of 10,863)	0.0% (of 10,846)	0.0% (of 21,703)
Metribuzin	Yes	0.0% (of 12,005)	0.0% (of 12,046)	0.0% (of 24,045)
Pyridate	Yes	0.0% (of 2,332)	0.0% (of 2,576)	0.0% (of 4,908)
Tepraloxydim	No	0.0% (of 3,227)	0.0% (of 3,267)	0.0% (of 6,494)
Tralkoxydim	Yes	0.0% (of 1,333)	0.0% (of 1,478)	0.0% (of 2,811)
Triasulfuron	No	0.0% (of 2,207)	0.0% (of 2,070)	0.0% (of 4,277)
Grand Total		34.9% (7,288 of 14,673)	14.2% (3,124 of 18,006)	23.5% (10,412 of 32,673)