

Dhananjaya Pratap Singh  
Harikesh Bahadur Singh  
Ratna Prabha *Editors*

# Microbial Inoculants in Sustainable Agricultural Productivity

Vol. 2: Functional Applications

 Springer

# Microbial Inoculants Sustainable Agricultural Productivity

**Rakesh Singh Sengar, Ashu Singh**



## **Microbial Inoculants Sustainable Agricultural Productivity:**

*Microbial Inoculants in Sustainable Agricultural Productivity* Dhananjaya Pratap Singh, Harikesh Bahadur Singh, Ratna Prabha, 2016-03-23 The performance of crops in the soil largely depends on the physico chemical components of the soil which regulate the availability of nutrients as well as abiotic and biotic stresses. Microbes are the integral component of any agricultural soil playing a vital role in regulating the bioavailability of nutrients, the tolerance to abiotic and biotic stresses and management of seed borne and soil borne plant diseases. The second volume of the book *Microbial Inoculants in Sustainable Agricultural Productivity Functional Applications* reflects the pioneering efforts of eminent researchers to explore the functions of promising microbes as microbial inoculants, establish inoculants for field applications and promote corresponding knowledge among farming communities. In this volume, readers will find dedicated chapters on the role of microbes as biofertilizers and biopesticides in the improvement of crop plants, managing soil fertility and plant health, enhancing the efficiency of soil nutrients and establishing systemic phytopathogen resistance in plants, as well as managing various kinds of plant stress by applying microbial inoculants. The impact of microbial inoculants on the remediation of heavy metals, soil carbon sequestration, function of rhizosphere microbial communities and remediation of heavy metal contaminated agricultural soils is also covered in great detail. In this Volume, a major focus is on the approaches, strategies, advances and technologies used to develop suitable and sustainable delivery systems for microbial inoculants in field applications. Subsequent chapters investigate the role of nanomaterials in agriculture and the nanoparticle mediated biocontrol of nematodes. An overview of the challenges facing the regulation and registration of biopesticides in India rounds out the coverage.

*Microbial Inoculants in Sustainable Agricultural Productivity* Dhananjaya Pratap Singh, Harikesh Bahadur Singh, Ratna Prabha, 2016-02-22 How to achieve sustainable agricultural production without compromising environmental quality, agro ecosystem function and biodiversity is a serious consideration in current agricultural practices. Farming systems growing dependency on chemical inputs, fertilizers, pesticides, nutrients etc. poses serious threats with regard to crop productivity, soil fertility, the nutritional value of farm produce, management of pests and diseases, agro ecosystem well being and health issues for humans and animals. At the same time, microbial inoculants in the form of biofertilizers, plant growth promoters, biopesticides, soil health managers etc. have gained considerable attention among researchers, agriculturists, farmers and policy makers. The first volume of the book *Microbial Inoculants in Sustainable Agricultural Productivity Research Perspectives* highlights the efforts of global experts with regard to various aspects of microbial inoculants. Emphasis is placed on recent advances in microbiological techniques for the isolation, characterization, identification and evaluation of functional properties using biochemical and molecular tools. The taxonomic characterization of agriculturally important microorganisms is documented along with their applications in field conditions. The book explores the identification, characterization and diversity analysis of endophytic microorganisms in various crops including

legumes non legumes as well as the assessment of their beneficial impacts in the context of promoting plant growth Moreover it provides essential updates on the diversity and role of plant growth promoting rhizobacteria PGPR and arbuscular mycorrhizal mycorrhizal fungi AMF Further chaptersexamine in detailbiopesticides thehigh density cultivation of bioinoculants in submerged culture seed biopriming strategies for abiotic and biotic stress tolerance andPGPR as abio control agent Given its content the book offers a valuable resource for researchers involved in research and development concerningPGPR biopesticides and microbial inoculants *Microbial Inoculants* Parul Chaudhary,Anuj

Chaudhary,2024-04-13 This book discusses the role of microbes in agriculture for plant attributes soil fertility and bio remediation which aid in sustainable agriculture Nowadays due to increase in human population it is essential to increase food productivity in the near future but exhaustive non sustainable agricultural practices such as the usage of agrochemicals threaten food security the economy and the environment globally Soil deterioration is the most serious environmental threat to food production resulting in poverty and hunger in developing countries As a result the global community has faced challenges regarding the development of ecologically sound efficient and long term alternative options to meet rising food requirements Therefore to contribute to food security the advancement of sustainable and innovative modern agriculture aimed at addressing environmental economic and social challenges connected with present intense non sustainable agriculture practices is required As a result beneficial microbial inoculants will be widely used in the development of new strategies to increase sustainable food production Bioinoculant application helps to provide nutrients that directly support soil health and sustainable food production Hence this book offers the role of microbial inoculants for better agronomical performance for sustainable advancement in agriculture and also pays attention to soil health improvement for extensive period benefits The book will be highly recommended for agriculture microbiologists agronomists plant pathologists and related areas **Microbial Inoculants in Sustainable Agricultural Productivity** Dhananjaya Pratap Singh,Dr. H. B.

Singh,Ratna Prabha,2016 How to achieve sustainable agricultural production without compromising environmental quality agro ecosystem function and biodiversity is a serious consideration in current agricultural practices Farming systems growing dependency on chemical inputs fertilizers pesticides nutrients etc poses serious threats with regard to crop productivity soil fertility the nutritional value of farm produce management of pests and diseases agro ecosystem well being and health issues for humans and animals At the same time microbial inoculants in the form of biofertilizers plant growth promoters biopesticides soil health managers etc have gained considerable attention among researchers agriculturists farmers and policy makers The first volume of the book *Microbial Inoculants in Sustainable Agricultural Productivity* Research Perspectives highlights the efforts of global experts with regard to various aspects of microbial inoculants Emphasis is placed on recent advances in microbiological techniques for the isolation characterization identification and evaluation of functional properties using biochemical and molecular tools The taxonomic characterization of agriculturally

important microorganisms is documented along with their applications in field conditions The book explores the identification characterization and diversity analysis of endophytic microorganisms in various crops including legumes non legumes as well as the assessment of their beneficial impacts in the context promoting plant growth Moreover it provides essential updates on the diversity and role of plant growth promoting rhizobacteria PGPR and arbuscular mycorrhizal fungi AMF Further chapters examine in detail biopesticides the high density cultivation of bioinoculants in submerged culture seed biopriming strategies for abiotic and biotic stress tolerance and PGPR as abio control agent Given its content the book offers a valuable resource for researchers involved in research and development concerning PGPR biopesticides and microbial inoculants

Microbial Inoculants Ajay Kumar,Joginder Singh Panwar,Ana Maria Queijeiro López,Ravindra N Kharwar,2025-05-23 Microbial Inoculants Soil Dynamics and Nutrient Bioavailability is an essential volume in the Plant and Soil Microbiome series This book delves into the foundational and contemporary details regarding the use of microbial inoculants which are living organisms like fungi bacteria and microalgae sourced from soil plants water and organic materials Acting as biostimulants or biocontrol agents these inoculants offer an environmentally friendly alternative to synthetic fertilizers and pesticides playing a crucial role in soil conservation plant health and crop yield enhancement Apart from exploring the nexus between plant and soil the book also discusses the range of applications of microbial inoculants in agricultural and environmental practices It provides insights into how these microorganisms contribute to sustainable farming by enhancing nutrient bioavailability and protecting crops from diseases thus promoting better yield and overall plant vitality This volume is a valuable resource for those interested in advancing agricultural techniques through the utilization of natural biotic solutions Includes perspectives from soil and plant nutrient impact Presents developments in dynamic network modeling including new experimental designs and techniques Emphasizes the diverse function of plant associated microbiomes

*Microbial BioTechnology for Sustainable Agriculture Volume 1* Naveen Kumar Arora,Brahim Bouizgarne,2022-05-03 This volume explains the recent findings on the mutualistic plant microbe interactions and how they can be utilized for sustainable agriculture practices including land reclamation The book covers mainly plant growth promoting microorganisms PGPMs including both the symbiotic bacteria and fungi and their role in mobilization of nutrients providing protection to the crops from phytopathogens and abiotic stresses PGPMs play important roles in survival and health of the plant These useful microorganisms provide plants with nutrients protect them from pathogens and help them combat abiotic stresses It is important that these mutualistic interactions between plant and soil microbes are well understood so as to develop reliable products in the form of biostimulants and biopesticides as well as managing biotic and abiotic stresses in crops Apart from enhancing crop productivity plant microbe interactions can also perform activities such as reclamation of degraded lands degradation of pollutants and remediation of saline or marginal lands This book is of interest to teachers researchers plant scientists and microbiologists Also the book serves as additional reading material for undergraduate and graduate students

of agriculture microbiology biotechnology ecology soil science and environmental sciences *Plant Growth-Promoting Microorganisms for Sustainable Agricultural Production* Everlon Cid Rigobelo, Saveetha Kandasamy, Duraisamy Saravanakumar, 2022-04-18 **Microbial Inoculants** Vijay Kumar Sharma, Ajay Kumar, Michel R Zambrano Passarini, Shobhika Parmar, Vipin Kumar Singh, 2023-05-26 In the recent past beneficial microorganisms have been sustainably used in agriculture as a safe economic and effective alternative to chemical fertilizers or pesticides These beneficial microbes including bacteria actinomycetes and yeast were efficiently applied in soil seeds fruits or plants as inoculants to achieve the optimum agricultural yield An efficient delivery method or enhanced shelf life of microbial inoculants in the soil or seed is still a matter of concern The response of local genetic or ecological factors after microbial applications are also unknown and less studied Therefore Microbial Inoculants Recent Progress and Applications fulfills the need to explore and learn about an efficient delivery mechanism selection of microbial strain as inoculants and related technological advances for the efficient and productive use of microbial inoculants Moreover factors like methods of formulation interaction between host plant and microbe impact of inoculation on the metabolomics of plants the effect of microbial inoculants on soil dynamics proteomics approach of plant microbe interaction as well as the registration and regulation process of bio inoculants for commercial production are described in 16 chapters by the leading academicians and researchers from different parts of the world Sums up the latest approaches and advancements in the field of microbial inoculants in microbial formulations and applications Proofs the potential development and applications of microbial inoculants as an alternative to chemical fertilizers herbicides and pesticides Shows the impact of microbial inoculants on microbial dynamics bioavailability and abiotic stress mitigation Gives insights on emerging challenges with the commercialization of microbial formulations technology patenting and legal perspectives Biofertilizers for Sustainable Agriculture and Environment Bhoopander Giri, Ram Prasad, Qiang-Sheng Wu, Ajit Varma, 2019-08-09 This book provides a comprehensive overview of the benefits of biofertilizers as an alternative to chemical fertilizers and pesticides Agricultural production has increased massively over the last century due to increased use of chemical fertilizers and pesticides but these gains have come at a price The chemicals are not only expensive they also reduce microbial activity in agricultural soils and accumulate in the food chain with potentially harmful effects for humans Accordingly it is high time to explore alternatives and to find solutions to overcome our increasing dependence on these chemicals Biofertilizers which consist of plant remains organic matter and microorganisms might offer an alternative They are natural organic biodegradable eco friendly and cost effective Further the microbes present in the biofertilizers are important because they produce nutrients required for plant growth e g nitrogen phosphorus potassium as well as substances essential for plant growth and development e g auxins and cytokinins Biofertilizers also improve the physical properties fertility and productivity of soil reducing the need for chemical fertilizers while maintaining high crop yield This makes biofertilizers a powerful tool for sustainable agriculture and a

sustainable environment The book covers the latest research on biofertilizers ranging from beneficial fungal bacterial and algal inoculants to microbes for bioremediation wastewater treatment and recycling of biodegradable municipal agricultural and industrial waste as well as biocontrol agents and bio pesticides As such it offers a valuable resource for researchers academics and students in the broad fields of microbiology and agriculture *The Plant Microbiome in Sustainable Agriculture* Alok Kumar Srivastava, Prem Lal Kashyap, Madhumita Srivastava, 2021-02-16 The most up to date reference on phytomicrobiomes available today The Plant Microbiome in Sustainable Agriculture combines the most relevant and timely information available today in the fields of nutrient and food security With a particular emphasis on current research progress and perspectives of future development in the area The Plant Microbiome in Sustainable Agriculture is an invaluable reference for students and researchers in the field as well as those with an interest in microbiome research and development The book covers both terrestrial and crop associated microbiomes unveiling the biological biotechnological and technical aspects of research Topics discussed include Developing model plant microbiome systems for various agriculturally important crops Defining core microbiomes and metagenomes in these model systems Defining synthetic microbiomes for a sustainable increase in food production and quality The Plant Microbiome in Sustainable Agriculture is written to allow a relative neophyte to learn and understand the basic concepts involved in phytomicrobiomes and discuss them intelligently with colleagues [Rhizosphere Revelations: Microbial Strategies for Sustainable Agriculture](#) ,2025-08-01 Rhizosphere Revelations Microbial Strategies for Sustainable Agriculture Volume 116 in the Advances in Botanical Research series highlights new advances in the field with this new volume presenting interesting chapters on topics such as Plant Microbe Partnerships Symbiotic Secrets of the Rhizosphere The role of rhizosphere microbes in phosphorus mineralization and acquisition Microbial Contributions to Soil Carbon Sequestration Role of Mycorrhizal Fungi in Nutrient Cycling Bioremediation Potential of Rhizosphere Microbes Rhizosphere Remedies Harnessing AMF for Disease Management and Genetic Engineering of Rhizosphere Microbes Provides the latest information on Rhizosphere Revelations Offers outstanding and original reviews on a range of grapevine research topics Serves as an indispensable reference for researchers and students alike **Enzyme Biotechnology for Environmental Sustainability** Praveen Dahiya, Joginder Singh Panwar, Ajay Kumar, 2024-07-13 Enzyme Biotechnology for Environmental Sustainability discusses recent applications of enzyme biotechnology in various industrial sectors and state of the art information on novel microbial enzyme technologies for a sustainable environment The book describes in detail the latest developments and modern methods in microbial enzyme biotechnology for wider application in bioremediation cleaner technology for industries and waste management green chemistry and pharmaceutical biotechnology sustainable textiles food production and biodegradation and other industries The chapters cover topics such as genetic engineering protein engineering nanotechnological advances of microbial enzymes computational tools for engineering enzymes and health risk assessment of enzymes in different sectors With contributors

from an array of experts in the field Enzyme Biotechnology for Environmental Sustainability is an informative reference for researchers biotechnologists microbiologists environmental scientists graduate and post graduate students working in the area of enzyme technology and their biomedical environmental and industrial applications Includes new methods and up to date information on modern methods with respect to its application in pharmaceuticals textiles food fermentation and many other related fields Provides in depth information about the recent applications of enzyme biotechnology in different industrial sectors Focuses on the rapid developments and biotechnological advances in microbial enzymology to enhance industrial and environmental sustainability

### **Eco-friendly Agro-biological Techniques for Enhancing Crop**

**Productivity** Rakesh Singh Sengar,Ashu Singh,2018-03-13 As the world population is exploding and alongside fluctuations in climate is also prevalent there is an increasing stress on the food requirements of the population We have an urgent necessity to produce more food in the limited agricultural land Further to feed 7 billion people there is a requirement of high yielding crops without harming environment and limiting the use of unnecessary pesticide and chemical fertilizers Therefore it has become crucial to develop agri bio techniques which are environment friendly and also give high crop productivity Many countries are evaluating the utility of biotechnology and its role in addressing problems of food security and poverty Biotechnology is the application of scientific and engineering principles to the processing and production of materials by utilising biological agents These agents are exploited to provide goods and services Agricultural biotechnology encompasses a growing list of techniques that range from simple probes to determine a relevant gene from the complete genome to manipulating genes for a desired outcome Many other popular methods used in the realm of agricultural technology are gene integration Marker assisted breeding Tissue culture Gene profiling or association mapping Metabolomics etc The fundamental challenge facing the scientific community is how to devise innovative strategies that will bring all developed as well as developing countries into the biological fold and to do so in ways that will take full advantage of advances in the biological sciences to curb poverty improve public health and promote human development This book contains information on eco friendly techniques for high crop productivity and it is a myriad of different techniques and technology used to sustain productivity in crop plants There are fewer books focusing on large scale organic farming molecular farming etc Multidisciplinary research and literature is needed to deliver knowledge and products into the marketplace which fulfil these requirements The present book is a collection of literature contributed by experts scientists professors and researchers from around the world it emphasizes work of concerned scientist and his choice of techniques used for enhancement of agricultural production This book analyses the use of modern techniques to increase crop yields production and risk of hunger linked to socioeconomic scenarios

Microbial Enzymes and Biotechniques Pratyosh Shukla,2020-10-09 This book compiles the latest research on the multifarious roles of microbial enzymes and provides an overview of microbial enzymes and biotechnologies It discusses the use of microbial enzymes in innovative areas like nanomedicine and synthetic



biotechnology as well as the use of starch digesting enzymes and bioactive proteins as biotherapeutics all of which have applications in modern drug discovery processes The book also examines the concept of microbial biotransformation and protein engineering and covers topics such as the immobilization of therapeutic enzymes bioengineering of enzymes for bioactive compounds the production of hydrolytic and oxidative enzymes from plant raw materials and prebiotics and probiotics Given its multidisciplinary scope this book will appeal to researchers and industry experts in the fields of microbiology biotechnology and molecular medicine      *Advanced Microbial Biotechnologies For Sustainable Agriculture* Ying Ma,Miroslav Vosatka,Christopher Rensing,Helena Freitas,2021-05-25      **Pesticides in Crop Production** Prabhat Kumar Srivastava,Vijay Pratap Singh,Anita Singh,Durgesh Kumar Tripathi,Samiksha Singh,Sheo Mohan Prasad,Devendra Kumar Chauhan,2020-04-27 A guide to the diversity of pesticides used in modern agricultural practices and the relevant social and environmental issues Pesticides in Crop Production offers an important resource that explores pesticide action in plants pesticide metabolism in soil microbes plants and animals bioaccumulation of pesticides and sensitiveness of microbiome towards pesticides The authors explore pesticide risk assessment the development of pesticide resistance in pests microbial remediation of pesticide intoxicated legumes and pesticide toxicity amelioration in plants by plant hormones The authors include information on eco friendly pest management They review the impact of pesticides on soil microorganism crops and other plants along with the impact on other organisms like aquatic fauna and terrestrial animals including human beings The book also contains an analysis of pesticide by GC MS MS Gas Chromatography tandem Mass Spectrometry a reliable method for the quantification and confirmation of multiclass pesticide residues This important book Offers a comprehensive guide to the use of the diversity of pesticides and the pertinent social and environmental issues Explores the impact of pesticides from morphological anatomical physiological and biochemical perspectives Shows how pesticides affects soil microorganisms crops and other plants along with the impact on other organisms like aquatic fauna and animals Critically examines whether chemical pesticides are boon or bane and whether they can be replaced by environmental friendly pesticides Written for students researchers and professionals in agriculture botany entomology and biotechnology Pesticides in Crop Production examines the effects of chemical pesticides and the feasibility of using bio pesticides      **Environmental Concerns and Sustainable Development** Vertika Shukla,Narendra Kumar,2019-04-30 The current global environmental crisis is primarily the result of non standardized parameters for environmental regulation and is impacting e g clean air safe drinking water and the quality of food particularly in developing nations Due to their poor lax execution of EIA protocols newly developing countries are preferred destinations for establishing pollution emitting industries which results in the degradation and depletion of their natural resources Lack of environmental policy intervention is another major incentive to base dirty industries in these nations In order to ensure sustainable development the highest priority issues include the monitoring and eradication of environmental problems stemming from economic development

virtually every form of economic development primarily results in the loss of forests and thus biodiversity followed by declining air quality and the contamination of natural resources Sustainable development ensures responsible interactions with the environment so as to minimize the depletion or degradation of natural resources and preserve environmental quality It involves integrated approaches to understanding the importance of environmental management systems and policy measures that lead to improved environmental performance This book addresses the environmental concerns associated with economic development and with approaches to attaining sustainable economic development which include monitoring the quality of water resources soil erosion and degradation of the natural environment

*Molecular and Physiological Insights into Plant Stress Tolerance and Applications in Agriculture (Part 2)* Jen-Tsung Chen, 2024-02-20

*Molecular and Physiological Insights into Plant Stress Tolerance and Applications in Agriculture Part 2* is an edited volume that presents research on plant stress responses at both molecular and physiological levels This volume builds on the previous volume to provide additional knowledge in studies on the subject

**Key Features** Explains aspects of plant genetics central to research such as the role of cytosine methylation and demethylation in plant stress responses and the importance of epigenetic genetics in regulating plant stress responses Explores how Late Embryogenesis Abundant proteins affect plant cellular stress tolerance with an emphasis on their molecular mechanisms and potential implications Focuses on beneficial microorganisms including rhizobacteria endophytes and mycorrhizal fungi which are expected to be alternative fertilizers with the advantages of being cost effective toxin free and eco friendly Highlights the potential use of endophytic bacteria for protecting crops against pathogens Presents an in depth analysis of the molecular level to understand the impact of ATP binding cassette transporters on plant defense mechanisms with a discussion of the potential anti pathogenic agents based on terpenes and terpenoids The content of the book is aimed at addressing UN SDG goals 2 12 and 15 to achieve zero hunger and responsible consumption and production and to sustainable use of terrestrial ecosystems respectively This comprehensive resource is suitable for researchers students teachers agriculturists and readers in plant science and allied disciplines

**Readership** Researchers students teachers agriculturists and readers in plant science and allied disciplines

**Biofertilizers** Inamuddin, Mohd Imran Ahamed, Rajender Boddula, Mashallah Rezakazemi, 2021-08-02

Great attention has been paid to reduce the use of conventional chemical fertilizers harming living beings through food chain supplements from the soil environment Therefore it is necessary to develop alternative sustainable fertilizers to enhance soil sustainability and agriculture productivity

Biofertilizers are the substance that contains microorganisms bacteria algae and fungi living or latent cells that can enrich the soil quality with nitrogen phosphorous potassium organic matter etc They are a cost effective biodegradable and renewable source of plant nutrients supplements to improve the soil health properties Biofertilizers emerge as an attractive alternative to chemical fertilizers and as a promising cost effective technology for eco friendly agriculture and a sustainable environment that holds microorganisms which enhance the soil nutrients solubility leading a raise in its fertility stimulates

crop growth and healthy food safety This book provides in depth knowledge about history and fundamentals to advances biofertilizers including latest reviews challenges and future perspectives It covers fabrication approaches and various types of biofertilizers and their applications in agriculture environment forestry and industrial sectors Also organic farming quality control quality assurance food safety and case studies of biofertilizers are briefly discussed Biofertilizers physical properties affecting factors impact and industry profiles in the market are well addressed This book is an essential guide for farmers agrochemists environmental engineers scientists students and faculty who would like to understand the science behind the sustainable fertilizers soil chemistry and agroecology      Biocontrol Mechanisms of Endophytic Microorganisms E.K. Radhakrishnan,Ajay Kumar,R. Aswani,2021-11-23 Biocontrol Mechanisms of Endophytic Microorganisms introduces endophytic microorganisms colonization diversity and distribution describes the isolation and identification of endophytic microorganisms by traditional cultivation and by next generation sequencing technologies and covers biocontrol mechanisms bacterial priming endophytic based methods the significance on fungi and metabolite based formulations The book concludes with chapters on biofilms microbiota and safety issues of microorganisms The intensive use of chemicals to control these plant pathogens has resulted in negative consequences such as the release of toxic chemicals in the environment reduced soil fertility and human health problems Therefore environmentally friendly and sustainable replacement of chemical fertilizers or pesticides is highly challenging Contains exclusive information about research on immunogenetics going on all over the world Includes all the minute and recent details that will be the prerequisite requirement for any researcher who wants to work on immunogenetics and its applications Comes fully equipped with pictures illustrations and tables delivering the information in a meticulous manner that makes it more attractive to readers

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