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Microbial Inoculants in Sustainable Agricultural Productivity

Vol. 2: Functional Applications

 Springer

Microbial Inoculants In Sustainable Agricultural Productivity Vol 2 Functional Applications

Vivek Kumar, Manoj Kumar, Ram Prasad



Microbial Inoculants In Sustainable Agricultural Productivity Vol 2 Functional Applications:

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 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.

Progress in Soil Microbiome Research Javid Ahmad Parray, 2024-11-21 This book focuses on the

latest research in soil and microbiome evaluating new and emerging innovations Recent research has connected specific microbial taxa to plant productivity and it is now possible to link changes in microbiome structure to the functioning of plants or crops due to advanced approaches It provides Insights into basic microbiome research Focusing on its applications in agriculture Soil bioremediation Environmental restoration It addresses the impact of global change on soil microbial diversity and ecosystem functions We aim to tailor microbiome applications to individual host species better improving treatment efficiency The book will discuss microbiome dynamics in various environments and their potential to improve soil and plant health to meet growing food demands It will also highlight the current developments in microbiome research and their implications for climate change 1 Linking the dynamics of microbial communities to microbiome function 2 Recent soil microbiome applications and harnessing for sustainable agriculture food security and environmental management 3 An advanced and elaborative view of the most recent microbiological research findings 4 Simple insightful illustrations of current microbial biotechnology trends 5 Future advances in microbial biotechnology research for sustainable development

New and Future Developments in Microbial Biotechnology and Bioengineering Jay Shankar Singh, DP Singh, 2019-03-19
New and Future Developments in Microbial Biotechnology and Bioengineering Microbial Biotechnology in Agro environmental Sustainability describes in detail the various roles of microbial resources in the management of crop diseases and how microbes can be used as a source of income for biomass and bioenergy production In addition the book covers microbial inoculants as bio fertilizers to enhance crop productivity along with degraded land restoration Users will find the latest information in the field of microbial biotechnology and its further applications in bio fertilizers bio pesticides its generation as an alternative source of energy restoration degraded and marginal lands the mitigation of global warming gases and more Describes microbial biotechnology and its applications in sustainable agriculture Provides information on the use of a variety of microbes for crop production Outlines microbe based separation techniques for the removal of metal contaminants from soil Describes the role of microbial agents in the generation of alternative sources of energy Includes microbial tools and technologies for the restoration of degraded and marginal lands the mitigation of global warming gases and the bioremediation of polluted sites

Plant Root Interaction With Associated Microbiomes to Improve Plant Resiliency and Crop Biodiversity Nikolay Vassilev, Eligio Malusà, Davide Neri, Xiangming Xu, 2021-09-10 **Plant Secondary Metabolites and Abiotic Stress** Ganesh C. Nikalje, Mohd. Shahnawaz, Jyoti Parihar, Hilal Ahmad Qazi, Vishal N. Patil, Daochen Zhu, 2024-11-27 This book provides a comprehensive overview of cutting edge biotechnological approaches for enhancing plant secondary metabolites to address abiotic stress offering valuable insights into the future of utilizing plants for medicinal and industrial purposes Various books on plant secondary metabolites are available however no book has an overview of the recent trends and future prospects of all the methods available to enhance the contents of the plant secondary metabolites Plant Secondary Metabolites and Abiotic Stress aims to give an overview of all the available strategies

to ameliorate abiotic stress in plants by modulating secondary metabolites using biotechnological approaches including plant tissue cultures synthetic metabolic pathway engineering targeted gene silencing and editing using RNAi and CRISPR CAS9 technologies

Microbes Based Approaches for the Management of Hazardous Contaminants Ajay Kumar,Livleen Shukla,Joginder Singh,Luiz Fernando Romanholo Ferreira,2024-07-08 Learn the various microbiological aspects one deals with in environment management and the remediation of toxic contaminants in the environment In recent years the accumulation of hazardous contaminants has caused a broad based deterioration in global environmental quality These have had wide ranging negative social impacts affecting climate soil and water ecosystems and more As traditional methods of contaminant mitigation have proven inadequate to the task microbial based remediation offers the clearest most environmentally friendly path forward for this crucial aspect of global environmental stewardship Microbes Based Approaches for the Management of Hazardous Contaminants offers comprehensive coverage of novel and indigenous microbes and their applications in contaminant mitigation Surveying all the major microbial products and methods for degrading and remediating hazardous pollutants it offers a key tool in the fight against global environmental degradation The result is a cutting edge introduction to an essential subject Microbes Based Approaches for the Management of Hazardous Contaminants will also find Current and future approaches to microbial degradation Detailed discussion of biofilms exopolysaccharides enzymes metabolites and many more Coverage of metabolic engineering as an alternative strategy Microbes Based Approaches for the Management of Hazardous Contaminants is ideal for those working in the field for the application of microbes in the remediation of hazardous pollutants and environment management particularly those interested in environmental sciences microbiology and microbial technology environmental biotechnology and molecular biology

Biopesticides Handbook Leo M.L. Nollet,Showkat Mir,2023-09-13 Biopesticides have a great influence in sustainable agriculture and their use in commercial farming ensures environmental protection qualitative products and effective use of resources The second edition of Biopesticides Handbook is fully updated and includes five new chapters on microbial biochemical and RNAi pesticides It details the benefits of biopesticides along the food chain offering a full spectrum of the range of organisms and organic products that may be used in the biological control of pests It discusses the uses and abuses of biopesticides their positive and negative consequences as well as more recent advances and the best mode of action to improve environmental safety FEATURES Thoroughly updated this edition explores not only the benefits but also all aspects of biopesticides Includes new chapters on the uses of biochemical and microbial pesticides and plant incorporated protectants Discusses the new field of RNAi pesticides Provides information on insect growth regulators and allelochemicals Introduces a new chapter on the uses of biopesticides in food and medicinal crops This book is intended for professionals researchers academics and postgraduate students with experience in fields such as chemistry biochemistry environmental sciences ecology and agriculture as well as those invested in the supply chain of agricultural products such as

farmers growers and other stakeholders Pesticides in the Natural Environment Pardeep Singh, Suruchi Singh, Mika Sillanpää, 2022-05-24 *Pesticides in the Natural Environment* Sources Health Risks and Remediation presents the direct and indirect impacts of the use of pesticides on the environment human health and agriculture The book explores sustainable alternatives to pesticide use along with policies for regulations and remediation techniques Bridging the gap between regulations and the tangible environmental threat the book proposes practical solutions while also providing important context on the hazards of pesticides It highlights the influence on climate change offering a holistic perspective for researchers in environmental science policymakers and land managers The book introduces pesticides and their applications then goes on to cover their impact on various ecosystems in the natural environment Health risks are covered followed by various remediation techniques such as biological processes phytoremediation and chemical treatments Describes the impact of pesticides on the environment human health and the food chain as well as regulations and policies to address the impact Presents remediation strategies and techniques for pesticides in a variety of ecosystems along with potential alternatives Includes case studies to illustrate the proper management of pesticides and intervention *The Potential of Microbes for a Circular Economy* E.K. Radhakrishnan, R. Aswani, Ajay Kumar, 2024-01-09 *The Potential of Microbes for a Circular Economy* provides a thorough understanding of the role of microbes in a circular economy CE It covers the development of effective bio based formulations for field applications and describes the basic principles and applications of the circular economy the important role of microorganisms and new insights into a sustainable ecosystem *The Potential of Microbes for a Circular Economy* compiles the latest advancement in the field of CE by covering the aspect of microbes and microbial products providing microbiologists the tools to engage with the wider public policymakers and industry to inform the debate on addressing current challenges and showcasing the positive impacts of microbiology for society Provides a thorough understanding on the role of microbes in the circular economy that can help to develop effective bio based formulations for field applications Describes the basic principles and applications of the Circular Economy Gives insights on the important role of microorganisms explored in the circular economy which in turn provides new insights into the sustainable ecosystem

Nanotechnology-Based Detection and Remediation for the Environment, Food and Agriculture Monika Kundu, Shiv Prasad, Ananta Vashisth, Prameela Krishnan, 2025-09-10 Nanotechnology is not just a tool of the future it is the catalyst transforming how we detect protect and sustain the world around us Nanotechnology surpasses conventional techniques by offering unparalleled precision efficiency and scalability It enables real time detection targeted remediation and resource optimization in ways traditional methods cannot achieve From revolutionizing environmental cleanup to enhancing food safety and agricultural practices nanotechnology is the key to sustainable innovation in a rapidly changing world This book illuminates cutting edge research and charts a visionary path for leveraging nanotechnology to address global challenges in the environment food safety and agriculture From ensuring food quality to revitalizing soil and purifying water it offers

innovative solutions to safeguard our planet's resources and future

Nanotechnology and Plant Disease Management
 Irshad Mahmood, Rizwan Ali Ansari, Rose Rizvi, 2024-12-16
 Nanotechnology and Plant Disease Management explores the intersection of nanotechnology and agriculture. This book serves as a comprehensive exploration of the current state and future potential of nanoparticles in revolutionizing plant disease management within the realm of agriculture. This book elucidates the synthesis, characterization, and judicious application of nanoparticles, providing a clear and accessible explanation of what nanomaterials are, how they are characterized, and their pivotal role in reshaping the plant disease management systems. It scrutinizes innovative strategies that influence the unique properties of nanoparticles to identify and monitor the presence of pathogens at early stages. The book also examines the limitations inherent in the use of nanomaterials for disease management in plants by critically evaluating both sides of the spectrum. This aims to provide a candid overview of the hurdles that must be overcome to unlock the full benefits of nanotechnology in this field. By pinpointing and understanding these obstacles, the current work aims to pave the way for effective strategies and solutions, ensuring the responsible and optimized application of nanomaterials for enhanced plant disease management. This in-depth examination serves as a cornerstone, providing readers with a profound understanding of the intricate processes involved in synthesis, characterization, and utilizing nanomaterials for disease control. Nanotechnology and Plant Disease Management is a testament to the transformative potential of nanotechnology in agriculture. The authors invite readers to embark on this enlightening journey, exploring the intricate world of nanomaterials and their application in safeguarding the health and vitality of plants.

Plant-Microbes-Engineered Nano-particles (PM-ENPs) Nexus in Agro-Ecosystems
 Pardeep Singh, Rishikesh Singh, Pramit Verma, Rahul Bhadouria, Ajay Kumar, Mahima Kaushik, 2021-03-22
 This book presents a collection of cross-disciplinary research with contributions addressing all key features of the plant-microbe-ENP nexus in agro-ecosystems. The uptake, transport, and transformation of nanoparticles in plants have attracted more and more attention in the past several years. Especially the impact of Engineered Nanoparticles (ENPs) on bioprocesses, low, medium, and high-level dose responses in the microbial community of soil, and long, medium, and short-term exposure responses, particularly microbial nitrogen transformations, are just a few of the aspects involved. Since ENPs are used in many industries, including cosmetics, agriculture, medicine, food technology, and waste management, their transport through biogeochemical cycles is an important focus of many studies today. Specifically, ENP-microbe interaction has been analysed with regard to disease treatment for plants; it plays a vital role in disease inhibition by releasing metal ions that act through many pathways, e.g., reactive oxygen species (ROS) generation, DNA transformation, and disruption of the cell cycle to stop cell growth in the pathogen. Due to these properties, ENPs are also used as slow-release or delayed-release pesticides and fungicides and as carrier systems for growth-promoting hormones. Despite their multiple uses in various industries, the negative effects of ENPs are still a major concern for the scientific community and consumers alike. For example, their transport to various food chains has been reported to

have adverse effects This raises a degree of doubt concerning a rapidly growing scientific field with major applications in many industries From a sustainable development perspective and particularly to ensure food security in light of the uncertainty accompanying climate change it is imperative to address this divergence by focusing on the plant microbe ENP nexus

Phytobiont and Ecosystem Restitution Vivek Kumar,Manoj Kumar,Ram Prasad,2018-12-31 This book offers present day retrospectives and future perspectives on phytobiont studies in the context of phyto micro restitution filling some of the information gaps in this promising research field It discusses several ecosystem restitution strategies using dissimilar groups of microbes alone or in association with plants as well as advances in metagenomics technology for studying in situ micro and macro communities in contaminated soil It addresses topics such as the status quo and the perspectives of microbial researchers and scientists foresters students environmentalists agriculturists and professional engineers The rising pollution levels caused by xenobiotics is one of the biggest problems of our times and as such the book comprehensively elaborates the latest research in this field and describes how the issue can be tackled using micro organisms With detailed diagrams and illustrations the book is a valuable resource for experts and novices in the field of microbial bioremediation phyto bioremediation and environmental microbiology

Biotechnological Interventions in the Removal of Emerging Pollutants Satarupa Dey,Sayan Bhattacharya,2025-02-24 This book focuses on the most recent developments in bioremediation techniques exploring how microorganisms can break down different pollutants and the future potential of bioremediation to reduce global pollution levels It examines the impact of various emerging pollutants on the environment and the health of living organisms while highlighting recent advancements in bioremediation methods needed to degrade these pollutants Addressing both inorganic and organic compounds from industrial and anthropogenic activities including personal care products endocrine disruptors and pharmaceutical products this book tackles pollutants that escape conventional water treatment processes contaminating groundwater soil sediments and oceans The chapters also cover topics such as the toxicity and health impacts of emerging pollutants ecotoxicological effects of nanoparticles policies related to emerging pollutants technologies for their detection and technological aspects of their fate during wastewater treatment Readers will find a comprehensive examination of the roles of microbes in bioremediation including the elimination degradation detoxification and immobilization of pollutants The book also introduces enzyme biotechnology as a cost effective low energy eco friendly technology for treating various pollutants Furthermore it discusses the combination of physical treatment and nanotechnology for sustainable pollutant removal This book serves as a valuable resource for policymakers aiming to develop effective environmental regulations educators seeking comprehensive educational material researchers looking to expand their knowledge on advanced bioremediation techniques climate change scientists dedicated to mitigating pollution and undergraduate and graduate students studying agriculture forestry ecology soil science or environmental sciences

Monitoring Forest Damage with Mass Spectrometry-Based Metabolomics Methods Carla

Antonio,2023-11-21 Understand forest responses to climate change with this timely introduction Forests are among the most critical parts of our global ecosystem responsible for the air we breathe home to most of the earth s species and crucial sources of food and raw materials Forest development is therefore one of the most important areas of ecological study and damage to forests is potentially existential Metabolomics a toolkit which accrues data on interactions between genetic and environmental conditions promises to advance our understanding of how these vital ecosystems respond to dramatic changes in climate and environment Monitoring Forest Damage with Mass Spectrometry Based Metabolomics Methods offers a thorough accessible discussion of metabolomic techniques and their applications in forest tree research It promises to enrich the reader s understanding of how forests are being transformed by globe spanning changes and to arm researchers with tools for reacting to these potentially epochal developments Monitoring Forest Damage with Mass Spectrometry Based Metabolomics Methods readers will also find Analysis of specialized secondary metabolites such as phytohormones Detailed discussion of ecologically important tree genera such as Pinus Populus Quercus and many more Supplementary materials related to study design sample preparation and instrumental analysis protocols Monitoring Forest Damage with Mass Spectrometry Based Metabolomics Methods is ideal for researchers in analytical chemistry mass spectrometry metabolomics forest research the life sciences and all other related fields *Plant Defence: Biological Control* Jean-Michel Méridon,Kishan Gopal Ramawat,2020-10-20 Insects pests and weeds are responsible for substantial loss of crops and reduced food supplies poorer quality of agricultural products economic hardship for growers and processor Generally chemical control methods are neither always economical nor are they effective and may have associated unwanted health safety and environmental risks Biological control involves use of beneficial biological agents to control pests and offers an environmental friendly approach to the effective management of plant diseases and weeds The chapters are written by well recognized group leaders in the field This book provides a comprehensive account of interaction of host and pests and development of biological control agents for practical applications in crops management utilizing inherent defence mechanism induced stimulation and biological control agents The contents are divided into the following sections General biology of plant defence Use of natural compounds for biological control Use of biological agents Mechanism of action and Commercial aspects The book will be useful for academicians researcher and industries involved in study and manufacturing these products Nanotoxicity Susai Rajendran,Anita Mukherjee,Chandraiah Godugu,Ritesh K. Shukla,Tuan Anh Nguyen,2020-04-09 Nanotoxicity Prevention and Antibacterial Applications of Nanomaterials focuses on the fundamental concepts for cytotoxicity and genotoxicity of nanomaterials It sheds more light on the underlying phenomena and fundamental mechanisms through which nanomaterials interact with organisms and physiological media The book provides good guidance for toxic prevention methods and management in the manufacture application disposal The book also discusses the potential applications of nanomaterials based antibiotics The potential toxic effects of nanomaterials result not only from the type of base materials but also from

their size ligands surface chemical modifications This book discusses why different classes of nanomaterials display toxic properties and what can be done to mitigate this toxicity It also explores how nanomaterials are being used as antimicrobial agents being used to purify air and water and counteract a range of infectious diseases This is an important reference for materials scientists environmental scientists and biomedical scientists who are seeking to gain a greater understanding of how nanomaterials can be used to combat toxic agents and how the toxicity of nanomaterials themselves can best be mitigated Explains the underlying phenomena and fundamental mechanisms through which nanomaterials interact with organisms and physiological media Outlines major methods for mitigating and prevention of nanotoxicity Discusses the applications of nanomaterials based antibiotics

Optimum Choice of Energy System Configuration and Storages for a Proper Match between Energy Conversion and Demands Andrea Lazzaretto,Andrea Toffolo,2020-01-31 This Special Issue addresses the general problem of a proper match between the demands of energy users and the units for energy conversion and storage by means of proper design and operation of the overall energy system configuration The focus is either on systems including single plants or groups of plants connected or not to one or more energy distribution networks In both cases the optimum design and operation involve decisions about thermodynamic processes about the type number design parameters of components plants and storage capacities and about mutual interconnections and the interconnections with the distribution grids The problem is absolutely general encompassing design and operation of energy systems for single houses groups of houses industries industrial districts municipal areas regions and countries The presented papers show that similar approaches can be used in different applications although a general standard has not been achieved yet

Root Biology Bhoopander Giri,Ram Prasad,Ajit Varma,2018-05-01 The book Root Biology written by experts in the field covers latest research on cellular genetic physiological and ecological developmental facets of root growth as well as the interaction of root with an array of microbes whether for the establishment of symbiosis increasing plant growth or protecting plant from pathogens attackers Plant roots provide an excellent model to study physiological developmental and metabolic processes at a system level Root system architecture an excellent creation of nature is closely interconnected with the availability of soil nutrients Several strategies including biotechnological interventions are gaining interest and importance for sustainable food production and enhanced resource acquisition Such strategies have largely focused on root traits for efficient utilization of soil resources The biotechnological application of root biology is expected to promote the production of food while maintaining ecologically and economically sustainable production systems With a fortune of information on technical and experimental aspects useful in the laboratory this extensive book is a valuable resource for researchers academicians and students in the broad field of microbiology plant and fungal biology

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Microbial Inoculants In Sustainable Agricultural Productivity Vol 2 Functional Applications Introduction

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