

SILICA ENABLES MORE EFFICIENT USE OF FERTILIZER IN AGRICULTURE

AEROSIL®
SIPERNAT®
ZEOFREE®



THE EARTH NEEDS EFFICIENT AGRICULTURE

As the world's population rises, so does demand for food. Meeting this challenge calls for greater global agriculture yields. At the same time, agriculture must adapt to changing climatic conditions while ensuring sustainability to protect the environment and preserve biodiversity. In Europe, for example, the EU Green Deal's "Farm to Fork" strategy calls for a 50% reduction in pesticide use and a 20% reduction in mineral fertilizers over the next decade.

Today, the agricultural sector relies heavily on synthetic fertilizers. Each year, approximately 113 million metric tons of nitrogen fertilizers are used worldwide, accounting for more than 50% of all fertilizers applied. Producing these fertilizers is a carbon-intensive process: for metric ton of nitrogen fertilizer produced, about 1.2 metric tons of CO₂ is released.

Not all this nitrogen benefits the crops. Around 20–25% of nitrogen fertilizer produced globally is not made bioavailable for farmland usage due to land erosion and emissions.* This inefficiency not only reduces crop uptake, but also contributes to environmental problems, such as the nitrification of ground water and soil, beyond the nitrogen emissions of livestock industry.

Agriculture

Using AEROSIL®, SIPERNAT®, and ZEOFREE® increases the efficacy of plant protection products. Silica offers solutions to reduce the amount of nitrogen fertilizer needed, which in turn saves CO₂ from fertilizer production and helps to reduce nitrate/phosphate pollution.

*Evonik Calculation based on J.N. Galloway et al., 2006

Although the specific impacts depend on various contextual factors, replacing current practices with more efficient solutions, such as using natural nitrogen-fixing bacteria immobilized on special carriers, can achieve the following benefits:

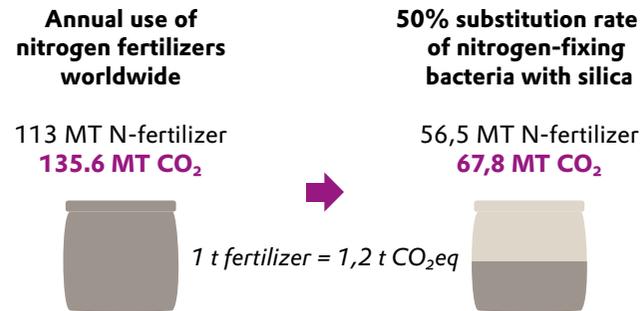
- Improved uptake and use of essential nutrients in crops
- Alternatives to synthetic nitrogen in modern farming
- Reduced carbon footprint of agricultural products in general through lower synthetic fertilizer use
- Reduced risk of harmful nitrification of soil and water resources

SILICA HELPS TO REPLACE SYNTHETIC FERTILIZER

One promising approach is to use silica as a carrier for nitrogen-fixing bacteria and apply it to plant leaves and seeds. The bacteria convert CO₂ from the air into nutrients for the plant, while the silica stabilizes them and extends their shelf life. In greenhouse trials (see graphic), this method allowed crops to achieve nearly the same nutritional effect with only 50% of the usual volume of fertilizer. Silica-based bacteria formulations could replace up to half of synthetic fertilizer, improving efficiency and preserving resources.

SILICA IS A NATURE-IDENTICAL ALTERNATIVE TO POLYMERS

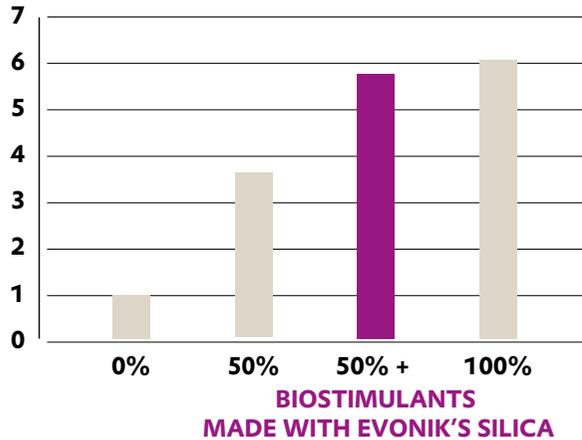
Silica also helps to prevent microplastic pollution, which is another threat to the environment. The chemical structure of synthetic amorphous silica is identical to that of natural silica. Therefore, silica particles are a nature-identical alternative to polymers in agrochemical formulations. They can be used as extrusion aids, binders and carriers in formulations for water-dispersible granules (WG). Evonik's synthetic amorphous silica simply joins the natural cycle of silica, and it is not harmful to soil and aquatic environments.



RESULTS OF GREENHOUSE TRIAL

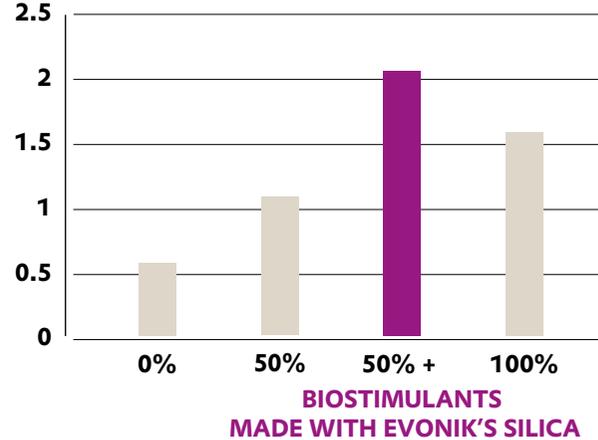
Sprout

Dry weight [g]



Roots

Dry weight [g]



Using 50% fertilizer and biostimulants made with Evonik's silica produces a plant biomass (without roots) almost equal (93%) to the result when using 100% fertilizer.

More details about the trials are available on request.

BENEFITS OF SILICA IN PLANT CARE FORMULATIONS

- Enhanced effectiveness of biofertilizers compared to chemical fertilizers, helping reduce nitrate and phosphate pollution
- Stabilization of chemical pesticides, allowing lower dosage
- Increased viability and performance of biological crop protection systems

Evonik provides comprehensive life cycle assessment (LCA) for silica products.

The Silica and Silanes experts at Evonik – From elements to excellence.



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OP-07-EN-02-2026/02-PW