



Federal Office of
Consumer Protection
and Food Safety



“Pesticide residues in food”

National reporting 2021 Federal Republic of Germany –
condensed version



Summary

The report presents the results of the analysis of food for pesticide residues. In accordance with Regulation (EC) No 396/2005, the compliance with current legislation was checked and analyses to assess consumer exposure were carried out.

In 18 official laboratories of 16 federal states, 20,603 food samples were analysed for the presence of pesticide residues. 5,351 of these samples were taken at random in the framework of the monitoring programme, in order to be able to make representative statements about consumer exposure. However, with regard to the selection of the other 15,252 samples, foodstuffs known for presenting higher risks were preferred. For this reason, the results do not allow to draw conclusions on the contamination level of the entirety of all foodstuffs available on the market.

For reporting to the European Food Safety Authority (EFSA) and the European Commission, the samples are divided in "surveillance" and "follow-up enforcement" samples. The routine and monitoring samples are denominated as "surveillance" samples, while suspect samples, complaint samples and persecution samples are summarised as "follow-up enforcement" samples. In the reporting year, a total of 20,022 samples fall under the category "surveillance" and 581 samples under the category "follow-up enforcement".

In 2021, 1,782 samples were analysed in the framework of the coordinated multiannual Community control programme. These samples were part of the 20,603 samples analysed in total.

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Information about maximum residue levels

“Maximum Residue Level” (MRL) means the upper legal level of a concentration for a pesticide residue in or on food. For setting MRLs, data on the toxicology of the substance and on the intake quantity of the respective foodstuff as well as data from field studies carried out in accordance with good agricultural practice are taken into consideration.

The report distinguishes between the exceedance of a MRL and the objection (non-compliance) of samples. Not all samples with MRL exceedances are objected (non-compliant) by the respective responsible authority, as for an objection (non-compliance) further arguments like the analytical measurement uncertainty have to be taken into account. When it is established that a consumer risk through pesticide residues in a foodstuff cannot be excluded, the European Rapid Alert System for Food and Feed (RASFF) is notified, so that all responsible authorities in the EU are informed accordingly.

In 2021, Germany issued 215 notifications due to pesticide residues; 119 of these were alerts.

1 Food-related view on the results

(only “surveillance” samples without substances which are proven (mainly) not to stem from pesticide use: chlorate and the quaternary ammonium compounds (QAC) didecyldimethylammonium chloride (DDAC) and benzalkonium chloride (BAC))

In total 284 different foodstuffs were analysed. As every year, the majority were fruit and vegetables.

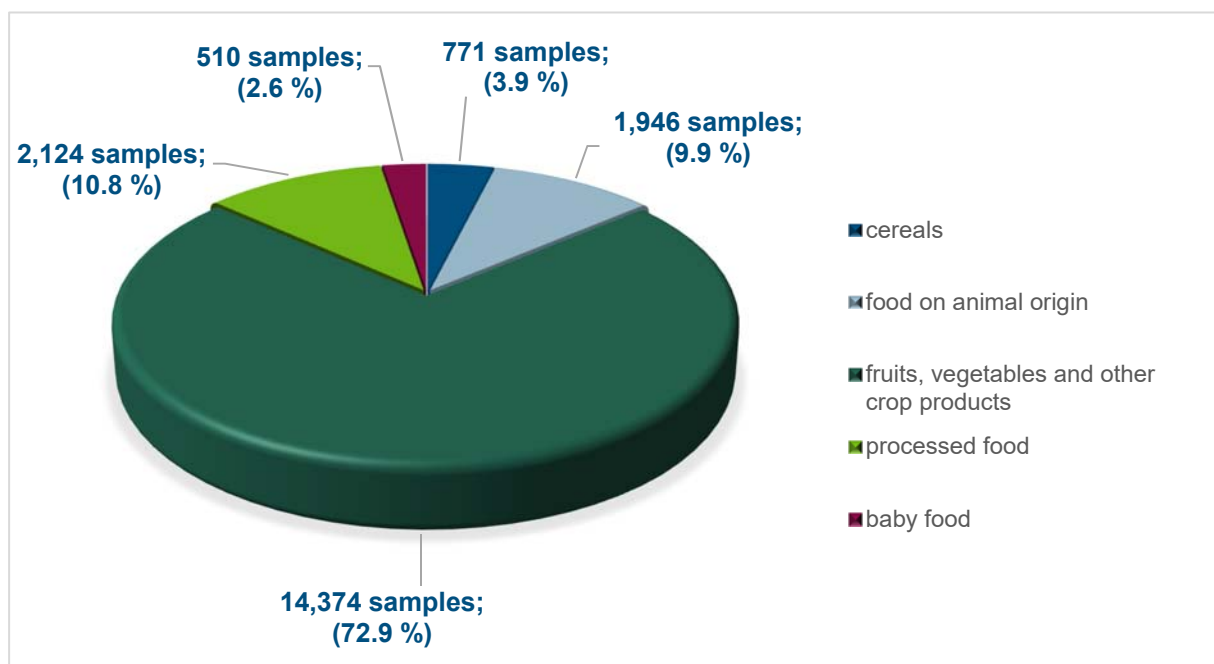


Figure 1: Distribution of sample numbers between the various food groups in 2021

Strawberries (605 samples), Tea (black and green; 594 samples), apples (584 samples), potatoes (565 samples), sweet peppers/chillis (536 samples) and bovine milk and milk products (528 samples) were analysed the most frequently.

Table 1: Residues in the various food groups in 2021

Food group	Number of samples total	Samples with residues < limit of quantification	Samples with residues	Samples with residues > MRL ¹	Samples with residues > MRL objected
Cereals	771	268 (34.8 %)	503 (65.2 %)	13 (1.7 %)	3 (0.4 %)
Food of animal origin	1,946	1,295 (66.5 %)	651 (33.5 %)	13 (0.7 %)	2 (0.1 %)
Fruit, vegetables and other products of plant origin	14,374	4,833 (33.6 %)	9,541 (66.4 %)	475 (3.3 %)	248 (1.7 %)
Processed food	2,124	717 (33.8 %)	1,407 (66.2 %)	174 (8.2 %)	137 (6.5 %)
Food for infants and young children	510	322 (63.1 %)	188 (36.9 %)	10 (2.0 %)	1 (0.2 %)
Total	19,725	7,435 (37.7 %)	12,290 (62.3 %)	685 (3.5 %)	391 (2.0 %)

In the category 'food for infants and young children', 2.0 % of the samples contained residues above the MRL. One of these samples (processed cereal-based foods for infants and young children) were objected due to the residue definition for the fungicide fosetyl (sum).

Residue definition of fosetyl includes the active compounds fosetyl and phosphonic acid and also its salts. It should be noted that phosphonic acid not only results from the use of the fungicide fosetyl, but can also originate from other sources such as authorised fertiliser. In general, predominantly phosphonic acid was detected in all food groups. Fosetyl was actually only detected in approx. 2.5 % of the samples.

For 'fruit, vegetables and other products of plant origin', the range of pesticide contaminations was particularly large, spanning from foodstuffs in which no residues were quantified, to products with objection rates of 52.4 % (Gotu kola also called Indian pennywort). However, foodstuffs with objection rates of 4.0 % and more were grapefruits/pomelos/sweeties, sesame seeds, beans with pods, fresh herbs and pomegranates.

¹ MRL = maximum residue level

Fortunately, many foodstuffs with particularly high intake like apples, carrots, potatoes or tomatoes only had few MRL exceedances and objections.

Table 2 summarises the 'fruit, vegetables and other products of plant origin' products with objections at most 1.0 %. Only foods with at least 100 analyzed samples are considered.

Table 2: Fruit and vegetables with objections at most 1.0 % in 2021 (≥ 100 samples)

Food	Number of analysed samples	Objections [%]
Peas (without pods, frozen)	201	0
Lamb's lettuce	125	0
Green lettuce	350	0
Blueberries	228	0
Carrots	373	0
Potatoes	561	0
Turnip cabbages	126	0
Radishes	232	0
Brussels sprouts	140	0
Sunflower seeds	122	0
Sweet potatoes	129	0
Tomatoes	465	0
Wild fungi	136	0
Apples	581	0.2
Apricots	238	0.4
Plums	245	0.4
Strawberries	602	0.5
Cultivated fungi	370	0.5
Kiwifruits	121	0.8
Broccoli	262	0.8
Table grapes	383	0.8
Onions	112	0.9
Pears	310	1.0
Chinese cabbages	100	1.0
Peaches	209	1.0

The ten foodstuffs with the highest objection rates are presented in Table 3 (at least 100 samples).

Table 3: Fruit and vegetables with the highest number of objections in 2021 (≥ 100 samples)

Food	Number of analysed samples	Objections [%]
Pomegranates	106	17.9
Fresh herbs	343	5.0
Sesame seeds	138	4.3
Beans (with pods)	163	4.3
Grapefruits, pomelos, sweeties	340	4.1
Mandarins	262	3.1
Aubergines, eggplant	225	2.7
Sweet peppers, chillis	515	2.5
Raspberries	130	2.3
Mangoes	134	2.2
Tea (black and green)	442	2.0
Cherries	293	2.0

As in the previous year, in the group of ‘processed foods’, processed vine leaves were particularly conspicuous. The maximum residue levels were exceeded in 71.8 % of the vine leaves, arranged and prepared in brine, and objections were raised in 61.3 % of these samples.

Since pomegranates, peppers/chillies and vine leaves are often conspicuous due to excessive pesticide residues, peppers/chillies from various countries of origin or pomegranates and vine leaves from Turkey have already been included in the "Implementing Regulation (EU) 2019/1793 on the temporary increase of official controls and on emergency measures governing the entry into the Union of certain goods from certain third countries". Goods originating in third countries listed in one of the annexes are subject to (temporarily) increased official controls.

Also in 2021, organic products were controlled for residues. The contamination of these samples was much lower than that of conventionally produced samples. Only 30.9 % of the products stemming from organic farming contained analytical quantified residues, compared to 66.9 % of other products.

2 View with regard to origin

(“surveillance” samples and “follow-up enforcement” samples without chlorate and QAC)

20,297 samples (surveillance sampling² - and „follow-up enforcement sampling) were controlled, 39.8 % thereof from Germany, 25.8 % from other EU-Member States² and 19.7 % from Third Countries. 14.7 % of the samples were of unknown origin.

Nearly two thirds of the samples were purchased from retail food traders and about less than one fifths from wholesalers. The rest was bought from growers, manufacturers and packers as well as from service providers, e. g. restaurants or delivery services.

² Including other states of the European Economic Area (EEA)

Big differences can be observed in the contamination level of foods with pesticide residues depending on their origin. In 2021 maximum residue levels were exceeded in 1.1 % of the analysed products (only “surveillance sampling“) from Germany (2020: 2.0 %) and in 1.8 % of the analysed products from other EU-Member States (2020: 1.3 %). With regard to products from Third Countries, this was the case in 10.9 % of the samples (2020: 7.8 %). Nevertheless, the percentage of samples without any quantifiable pesticide residues is still the highest in German foodstuffs.

3 Substance-related view on the results (“surveillance sampling“ and “follow-up enforcement sampling“)

The range of pesticide substances tested for in 2021 comprised 1,049 different substances (including the legal residue definitions of sums, their metabolites and isomers). In the years before 2017, the number of active substances according to their legal residue definition was counted without metabolites and isomers. Since 2017 in addition to definitions of sums, their metabolites and isomers are included. This change had become necessary because of the increasing numbers of complex and for different foods varying residue definitions. Otherwise this data would have been disregarded.

No sample was analysed for all substances. On average, each food sample was analysed for 381 different substances.

At 604 of the assessed 1,049 substances quantifiable levels were not found in any sample. On the other hand, for 208 substances residues above the valid maximum residue levels were detected.

The most noticeable substances among the 771 stated MRL exceedances were dithiocarbamates, ethylene oxide, chlorpyrifos and fosetyl.

The determination of **dithiocarbamates** (Maneb, Mancozeb, Metiram, Propineb, Thiram, Ziram) occurs nonspecific as carbon disulfide (CS₂). Therefore, it cannot be concluded analytically which dithiocarbamates were used. Besides also natural sources of CS₂, as certain plants with natural sulfur or carbon disulfide compounds (for example Brassicaceae such as cabbage and rapeseed or allium species), can lead to false positive results. Meantime, work is being done on methods that should enable both a more sensitive and more selective analytical determination of the individual dithiocarbamates. In addition, a general review of the maximum residue levels for dithiocarbamates is currently executing, taking into account the natural background exposure to CS₂.

The use of **ethylene oxide** as a pesticide has been banned in Germany since 1981 and in the EU since 1991. In 2020 and 2021, high levels of ethylene oxide residues in sesame seeds originating from India were the subject of various warnings in the RASFF rapid alert system. It is presumed that sesame seeds are treated inadmissibly with the gas ethylene oxide for the protection against salmonella and other microbiological contamination. Due to further ethylene oxide findings, in addition to sesame seeds, other foods of plant origin such as okra or spices, but also instant soups and additives and thickeners have been included since October 2020 in Annexes I and II of the Implementing Regulation (EU) 2019/1793 on the temporary increase of official controls and on emergency measures governing the entry into the Union of certain goods from certain third countries.

Plant protection products with the active ingredient **chlorpyrifos** are no longer approved in Germany; the use-by period ended on April 2, 2015 and May 6, 2015. In the EU, the approval for chlorpyrifos as an active ingredient in plant protection products expired on January 31, 2020. Due to the ban, Regulation (EU) 2020/1085, which came into force on November 13, 2020, lowered the maximum residue levels for all products to the analytical limit of quantification of 0.01* mg/kg.

When **fosetyl**-(aluminium) is broken down, the active substance phosphonic acid is formed via the intermediate product fosetyl. Samples are therefore usually analysed for both fosetyl and phosphonic acid. The detected residues of phosphonic acid are non-specific. They can result not only from fosetyl, but also from the pesticide active ingredients disodium phosphonate and potassium phosphonate. Phosphonic acid can also stem from the use of potassium phosphonate in previously approved EU fertilizers.

4 Findings of multiple residues (“surveillance sampling“ and “follow-up enforcement sampling”)

In 35.9 % of all samples, more than one substance was detected in quantifiable quantities. The percentage distribution of the number of quantified residues is presented in the following figure:

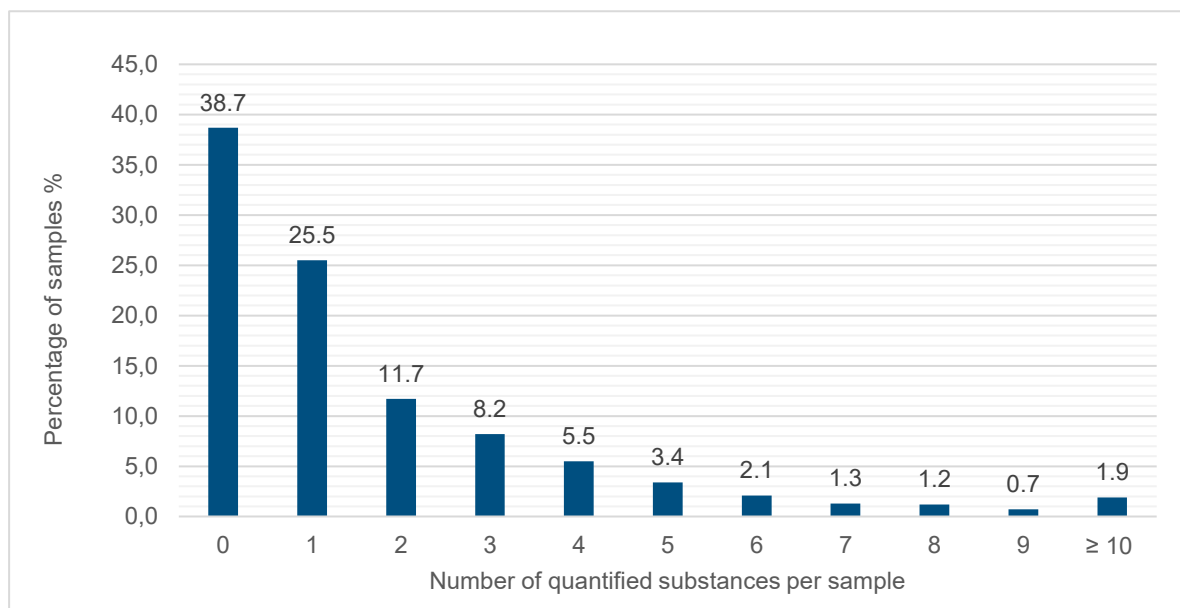


Figure 1: Percentage of samples without any residues or with residues of 0 to ≥ 10 substances.

Multiple residues above 75.0 % were found particularly in currants, cherries, mandarins, table grapes, roman rocket/arugula and strawberries.

5 Substances which are proven to (mainly) not stem from pesticide use

Some substances are legally regulated as pesticides, but their residues mainly originate from other sources than pesticide treatments. In order not to distort the overall picture of pesticide contamination, the quaternary ammonium compounds didecyldimethylammonium chloride (DDAC) and benzalkonium chloride (BAC) as well as chlorate are treated separately in the report.

Residues of **chlorate** can enter the food during processing, e. g. through washing and disinfection steps.

With Regulation (EU) 2020/749, which entered into force on 28th June 2020, specific maximum residue levels (MRL) were established for chlorate. The maximum levels were set for each entire product groups.

In 2021, chlorate was quantified in 11.1 % of 5,158 samples tested for it. In 0.8 % of the samples, residues were exceeding the MRL. Chlorate was objected in 0.3 % of the samples.

4,074 samples of ‘Fruit, vegetables and other products of plant origin’ were examined, of which 16 samples (0.4 %) exceeded the maximum residue levels and six samples (0.1 %) were objected. Eleven samples (4.1 %) of ‘Food of animal origin’ (a total of 270 samples) were above the MRL. This food group showed the highest objection rate (1.9 %). For ‘processed foods’ (a total of 393 samples), the objection rate was 0.3 %. 196 ‘cereal’ samples were tested for chlorate, hereof maximum residue levels were exceeded in two samples, but none of the samples were objected. In the case of ‘food for infants and young children’ (a total of 225 samples), seven samples (3.1 %) were above the maximum residue limit, of which one sample (0.4 %) was objected.

In 53 (6.4 %) of a total of 830 samples of products from organic farming chlorate residues were detected. In 0.8 % of the 830 samples of organic origin the maximum residue levels of chlorate were exceeded and 0.1 % of samples were objected.

Quaternary ammonium compounds (QAC) are used among other things to disinfect milking plants and tanks. For this reason, they are often detected in dairy products. In 2021, 9,734 samples were analysed for residues of the quaternary ammonium compounds DDAC and/or BAC. Residues of DDAC and BAC were detected in 2.3 % of these samples. ‘Food of animal origin’ was particularly contaminated, 4.8 % of these samples exceeded the maximum levels of DDAC and/or BAC. Overall, the maximum levels for DDAC or BAC were exceeded in 0.6 % of the samples examined. This led to complaints in 0.5 % of the samples.

In products from organic farming, the residue situation with regard to DDAC and BAC is also better than in conventional products. Only in 0.8 % of samples of organic origin, residues of DDAC or BAC were detected, two samples (0.1 %) contained residues above the MRL, no sample was objected.