HUN REN ATK INSTITUTE FOR SOIL SCIENCES

iASK INSTITUTE OF ADVANCED STUDIES KŐSZEG

MINISTRY OF AGRICULTURE

AKI 1954–2024

Pázmány Péter Katolikus Egyetem

Budapest Soil Health Forum

BSHF

Book of Abstracts

4 December 2024, Budapest, Hungary

Budapest Soil Health Forum

(BSHF2024)

Book of abstracts

International conferences, Workshop, and Panel discussion on

4 December 2024, Budapest, Hungary

edited by

Nándor Csikós, Ágota Horel, Gergely Tóth, Zsófia Bakacsi

cover

Ágota Horel

copy editor

Ágota Horel and Nándor Csikós

Institute for Soil Sciences, HUN-REN Centre for Agricultural Research

Budapest

2024

Main organizers:

Institute for Soil Sciences, HUN-REN Centre for Agricultural Research

(HUN-REN ATK Talajtani Intézet – TAKI, Budapest, Hungary)

Institute of Advanced Studies Kőszeg (IASK), Kőszeg, Hungary

Institute of Agricultural Economics (AKI), Budapest, Hungary

Pázmány Péter Catholic Univiversity, Budapest, Hungary

Ministry of Agriculture, Budapest, Hungary

Scientific Committee:

Nima Shokri, Vladimir Ciric, Zoltán Szántói, Carlos Guerra, Stjepan Husnjak, Kari Ylivainio, Vesna Zupanc, Dragana Vidojevic, Teodor Rusu, Lubos Boruvka, Endla Reintam, Zhanguo Bai, Fabio Terribile, George Bilas, Calogero Schilacci, Xiangbin Kong, Xiubin Li, Anke Schickling, Ahmad Faizal Abdull Razis, Nunzio Romano, Ganlin Zhang, Tomáš Řezník, Abdul Mouazen, Francesco Vuolo, Lutz Weihermüller, Eyal Ben Dor, Martin Volk, Violette Geissen, Jorge Mataix-Solera, Yijian Zeng, Yonggen Zhang, Matjaz Glavan, Dominika Krzeminska, Tobias Weber

Organizing Committee:

Zsófia Bakacsi, Nándor Csikós, Anett Gundel-Fekete, Tamás Hermann, Ágota Horel, Gábor Király, Annamária Laborczi, Péter László, Judit Pump, Petra Stankovics, Anita Szabó, Brigitta Szabó, Tünde Takáts, Gergely Tóth
(HUN-REN ATK TAKI, Budapest, Hungary)

ISBN 978-615-5387-13-5

DOI: 10.6084/m9.figshare.27988046

Biological solutions to phosphorus deficiency: promoting maize growth with phosphate-solubilizing bacteria

Sofia I.A. Pereira and Paula M.L. Castro

Universidade Católica Portuguesa, CBQF - Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal; sapereira@ucp.pt

The agricultural sector is grappling with numerous challenges, including the effects of climate change and the decline in soil fertility, which are significantly hindering the production of essential food crops. To address the growing global food demand and compensate for nutrient-depleted soils, farmers often apply large quantities of chemical fertilizers. Unfortunately, this approach raises environmental and health concerns and fails to address the low bioavailability of certain nutrients, particularly phosphorus (P). Furthermore, natural P reserves are limited, making it crucial to mobilize P from every possible source. Soil microorganisms, particularly phosphate-solubilizing bacteria (PSB), can convert insoluble forms of P into plant-available forms, thereby enhancing crop growth in P-deficient conditions. This work explores innovative strategies to enhance P availability and promote sustainable agricultural practices using phosphate-solubilizing bacteria (PSB). The research is focused on three main objectives: (i) evaluating the effects of PSB inoculation on the growth of maize in a P-deficient soil; ii) assessing the ability of PSB to solubilize calcium phosphate from by-products; and (iii) devising new formulations of PSB using by-products-derived carriers.

Three PSB strains, Rhodococcus sp. EC35 (B1), Pseudomonas sp. EAV (B2), and Arthrobacter nicotinovorans EAPAA (B3) were tested individually and in combination (BM) on maize grown in a P-deficient soil. The soil received three different P treatments: control (no P fertilizer), soluble P (KH_2PO_4), and sparingly soluble P (tricalcium phosphate; TCP). Overall, PSB inoculation enhanced maize growth across all treatments. In the absence of P fertilization, bacterial inoculation increased P accumulation in both roots and shoots, as well as dry biomass by approximately 20%. Strain B2 exhibited the best results in soils with soluble P, boosting root and shoot biomass by 102% and 63%, respectively. In TCP-amended soils, PSB inoculation, particularly with strain B3 and the mixed inoculants (BM), also promoted maize biomass and P uptake.

In addition, the research includes efforts to develop new formulations of PSB using carriers derived from by-products. Indeed, several strains showed ability to solubilize hydroxyapatite obtained from fish by-products, suggesting that by-product of the fishing industry, could serve as an alternative P source when combined with PSB. These advances will enable to create more efficient and sustainable biofertilizers, further contributing to environmentally friendly agricultural practices.