

A symbiotic biostimulant: combining pro- and pre-biotics to face the current Agricultural challenges



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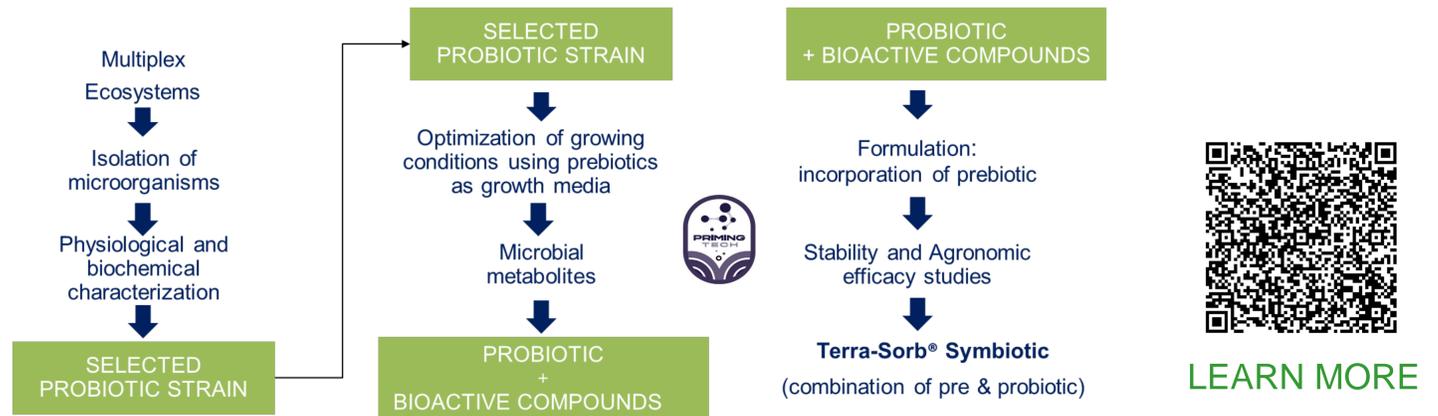
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INTRODUCTION

Terra-Sorb® SymBiotic (TSS) is a next-generation biostimulant combining L- α -amino acids and the extremophile bacterium *Bacillus velezensis* PH-023 fermented by Priming Tech™, an innovative fermentation process where PH-023 is grown directly in the same liquid carrier used for final formulation. This enhances PH-023 viability, activity, and root colonization leading to better nutrient uptake and stress resilience.



RESULTS

Untargeted metabolomic analysis UHLC-MS/MS

A greater number of beneficial metabolites were produced by the bacteria when using Priming Tech (FB_PA) than in a conventional media (FB_M).

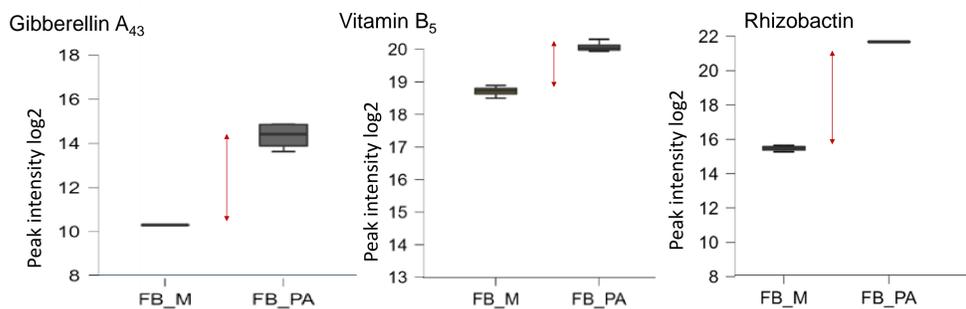


Fig.1 Promoted biosynthesis of Gibberellin A₄₃ (most active form), Vitamin B₅ (plant growth stimulation) and siderophore Rhizobactin (iron assimilation).

Population dynamics & root colonization

A strain-specific qPCR and viability qPCR (v-qPCR) detect and quantify live spores in tomato rhizosphere treated with TS symbiotic.

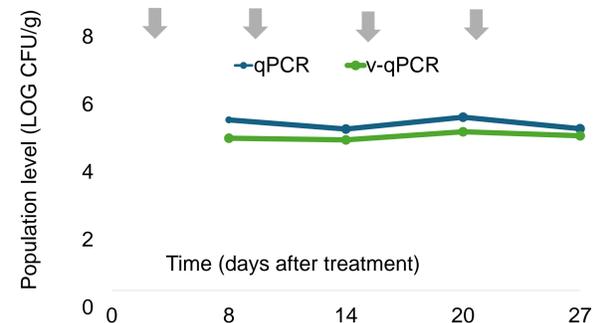


Fig. 3. Population level (log cfu/g) of PH-023 estimated by qPCR & v-qPCR amplifying DNA from rhizosphere samples of tomato plants treated with TSS. Grey arrows show product treatments.

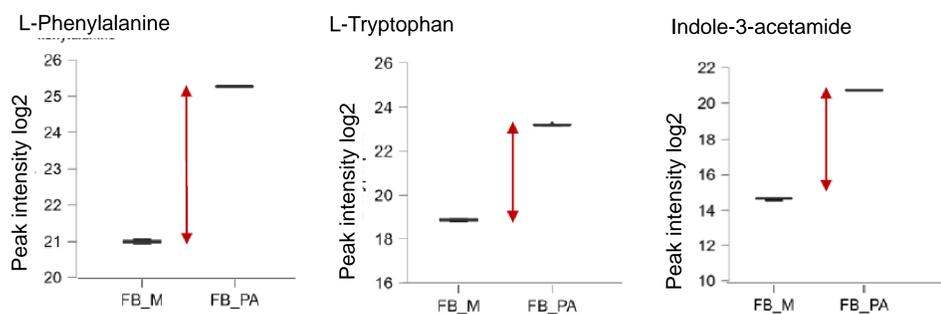


Fig.2 Promoted biosynthesis of amino acids (L-Phe) and auxin precursors (L-Trp & IAM)

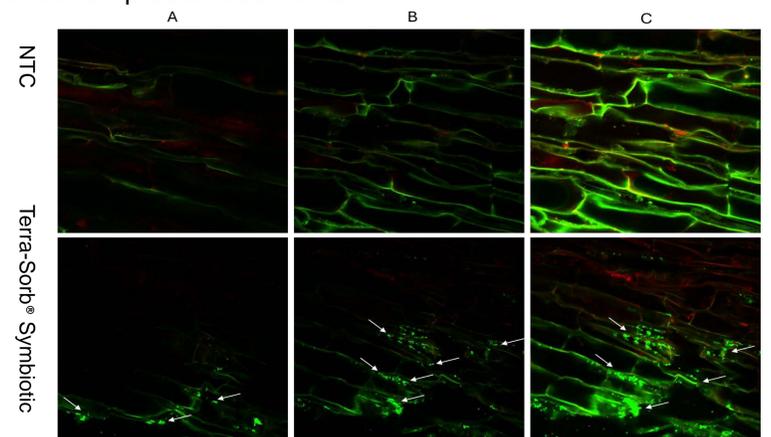


Fig. 4. Tomato root surface colonization by viable PH-023 cells is shown with white arrows after 7 days of the 3rd application of TSS in comparison with non-treated control (NTC). Viable bacteria fluoresced green and non-viable red. Confocal microscopy images taken along the z-axis show colonization near the surface (A) and deeper in the root (B and C).

Priming Tech™ promotes metabolite production by PH-023 like amino acids, phytohormones' precursors, siderophores, vitamins and so on with beneficial features for crops.

Successful interaction between PH-023 and tomato plants roots treated with TS symbiotic was observed. PH-023 viable cells colonized tomato plants rhizoplane under greenhouse conditions.

Additional information:

Utgés-Minguell, L.; Sierras-Serra, N.; Marín, C.; Pintó-Marijuan, M. Enhanced Production by Terra-Sorb® Symbiotic Biostimulant in Two Model Species Under Nitrogen Stress. *Plants* 2025, 14, 1087.

This cutting-edge system -patent pending- fermentation technology guarantees a higher production of beneficial metabolites by the bacteria PH-023. Consistent with strain-specific qPCR and v-qPCR assays, PH-023 remains viable in the rhizosphere and colonizes tomato roots.