Could potassium phosphonates be authorized in organic viticulture ?

1. The Phosphonates Family

a. Background and chemical description

Phosphonates include several groups of chemical substances, some of which are used in agriculture. In viticulture, there are two main chemical groups belonging to this family (Macary, 2023):

- Phosphonates with fungicidal use which can be inorganic such as potassium phosphonate or from organic origin such as aluminium fosetyl,
- Amino phosphonates with herbicidal use, including glyphosate and glufosinate.

b. Specificities of Potassium phosphonates

Potassium phosphonates are composed by a mixture of potassium hydrogen phosphonate and dipotassium phosphonate, where phosphorus is bound exclusively with O-P bonds. They have similar properties to fosetyl-Al, which is also characterised by O-P bonds.

2. Potassium phosphonates as a plant strengthener or an active substance with anti-fungal properties

Potassium phosphonates have 2 modes of action: an indirect one as a plant defense stimulator and a direct one as a fungicide anti-oomycetes.

Potassium phosphonates have never been authorized by the European Commission in organic farming, neither as pesticide nor as fertilizer.

Before the 1st October 2013, in some Member States, potassium phosphonates had a status of plant strengthener, and therefore, were considered as fertilizers. This status allowed them to be authorized in organic farming in those same States, in accordance with Article 16 of Regulation 834/2007, without being explicitly listed in Regulation 889/2008. This was the case in Germany but also in Austria, Czech Republic, Hungary or Slovakia.

These Member States indeed made use of their delegation from the European Commission to draw up the list of fertilizers usable in organic farming on their territory (EGTOP, 2014)

The 1st October 2013, potassium phosphonates have been registered as an active substance for a fungicide use under the regulation n°369/2013 of the European Commission.

Since that date, potassium phosphonates are no longer authorised in organic farming, even under a plant strengthener status (BNN, 2023).

3. Germany's attempts to register potassium phosphonates on Annex I of EU regulation 2021/1165

At the request of Germany, potassium phosphonates have been evaluated twice by EGTOP (Final report on plant protection products II, 2014 and EGTOP PPP V report on reassessment of Potassium Phosphonates, 2020). The template was expertised twice by the expert group EGTOP leading each time to the same conclusion: the acceptance of potassium phosphonate as a fungicide in organic agriculture is not consistent with the organic regulation. The main reasons why potassium phosphonate doesn't comply with organic principles are amongst other their synthetic origin, persistence in plant and residue findings.

4. What about the origin of potassium phosphonates?

Phosphonates have been detected in extraordinary, rare natural environments (EGTOP, 2014).
The BNN (Bundesverband Naturkost Naturwaren) argue 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" (BNN factsheet, 2023) (Hofmann, 2012)

In any case, their scarcity in nature implies that phosphonates are produced in a synthetic and industrial way.

5. What about residues, metabolites, and persistence?

Potassium and disodium phosphonates have the same degradation product than fosetyl-Al : phosphonic acid. Jointly for these three active substances, their MRL are expressed as phosphonic acids (PA) ((Authority (EFSA) et al., 2021). This is one of the most common residue found in organic farming. However it is not possible to fully linked these residues

to phytosanitary treatments (Grimbaum et al, 2019) as it can be found in several inputs and environmental compartments.

The following elements illustrate this situation:

- In the environment

There is also evidence that phosphonic acid occurs naturally in the environment. One possible hypothesis is that microorganisms produce phosphonic acid, such processes are most likely to occur in oxygen-poor waters or sediments (Nader et al., 2020).

- In agricultural inputs

One third of the fertilizers contained PA (OPTA, 2022); Cu-containing pesticides and fertilizers approved for organic farming often contain phosphonates in an inadmissible manner. (AOEL, 2021). Results show that phosphonic acid occurs in almost all materials examined (plants, soil, manure, animal urine, slurry and digestate) (Gasser and Speiser, 2025.)

- In plants

Phosphonates are persistent in grapevines and can be quantified as phosphonic acids until 6 years after treatment in the plant with concentration below 0.1 mg/kg (Bögli and Speiser, 2019).

- In the soil

AMPA can come from the transformation of glyphosate, but also from the transformation of domestic or industrial phosphonates. (Macary, 2023)

- In the food product (wine)

Winemaking process concentrates phosphonic residue (Pf= 1.3, EFSA 2012), so it's presumed that phosphonic residues can be found in wine for many years after treatment.

6. Efficiency against downy mildew (*Plasmopara viticola)* on vines

In numerous trials that have been conducted on vines in France, it has been shown that phosphonates cannot be used alone but in addition to copper-based products to have sufficient effectiveness against downy mildew (*Plasmopara viticola*).

Potassium phosphonates can be efficient, but only on low or medium downy mildew pressure. They are inefficient with heavy pressure in downy mildew

It was the case in 2024 in the Bordeaux region, where conventional winegrowers have been as overwhelmed by downy mildew as organic winegrowers, despite the use of phosphonates.

Years with high downy mildew pressure are likely to occur in the future because of global warming.

Conclusion

Even if potassium phosphonates could represent a complementary way to manage downy mildew on grapevine in association with copper (as they are not sufficiently effective on their own), they remain a systemic chemical fungicide of synthetic origin, whose degradation product, phosphonic acid, is remanent in plants, soil, inputs and food products.

But above all, phosphonic acid is also the degradation product of fosetyl-Al, making impossible to trace the origin of the contamination.

Authorize the use of potassium phosphonates in Europe for organic viticulture would therefore be to i) authorize the use of a product of synthetic origin in organic farming and ii) no longer being able to guarantee the non-use of products such as fosetyl-Al iii) without providing an effective technical solution that respects the environment and the principles of organic farming.

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