



NUTRITRADE POLICY BRIEF NO 2

Gypsum amendment of fields: a cost-efficient measure for the Baltic Sea Including gypsum in the Agri-Environmental Policy

Possibilities to reduce phosphorus runoff from agriculture are limited, especially in the short-run. The rapid increase and regional concentration of livestock production requires measures that can cut phosphorus load quickly and in large amounts. Now, a new and efficient measure has been developed and tested: gypsum treatment of arable fields provides an immediate, large and cost-efficient reduction in both particulate and dissolved phosphorus.

Need to strengthen phosphorus policies

The HELCOM recommendations and Common Agricultural Policy (CAP) do not yet account for gypsum amendment. The same holds true for several EU member states, which must have their own national agri-environmental programmes to promote environmental goals. The ongoing planning of CAP from 2021 onwards should facilitate the incorporation of gypsum in the agri-environmental policies of member states. Also, gypsum should be included in the recommended measures of HELCOM. This NutriTrade Policy Brief No 2 presents gypsum as a new water protection measure and suggests how it can be incorporated into CAP and member states' agri-environmental policies and in HELCOM's recommendations. NutriTrade Policy Brief No 1 provides a more general description of gypsum treatment of arable lands.

The promise of gypsum: large reduction in P load cost-effectively

Gypsum treatment of fields reduces both dissolved reactive phosphorus and particulate phosphorus load by a total of 50% and its impact lasts five years. No other known

measures in agriculture can provide as large a reduction in phosphorus load. Among the Baltic Sea countries, gypsum treatment provides an excellent way to reduce agricultural phosphorus load in Denmark, Estonia, Finland, Poland and Sweden. Agricultural phosphorus load to the Baltic Sea from these four countries amounts to 8000 tonnes annually. By preliminary estimates, gypsum amendment of arable fields could reduce this load by 1500–2000 tonnes annually from these countries alone. The estimated costs of this reduction are approximately one third of those achieving the same reduction by the currently used measures, such as buffer strips and zones. In the large-scale gypsum pilot in the River Savijoki, Finland, the unit cost of reducing phosphorus was about 70 €/kg P reduced, while using the current measures would be 220 €/kg P reduced in the short-run.

How gypsum works

Already ancient Greeks used gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) as a soil amendment measure, but its use as a water protection measure is of very recent origin: theoretical considerations date back to the 1930s and the first experiments were conducted at the beginning of this century. Over 10 years of empirical research has proven the effectiveness of gypsum. It effectively reduces phosphorus runoff from agricultural fields. Gypsum amendment increases the ionic strength of soil pore water. It creates larger aggregates of soil particles, calcium bridges and affects phosphorus binding, which decreases erosion and the phosphorus losses to waterways. Importantly, phosphorus remains fully available to plants. An important benefit is reduction in dissolved organic carbon loss. These beneficial effects to water quality occur immediately after the dissolution of gypsum, they last for several years and are achieved without any loss of crop yields or taking land out of cultivation.

Gypsum and biotic environment

Gypsum contains sulfate, which is gradually flushed away from soil to nearby waterways. As sea water naturally contains sulfate, it is safe to use gypsum in arable fields along waterways running into the sea. Using multiple indicators of aquatic biota, environmental research in the River Savijoki gypsum pilot area shows that sulfate losses do not cause any harm to biota in rivers. This research showed that sulfate concentrations, even at markedly higher levels than those observed in the pilot, do not impact trout (*Salmon trutta*), the thick-shelled river mussel (*Unio crassus*, a red-listed species) and the common water moss (*Fontinalis antipyretica*). Also, the mean increase in sulfate levels in the river turned out to be minor and the higher temporary peaks short-lived.

Farmer perception and gypsum

In the Finnish large-scale gypsum pilot, farmers perceived gypsum amendment of fields very positively. The pilot farmers were involved from the beginning in the development of the amendment practice. Gypsum spreading after harvest was easily incorporated into ordinary farming activities. Farmers valued the fact that using gypsum neither requires any changes in land use nor changes in cultivated crops. Farms' lime or manure spreading equipment is well-suited for gypsum spreading. Furthermore, farmers reported that the local public perceived well gypsum amendment. The number of farmers who originally had doubts about that gypsum would reduce yields and lead to soil crust was reduced after their experiences spreading and the first harvest. Most farmers were keen to repeat the gypsum amendment in the future and to recommend the gypsum amendment to other farmers.

Time to include gypsum in water policies

Environmental, agronomic and social aspects are very favourable for gypsum amendment of fields. Thus, the EU,

HELCOM and Baltic Sea states could start promoting the use of this promising measure. By including gypsum in the list of recommended water protection measures, HELCOM would provide the first step in making the measure known for all states. The next step is to incorporate gypsum in national agri-environmental policies as a voluntary measure, which is given monetary support. The third step is to ensure that the CAP reform 2021 is made so that it facilitates this inclusion. The practical aspects of a large-scale gypsum amendment of arable fields, such as availability of agricultural gypsum and potential land area, are described in Policy Brief No 1.

A non-remunerative investment support scheme

Gypsum differs from ordinary annual measures in being an environmental investment for several years. Therefore, it does not fit the ordinary set of annual area-based payments promoting annual measures. One possibility is to include gypsum in a non-remunerative agricultural investment support scheme. In this scheme, farmers indicate the field parcels on which they wish to apply gypsum based on a gypsum feasibility check for the field. Funding the gypsum and its transport is best arranged by the state though a tendering system for gypsum providers and transporters.

Recommendations to

- HELCOM and its member states to include gypsum amendment of arable fields in recommendations and documents.
- EU member states to include gypsum amendment in their agri-environmental payment schemes and make concrete plans promoting gypsum as a measure reducing phosphorus load.
- The EU Commission to ensure that CAP reform facilitates flexible introduction of gypsum in member states' national programmes.

Further information

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Related material

NutriTrade Policy Brief No 1

<http://nutritradebaltic.eu/pilots/pilot-gypsum/>

<https://blogs.helsinki.fi/save-kipsihanke/?lang=en>