Bundesverband Naturkost Naturwaren e. V.

BNN factsheet

Phosphonic acid

Version December 2024

For the BNN factsheet, a solid database is used to assess the current phosphonic acid situation, which makes it possible to calculate the recommended values listed below. The differentiated consideration of annual and biennial crops vs. perennial crops has proven its worth and is also retained in the current version.

*The **recommendations in this factsheet** are based on the evaluation of a total of 13,470 data sets, which were kindly provided to the BNN in anonymised form by three BNN-approved laboratories[*]. We have subjected the data to a percentile calculation and discussed and evaluated it together with the BNN Scientific Advisory Board.*

As the results of the analyses for 2022, 2023 and 2024 did not reveal any significant changes, the BNN has decided to retain the previous recommended values.

It should be emphasised at this point that the values mentioned under point 8 are neither a regulatory requirement nor limit, threshold or similar action values, but exclusively a recommendation of the BNN on how findings of phosphonic acid in organic products can be classified.

The next review of the values is planned for autumn 2026 at the latest.

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1. Introduction

Since autumn 2013, phosphonic acid has been regularly detected in conventional and organic fruit and vegetables, as state and private laboratories had established the analysis. Initially, the use of potassium phosphonate (was permitted in organic farming, see *Legal classification*) or fosetyl-Al (trade name e.g. "Aliette") were possible causes, as in both cases the actual active ingredient is phosphonic acid (for details, see the next section). Potassium phosphonate can be a declared or undeclared component of (foliar) fertilisers or plant strengtheners that were permitted in organic farming in some EU countries. These (previously authorised) applications can lead to evidence of phosphonic acid being stored in vegetative plant parts even after several years.

2. Potassium phosphonate, phosphonic acid and what both have to do with fosetyl aluminium

Potassium phosphonate is the potassium salt of phosphonic acid (KH_2PO_3, also known as phosphorous acid). Potassium phosphonate is an inorganic phosphonate, which is why it used to be called potassium phosphite (now obsolete). Potassium phosphonate, or the actual active substance phosphonic acid, is an agent with a systemic effect against fungal diseases, in particular it helps against downy mildew. Potassium phosphonate has a natural substance character. Organic phosphonates (which do not include potassium phosphonate) are found in all living organisms. In addition to potassium phosphonate, there are other salts of phosphonic acid such as disodium phosphonate, which has also been approved as an active ingredient in plant protection products in the EU since 1 February 2014.

The degradation of the fungicide fosetyl aluminium (molecular formula: $(C_2H_6PO_3)_3$ Al), **which is not permitted in organic farming**, phosphonic acid is also formed via the intermediate product fosetyl ($C_2H_6PO_3$ H, three "individual components" of fosetyl are formed from one fosetyl-Al, as aluminium is trivalent). For this reason, the previous residue definition of fosetyl-Al according to Regulation EU 396/2005 was: Fosetyl-Al = sum of fosetyl and phosphonic acid and their salts, expressed as fosetyl. This often led to confusion, as a sum of fosetyl-Al was stated in laboratory reports, although no fosetyl was detected, but in the vast majority of cases only phosphonic acid.

Due to the fact that even when fosetyl-Al is used in conventional agriculture, fosetyl is generally converted to phosphonic acid after a short waiting period (and even more so at harvest time) and therefore only phosphonic acid is detectable, the legislator has decided to adapt the residue definition for fosetyl and phosphonic acid accordingly.

With Regulation (EU) 2024/2619 of 8 October 2024, the residue definition is as follows:

Phosphonic acid: phosphonic acid and its salts, expressed as phosphonic acid

No specific maximum residue level is regulated for the active substance fosetyl. The precautionary value of 0.01 mg/kg is also not applied. This is specified in a footnote in the above-mentioned regulation.

This also eliminates the discussion about the possible use of fosetyl-Al for organic products if only phosphonic acid is detected. Of course, the BNN orientation value must still be applied for the active substance fosetyl, even if this will not play a role in practice.

3. Potassium phosphonate in organic farming

In order to reduce dependence on copper in **organic viticulture**, potassium phosphonate (a well-known product was "Frutogard") has long been used in Germany. When potassium phosphonate is applied to leaves, resistance mechanisms are triggered. This results in the natural resistance and hardening of the vine and other plants against fungal diseases and in particular peronospora ("downy mildew"). This application of potassium phosphonate was approved for organic farms in a number of EU countries (e.g. Germany, Greece, Austria, Spain, Czech Republic, Hungary) until 30 September 2013. In addition to use in organic viticulture, there were also other applications, particularly in **organic vegetable production** (e.g. cucumbers and tomatoes)**, organic pome fruit and organic citrus fruits**. However, the evidence is not limited to the crops mentioned.

4. Legal categorisation

Until 30 September 2013, plant strengthening agents and fertilisers containing salts of phosphonic acid (e.g. potassium phosphonate) were still permitted for use in organic farming in Germany and other EU countries. Since 1 October 2013, potassium phosphonate and, since 1 February 2014, disodium phosphonate are authorised as plant protection products in the EU and may therefore no longer be contained in plant strengthening agents or fertilisers. Utilisation periods made it possible to use them after this date. **The use of phosphonates in organic farming is therefore not permitted in any EU member state**!

In order for phosphonates to be used in organic farming, they would first have to be included in the legal framework of the EU Organic Regulation (here: Annex I of the Implementing Regulation (EU) 2021/1165). Together with the BÖLW, the BNN is in favour of their inclusion in the EU Organic Regulation. This should be limited to viticulture and until the end of flowering in order to minimise residues.

5. Toxicology

The phosphonates or phosphonic acid itself are hardly toxic, so that the EFSA has not established an acute reference dose for potassium phosphonate ("ARfD: Not relevant"). The acceptable daily intake (ADI) is 2.25 mg/kg bw per day.

6. Analytics

For phosphonic acid, reporting limits (RL) of 0.01 mg/kg to 0.05 mg/kg have been established in the laboratories, depending on the food in question. The analysis is carried out by aqueous and/or methanol extraction and subsequent measurement by LC/MSMS in ESI-negative detection mode. Mixing up is not possible as chromatographic separation takes place. However, the "origin" of the phosphonic acid cannot be determined by the analysis. Phosphonic acid cannot be analysed using the known multi-methods; the method for polar pesticides ("QuPPe" = Quick Polar **Pesticides**)[1] has been established for this purpose.

7. Evidence and its cause

In principle, residues from plant protection products should be limited as far as possible. According to all previous experience, evidence of phosphonic acid can be traced back to the application of phosphonates. However, the application may have taken place a long time ago, particularly in permanent crops, and therefore at a time when use in organic farming was still permitted. A pilot study by Bögli and Speiser (2019) in organic viticulture shows that phosphonic acid can still be detectable in wine 5-6 years after application and that the levels in the samples analysed were only below 0.1 mg/kg in the 6th year.

In addition to the use of phosphonates, according to the Julius Kühn Institute (JKI), impurities in phosphorus fertilisers are also a possibility, although according to the experts this does not apply to the soft rock phosphate approved for use in organic farming. The rumour that phosphonates could be naturally contained in algae products is presumably based on the misleading statement of the ingredients of the plant strengthening agent Frutogard, which also contains brown algae extract. However, the stated potassium phosphonate is added, which is also consistent with the fact that no potassium phosphonate could be found in nature as part of the BÖLW report on "natural substances" or only as an intermediate product that is always converted very quickly.

In addition, there are also cases of often **undeclared additions of phosphonic acid in inputs authorised for organic farming**. Overall, inputs are a critical source of possible phosphonic acid findings in organic food and should therefore be part of an appropriate risk management system.

[1] https://www.quppe.eu/method.asp

8. Evaluation of phosphonic acid detections

Until 31 December 2026, the BNN orientation value for **phosphonic acid** or its salts is considered to be fulfilled if

- for **annual and biennial**[1] crops a level of **0.05 mg/kg**
- for **perennial** crops a level of **0.1 mg/kg**

is not exceeded.

An expanded measurement uncertainty of **50%** (in relation to the analysis result) can be taken into consideration[2].

Until 1 October 2013, the use of phosphonates as plant strengthening agents or in fertilisers was permitted in organic farming in many EU countries. Such applications, especially in permanent crops, can often still be detected analytically for a long time. In non-EU countries, inputs or fertilisers containing phosphonates may be permitted or not explicitly prohibited according to national standards for organic farming. In these cases, an explicit confirmation from the third country control body confirming equivalence must be submitted. This means that the BNN orientation value is also deemed to be complied with. The relevant inspection body/inspection authority is responsible for assessing residues that are attributable to the use of products that contain undeclared phosphonates as an active ingredient. From BNN's point of view, the affected organic foods should remain marketable with reference to organic farming, provided that measures have been taken to prevent the future use of these products.

Further recommendations and information on investigating causes

It is recommended to check whether and, if so, which products are affected by phosphonic acid detections as part of the self-checks. **A critical review of the operating resources is urgently recommended**, especially when investigating the causes of unexpected phosphonic acid detections.

We call on all those involved to take evidence of phosphonic acid seriously, to investigate the cause and, if necessary, to remedy the situation. **At the same time, we ask for a measured response** so as not to falsely discredit goods that have been produced correctly in accordance with organic farming regulations.

[1] Also includes biennial, so-called winter annual plants, whose life cycle in the botanical sense requires two vegetation periods for seed formation. However, these are usually only cultivated as annuals, as seeds or fruit are often not harvested. These include, for example, the various beetroots.
[2] For reasons of harmonisation with the requirements of the document SANTE 11312/2021 (Analytical Quality Control and Method Validation Procedures for Pesticide Residue Analysis in Food and Feed), an expanded measurement uncertainty of 50% is accepted.

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Sources

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- Trinchera A, et. al. (2020): Assessing the Origin of Phosphonic Acid Residues in Organic Vegetable and Fruit Crops: The Biofosf Project Multi-Actor Approach. Agronomy 10: 421

*** Data sources**

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- Labor Friedle GmbH, Regensburg
- Labor Greit s.r.l, Bologna