RELACS
IMPROVING INPUTS FOR ORGANIC FARMING

FiBL

Struvite's potential as an alternative phosphorus source for organic agriculture

Problem

All crops need phosphorus (P) to grow. Negative P budgets deplete the soil's P reserves in the long term. In organic farming, there are only a few permitted P sources. Use of P fertiliser can be crucial, especially when reliance on biological nitrogen (N) fixation is high.

Solution

Struvite (magnesium ammonium phosphate) is a naturally occurring mineral used to satisfy plants' phosphorus needs. Struvite obtained from municipal wastewater treatment plants allows P recycling (including some N) and can thus partially replace non-renewable P sources.

Outcome

Depending on the process, normally 12-22% of P present in wastewater is recovered in struvite. The P in struvite is not water-soluble but soluble in weak organic acids, such as those present in root exudates. The quality and purity of the final product depends on the production process, but contaminant levels are generally very low.

Applicability box

Input used

☐ Copper	☐ Anthelmintics
☐ Mineral oil	☐ Antibiotics
x Fertilisers	☐ Vitamins

Geographical coverage
Global relevance in agronomic terms, but availability depends on struvite production

Application time
Best applied before or at sowing

Period of impact
P release throughout one cropping season

Equipment
Normal farm machinery (fertiliser spreader, tillage implements for incorporation)

Practical recommendations

- Given the nutrient content of struvite (5% N, 28% phosphate (P_2O_5), 10% Magnesium (Mg)) we recommend using it to provide P together with limited amounts of N and Mg.
- We recommend the use of struvite for crops with continuous need for P. Struvite slowly dissolves in the soil over time, especially when solubilised by root exudates, such as citrate, or under acidic conditions. In contrast to rock phosphate, it becomes available to the plant over time, even in alkaline soils.
- The maximum amount to apply corresponds to the expected P removal by the crop. The recommended doses are similar to any other P fertiliser.
- Struvite can be used in all crops (arable, horticultural, forage).
- The product is formulated in granules of about 1 to 3 mm in diameter, allowing the use of normal farm machinery.
- Since struvite releases P rather slowly, application before or at sowing is recommended. Struvite must be incorporated into the soil after broadcast application. Use of struvite in rows is also possible.

Picture 1: Phosphorus deficiency in maize (Photo: Else Bünemann, FiBL)
Picture 2: Struvite granules (Photo: Else Bünemann, FiBL)

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PRACTICE ABSTRACT

On-farm application

System approach

Using struvite produced from wastewater is in line with the organic principle of minimising the use of non-renewable resources, as it recycles P and N. Furthermore, the overall risk for pollution is reduced as P and N are removed from wastewater and struvite does not contain Cadmium, unlike rock phosphate. However, struvite production needs to be combined with other P recycling methods to ensure complete P recovery from wastewater.

Regulatory status

Struvite is not yet permitted as a source of phosphorus in organic farming. However, in their 2016 report on organic fertilisers, the Expert Group for Technical Advice on Organic Production (EGTOP) advised that struvite should be included in Annex I of the EU Regulation on Organic Farming without further consultation once struvite is authorised under EU horizontal legislation on fertilisers. This will be the case as from July 2022, when the new Regulation (EU) 2019/1009 on Fertiliser Products will become applicable. Struvite is then expected to be included in the annex of the EU Organic Regulation listing the fertilisers authorised in organic farming, on the occasion of an update of this list.

Further information

Further readings

Factsheet on Sewage precipitation products. Available at https://www.fibl.org/en/shop-en/1665-sewage-precipitation-products.html.

EGTOP (2016). Final Report on Organic Fertilizers and Soil Conditioners (II). Available at https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/final-report-egtop-fertilizers-ii_en.pdf.

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RELACS: 'Replacement of Contentious Inputs in Organic Farming Systems' (RELACS) builds on results of previous research projects and takes far-advanced solutions forward. As a system approach to sustainable agriculture, organic farming aims to effectively manage ecological processes whilst lowering dependence on off-farm inputs. The RELACS partners will evaluate solutions to further reduce the use of external inputs and, if needed, develop and adopt cost-efficient and environmentally safe tools and technologies.

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