



THE POWER OF MICROORGANISMS



SOLUTION FOR FERTILE SOIL

Biofor System d.o.o. is an applied biotechnology company that specialises in creating unique and innovative products. The synergy of our expertise in soil microbiology, agronomic practices and the superior properties of selected microorganisms results in a healthy plant and enhanced soil fertility. Biofor System d.o.o. was founded in Serbia in 2005. Its establishment was preceded by three years of scientific research in the field and in the lab. It all started with scientific projects funded by the Serbian Ministry of Science and Technological Development and the research conducted at the Faculty of Agriculture in Zemun. By applying scientific accomplishments and eco-friendly methods, we have achieved outstanding results in soil nurture with our range of Biofor microbiological fertilisers. Today, our products can be found in the Western Balkan region and four countries of the European Union.

Soil

Our soil devastation rapidly due to lost of organic matter and salinisation. This processes firstly and directly ruin soil microbiom. Of course if we losing living phase of soil that have dramatic consequences in fertility of soil. Microbs have essention role component of soil biologic, physical and chemical characteristic of soil.

The reduced use of manure has led to a decline in soil microorganisms, thereby reducing its biogenicity. Soil compaction has increased, leading to a decline in organic matter content, and soil dusting has become a more common agrotechnical measure.


The “Biological Treatment of Soil” (BTS) is a concept practiced since 2016, when users were awarded first certificates. Today, 120 farmers holding BTS certificates have enhanced the quality of their soil and crops using Biofor products.

Biofor microbiological fertilizers contain carefully selected microorganisms that have a continuous positive effect on soil fertility and crop growth.

The aim of the BTS is to re-establish a sustainable soil fertility system.

Building upon these principles, we have developed a range of products that harness the constant positive influence of carefully selected strains of microorganisms found in Biofor microbiological fertilizers.

Results of measured production trials in 2006 - 2021

|  | Average crop increase in kg/ha using Biofor technology | Products used for demonstrable results | Income per ha when using Biofor technology (EUR) | The number of measured production trials |
|-------------------------------------------------------------------------------------|--------------------------------------------------------|----------------------------------------|--------------------------------------------------|------------------------------------------|
| Corn | 798 | BioGnezdo + Biofor Active | 170,00 | 47 |
| Wheat | 625 | Biofor Active + BioEho | 152,00 | 22 |
| Sunflower | 284 | BioGnezdo + Biofor Active | 157,00 | 28 |
| Sugar beet | 4740 | Biofor Active + Biofor BioP | 246,00 | 20 |
| Rapeseed | 391 | Biofor Active + BioEho | 158,00 | 15 |
| Tomato | 1986 | Biofor Active + Biofor BioP | 235,00 | 15 |
| Pepper | 2126 | Biofor Active + Biofor BioP | 808,00 | 15 |
| Soya | 313 | Biofor Soya Liquid + Biofor Active | 186,00 | 52 |

All results of the production trials conducted from 2006 to 2021 were published in relevant publications. The published reports were signed by the farmer or organisation that applied the products and measured the yields.

The investment-to-gain ratio of **1:10.5**, based on the measurement of production results in very different agroecological conditions, makes the **BTS technology** one of the most profitable methods in agricultural production.

The trials were conducted under production conditions using commercially available products. The calculation did not take into account the potential reduction of mineral fertilisers or effects on the biological and physical properties of the soil.



SOLUTION FOR NITROGEN

Enriches soils with
40-80 kg/ha
of nitrogen

- By biological fixation providing nitrogen directly to plant
- Enriches soils with 40-80 kg/ha of nitrogen
- Increases the effectiveness of fungicides
- Increase quantity and quality of yields

NITROGENIUS - A GENIUS FOR NITROGEN!

Nitrogen makes up three quarters of the air content. Above every m² there is 1 kg N that can be a source of N for cultivated plants. Years of experience and work with *Azotobacter Chroococcum* strains have resulted in the microbial fertiliser Nitrogenius - an effective solution for nitrogen nutrition. The F8/2 and F 14/2 Azotobacter strains, proven to be effective in the free **nitrogen fixation** of the atmospheric nitrogen, were selected. The effect of Nitrogenius is in line with basic nutritional principles: the right amount at the right place and at the right time provides immediately absorbable nitrogen minerals to the roots of plants throughout their vegetation period. If there is air in the soil, plants get their nutrition every day without any losses.

Nitrogen-fixing bacteria have been present for 4 billion years and are responsible for the existence of life on land. The vast majority of N found in the plant-soil system is fixed by nitrogen-fixing bacteria. This group of microorganisms is unique due to its nitrogenase content and ability to convert atmospheric nitrogen into ammonium NH₄. According to the official data of the United Nations Food Organisation (FAO), nitrogen-fixing bacteria enrich the soil of planet Earth with 40 million tonnes of mineral nitrogen every year. This accounts for 8.7 % of all nutrients that are input into the soil.

Nitrogen in the soil is a guest and cannot be kept in mineral form. In soil, 96 % of nitrogen is found in humus and microbial biomass. Microorganisms are key to supplying plants with nitrogen and better utilising mineral nitrogen fertilisers. Also, Nitrogenius and other Biofor preparations are part of the **BTS technology**, which increases the use of nitrogen mineral fertilisers and significantly reduces nitrogen losses by improving soil structure, strengthening roots, increasing the number of microorganisms and eliminating losses caused by waterlogged land.

Over-land and foliar application, along with the effect of 2-3 l/ha, without any restrictions on mixing with other chemical agents, make it ideal for all application conditions in terms of reducing application costs.

Trials with Nitrogenius in 2022

| | |
|-----------|--------------|
| Wheat | +352.7 kg/ha |
| Corn | +365.5 kg/ha |
| Sunflower | +345.5 kg/ha |

The bacterium *Azotobacteria Chroococcum* enters the plant tissue and fixes nitrogen in the leaf so efficiently that even small amounts of N provided in this way can make a significant difference. This effect is manifested in a darker leaf colour and increased photosynthesis.

Nitrogenius is a microbiological fertiliser that uses the natural microbiological resources to provide high-quality and continuous plant nutrition with N throughout the growing season.

By selecting the best performed strains of the bacterium *Azotobacter Chroococcum* that act dually, through soil and foliage, we have enabled a natural, sustainable and continuous supply of nitrogen to the plant from the largest free nitrogen reservoir in our atmosphere, throughout the growing season.

By applying this microbiological preparation, plants can be provided with 40 - 80 N kg/ha of pure nitrogen. Moreover, Nitrogenius has a pronounced inhibitory effect, i.e. acts preventively against the

appearance of *Fusarium* sp, which adds to the quality of the preparation.

When combined with other Biofor preparations, Nitrogenius is an indispensable part of the innovative BTS technology, creating the basis of plant nutrition and focusing exclusively on the needs of the cultivated plant



NITROGENIUS - A GENIUS FOR NITROGEN!
2-3 l/ha



LIQUID

Biofor Soya Liquid

- Liquid formulation, easier treatment of soya beans up to 3 weeks before sowing
- Highly effective strains
- Unique formulation

Bradyrhizobium japonicum

Azotobacter Chroococcum

Application dose: Mix 250 ml with approximately 50 kg of soya beans before sowing without adding other liquids.

The seeds can be treated for up to **3 weeks** before sowing.



Biofor Soya

-Improved nitrogen-

Bradyrhizobium japonicum enriched with 3 more strains of bacteria

Azotobacter Chroococcum - free NITROGEN fixation

Bacillus megaterium - mobilises PHOSPHORUS

Bacillus circulans - mobilises POTASSIUM

Mix the contents of a dose-per-hectare bag (300 g) with 500 ml of water and mix with soya beans for 1 ha (approximately 100 kg).



Cares for every seed

BioGneздо

-Cares for every seed-

- Faster germination, sprouting and rooting
- Uniform crop
- Increase number of sprouted plant per ha



① Faster germination and sprouting



② Strong roots



③ Uniform crop and better structure

BioGneздо contains plant growth stimulator bacteria that are a source of natural auxins and gibberellins.

The preparation contains zinc, which is especially important for corn and soya beans.

BioGneздо in field conditions: no matter how well the pre-sowing preparation is done, a number of sprouts fail. People usually say that the seed is not good. The truth is that bad soil conditions result in losses.

BioGneздо is of huge help in cold springs because it increases the number of seedlings and gives additional energy to the seed to survive adverse conditions.

Application dose:

250 ml - to treat the seed norm for sowing one hectare of corn, sunflower and rapeseed.

500 ml - to treat wheat, barley and soya bean (together with Biofor Soya).

Application:

Pre-sowing seed treatment, can be combined with any other pesticides.



BTS TECHNOLOGY
IN SOYA





Solution for phosphorus

Effective at low soil pH

Biofor BioP

-Solution for phosphorus-

- Feeds plants with phosphorus from mineral and organic soil compounds
- Reduces the infectious potential by controlling pathogens in the soil
- Supply of Fe and microelements

The mobilisation of phosphorus affects further development of the roots **and the provision of energy for plants** through the basic energy compound, ATP, for which phosphorus is necessary. The strains of bacteria in Biofor BioP are characteristic for the production of complex organic siderophore compounds that transport Fe and other microelements. As a side effect, this deprives pathogenic fungi of the essential Fe nutrient. *Bacillus subtilis* secretes bioactive substances lipopeptide iturin, surfactin and fengicin, and actively participates in preventing the spread and **reducing the infectious potential** of Botrytis, Fusarium, etc. This active fight, along with increasing the number of beneficial microorganisms, brings the soil to its full capacity of biocontrol. The aim is to combat pathogens in the soil when they are most susceptible. The active bacterial population triggers the induced resistance in plants, which is also very important.

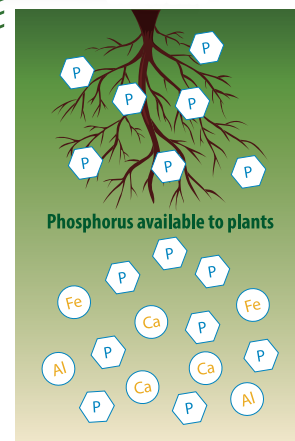
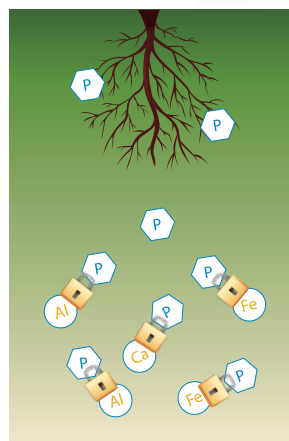
Although our soil is generally well-supplied with phosphorus, the issue lies in its availability to plants. This is particularly problematic in soil with a low pH. Biofor BioP contains microorganisms that are effective even in acidic soil. Microorganisms supply plants with phosphorus and other microelements. *Bacillus megaterium* var. *phosphaticus* is a bacteria that secretes acid and alkaline phosphatase and directly supplies plants with phosphorus from the soil.

Biofor BioP enhances the mobility of phosphorus, making it ideal for use in soil with impaired phosphorus absorption, such as soil with either high or low total phosphorus content.

Phosphorus nutrition (P)

Your soil

Biofor BioP



Key to phosphorus!



There is no substitute for phosphorus - without it, there is no life. Biofor BioP is an innovative product that addresses the issue of phosphorus nutrition in plants. Phosphorus is highly reactive (it is on the tip of every matchstick). It is not found free in the soil but only in mineral and organic compounds.

Not a single gramme of phosphorus can be absorbed without the engagement of phosphomobilising bacteria.

The release of phosphorus also results in the release of many other necessary microelements. This is extremely important due to the role of microelements (Fe, Zn, Mn) in the normal functioning of plant metabolism. When the spring is cold, the leaves redden due to low temperatures and reduced microorganism activity, which halts the supply of phosphorus from the soil to

plants. Prior application of Biofor BioP prevents **redness in corn: Biofor BioP recovers and restores colour up to 7 days after application.**

Application:

In agriculture: Use 3 l/ha in the first stages of development, using 200-400 l of water

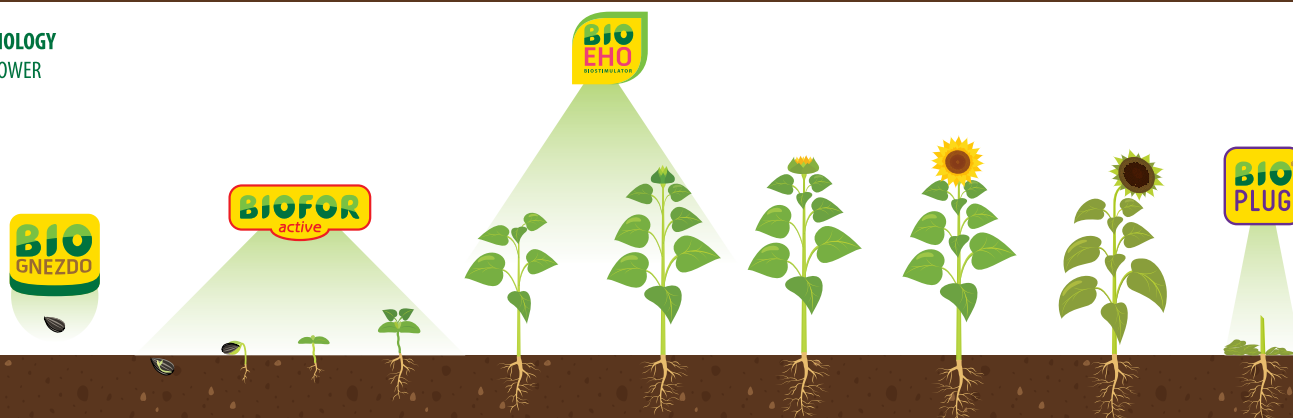
In vegetable growing, fruit growing and viticulture: Use 5 l/ha several times during the growing season

Method of application: Spray it on its own or in combination with plant protection products over the entire surface area of the land. Can be mixed with all pesticides.

The product was created with the financial support of the Green Innovation Voucher



BTS TECHNOLOGY
IN SUNFLOWER





**Healthy soil,
healthy food!**

Biofor Active

-Biological NPK-

- **Balanced nutrition, mobilises NPK, strengthens roots**
- **Reduces phytotoxicity cause by pesticid stress**
- **Increases the number of microorganisms in soil**

Biofor Active contains selected beneficial soil bacteria. Thanks to their activity, nutrients from the soil become available to plant roots. Biofor Active is the best-selling Biofor System product because of its universal application and diverse effects.

Application:

Use with herbicides, in the first herbicide treatment **2 l/ha Biofor Active**, after sowing and before emergence, or spray with herbicides during the growing season in corn, sunflower, soya bean, vegetables and sugar beet. For wheat, apply **Biofor Active** in autumn, on its own, 2 l/ha with 200-400 litres of water, or in spring, with herbicides. Depending on the soil conditions, it can be applied several times during the growing season.

For sugar beet: 3.5 l/ha.

For vegetable growing: Spray 3-5 l/ha after planting and transplanting.

For watering the seedlings: Mix 250 ml with 10 l of water.



Kristian Todorov, Banatsko Novo Selo



Powerful roots are treated with Biofor Active



Natural biostimulator

BioEho

-Natural biostimulator-

- **Increases plant resiliency and helps recovery after abiotic stress (temperature shock, hail, drought)**
- **Accelerates branch formation - more blossoms and fruits**
- **Larger and better grain fill**

BioEho is a biostimulator of a new generation. It was created with the aim to support plant growth by fully supporting natural processes. It contains secondary products of bacterial metabolism and products of bacterial cell decomposition - protein hydrolysates. Unlike chemical methods, protein hydrolysates in BioEho are produced by the enzymatic activity of bacteria, preserving all amino acids. The product has a high content of glutamine obtained from a natural, microbiological source.

Plants can produce amino acids themselves, but the synthesis of amino acids requires a lot of energy. Therefore, the application of amino acids ready for intake allows plants to save energy and speed up development, especially in stressful conditions. Amino acids have a variety of roles in plants, such as stress reducers, nitrogen sources and hormone precursors.

BioEho uses the combined effect of auxin, gibberellin and amino acids. It is usually recommended for use in critical plant growth conditions: after transplanting, during the flowering period and during climatic stress (night frosts, droughts) or plant diseases. Also, amino acids build organic bonds with minerals (chelates of amino acids), increasing the availability of nutrients to plants when applying foliar and mineral fertilisers.

Contains:

growth factors (auxins and gibberellins), bacteria *Bacillus amyloliquefaciens* and their products (enzymes) and amino acids (glutamine, histidine, glycine, proline and alanine).

BioEho has a significant effect on the acceleration of metabolic processes in plants, leading to an increased yield, preservation of leaf mass and rapid recovery of plants after hail.

Application: Use **3 l/ha** for sugar beet, vegetables, fruits, soya beans, sunflower and wheat, before plants start flowering.

For sugar beet: use with fungicides against cercospora.

For wheat: use with fungicides against fusariosis.



**BTS TECHNOLOGY
IN CORN**





Decomposing harvest residue, creating humus!

BioPlug

- Breaking down crop residues
- Synthesis of humus and significantly easier tillage
- Releasing a large amount of mineral matter from crop residues

BioPlug is a powerful microbiological preparation containing microorganisms that humify crop residues. Microorganisms in BioPlug originate from the soil and are responsible for creating humus.

Crop residues are made up of different compounds. The transformation of these substances into humus is a complex and demanding process creating a more complex substance than the one it started with. There is no chemical formula for humus. Humus, the essential component of soil, is the only thing that cannot be made in China. Humus is created by humifying microorganisms in BioPlug. Humus contains living and dead microorganisms. No soil analysis can separate microorganisms from other organic matter. Therefore, humus implies 5-10 tonnes of microorganism mass.



Earthworms in the fields where BioPlug was used to break down crop residues.

Earthworms appear because of the introduction of a large amount of crop residues, transformed into the highest quality organic fertiliser by the activity of microorganisms in BioPlug.



① Spraying crop residues with 5 l/ha BioPlug



② Ploughing or aerating of treated crop residues



③ Fertile soil with higher content of humus

Of course, when we say that the content of humus has dropped, we mean that the number of microorganisms is lost first. The content of humus has decreased in our soil due to agricultural practices. If the mineralisation process is faster than the humification process, the soil is sick. This is the degradation process, i.e. the loss of soil organic matter.

Lignin is the most difficult to decompose, and without it there is no basic humus chain. Humus has a role in retaining moisture in the soil. To describe a 1% decrease in humus content as a minor setback is to downplay the severity of the situation. If there is a drop from 3 % to 2 %, a third has been lost. Humus is as light as a cobweb, binding the soil together and making it breathe. As important as it is to rain, it is even more important that the soil retains moisture. The impact of increased microbiological abundance is best seen in the expression "the root holds moisture". The soil's ability to retain moisture around the roots is influenced by various factors, including physical properties. Better structure improves water retention capacity. We measured this publicly on field days. Plants treated with Biofor microbiological fertilisers had 10-12 % higher moisture content in the root zone compared to the control sample.

Retention of moisture and organic matter

| Organic matter content (%) | Water available to plants (%) |
|----------------------------|-------------------------------|
| 1,9 | 3,6 |
| 2,5 | 6,2 |
| 3,0 | 7,4 |

Application:

Spray crop residues with **5 l/ha**. After spraying by aerating or ploughing, mix crop residues with the soil. Use 0.5-1 l **BioPlug** to compost 1 m³ organic matter.

BTS TECHNOLOGY
IN WHEAT



**Healthy soil,
healthy food!**



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