

Biostimulants for sustainable agriculture

Reducing pollutants and improving water and soil quality through improved nitrogen use efficiency

Biostimulants, both natural products and micro-organisms, are novel and increasingly available, but not yet fully understood. INBIOS is an Operational Group from Italy which aims to test these products in combination with decision-support tool models and innovative agricultural cropping systems. The adoption of these complementary strategies should enhance the natural defences of plants and reduce the use of plant protection products, and increase resistance to water stress and other effects of climate change.



We spoke to Luigi Lucini from the project who told us about what they have been doing:

“An increasing world population and the steady growth in global demand for food means that agriculture is called upon to increase production, whilst respecting environmental, social and economic sustainability. The need for mitigation and simultaneous adaptation of agricultural systems to climate change is increasingly urgent. This adaptation concerns most importantly the efficiency of input use and protecting and restoring agricultural soils.”

“Primary production in general is therefore under pressure to respond to growing production demand on the one hand and to guarantee high quality standards in a sustainable manner on the other. The challenge is even greater as there are increasing nitrate use restrictions and water protection measures, reduction of pesticides, and need for the protection of biodiversity.”

“The use of biostimulants in agriculture is rapidly expanding across Europe. While initially they were used in more profitable production sectors such as wine-growing, horticulture and fruit-growing, their use is also expanding to herbaceous field crops. **EU regulation** distinguishes between fertilisers and biostimulants, specifying how biostimulant activity manifests itself beyond the simple supply of nutrients to the plant. They are products based on natural extracts or beneficial micro-organisms that improve crop response. They help the plant resist stresses such as high temperatures, drought, soil salinity, which can support growth and productivity even in sub-optimal conditions. According to EBIC (European Biostimulants Industry Council) data, biostimulants can improve the absorption and use of nutrients by up to 25% and the intrinsic characteristics of the product (size, colour, ripeness, impact resistance) by up to 15%.”

“As they are natural products or microorganisms from agrarian environments, their use is in line with the demand for increasing sustainability in the agri-food sector and their profile is also suitable for both organic and conventional farming. The most commonly used microbial biostimulants include arbuscular mycorrhizal fungi, fungi belonging to the genus *Trichoderma*, and rhizosphere bacteria (PGPR - Plant Growth Promoting Rhizobacteria). All these microorganisms can establish a symbiotic relationship with the plant.”

"For several years now, chemists, agronomists and microbiologists from the Faculty of Agricultural, Food and Environmental Sciences at the Università Cattolica del Sacro Cuore have been carrying out research in this field. The INBIOS Operational Group is looking at maize and tomato as model crops, as they have high nitrogen (and low nitrogen use efficiency) and high pesticide requirements, respectively. Within this project we are studying the possibility of guaranteeing production while reducing nitrogen and pesticide inputs, through the combined use of biostimulants and Decision Support Systems. The research is carried out together with two experimental agricultural companies and with the cooperation of several farms. A training centre will also be involved for the transfer of the results obtained."

"Within INBIOS we are testing the following: (i) a consortium of biostimulants which includes nitrogen-fixing microorganisms to reduce nitrogen fertilisers, (ii) biostimulant microorganisms which can induce crop resistance and biocontrol agents to reduce doses of phytosanitary products and (iii) second-generation biostimulants- a combination of mycorrhizal and hydrolysed protein fungi to improve resistance to water stress and therefore the response to climate change."

"The first year of experimentation showed how nitrogen inputs for maize could be reduced without impacting productivity. We used different formulations of biostimulants at different crop stages (seed covering, pre-flowering...). Although we will continue our experiments for another season, the results so far are very encouraging. The observed effect is the result of improved nitrogen use efficiency, while maintaining productivity. Further research will be carried out to deepen our understanding of the mechanisms underlying this improved nitrogen uptake, and its link to soil biodiversity." "Preliminary results in tomatoes also point to enhanced functional potential of the berries by increasing the content of antioxidant compounds."

"At the end of the project, INBIOS will disseminate the results to farmers through courses on biostimulants use in agriculture. We will promote the results through scientific journals, but dissemination to farmers is considered a primary goal because of the potential impact on agriculture and society."

Photos and text source: INBIOS - Luigi Lucini

More information

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- [Project website](#)
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