

BIOCONTROL SOLUTIONS: THE SIGNIFICANCE OF GROWTH FACTORS IN MICROBIAL PRODUCTION

The agricultural industry is undergoing a shift towards nonsynthetic products, and farmers and gardeners are seeking innovative solutions. As a global leader in plant-based ingredients, Roquette has developed a range of products that can be used to formulate and manufacture **stable biological formulations**, meeting efficiency efficiency and sustainable needs, such as biocontrol.

Unlock the potential of microorganisms with Roquette

Microorganisms represent an important part of agricultural products and play a diverse and complex role in plant cultivation. They are being used as plant care solutions to improve plant health and growth. Products that fall under the general classification of **biofertilizers/biostimulants** directly improve plant development and vigor. Microorganisms are also used for their biocontrol properties such as **bioinsecticide, biofungicide, bioherbicide and bionematicide**.

As a result, our scientific team are constantly working on extensive knowledge in fermentation, specifically in the development of microorganisms **using growth factors**. With our expertise, we are at the forefront of the development of new agricultural products that are both sustainable and effective.

DEVELOPING SUSTAINABLE BIOCONTROL SOLUTIONS BY ENHANCING MICROORGANISMS

Biocontrol solutions, also named **biopesticides**, use living organisms to control or suppress biotic stresses that can damage crops and other plant-based resources. Microorganisms (bacteria, fungi, and viruses) are used in biocontrol to target specific diseases without harming other organisms.

Agricultural stakeholders are in demand of biocontrol products with proven efficiency on pest resistance that are nonchemical based and authorized in their markets (see Fig. 1).

Therefore, it is essential to support biocontrol producers in the production of molecules of interest that are produced by microorganisms.

In addition, microorganisms are dependent on their culture medium and require key nutrients to develop in optimal conditions. Roquette's protein extracts provide essential nitrogen and growth factors that support robust growth and yield of microorganisms.

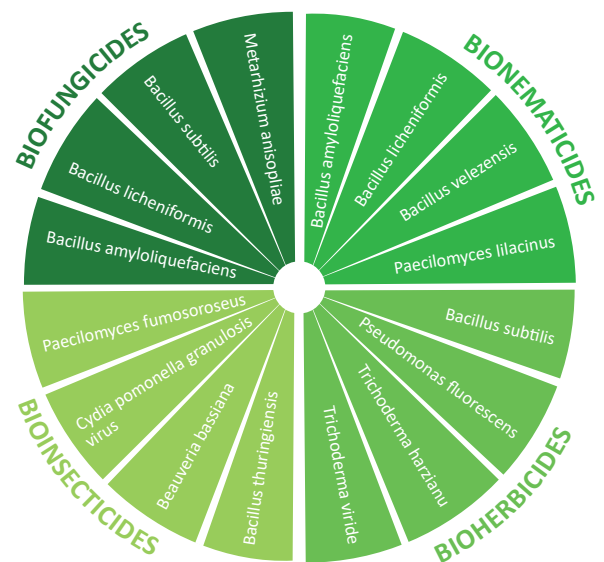


Fig. 1: Microbial species whose strains, or the products thereof, are registered with the U.S. EPA and/or European Commission.



FERMENTATION EXPERTISE – CASE STUDY (*B. LICHENIFORMIS*)

Bacillus licheniformis is a bacterium commonly used in the production of **enzymes, antibiotics or biopesticides**.

A formulation study was performed to test growth of *B. licheniformis* with different blends of nitrogen sources: **SOLULYS® 048** corn protein extract, **NUTRALYS® H85** pea protein extract, and **TUBERMINE® FV** potato protein extract. The goal was to identify the blend that supports the optimum growth of this bacterium.

The contour plot (see Fig. 2) shows how the main component proportions impact growth of *B. licheniformis*. The highest growth is the darkest green area of the plot, which identified a blend of all three proteins as the preferred protein mixture composition.

The optimized blend was used to design confirmation studies in bioreactors.

Mixture contour plot of OD600
(component amounts)

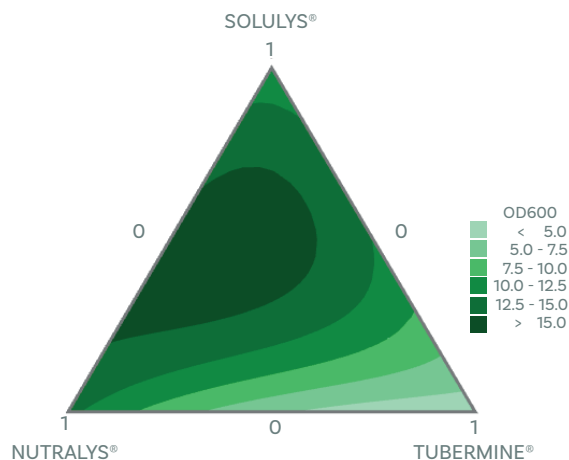


Fig. 2: Design of experiment for testing optimum nitrogen source blends comprising SOLULYS® 048, NUTRALYS® H85, TUBERMINE® FV.

FORMULATIONS THAT ENHANCED GROWTH FERMENTATION

The optimized formulation was scaled up to 1L stirred tank reactors to confirm the performance of the three-product blend.

The performance of the formulation was compared to traditional industry standards composed of Nutrient Broth + Tryptone and a mix of Yeast Extract + Peptone + Tryptone. All conditions were tested at an equivalent total nitrogen basis. The growth and viability of *B. licheniformis* was similar to, or slightly better, in Roquette's products' blend than in the two industry standard formulation media (see Fig. 3 and 4).

For better growth, Roquette scientists recommend a mixture of 50% SOLULYS® 048 with 25% NUTRALYS® H85 and 25% TUBERMINE® FV (on per nitrogen basis).

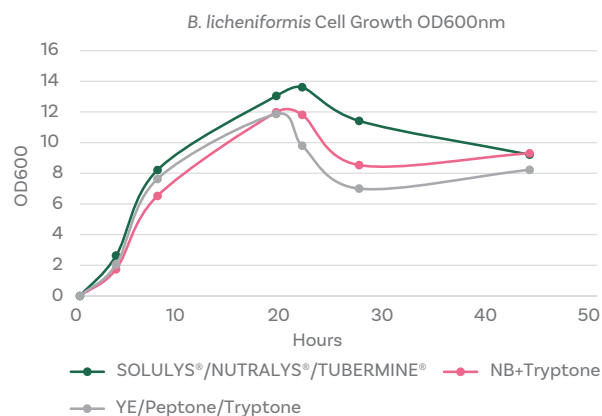


Fig. 3: Comparison of viability of *B. licheniformis* through time depending on nitrogen source blends.

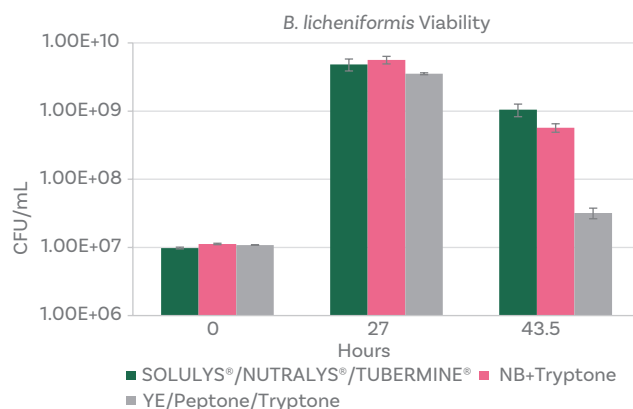


Fig. 4: Comparison of cell growth of *B. licheniformis* depending on nitrogen source blends.

Roquette has made significant strides to support customers in developing safe and effective biologically derived pesticides through fermentation processes. By utilizing plant-based protein extracts as growth factors, our technical team of scientists is able to develop optimal solutions to support customers' unique needs. Roquette's goal is to establish a technical understanding of their customers' products and support their manufacturing processes or formulation requirements, ultimately providing high-value technical solutions.

