GYPSUM CAN DECREASE PHOSPHORUS LOSSES FROM AGRICULTURAL SOILS

Interreg Baltic Sea Region
Co-funded by the European Union
SUSTAINABLE WATERS
GYPREG

Phosphorus discharges into water bodies result in excessive algal growth

Phosphorus losses from agricultural fields, together with municipal and industrial wastewater discharges, are major contributors to excess of nutrients, eutrophication, in watercourses. In agricultural fields, rain and surface runoff detach soil particles. These phosphorus rich soil particles are transported into watercourses, increasing water turbidity, and causing eutrophication and subsequent excessive algal growth.

Reducing agricultural phosphorus discharges has been challenging. During recent years, promising results have now been achieved utilising soil amendments such as gypsum to improve soil structure: making the soil less erosion prone and increasing its water absorption capacity. As gypsum may improve water infiltration and percolation, it may also help farmers to confront extreme climate change conditions, such as drought and heavy rainfall.

Tackling agricultural phosphorus load by soil amendments

Project **GYPREG** aims to improve the state of eutrophic coastal waters by facilitating the uptake of the gypsum method in Latvia, Lithuania, Poland, Sweden, and Finland (Åland). The project consortium invites authorities and farmers to discuss how to adapt the method to the agricultural and environmental conditions in the partnering countries, and to follow its implementation in pilot activities.

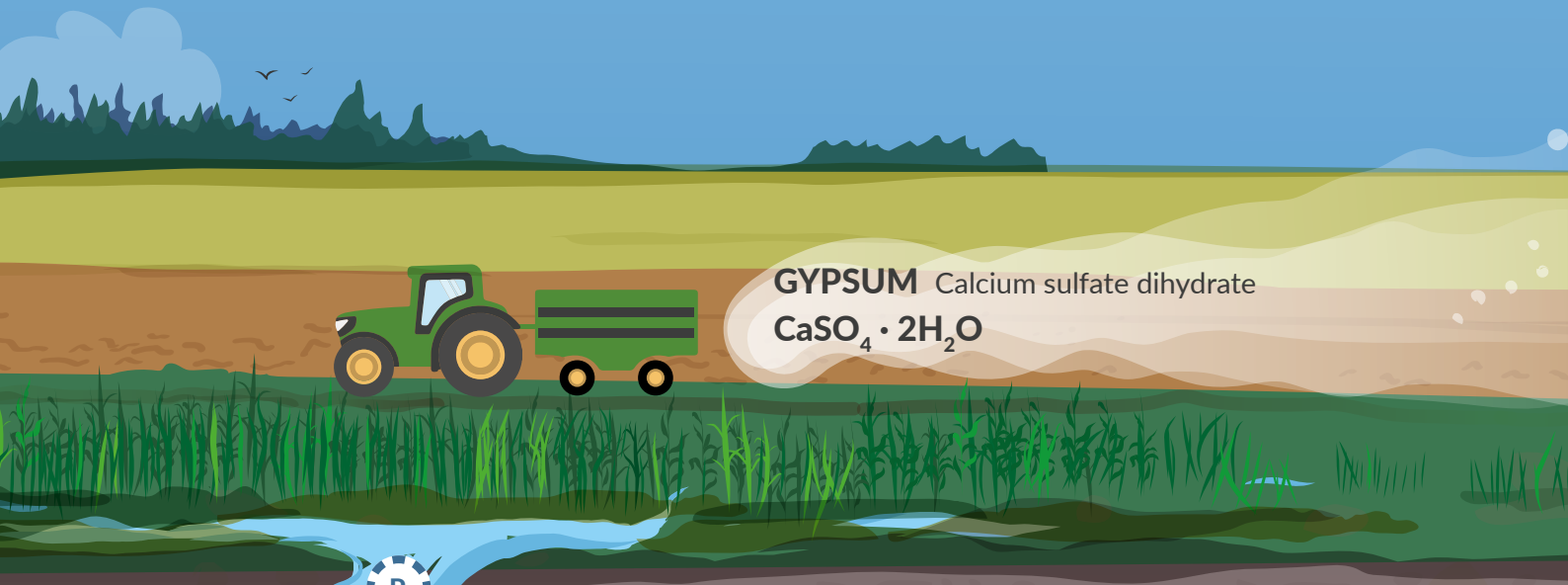
Gypsum treatment increases phosphorus retention and reduces leakage

Gypsum can be spread like lime after harvest. It dissolves and improves soil aggregation and increases ionic strength for better phosphorus retention and thus reduces phosphorus leakage. Gypsum does not affect plant availability of phosphorus.

In clay soil, standard gypsum application rate is **4 t/ha**.

In sandy loam soil, **2.5 t/ha** has been considered optimal.

The effect of gypsum treatment remains about **5 years**.



Gypsum holds promise to cut down phosphorus leakage

- Positive research evidence of gypsum treatment

Gypsum decreased

- **34-71%** particulate phosphorus
- **29-66%** dissolved phosphorus
- **30-74%** total phosphorus

in runoff water

Effects of gypsum treatments on agricultural fields

POSITIVE

+ reduces the mobility of P

+ has the most positive effect on soil structure on dispersive clay soils

+ improved soil structure has also been reported in silt and sandy loams, and in sandy and organic soils

+ decreases the loss of particulate and dissolved organic carbon

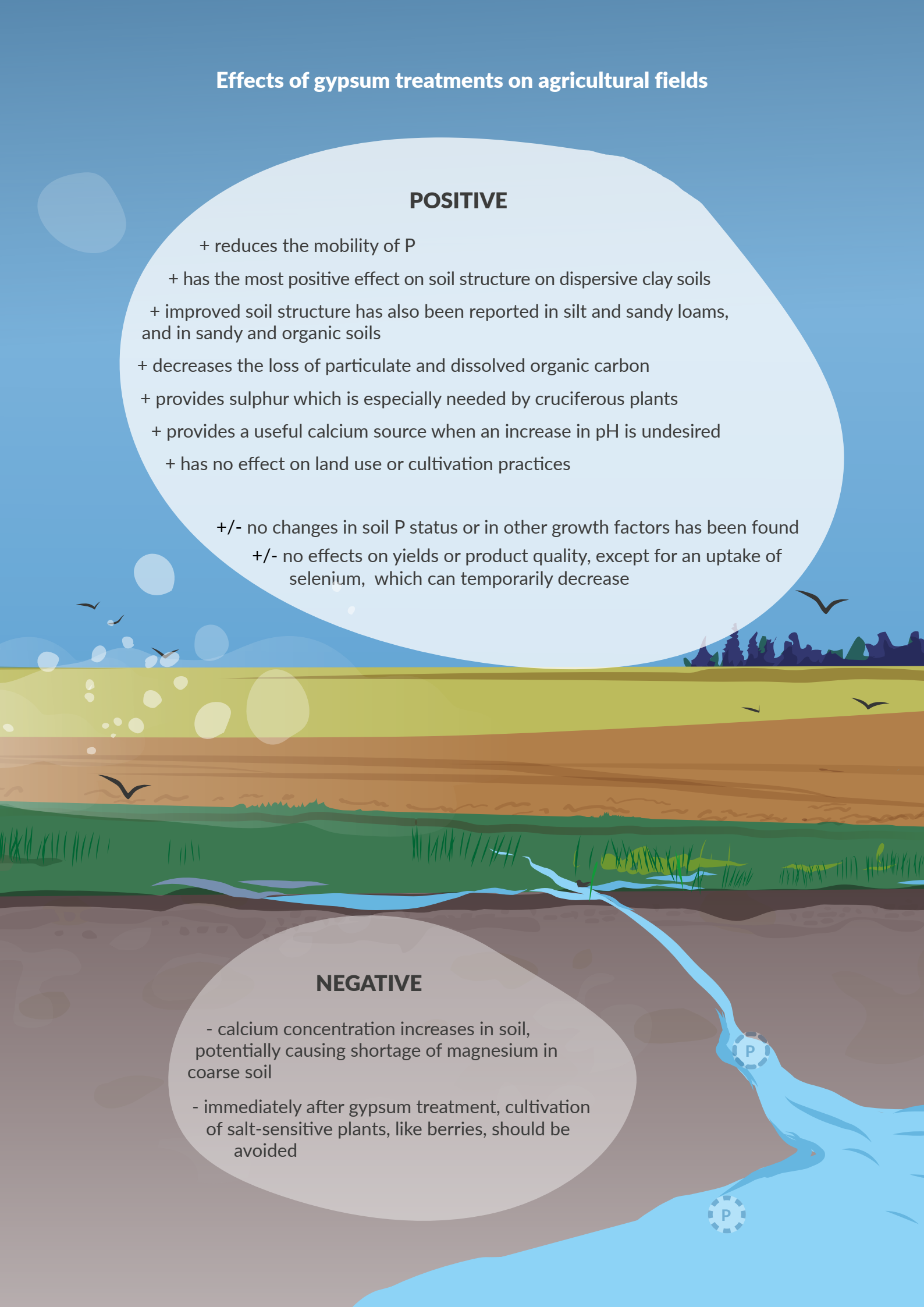
+ provides sulphur which is especially needed by cruciferous plants

+ provides a useful calcium source when an increase in pH is undesired

+ has no effect on land use or cultivation practices

+/- no changes in soil P status or in other growth factors has been found

+/- no effects on yields or product quality, except for an uptake of selenium, which can temporarily decrease



NEGATIVE

- calcium concentration increases in soil, potentially causing shortage of magnesium in coarse soil

- immediately after gypsum treatment, cultivation of salt-sensitive plants, like berries, should be avoided

Preconditions for gypsum application

Quality requirements of gypsum for agricultural use

Gypsum used in agriculture must be free from contaminants. In conventional farming gypsum created as an industrial side product from fertilizer production or flue-gas desulfurization may be used. Organic farming requires the use of natural, mined gypsum.

Requirements for catchment areas

Gypsum is suitable for river catchment areas but not for catchment areas with soft-water lakes, naturally low in sulfate. Gypsum has no adverse effects in running waters or in the Baltic Sea, where the seawater is inherently rich in sulfate. In lakes, sulfate may accelerate eutrophication by increasing phosphorus release from bottom sediments.

Legislation may restrict the application of gypsum in areas where groundwater is used as drinking water. A moderate increase in sulfate is harmless to humans and water infrastructure.

Constraints for gypsum use

Gypsum should not be used in field where there is a shortage of magnesium. Gypsum treatment combined with simultaneous seeding with no-tilling cultivation method is not recommended. Gypsum should not be spread on frozen soil or on snow.

The best results have been achieved when gypsum has been mixed with the soil . The positive effects of gypsum may be considerably smaller in direct drilling where no tilling is used.

Sources of gypsum

Gypsum is mined from geologic deposits, and it is also formed as a by-product in phosphoric acid manufacturing and flue-gas desulfurization.

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READ MORE

Gypsum, fibre and structure lime: guide for farmers, 2022 (download free of charge from proagriaverkkokauppa.fi); https://proagriaverkkokauppa.fi/tuote/gypsum_fibre_and_structure_lime_guide/23428651GYPSUM

WATCH the animation: Gypsum method in water protection. https://youtu.be/vdOKUW52TYc

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