



# Watch out for the apple?

**Many people are afraid of “toxic” plant protection product residues in fruit and vegetables. This is not justified because a comprehensive control and authorisation system ensures food safety.**

Red and round, the apple rests in the fruit bowl, its scent tempting you to take a bite. If it wasn't for these headlines running through your head. “Sprayed up to 31 times with pesticides – cancer risk in apples?!”: a major tabloid's headline; an economic journal reports: “90 percent of German apples contaminated with pesticides.” Two of many examples conjuring dangers posed by plant protection products (pesticides) – and that can ruin your appetite for fresh fruit and vegetables. But what is the real health risk?

“Many consumers believe that pesticide residues on or in food are banned no matter what,” says Dr. Britta Michalski, chemist and the BfR's responsible expert on the topic. “But this is not the case, nor is the allegation that traces of these plant protection products are always harmful to health.”

## **Pesticides protect plants – and harvests**

Let us begin with the first assumption: food must be free of pesticides. The first purpose of these chemicals is to protect crops in the field from fungi, insects and other pests. Less well known is the fact that they are also useful for safely transporting and storing the harvest afterwards. “In countries with a warm and humid climate, such as India, 20 to 30 percent of the yield can be lost after the harvest, for example, due to a fungal infestation or insects,” says Michalski's colleague, Michael Herrmann. “Simply put, if you don't protect the harvest, a large part of it will rot – or is only good for animal feed.”

Finding residues of plant protection products and their degradation products in or on food is almost inevitable. “And now more than ever, since high-precision analytical methods can detect even the smallest traces,” explains Michalski. “These kinds of ‘leftovers’ are permitted by law provided that they are kept within limits and do not pose a health risk.”

## **Permitted residue: what level is allowed?**

But where is the limit? This is where the maximum residue level comes into play. This specifies the maximum amount of a pesticide that a food is allowed to contain. The maximum content is specified as a concentration, for example, one milligram (mg) of active substance per kilogramme (kg) of food (1 mg/kg). If the maximum residue level of an active substance is exceeded, the food is no longer marketable. It may not enter the market at all or must be withdrawn from the market.

Maximum residue levels (MRLs) are standardised for the European Union; the process involves experts from the member states and the European Food Safety Authority (EFSA). The BfR also makes proposals for MRLs. The principle for this is that the active substance quantities that a food may contain should be as low as can be reasonably achieved..

MRLs are established based on residue crop field trials. The trials determine how much of an active substance can be found in the edible parts of the plant after



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harvesting. These experiments are usually carried out by plant protection products' manufacturers. Only if there are no indications that the residues pose a health risk to consumers, will the BfR propose an MRL.

But what if food controls reveal that the MRL of an active substance has been exceeded – does the contaminated product then have adverse effects for consumers? This brings us to the second widespread assumption: are pesticides not toxic as such, even in the smallest doses?

### The dose makes the poison

From a toxicological (toxicology is the science of poisons) perspective, this is not the case. Whether a substance is toxic depends significantly on its dose. This is the “basic law” of toxicology, which can be traced back to the physician Paracelsus. It generally says that even a dangerous substance can barely harm the body if it only enters the organism in extremely small quantities. Conversely, a generally harmless (and vital) substance, such as table salt, can be deadly if taken in excess.

Extensive (and statutory) scientific studies are carried out to determine how hazardous a pesticide is to the human organism. Each active substance is closely examined before being approved in the EU. This involves looking at whether a substance can damage genetic material, cause cancer or impair reproduction. “The active substances in plant protection products are among the most thoroughly examined chemical substances when it comes to health risks,” says Herrmann, an agricultural scientist.

Risk assessment authorities, such as the BfR, “distil” two important toxicological limit values for a substance from the test data. Firstly, there is the acute reference dose or “ARfD” for short. This indicates the quantity of a substance that a person can ingest on one day without any discernible health risk. Therefore, the ARfD is a measure of the short-term (acute) occurring quantity of a substance which does not pose any adverse effect to the body.

### Two limit values for risk assessment

The ADI refers to the long-term (chronic) intake of a substance. ADI stands for “acceptable daily intake”. The ADI indicates the amount of a substance that a consumer can ingest every day for a lifetime without any discernible health risk.

The ARfD and the ADI value are the “crash barriers” on which the pesticide risk assessment is based. The risk assessment also takes into account which foods are consumed in this country and in which quantities. Information about this is provided by consumption studies in which the eating habits of consumers for different age groups are identified. “If, for example, it can be predicted that residues of an active substance ingested with apples will exceed the ARfD or the ADI value, use of the plant protection product in question will not be authorised for apples,” explains Michalski.

Food sellers must guarantee compliance with MRLs. The food monitoring authorities of the German federal states (“Laender”) check whether this is the case as part of extensive control programmes (monitoring). Some of the data obtained here are included into an EU-wide monitoring programme, the results of which are published annually. In 2018, more than 90,000 samples were evaluated as part of this programme.

The MRL was exceeded in 4.5 percent of the EU-wide measurements. However, this is not synonymous with a health risk because the MRL is usually well below the toxicological threshold. This is marked by the ARfD and the ADI value. EFSA's report published this year on the monitoring results from 2018 comes to the conclusion that these exceedances are not a cause for concern.

Back to the apple. Headlines such as “pesticide pollution” or even “cancer risk” attract attention, but on closer inspection they turn out to be less conclusive. Therefore, there is no good reason not to enjoy a piece of fruit! ■

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**More information:**  
 20th BfR Consumer Protection Forum: “Plant protection products - a cause for concern?” 20/21 April 2021 in Berlin (programme and registration at [www.bfr-akademie.de](http://www.bfr-akademie.de))