agrounik

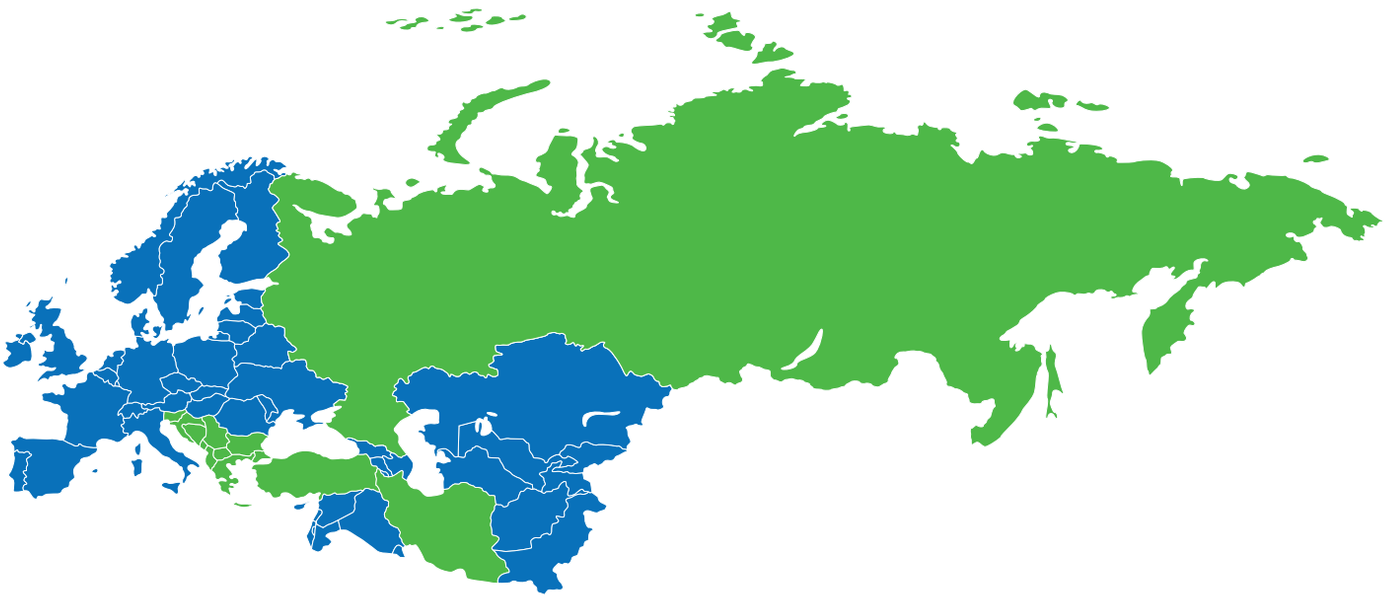
Science dedicated to nature.

# SCIENCE DEDICATED TO NATURE.


UNI MAX · UNIKER · UNISTART · SLAVOL S · Slavol za soju · Rizol za soju · Rizol za grašak · Rizol za lucerku · BISTROL home

Slavol · SLAVOL VVL · FLOSAL · AMIKSOL AMINOKISELINE · SilkO · SilkO ZA LUCERKU · SilkO ZA TRAVE I ŽITARICE · BISTROL

# AGROUNIK'S DISTRIBUTION NETWORK



1.Serbia
2.Croatia
3.Bosnia and Herzegovina
4.Macedonia
5.Slovenia
6.Montenegro
7.Bulgaria
8.Albania
9.Greece,
10.Turkey
11.Russia
12.Iran

Countries where Agrounik operates.

agrounik
Science dedicated to nature.

# PRODUCT CATALOGUE

Belgrade, 2018

# AWARDS AND CERTIFICATES










# AGROUNIK

Agrounik is involved in research in the areas of biotechnology, production, distribution and sales of microbial preparations with applications in agricultural production.

Agrounik has 17 registered and certified products that are applied as biofertilisers for the treatment of soil and seeds, and for supplemental foliar feeding, as inoculants for the preparation of silage and for the treatment of wastewater.
All the preparations are the intellectual property of Agrounik and are patent-protected.

Industrial production of the microbial fertiliser SLAVOL began in 2005 according to the recipe of Prof. Snežana Đorđević, PhD. The firm's headquarters and production plant are located in Šimanovci, next to the Belgrade-Šid motorway.

Distribution of the product range and training of consumers in the territory of Serbia take place through the distribution centres in Belgrade, Bečej, Novi Sad, Sombor, Zrenjanin, Bela Crkva, Loznica, Smederevo, Čačak, Kruševac and Leskovac.

In Croatia, Bosnia and Herzegovina, and Macedonia, Agrounik operates via its representative offices and subsidiaries. Agrounik exports its products to Russia, Iran, Turkey, Greece, Bulgaria, Albania, Slovenia and Montenegro.
Agrounik's vision is to become the regional leader for research, development, production, distribution and sales of preparations based on microorganisms and their metabolites.

We have an HACCP certificate which guarantees standard quality at every stage of production and maximum safety of use of our products in agricultural production.

We also have an ETKO certificate for our products used in organic production, accredited by the European Union. The certificate confirms that the use of our products in organic production is safe for the environment and that the product is completely natural and free of chemical additives.

Agrounik received the award for leadership, technology and innovation, the International Star for Leadership in Quality Paris 2011, awarded by an international committee in Paris for good business results, customer satisfaction, planing and decision-making, human resources and production processes.


# PRODUCTION

Production takes place in Šimanovci, near Belgrade. The manufacturing plant is equipped with cutting-edge fermenters for multiplying microorganisms on an industrial scale and producing their metabolites.

The production process is automated, with an in-built CIP system for cleaning and sterilisation. Modern, electronically-controlled packing lines pack products into different kinds of packaging. Inspections of the production process, as well as of the quality of intermediate goods and finished products, are carried out at each stage of the production cycle in microbiology and plant physiology laboratories equipped with the latest equipment.

The warehouse area is equipped with pallet storage and controlled conditions for preserving and storing the finished products.

## SCIENCE AND RESEARCH WORK

Agrounik is registered as a research and production centre with the Ministry of Education, Science and Technological Development of the Republic of Serbia, which gives it the opportunity to research, create, develop, apply and market innovations.

Agrounik is involved in a large number of scientific projects financed by the Innovation Activity Fund and the Ministry of Education, Science and Technological Development, where it cooperates with a number of official scientific institutions in Serbia and the region: The Faculties of Agriculture in Zemun and Novi Sad, the Faculties of Agronomy in Zagreb and Čačak, the Faculty of Agricultural Sciences and Food in Skopje, the Faculty of Chemistry in Belgrade, and the Institute of Molecular Genetics and Genetic Engineering in Belgrade, etc.

SLAVOL, as the first recognisable Agrounik's product, has received a number of awards. They include the EUREKA gold medal in Brussels in 2005, the IDEA gold medal in 2005 in Hungary, and a patent award from the Belgrade Chamber of Commerce in 2007.

### CONNECTING SCIENCE AND BUSINESS

Agrounik is recognisable in Serbia and abroad for its implementation of science in business: connecting of scientific work resulting in the creation of new products, their manufacture, application and sales. The results of our research work are conveyed to agricultural producers via our employed agricultural engineers. We have 21 full-time agricultural engineers in Serbia, Croatia, Bosnia and Herzegovina and Macedonia, who are in daily contact with agricultural producers, providing training on the advantages of using our technology in organic and conventional production, distributing products and participating in fairs and seminars.

The results of experiments are published in brochures which are available to a large number of producers. This has led to the creation of our motto: "Science from laboratory to field". Agrounik has received numerous awards for the achieved results. Agrounik was named the best small- and medium-sized enterprise, and Prof. Snežana Đorđević, PhD, as entrepreneur of the year in 2008. The award was handed out by Blic, one of the highest circulation newspapers in the country, and Banca Intesa, with the support of the Ministry of Economy and Finance, the Serbia Investment and Export Promotion Agency (SIEPA), the Serbian Chamber of Commerce and the National Employment Service. Agrounik is recognised by the credit agency Coface as a company that deserves the Excellent SME certificate, thanks to its positive financial and credit standing.

Agrounik received the Golden Superbrand award for the most innovative company in 2015/2016, based on the following criteria: brand recognisability and reputation, long-term consistency and reliability, and corporate responsibility. In 2017, Agrounik received the Innovative Entrepreneur of the Year Award from the organisation Ernst & Young.

# BIOUNIK

For the purpose of improving the scientific research, Agrounik has established the company Biounik, which is registered as a research and development centre with the Ministry of Education, Science and Technological Development.
The science and research work is focused on innovations and creating new active formulations that are based on microorganisms and their metabolites with applications in agricultural production. Biounik employs three PhDs in the field of microbiology, biochemistry and molecular biology, several doctoral students and masters of science. Biounik's mission is to participate through its science and research work in a variety of local and international projects, to engage science institutions and eminent experts in the field of biotechnology, and to employ highly educated staff who will continue working on developing new innovative products.

Biounik has microbiology, plant physiology, agrochemical and silage testing laboratories and a PCR laboratory, which have the latest equipment, as well as an expert team that carries out local and foreign research projects.

**The microbiology laboratory** is equipped with apparatus for carrying out standard microbiological methods for isolating and identifying microorganisms from the natural environment. Their cultivation, production and the isolation of their metabolites are carried out in modern and controlled fermentation conditions, in a bioreactor, which are controlled and monitored using the SCADA software. Furthermore, the automated identification of microorganisms is carried out using a Crystal Autoreader.

**The PCR laboratory** is equipped for the isolation of genomic DNA using contemporary genetic methods, PCR (Polymer Chain Reaction) gene amplification for 16 S RNA, for confirming the presence of genes by horizontal electrophoresis, and for UV transilluminator detection.

**The plant physiology laboratory** is equipped for quantitative and qualitative determination of plant hormone content using biological and ELISA ( Enzyme-Linked Immunosorbent Assay) tests. We carry out physiological tests on plants in hotbeds, a phytotron and a greenhouse. Experiments are conducted all year round in our modern, equipped greenhouse, where we test our new active substances.

**The agrochemical laboratory** has modern equipment for soil analysis. We carry out basic soil analyses for individuals and companies at an affordable price, and quickly and precisely. Based on the analysis, we are able to give recommendations on fertilising and the correct utilisation of the soil.

**The silage testing laboratory** has modern equipment for determining the silage quality based on the content of acids, proteins, fats, cellulose, ADF (Acid Detergent Fiber) and NDF (Neutral Detergent Fiber).


## AGRO-NIKA, CROATIA

**Agro–nika** was established in 2010 in Croatia, as a subsidiary of Agrounik. Agrounik founded the company out of its desire to market its products in Croatia and other European Union member countries. The company's headquarters, distribution centre and agricultural pharmacy are located in Trpinja near Vukovar. The agricultural pharmacy is stocked with seeds of a variety of plant species and a selection of pesticides, fertilisers, animal feed and other production materials for successful agricultural production.

Agro-nika employs agricultural engineers who sell products from Agrounik's product range in the territories of Srem, Slavonija, Baranja and Zagorje. Our team also offers a professional advice service for the protection and nutrition of plants and animal nutrition. The demonstrated results of our products in real-life production have been recognised by many agricultural producers in Croatia, and Agro-nika has achieved outstanding business results thanks to their long-term confidence in the company.

## AGROUNIK, BOSNIA AND HERZEGOVINA

**Agrounik BIH** was established in 2014. It employs two graduate agricultural engineers who present and sell our products. The distribution centres in Bosnia and Herzegovina are located in Bijeljina and Banja Luka.

## AGROUNIK, MACEDONIA

**Agrounik** founded its company in Macedonia in 2016 and it employs one graduate agriculture engineer. The distribution centre is located in Skopje.


# BIOFERTILISERS FOR SOIL TREATMENT

Soil fertility is reflected in its ability to supply plants with the necessary amounts of nutrients during the vegetative season. In the rhizosphere, 2 mm from the root system, very dynamic processes of mineralisation and immobilisation take place in which microorganisms in the soil turn nutritive elements from inaccessible forms into accessible forms for plants and vice versa.

Micro-organisms mineralise fresh organic matter, participate in the processes of synthesis of humus, release the micro elements Fe, Mn, Mo, Al, B, Zn, S from hard-to-dissolve compounds, carry out nitrogen fixation, contribute to the creation of favourable soil structure, and produce plant hormones that stimulate plant growth. Microbial biomass that remains in the soil accounts for 1-5% of total nitrogen and 0.5-1% of total phosphorus in the soil and is considered a very important source of nutritional matter for plants which is available to plants the quickest.

Knowledge of these processes in the plant-microorganism-soil system is the foundation of proper plant nutrition. However, inadequate application of different agrotechnical measures (tillage, fertilisation, application of pesticides, irrigation) results in soil degradation, which is manifested through changes in its physical, chemical and biological properties. All this negatively impacts different populations of microorganisms in the soil as well as the processes in which they participate.

The application of large quantities of mineral fertilisers often results in insufficient utilisation of fertiliser by plants due to the process of immobilisation, evaporation, and denitrification. These processes cause permanent or temporary loss of a significant amount of available nitrogen in the soil which is unfavourable in terms of plant nutrition and for economic reasons.

Application of inadequate types and quantities of fertiliser results in an increase in pH, content of salt and heavy metals in the soil, blockage of the take up of certain macro- and micro-elements. Removal of organic matter (crop residues) from the soil and a lack of other fertilisers result in a decrease in humus content, destruction of the soil structure, water and air and thermal regime. All this results in a decrease in the natural fertility of the soil, due to which yields stagnate or decrease.

The microbial fertilisers **UNI-MAX, UNISTART, UNIKER** have a positive effect on increasing and maintaining natural soil fertility.

**UNI–MAX**, a starter micro-granulated microbial fertiliser, is used during sowing with depositing devices for the purpose of improving nutrition in initial stages of growth and development through the mobilisation of macro- and micro-elements. **UNI-MAX** contains bacteria that break down organic compounds of nitrogen, phosphorus as well as other very important micro-elements (Mg, Ca, Fe, Zn, B, Al, Mo, Mn) in the soil. Applying **UNI-MAX** enhances plant nutrition and utilisation of mineral and organic fertilisers, which will ultimately lead to increased yields of the grown crops.

**UNISTART** contains strains of bacteria that participate in the processes of mobilisation and immobilisation of nutrients in the soil, prevent salinisation of the soil and have an effect on the availability of nutrients in the quantity and form that is optimal for plant nutrition.

**UNIKER** contains bacteria that accelerate the processes of decomposition of field residues that are turned into a new organic matter – humus. These preparations have a positive impact on maintaining and increasing the soil fertility.

On the basis of knowledge of the content of nutrients, soil pH, organic matter content and, depending on plant nutritional requirements in the specific phenophases of development, recommendations on proper fertilisation can be given.

Agrounik owns **soil testing laboratories** equipped with the latest equipment and an expert team comprising chemists, agronomists and plant physiologists who, on the basis of agrochemical and microbial soil analyses, provide expert opinion on the need for applying various agromeliorative measures in the soil use for the purpose of increasing and maintaining its fertility.


# SOIL ANALYSIS

Agrochemical soil analysis is the prerequisite for successful agricultural production in vegetable farming, field crop farming, fruit farming and grape growing. Plant yields every year remove a certain type and amount of nutrients from the soil and they need to be returned to the soil via fertiliser.

Excessive fertilising or introducing large quantities of fertilisers into the soil results in increased pH and EC (Electrical Conductivity) of the soil, blockage of the take up of certain macro- and micro-elements by plants, which contributes to an increase in production costs and a decrease in yields. It is therefore necessary to determine the potential and effective soil fertility from soil samples taken from production plots.

On the basis of knowledge of the content of nutrients in the soil as well as the need of specific plants for these elements, recommendations on the application of appropriate types, formulations and quantities of fertilisers can be given.

Balanced plant nutrition results in greater yields and preservation of the soil fertility for the upcoming years. In addition, recommendations on implementing agromeliorative measures for the improvement of soil fertility are necessary for the prevention of further soil degradation.

## BASED ON THE CHEMICAL SOIL ANALYSIS, THE AGROUNIK EXPERT TEAM CAN GIVE RECOMMENDATIONS ON:

- Fertilising of field crops;
- Formation of new plantations;
- Fertilising of plantations in full crop;
- Supplemental feeding of crops;
- Repair and maintenance of soil fertility.

## AGROUNIK'S AGROCHEMICAL LABORATORY PERFORMS THE FOLLOWING ANALYSES:

- pH of soil in water and KCl;
- Determination of humus content;
- Determination of total nitrogen content;
- C/N ratio;
- Determination of easily accessible nitrogen;
- Determination of content of easily accessible potassium and phosphorus;
- Determination of $CaCO_3$ content;
- N-min method.

## PROPER SAMPLING

Soil samples for analyses are taken at the end or at the beginning of vegetation, and they must be collected prior to the formation of multi-year plantations. Taking samples for analysis after the fertiliser introduction is not recommended.


# UNI-MAX

UNI-MAX is a starter micro-granulated microbial fertiliser – a mobiliser of nutritional elements, which is certified for application in organic and traditional agricultural production, in field crop farming, vegetable farming, horticulture and fruit farming.
UNI-MAX is applied during sowing using a micro-granule depositing devices located on a seed drill. It can be placed directly in rows with seeds or by its physical mixing with soil insecticides for the purpose of simultaneous nutrition and protection of grown plants. It is also applied during planting of pome fruits, stone fruits, nuts, berries and grapevine.

## COMPOSITION

UNI-MAX contains effective strains of bacteria producing protease and phosphatase enzymes that decompose organic compounds into accessible forms of nitrogen ($NH_4$+$NO_3$) and phosphorus (primary and secondary orthophosphate ion, $H_2PO_4$- and $HPO4^{2-}$). The bacteria are applied on special carriers - micro-granules, from which they are gradually released.

## MANNER OF ACTION

UNI-MAX contains bacteria that are applied on special carriers, from which they are released over a long period of time, and bind with the root system of a germinated plant, providing it with nitrogen and phosphorus from reserves already present in the soil. Organic compounds of phosphorus in the soil account for 70–90% of the total content of nitrogen and phosphorus, but are inaccessible for plants.

By the use of UNI-MAX these compounds are decomposed and turned into nitrogen and phosphorus forms that can be absorbed by plant directly on the root system. This ensures that plants are supplied with these elements in first stages of their development, when they need them most.

This ensures utilisation of natural resources of the soil, which reduces the application of mineral phosphorus fertilisers and the cost of agricultural production, and preserves the soil fertility.

UNI-MAX is recommended for application on soils with high phosphorus content. High phosphorus concentrations in the soil result in blockage of the take up of Fe, Mg, Zn, Mn, Mo, Al and other micro-elements of great significance for plant metabolism. In addition, high phosphorus concentrations in the soil can be toxic.

## HOW TO APPLY UNI-MAX?

| | | |
|---|---|---|
| **FIELD CROP FARMING** | Upon sowing with depositing devices | 20 kg/ha |
| **FRUIT FARMING AND GRAPE GROWING** | • Upon planting of pome fruits, stone fruits and nuts<br>• Upon planting of berries | 20 – 25 g/stem<br>50 g/metre of length |
| **VEGETABLE FARMING AND HORTICULTURE** | • For nursery production<br>• Upon sowing with depositing devices | 5-10% for the total substrate mass<br>20-40 kg/ha |

## WHAT WILL YOU GAIN BY USING UNI-MAX?

- Faster and more uniform plant growth in initial development stages;
- Better rooting of plants;
- Increased plant resistance to stress conditions;
- Better plant nutrition during vegetation;
- Increased microbial activity;
- Increased potential and effective soil fertility.


# UNISTART

UNISTART is a liquid microbial fertiliser – a mobiliser of nutritional elements, which is certified for application in organic and traditional agricultural production.

UNISTART is used for the treatment of soil in field crops, vegetable farming and fruit farming.

## COMPOSITION

UNISTART contains effective strains of proteolytic and cellulolytic bacteria that break down the hard-to-dissolve compounds of carbon, nitrogen and phosphorus, turning them into accessible forms for plants. It is applied before or after sowing, but before plant sprouting, together with soil herbicides, by spraying over the surface of the soil or via a drip system. The bacteria contained in UNISTART reach the root system of the sprouting plant and directly provide it with nutrients.

## MANNER OF ACTION

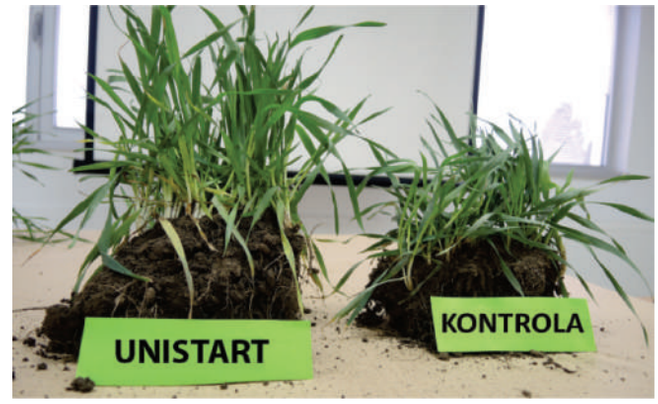
The bacteria form a thin, slimy sleeve on the surface of the root, building a very firm bond with the plant where they establish a specific form of community, called association.
In the root system, the bacteria mineralise the organic compounds of nitrogen, phosphorus, sulphur, produce acids that release K, Mg, Ca, Fe, Zn, B, Al, Mo, Mn and other micro-elements from hard-to-dissolve compounds and transfer them directly to the plants.
In that manner, plants are additionally supplied with nutrients that are already present in the soil.

## HOW TO APPLY UNISTART?

| | | |
|---|---|---|
| **FIELD CROP FARMING** | Before sowing<br>or<br>After sowing<br>or<br>Before plant sprouting | Unistart is applied in the dose of 3 L/ha with 200-300 L of water; spray it over the surface of the soil.<br>Can be mixed with pesticides |
| **FRUIT FARMING AND GRAPE GROWING** | 1. Before the beginning of vegetation for root activation<br>2. Beginning of vegetation and foliar mass forming<br>3. Intensive growth and flowering<br>4. Beginning of fruit setting<br>5. Intensive fruit growth | 1. Drip system: 0.1-0.2% or 1-2 litres of Unistart with 1,000 litres of water.<br>Can be mixed with pesticides<br><br>2. By spraying into the bands along the rows Unistart 3 L/ha. |
| **VEGETABLE FARMING** | 1. Removal of seedlings<br>2. Drip system | 1. Unistart 3 L/ha; spray it over the surface of the soil<br><br>2. Unistart 1 litre on 10 ares; deliver it through the system every 7-10 days. |

## WHAT WILL YOU GAIN BY USING UNISTART?

- Better utilisation of the applied minerals and organic fertilisers.
- Elimination of the negative effects of the use of mineral fertilisers, especially where high concentra tions of phosphorus, which block proper take up of other nutrients by the plant, are present due to i mproper fertilising.
- Increased content of easily accessible N, P, K.
- Increased content of microbial biomass.
- Greater soil fertility.




# UNIKER

UNIKER is a liquid microbial fertiliser – a mobiliser of nutritional elements, which is certified for application in organic and traditional agricultural production, in field crop farming, vegetable farming, fruit farming and grape growing for decomposition of crop residues and composting.

## COMPOSITION

UNIKER CONTAINS :

- Effective strains of proteolytic and cellulolytic bacte ria that break down the hard-to-dissolve compounds of carbon, nitrogen and phosphorus, turning them into plant-accessible forms.
- Organic material that transforms in the soil into mineral nitrogen (NH4+), thus preventing the creation of nitrogen depression.

## MANNER OF ACTION:

Applying UNIKER speeds up the transformation processes of crop residues in the soil. UNIKER prevents the creation of nitrogen depression (lack of accessible nitrogen in the soil), because it contains easily hydrolysable organic material that breaks down with the help of proteolytic bacteria into accessible nitrogen ($NH_4+$), thereby regulating the C/N ratio. The crop residues turn into a new organic material – humus. Humus prevents rinsing off of nutrients, improves the water and air regime and the structure of soil. Applying UNIKER results in faster decomposition of crop residues, which facilitates the pre-sowing preparation of soil and sowing.

UNIKER is used in fruit farming and grape growing for spraying fallen leaves, branches and tree bark, thus reducing pathogen inoculum and infectious potential for the following year. The soil is enriched with a new organic material that increases the soil fertility.

Composting of organic residues results in the creation of a stable organic material similar to humus – compost. Compost is a high-quality organic fertiliser used for fixing the physical, chemical and biological properties of soil, and it can be produced in any household by composting food residues, fallen leaves, grass, branches, raw manure.

## HOW TO APPLY UNIKER?

| | |
|---|---|
| **FIELD CROP FARMING** (For decomposition of crop residues) | 1. Mulch the crop residues.<br>2. Spray 5 L/ha Uniker with 200-400 L/ha water<br>3. By means of tillage, merge with the soil. |
| **FRUIT FARMING AND GRAPE GROWING** (For decomposition of crop residues) | 1. Spray the plant residues - fallen leaves, branches, etc. with 5 L/ha Uniker with 200-400 L/ha of water<br>2. By means of tillage, merge the plant residues with the soil. |
| **COMPOSTING** | 1. Stack the mass of organic matter (layer of leaves, soil, chopped branches) one on top of the other.<br>2. Spray each layer separately with 3-5% Uniker so the mass is wet.<br>3. The last layer should be shaped like a pyramid. |

## WHAT WILL YOU GAIN BY USING UNIKER?

- Greater soil fertility;
- Greater content of organic matter in the soil;
- Better water and air and thermal regime of the soil;
- Humus formation;
- Prevention of nitrogen depression – a lack of nitrogen;
- Improved structure and mechanical properties of soil;
- Increased content of microbial biomass in the soil.

# BIOFERTILISERS FOR SEED TREATMENT

SLAVOL

S

## Slavol za soju

## Rizol za soju

## Rizol za lucerku

## Rizol za grašak

In the soil, at about 2 mm from the plant root system (rhizosphere), intensive biochemical processes take place involving bacteria that contribute to the growth of plants. They are called PGP bacteria (Plant Growth Promoting Bacteria). This group of bacteria includes free, associative and symbiotic nitrogen-fixing bacteria, phosphorus-mineralising bacteria, bacteria that produce hormones (auxins, gibberellins, cytokinins), antibiotics, enzymes, vitamins, etc.

On the surface of the root PGP bacteria establish a specific form of community, called association. In the root system, they affect plant nutrition as they carry out the nitrogen fixation, mineralisation of the organic compounds of nitrogen, phosphorus, sulphur, they produce acids that release K, Mg, Ca, Fe, Zn, B, Al, Mo, Mn and other micro-elements from hard-to-dissolve compounds in the soil. These bacteria also produce hormones that control important physiological processes in plants: cell volume enlargement, cell division, and tissue and organ differentiation.

Symbiotic nitrogen-fixers form nodules in the roots of legumes (soybean, alfalfa, peas, beans, clover), where they perform nitrogen fixation, i.e. turn the inert nitrogen from the atmosphere into NH4+. A specific type of bacteria forms nodules only on the appropriate plant species with which it establishes a symbiosis - a form of community in which the bacteria directly gives accessible nitrogen to plants, while the plants supply the bacteria with nutrients created by the photosynthesis process. The pH of the soil, humus content, soil texture, the use of pesticides and mineral fertilisers all affect the formation of nodules.

Through scientific and research projects, the company Agrounik has developed a range of biofertilisers for seed treatment by isolating and selecting PGP bacteria. Through the realisation of the project "Application of a New Biostimulator in Corn Seed Processing", financed by the EU and World Bank via the Innovation Activity Fund, Agrounik has developed preparations for seed treatment of field, vegetable and legume plants.

The preparation **SLAVOL S** contains an auxin - indole-3-acetic acid (IAA), which is created during fermentation as a secondary metabolite of bacteria and is analogous to the natural auxin that is present in seeds.

It has been determined that the IAA concentration that is already present in seeds suddenly decreases 2 days after initial seed germination, after which it remains constantly low during the further germination period. Applying SLAVOL S to the seeds increases the IAA concentration, which accelerates the germination and sprouting process, differentiation of tissues and organs, creation of the root system and the aboveground part of the plant.

Our experiments have proven that applying SLAVOL S increases the seed germination energy and that sprouted plants have a stronger root system and a greater foliar mass. The seeds sprout evenly and simultaneously go through the same phenophases, which is of significance for further application of other agrotechnical measures in production. Our experiments have also confirmed that treated seeds can be stored for more than a year until sowing, which is very important for treatment centres.

**SLAVOL FOR SOYBEAN, RIZOL FOR SOYBEAN, RIZOL FOR ALFALFA AND RIZOL FOR PEAS** contain effective strains of symbiotic nitrogen-fixing bacteria that possess a high nitrogenase activity. Applying these bacteria to seeds promotes the formation of nodules in the roots. The symbiotic nitrogen-fixing bacteria via root hairs reach the interior of the root (parenchyma) where they rapidly begin to divide, resulting in the formation of nodules in which the bacteria fix nitrogen and give it to the plant directly.

Agrounik has developed a new generation of preparations (RIZOL FOR SOYBEAN, PEAS AND ALFALFA) where the symbiotic nitrogen-fixing bacteria are applied to a liquid carrier which ensures longer survival of these bacteria on the seed after treatment. These preparations also contain IAA which increases seed germination, the length of the root and aboveground part of the plant, ensure more successful establishment of symbiosis and the formation of nodules. The treated seeds are coloured, which enables us to check whether the seed inoculation - treatment has been successful. Seed treatment can be carried out several days prior to sowing.


# SLAVOL S

SLAVOL S is a liquid fertiliser - a growth stimulator certified for application in organic and traditional agricultural production for:

- **Treatment of field and vegetable crops** (corn, wheat, soybean, sunflower, peppers, etc.);
- **Rooting of cuttings of ornamentals plants** (indoor or seasonal flowers, perennials, deciduous and coniferous trees and shrubs).

## COMPOSITION

SLAVOL S contains auxin - indole-3-acetic acid (IAA), an essential plant hormone that regulates all growth and development processes of plants.

The indole-3-acetic acid in SLAVOL S is isolated and identified by analytical chemistry methods. It is a metabolite of bacteria that improve the growth of plants (PGP bacteria). The indole-3-acetic acid found in SLAVOL S is biologically active.

IAA stimulates all physiological processes in plants as well as auxin which is naturally synthesised in plant cells. Applying exogenous auxin (in Slavol S) to the surface of the seeds in optimal concentrations increases the concentration of auxins during seed germination and sprouting.

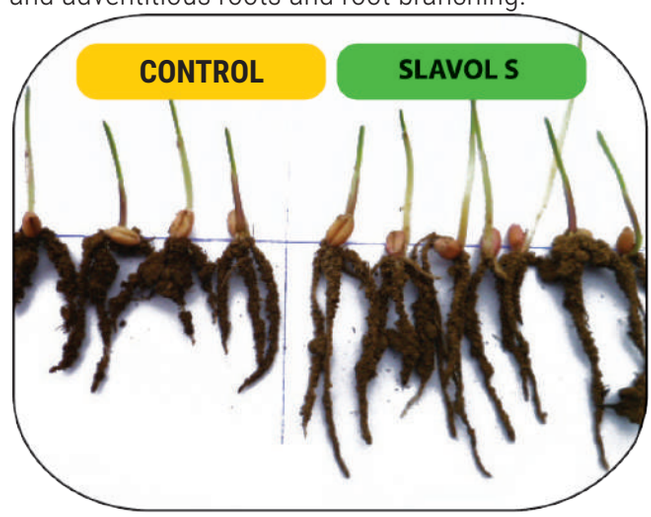
## MANNER OF ACTION

Applying SLAVOL S to the plant seeds stimulates germination and sprouting, development of the root system and the aboveground part of the plant. Indole-3-acetic acid has a positive effect on the elongation of cells and organs, stem growth, development of adventitious and lateral roots, the development of conduction tissue.

Uniform sprouting of plants facilitates the application of appropriate agrotechnical measures (application of pesticides, fertilisers, cultivation) because the plants go through phenophases at the same time.

A stronger root system has greater power to absorb nutritive elements from the soil, resulting in better plant nutrition, and the larger leaf surface facilitates a more intensive process of photosynthesis, greater production of organic material, which results in better yields.

Immersing cuttings of ornamental plants in SLAVOL S solution has an effect on the rhizogenesis - rooting, i.e. root system formation, the development of lateral and adventitious roots and root branching.



## HOW TO APPLY SLAVOL S?

| CROPS | APPLICATION | METHOD OF APPLICATION |
|---|---|---|
| **FIELD CROPS** (wheat, barley, triticale, corn, soybean, sunflower) | Dissolve 250 mL Slavol S in water and treat the standard amount of seeds for a hectare | **Small grains:** 250 mL Slavol S + 250-500 mL water<br>**Corn, sunflower:** 250 mL Slavol S + 250 mL water<br>**Soybean:** 250 mL Slavol S + 200 g Slavol for Soybean |
| **VEGETABLES** (tomatoes, peppers, cucumber, cabbage, root vegetables, tubers and bulbs) | Apply 250 mL Slavol S to the seeds | Spray the seeds directly with Slavol S and/or leave the seeds to germinate |
| **FLOWERS, SEEDLINGS AND CUTTINGS OF ORNAMENTAL PLANTS** (indoor or seasonal flowers, perennials, deciduous and coniferous shrubs) | Pour 250 mL Slavol S into 250-500 mL of water | Leave cuttings to stand in the solution, and after transplanting water the plants with the remaining quantity of solution |

## FIELD CROPS





## VEGETABLES





## FLOWERS, SEEDLINGS AND CUTTINGS OF ORNAMENTAL PLANTS





## WHAT WILL YOU GAIN BY USING SLAVOL S?

- Greater sprouting strength;
- Better seed germination;
- Greater 1000 grain mass;
- Greater yields;
- Increased leaf mass and photosynthesis activity;
- Formation of lateral and adventitious roots;
- Rooting of cuttings and grafts


# SLAVOL FOR SOYBEAN / RIZOL FOR SOYBEAN

SLAVOL FOR SOYBEAN / RIZOL FOR SOYBEAN are microbial fertilisers used to inoculate soybean seeds with bacteria that fix nitrogen and form nodules in the root. SLAVOL FOR SOYBEAN / RIZOL FOR SOYBEAN contain:

**NITROGEN-FIXING BACTERIA –** carry out nitrogen fixation as follows:

- **Symbiotic:** *Bradyrhizobium japonicum* **–** form nodules in the soybean root.
- **Associative:** *Azotobacter* sp. - colonise the soybean root surface

**PHOSPHORUS-MINERALISING BACTERIA -** turn organic phosphorus compounds into mineral forms, colonise the root, supply the plant with phosphorus in the early stages of development.

## MANNER OF ACTION

In SLAVOL FOR SOYBEAN, these bacteria are applied to a peat carrier in hard state, while in RIZOL FOR SOYBEAN, they are on special, new carrier that is in liquid state. The advantage of using the liquid carrier is that the bacteria applied on the seeds survive longer. Seed inoculation with RIZOL FOR SOYBEAN can be carried out more than 30 days prior to sowing. The dried and treated seeds are kept until sowing. Inoculated seeds are of light orange colour.

## HOW TO USE SLAVOL FOR SOYBEAN/RIZOL FOR SOYBEAN?

| | |
|---|---|
| **SLAVOL FOR SOYBEAN (200 g)** | Dissolve the contents of the bag in 250 mL of water or Slavol S and mix with the required amount of soybean seed for 1 ha (100 kg) immediately prior to sowing. |
| **RIZOL FOR SOYBEAN (200 g)** | Mix the contents of the bottle with 250 mL of water or Slavol S and mix with 100 kg of soybean seed (hectare norm). Seed treatment can be carried out more than 30 days prior to sowing. |
| It is recommended spraying with Slavol in the phase when the plant forms the first two pairs of trolls to the stage education of pods. | |

## WHAT WILL YOU GAIN BY USING SLAVOL FOR SOYBEAN/RIZOL FOR SOYBEAN?

- Improved formation of nodules in the root;
- Greater seed germination;
- Improved uptake of N, P and K;
- Developed root system;
- Increased yields;
- Coloured inoculated seeds.


# RIZOL FOR PEAS/ RIZOL FOR ALFALFA

RIZOL FOR PEAS is a microbial fertiliser for the inoculation of pea seeds, and RIZOL FOR ALFALFA is used for the inoculation of alfalfa seeds.

## COMPOSITION

RIZOL FOR PEAS contains Rhizobium legominosarum bv.viciae, and RIZOL FOR ALFALFA contains Rhizobium (Sinorhizobium) meliloti, symbiotic nitrogen-fixers that form nodules in the pea or alfalfa root.

Apart from symbiotic nitrogen-fixers, RIZOL FOR PEAS and RIZOL FOR ALFALFA also contain bacteria – associative nitrogen-fixers and phosphorus-mineralising bacteria, which colonise the root surface where they perform associative nitrogen-fixation and mineralisation of organic phosphates. The bacteria are applied to carriers in liquid form.

## HOW TO USE RIZOL FOR PEAS/RIZOL FOR ALFALFA?

| | |
|---|---|
| **RIZOL FOR PEAS (200 mL)** | Pour 200 mL into 100-250 mL of water or Slavol S, apply on seeds and leave to dry in the air and then sow. The 200 mL bottle content is sufficient for the hectare seed standard. Rizol for Peas can be mixed with pesticides for seed treatment. |
| **RIZOL FOR ALFALFA (200 mL)** | 200 ml pomešati sa hektarskom normom semena lucerke ostaviti da se prosuši na vazduhu i sejati.<br>Po potrebi može se dodati malo vode ili SLAVOL-a S. Tretman semena se može izvesti više dana pre setve. |
| It is recommended that you spray Slavol from the stage when the plant forms the first two pairs of trifoliate leaves until the formation of the husk, as well as after each cutting of alfalfa. | |

## WHAT WILL YOU GAIN BY USING RIZOL FOR PEAS/RIZOL FOR ALFALFA?

- Improved formation of nodules in the root;
- Increased seed germination, germination energy and sprouting strength;
- Better growth and development of the root system and the aboveground part of the plant;
- Improved plant nutrition with N, P and K;
- Greater yields

# BIOFERTILISERS FOR SUPPLEMENTAL FOLIAR FEEDING

Slavol

MIKROBIOLOŠKO ĐUBRIVO

SLAVOL VVL

MIKROBIOLOŠKO TEČNO ĐUBRIVO

ZA SOBNO I BALKONSKO CVEĆE

FLOSAL

ORGANIC

AMIKSOL

AMINOKISELINE

Plant growth-promoting bacteria (PGPB) produce various secondary metabolites that directly or indirectly enhance plant growth, increase resistance to disease and stress, contribute to plant nutrition, etc.

Agrounik has a collection of bacteria isolated from the rhizosphere of various plants that belong to the group of PGP bacteria. As a result of research financed through projects of the Ministry of Education, Science and Technological Development of the Republic of Serbia - Innovation Activity and Agrounik, we have developed preparations - biofertilisers for supplemental foliar feeding of field and vegetable plants - **SLAVOL**, fruits and grapevine - **SLAVOL VVL**, flowers, ornamental and decorative plants - **FLOSAL**, as well as , which contains amino acids of plant origin. These preparations have been tested and their effects have been proven in various doctoral dissertations defended at the Faculties of Agriculture in Novi Sad and Belgrade, and the Faculty of Agricultural Sciences and Food in Skopje, and the results have been published in a number of scientific journals.

During the testing it has been determined that the growing of these bacteria on special nutritious substrates and under specific fermentation conditions results in the creation of secondary metabolites - plant hormones.

The bacteria from the genera Bacillus and Azotobacter have the ability to produce auxins.
Indole-3-acetic acid (IAA) has been detected in the fermentation liquid of these bacteria and it has been qualitatively and quantitatively determined with the use of precise analytical techniques (liquid chromatography coupled with tandem mass spectrometry, HPLC-MS-MS) at the Faculty of Chemistry, University of Belgrade. IAA is completely natural in origin, it is analogous to IAA synthesised by plant cells and as such is subject to all catabolic decomposition processes in plant cells. This means that it cannot cause any phytotoxic effects as it is the case with the application of synthesised IAA.

When applied foliarly, indole-3-acetic acid reaches all parts of the plant through the stomata openings and the phloem, where it promotes cell division and elongation of cells and organs, thus participating in all physiological processes in the plant: formation of lateral and adventitious roots (rhisogenesis); stem development; leaf development; formation of flowers; fertilisation; fruit development. The treated plants have stronger roots, greater foliar mass, a larger number of stomata openings on leaves, more intensive metabolism, uniform fruits and greater yields. A stronger root system has greater power to absorb nutritive elements from the soil, and the larger leaf surface and the content of chlorophyll facilitates more intensive processes of photosynthesis, which results in greater synthesis of organic material and yields. It has been determined that the application of these preparations results in a larger number of stomata openings in the surface and underside of leaves, which indicates more intensive breathing and metabolism as well as protection from plant drying during droughts.

The IAA present in **SLAVOL VVL** affects the differentiation of flower buds, prevents fruit falling and cracking before harvest, alleviates the attack of saprophytes in storage facilities, and increases fruit colouration. In the production of planting material the IAA contributes to the initiation and formation of adventitious rootstock, faster healing of the contact surfaces between the rootstock and the scion. Fruits (apple, cherry, plum, peach, strawberry, raspberry) and grapevines are bigger and have greater content of sugar, dry material, vitamin C, while berries are firmer and more suitable for storage and transport. The IAA concentrations and the time of application of these preparations are tailored to the needs of the plants they are intended for.

**AMIKSOL** contains L-amino acids of plant origin obtained by microbiological hydrolysis. Amino acids as an integral part of proteins have a very important role in plant cells. Plants, as opposed to animals, have the ability to synthesise all amino acids. To synthesise them, a large amount of energy is needed, but in stressful situations such as drought, frost, hail, high temperatures, diseases and pest attack, synthesis is reduced or prevented.

Through foliar application of AMIKSOL, amino acids become directly involved in the metabolism of the plant and incorporated into the proteins involved in the plant regeneration. Use of Amiksol in stressful situations and in situations when the plant has a greater need for amino acids (intensive vegetative growth, formation and growth of fruits), contributes to rapid recovery and the creation of favourable conditions for plant growth and development.


# SLAVOL

**SLAVOL** is a liquid microbial fertiliser, a growth stimulator which is certified for application in organic and traditional agricultural production for supplemental foliar feeding of:

- **FIELD CROPS**
  wheat, barley, triticale, corn, soybean, sunflower, sugar beet, fodder, tobacco.

- **VEGETABLES**
  tomatoes, peppers, cucumber, cabbage, root and tuberous vegetables, leafy vegetables, legumes.

- **FLOWERS**
  roses and seasonal flowers, perennial and ornamental grasses, coniferous trees and shrubs

## COMPOSITION

SLAVOL contains bacteria:
**nitrogen-fixers** - associative nitrogen-fixing bacteria and **phospho-mineralisers** – bacteria that decompose organic phosphorus compounds. They are isolated from the root surface and multiplied on suitable nutrient agars. In the process of fermentation (multiplication of these bacteria), **auxins** – (indole-3-acetic acid - IAA)) are synthesised as secondary metabolites which are completely natural in origin, similarly to auxins synthesised by the plant.

## MANNER OF ACTION

With the foliar application of SLAVOL, auxins (IAA) enter the leaf through the stoma, openings in the surface and underside of the leaves, and reach the phloem (conduction plant tissue) via the spongy tissue. Through the phloem, auxins reach all the other parts of the plant where they act on a large number of physiological processes: elongation of cells and organs, formation of lateral and adventitious roots, creation and development of leaves, flowering and pollination, development of fruits. Plants treated with SLAVOL have stronger roots – greater capacity for the uptake of water and nutrients from the soil and greater leaf mass through which they perform the photosynthesis process. Plants treated with SLAVOL have greater yields and higher fruit quality.

## HOW TO APPLY SLAVOL?

### WHEAT

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| SOIL TREATMENT - PRE - SOWING PREPARATION | UNISTART | 3 L/ha |
| SEED TREATMENT | SLAVOL S | 250 mL per standard hectare seed rate |
| FOLIARLY - tillering phase | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - stem elongation stage | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - heading stage | SLAVOL | 7 L/ha alone or with pesticides |
| SOIL TREATMENT - CROP RESIDUES | UNIKER | 5 L/ha |



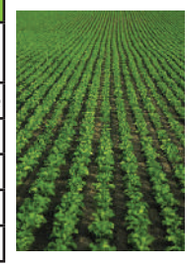
### CORN

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| SOIL TREATMENT - PRE - SOWING PREPARATION | UNISTART<br>UNI-MAX | 3 L/ha<br>20 kg/ha |
| SEED TREATMENT | SLAVOL S | 250 mL per standard hectare seed rate |
| FOLIARLY - in the stage of formation of the 4th and 5th leaves | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - in the stage of formation of 5th and 6th leaves | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - 9th leaf stage | SLAVOL | 7 L/ha alone or with pesticides |
| SOIL TREATMENT - CROP RESIDUES | UNIKER | 5 L/ha |



### SUGAR BEAT

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| SOIL TREATMENT - PRE - SOWING PREPARATION | UNISTART<br>UNI-MAX | 3 L/ha<br>20 kg/ha |
| SEED TREATMENT | SLAVOL S | 250 mL per standard hectare seed rate |
| FOLIARLY - eight-leaf stage | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - canopy closure stage | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - anti-Cercospore treatment stage | SLAVOL | 7 L/ha alone or with pesticides |
| SOIL TREATMENT - CROP RESIDUES | UNIKER | 5 L/ha |



### SOYBEAN

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| SOIL TREATMENT - PRE - SOWING PREPARATION | UNISTART<br>UNI-MAX | 3 L/ha<br>20 kg/ha |
| SEED TREATMENT | SLAVOL FOR SOYBEAN / RIZOL FOR SOYBEAN | Pour 200 mL of Rizol for Soybean into 250 mL of Slavol S and apply to the standard hectare seed rate. |
| FOLIARLY - three trifoliate leaves stage | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - internode formation stage | SLAVOL | 7 L/ha alone or with pesticides |
| FOLIARLY - flowering stage | SLAVOL | 7 L/ha alone or with pesticides |
| SOIL TREATMENT - FIELD RESIDUES | UNIKER | 5 L/ha |



### VEGETABLES AND FLOWERS

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| SOWING | SLAVOL S | Spray seeds with Slavol S, mix, dry and sow |
| NURSERY | SLAVOL | Water with 1-2% Slavol solution 1-2 times a week |
| REMOVAL OF SEEDLINGS FOR NURSERY PRODUCTION | UNISTART<br>UNI-MAX | UNISTART - SPRAY 3 L/HA OVER THE SURFACE OF THE SOIL<br>5-10% UNI-MAX FOR THE TOTAL SUBSTRATE MASS |
| FOLIARLY | SLAVOL | Spray 2% Slavol solution alone or together with fungicides |
| DRIP SYSTEM | UNISTART | 1-2 mL/m2 Unistart for 7-10 days |
| | SLAVOL | 7 L/ha |




# SLAVOL VVL

SLAVOL VVL is a liquid microbial fertiliser, a growth stimulator certified for application in organic and traditional agricultural production, which is used for:

- **PLANTING FRUITS AND GRAPEVINE;**
- **SUPPLEMENTAL FOLIAR FEEDING OF:**
  - **FRUITS:**
    pome fruits, stone fruits, berries and nuts ,
  - **GRAPEVINES,**
  - **SEEDLINGS AND GRAFTS.**

## COMPOSITION

SLAVOL VVL contains PGP – bacteria that produce auxin – indole-3-acetic acid (IAA) in the process of fermentation. IAA stimulates formation of leaves, flowering, pollination, fertilisation, fruit development, differentiation of flower buds, rhisogenesis (rooting of seedlings and grafts)
SLAVOL VVL reduces fruit falling in apples and cracking of cuticle in cherries prior to harvest, increases colouration and firmness of fruits in berries as well as the percentage of first class fruits.

SLAVOL VVL reduces fruit falling in apples and cracking of cuticle in cherries prior to harvest, increases colouration and firmness of fruits in berries as well as the percentage of first class fruits.

## WHAT WILL YOU GAIN BY USING SLAVOL VVL?

| FRUIT | GRAPEVINES |
|---|---|
| • Increased fertilisation;<br>• Greater number of set fruits;<br>• Fruit size, better colouration;<br>• Better differentiation and number of fruit buds;<br>• Increased overall yields;<br>• Smaller number of cracked fruits (cherries);<br>• Less fallen fruit; | • Increased fertilisation;<br>• Increased content of total acids and sugars, which lead to a harmonious wine bouquet in wine varieties;<br>• Better formation and maturation of shoots;<br>• Increased overall yields;<br>• Less grape withering;<br>• Larger number and size of berries |

## POME FRUITS (APPLE, PEAR, QUINCE, MEDLAR)

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| START OF VEGETATION | UNIKER | Spray 5 L/ha over the soil |
| PETAL FALL | SLAVOL VVL | Foliarly 5 L/ha |
| FRUIT GROWTH AFTER FERTILISATION (FRUIT THE SIZE OF HAZELNUTS) | SLAVOL VVL | Foliarly 5 L/ha |
| AFTER JUNE FERTILISATION OF FRUITS | SLAVOL VVL | Foliarly 5 L/ha |
| PERIOD JULY-AUGUST | SLAVOL VVL | Foliarly 5 L/ha |
| 10 DAYS PRIOR TO HARVEST | SLAVOL VVL | Foliarly 5 L/ha |
| END OF VEGETATION | UNIKER | Spray 5 L/ha over the soil |



**Slavol VVL can be mixed with pesticides.**

## STONE FRUITS (PEACH, PLUMS, APRICOTS, CHERRIES)

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| START OF VEGETATION | UNIKER | Spray 5 L/ha over the soil |
| PETAL FALL | SLAVOL VVL | Foliarly 5 L/ha |
| AFTER FRUIT THINNING (INTENSIVE FRUIT GROWTH) | SLAVOL VVL | Foliarly 5 L/ha |
| COLOUR CHANGE - START OF RIPENING | SLAVOL VVL | Foliarly 5 L/ha |
| A FEW DAYS PRIOR TO HARVEST | SLAVOL VVL | Foliarly 5 L/ha |
| END OF VEGETATION | UNIKER | Spray 5 L/ha over the soil |



**Slavol VVL can be mixed with pesticides.**

## BERRIES (STRAWBERRY, RASPBERRY, BLUEBERRY, BLACKBERRY)

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| IMMEDIATELY PRIOR TO FORMING BANKS AND PLACING FOIL | UNIKER | Spray 5 L/ha over the soil |
| START OF VEGETATIVE GROWTH (FORMATION OF LEAF ROSETTES) | SLAVOL VVL | Foliarly 5 L/ha |
| DURING FLOWERING | SLAVOL VVL | Foliarly 5 L/ha |
| AFTER FERTILISATION - FRUIT SIZE 2-3cm | SLAVOL VVL | Foliarly 5 L/ha |
| PRIOR TO HARVEST | SLAVOL VVL | Foliarly 5 L/ha |
| AFTER HARVEST FOR HEDGE CONDITION | SLAVOL VVL | Foliarly 5 L/ha |



**Slavol VVL can be mixed with pesticides.**

## GRAPEVINES

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| START OF VEGETATION | UNIKER | Spray 5 L/ha over the soil |
| VISIBLE FORMATION OF INFLORESCENCE - PETAL FALL | SLAVOL VVL | Foliarly 5 L/ha |
| INTENSIVE FRUIT GROWTH | SLAVOL VVL | Foliarly 5 L/ha |
| GRAPEVINE CLOSURE STAGE | SLAVOL VVL | Foliarly 5 L/ha |
| VERAISON STAGE | SLAVOL VVL | Foliarly 5 L/ha |
| END OF VEGETATION | UNIKER | Spray 5 L/ha over the soil |



**Slavol VVL can be mixed with pesticides.**

## SEEDLINGS

| TIME OF APPLICATION | PRODUCT | METHOD OF APPLICATION |
|---|---|---|
| 3-4 MONTHS BEFORE PLANTING | UNIKER | Spray 5 L/ha over the soil |
| IMMERSION OF SEEDLINGS | SLAVOL VVL | Immerse the root of the seedling in 2% solution |
| DURING PLANTING<br>WATERING AFTER PLANTING | UNI-MAX<br>SLAVOL VVL | 20-25 g per seedling<br>Watering with the remaining amount of solution |
| FOLIARLY | SLAVOL VVL | Foliarly 5 L/ha |



**Slavol VVL can be mixed with pesticides.**


# FLOSAL

FLOSAL is a liquid fertiliser
- a growth stimulator intended for:

- **SUPPLEMENTAL FOLIAR FEEDING OF DECORATIVE AND FLOWERY PLANTS**
  Ficus, Philadendron, Dracaena, Schefflera, Dieffenbachia, Spathiphyllum, etc.

- **SUPPLEMENTAL FEEDING OF FLOURISHING FORMS OF BALCONY PLANTS**
  Chrysanthemum, Petunia, Surfinia, Begonia, Verbena, etc.

## COMPOSITION

FLOSAL contains micro-organisms, growth stimulators producing auxins – indole-3-acetic acid (IAA) in the process of fermentation.

## HOW TO USE FLOSAL?

FLOSAL is applied foliarly in the original packaging by spraying it over the leaves during the vegetative period (from early spring to late autumn).
Plants should be sprayed once-twice a week, and every 10 days during winter.

## WHAT WILL YOU GAIN BY USING FLOSAL?

- Greater foliar mass;
- Larger number of flowers;
- Better colouration and more vivid flower colour;
- Enhanced plant growth and development;
- Strengthening of the root system;
- Increased plant resistance to disease and stress situations.


# AMIKSOL

AMIKSOL is a liquid fertiliser that contains L-amino acids of plant origin. It is certified for application in organic and traditional agricultural production and is used in the production of all crops

## COMPOSITION

AMIKSOL contains 16% free L-amino acids of plant origin. AMIKSOL is obtained through enzymatic hydrolysis of high-quality plant proteins. Enzymes of PGP bacteria - proteinase are used in the process of hydrolysis and they break down proteins into amino acids of L-form during the fermentation process. This technological procedure has a number of advantages in relation to chemical hydrolysis when strong acids and animal proteins (meat, hair, feathers, skin), which produce amino acids in L and D forms, are used. Plants cannot incorporate in their proteins amino acids that are in D-form, and they are thus not useful for plants.

## MANNER OF ACTION

Amino acids obtained by hydrolysis of plant proteins with the use of microbial proteinases present in AMIKSOL are quickly absorbed over leaves and become directly involved in the synthesis of proteins that control all physiological processes in plants (synthesis of enzymes, chlorophyll, plant hormones, development of leaves, fruits, roots, etc.). When a plant is in a state of stress due to high or low temperatures, inadequate water regime, impaired nutrition, damage from hail, pests and disease, the synthesis of amino acids and proteins is reduced. Applying AMIKSOL, free L-amino acids rapidly pass through the cell membrane and become directly involved in protein synthesis, thus helping the plant recover quickly .

## HOW TO APPLY AMIKSOL?

| | |
|---|---|
| **FIELD CROPS** | in the amount of 2-3 L/ha during the intensive growth phase 2 times during vegetation. Can be mixed with pesticides |
| **FRUIT FARMING** | in the amount of 2-3 L/ha in the following phenophases:<br>-After flowering<br>-Upon the formation of fruit the size of a walnut<br>-Fruit colour change phase |
| **DRIP SYSTEM** | 2-3 L/ha via a drip system 3 to 4 times during vegetation. |
| **IN STRESS CONDITIONS** | 3-4 L/ha alone or combined with Slavol 5 L/ha + Amiksol 2 L/ha. |

## WHAT WILL YOU GAIN BY USING AMIKSOL?

- Increased protein synthesis and increased content of chlorophyll;
- Stimulation of photosynthesis and transpiration;
- Enhanced opening of stomata in plants and take up of macro- and micro-elements.
- Fast recovery of plants after stress

# INOCULANTS FOR SILAGE/HAYLAGE

SilkO

SilkO

ZA TRAVE I ŽITARICE

SilkO

ZA LUCERKU

Contemporary production of ruminants implies the use of silage in nutrition, as it ensures the production of milk and meat with minimum costs. The goal of conserving green plants by ensiling is to preserve their nutritional value as much as possible and for as long as possible, and for the animals to receive delicious and healthy food, as well as to ensure stable milk and meat production.
Silage is a product that is formed during the conservation of animal feed by ensiling it using natural microflora or additional inoculated and selected lactic-acid fermentation bacterial strains. The silage obtained by ensiling plants using spontaneous microflora present on leaves is normally not of a satisfactory quality, does not have a pleasant taste and smell, and animals are reluctant to eat it. This is due to the fact that there are few lactic-acid fermentation bacteria on leaves and the fermentation of sugar they carry out is heterofermentative; the course of fermentation is thus uncontrolled and silage is not of uniform quality.

For this reason, the use of inoculants is recommended, i.e. special additives based on homofermentative lactic bacteria, because a large number of these bacteria is attained at the very beginning. For silage preparation to be successful, it is necessary to ensure anaerobic conditions by compacting, which prevents the growth of aerobic microorganisms, such as yeasts, moulds and spoilage bacteria that badly affect the quality of silage and animal health.

Agrounik in the course of its scientific research through participating in projects funded by the Ministry of Science and Technological Development has developed a range of products (SILKO) for the preparation of corn silage and the silage and haylage of alfalfa, grass and legume mixtures.

**SILKO** contains homofermentative bacteria which use sugar for the synthesis of lactic acid, which has strong bactericidal and fungicidal properties, important for controlling the activities of fungi (moulds and yeasts) in potential subsequent fermentation. In that manner Silko increases aerobic stability of silage after opening of the silo trenches. The lactic acid produced by the lactic-acid bacteria in Silko inhibits the growth of other microorganisms that are intolerant to acidic conditions (yeasts, moulds, enterobacteria and clostridia - which cause spoilage of silage). As the pH value decreases, so do silage losses due to conversion of soluble plant carbohydrates into 96.9% lactic acid. Silko contains a combination of different bacterial strains that can ferment the variety of sugars in the material that is being ensiled, resulting in maximum utilisation of sugars and production of lactic acid. By using Silko we shorten the natural fermentation time, attain the optimum pH value faster, reduce losses of organic matter, improve the digestibility of NDF and ADF. This leads to increased daily yields of milk and growth.

**SILKO FOR ALFALFA** contains homofermentative lactic bacteria that produce enzymes that hydrolyse polysaccharides into monosaccharides and thus reduce the deficit of sugar in alfalfa. It also contains a consortium of homofermentative lactic bacteria that are active in different pH values. It is used for preparing silage and haylage of alfalfa.

**SILKO FOR GRASS MIXTURES AND CEREALS** contains 3 types of lactic-acid fermentation bacteria: *Lactobacillus plantarum, Lactobacillus buchneri and Lactobacillus casei.*

All strains are patent-protected.

Quality testing of produced silage is very important as it serves as a basis for creating a meal, i.e. optimal intake of all needed matters in animal nutrition, which ensures proper nutrition, milk and meat production.

Agrounik owns a **laboratory for animal feed testing**, where it performs chemical and microbiological analyses of silage. Our laboratories possess modern equipment and trained personnel comprising PhDs in the fields of microbiology, biochemistry, molecular biology, chemistry, as well as an expert team in the field of animal nutrition.


# INOCULANT FOR PREPARING SILAGE

**SILKO FOR CORN** contains 4 specially selected strains of the bacteria *Lactobacillus plantarum* that are able to ferment different types of simple sugar (monosaccharide) to lactic acid, thus producing greater quantities of lactic acid and less butyric and acetic acid.

With the application of SILKO silage has greater content of dry material and proteins, and less ammoniacal nitrogen. This leads to improved digestibility of feed and better animal growth. Lactic acid has a fungicidal effect, i.e. it stops mould growth after opening of silage, which lowers the risk of mycotoxins and spoilage.

**SILKO FOR ALFALFA** contains *Lactobacilius plantarum and Peciococcus sp.* Alfalfa is difficult to ensile due to its chemical composition, as it contains only 7% of sugar. Homofermentative lactic bacteria produce enzymes that hydrolyse polysaccharides and release sugars that are turned into pH-reducing acids during lactic-acid fermentation. Lactobacillus plantarum is active at pH 6, and Pediococcus sp. is active at pH 5 and additionally lowers the pH of silage to 4. All this improves the digestibility of the fibres NDF and ADF, and preserves proteins in their natural form, due to which the nutritional value of the silage increases.

**SILKO FOR GRASS AND CEREALS** contains *Lactobacillus plantarum, Lactobacillus buchneri, Lactobacillus casei.* The number of colony forming units is $1x10^{11}$ cfu/ml. The product is compliant with the HACCP standard. By Decision of the Ministry of Agriculture and Environmental Protection of the Republic of Serbia, Agrounik has received authorisation to manufacture inoculants for silage

## HOW TO APPLY SILKO FOR CORN, SILKO FOR ALFALFA, SILKO FOR GRASS AND CEREALS

| | |
|---|---|
| Mix 100 mL of SILKO with 20 L of water - for preparing 20 t of silage | **Prepare the silage using standard technology.** |
| Mix 250 mL of SILKO with 50 L of water - for preparing 50 t of silage | |
| Mix 1 L of SILKO with 20 L of water - for preparing 200 t of silage | |

## WHAT WILL YOU GAIN BY USING SILKO FOR CORN, ALFALFA, GRASS AND CEREALS?

- Accelerated fermentation;
- Increased aerobic stability of silage;
- Improved digestibility of NDF and ADF (digestibility of fibres);
- Preservation of proteins in their natural form;
- Increased daily yields of milk and growth;
- Decreased use of concentrates;
- Lower percentage of acetic and butyric acid;
- Greater nutritional value of silage.

# SILAGE TESTING LABORATORY

Balanced nutrition of ruminants is necessary for an increase in daily growth and yields of milk. Fodder - silage represents a basic meal in the production of ruminants. The contents and quantity of a supplemental meal comprising concentrated nutrients is determined on the basis of knowledge of the nutritive value of silage. When composing a meal, we normally start from the ratio of dry material (or energy) from fodder and concentrated feed.

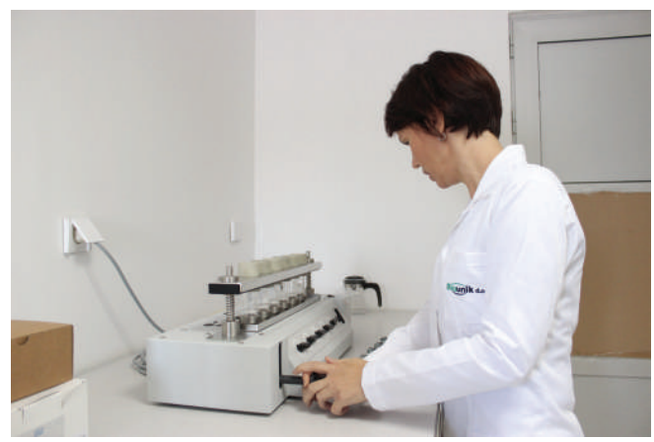
Prior to the use of silage in nutrition, it is necessary to carry out organoleptic inspection of silage by an expert, as well as chemical and microbiological analyses.

Agrounik owns a laboratory for animal feed testing, where it performs chemical and microbiological analyses of silage. Our laboratories possess modern equipment and trained personnel comprising PhDs in the fields of microbiology, biochemistry, molecular biology, chemistry, as well as an expert team in the field of animal nutrition.

The silage testing laboratory has devices for the extraction and determination of fat content, an automated system for determining the content of nitrogen and proteins, a system for determining raw cellulose, pH-meter, a drying facility and an annealing furnace.

**THE SILAGE TESTING LABORATORY PERFORMS THE FOLLOWING ANALYSES:**

- Content of moisture and dry material;
- Content of ashes and mineral material;
- Content of total proteins;
- Content of total fats;
- Content of raw cellulose;
- Content of ADF, NDF and ADL;
- pH of silage;
- Content of acids (acetic, butyric and lactic);
- Content of starch;
- Microbiological analyses.



# TREATMENT OF SANITARY WASTEWATER

Water pollution is the most complex environmental problem affecting the world and is a result of inadequate management of wastewater which can originate from households or industrial production. Wastewater is generated during various production processes in industries, primarily agricultural and food industries, small and big agricultural holdings and as a result of improper management of sanitary wastewater and septic tanks.

The inadequate wastewater treatment and management results in their reaching aquatic ecosystems - groundwater, wells, rivers, lakes and seas. Since this water has a high content of organic compounds and high values of BOD (Biological Oxygen Demand) and COD (Chemical Oxygen Demand), they result in environmental pollution and endanger the health of humans and animals.

Household wastewater contains tap water or natural water that is used for cooking, washing or sanitary needs in the home. Besides mineral and organic matter, it contains substantial quantities of human excrement, paper, shampoo, cleaning agents, food residues and other waste fractions. Water from cattle farms is also loaded with high organic matter content (proteins, fibres, fats, etc.). It contains substances in the form of real solutions, colloid solutions, suspended and floating substances (partially fragmented faeces, paper, plant parts). This wastewater is harmful for the environment due to the presence of pathogenic microorganisms, primarily of human origin (faeces, urine), disinfectants and tenzides.

The modern way of life imposes the use of different chemical agents for maintaining personal and general hygiene in the home, which after use reach the septic system and adversely affect its physical and chemical properties. Destruction of the natural biological balance first slows down the operation of the septic tank, and can later result in complete blockage due to sedimentation of non-degraded waste. A special problem is also additional sedimentation of fats and oils in the land around the tank itself, which leads to the creation of a completely impenetrable zone, which becomes a closed container the content of which flows out onto the surface, spreads unpleasant smells and carries the risk of the development of infectious diseases.

For treating sanitary wastewater and water from cattle lagoons, the recommendation is to use preparations based on microorganisms and their metabolites. Biological treatment is used for: removing organic matter; removing nitrogen (as a biogenic element) by means of nitrification and denitrification; breaking down sludge from primary processes of wastewater processing. The biological processes of water treatment can be aerobic and anaerobic, with the use of aerobic or anaerobic microorganisms and their metabolic paths.

Agrounik's science and research team has developed **BISTROL** for treating sanitary wastewater from cattle lagoons and **BISTROL HOME** for cleaning septic tanks.

BISTROL contains a consortium of indigenous isolates of aerobic and anaerobic bacteria from sludge that produce proteolytic, cellulolytic and lipolytic enzymes as secondary metabolites. These bacteria also produce matters that are active on the surface – biosurfactants, which are involved in the formation of biofilms, i.e. linking – aggregation of various populations of microorganisms that, as a consortium, break down organic waste faster. Biosurfactants improve the solubility of compounds in water, bind and remove heavy metals and have emulsifying properties.

The bacteria contained in **BISTROL** activate biological decomposition of organic waste, decrease the amount of silt, dissolve and mineralise the layer of hard sludge, reduce biological and chemical oxygen consumption, thus re-establishing the biological balance and adequate functioning of septic tanks. Applying **BISTROL HOME** eliminates unpleasant smells and harmful gases, prevents clogging and leaking, and increases the durability of septic systems.


## MANNER OF ACTION

With the use of microbial enzymes and biosurfactants, BISTROL transforms proteins, cellulose, fats and oils and simultaneously dissolves the layer of hard sludge and purifies wastewater.

Bistrol eliminates ammonia and other unpleasant smells, decreases outgoing water contamination and the amount of sediment on the bottom. BISTROL maintains the natural biological operation of cattle lagoons, prevents clogging and leaking, and facilitates emptying.

## HOW TO APPLY BISTROL?

| | | |
|---|---|---|
| **LAGOONS** | Closed lagoons | 1 litre of Bistrol for 8-10 m3 of water, pour into the lagoon through the floor gate. |
| | Open lagoons | 1 litre of Bistrol for 8-10 m3 of water pour directly into the lagoon from all sides. |

## WHAT WILL YOU GAIN BY USING BISTROL?

- Biological activation of decomposition.
- Elimination of unpleasant smells and harmful gases.
- Lower amount of hard matter.
- Maintenance of natural biological operation of cattle lagoons
- Prevention of clogging and leakage
- Cleansing of the entire system.

# BISTROL

BISTROL is a microbial preparation for the treatment of wastewater from cattle farms.

## COMPOSITION

BISTROL contains a consortium of aerobic and anaerobic saprophytic bacteria that produce surfactants - biosurfactants and enzymes, protease, cellulase and lipase, which are involved in the formation of biofilms and decomposition of organic waste from cattle lagoons.


# BISTROL HOME

BISTROL HOME is a microbial preparation for natural purification of septic tanks. It is used for the elimination of unpleasant smells from sewage through lavatories, sinks, septic tanks and toilets.

## COMPOSITION

BISTROL HOME contains aerobic and anaerobic saprophytic bacteria, which break down proteins, cellulose, fats and oils. The bacteria produce enzymes - protease, cellulase and lipase, which break down sludge in septic tanks.

## MANNER OF ACTION

With the use of microbial enzymes, biosurfactants and formed biofilms, BISTROL HOME activates biological decomposition of organic waste, decreases the amount of sludge, dissolves and mineralises the layer of hard sludge, and reduces chemical and biological oxygen demand (COD and BOD). It also eliminates ammonia and other unpleasant smells, decreases outgoing water contamination and the amount of sediment on the bottom. BISTROL HOME maintains the natural biological operation of septic tanks, prevents clogging and leaking, facilitates emptying and does not damage sewage pipes.

## HOW TO APPLY BISTROL HOME?

| | | |
|---|---|---|
| **SEPTIC TANKS WITH A VOLUME OF 8-10 $m^3$** | FOR NEGLECTED SEPTIC TANKS: | Pour 1 L of BISTROL HOME directly into the toilet, lavatory or the septic tank. Shake the content prior to use. |
| | FOR REGULAR MAINTENACE OF SEPTIC TANKS | Pour 250 mL into the toilet, sink and lavatory and other drains, or directly into the septic tank, every 7 days |

## WHAT WILL YOU GAIN BY USING BISTROL HOME?

- Natural purification of septic tanks;
- Elimination of unpleasant smells from the sewage, sinks, lavatories;
- Prevention of clogging and leakage;
- Easier emptying of septic tanks.

# COLLECTIVE **SERBIA**

Research and Development
Prof. Snežana Đorđević, PhD
Mobile: +381 (0)64 159 2931
E-mail: snezana.djordjevic@agrounik.rs

Executive Director
Uroš Đorđević
Mobile: +381 (0) 64 646 7324
E-mail: uros.djordjevic@agrounik.rs

Sales Director for the Territory of Vojvodina
Siniša Simonović, BEng
Mobile: +381 (0) 64 642 2030
E-mail: sinisa.simonovic@agrounik.rs

Sales Director for the Territory of Serbia
Nikola Obradović, BEng
Mobile: +381 (0) 64 642 2029
E-mail: nikola.obradovic@agrounik.rs

## Regional Managers for Vojvodina

Regional Manager
for Central Banat
Vencislav JANKOVIĆ, BEng
Mobile: +381 (0) 64 642 2032

Regional Manager
for Central and North Banat
Branislav DUKIĆ, BEng
Mobile: +381 (0) 64 642 2036

Regional Manager for
Central and South Banat
Dragan STANKOVIĆ, BEng
Mobile: +381 (0) 64 642 2031

Regional Manager for Srem
Predrag JEZDIĆ, BEng
Mobile: +381 (0) 64 646 7319

Regional Manager for South Bačka
Miloš BLAGOJEVIĆ, BEng
Mobile: +381 (0) 64 646 7330

## Regional Managers for Serbia:

Regional Managers for Mačva
Srđan PRODANIĆ, BEng
Mobile: +381 (0) 64 646 7325

Regional Manager for South Serbia
Bratislav PETROVIĆ, BEng
Mobile: +381 (0) 64 646 7327

Regional Manager for
Šumadija and Braničevo
Marko KLISARIĆ, BEng
Mobile: +381 (0) 64 642 2034

Regional Manager for Belgrade
Vladimir Milosavljević, BEng
Mobile: +381 (0) 64 646 7322

Regional Manager for
the South Part of Eastern Serbia
Dušan Stanić, BEng
Mobile: +381 (0) 64 646 7321

agrounik
SCIENCE DEDICATED TO NATURE.

Agrounik d.o.o.
Krnješevačka bb, Šimanovci 22310, Republic of Serbia
Telephone: +381 (22) 481 981,Fax: +381 (22) 481 399
E-mail: office@agrounik.rs; www.agrounik.com

# COLLECTIVE CROATIA

Sales Director for the Territory of Croatia
Sanja RELIĆ-BALENTOVIĆ, BEng
Mobile: +385 (0) 91 198 8104
E-mail: sanja.relic@agro-nika.hr

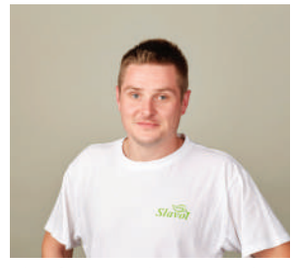
agro-nika CROATIA

Hrvoja Vukčića Hrvatinića 2,
Vukovar 32000
www.agro-nika.hr

Regional Manager for Eastern Osijek-Baranja County
Goran MIKULIĆ, BEng
Mobile: +385 (0) 99 804 0154

Regional Manager for Osijek-Baranja County and Virovitica-Podravina County
Robert JAGODIĆ, BEng
Mobile: +385 (0) 98 960 2081

Regional Manager for Western Slavonia
Marijan BRKIĆ, BEng
Mobile: +385 (0) 91 198 7002



Regional Manager for Western Croatia
Marko KOLARIĆ, BEng
Mobile: +385 (0) 92 152 9917

# COLLECTIVE BiH

Regional Manager for Banja Luka
Milan JANJUZ, BEng
Mobile: +387 (0) 65 049 298

Regional Managers for Bijeljina
Nikola JOVIĆ, BEng
Mobile: +387 (0) 66 029 002

agrounik BOSNIA AND HERCEGOVINA

Meše Selimović 4, TC Milenijum,
Bijeljina 76300

# COLLECTIVE MACEDONIJA

agrounik MACEDONIA

Agrounik d.o.o. Macedonia
Dositej Obradovik 1/8, Kisela Voda, Skopje 1000

agrounik

Nauka posvećena prirodi

**www.agrounik.com**