frontiers | Frontiers in Sustainable Food Systems

TYPE Editorial
PUBLISHED 18 July 2023
DOI 10.3389/fsufs.2023.1251054

OPEN ACCESS

EDITED AND REVIEWED BY
Autar Krishen Mattoo,
Agricultural Research Service (USDA),
United States

*CORRESPONDENCE
Javid A. Parray
✉ javid06@gmail.com

RECEIVED 30 June 2023
ACCEPTED 10 July 2023
PUBLISHED 18 July 2023

CITATION
Parray JA, Egamberdieva D, Abd_Allah EF and Sayyed RZ (2023) Editorial: Soil microbiome metabolomics: a way forward to sustainable intensification.
Front. Sustain. Food Syst. 7:1251054.
doi: 10.3389/fsufs.2023.1251054

Editorial: Soil microbiome metabolomics: a way forward to sustainable intensification

Javid A. Parray[1]*, Dilfuza Egamberdieva[2,3], Elsayed Fathi Abd_Allah[4] and R. Z. Sayyed[5]

[1]Department of Higher Education, Government Degree College Eidgah, Srinagar, India, [2]Institute of Fundamental and Applied Research, National Research University, (TIIAME), Tashkent, Uzbekistan, [3]Central Asian University, Tashkent, Uzbekistan, [4]Plant Production Department, College of Food and Agricultural Sciences, King Saud University, Riyadh, Saudi Arabia, [5]Department of Microbiology, PSGVP Mandal's S I Patil Arts, G B Patel Science and STSKV Sangh Commerce College, Shahada, India

KEYWORDS

microbiome, metabolome, sustainability, crop productivity, omics, technology

Editorial on the Research Topic
Soil microbiome metabolomics: a way forward to sustainable intensification

Introduction

The focus of the Research Topic is related to improving plant productivity, improving the architecture, and maintaining the balance between soil and plant health. This Research Topic covers various inter/intra-communications, like quorum sensing by releasing different signal molecules with particulate phytohormones and bacteriocins.

Metabolites or the metabolome are the bands of molecules produced by various processes within cells or the end products of the biological system in response to the outer or inner changes for improving the microbial health in the soil rhizobiome. A contemporary approach to microbial miscellany invigorates fast progress in microbiome research and unique advancements in generating complete datasets of natural processes of all essential life molecules, including genes, protein, and metabolites. The microbial metabolites have been involved in microbial interactions and can perform important functions in ecological interactions.

A widely studied mechanism of microbial interaction is quorum sensing which consists of a stimuli-response system related to cellular concentration. The production of signaling molecules allows cells to communicate and respond to the environment in a coordinated manner. The driving motivation for harnessing beneficial microbes and analyzing the metabolome is to improve the quality and productivity of crop plants.

Therefore, a multi-omic and coordinated research effort for plant microbes and metabolome and communication signaling pathways is the need of the hour to put into modern agricultural practices for sustainable agriculture. Omic studies are required to determine the role and understanding of beneficial strains and inoculation with crop varieties to improve plant architecture and other traits like stress tolerance and host-pathogen interaction. Multi-omic approaches are requisite for studying the mechanisms of plant-microbe interaction vis-à-vis the growth and development of crops. The metabolome signaling or two-way communication study is also a challenging thrust area that will provide new opportunities to reveal the understanding of plant-microbe interaction. The driving

motivation for harnessing beneficial microbes to treat various crop diseases is for crop plants' quality and productivity.

We approved and published seven research articles for the current Research Topic, comprising six and one pieces on plant beneficial properties of microbes and toxin producing cyanobacteria, respectively.

Among the articles related to studies on plant beneficial traits Bashir et al. revealed cyanobacterial species, the genes responsible for their cyanotoxin biosynthesis, and the use of advanced proteomic methods to describe the cyanotoxins.

Fitriatin et al. found that application of P fertilizer increased soil P availability, and upland rice yields. By reducing the soil's P organic content, this bacterial inoculation that solubilizes phosphate can improve P organic mineralization. When *Burkholderia* sp. and *Penicillium* sp. mixed inoculant is applied, the effects of increasing P available content, soil phosphatase activity, organic P mineralization, P content of the plant, and upland rice production are improved. As a biofertilizer, PSM lowered the dose of inorganic fertilizers by up to 25%.

Vafa et al. examined how two wheat cultivars' development and yield were affected by the use of supplemental irrigation, beneficial soil microbes, and biological substances in the form of bio-fertilizers (as another way to mitigate the impacts of drought stress). Supplemental irrigation improved the attributes of RWC, SPC, enzymatic and non-enzymatic antioxidants, reduced oxidative stress-related damage, decreased MDA levels, and boosted plant growth and grain production in both wheat cultivars, according to the findings of the current study.

Global support for the use of biopesticides derived from biological sources, such as plant extracts and the usage of microorganisms, is increasing. Suriani et al. evaluated the effect of *Piper caninum* leaf extract and *Brevibacillus agri* on the leaf spot pathogen, *Nigrospora oryzae*, and plant growth and yield of Bali red rice. In comparison to all other treatments, biological applications considerably enhanced the number of productive tillers, the number of grains per panicle, and grain yield.

Among the articles related to plant beneficial applications, Joshi et al. characterized bacteria *Pseudomonas aeruginosa* NJC4 (OP289324), *Serratia marcescens* NJC21 (OP289323), and *Bacillus* spp. isolated from medicinal plant for their ability to produce multiple plant beneficial activities. The results of this study support the hypothesis that microbial consortiums made up of many efficient strains may be more potent than single cultures in increasing agricultural productivity in a sustainable manner. Ait-El-Mokhtar and Baslam article focused on the promise of holo-omics to produce a more comprehensive understanding of molecular networks, and we also go through its use and existing constraints in microbial horticulture. According to the study of Eswaran et al. the consortium of PGPR biostimulants significantly the consortium of PGPR biostimulants significantly surpassed the un-inoculated control in terms of growth, photosynthetic pigments, nodulation status, leghaemoglobin content, yield attributes, and biofortification of seed nutrients in oilseed crops grown in pots and on the field.

We are excited to share this Research Topic with readers of Frontiers in Sustainable Food Systems. We hope that the journal's readers will find this Research Topic fascinating and helpful, and that it will increase understanding of the soil microbiome. Future study will surely uncover additional fascinating features of the soil microbiome and its significance to environmental sustainability through the application of cutting-edge research techniques and close international collaboration.

Conclusions

To conclude with the sustainable production and crop improvement involves either modulation of metabolic flux through microbiome through signaling mechanisms or engineering of microbiota.

Author contributions

JP and DE were conscientious for the overall preparation of the Research Topic and took the lead in writing the initial draft of the editorial by exhibiting the ideas and concepts of all contributing articles. EA_A and RZS equally contributed to the review and editing process and provided critical feedback that enriched the findings of the editorial. All authors discussed together the results and contributed to the final version of the manuscript.

Acknowledgments

We want to thank the contributors, editors as well as all the reviewers involved during the whole process.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note