**IConBM2026, International Conference on BIOMASS 24-27 May 2026 Bologna, Italy.**

# Screening of Microalgal Species for Biostimulant and Biofertilizer Applications

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## Abstract

The increasing dependence on chemical fertilizers has raised environmental concerns due to their low absorption by crops and the subsequent pollution of ecosystems. The transition towards sustainable agriculture requires the development of environmentally friendly alternatives to synthetic fertilizers. Microalgae are emerging as a promising solution, functioning effectively as both biofertilizers and biostimulants. Microalgal biomass is rich in essential nutrients and phytohormones that enhance plant growth, offering an ecological approach to improving agricultural productivity.

In this study, eight species, including *Arthrospira platensis* (standard and phosphorus-limited), *Nannochloropsis* sp., *Chlorella* sp., *Chlorella vulgaris*, *Acutodesmus obliquus*, *Parachlorella kessleri*, *Chlorella vacuolata*, and an isolated mixed culture, were evaluated for their potential as biostimulants and biofertilizers cultivated under autotrophic conditions. Biomass concentrations ranged from 0.57 to 1.30 g $L^{-1}$, with the highest value reported for the mixed culture. Biomass analysis revealed nitrogen content up to 8.8% and 8.2% for *Chlorella* sp. and *C. vulgaris,* respectively, suggesting their potential application as nitrogen-rich biofertilizers.

Biostimulant activity was evaluated using different bioassay tests, including germination index, rooting assays, and plant growth tests, under different concentrations using both the whole culture and the supernatant. Biostimulant effects depended on both concentration and the applied fraction, with noticeable differences between whole biomass and supernatant. *Chlorella vulgaris* and *Chlorella* sp. exhibited strong stimulatory effects, with rooting activity exceeding 150% of the control, whereas *Nannochloropsis* sp. induced inhibitory effects. Comparison between whole culture and supernatant fractions indicated that both intracellular and extracellular compounds contribute to plant stimulation. Strain selection should be based on a combined evaluation of nutrient composition (N-P-K) and biostimulant activity to ensure sustainable application.

This study is a primary stage of selecting the most suitable species as substitutes for synthetic fertilizers. Overall, this study highlights the potential of selected microalgal strains as sustainable agricultural inputs and provides a basis for further optimization toward practical applications.

### Acknowledgement

This research work was financially supported by the research program "BioBOOST: Development of innovative competitive biostimulants and biofertilizers through cultivation of photosynthetic microorganisms". The project is implemented in the framework of SUB1.1 call "Clusters of Research Excellence (CREs)" under the National Recovery and Resilience Plan "Greece 2.0" funded by the European Union – NextGenerationEU (Project Number: ΥΠ3ΤΑ-0561393).