No.3 / MAY 2023

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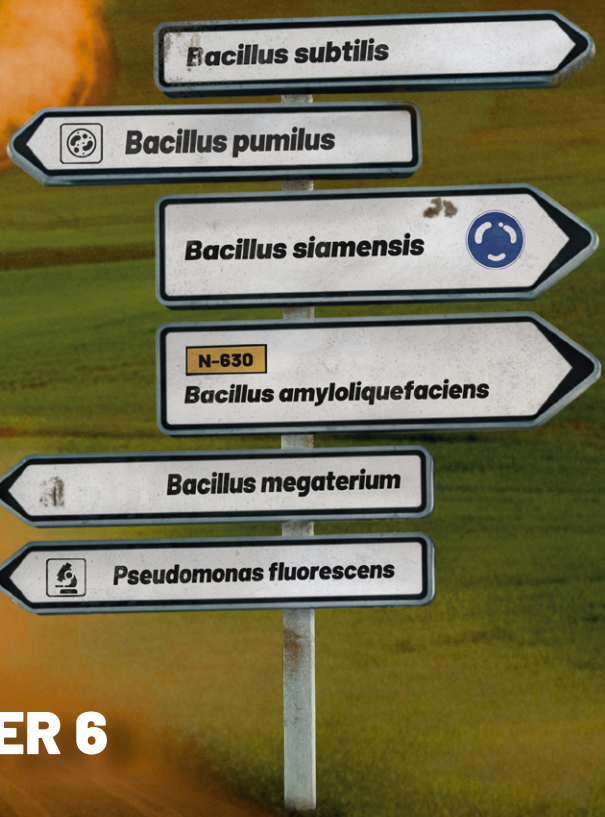
Discover strategies based on the most effective MICROBIAL BIOSTIMULANTS for each crop

"mindfulness OF THE SOIL"
We meditate on the importance of soil

Use of MICROORGANISMS in organic farming



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BIOSTIMULANT FOCUSED ON **DEVELOPING THE ROOT SYSTEM** TO INCREASE THE **SEED GERMINATION** RATE, PROMOTE **SEEDLING DEVELOPMENT** AND **OPTIMISE THE ROOT-SOIL RELATIONSHIP** (PREBIOTIC FUNCTION)

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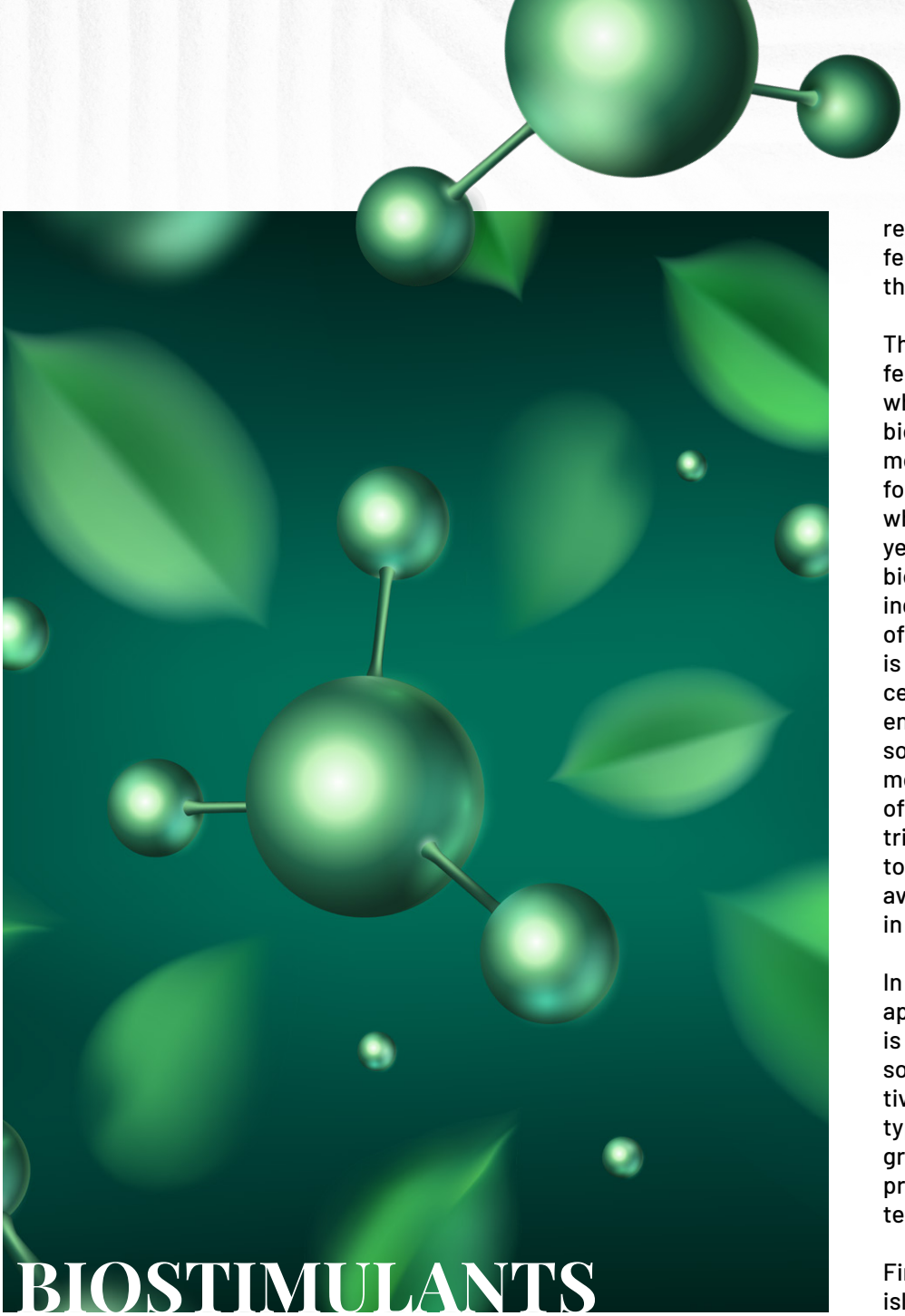
ROOT SYSTEMS FROM ANOTHER PLANET



BIOSTIMULANTS MICROBIANOS

Regulatory Framework

The progress of R&D&I in biotechnology companies dedicated to the development of micoorganism-based plant biostimulants, in addition to the scientific advances of other institutions, have, to some extent, encouraged both European and National Authorities to update and thoroughly review their applicable legislation on fertiliser products in order to include them in their own legislation.

Thus, nowadays, we can find different regulatory frameworks with which to position these microbial biostimulants on the market, the most current definition of which is found in Regulation (EU) 2019&1009[1], which came into force on 16 July last year, and which defines a microbial biostimulant as a product consisting of a microorganism or a group of microorganisms "whose function is to stimulate plant nutrition processes independently of the nutrient content of the product, with the sole objective of improving one or more of the following characteristics of plants and their rhizosphere: nutrient use efficiency, abiotic stress tolerance, quality characteristics or availability of immobilised nutrients in the soil and rhizosphere".

In order to seek the "affability" of the applicable regulatory framework, it is necessary to analyse, in the most sober manner, each of the legislative possibilities that regulate these types of products and which, to a greater or lesser degree, require a prior procedure before the competent authority.

Firstly, we have Community legislation, through Regulation (EU) 2019/1009, mentioned above, which includes microbial biostimulants in the Functional Product Category FPC 6 (A). Microbial inputs positioned according to this harmonised standard must undergo a conformity assessment in which the participation of an accredited external Notified Body is essential. In order to obtain the CE marking, efficacy tests are also required, the main drawback of the legislation at present being the limitation of authorised microorganisms (*Azotobacter spp.*, mycorrhizal fungi, *Rhizobium spp.* and *Azospirillum spp.*)

With European Regulation, the various national regulations of the individual EU Member States coexist. In Spain, in 2017, the latest amendment

BIOLÓGICA NATURE

to Royal Decree 506/2013[2], the existing fertiliser regulation, was published, in which microorganism-based fertilisers were included for the first time. To this end, section 4.4 "Special products based on microorganisms" was created within group 4 "Other fertilisers and special products", incorporating six new types of special products based on microorganisms: mycorrhizae, fertiliser with mycorrhizae, non-mycorrhizal microorganisms, fertiliser with non-mycorrhizal microorganisms, mixture of microorganisms and fertiliser with microorganisms.

These six types of products, subject to registration, must comply with specific requirements, including the identification and characterisation of the microorganisms present at strain level, the need to provide the method of production, propagation, growth conditions, quantification and isolation of the microorganism used, the justification of deposit in an official collection, as well as the performance of agronomic efficacy tests per group of crops carried out by an independent body or accredited company, in which the action to be demonstrated must be defined.

Due to the limitations that can still be found in the implementation of Regulation (EU) 2019/1009, it is still necessary to rely on national legislation in order to place many of the different types of microbial biostimulants on the market. With this Register at national level, the possibility of marketing in other member states is also opened up through the application of Regulation (EU) 2019/515[3] on the principle of Mutual Recognition of products authorised by the national regulations of other European Union countries.

Vicente Pérez

Registrar Biológica Nature

REGISTRATIONS

Bearing in mind this regulatory context, Biológica Nature is committed to a defined strategy to obtain registrations in Spain and other European Union countries for the B'Nature range of microbial biostimulants, while waiting to be able to adapt them to the new Regulation (EU) 2019/1009:

Registrations obtained in Spain

Registrations obtained in other EU Member States

[1] REGULATION (EU) 2019/1009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 laying down rules on the placing of EU fertiliser products on the market, amending Regulations (EC) No. 1069/2009 and (EC) No. 1069/2009 and (EC) No. 1107/2009 and repealing Regulation (EC) No. 2003/2003.

[2] Royal Decree 506/2013 of 28 June on fertiliser products.

[3] REGULATION (EU) 2019/515 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 March 2019 on the mutual recognition of goods lawfully marketed in another Member State and repealing Regulation (EC) No. 764/2008.

Mindfulness of the soil

Mindfulness can be considered a philosophy of life that starts with the objective of achieving a deep state of awareness by giving great weight to **to the here and now** and includes the practice of meditation. Research published in the *Journal of Internal Medicine* found that practising mindfulness daily relieved the symptoms of disorders such as depression, anxiety and stress, improved memory, concentration, self-awareness and emotional intelligence, and increased overall well-being.

MINDFULNESS, AGRICULTURE AND MICROORGANISMS

The same logic needs to be applied to agriculture and a "mindfulness" of the here and now needs to be adopted ***here and now*** to develop new agricultural practices adapted to respond to new forms of demand based increasingly on sustainability.

Well, just as *mindfulness* aims to improve people's quality of life and influence their well-being, the farmer, in one way or another, also practices *mindfulness daily* in order to improve the quality of life of their crops and influence their well-being and, of course, their profitability.

Weary of having to study, observe and manipulate (with more or less success) the aerial part of plants, we are now witnessing a time in which attention and awareness must be (and is) focused on the main sustenance of crops: the soil, thus opening up a research area for microbiologists, ecologists, geologists, agronomists and other interested parties to unravel the science behind it. I subscribe to the words of my colleague Pedro Pons, who said in the first edition of this magazine:

In short, we must continue to unravel the enigmas of the soil microbiota and its influence on what happens in the soil, stimulating the practice of *mindfulness* because if we agree on one thing, it is for the benefit of everyone.

> *Gradually, and in accordance with the indicators of science, soil has ceased to be an inert substrate or a crude support for farmers and technicians, and has become a reservoir of life that must be preserved if we want to reap the harvest*

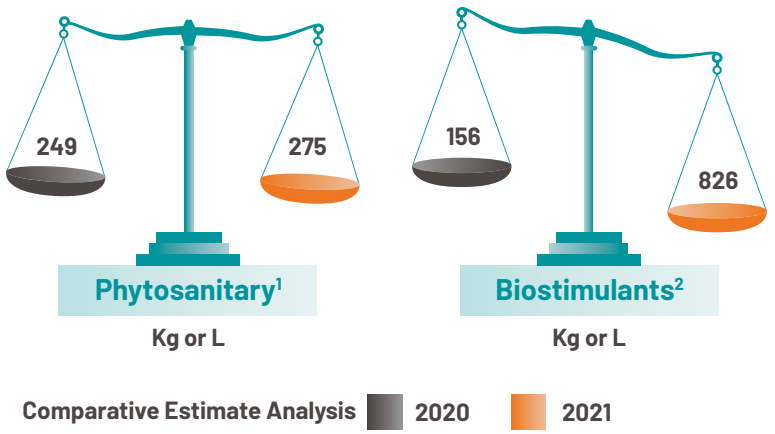
HERE AND NOW, MINDFULNESS OF THE SOIL IS INCREASINGLY BEING PRACTISED

Mindfulness of the soil has been practised in agriculture for decades now, but it is **here and now** gaining in intensity. There is a consensus among experts that microorganisms are effective and increasingly indispensable tools in fertilisation management, biostimulation and pest and disease control.

Looking at the data on the use of microorganisms in agriculture in Spain in 2021 compared to 2020, we observe a very significant upward

trend. On the one hand, in order to analyse the market for these products in Spain, the annual statistics on the consumption of crop protection products of the Spanish Ministry of Agriculture, Fisheries and Food include microorganism-based products in two categories: *Microbiological/botanical fungicides and biological/botanical insecticides*. On the other hand, the Spanish Association of Agronutrient Manufacturers, in its annual report, collects the data in one category: *microbial biostimulants*.

Developments in the market for microorganism-based agricultural products in Spain (in tonnes)



SOURCES:
[1]Ministry of Agriculture, Fisheries and Food
[2]AEFA (Spanish Association of Fertilisers and Agronutrients)

Pascual Bauset

Marketing Director for Servalesa

In short, it is clear (with the exception of "botanical" products) that the trend towards greater use of microorganism-based products is unstoppable and that all actors involved in agriculture have assimilated and found added value in this technology, and this is reflected in the consumption data. Therefore, we can say with certainty that the practice of *floor mindfulness* has many followers and that it has only just begun.

Finally, it is clear that microbiology is intimately linked to the existence of life on Earth and that, from the beginning of civilisation until today, it has been used effectively and efficiently in numerous industries. Microorganisms, therefore, are not novel, rather the novelty and innovation lies in the full awareness and attention, or *mindfulness*, when it comes to using them in a timely manner for the benefit of agriculture.

"You don't have to have faith in microbiology, all you really need is a microscope", said one of the pioneers of microbiology applied to agriculture in Spain a few months ago. Thank you very much, Paco Soriano, for all the knowledge you have shared with us.

*Last but not least*if you get the chance, I recommend that you practice *mindfulness*.

The importance of quality
in the manufacture of microorganisms

Bacillus megaterium · Spores

In order to guarantee food safety and improve the balance and fertility of soils, thereby optimising crop yields, it is essential to use agricultural solutions that have been subjected to stringent quality controls during their manufacturing processes and, of course, have passed these controls satisfactorily.

Today, biostimulants and biofertilisers of microbiological origin have burst onto the plant nutrition market with great success. In the formulations of these products, microbial fermentation represents the main raw material and, as such, has to follow these strict quality controls during the production process.

The quality standards are fundamentally based on ensuring the purity of the strains used in the production process, avoiding the presence of other contaminating microorganisms that could compromise the quality of the fermented product, either by producing other metabolites that alter the efficacy of the product or by being potentially pathogenic microorganisms.

For this purpose, during the industrial production process, it is of vital importance to implement purity controls in which, through regular sampling, the absence of contamination in the fermented product is verified. There are different techniques that allow these verifications that, although variable in precision, are also variable over time to obtain the results, so they must be combined and used in a complementary manner. Such techniques include direct observation of the strain by light microscopy, phenotypic characterisation based on seeding on specific solid culture media, biochemical tests and, finally, molecular identification.

By observation under the light microscope it is possible to distinguish the microorganisms present in the sample morphologically. As a pure culture, there should be no variability in the observed morphotypes and movement patterns for those strains with motility. This immediately observed homogeneity is verified by the purity of the triple streak culture, sown in Petri dishes and incubated for the corresponding period of time, where all colonies - except for cases with double morphology - must be identical. Also, the response to biochemical test batteries must be accurate, confirming that all colonies maintain the same metabolic properties.

Lastly, partial sequencing of the 16S rRNA gene in prokaryotes, or the D1/D2 domains of the 28S rRNA gene and/or the ITS region in eukaryotes, allows to clarify or confirm precisely any uncertainty that may have arisen from the above controls, and thus to ensure the purity of the fermented batch.

Bacillus megaterium · Spores

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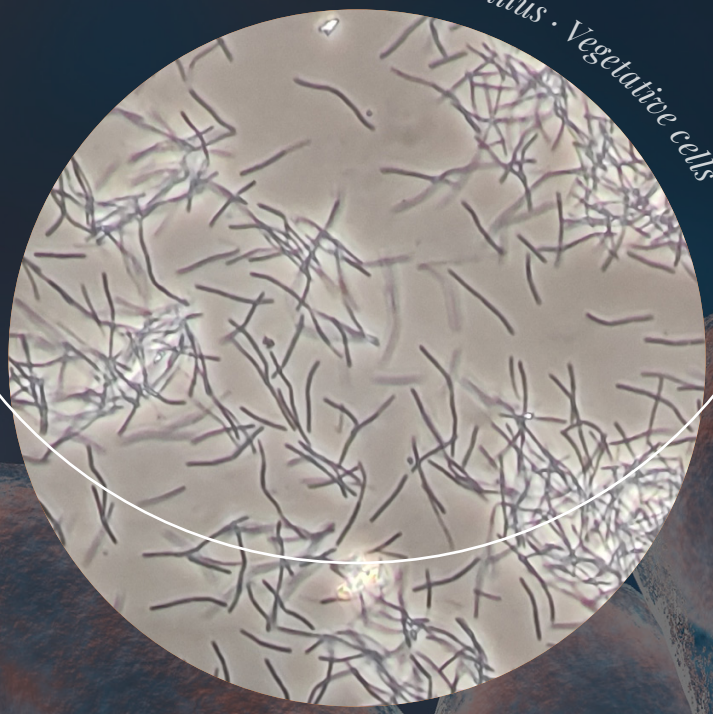


Apart from the purity of the strain, another primary quality standard is its viability. It is not only about producing large volumes of fermentation with the target microorganism, but also about achieving the highest concentration of the target microorganism, in compliance with the colony-forming units declared on the labelling of the final product, and ensuring its viability throughout the shelf life of the product.

This is achieved because large-scale microbial fermentation is a complex, highly monitored industrial bioprocess in which nothing is left to chance. Factors such as agitation, aeration or culture medium components are methodically calculated and adjusted for each particular strain, obtaining high cell or spore yields in relatively short periods of time for sporulating microorganisms. Absorption optical density sensors are useful tools for monitoring cell growth, as they allow relationships to be established between absorbance measurements and colony forming units, providing information on the evolution of culture growth in real time. Additionally, the concentration of viable cells in the batch, expressed in colony forming units per millilitre of fermented product, has to be confirmed by plate colony count.

In short, the controls necessary to ensure the quality of the batches during the industrial fermentation process are multiple and complex, but at the same time essential in order to guarantee the placing on the market of effective and safe agricultural solutions that ultimately provide healthier foodstuffs for the end consumer.

Ana Pardo

Head of Microbiology Laboratory - Industrial fermentation

BIOLÓGICA NATURE

Suppressive soils

Keys to understanding this concept

Until now, we have been suppressing the soil ourselves. The anthropomorphism that the latter has undergone in the 20th century has suppressed the suppressive character of the soil. The fact is that human beings, in their eagerness to simplify the world around them, have had a direct impact on nature when it comes to agriculture.

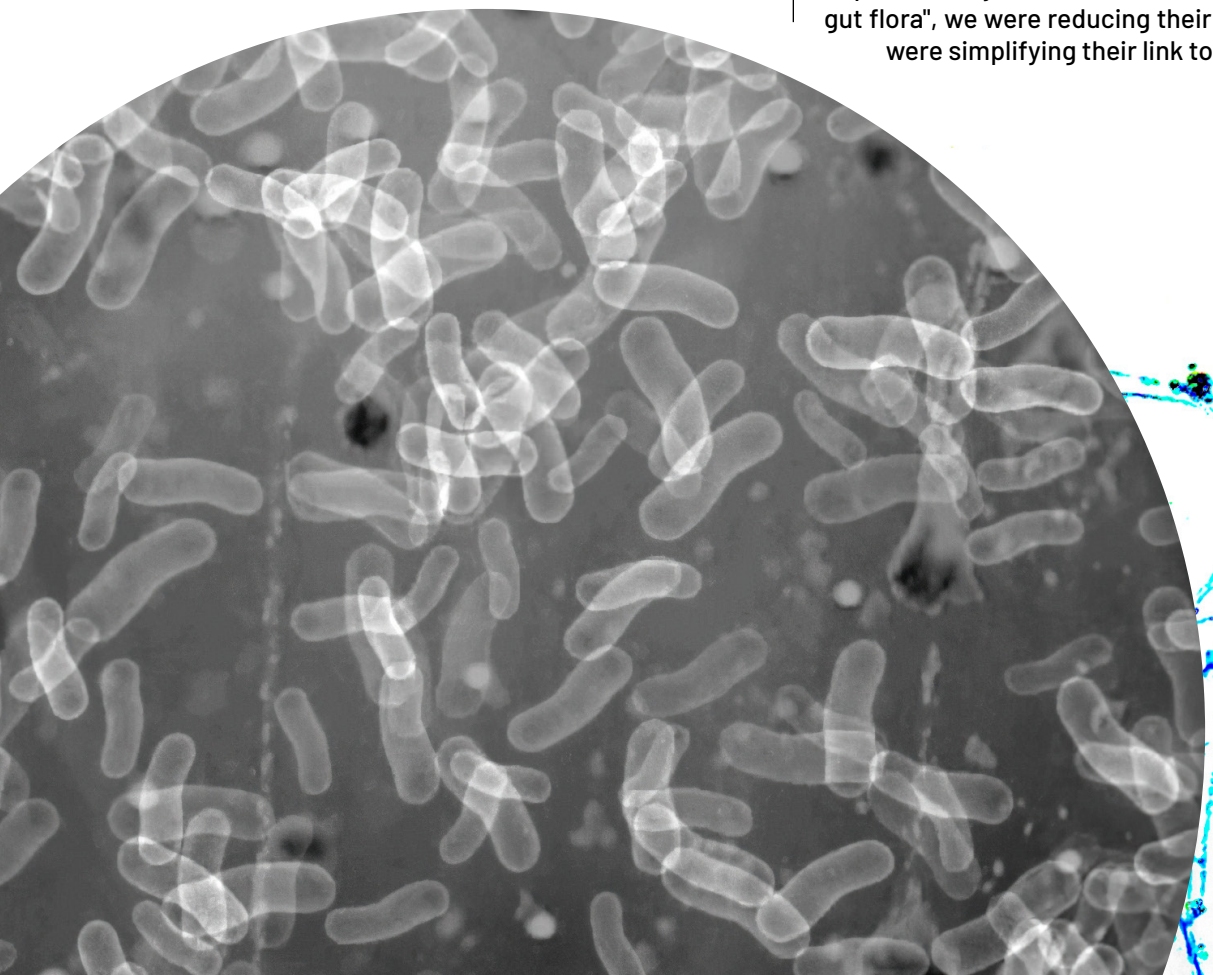
We have repeatedly read that the soil was a space that supported plants. And nothing more. Just a mere pot in which to establish our crops. But we encountered a gap between theory and practice when we translated this hypothesis into reality: it was not a matter of planting and harvesting. Because between those two stages there was a multitude of actions applied to the soil to prevent our plants from perishing due to pathogens (*Pythium spp., Fusarium spp., Meloidogyne spp*...). Because we have always thought that there were more "bad guys" than "good guys" in the soil epidermis. But what if there are actually more beneficial organisms than pathogens, and that by combating the latter we have wiped out the former?

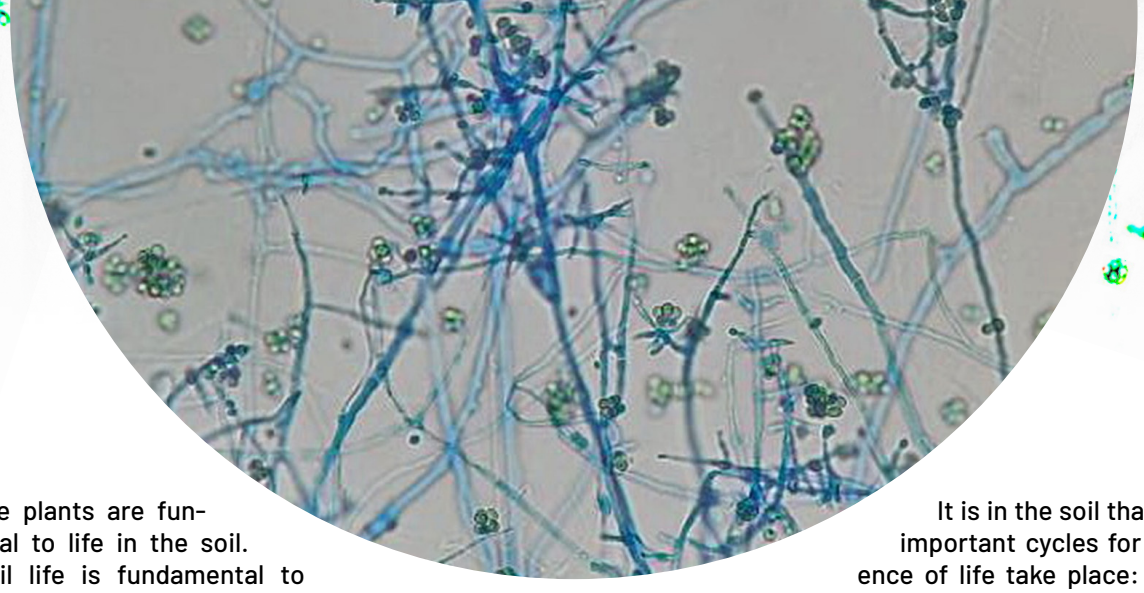
López Bellido (2020) reminds us that the role of biology in soils is fundamental for their good health and that the biological processes that take place there contribute to the sustainability of agriculture.

A healthy soil is a living soil, an organism made up of billions of other organisms that keep plant pathogens at a low enough population level so that diseases that might occur do not occur. Or so that, even with high levels of organisms harmful to plants, the balance is in favour of good plant growth.

A healthy soil can become a suppressive soil, with a large number of microorganisms and a great variety of species, each with a different function, with a diverse capacity to produce enzymes, antibiotics (remember that the most common antibiotics are produced by microorganisms from the soil), biofilms, phytohormones and many other substances that maintain a continuous struggle for the right to life.

So we, in about a century, have wanted to change the very evolution, not only of plants but also of the soil environment. We wanted to reduce the possible trophic relationships, thinking that by cleaning the roots of our crops or, more specifically, by cleaning the rhizosphere of our crops, we were helping them to show their maximum expression of productivity. Meanwhile, in reality, we were killing "their gut flora", we were reducing their nutritional capacity, we were simplifying their link to life.





Because plants are fundamental to life in the soil. And soil life is fundamental to plant survival. You cannot have one without the other. Kills *Pseudomonas spp.* or *Trichoderma spp.* and leaves the door open to *Phytophtora spp.* It reduces the population of saprophytic nematodes and *Ditylenchus dipsaci* , it will be waiting to taste your *Allium sativum.*

Therefore, in order to recover the life of our soils and the right to their maximum health, we have the obligation to regenerate them, to re-establish the trophic equilibrium that should already exist there.

Regenerating the balance between different organisms and microorganisms, whether pathogenic and beneficial, microscopic or macroscopic, is in our hands, in the way we want to face the great challenge of sustainability.

"Soil regeneration is about restoring vital ecosystem processes"

Pérez Casar (2021)

It is in the soil that the most important cycles for the existence of life take place: the nitrogen, carbon and sulphur cycles. It is there that nitrogen-fixing bacteria (thanks to nitrogenase) are able to separate the two atoms that make up the N_2 molecule, the form in which atmospheric nitrogen is found and which cannot be assimilated by plants.

Soil formation is a long, laborious process involving a multitude of closely related actors.

And let us not forget that soil, like other natural resources, is non-renewable and the foundation that supports, feeds and distributes life throughout our crops; throughout our planet.

Mar Rubio

Development Technician for Servalesa

The microscope:
VISIBLE FAITH

To Francisco Soriano Pons

Ever since Protagoras, in the 5th century B.C., stated that "man is the measure of all things", we have been humiliating ourselves in many ways, driven by an excessive eagerness to disprove him. Some of them, perhaps the most dramatic, using our own technology. So, in the present time, and far from enlightening us, the screens are overshadowing us into a slavish following, herded by the omnipresent algorithm.

Pedro Pons

Head of Department
Servalesa Technician

However, of all the technological advances, the telescope was not the instrument through which we managed to undervalue ourselves with greater efficiency to bring us to reality, but, paradoxically, the microscope. Because, by mustering the courage to look into its eyepieces, we discovered the greatness of bacteria. So we now know for certain that the history of life on Earth has been overwhelmingly microbial and that humans are no more than mere upstarts. We came from the swamps; we are made of mud as the bibles claim, but of mud sculpted by bacteria. Indeed, some of them are credited with creating the air we breathe by transforming the primordial anoxic atmosphere. **Lynn Margulis**, the indomitable and brilliant, explained it to us through her "theory of serial endosymbiosis": we are neither the pinnacle of evolution, nor are we essential for the earth to continue to live. It is indisputable that bacteria have been shaping the biosphere. If it weren't for them, we would have expired due to carbon dioxide poisoning or sunk in our own filth.

Microbiologists are striving to familiarise us with the concept of the **holobiont**: a set formed by an individual and the microbiota it hosts. They even risk talking about the **hologenome**i.e. the set of genomes of the host and its microbiota.

The "hologenome theory of evolution" is now accepted by the scientific community. **Eugene Rosenberg**, its most tenacious advocate and most eloquent proponent, puts it into four empirically supported principles (C. Peláez and T. Requena, 2017):

1) All animals and plants establish a symbiotic relationship with the microorganisms that inhabit them.

2) Cooperation between the host and its microbiota contributes to the survival of the holobiont.

3) Variations in the hologenome can be verified in both the host genome and its microbiota. It is even the case that, under stressful conditions, the microbiota adapts earlier and more successfully than the host itself.

4) The symbiotic microbiota is transmitted between generations.
It is therefore easy to imagine any garden as a holobiont made up of its plants and its soil microbiota: the soil (space explored by the roots) is essential for life and the life (time governed by the bacteria) is essential for the soil. It is worth pondering over the fact that bacteria have cleared and explored all known metabolic pathways, including the Krebs cycle (respiration), fermentations and the Calvin cycle (photosynthesis). Bacteria that fix atmospheric nitrogen, bacteria that solubilise phosphorus, bacteria that mobilise potassium, bacteria that secrete siderophores, enzymes, hormones or antibiotics. Ubiquitous, pioneering, exemplary bacteria, capable of starring in *biofilms* in the most inhospitable outdoor locations and the most secluded sets. Bacteria innately endowed with the ethics of recycling. Bacteria that, by mutating and recombining, remain. Bacteria that confirm that statistically, historically and fortunately, the pathogenicity of some of them is not significant: the proof of this is that we are alive, here and now, to tell the tale. Bacteria that generously allow us to idealise them as the "silent majority with visible effects" and whose true mode of action is nothing more than **symbiosis**, understood as an enduring partnership. Bacteria that, in anticipation of sound financial studies, corroborate that cooperating is more profitable than competing.

But let's insist on wonder: on an organism brimming with health, with the number of microbes present outnumbering the cells that make it up. Even our present-day cells claim direct descent from a common bacterial ancestor. We are therefore, in evolutionary terms, recognisable bacterial colonies.

Paediatricians and immunologists argue that newborns with no symbiotic microbiota should be confined in individual bubbles, which cost around 90,000 euros per day. This is how we have been growing seedlings and saplings. By ignoring and hating microbial life, we have been, as a species, on the verge of ruining ourselves - to the point of conceit - through obfuscation. However, all we need to do is look through a microscope for the Universe to open our eyes.

RENOV® SUPER 6
B'Nature

Just take all 6 with you

RENOV® SUPER 6,
the most complete consortium of microorganisms

Microbiology applied to agriculture is in vogue. This is easily detected in a constantly growing market crowded with microorganism-based products, but which in turn causes a blurred and distorted view for the farmer as to which are the right tools to solve problems in an efficient and, of course, profitable way.

In response to this situation and after years of research, Servalesa creates and puts on the market the most complete consortium of microorganisms, formulated with 6 unique rhizobacteria on the market, **RENOV® SUPER 6**.

YES! YOU HEARD RIGHT. NOT 2, NOT 3... 6 STRAINS! WITH RENOV® SUPER 6, JUST TAKE ALL 6 WITH YOU AND GET THE FULL POWER OF A UNIQUE CONSORTIUM OF MICROORGANISMS IN YOUR CROPS. A COMBINATION SPECIFICALLY DEVELOPED FOR GREATER ADAPTABILITY, VERSATILITY AND PROVEN EFFECTIVENESS.

RENOV® SUPER 6 is Servalesa's answer for the farmer to find a simple and effective solution for his management strategies with microorganisms, offering an all-in-one solution with which to apply many strains with a multitude of functions.

The consortia of microorganisms are microbiologically based products that combine, in a single formulation, different microorganisms and strains of microorganisms that stand out due to their biodiversity, which enables their adaptability, polyvalence, synergy and efficacy. "Life conquered the globe not by combat, but by alliances" (Margulis & Sagan, 1986, 15, quoted by Capra, 1998, 242)

RENOV® SUPER 6a unique consortium of 6 plant growth promoting rhizobacteria (PGPRs) which, thanks to the quality of the formulation, concentrates the highest possible number of spores of each strain:

Bacillus subtilis.....(strain BC03-Bss)
Bacillus pumilus .....(strain BNT10-Bp)
Bacillus siamensis.....(strain BC02-Bsm)
Bacillus amyloliquefaciens.....(strain BC04-Ba)
Bacillus megaterium.....(strain BC07-Bmeg)
Pseudomonas fluorescens.....(strain BC06-Pf)

The benefits of using **RENOV® SUPER 6** are multiple, with versatility the differentiating element. Thanks to the diversity of microorganisms in the formulation and the synergies they create, **RENOV® SUPER 6** is aimed at optimising fertilisation, stimulation of the plant and root system, competition for space for improved soil-plant interaction, generation of biofilms and soil regeneration by increasing microbial populations. In addition, it is worth highlighting the benefits in the agro-ecosystem that allow the plant to overcome critical phases of the crop cycle due to soil problems in order to reach full production.

RENOV® SUPER 6 is certified for use in organic farming and suitable for all crops.

JUST TAKE ALL 6 WITH YOU WITH **RENOV® SUPER 6**

BENEFITS OF APPLYING **RENOV® SUPER 6**

• Recommended in soil regeneration strategies, it contributes to a gradual increase in beneficial microorganism populations in soils and helps to optimise the degradation of organic matter and the improvement of the physico-chemical and biological characteristics of soils.

• Due to the capacity of the microorganisms that compose it, It stimulates root and aerial development of the plant in order to produce growth-promoting substances once installed in the rhizosphere (auxins, gibberellins, cytokinins, polysaccharides, amino acids, among others).

• Activates metabolic pathways to overcome critical phases of the crop cycle.

• Thanks to the content of *Bacillus megaterium* and *Pseudomonas fluorescens*is aimed at boosting and optimising fertilisation due to the potential of these two microorganisms to solubilise both phosphorus and potassium.

• Has the ability to form biofilms and occupy around the rhizosphere. In this way, microorganisms will occupy the ecological niche to the detriment of other non-beneficial microorganisms and will be able to enhance the generation of biostimulant compounds for optimal root and plant development. Meanwhile, the plant, through root exudates, favours the installation and growth of microorganisms.

Servalesa, with **RENOV® SUPER 6**aims to continue to give importance and value to the soil, to promote the use of microorganisms and, at the same time, to simplify the purchasing decision through a formulation that combines different key microorganisms with a product certified for use in organic agriculture and for all crops.

THE IMPORTANCE OF

the consortia of microorganisms

IN AGRICULTURE

José Antonio Rojas

Technical Manager
South-South-East Zone

Soil is essential for life and the novelty is that life is essential for soil. However, the human eye is not able to see this life in the soil, which is made up of a multitude of organisms, including microorganisms.

Do we believe the microorganisms? Well, it is a current question, but microorganisms are not just a matter of belief or faith, as we can have confidence or trust in them to a greater or lesser extent, but we can also observe them through a microscope and, of course, it is an irrefutable truth that they are the great protagonists of life, responsible for the multitude of processes that make it happen. After all, microorganisms are the oldest inhabitants of the Earth and only about 1% of fungi and 8% of bacteria have been identified.

Let's think about one of the great wonders of nature: the Amazon, for example. Are we really aware of the immense number of microorganisms that work there every day? Or consider the only one of the seven wonders of the ancient world that survives: the Pyramids of Giza. How many microorganisms were involved in their construction, and how many still inhabit that portion of the desert today? These are difficult questions to answer, but they lead us to conclude that surely the number is (or was) very high and that they have (or had) to work in partnership or in a **consortium** to achieve their goals and that, moreover, this is the natural cycle of life. Furthermore, it is estimated that the human microbiome may be composed of 37 billion microorganisms and that they are the architects of our creation and existence.

All these universal truths should be reason enough to revere microorganisms and to be, quite literally, eternally grateful, as they are, for the moment, eternal.

Well then, with agriculture now in mind, and against all odds, humans have for decades decided to interfere with the natural cycle of life through the use of synthetic fertilisers and pesticides. The pursuit of technological performance and new business models after the Second World War brought us to the point of producing food in abundance, increasing the welfare standards of societies (to a greater or lesser extent) and, ultimately, exponentially increasing the population. But at what cost? At the cost of the unrestrained use of synthetic fertilisers and phytosanitary products that have increased erosion problems (drastic reduction or total elimination of organic matter from the soil), impoverished soils, blocked nutrients in forms that cannot be assimilated by plants, unbalanced flora and fauna, increased salinity problems and, among many other consequences, left soil life on the sidelines and bacteria **at a standstill**.

Biomimicry

It is curious that microorganisms in agriculture, the creators of human beings, have until recently been neglected and forgotten by humans themselves: About 80 years ago, we decided to underestimate the agricultural potential of microorganisms and replace them with alternatives that were a priori more efficient, creating less complex and unbalanced systems.

Fortunately, more than two decades ago, different intellectual currents or stakeholders raised their voices in favour of sustainability in order to meet the needs of the present (safer food) without compromising the capacity of future generations (taking care of resources and means of production). **Sustainability** has emerged as the main bastion and raison d'être for many companies in the agri-food sector, and an unstoppable consumer trend for consumers around the world. To this end, science has been focused on the research and development of technology that mimics nature, i.e. designing solutions to problems that arise by imitating strategies tested and optimised over billions of years by nature, or by using nature as a source of inspiration. In short, the **biomimicry**.

Consortia

Based on the principle of biomimicry, Servalesa proposes the use of consortia of microorganisms with the aim of complementing conventional fertilisation practices with greater rationality and contributing to the restitution of the **commonwealths** in agricultural soils, participating in the increase and rebalancing of microorganism populations through the exogenous application of those strains considered beneficial for soils and crops, and bearing in mind that they are not a substitute for anything, but rather a supplement.

Generally, the consortia of microorganisms are microbiologically based products that bring together, in a single formulation, different microorganisms and strains of microorganisms that stand out due to their **biodiversity**, which gives rise to their adaptability, polyvalence, synergy and efficacy.

> "Individual cells form populations; populations using the same resources form groupings called "guilds", and sets of guilds carrying out complementary physiological processes interact to form microbial communities. These communities interact, in turn, with communities of macroorganisms and define the ecosystem as a whole"
>
> • (Madigan, Martinko & Parker, 1999, 533)

A first aspect to point out is **adaptability**, which is based on the ability of the microorganisms and the different strains to establish and develop in a wide range of soils with different pH values, texture, electrical conductivity. The microorganisms included in the different consortium-based formulations must have the capacity to adapt, which is why quality plays a fundamental role, as a high concentration of spores in the formulation will be a determining factor in adaptation.

> "Life did not conquer the globe by fighting, but by alliances"
>
> Margulis & Sagan, 1986, 15, quoted by Capra, 1998, 242

A second fundamental aspect is the **polyvalence** of the consortia of microorganisms. There is an effort to adapt the conceptualisation of synthetic molecules to microbiology, resulting in a multitude of products on the market with a single strain to which only a single benefit or function (plant protection, biostimulant or biofertilisation) is attributed. However, to be strict with science, a single strain of a microorganism can be attributed, with greater or lesser intensity, to a multitude of modes of action. If we multiply the number of microorganisms and/or strains in a formulation, we are multiplying the range of action and benefits for the crop.

A third aspect is the **synergy**. The association reflects **synergistic or syntrophic** lifestyles (meaning "eating together") in which growth and cyclical nutrient flow is conducted more effectively and efficiently than in individual populations (López, Domínguez & García, 2007). Functionally, a microbial consortium is greater than the sum of its parts; its members maintain metabolic and ecological compatibility as long as the environmental transformations that are generated allow them to coexist in close proximity.

Finally, taking into account that the secretions of the root system are rich in carbon compounds from photosynthesis and that the plant kingdom decides what type of microbial populations should accompany it in its life cycle, it is worth noting that **the effectiveness of the consortia** of microorganisms can be approached from many points of view:

- Act as biological control agents, i.e. assist in the control of diseases caused by other pathogenic bacteria and fungi.
- They produce an induction of resistance mechanisms to pathogens and abiotic factors.
- They are producers of stimulating substances, causing an increase in the speed of root system development, increased vigour and higher productivity.
- They are able to solubilise macronutrients, such as phosphorus and potassium, and to metabolise organic matter.
- They produce extracellular enzymes and phytohormones, such as auxins.
- They secrete siderophores, iron chelating substances.
- They are capable of fixing atmospheric nitrogen.
- They promote plant growth and stimulate the establishment of other beneficial root-associated microorganisms such as mycorrhizae.
- They degrade ethylene precursors.
- They produce proteases and other enzymes to degrade a wide variety of natural substrates.

As in other industries, biology and agronomy must once again recognise and embrace the potential of microorganisms. We should consider that microbial consortia offer the possibility of understanding how association and the division of tasks within a social system allow, through specialisation, the development of projects that could not be achieved autonomously.

The challenge of **sustainability** is the perfect opportunity for us, through **biomimicry** , we make **use of microorganisms** in the form of **consortia** to bring life back to the soil, optimising harvests without compromising the production capacity of future generations.

MYCODRIP®
B'Nature

Spore concentration does matter

Mycorrhizal fungi are, together with trichoderms, the ones that started the "movement" of microbiology applied to agriculture. This is logical, as they are a key component of the soil microbiota. Mycorrhizal fungi have the ability to colonise plant roots and explore the soil functioning as extensions of the root system, absorbing water, nutrients and strengthening the root system, as well as the plant as a whole, against different stress phenomena.
In recent years, the concept of mycorrhizae in agriculture has been consolidated by technicians and farmers and there are numerous mycorrhizal fungi solutions on the market. For this purpose, Servalesa has **MYCODRIP®**a solution based on *Rhizophagus irregularis* which is hailed for its high concentration of spores, with a minimum concentration of 4,000 spores/gramme (4,000,000 spores per kilogramme).

WHY MYCODRIP®??

MYCODRIP® is obtained after a meticulous manufacturing process in which selected mycorrhizal fungi are produced in vitro under sterile conditions. **MYCODRIP®** contains **spores**, which are resistance structures that protect the genetic material until conditions are right for them to develop. We understand that this is the highest expression of quality in this type of product and the differential element with respect to other products on the market that are based on propagules such as root fragments with hyphae.

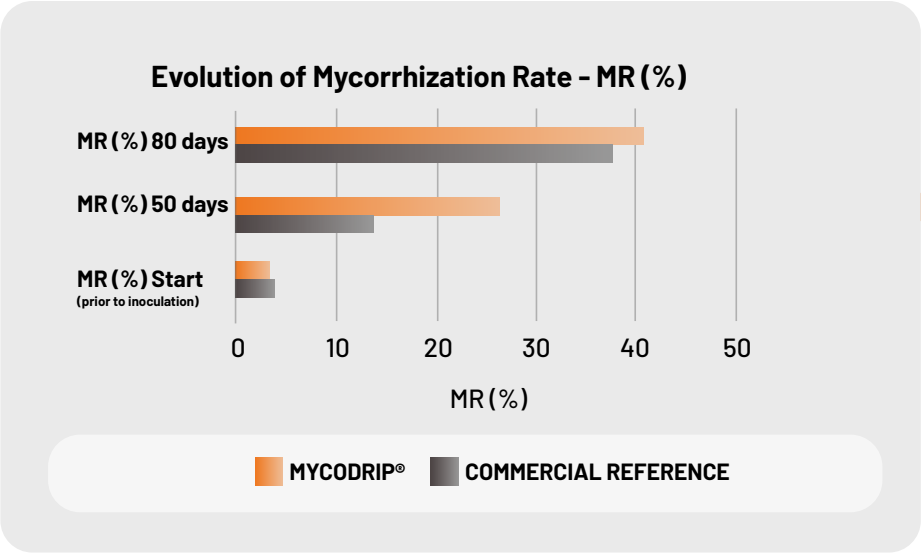
MYCODRIP® is probably one of the products available **with the highest concentration of spores**. When we talk about spore concentration we should immediately associate it with a more likely mycorrhization rate and a higher efficiency. This is an advantage in terms of **profitability for the farmer,** because, given the high concentration of spores, **only one application is required.**

The manufacturing process of **MYCODRIP®** also allows us to guarantee its high solubility, which facilitates its application through irrigation systems with the maximum guarantee. **MYCODRIP®** and**vita filter and dripper clogging problems.**

PROVEN EFFECTIVENESS

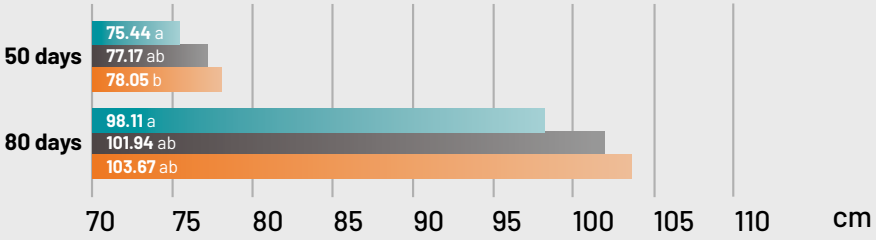
The **Intra Radice** laboratory has carried out a study on citrus seedlings of the Lane late variety, in which it compared **MYCODRIP®** was compared with a benchmark product based on the mycorrhizal fungus *Glomus iranicum* and an untreated control.

Firstly, the mycorrhization rate was evaluated after 50 days, and confirmed a higher rate of mycorrhization by **MYCODRIP®** when mycorrhizing and established a symbiosis with the root with respect to the benchmark product.

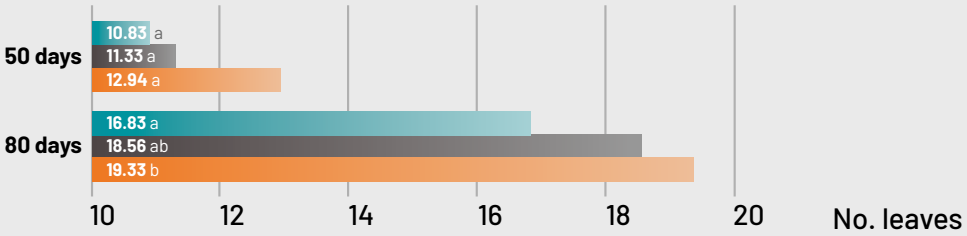


After 80 days, the evaluation of other parameters linked to the development of both the aerial part and the root system was carried out to confirm the efficacy of **MYCODRIP®**.

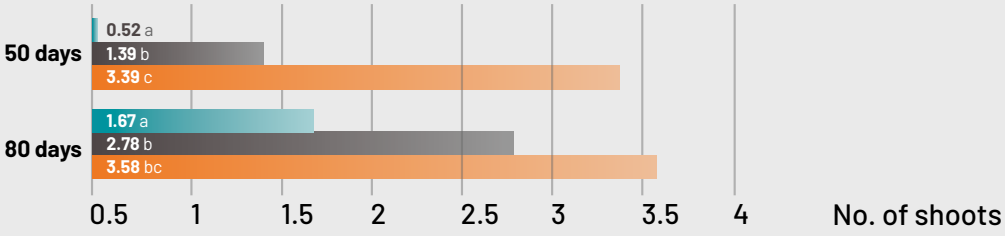
Evolution of plant height (cm)



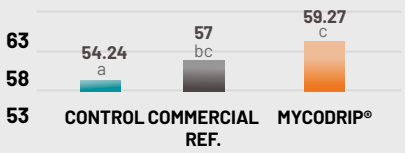
Evolution of the number of leaves/tree



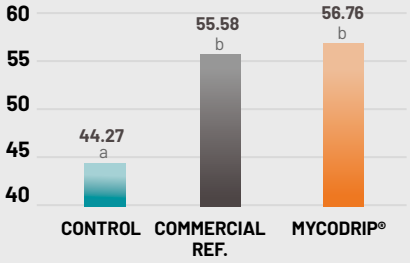
Evolution of the number of shoots/tree



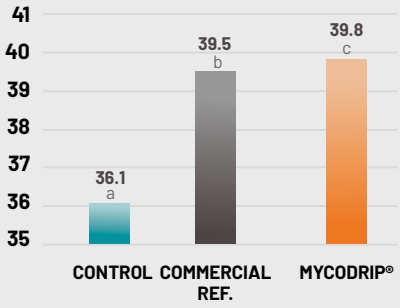
Weight Aerial Part (g)
80 DAYS



Root part weight (g)
80 DAYS



Root part length (cm)
80 DAYS



CONTROL COMMERCIAL REFERENCE MYCODRIP®

Finally, it was observed that the seedlings inoculated with **MYCODRIP®** emitted a greater number of shoots and, therefore, showed greater meristematic activity, as well as a significant increase in the number of leaves, which leads to a higher photosynthetic rate. Thus, this trial verified that the high concentration of mycorrhizal fungal spores that characterises the formulation of **MYCODRIP®** ensures a high colonising potential and, therefore, a higher efficacy compared to the commercial reference.

Luis Belmonte

Responsible for Southeast Zone
Servalesa

Improve the fertilisation of your crops

It is well known that **phosphorous (P), potassium (K)** and **nitrogen (N)** are present in our soils, but not always in a form that can be assimilated by crops. Phosphorus and potassium are elements that can be blocked and plants alone cannot assimilate these nutrients. A similar situation occurs with atmospheric N, which plants cannot assimilate. **The only ones that can make these nutrients available to the crop are microorganisms.**

On the one hand, phosphorus in soil can be found as phosphate salts formed by reacting with cations in the soil, or as phosphates that are part of organic compounds. Certain microorganisms are able to release phosphorus from inorganic sources by solubilisation and from organic sources by mineralisation. In both cases, phosphorus is available to the plant in the soluble fraction of the soil. This is due to the organic acids and/or enzymes produced by the microorganisms, which release the phosphates and make them available to the plant.

On the other hand, potassium is either immobilised between the clay layers or adsorbed on the surface of the clay particles. As in the previous case, certain microorganisms are able to mobilise this potassium and make it available to the plants. The organic acids produced by the microorganisms deprotonate in alkaline environments and thus enable the exchange of H^+ for the K^+ cations immobilised in the clays. For example, potassium is released by the alteration of silicates, but it is also possible by the mineralisation of humus.

The **need to optimise natural resources as much as possible**, among them fertilisers, which are necessary for good crop nutrition. There is no doubt that the best way **to optimise phosphorus and potassium is to use those that are already in the soil** and allow a reduction of fertilisation and adjust it as much as possible to the needs of the crop: no more and no less, just enough and what is needed.

This is why the need for the product **RIZOBACTER® PK**, based on two plant growth promoting rhizobacteria (PGPR): *Bacillus megaterium* (strain BC07-Bmeg) and *Pseudomonas fluorescens* (strain BC06-Pf). This combination is ideal, as both

strains have high phosphorus solubilisation and potassium mobilisation potential.
In addition, these microorganisms also produce other types of secondary metabolites, including siderophores: iron chelating agents, which make iron available to the plant, thus aiding plant nutrition.

Along the same lines of fertiliser unit reduction, it is well known that nitrogen is one of the least stable elements in the soil because of its high tendency to leach in its nitric form. In this respect, microorganisms that fix atmospheric nitrogen, which is an abundant element in the soil, play a fundamental role in the fertilisation of crops by providing a means of supplying this nutrient. In this sense, at Servalesa we have **RIZOBACTER® N**, a product based on *Azotobacter chroococcum* (strain BNT-09-Ac), which has a **very high atmospheric nitrogen fixation capacity**. And that, regardless of the crop, it is able to reduce N2 to NH3. Thus, *Azotobacter chroococcum* works by fixing nitrogen according to the needs of the crop, since its performance is directly related to root activity and the exudations produced by the roots.

Another important feature of **RIZOBACTER® N** is the **production and supply of metabolites**including AAC deaminase, an enzyme that inhibits ethylene synthesis and thus enables the plant to cope with various abiotic stresses. Another notable metabolite is **the auxins**, which have many stimulating functions, such as increasing root development and, consequently, the nutritional supply to the crop.

In conclusion, applications of **microorganisms are more than justified in agriculture**. In this particular case, when applying **RIZOBACTER® PK** and **RIZOBACTER® N**, a more efficient use of nutrients is achieved. Not to mention the stimulating benefits they provide, which are becoming increasingly important in present and future agriculture.

Iris Garcia
Agricultural Engineer
Sales Delegate
North East Zone

Jonatan Mateo
Technical Agricultural Engineer
Sales Manager
North Zone

P

RIZOBACTER® PK
B'Nature

N

K

RIZOBACTER® N
B'Nature

FUSVER®, much more than *Bacillus subtilis*

If there is currently a pioneering bacterium that stands out from the rest in terms of agricultural use, it is undoubtedly *Bacillus subtilis*. *Bacillus subtilis* is a cosmopolitan bacterium present in numerous habitats and has the particularity to generate endospores resistant to high temperatures and osmotic changes and can survive in inhospitable soils and highly stressful crop conditions.

Bacillus subtilis is one of the most studied bacteria in the world for its antifungal activity due to the synthesis of secondary metabolites with antibiotic action (gramicidin, surfactin, iturin, and fengycin). But there are also a multitude of strains that stand out for their biostimulant function, a wide range of modes of action that highlight their antagonistic activity, i.e. their high capacity to colonise the rhizosphere zone (spatial competition), their rapid assimilation of nutrients and the secretion of secondary metabolites which, among other things, are responsible for stimulating Induced Systemic Resistance (I.S.R) in plants.

FUSVER® is a product formulated with *Bacillus subtilis* and a concentrate of secondary metabolites from the fermentation process. **FUSVER®** is, without a doubt, one of the tools developed by Servalesa for present-day agriculture, with a great future.
The agriculture of the future requires a change of mentality with regard to the conception and understanding of the mode of action of products, leaving behind classic paradigms linked to synthetic molecules. On the one hand, with these new tools, the mechanisms of action are no longer so direct and specific, but with no reduction in efficacy, as in addition to stimulating the plant, we are preventing potential resistance problems. On the other hand, the farmer must be aware of the factors that surround his crop in order to incorporate the concept of "working protocols" - and thus prevent rather than cure - avoiding a point of no return for the crop.

As in veterinary medicine, there are a number of vaccines for specific problems and protocols for each stage of development. In plants and for certain diseases, we must do something similar. In other words, we have to induce our crops to defend themselves against certain pathologies.

This line of work is the backbone of the "Servalesa Protocol" concept, which has been successfully implemented. This consists, as mentioned above, of keeping the plant forewarned and prepared so that it is able to overcome setbacks in its development by its own means.

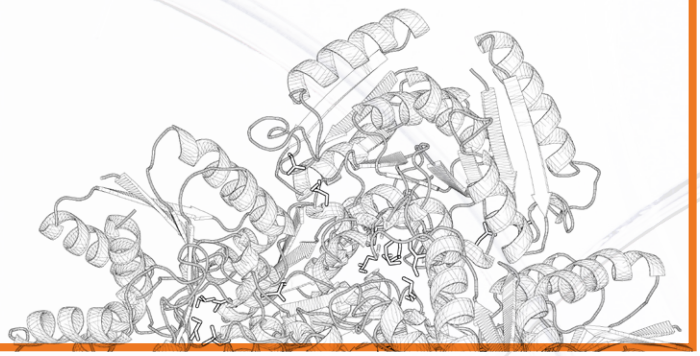
One of the key products in this "Servalesa Protocol" concept is **FUSVER®**. A compound product for foliar or root application, in which we can find two mechanisms of action:

1) Systemic action generated by the high specific concentration of **secondary metabolites** contained in the formulation. This is a **short term** systemic action, independent of environmental conditions (such as humidity, temperature...). A number of key issues should be highlighted here:

a. The importance of the microorganism and the strain reproduced (different strains of the same microorganism do not produce equal effects).

b. Parameters that influence the production process such as: temperatures, times, nutrition used... By managing these parameters the production of primary and secondary metabolites is controlled. In addition, the progression of the most suitable ones can be encouraged to achieve a greater effect with the product.

2) **Medium and long term** action achieved by the development of the bacterium ***Bacillus subtilis*** which is part of the formulation. This is an action that is influenced by environmental conditions such as humidity, temperature and M.O. levels, exudate emission, etc.



Thus, we can affirm that **FUSVER®** is an exclusive product, with its own formulation and production, with a registered strain and a high concentration of specifically selected secondary metabolites.

Fungi, bacteria and many pests are able to relate to plants through the volatile compounds they emit and detect if they are weak and even locate pathways of entry to begin pathogenicity. The application of **FUSVER®** minimises this problem by occupying the ecological niche in the rhizosphere and strengthening the plant.

As discussed, plants are capable of defending themselves against attack and always do. In fact, what we commonly call "resistant varieties", in most cases, are not plants that are not attacked by the pathogen, but which, through more effective defence mechanisms than "susceptible varieties", tip the balance in their favour. However, in the face of severe attacks, they are not a great solution. For this reason, it is of vital importance to prepare our crop from the very beginning to defend itself through the I.S.R generation pathways. (Induced Systemic Resistance), or what is also known as the priming state.

FUSVER® is undoubtedly one of the key products in the "Servalesa Protocols" to minimise soil problems at critical moments in the crop cycle and to stimulate the crop to achieve optimum yields.

FUSVER®
B'Nature

Jose M. Sanchez

Responsible for the Central Zone
Servalesa

B'Nature

ALL OUR

microbial biostimulants

RIZOBACTER® N

Biostimulant based on *Azotobacter chroococcum.*
Registry Number: 0037620/22

RIZOBACTER® PK

Microbial phosphorus and potassium solubilising microbial biofertiliser based on *Bacillus megaterium* and *Pseudomonas fluorescens.*
Registry Number: 0037621/22

FUSVER® ECO

Biostimulant based on *Bacillus subtilis.*
Registry Number: 0038595/23

FUSVER®

Biostimulant based on *Bacillus subtilis.*
Fertiliser Products Register number: F0004083/2030

RENOV® TRICCO

Biostimulant based on *Trichoderma harzianum*.
Registry Number: 0027559/19

RENOV® SUPER 6

Biostimulant based on *Bacillus subtilis, Bacillus pumilus, Bacillus siamensis, Bacillus amyloliquefaciens, Bacillus megaterium and Pseudomonas fluorescens*.
Registered in Italy under No: **0034775/21**

MYCODRIP®

High concentration of mycorrhizae. Optimises root development.
Registered in the Czech Republic under No. 3862

RENOV® MICRO

Biostimulant based on *Bacillus siamensis, Bacillus amyloliquefacien, Bacillus megaterium* and *Pseudomonas fluorescens*. Fertiliser Products Register number: F0004270/2031

RENOV® SUPER 2

Biostimulant based on *Bacillus subtilis* and *Bacillus megaterium.*
Registry Number: 0034780/21

NOVA®

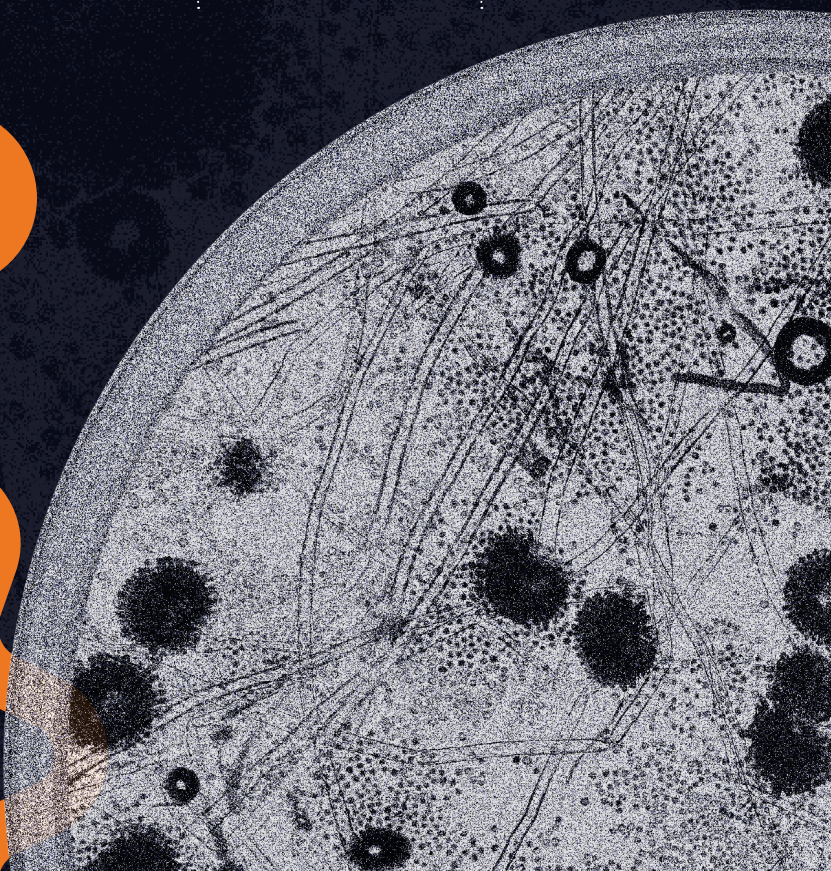
Biostimulant a based on *Lysinibacillus xylanilyticus*. Fertiliser Products Register number: F0004105/2030

ZYMEX®

Foliar biostimulant, activator of metabolic pathways.

NICAN®

Biostimulant based on *Bacillus mojavensis*.
Registered in the Czech Republic under No: **5462**



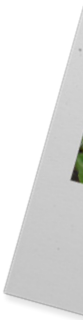
MITIGATE PROBLEMS in cucurbits

The current situation in the production of cucurbits presents a complicated panorama in view of the important restrictions on the use of active substances imposed by the administrations. In addition to this, there are market requirements, which are even more restrictive than the previous ones, with the aim of offering a "clean" product to consumers. In addition to all of this is the fact that we have to produce the same or more per hectare (to compensate for the increase in input costs and fixed costs in production), not forgetting that, for various reasons, the area of usable land for cultivation has decreased. In conclusion, the plant has to be driven from start to finish, forced to 100% with fewer tools to handle it and on an increasingly difficult soil.

With these prospects, the need for technical and efficient management of the farm is becoming more and more evident, trying to minimise as far as possible the likely setbacks that may arise. To this end, we have tools such as:

- Soil analysis. **Fertilisation and soil health.**
- "Resistant" varieties.
- Irrigation probes. **Irrigation optimisation.**
- Humidity and temperature recording devices that can predict the occurrence of diseases and pests. **More efficient use of active ingredients.**
- Conductivity probes. **Fertilisation control.**
- Management of biostimulants that **nourish, strengthen and generate defence mechanisms in I.S.R. plants.** (Induced Systemic Resistance).

The use of these tools requires a change in the way of working, as it is necessary to act preventively and not correctively. The mode of action is to induce a stimulus that stresses the plant and encourages it to learn to generate coping mechanisms. Thus, when an exogenous stress occurs, the plant has these "learned" mechanisms at its disposal (I.S.R. - Induced Systemic Resistance) that help you to cope. This is known as the *priming* and it has a certain similarity (with a few differences) to the way vaccines work in animals.



Microorganisms. Mitigate soil and vascular problems, biostimulation, fertilisation and generation of waste-free I.S.R

In recent years, what we call the "Servalese Protocol" has been developed. It consists of combining the knowledge and experience of farmers and technicians with the use of our products and crop monitoring.

With these protocols, it has been possible to mitigate, to a large extent, the losses that usually occur in apparently sensitive varieties, as well as to be able to carry out melon crops on "tired soils", which would be technically much more complicated without the "Servalesa Protocol".

To achieve this, we propose to increase the microbial population with the aim of trying to create a balance between pathogens and beneficials in the rhizospheric environment that will allow the crop to develop as close as possible to what is defined as "suppressive" or balanced soil.

Sergio Villalta

Manager of Villalta Satirium

Jose M. Sanchez

Responsible for the Central Zone Servalesa

Servalese protocol on cucurbits

PRE-TREATMENT/ TIME OF TRANSPLANTATION

Leaf application

Combination: **MAS RAIZ® +** and **FUSVER®**

Objective: to mitigate stress on the plant and prevent it from emitting signs of weakness recognisable by pathogens.

PHASE 1 / 10 - 15 DAYS AFTER TRANSPLANTATION

Root application marked by crop development assessment

Combination: **RENOV® TRICCO**, **FUSVER®** and **MAS RAÍZ® +**

Objective: to achieve a powerful and effective root system in which a balance and effective establishment of beneficial microbial life in the rhizosphere is achieved. At the same time, the plant is nourished and generates I.S.R. mechanisms. (Induced Systemic Resistance) that help it to build up defences

PHASE 2 / 20-30 DAYS AFTER PHASE 1

Root application

Combination: **MAS RAÍZ®** + and **RENOV® SUPER 6**

Objective: to maintain an effective root system, promote fruit set, more effective calcium assimilation, phosphorus and potassium solubilisation; and most importantly, to increase and diversify the beneficial microbial population with a consortium of 6 bacteria (the basis of the formulation of **RENOV® SUPER 6**) which, once installed in the rhizosphere, make it very difficult for pathogens to enter.

With the field monitoring of the crop, the need for further applications will be assessed, using the above-mentioned products at the doses and times that the technical criteria deem appropriate.

Garlic, onions and microorganisms

ESSENTIAL TO YOUR STRATEGY

Good soil health is a prerequisite for increasingly profitable and sustainable agriculture.

Soil is considered a heterogeneous space defined by its physical, chemical and biological properties, which under natural conditions, tends to develop a dynamic equilibrium between its components and inhabitants, which generates the right conditions to develop healthy and vigorous crops, producing healthier, residue-free food for human and animal consumption, all with, in addition, a lower environmental impact.

Soil microbiota, consisting mainly of fungi and bacteria, are generally considered to play an important role in soil fertility, evolution, structure and conservation.

Productivity in agro-ecosystems depends to a large extent on the activity of various microorganisms in the rhizosphere, rhizoplane and phyllosphere that establish beneficial relationships with plants.

The beneficial effect of plant-microorganism interaction may result from the ability of microorganisms to enhance nutrient uptake, produce growth promoting substances, fix atmospheric nitrogen, solubilise phosphorus and potassium, produce siderophores and phytohormones, improve soil structure or act as biocontrol agents against pathogenic organisms. The result is reflected in various physiological parameters of the plant, which are linked to increased productivity and improved crop health, as well as reduced production costs.

In garlic and onion cultivation, the use of microorganisms improves and enhances the root system, maximising nutrient uptake, significantly increasing yields and improving plant defences against diseases transmitted by soil-borne pathogens.

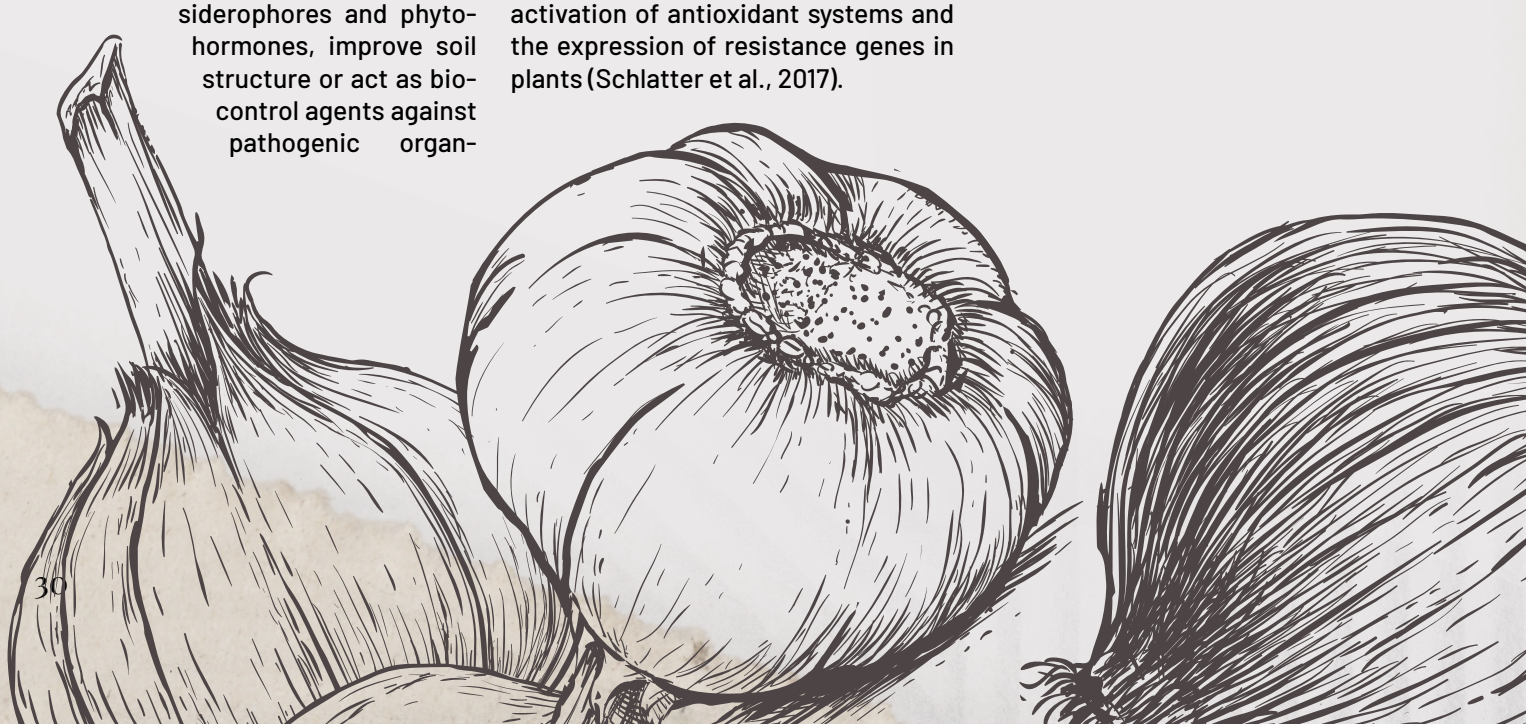
Diseases such as pink root caused by *Pyrenochaeta terrestris*, white rot caused by *Sclerotium cepivorum*, green rot or blue mould produced by different species of the *Penicillium* genus, bacteriosis caused by *Pseudomonas syringae* and basal rot caused by *Fusarium oxysporum f. sp. Cepae* and nematodes such as *Ditylenchus dipsaci* are well known threats in both garlic and onion cultivation, leading to decreased productivity and increased production costs. The application of microorganisms encourages them to occupy different niches in the root zone and thus compete for space and nutrients, which limits the development of harmful species. Microorganisms can also exert their beneficial activity through the secretion of compounds with antimicrobial activity and secondary metabolites, the production of siderophores, the activation of antioxidant systems and the expression of resistance genes in plants (Schlatter et al., 2017).

The application of microorganisms generates important added benefits by increasing soil biodiversity and making the plant more tolerant to sudden changes in temperature and able to overcome stress caused by extreme conditions.

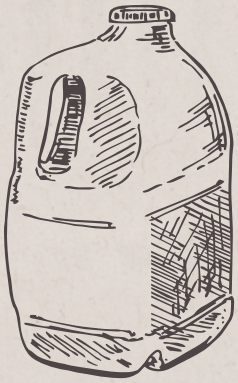
Biological protection against leaf diseases is another of the most studied aspects, both in garlic and onion cultivation.

The application of different microorganism-based solutions helps to make both garlic and onion crops more resistant to aerial disease pressure, as these solutions exert a biostimulant effect on the plant.

Aware of this, Servalesa has a wide range of products based on its own strains of microorganisms and their corresponding metabolites, with which it has developed various protocols for both garlic and onion cultivation:

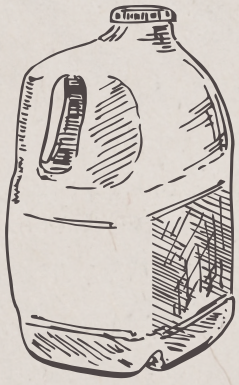


servalesa®



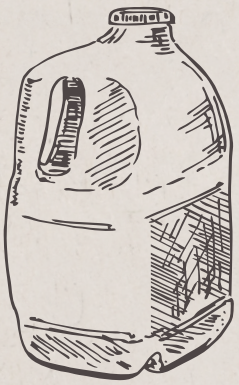
RIZOBACTER® N
B'Nature

Biofertiliser based on the rhizobacterium *Azotobacter Chroococcum* (strain BNT-09-Ac), a nitrogen fixer and fertiliser optimiser



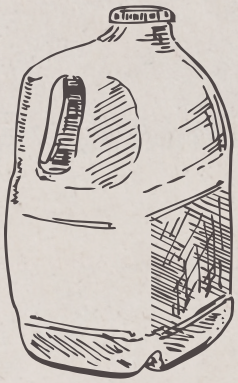
RIZOBACTER® PK
B'Nature

Biofertilisers based on mycorrhizal fungi combined with two plant growth promoting rhizobacteria (PGPR): *Bacillus megaterium* (strain BC-07-Bmeg) and *Pseudomonas fluorescens* (strain BC06-Pf)



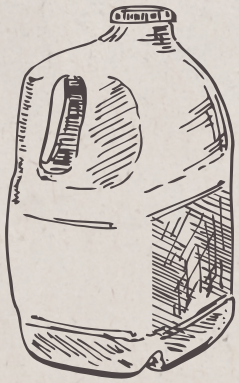
FUSVER®
B'Nature

Biofertilisers based on *Bacillus subtilis* (strain BC03-Bss)



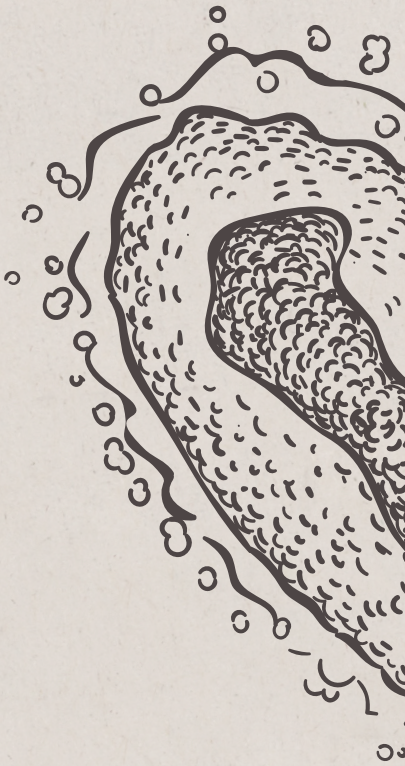
RENOV® SUPER 6
B'Nature

Biofertiliser composed of plant growth promoting rhizobacteria (PGPR)



RENOV® TRICCO
B'Nature

Soil regenerator based on mycorrhizal fungi, rhizobacteria and microorganisms of the *Trichoderma* genus



Agro-Servicios POLI
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ADVANTAGES OF THE USE OF MICROORGANISMS *for industrial tomatoes*

During the last few years, the cultivation of industrial tomatoes has undergone a major transformation. There has been a shift from a traditional crop to a more technical one, with medium to large farms where, in order to be profitable, higher and higher yields have to be achieved. In short, we have to push the crop to the maximum from the beginning to the end of the cycle, with the few tools we have available.

As a result, farming is becoming more and more technical and is gaining in importance:

- Soil analysis
- The varieties chosen
- Irrigation management
- More competent use of active substances
- Fertiliser quantities
- The use of new products that strengthen and generate defence mechanisms in plants (Induced Systemic Resistance)

- The promotion of the balance of soil microorganisms, regeneration of "tired soils"

For all these reasons, Servalesa has been developing products for years that help to optimise crops by strengthening, nourishing, biostimulating and getting plants to generate their own defences, to complement the work of the active ingredients.

With regard to what we commonly call "tired soils", it is observed that they normally suffer from a great imbalance, in which the development of pathogens (fungi, nematodes, bacteria...) takes precedence, causing harmful alterations for the good development of the crop. To mitigate this problem, the exogenous supply of beneficial microorganisms is proving to be an effective remedy. In doing so, we try to restore a balance between pathogens and beneficial microorganisms in the rhizospheric environment, which makes better crop development possible, which is defined as "balanced soil".

For this reason, in recent years we have developed a series of working protocols for tomato cultivation, which we call "Servalesa Protocols". The "Servalesa Protocols" consist of the controlled and gradual addition of beneficial microorganisms and prebiotics throughout the growing cycle. They bring the plantations closer to a "balanced soil" in which our crop will grow better and where, with the authorised active substances, the probability of controlling vascular diseases or mitigating damage caused by nematodes can be increased.

These inputs have direct effects on both the rhizospheric environment and the plant:

- Acting positively at every stage of its development.
- It is extremely conducive to the creation of plant-generated defences. What is known as I.S.R. (Induced Systemic Resistance), a concept that must be taken into account in these work strategies, as it contributes very effectively to the mitigation of damage caused by diseases.

Servalesa Protocol FOR INDUSTRIAL TOMATOES

PRETREATMENT/ Time of transplantation

Leaf application

Combination: **MAS RAIZ® +** and **FUSVER®**

Objective: to mitigate the stress suffered by the plant in this process. At the same time, due to the way the mixture works, we prevent the tomato plant from sending out weak signals that would facilitate the entry of pathogens.

PHASE 1 / 10-15 days after transplantation

Root application

Combination: **RENOV® TRICCO**, **FUSVER®** and **MAS RAÍZ® +**

Objective: to root the plant as effectively as possible, while at the same time facilitating the implantation of the microorganisms included in the formulations, in order to increase the population of beneficial organisms and hinder the development of pathogens. In addition, while the plant is being nourished, its immune system is being induced.

PHASE 2 / 20-30 days from Phase 1

Root application

Combination: **MAS RAÍZ® +** and **RENOV® SUPER 6**

Objective: Based on the evaluation of crop development, it will be applied to maintain an active root system, promote fruit set, improve calcium assimilation, speed up phosphorus and potassium solubilisation. Most importantly, this application increases and diversifies the beneficial microbial population with a consortium of 6 bacteria which, once installed in the rhizosphere, make it very difficult for pathogens to enter.

PHASE 3 / Implementation according to assessment

Once again, based on technical criteria, we will assess the possibility of carrying out a third application, in which the tools described above will be used as required.

servalesa®

Carabias, s.a.

Angel Chamizo

Sales Delegate Extremadura

Jose Luis Carabias

Carabias Technical S.A.

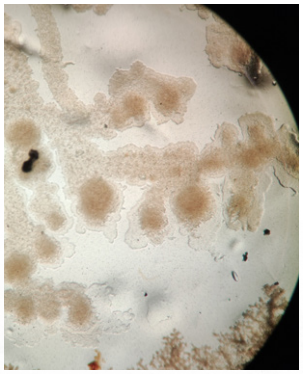
THE USE OF MICROORGANISMS *In olive trees*

The current situation of the traditional olive grove presents a series of challenges that are motivating farmers to impose a series of changes in olive grove management to make it more profitable and, at the same time, more respectful of the environment.

One of the challenges it faces is to bring the soil back to life and treat it as a living organism in which different organisms interact.

The European Environment Agency defines it in a global way "as a natural, organised and independent system, whose formation is due to the combined action of climate, organisms, vegetation, relief and time on the bedrock, and which constitutes a matrix of organic and mineral components that encompasses a porous network through which liquids and gases circulate, harbouring numerous populations of living organisms in a situation of dynamic equilibrium".

For many years, the farmer has focused his efforts on nutrition based on inorganic fertilisers, with the aim of increasing yields, focusing only on the mineral part of the crop, with the result that most of the soils in our olive groves are totally unbalanced with very low levels of organic matter.



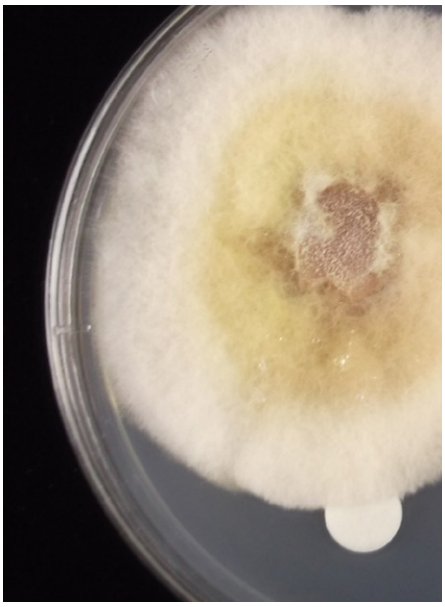
Sierra de Segura

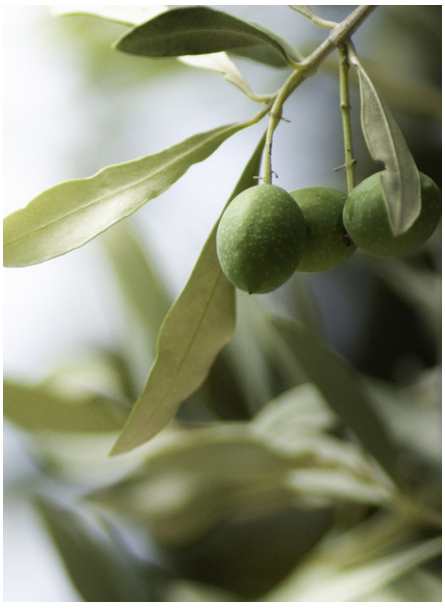
The European Commission has set an ambitious plan through the European Green Pact that aims to reduce nutrient losses by at least half by 2030, without deteriorating soil fertility, which will reduce fertiliser use by at least 20% by 2030.

In particular, the following objectives are to be achieved:

- Sustainable crop nutrition management.

- To maintain or increase, where appropriate, the organic matter, carbon sink capacity and biodiversity of agricultural soils.





In this sense, it is a question of nourishing as in the past, but with the technology of the present; and this is where the introduction of microorganisms plays a fundamental role in the fertilisation plan for olive groves, as they are key to good soil fertility and regeneration.

The highest concentration of microorganisms is found in the area close to the roots, known as the **rhizosphere**. Their activity produces root exudates that serve as food for the microorganisms and, in return, these provide the minerals that the plant needs.

Among the microorganisms that establish symbiosis with plant roots, we highlight three types: **plant growth promoting bacteria (PGPR), mycorrhiza-forming fungi and atmospheric nitrogen-fixing bacteria.** They promote root growth and root hair proliferation, inhibit the growth of pathogenic microorganisms and produce iron chelating substances (siderophores) that increase iron uptake by plants.

At Servalesa, we are committed to a strategy based on biofertilisation, for which we use **ORGANSER® L**, which, thanks to its high content of organic matter free of impurities, is capable of exerting a biostimulant action on the crop, as well as improving the physicochemical characteristics of the soil, and which, combined with our **RIZOBACTER® N** and **RIZOBACTER® PK**, two of the most powerful biofertilisers on the market, will allow us to carry out fertilisation adapted to the new market requirements, both in terms of fertilisation and the recovery of the soil's biological activity.

RIZOBACTER® N is a liquid biofertiliser based on a concentrate of the rhizobacterium *Azotobacter chroococcum* (strain BNT-09-Ac), an N2-fixing and plant growth promoting bacterium (PGPR).

RIZOBACTER® PK is a liquid biofertiliser formulated with mycorrhizal fungi combined with a high concentration of two plant growth promoting rhizobacteria (PGPR): *Bacillus megaterium* (strain BC07-Bmeg) and *Pseudomonas fluorescens* (strain BC06-Pf).

Thanks to the secretion of organic acids by both rhizobacteria, **solubilisation of phosphorus is promoted** from insoluble forms and **mobilisation of potassium**, making it possible for the plant to assimilate them.

This year, 2023, we have started to carry out applications in different irrigated plots in the province and, in parallel, we have started some trials in the Bonilla experimental farm within the project

José Vera

Sales Delegate
Jaén

servalesa® days

The most specialised events of Servalesa

During 2023, we will propose the creation of the **Servalesa Days**: Events designed, developed and organised by Servalesa with a specific theme or crop, in a key geographical location.

During the first half of this year, we held two of these conferences that have aroused great interest and have had an extraordinary number of participants and repercussions.

Servalesa days
Stone fruit trees and table grapes

February 9 *Cieza*

We chose Cieza (Murcia) as the key location for these crops. It was a day marked by technical talks on topics such as the new fertiliser law, microorganisms in agriculture and possible solutions to problems in these crops. The highlight of this day was the intervention of our colleague Jesús Sanchez to talk about **TOTUSAL®**, our salt displacer based on carboxylic acids, and that of Iris García talking about the new sustainable molluscicide for the control of snails and slugs from Servalesa, **ELIREX® IP**.

Servalesa days
Melon and watermelon

March 30 *Tomelloso*

It could not be anywhere else on the planet, it had to be in Tomelloso, and so it was that we brought together around 100 professionals specialised in the crop. The event focused on the use of microorganisms for the management of melon and watermelon crops and on products such as **RENOV® SUPER 6**, **FUSVER®** AND **RENOV® TRICCO** were the main protagonists of the day together with our colleague Jose Manuel Sanchez, who led the event.

What will be our next Servalesa Days?

Stay tuned to our networks and subscribe to our newsletter.

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ELIREX®IP

The natural movement

SUSTAINABLE CONTROL OF SNAILS AND SLUGS

* Only available in Spain

ELIREX® IP is a product registered in the of plant protection products with the **NO. ES-01169**

Plant protection product certified by CAAE for its use in organic farming according to EU Regla-ment 2018/848

Importance of microorganisms

IN ORGANIC (AND CONVENTIONAL) FARMING

We have been hearing about the application of microorganisms in agriculture for quite some time now, although it is only in recent years that microbiology has started to become relevant. The constant disappearance of active ingredients, the increasing tolerance of pathogens, the growing awareness of the importance of the rhizosphere, the price of mineral fertilisers and the imminent appearance of the nutritional plan in field notebooks have led to the major multinational crop protection companies acquiring small companies dedicated to the production of microorganisms in order to incorporate them into their portfolio. The result is that the entire distribution already has several products based on microorganisms and words such as mycorrhiza, trichoderma or *Bacillus* have been familiar to us for some time now.

The use of microorganisms in agriculture is the present. Their use is widely developed in organic farming and is becoming more and more widespread in conventional farming, so it is essential to learn how to handle them correctly.
Macronutrient intake has changed in the last two years leading to a more austere trend. In other words, the aim is to achieve maximum utilisation by the plant and a lower input (more with less). In this respect, the rhizobacterium ***Azotobacter chroococcum*** is an atmospheric nitrogen fixer and plant growth promoter (**RIZOBACTER® N)**. And other rhizobacteria such as ***Bacillus megaterium*** and ***Pseudomonas fluorescens***, **formulated in combination with mycorrhizal fungi**they promote the solubilisation of phosphorus and potassium from insoluble forms through the secretion of acid substances, enabling the plant to assimilate them (**RIZOBACTER® PK**). In addition, they are able to produce high affinity chelators (siderophores) that bind iron and facilitate the correction of iron deficiency. All these rhizobacteria will allow us to reduce the supply of mineral fertilisers and improve their assimilation.

The following pathogen control measures shall be applied, *Bacillus subtilis* is a bacterium well known for its ability to colonise the rhizosphere very rapidly, being of great benefit to both soil and plant. By occupying this ecological niche, it tends to displace and hinder the development of a multitude of soil-borne fungi associated with vascular diseases. By incorporating an adequate balance of

ECO ATTITUDE

Find out more in our ECO-ACTITUDE web section

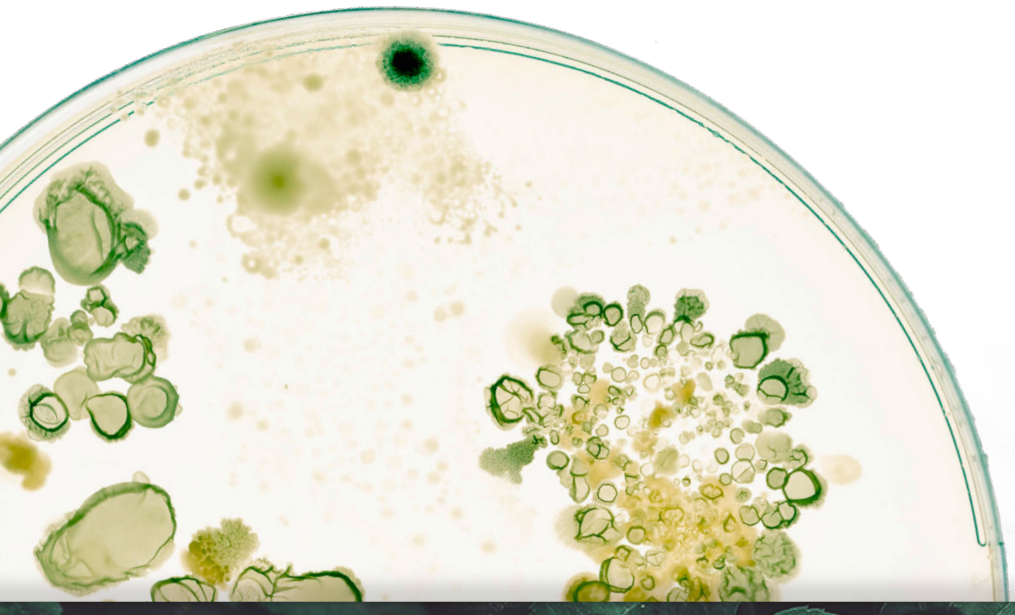
macronutrients (**FUSVER®**), it is possible to increase the nutritional and elicitor effect, allowing the plant to have more vigour against biotic and abiotic stresses, also in foliar applications.

One very interesting strategy is the use of a consortium of different strains. The consortium of *B. subtilis, B. pumillus, B. siamensis, B. amyloliquefaciens, B. megaterium* and *Pseudomonas fluorescens* in a single formulation (**RENOV® SUPER 6**), rapidly colonises the rhizosphere, minimising the development of pathogens, generates *biofilms* and other elements that improve root development, regenerates the soil by increasing the beneficial microbiota, stimulates the decomposition of organic waste, solubilises phosphorus and potassium, slows down the activity of nematodes...

These are just a few examples of what we know that microorganisms can do for agriculture. As living, non-genetically modified organisms, they are suitable for organic farming. And in conventional agriculture, they are a good tool to alternate with pesticide applications and have no application restrictions or safety periods.

Servalesa's B'Nature range is the result of more than thirty years of research, development and in-house manufacture of microorganism-based products. Controlling the whole process from an isolated strain to the finished product gives us the security and confidence to develop it in the field and obtain results.

The use of microorganisms in agriculture is increasing and they will eventually be present in all crops.



Antonio Maria Sanchez

Sales Manager Servalesa South

RENOV® SUPER 6 is a biostimulant based on a consortium of 6 plant growth promoting rhizobacteria based on *Bacillus subtilis, Bacillus pumilus, Bacillus siamensis, Bacillus amyloliquefaciens, Bacillus megaterium* and *Pseudomonas fluorescens*.

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