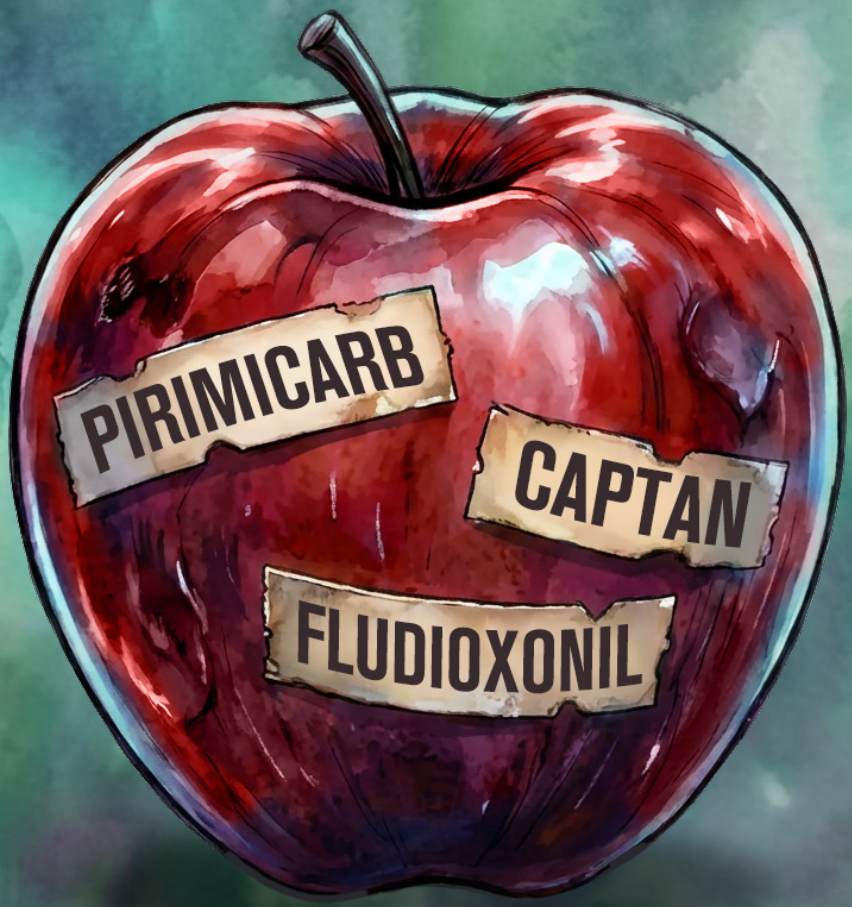
Pesticide Action Network Europe

REPORT

Pesticide cocktails

PFAS and neurotoxins in most European apples



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Executive Summary

Apples are among the most consumed fruits in Europe. Their local production has intensified over the last decades and their production methods heavily rely on pesticides. Conventional apples are sprayed on average around 30 times a year with pesticides.

Jointly with 13 partner organisations in 13 European countries, we have analysed pesticide residues in 59 samples of locally produced apples. Nearly all (93%) apple samples contained at least one residue of pesticide and 85% of the samples contained multiple residues of pesticides. Some samples contained up to 7 different pesticide residues.

The authors of this report are concerned by the fact that apples are contaminated with pesticides that are considered as highly toxic. The EU category of the most toxic pesticides (namely *Candidates for Substitution*) contaminate 71% of the samples, while 64% of the samples contain at least one PFAS pesticide. Neurotoxic pesticides were found on 36% of the samples.

The report underlines the issue of multiple exposure, that is not taken into account in the regulatory process. Pesticides are still risk assessed in silo, but the cocktail (synergistic) effect of pesticides is mostly disregarded. Mounting scientific evidence points at the potential impact of exposure to multiple residues of pesticides via food, in particular on reproductive diseases. The Maximum Residue Levels (MRLs) regulation (EC) 396/2005 nevertheless foresees that the European Food Safety Authority (EFSA) develops a methodology to take into account the risk of multiple exposure. Twenty years later, it is still not the case. The authors of this report regret a lack of prioritisation on this important topic.

Finally, a striking outcome of this study is that, if they were sold as processed baby food, 93% of the apple samples would not be allowed, as they exceed the legal limit of 0.01 mg/kg. The EU has indeed set strict limits for children under the age of 3, in order to protect their development.

The authors of this report recommend parents to give priority to organic apples, when feeding their children, and to peel them if they are non-organic. They also request decision makers to better implement the law, as a series of found substances should have been banned, because of their intrinsic toxicity, according to EU law. They also request to speed up the development of a methodology to take into account exposure to multiple pesticides via food, and, in the meantime, to set a safety factor of 10, to increase consumer protection.

This report shows how much a better implementation of EU law is crucially needed, in contrast with the current proposal from the European Commission, via an Omnibus regulation on food and feed safety that will lower the level of protection of citizens and the environment.

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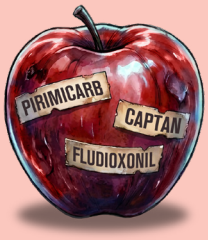


Pesticide cocktails, PFAS and neurotoxins in most European apples

Introduction

"An apple a day keeps the doctor away" is an old saying that is backed by science. Indeed, apples are a source of fibers and vitamins, they help regulate hunger, while recent research shows they are beneficial for our gut microbiota.

Healthy school snack, crumbles, pies, compotes, stuffed apples: this emblematic fruit is central in European's feeding habits and it is promoted as healthy food. From wild sour apple trees originally naturally growing on the slopes of Kazakhstan mountains, apple trees spread to all temperate regions of the world through trade, and each region developed its local varieties over centuries.

Over time, new varieties were developed to suit industrial apple production: easier to manage low-stem varieties that heavily depend on the use of agrochemicals became mainstream. Unfortunately, apple production is nowadays one of the biggest consumers of pesticides. On average, a conventional apple is sprayed 30[1] times before reaching the shop. Considering apples' position as one of the most consumed fruits, it potentially represents an important source of pesticide exposure for consumers.

With this research, the Pesticide Action Network Europe wishes to give a glimpse on how contaminated apples are throughout the EU. Even if individually, pesticide residues remain within the maximum residue limit (MRL), the findings are highly concerning, considering the diversity of substances found, as well as the fact that a majority of apples contain multiple residues, the so-called "cocktails of pesticides". Despite being a legal requirement from 2005, there is currently still no regulatory framework concerning exposure to such cocktails in the EU.

Finally, our findings show that over 90% of the tested European conventional apples would not be fed to babies as processed food, according to the EU legislation. Parents are usually not aware that pesticide residue limits for processed baby food are much stricter than those for fresh products.

We do encourage people to eat fruit, but they have the right to healthy food not contaminated with a cocktail of toxic chemicals. This report contains recommendations for citizens to better protect themselves and for decision makers, on legislative and agronomic tools to reduce pesticide needs.

[1] Zaller et al. 2023

1. Methods

Between 1 and 20 September 2025, three to five samples of different locally-produced conventional apples were bought from supermarkets or markets in 13 European countries, namely Belgium, Croatia, Czechia, Denmark, France, Germany, Hungary, Italy, Luxembourg, the Netherlands, Poland, Spain and Switzerland[2]. A total of 59 nationally-grown apple samples were sourced (see table 1).

Each sample was composed of several apples (min. 500g) from the same variety[3]. For the production of the statistics, it was considered that all apples from one sample came from the same producer and were equally treated and contaminated.

Samples were immediately shipped to an accredited laboratory for pesticide residue analysis. Residue analysis was carried out according to international standard certification[4].

Apples were collected in some markets and mostly in supermarkets (see Table 1).

Only results above the Limit of Quantification (LOQ), i.e. usually 5-10 µg/kg, were considered in this report. Samples containing residues between the Limit of Detection (LOD) and the LOQ were not taken into account. In other words, the concentration of pesticides present in "positive apple samples" cannot be considered as simple traces but as a genuine pesticide exposure.

Specific statistics were derived for a series of pesticide substances:

1. PFAS pesticides, based on their chemical formula,
2. Candidates for Substitution, based on the EU legal definition and
3. Neurotoxic pesticides, based on work carried out by the European Food Safety Authority (EFSA)[5].

[2] Partners in sampling project: Nature et Progrès Belgique (Belgium), Earth Trek (Croatia), Hnuti DUHA - Friends of the Earth Czech Republic (Czech republic), Danish Consumer council THINK CHEMICALS. Forbrugerrådet Tænk (Denmark)(Czech republic), Générations Futures (France), PAN Germany (Germany), MTVSZ - Friends of the Earth Hungary (Hungary), Koen Hertoge - PAN Europe (Italy), Mouvement Ecologique (Luxembourg), Pesticiden Netwerk - PAN Netherland (Netherlands), Koalicja Żywa Ziemia - Living Earth Coalition (Poland), Ecologistas en Accion (Spain), WWF Schweiz (Switzerland)

[3] One exception lies with Luxembourg, where two samples were, each time, constituted of different varieties coming from the same producer. It was considered that they were equally treated with pesticides by the producer.

[4] Method based on DIN EN 15662 and §64 LFGB L00.00-115, with an uncertainty of ± 50%

[5] https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2021.6392
https://efsa.onlinelibrary.wiley.com/doi/10.2903/j.efsa.2019.5800

1. Methods

Table 1: Origin of apple samples per country

Country	No. of Samples	Sources	Main Apple Varieties Collected
Belgium	4	Intermarché and Carrefour express	Boskoop, Wellant, Golden, Jonagold
Croatia	3	One supermarket (anonymised)*	Gala, Red Delicious, Golden Delicious
Czech Republic	5	Tesco, Lidl, Billa	Golden Delicious, Red Apples, Gala, Honey Crunch
Denmark	5	Netto, Superbrugsen, Føtex, Rema1000	Aroma, Rød Ingrid Marie, Discovery, Rød Gråsten
France	5	One supermarket (anonymised)**	Gala, Golden Delicious, Elstar, Reine des Reinettes, Belle de Boskoop
Germany	5	Farmer Market and one supermarket (anonymised)*	Elstar, Gravensteiner, Gala, Wellant
Hungary	5	Prima, Penny Market, Spar	Red Chief, Golden, Gala
Italy (South Tyrol)	5	Local farmer markets (Rabland, Eyrs – Val Venosta)	Golden Delicious, Pinova, Jonagold, Gala, Sweetango
Luxembourg	3	Two apple producers and one supermarket (anonymised)**	Elstar, local varieties
Netherlands	5	Lidl, Albert Heijn, Jumbo, De Groentemarkt (Heemskerk)	Elstar, Delcorf
Poland	4	Biedronka, Carrefour Express	Cortland, Mazowieckie mix, Lobo, Gala
Spain	5	Mercadona, BM Urban	Gala, Granny Smith, Royal Gala, Reineta
Switzerland	5	4 supermarkets (anonymised)***	Gala, Golden, Jonagold

* All samples came from a single supermarket source, we therefore decided to anonymise the source.

** Because apples of two samples were purchased directly at the producer and the other sample also at a single supermarket, the authors preferred anonymizing the origin of the samples.

*** Our partner requested to anonymise the source.

2. Results

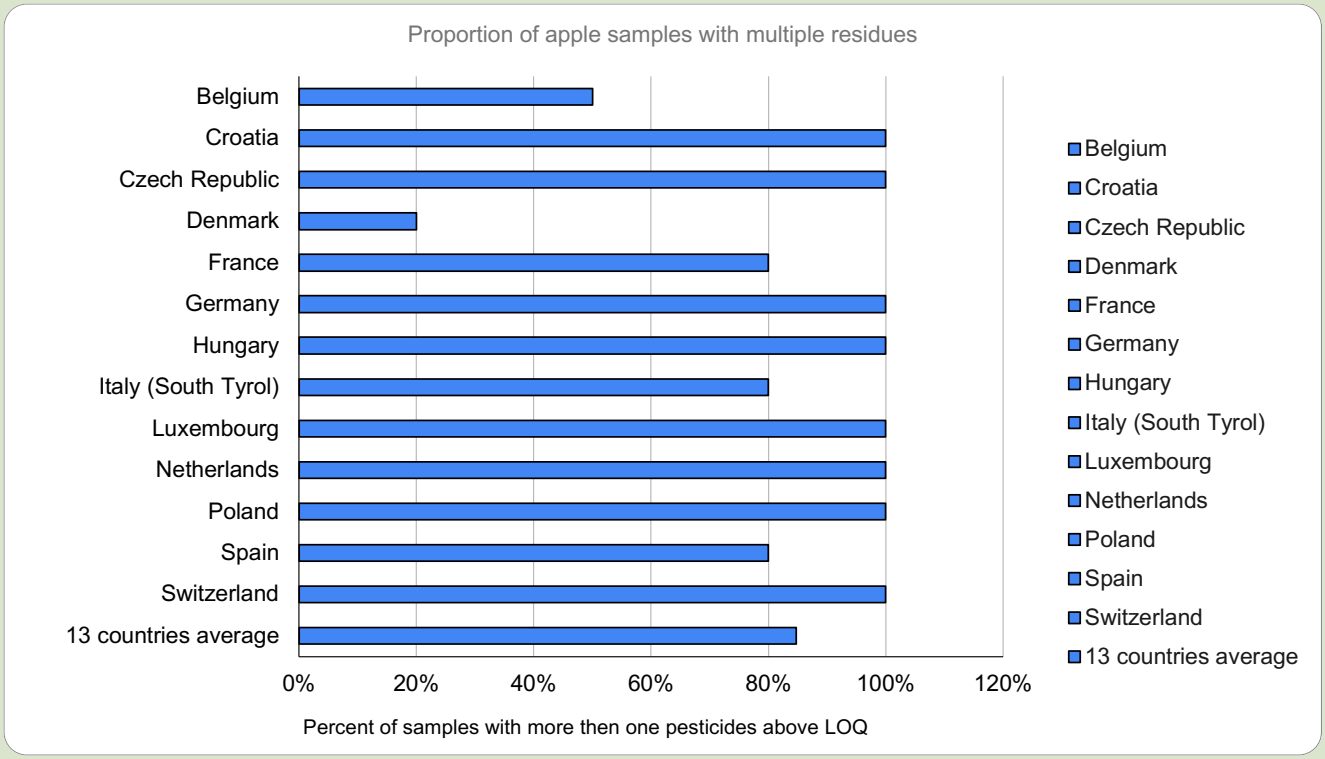
2.1 Cocktail of pesticides on most apples

Our research shows that 85% of the samples contained more than one pesticide residue. In many countries, cocktail-free conventional apples simply were not found[6]!

On average, European apples contain 3 pesticide residues. Countries where the cocktail contains, on average, the most pesticide ingredients are Luxemburg (5 different pesticide residues), while Croatian and Hungarian apples contain 4 residues on average!

The most colourful cocktail? The winners are Luxembourg and the Czech Republic, where up to 7 different pesticide residues were detected in a single sample! In opposition, Denmark had only one sample (out of 5) with more than 1 pesticide.

As discussed further, there is currently in Europe no regulation of multiple residues in food: the process is blocked by the European Food Safety Authority (EFSA) for 20 years (see below, page 12)!



[6] Croatian, Czech, Dutch, German, Hungarian, Luxemburgish, Polish and Swiss samples all contained multiple pesticide residues

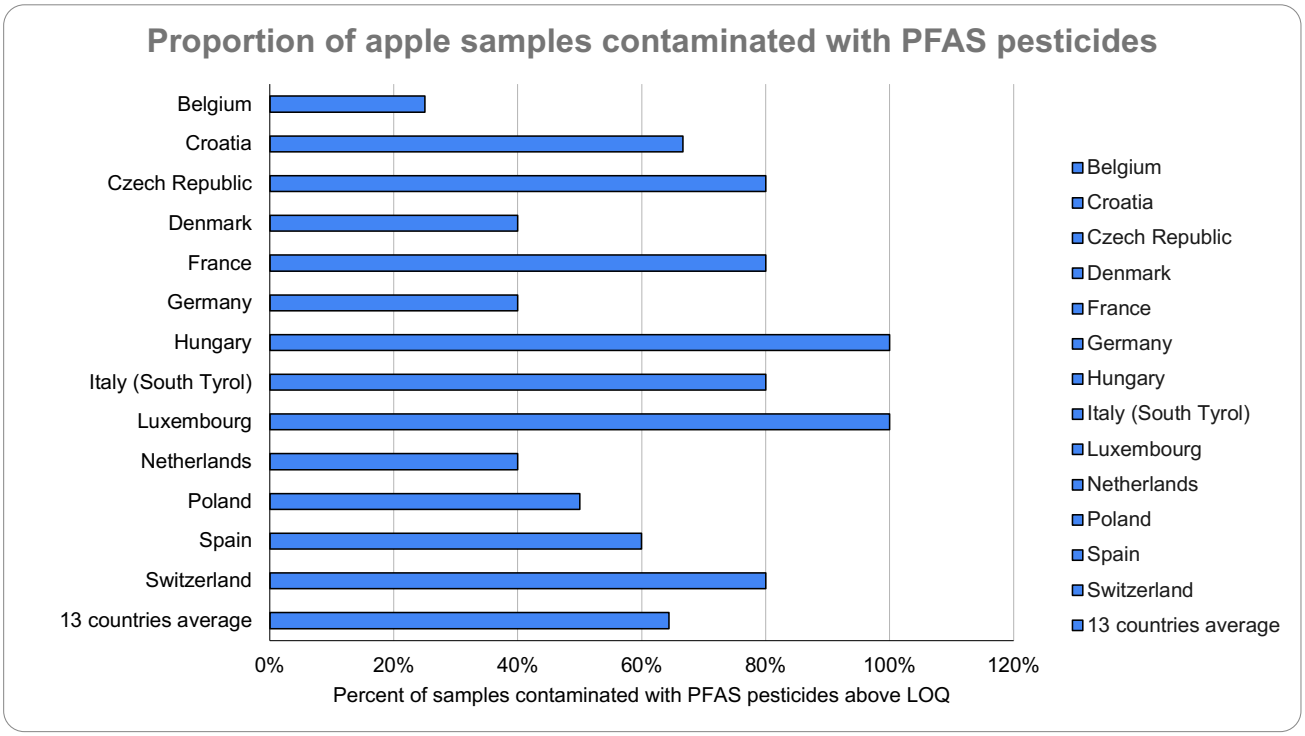
2.2 PFAS apple

If you're looking for your daily shot of Per- and Polyfluoroalkyl Substances (PFAS), consume 2 apples, and you'll likely get it! More than one out of 2 apples (64%) contain at least one PFAS pesticide residue. Eight different PFAS pesticides were detected across all apple samples. There was no country where PFAS pesticides were not detected in at least one sample.

These PFAS pesticides detected are toxic and very persistent themselves (e.g. fludioxonil, tetraconazole) while most of them also break down to TFA (cyflufenamid, fluopyram, flonicamid, fluvalinat, lambda cyhalothrin, trifloxystrobin)[7].

TFA -Trifluoroacetic acid - is highly persistent, very mobile and very toxic. Recent studies have shown it causes developmental toxicity and adverse effects on thyroid and reproduction. Due to its high mobility and persistence it is detected in water resources all across Europe[8]. Although TFA was not measured in the current study, it has been detected in plant based products such as cereals and wine. According to the pesticide Regulation (EC) 1107/2009, pesticides that break down to such toxic compounds have to be banned, but the European Commission and Member States have not taken action to remove all PFAS pesticide from the market. As a result they contaminate our food.

Considering the long-term persistence and toxicity of PFAS, their presence in apples is highly concerning.



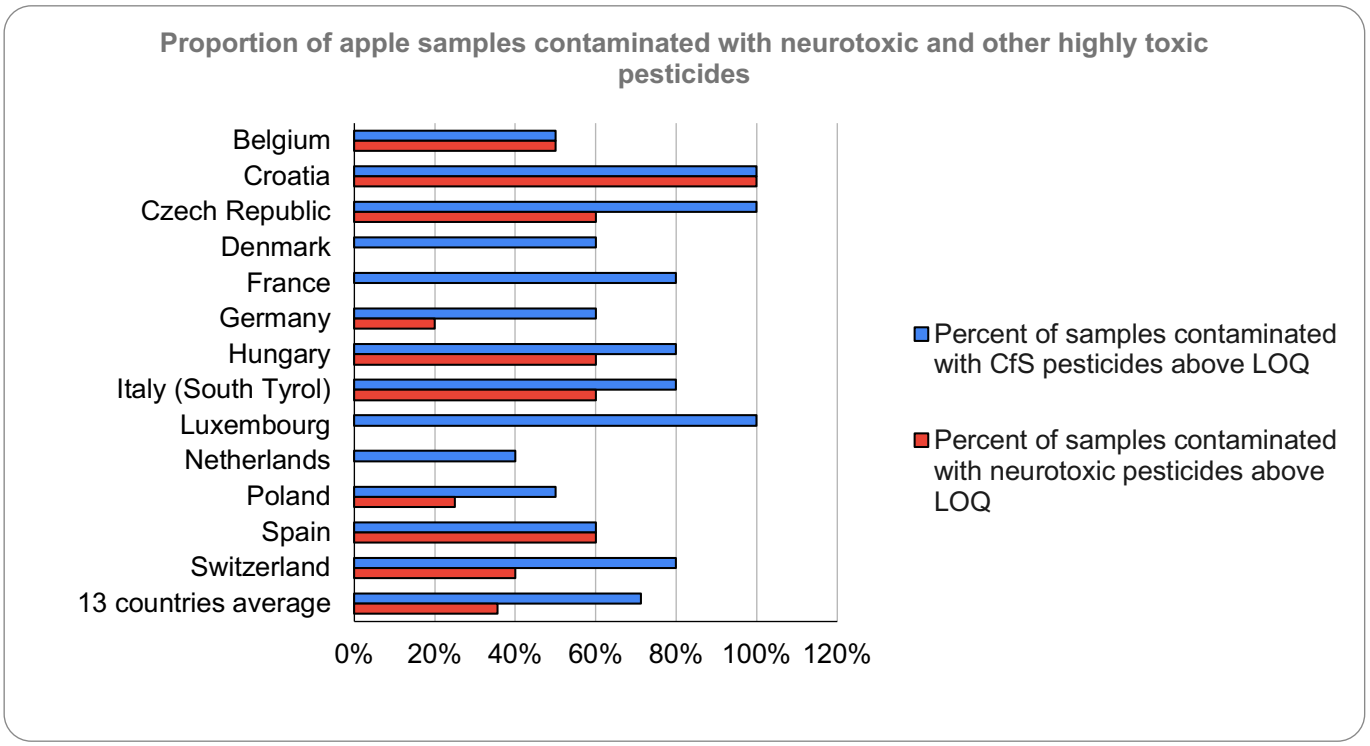
[7] https://www.pan-europe.info/campaigns/ban-pfas-pesticides-and-tfa

[8] PAN Europe Position Paper - banning PFAS pesticides and other sources of TFA, 2025.

2.3 Fancy for a more-toxic or just a neurotoxic apple?

Seventy one percent (71%) of the tested apples contain residues of European's most toxic pesticides list - namely *Candidates for Substitution*[9]. Member States have been supposed to phase them out since 2011, but they never did. For example, difenoconazole and pirimicarb, which should have been banned because alternatives exist, were often found on apples

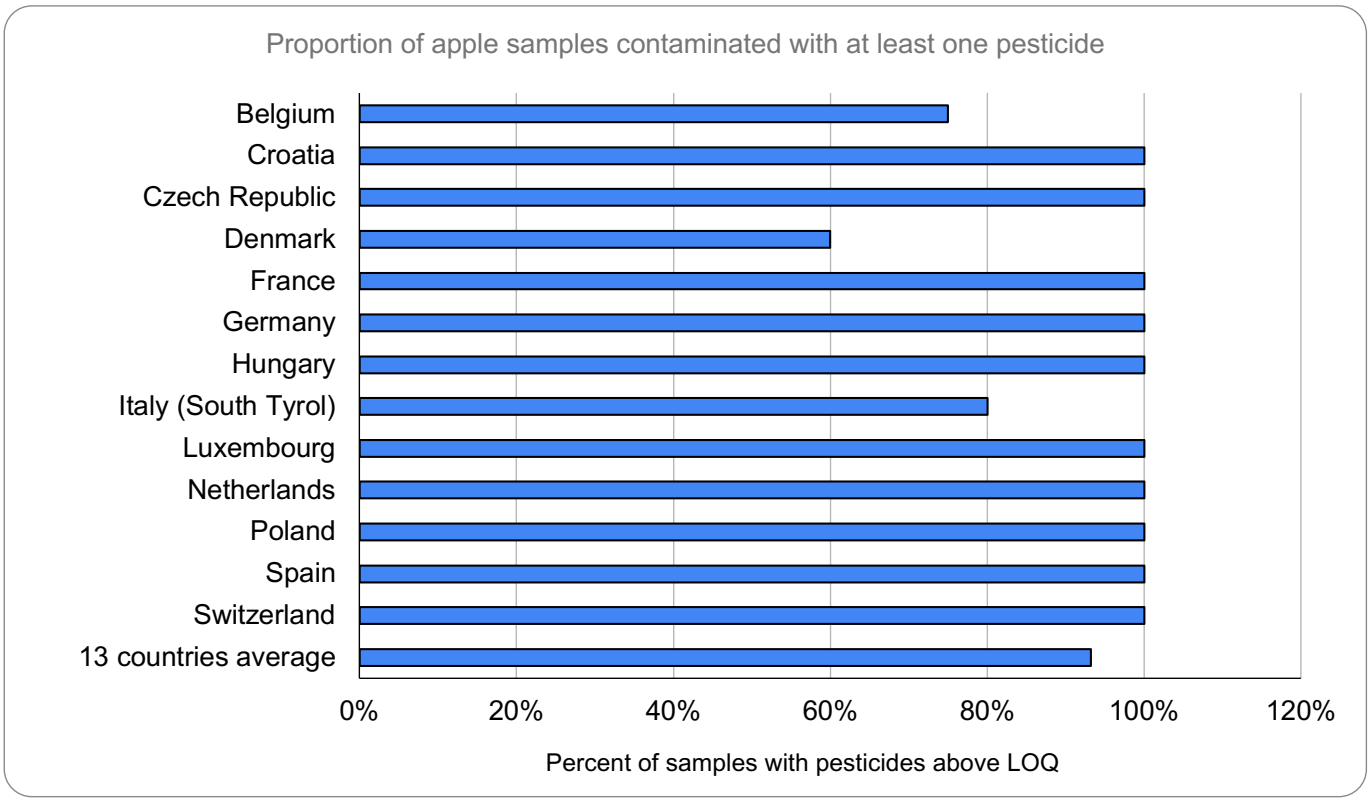
Among the most toxic properties of pesticides, neurotoxicity[10] is a growing concern (e.g. Parkinson's disease, reduced IQ because of exposure before and after birth): 36% of tested apples contained at least one neurotoxic pesticide residue, such as acetamiprid or deltamethrin. In some countries, exposure to neurotoxic pesticides is systematic (3 out of 3 in Croatia), while in others, citizens can feel lucky with their national apples, where no neurotoxic pesticide residue was found: Denmark, France, Luxembourg and the Netherlands.



[9] https://www.pan-europe.info/eu-legislation/eu-legislation-pesticides/candidates-substitution
[10] https://www.pan-europe.info/campaigns/save-our-brain

2.4 Conventional apples usually exceed legal limits for processed baby food

European law forbids providing processed food with quantifiable residues of pesticides to infants (under 12 months of age) and young children (between one and three years of age). If the apples from our study were processed baby food, less than 7% of tested apples could legally be fed to babies and toddlers. Indeed, 93% of apples contain pesticide residues, and usually more than one. Residues found in this study were up to 600 times higher than the legal limit for processed baby food. Only four samples out of 59 (two from Denmark, one from Belgium and one from Italy) can be considered pesticide-free.



2.5 Acetamiprid, Captan, and more...

Some of the most (toxic and) controversial European pesticides are frequently found in our testing campaign:

- **Captan** can be found in 61% of the apples. This widely used fungicide is classified as a suspected carcinogen, and is highly toxic to aquatic organisms. Captan was reapproved in Europe in contradiction with EU law according to PAN Europe, and a legal action is ongoing. No safe use was identified by the European Food Safety Authority (EFSA) and the European Commission re-approved it with unrealistic risk mitigation measure conditions.

- **Fludioxonil** PFAS pesticide is found in nearly 40% of the samples. As a Candidate for Substitution, it should have been phased out in Europe since 2011, considering the numerous available alternatives. Toxic to liver and kidney for humans, identified by EFSA as an endocrine disruptor in 2024, while it decimates fish and amphibians in aquatic environments. Its classification as an endocrine disruptor should have led to a ban on the substance but Member States are blocking the process.

- **Acetamiprid**: nearly one out of five European apples contain residues of this highly concerning bee-toxic pesticide. Mounting scientific evidence shows that this neurotoxic substance, like other neonicotinoids, passes directly the placental barrier and can affect the development of foetuses' brains[11]. The European Food Safety Authority (EFSA) has highlighted it to the European Commission since 2013 and only last year, after years of slowing down the process, has the European Commission requested from pesticide companies, a developmental neurotoxicity study. PAN Europe and Générations Futures stressed that academic research results are more than sufficient today to ban this substance immediately.

Table 2: Number of detections for the top 5 most detected pesticides in apples (above LOQ)

Rank	Pesticide	Number of detections (LOQ)	Effects
1	Captan	36	A suspected carcinogen fungicide, and is highly toxic to aquatic organisms.
2	Fludioxonil	23	A PFAS pesticide, endocrine disruptor and member of the EU's most toxic pesticides list.
3	Pirimicarb	14	A suspected carcinogenic insecticide classified as CfS and it poses a high risk to aquatic organisms. Neurotoxic and one of the 12 most toxic pesticides in the EU.
4	Chlorantraniliprole	12	Chlorantraniliprole is very toxic to aquatic invertebrates and sediment-dwelling organisms - both acute and chronic terms
5	Acetamiprid	11	A neonicotinoid toxic to bees, with scientific findings pointing at toxicity to developing foetuses' brains.
5	Boscalid	11	Persistent in the environment and shows high toxicity to aquatic invertebrate

[11] Longoni et al. 2024, Lee et al. 2024, Pan et al. 2023

3. Discussion

3.1 Concerning findings

The results found in this report are consistent with previous research on pesticide residues in apples, revealing that they are highly contaminated fruits[12]. The level of contamination of apples remains high, and apples are a significant source of pesticide exposure for European consumers. Overall, despite the growing availability of alternatives to synthetic pesticides, it seems that the uptake by the sector is low and incentives are insufficient.

In contrast, the level of contamination of organic apples is usually very low[13]. Pesticides authorised in organic apple growing are of low toxicity to humans and usually of lower toxicity to the environment.

3.2 Cocktail residues: Happy 20th Birthday of inaction to EFSA

In 2005, the European Union harmonised Maximum Residue Levels (MRLs) of pesticides across the EU through the MRL Regulation (EC) 396/2005. This regulation stipulates that the toxicity of multiple exposure to pesticides is to be taken into account in the regulatory process, once the European Food Safety Authority (EFSA) develops a methodology. After 20 years, no methodology is in sight! While synergistic and additive effects, the so-called "cocktail effects" are well described in the scientific literature, the EFSA has failed to provide a methodology to assess their impact, which has never been questioned by the European Commission.

During two decades, the EFSA has funded a few research projects and decided to focus on cumulative (additive) effects, through the concept of Cumulative Assessment Groups (CAGs)[14]. These CAGs include substances with a similar mode of action, and EFSA carries out a risk assessment based on additivity. While PAN Europe acknowledges the importance of this work, this approach does not cover potential synergistic effects, and EFSA has failed to develop a methodology to implement the EU legislation.

Mounting scientific evidence shows that chronic exposure to higher levels of pesticide residues via

[12] EFSA pesticide residues annual report 2025
Greenpeace report 2015 «Pesticide application as routine in EU apple production»
[13] Kutman et al. 2025
[14] https://food.ec.europa.eu/plants/pesticides/maximum-residue-levels/cumulative-risk-assessment_en

food is associated with health concerns. Long-term exposure to multiple residues of pesticides is linked to reduced fertilisation rate[15], to lower ovary reserve[16], to lower sperm quality[17], as well as a lower chance of success of reproduction under assisted reproductive technology[18]. In addition, a French epidemiologic study concluded that the regular consumption of organic food reduces by 25% the likelihood to develop different types of cancers, and in particular lymphomas (blood cancers)[19].

Testing every pesticide cocktail combination is not possible but the level of knowledge on the toxicity of exposure to multiple residues of pesticides is low due to a lack of research funding. While the EFSA continues to assess the risk of pesticides, substance by substance, this does not correspond to the reality. Until a methodology is developed, an additional safety factor of 10 should be set, in order to account for the absence of a methodology (see page 12).

3.3 Concerns for our babies and toddlers

In the EU, the legislation foresees that processed baby and toddler food must not contain residues of pesticides above the legal Limit of 0.01 mg/kg. While this limit is arbitrary, as technology actually allows to quantify residues of most pesticides far below 0.01 mg/kg, preventing exposure of babies and toddlers at such a vulnerable stage of their lives is paramount. Indeed, the neurologic and immune systems are in full development and sensitive to exposure to chemicals. Even very low concentrations of some chemicals can do irreparable harm.

If fresh food was treated equally to processed food, less than 7% out of the tested samples would meet this requirement of the EU legislation[20]. Therefore, it is incomprehensible that public authorities do not strongly recommend parents and childcare professionals to feed young children only with organic fruit and vegetables.

In addition, a growing body of scientific evidence points at the risk of pesticide exposure during pregnancy. Indeed, certain pesticides such as acetamiprid directly pass the placental barrier and interact with foetuses' developing brains. Public authorities should therefore actively inform citizens on the importance of eating organic food during pregnancy.

[15] Kazemi et al. 2025
[16] Kazemi et al. 2025
[17] Chiu et al. 2015
[18] Chieu et al. 2017
[19] Baudry el al. 2018
[20] Regulation (EU) 2016/127 on the specific compositional and information requirements for infant formula and follow-on formula and as regards requirements on information relating to infant and young child feeding

3.4 Sustainable Use of Pesticides Directive: 17 years of inaction

The EU has adopted in 2009 a Directive on the Sustainable Use of Pesticides (SUD).[21] The objective of this legislation is to gradually reduce pesticide dependence in the EU, while protecting citizens and the environment against exposure to pesticides.[22] While the SUD does not deal with pesticide residues in food, it should have led to a gradual reduction of the presence of such residues, through the implementation of alternative crop protection methods, and a reduction in synthetic pesticide use.

Indeed, the SUD foresees that Integrated Pest Management (IPM) must be mandatory in all farms as from 2014. IPM is a systemic approach of crop protection, investing in prevention, while giving priority to non-chemical pest control approaches when needed.

Non-chemical alternatives to synthetic pesticides are broadly available in apple production. Insecticides can be replaced by non-chemical alternatives such as mating disruption, funghi-resistant varieties are available, while herbicides are replaced by other grass or weed management practices (mowing, use of sheep, etc.).

The significant share of organic apple production in some European countries shows that producing apples without synthetic pesticides is technically feasible. In Germany for instance, 15% of apples are organic[23].

The non-implementation of the SUD has been highlighted in a report[24] from 2020 from the European Court of Auditors. The report underlines that the transposition of the SUD into national legislation was never assessed by the European Commission. The report also highlights that the SUD did not meet its objectives, mostly through a non-implementation at Member States level.

[21] Directive 2009/128/EC
[22] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1768841467053&uri=CELEX%3A32009L0128
[23] https://www.landwirtschaft.de/infothek/landwirtschaft-in-zahlen/pflanze/jeder-siebte-heimische-apfel-ist-ein-bio-apfel
[24] https://www.eca.europa.eu/en/publications?did=53001

3.5 Candidates for substitution: 17 years of inaction

In 2009, the EU harmonised and improved the pesticide authorisation system at Member States level. It created a new pesticide classification, namely Candidates For Substitution (CFSs), which represents particularly toxic pesticides that should be phased out in priority at Member States' level, when alternatives are available (see Recommendations section page 18).

While a proper implementation of this obligation should lead to a reduction of CFS residues in food, a previous report[25] from PAN Europe has shown that the presence of CFSs in European food is on the rise over the last decade. The non-implementation of the substitution principle has been raised to the European Commission without any change.

At national level, although countries do have the obligation to carry out an assessment of the existence of alternatives, they fail to comply with this legal requirement[26] and do authorise or renew systematically the authorisation of the final product.

[25] https://www.pan-europe.info/resources/reports/2022/05/forbidden-fruit-dramatic-rise-dangerous-pesticides-found-fruits-and

[26] Art. 50 of pesticide regulation (EC) 1107/2009

4. Recommendations to citizens

4.1 Favour local organic apples

Organic apples are grown without synthetic pesticides. Buying local organic food ensures to strongly reduce the risk of being exposed to pesticides via food. In addition, this supports local organic farmers. As organic apples are usually slightly more expensive than conventional ones[27], it is recommended to buy them in farmers' markets rather than supermarkets, often at a cheaper price.

Fruits and vegetables must represent a significant share of citizens' diet, for the health benefits they represent. In case no organic food is available, PAN Europe recommends to consume in priority fruits and vegetables that can be peeled, in order to remove part of their pesticide load (part of the pesticide loads still remains in the apple though). PAN Europe also recommends favouring fruits and vegetables that contain low pesticide residues[28].

4.2 Write to your politicians

Citizens often underestimate the impact of writing to their local, national and European decision-makers. But writing to your ministers of health, agriculture or environment, writing to your members of the European Parliament, or writing to your political parties to inform them on your demands, as a citizen, may have more impact than you think, especially if you collect signatures in your surroundings! It is unacceptable that the toxicity of exposure to multiple residues is still not assessed in the EU.

4.3 Plant an apple tree

Planting an apple tree in your garden or in a community garden has several benefits: apple flowers produce pollen and nectar that are beneficial for pollinators, and will provide you with healthy apples. Favour an indigenous resistant variety and choose the right tree size for the space you have at your disposal.

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[27] Producing healthy food in a clean way has a cost. Producing cheaper conventional apples with important amounts of pesticides and fertilisers has an important societal cost (health costs, costs of lack of pollinators and damage to biodiversity) that is unfortunately not included in the price.

[28] See p.14, PAN Europe Consumer guide.

5. Policy recommendations

5.1 Inform (future) parents

A mounting body of scientific evidence points at exposure to multiple pesticide residues as a cause of infertility. Furthermore, in order to protect babies and toddlers, industrial baby food must not contain pesticide residues above the legal limit (0.01 mg/kg). This is a proper implementation of the precautionary principle, considering the scientific limitations in the definition of Maximum Residue Levels by EFSA. Most parents are unaware that processed food and fresh food are not regulated in a similar way. Logically, parents should not feed their young children with conventional apples, neither fresh nor processed at home, considering that more than 9 out of 10 technically exceed regulatory limits for young infants.

Public authorities should run continuous information campaigns towards citizens, to inform them on the importance of consuming organic apples and other food to protect foetuses, babies and young children, while consumption of organic food potentially reduces infertility rates.

5.2 Implement the SUD at once, reduce pesticide use

Europeans are well aware[29], throughout the EU, of the risks posed by pesticides. They regularly raise their voice to demand a rapid and significant reduction of pesticide use in Europe[30]. The Directive on the sustainable use of pesticides (Dir. 2009/128/EC, the SUD) sets the legislative framework to reach such a reduction but it is not properly transposed and implemented.

The European Commission ought to audit national transpositions of the SUD, which has never been done, and ensure a gradual reduction of pesticide use in the EU.

Member States ought to implement without delay art. 14 of the SUD, and implement Integrated Pest Management, while ensuring that farmers receive high quality and independent crop pest management advice. Furthermore, Member States ought to develop or improve IPM guidelines and make them mandatory, to increase knowledge on alternative practices, while accompanying farmers in their proper implementation by farmers.

In particular, in apple production, many more resistant varieties have been developed, as well as pruning and other orchard management approaches have allowed to strongly reduce the need for pesticides. Furthermore, up to 60% of the pesticides used in apple production are sprayed for cosmetic reasons[31]: agro-industry considers that only apples that are perfect in appearance can be sold. This could be solved by educating consumers, through targeted campaigns.

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[29] https://www.pan-europe.info/resources/reports/2023/10/pesticides-play-it-safe

[30] https://www.pan-europe.info/sites/pan-europe.info/files/public/resources/factsheets/FRI-24-F2-citizens%20demands-4.pdf

[31] Zachmann et al. 2024

5.3 Better implement the pesticide legislation

The most toxic pesticides, namely Candidates for Substitutions, must be replaced by available alternatives, and banned by Member States. This provision of the pesticide legislation is currently not implemented by Member States. PAN Europe and its members regularly asked the European Commission to review its guidance document on the implementation of the substitution principle in the EU to make it more effective.

In the same vein, Denmark has banned a series of PFAS pesticides[32], to protect the quality of its groundwater. PFAS pesticides are also among the most toxic to humans and degrade into a metabolite (trifluoroacetic acid - TFA) that is linked with development malformations[33]. These restrictions should take place in the entire EU: all Europeans deserve protection against PFAS pesticides and their metabolites.

Finally, scientific evidence shows that acetamiprid and deltamethrin, two neurotoxic insecticides are toxic to foetuses. PAN Europe considers they should be banned, as sufficient scientific knowledge is available for decision-makers to decide for a ban. As was observed in the case of chlorpyrifos, a neurotoxic pesticide that reduces children's IQ, or with bee-toxic neonicotinoids, it often takes 20 years for the EU to ban pesticides, even when the scientific evidence is there.

5.4 Develop a methodology to evaluate the toxicity of multiple exposure in food

EU Maximum Residue Levels (MRLs) regulation (EC) 396/2005 foresees that the European Food Safety Authority (EFSA) develops a methodology to assess the risk of exposure to multiple residues of pesticides in food. The EFSA has financed a series of research projects including scientists with dubious conflict of interests issues[34]. These projects included industry-linked researchers that promoted a probabilistic approach that does not protect all Europeans, but rather serve agro-industry's interests.

Since 2005, the EFSA has not delivered an assessment methodology to consider the impact of chronic exposure to multiple pesticides via food. In the meantime a mounting body of scientific evidence points at the impact of pesticides on citizens' health, and in particular on fertility issues (see references in Cocktail section page 12). As a scientific agency, EFSA must take into account the most scientific knowledge and respect EU law. It is thus more than time that it delivers a methodology to protect Europeans from exposure to cocktails of pesticides.

[32] https://www.pan-europe.info/blog/denmark-bans-23-pfas-pesticide-products-because-they-pollute-groundwater

[33] https://www.pan-europe.info/resources/reports/2025/12/unseen-and-unregulated-tfa-%E2%80%98forever-chemical%E2%80%99-europe%E2%80%99s-cereals

[34] See PAN Europe report A Toxic Mixture (2011) and A Poisonous injection (2014)

5.5 More protective rules on multiple residues

Until a scientifically-robust methodology is developed in order to assess the risk of exposure to multiple pesticides in food, PAN Europe advocates[35] for the setting of a "Mixture Assessment Factor" (MAF) of 10, based on the absence of risk assessment for exposure to multiple residues, and based on the precautionary principle. A MAF of 10 means that regulatory "safe levels" will be set 10 times lower.

5.6 Increase scientific knowledge on exposure to multiple residues

Considering the highly concerning scientific findings mentioned above, the European Union should finance research on the impact of exposure to multiple residues of pesticides on citizens' health. Citizens are exposed to chemicals present in the air, in clothing, at home, etc. Pesticides are chemicals that are intentionally sprayed on our food, and for which alternatives exist. It is thus unacceptable that, with the constant rise in infertility, neurologic disorders or cancers, and in particular those associated with pesticide exposure (breast and prostate cancers, as well as lymphoma), the EU does not carry out more research work in this area.

[35] https://www.pan-europe.info/sites/pan-europe.info/files/field/CRA_Towards%20the%20implementation%20of%20a%20MAF.pdf

Conclusions

This research carried out in 13 European countries confirmed the omnipresence of pesticide residues in a significant amount. The results suggest that most European conventional apples should not be fed to young children. Most apples contain multiple residues of pesticides, which is linked to health concerns, such as infertility. Despite its legal obligation for over 20 years, the European Food Safety Authority (EFSA) has not developed a methodology that accounts for multiple residues of pesticides in our food. Public authorities do not react, despite the availability of non-chemical alternatives in apple production. PAN Europe recommends that consumers choose organic apples in priority, and in particular in case of pregnancy, and to feed their children.

Omnibus on Food and Feed Safety

In December 2025, the European Commission sent a legislative proposal to the European Parliament and Council, for an Omnibus regulation on food and feed safety. This Omnibus proposal paves the way to a much lower level of protection of citizens' health and the environment against pesticides. With the Commission proposal, pesticide regulation would become much more political and less scientific. Furthermore, identifying the toxicity of many substances would become more random, leaving citizens and the environment unprotected.

This report highlights the importance of maintaining strict pesticide policies and better implement them. Indeed, the current approach to pesticide residues is insufficient, not removing pesticides that should have been banned long ago, not covering the impact of exposure to multiple residues in food, as well as not covering the impact of exposure to residues for very young children or during pregnancy.

The European Commission and the European Food Safety Authority (EFSA) should therefore focus on improving the implementation of the current legislation, not water it down. An additional safety factor, a Mixture Assessment Factor (MAF), of 10 should be implemented to account for the fact that currently, there is no risk assessment of exposure to multiple residues of pesticides.

REPORT

Pesticide cocktails

PFAS and neurotoxins in most European apples

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