WEEK OF MICROBIAL TECHNOLOGIES

ABSTRACTS BOOK

7-11 NOVEMBER, 2022
LJUBLJANA, SLOVENIA

Jožef Stefan Institute

SURF BIO

Surfbio project has received funding under the European Union's Horizon 2020 research & Innovation programme under grant agreement N° 952379

BOOK OF ABSTRACTS

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Book of Abstracts: Week of Microbial Technologies

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PREFACE

The Week of Microbial Technologies –MicroTechWeek– was a five-day summit full of project meetings and open public events, such as an industrial workshop, a poster session and a hands-on training, aimed at gaining knowledge on the applications of surface and colloid biology in different industrial sectors. It was jointly organised by the European projects SURFBIO and GREENER.

The main goal of this event was networking between EU projects and stakeholders, sharing applications of surface and colloid biology and planning new initiatives based on microbiology technologies.

This book gathers the contents generated in the SURFBIO industrial workshop and in the poster session. Professionals from international companies and organisations contributed knowledge from different perspectives, creating very fruitful roundtables for the project partners.

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ABSTRACTS INDUSTRIAL WORKSHOP

INFLUENCE OF MICROBIAL AND ORGANIC FERTILIZERS ON BACTERIAL COMMUNITIES COMPOSITION DURING KEY GROWTH PHENOPHASES OF MAIZE

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INTRODUCTION

Maize is among the three world's most important and widely grown cereals (Seyi-Amole & Onilude, 2021). The excessive and long-term application of agrochemicals for providing maize with essential nutrients, required for the development of all growth phenophases and for yield enhancement, leaves adverse consequences for human health and the environment (Khaliq et al., 2004). Although their use is inevitable to meet the increasing demand of the growing human population for a healthy food supply, organic fertilizers and biofertilizers (microbial fertilizers) are becoming recognized as effective, economically feasible, and environmentally sound alternatives for sustainable agriculture (Lawal & Babalola, 2014; Hui et al., 2017; Mahanty et al., 2017). The main objective of this study was to evaluate the influence of the microbial inoculant Phytobiotic (PHY), containing a consortium of Bacillus subtilis sp. subtilis and Microbacterium sp., on native maize microbiome during key growth phenophases (seedling, flowering, and harvesting) under field conditions, as well as to compare whether differences in efficacy between PHY, poultry manure (PM) and their combination (PHY_PM) exist, based on yield parameters.

STATE OF THE ART

Seeds, roots, and soil samples were taken for metabarcoding analysis during four growth phenophases (I-IV). Samples of uninoculated seeds and soil, poultry manure, and seeds inoculated with PHY were primarily taken before sowing (phenophase I). Further, during the growing season [phenophases II (seedling), III (flowering), and IV (harvesting)] the effect of PHY, PM, and PHY_PM on maize seeds, roots, and soil microbiome was evaluated in relation to concurrently sampled negative controls. A total DNA from the collected samples was isolated, amplified with primers 515F/ 806R targeting the V4 region of the 16S rRNA, and subjected to next-generation sequencing (NGS). The obtained sequence data were bioinformatically processed and used for the evaluation of alpha and beta diversity. Yield and associated parameters (number of grown and fallen/broken plants, rating fence, plant vigor, the occurrence of Ustilago sp., and grain moisture) were evaluated after harvest.

RESULTS

Seeds exibited lower bacterial diversity compared to the soil, root, and manure samples.The most abundant taxon in uninoculated seeds pre-harvest was Pantoea, while in seeds treated with PHY the most abundant was Acinetobacter, followed by Pantoea, Pseudomonas, and Bacillus. After harvest, Pantoea and Pseudomonas prevearled in seeds. Soil bacterial communities mostly remained unchanged, regardless of the treatment (PHY, PM, and PHY_PM) applied or the tested phenophase, with uncultured Gaiellales and Bacillus being the most abundant. Contrarily, root bacterial communities differed in distribution and relative abundance of different taxa between phenophases and between treatments. The most abundant taxa in roots during the inial phenophase (II) was Pseudomonas. In the flowering phenophase (III), Bacillus prevealed with two to three times higher relative abundance in treatments with PHY or PM compared to the negative control, while Lechevalieria dominated in harvesting phenophase (IV). A statistically significant increase in maize yield was obtained in the treatment with PHY, with an average value of 650 kg/ha compared to the negative control. The lowest yield was obtained in the treatment with PM.

DISCUSSION

The prevalence of Acinetobacter, Pantoea, Pseudomonas, and Bacillus in seeds treated with PHY pre-harvest, indicates that treatment with PHY is highly beneficial considering the known plant growth promoting potential of these genera, that were also previously confirmed as core maize inhabitants (Mehta et al., 2021). As core members, Pantoea and Pseudomonas remained present after harvest. The benefit of the application of Bacillus-based fertilizers to soil is the enhancement of the plant-available forms of nutrients and the inducement of pest and pathogens defense systems (Radhakrishnan, et al., 2017). It is of crucial importance that none of the three treatments applied in this study affected the composition of the indigenous soil bacterial communities during four tested phenophases, which is highly important when selecting suitable agricultural practices. Shifts in root microbiome over maize growth could be related to the production of different root metabolites over the growing season (Bourceret et al., 2022). Roots were especially rich with genera (Pseudomonas, Stenotrophomonas, Sphingobacterium, Achromobacter) known as phosphate solubilizers (Mehta et al., 2021). Furthermore, Bacillus was dominant in roots in flowering phenophase. This genus is known for its wide spectrum of beneficial effects on plants, like phosphate solubilization, biosynthesis of growth hormones, antimicrobial activity, induction of systemic resistance, etc. (Dimkic et al., 2022).

CONCLUSIONS

Considering the above-mentioned effect of PHY on maize yield incensement, its non-disruption effect on the core microbiome, and the positive effect on enhancing the presence of beneficial bacterial genera, this microbial inoculant could be proposed as a promising alternative to chemicals and organic fertilizers in maize cultivation.

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