

Preface

The rapidly increasing human population has placed tremendous pressure on agriculture sector to provide sufficient quantity and better quality foods in a more sustainable manner. In order to achieve food security, artificially developed chemicals (fertilizers/pesticides) have been used over the years in energy-intensive agricultural practices to overcome the nutrient deficiencies of the soils and hence to optimize the food production. Even though the synthetic fertilizers among agrochemicals, for example, single super phosphate, when applied in different production systems, have shown promising results, when used excessively and inadvertently, they cause a profound diminishing impact on soil health (soil fertility) and concurrently diminish the viability and productivity of crops. Phosphorus among soil constituents is one of the most important plant nutrients next to nitrogen. Even though there is no deficiency of phosphorus reserves in agronomic soils worldwide, the availability of soluble phosphorus to plants is a major global problem due largely to its rapid fixation and precipitation ability. This, in effect, leads to severe phosphorus deficit in soils. To mitigate such acute phosphatic problems, especially in resource crunch agricultural sector, chemically synthesized fertilizers are applied on a regular basis and at larger scale. Even though the use of artificial fertilizers in agricultural practices has resulted in some better results, their use and misuse has been questioned due in part to its cost and hazardous impact onto natural environment including soil ecosystems. Considering these challenging threats, the interest and awareness have been generated among scientists to uncover some easy-to-operate options. In this regard, in order to accomplish lab-to-land concepts, the naturally abundant yet functionally divergent phosphate-solubilizing microorganisms (PSM) have attracted greater attention of the farm practitioners due to its low cost and easy-to-apply approach. Indeed, PSM offer a practicable alternative to hugely expensive chemical P fertilizers. Application of PSM involving bacteria, fungi, and actinomycetes in agricultural practices has shown some overwhelming results with different crops like legumes, vegetables, and cereal, etc. Apart from providing phosphorus to plants, these organisms also profoundly increase the plant growth by supplying other major plant nutrients like nitrogen via N_2 fixation, increasing the availability of plant hormones, absolving the lethal impact of pathogenic microorganisms, and secreting

a few enzymes, etc. Thus, PSM possessing numerous multifunctional plant growth-promoting abilities could be of great practical help to both farmers and students/teachers/scientists across different ecological regions of the world.

Phosphate-Solubilizing Microorganisms: Principles and Application of Microphos Technology is an inclusive source of information on numerous useful aspects of phosphate-solubilizing microorganisms which could be applied and practiced for enhancing crop production in distinctly variable agro-ecosystems. This book highlights both fundamental information on the subject and strategies as to how the PSM could be raised to the level of microbial inoculants (microphos), mechanisms, and physiological functions of PSM and factors affecting the growth and phosphate-solubilizing potentials of such microbes. Furthermore, there are separate chapters on the role of phosphate-solubilizing fungi and actinomycetes in the survivability and development of some economically important plants. Discussion on cold-tolerant PSM as elaborated in this book may upgrade and popularize the use of such microbes in enriching the soil P pool and hence increasing the agricultural produce in temperate climatic zones of the world. The ecological diversity and biotechnological implications of PSM and their consequent impact on crops are discussed separately. Special attention is given on to assess the sole/synergistic/additive effects of PSM on some important legumes and cereal crops grown distinctively in different production systems. This book further describes the role of PSM in improving the nutrient uptake and consequently the yield of aerobic rice. The book also highlights a broad and updated view of the management of plant diseases using phosphate-solubilizing microbes. Moreover, the book describes as to how the consortia of plant growth-promoting rhizobacteria other than phosphate solubilizers facilitate the plant growth under stressed environment. The impact of PSM on the growth and development of some notable vegetable crops is also considered and effectively discussed.

The major aim of **Phosphate-Solubilizing Microorganisms: Principles and Application of Microphos Technology** is to compose scientific information available so far in this area and to make this information available to readers and practitioners in a more meaningful and practical way so that maximum benefits of this technology could be achieved. The book gives an extensive and well-organized scientific coverage in the area of microphos and how the use of microphos technology could be exploited and extended to larger section of the agronomic society in an inexpensive and easy way. This book is likely to be of special interest to the postgraduate students, research scholars, teachers, scientists, and professionals working in the field of microbiology, soil microbiology, biotechnology, agronomy, plant sciences, plant physiology, and plant protection sciences. In addition to gratifying the desires of the academicians/professionals, **Phosphate-Solubilizing Microorganisms: Principles and Application of Microphos Technology** also provides information to the policy makers, inoculant making industries and the people practicing agriculture, and microbial biotechnology across the globe. Each chapter presented herein is contributed by highly experienced academicians/professionals, and attempts have been made to emancipate the quality information and updated knowledge on the subject for ultimate use in academics and/or agriculture practices.

We are very much grateful to our experienced and highly professional scientific colleagues who participated in this endeavor and contributed the state-of-the-art information and balanced scientific knowledge to make this book a reality. Chapters contributed by each scientist/teacher are well structured and involve suitable tables and well-formatted figures. The cooperation extended by our research scholars in designing and weaving the manuscripts presented in this book is deeply acknowledged. We are undeniably very appreciative of our family members who provided their full support and affection during the entire period of this book preparation. Above all, AZ and MSK are extremely thankful to their adorable children, Zainab and Butool, for their patient and helpful attitude all through the book project. Further, we appreciate the great efforts of book publishing team at Springer-Verlag, Switzerland, in responding to all our queries very promptly and earnestly. Finally, if someone finds any typographical mistakes or otherwise in this book, they are requested to inform us so that the mistakes can be corrected and improved in subsequent print/edition. We also invite suggestions and healthy criticism from the readers of this book in order to improve the scientific contents in future print/edition.

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