Preface

Vegetables are one of the most essential components of human dietary systems due to their high nutritional value which provides carbohydrates, proteins, vitamins, and several other useful food elements. Due to these, the consumption of vegetables among health-conscious consumers has increased considerably. In order to fulfill the growing demands of vegetarians, there is an urgent need to enhance the production of fresh and quality vegetables. To optimize production, growers often use energy-intensive fertilizers and pesticides in vegetable farming. The excessive and abrupt application of such agrochemicals for longer duration has, however, been found to disrupt soil fertility and consequently the production of quality vegetables. In addition, soil destruction through abiotic stress and loss of soil fertility following various soil management practices has also compounded vegetable farming in recent times. Therefore, to avoid/minimize the consistent application of expensive and disruptive chemicals in vegetable production practices, viable and practically applicable alternative strategies need to be developed. In this regard, the advent of microbial preparation often called biofertilizers involving many useful soil microbiotas has provided an effective solution to high-input agrochemicals. And hence the use of nonpathogenic rhizosphere microbes to enhance vegetable production is currently considered as a safe, viable, and low-cost alternative to chemicals. Since soil microorganisms are inexpensive and do not cause any pollution, they have been used repeatedly for maximizing the production of many crop plants across different agronomic practices. Also, even though there are no direct connections between many rhizosphere microfloras and vegetables, yet several plant growth-promoting rhizobacteria (PGPR) spanning different genera have been used to facilitate the growth and yield of numerous vegetables through different mechanisms.

Recently, the interest in using renewable resources like beneficial soil microbes for producing fresh and high-quality vegetables has grown substantially. However, most of the farmers engaged in growing organic vegetables, even though they adopt such microbial strategies, do not have correct understanding of such bioformulations and do not know how to apply them properly so that maximum benefits are achieved. Additionally, soil microflora has become important due to its role in disease management and reclamation of derelict soils (salinized/polluted soils). The success of microbes, however, depends largely on their inherent ability and the acceptance and adoption by the vegetable growers. A considerable amount of research work has been conducted to explain the impact of rhizosphere microbes in

the enhancement of vegetable crops, but very few efforts have been made to systematize such information that could benefit students/teachers/horticulturists and progressive vegetable-growing farming communities. Considering the importance of beneficial soil microbes and success achieved so far, efforts herein have been directed to highlight the impact of microbiota on the quality and yield of vegetables grown in different agronomic regions of the world. Furthermore, efforts in this book will also be made to identify most suitable organisms which could effectively be applied for optimizing vegetable production.

Microbial Strategies for Vegetable Production edited by experts focuses on the fundamental and practical aspects of beneficial soil microbes employed commonly in the sustainable production of vegetables. This book further presents exceptional, simplified, and wide-ranging information on important soil microbiota which could be used to enhance the production of vegetables in different regions. The book deals with the application of microbial inoculants and many plant growth-promoting rhizobacteria (PGPR) including nitrogen-fixing and phosphate-solubilizing organisms in vegetable production. Even though there is no direct connection between nitrogen-fixing organisms and vegetables as reported for rhizobia and legumes, yet the recent developments in the use of nitrogen-fixing, plant growth-promoting rhizobacteria in sustainable production of vegetables have been sufficiently discussed. The application of PGPR in the improvement of vegetable crop production under stress conditions like salinized soils, drought, high and low temperature, and nutrient stress and heavy metal-stressed conditions is broadly covered in the book. The role of PGPR in growth and yield promotion of tomato is dealt separately. This book also provides information on sources of heavy metal pollution, metal toxicity to vegetables, and bioremediation strategies adopted to clean up metal-contaminated soils. Furthermore, the role of microbes in enhancing the quality and production of vegetables grown under metal-polluted soil is discussed separately. Recent advances in effective disease management by PGPR to control phytopathogens causing diseases on onion (*Allium cepa*), cucumber (*Cucumis sativus* L.), lettuce (*Lactuca sativa*), spinach (*Spinacia oleracea*), and broccoli (*Brassica oleracea*) are discussed paving the way for exploration of microbes for other vegetable crops as well. This book, therefore, can be used as a reference which is likely to be a very useful resource for vegetable growers.

We are highly thankful to our learned colleagues who from different countries contributed their recent and updated chapters in this informative and most demanding book. All chapters presented in this book are written superbly and give elaborate and meaningful information. We would also like to thank our research scholars who were easily available at all times during the preparation/compilation of this book and made this book a reality. *Microbial Strategies for Vegetable Production* provides enough information especially to farmers engaged in vegetable production. The facts and data together with various methodologies presented here may be an imperative source material. This book will practically be valuable for a wide range of people including students/researchers/vegetable growers.

The support and patience of our family members especially our two adorable daughters Zainab and Butool during the entire period of preparation and

compilation of this book were commendable for which we are extremely thankful to them. We are also very grateful to the publisher of this book in responding to all our queries very promptly and urgently. Finally, we will be extremely happy and obliged if someone identifies some conceptual or printing mistakes and inform us. We will try to resolve them in our next edition.

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