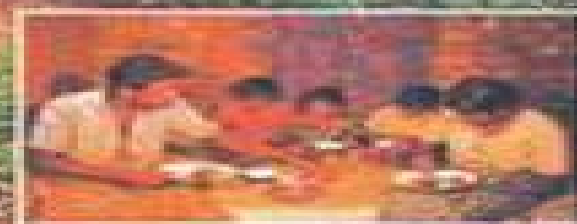




# Food Security in Nutrient-Stressed Environments: Exploiting Plants' Genetic Capabilities



Japan International Research Center for Agriculture Sciences (JIRCAS)  
International Crop Research Institute for the Semi-Arid Tropics (ICRISAT)

# Food Security In Nutrientstressed Environments Exploiting Plants Genetic Capabilities

**Acharya Balkrishna**



## **Food Security In Nutrientstressed Environments Exploiting Plants Genetic Capabilities:**

### **Food Security in Nutrient-Stressed Environments: Exploiting Plants' Genetic Capabilities J.J.**

Adu-Gyamfi,2013-06-29 Ultimate success in exploiting the genetic capabilities of plants to grow in nutrient stressed environments of the semi arid tropics SAT requires a holistic view of food systems to ensure that genetic selections for improved yields on nutrient poor soils will actually be adopted by farmers This book sets out to address the important issue of how physiological mechanisms of nutrient uptake can best be combined with genetic options to improve the adaptation of crops to low nutrient availability thereby enhancing productivity of nutrient poor soils in the semi arid tropics The book examines i the sustainability of breeding for low nutrient environments from the viewpoint of three interrelated disciplines physiology breeding and socio economics ii candidate mechanisms and physiological traits to enhance uptake and utilization efficiencies iii genetic approaches for manipulation of crop plants to enhance root exudation and access nutrients in the rhizosphere and iv field practices and farmers preferences for crop varieties grown in low nutrient environments Finally the role of modelling in improving nutrient efficiency in cropping systems recommendations for future research needs and strategies were highlighted Attended by 50 international participants this book is the outcome of the workshop held at ICRISAT India during 27 30 September 1999 to mark the culmination of the Government of Japan ICRISAT Project *Plant Nutrition and Food Security in the Era of Climate Change* Vinay Kumar,Ashish Kumar Srivastava,Penna

Suprasanna,2021-09-19 Plant nutrients are the vital elements essential for plant growth and survival with key roles in adapting to challenging environments Each nutrient whether required in relatively large macronutrients or minute concentrations micronutrients plays a unique role in plant life cycle Both the insufficient and surplus concentrations of these nutrients may render negative impacts on plant growth and development and therefore their homeostasis is considered critical for optimal plant growth and yield Plant Nutrition and Food Security in the Era of Climate Change comprehensively reviews all critical plant nutrients Chapters include topics such as biological roles uptake and transport of vital nutrients in plants an in depth review of the roles of potassium calcium magnesium and trace element molecular breeding approaches for enhanced plant nutrients and exploring the rhizosphere microbiome for enhance nutrient availability Written by leading experts in the field of plant biology this is an essential read for researchers and scientists interested in plant science agronomy food security and environmental science A comprehensive review of all the important plant nutrients Discusses plant homeostasis under natural and changing environments Introduces novel approaches and state of the art tool for enhancing the levels of targeted nutrients within plant tissues **Fighting Poverty in Sub-Saharan Africa: The Multiple**

**Roles of Legumes in Integrated Soil Fertility Management** Andre Bationo,Boaz Waswa,Jeremiah M. Okeyo,Fredah Maina,Job Kihara,Uzo Mokwunye,2011-08-24 Legumes play an important role in the cropping systems of sub Saharan Africa SSA Legumes are an important source of nutrition to both humans and livestock by providing the much needed protein

minerals fibre and vitamins The sale of legumes seed leaves and fibre generates income for the marginalized communities especially women Cultivation of legumes is essential for the regeneration of nutrient deficient soils By biologically fixing nitrogen BNF in the soil legumes provide a relatively low cost method of replacing otherwise expensive inorganic nitrogen in the soil This enhances soil fertility and boosts subsequent cereal crop yields Production of legumes in SSA is however hampered by a number of constraints among them low and declining soil fertility low soil pH high salinity drought and flooding poor access to improved germplasm diseases pests and weeds Farmers need to learn how to overcome these constraints if the full benefits of legumes are to be gained This book presents a synthesis of research work on legumes and draws attention to the importance of legumes in integrated soil fertility management ISFM and poverty alleviation in SSA

**Sustainable Agriculture for Food Security** Acharya Balkrishna, 2021-09-30 Sustainable Agriculture for Food Security A Global Perspective takes an analytical approach to issues related to current agricultural practices It looks at global geographical data and key statistical reports to aid readers in comparing understanding and making agricultural decisions The book is divided into chapters with each dealing with a specific problem and its solutions keeping in mind the context of geographical variations The book first provides a historical overview of the socioeconomic importance of agriculture around the world along with a discussion on threats and opportunities in the agricultural sector It goes on to explore the importance of water sources for agriculture including rain fed agriculture practices water harvesting techniques sustainable irrigation practices and irrigation water management Guidance on the usage of agrochemicals and solutions to their detrimental effects from non standardized consumption is also addressed The volume also includes a discussion on organic farming methods certification standards and key restrictions in crop production Part 2 goes on to examine postharvest management practices used in different geographical areas along with analysis on the role of technology and obstacles in implementation The commercialization of agriculture through food processing branding and retailing is reviewed along with suggestions on available marketing platforms and promotional aspects It goes on to outline the situational analysis of food adulteration as well as norms and regulations of food security at the international level Lastly the concept of biofortification is explained along with methods and strategies of biofortified food production The impact of biofortification over socioeconomic development of a specific country is also analyzed Written for a wide audience this volume is a thoughtful overview and analysis of the increasingly necessary topic of sustainable agriculture for food security and will be of interest to faculty and research scholars working professionals social activists policymakers farmers and institutions and organizations involved in agricultural education research and development

**Plant Life under Changing Environment** Durgesh Kumar Tripathi, Vijay Pratap Singh, Devendra Kumar Chauhan, Shivesh Sharma, Sheo Mohan Prasad, Nawal Kishore Dubey, Naleeni Ramawat, 2020-04-10 Plant Life under Changing Environment Responses and Management presents the latest insights reflecting the significant progress that has been made in understanding plant responses to various changing environmental

impacts as well as strategies for alleviating their adverse effects including abiotic stresses Growing from a focus on plants and their ability to respond adapt and survive Plant Life under Changing Environment Responses and Management addresses options for mitigating those responses to ensure maximum health and growth Researchers and advanced students in environmental sciences plant ecophysiology biochemistry molecular biology nano pollution climate change and soil pollution will find this an important foundational resource Covers both responses and adaptation of plants to altered environmental states Illustrates the current impact of climate change on plant productivity along with mitigation strategies Includes transcriptomic proteomic metabolomic and ionomic approaches

**Plant Microbiome and Biological Control** Piyush

Mathur, Swarnendu Roy, 2025-01-07 This book offers a comprehensive guide to discovering assessing and utilizing consortia of beneficial microbes for crop protection and enhanced crop production in the context of climate change It provides deep insights into the functional roles of the rhizomicrobiome including AMF endophytes PGPRs and the phyllosphere microbiome as well as the microbiomes of different plant parts such as seeds fruits and stems in promoting plant growth development and the biocontrol of pests and pathogens in a sustainable manner The book also presents the latest updates on molecular biology techniques genetic engineering biotechnological tools and metagenomics which are widely used for analyzing plant pathogen interactions and microbial identification It will be especially valuable for students and faculty involved in the study and teaching of plant microbe interactions as well as researchers working on sustainable methods for plant disease management With cutting edge research from leading experts this book aims to contribute to the development of an eco friendly sustainable agricultural system

**Microbial Interventions in Agriculture and Environment** Dhananjaya Pratap

Singh, Ratna Prabha, 2019-11-09 Microbial communities and their multi functionalities play a crucial role in the management of soil and plant health and thus help in managing agro ecology the environment and agriculture Microorganisms are key players in N fixation nutrient acquisition carbon sequestration plant growth promotion pathogen suppression induced systemic resistance and tolerance against stresses and these parameters are used as indicators of improved crop productivity and sustainable soil health Beneficial belowground microbial interactions in the rhizosphere help plants combat abiotic challenges in the unfavourable environmental conditions of native soils These microorganisms and their products offer potential solutions for agriculture in problematic areas since they are able to degrade xenobiotic compounds pesticides and toxic chemicals and help remediate heavy metals in the rhizosphere and so make deteriorated soils suitable for crop production This book compiles the latest research on the role of microbes in the rhizosphere and agro ecology covering interaction mechanisms microbe mediated crop production plant and soil health management food and nutrition nutrient recycling land reclamation clean water systems agro waste management biodegradation bioremediation biomass and bioenergy sanitation and rural livelihood security It is a comprehensive reference resource for agricultural activists policymakers environmentalists and advisors working for governments non governmental organizations and industries

helping them update their knowledge of this important but often neglected research area      **Agro-industrial Perspectives on Sugarcane Production under Environmental Stress** Krishan K. Verma,Xiu-Peng Song,Vishnu D. Rajput,Sushil Solomon,Yang-Rui Li,Govind P. Rao,2023-01-01 This edited volume focuses on the core aspects of sugarcane production management under stressful environments as well as innovative strategies for augmenting crop growth productivity through intrinsic and extrinsic manipulations The various chapters aim at bringing out comprehensive and advance information on different aspects of sugarcane cultivation under stress environments and impact of climate change on the sustainability of sugarcane production The book encompasses information about crop production management physiological nutritional requirements ratooning ripening and post harvest losses management It also delineates various technologies that support the continued use and improvement of sugarcane as renewable source of food fiber and bio energy The manipulations at cellular and molecular levels molecular breeding approaches and post harvest technologies are also included The area under sugarcane cultivation is gradually increasing because of its diversification potential The high productivity and biomass of the cane crop also makes it a key source for use as bio energy crop and a promising raw material for bio based agro industries However poor crop biomass productivity due to abiotic stress is the foremost constraint in its future commercial exploitation as sustainable feed stock for bio based industries It is therefore imperative to understand the cellular molecular modulation responsible to productivity barrier under specific stress situation s for better sugarcane quality and quantum under field condition Some of these innovative approaches are delineated in this book This book is of interest to progressive sugarcane growers millers industrial entrepreneurs sugarcane scientists cane development and extension officers sugar industry managers and valuable source of reference worldwide      **Probiotics and Plant Health** Vivek Kumar,Manoj Kumar,Shivesh Sharma,Ram Prasad,2017-06-30 This book primarily focuses on microbial colonization its role in plant growth and nutrient cycling mycorrhizae and providing an overview of phytospheric microorganisms in sustainable crop systems Despite the advances made in the study of plant microbe synergism the relation between microbes and plant health in the context of food security soil nutrient management human and plant health is still largely unexplored Addressing that gap the book presents reviews and original research articles that highlight the latest discoveries in plant probiotics their specificity diversity and function Additional sections addressing nutrient management human health and plant microbiome management to improve plant productivity round out the coverage      **Removal of Refractory Pollutants from Wastewater Treatment Plants** Maulin P. Shah,2021-10-08 This book discusses new and innovative trends and techniques in the removal of toxic and or refractory pollutants through various environmental biotechnological processes from wastewater both at the laboratory and industrial scale It focuses primarily on environmentally friendly technologies which respect the principles of sustainable development including the advanced trends in remediation through an approach of environmental biotechnological processes from either industrial or sewage wastewater Features Examines the fate and occurrence of refractory pollutants in

wastewater treatment plants WWTPs and the potential approaches for their removal Highlights advanced remediation procedures involving various microbiological and biochemical processes Assesses and compares the potential application of numerous existing treatment techniques and introduces new emerging technologies Removal of Refractory Pollutants from Wastewater Treatment Plants is suitable for practicing engineers researchers water utility managers and students who seek an excellent introduction and basic knowledge in the principles of environmental bioremediation technologies **Microbial Biostimulants for Sustainable Agriculture and Environmental Bioremediation** Inamuddin, Charles Oluwaseun Adetunji, Mohd Imran Ahamed, Tariq Altalhi, 2022-06-29 Today the agriculture industry is confronted with simultaneous issues of how to fully embrace mass production of safer food in terms of both quality and quantity Most industries are concerned with avoiding significant levels of soil pollution and environmental threats as a result of the excessive and harmful use of synthetic products on crops Therefore there is a need to adopt sustainable technological innovations that can ensure the sustainability of agricultural production systems Microbial Biostimulants for Sustainable Agriculture and Environmental Bioremediation discusses the benefits challenges and practical applications of eco friendly biotechnological techniques using biostimulants derived from beneficial microorganisms The chapters cover the use of these organisms to increase crop production enhance soil fertility and maintain soil health create crop and plant tolerance to different abiotic stressors release required nutrients to the soil increase resistance to plant pathogens pests improve nutrient use efficiency of crops and rejuvenate polluted environments FEATURES Explores the physiological morpho anatomical and biochemical molecular plant rejoinders involved in stimulating crop productivity Provides information on the physiological cellular and molecular modes of action underlying microbial biostimulant interfaces Summarizes methods and approaches for executing microbial stimulant technology Outlines numerous environmental management and remediation strategies This book is an ideal resource for researchers engineers and academics working in soil science crop science water remediation microbiology and biotechnology **Organic Fertilizers - Their Role in Sustainable Agriculture** , 2025-04-10 Scientific developments in agriculture and technologies of chemical fertilizers and pesticides fed the green revolution of the mid 20th century Still a few decades later pollution and toxins from those chemicals became evident Now climate change partially caused by agricultural technologies has also moved to the centre of our preoccupations These environmental problems as well as economic and social inequities incentivize the search for more sustainable agricultural technologies that can be brought about by deeper scientific insight Replacing chemical fertilizers with less harmful products which we can refer to as organic fertilizers while still maintaining crop production capable of feeding the global population is an objective for farmers policymakers and in fact for everyone In today s world science and technology move forward rapidly pervading every aspect of social and individual lives keeping in touch with them is necessary for each of us in our field of work This book aims to help us replace chemical fertilizers with organic ones In the following chapters the reader can find reviews of recent developments and reports of

experimental works on organic fertilizers that might help better understand their advantages and drawbacks [Plant Growth Promoting Rhizobacteria for Sustainable Stress Management](#) R. Z. Sayyed, Naveen Kumar Arora, M. S. Reddy, 2019-08-28 Increasing agro productivity to feed a growing global population under the present climate scenario requires optimizing the use of resources and adopting sustainable agricultural production This can be achieved by using plant beneficial bacteria i e those bacteria that enhance plant growth under abiotic stress conditions and more specifically microorganisms such as plant growth promoting rhizobacteria PGPR which are the most promising candidates in this regard Attaining sustainable agricultural production while preserving environmental quality agro ecosystem functions and biodiversity represents a major challenge for current agricultural practices further the traditional use of chemical inputs fertilizers pesticides nutrients etc poses serious threats to crop productivity soil fertility and the nutritional value of farm produce Given these risks managing pests and diseases maintaining agro ecosystem health and avoiding health issues for humans and animals have now become key priorities The use of PGPR as biofertilizers plant growth promoters biopesticides and soil and plant health managers has attracted considerable attention among researchers agriculturists farmers policymakers and consumers alike Using PGPR can help meet the expected demand for global agricultural productivity to feed the world s booming population which is predicted to reach roughly 9 billion by 2050 However to do so PGPR strains must be safe for the environment offer considerable plant growth promotion and biocontrol potential be compatible with useful soil rhizobacteria and be able to withstand various biotic and abiotic stresses Accordingly the book also highlights the need for better strains of PGPR to complement increasing agro productivity [Nematodes in Phytobiomes](#) Holger Heuer, Andreas Westphal, Stefan Schrader, Danny Coyne, Mette Vestergård, Johannes Hallmann, A. Sylvia S. Schleker, Bing Yang, Amir Szitenberg, 2021-04-21 [Microbial Models: From Environmental to Industrial Sustainability](#) Susana Castro-Sowinski, 2016-11-17 This book describes selected microbial genera from the perspective of their environmentally and commercially sustainable use By focusing on their physiology and metabolism and combining historical information with the latest developments it presents a multidisciplinary portrait of microbial sustainability The chapters provide readers descriptions of each genus in the form of microbial models that move us closer to the goal of sustainability selected chapters also include worldwide market information and lists of corresponding patents **New and Future Developments in Microbial Biotechnology and Bioengineering** Ali Asghar Rastegari, Ajar Nath Yadav, Neelam Yadav, 2020-05-15 New and Future Developments in Microbial Biotechnology and Bioengineering Trends of Microbial Biotechnology for Sustainable Agriculture and Biomedicine Systems Perspectives for Human Health discusses how microbial biotechnology helps us understand new strategies to reduce pathogens and drug resistance through microbial biotechnology The most commonly used probiotic bacteria are Lactobacillus and Bifidobacterium Therefore the probiotic strains exhibit powerful anti inflammatory antiallergic and other important properties This new book provides an indispensable reference source for



engineers bioengineers biochemists biotechnologists microbiologists pharmacologists and researchers who want to know about the unique properties of this microbe and explore its sustainable biomedicine future applications Introduces the principles of microbial biotechnology and its application for sustainable biomedicine system Explores various microbes and their beneficial application for biofortification of crops for micronutrients Explains the potentials and significance of probiotics prebiotics and synbiotics in health and disease Includes current applications of beneficial microbes as Functional Food Products of Pharmaceutical Importance

*Current Trends in Microbial Biotechnology for Sustainable Agriculture* Ajar Nath Yadav, Joginder Singh, Chhatarpal Singh, Neelam Yadav, 2020-11-10 Microbial biotechnology is an emerging field with applications in a broad range of sectors involving food security human nutrition plant protection and overall basic research in the agricultural sciences The environment has been sustaining the burden of mankind from time immemorial and our indiscriminate use of its resources has led to the degradation of the climate loss of soil fertility and the need for sustainable strategies The major focus in the coming decades will be on achieving a green and clean environment by utilizing soil and plant associated beneficial microbial communities Plant microbe interactions include the association of microbes with plant systems epiphytic endophytic and rhizospheric The microbes associated with plant ecosystems play an important role in plant growth development and soil health Moreover soil and plant microbiomes help to promote plant growth either directly or indirectly by means of plant growth promoting mechanisms e g the release of plant growth regulators solubilization of phosphorus potassium and zinc biological nitrogen fixation or by producing siderophores ammonia HCN and other secondary metabolites These beneficial microbial communities represent a novel and promising solution for agro environmental sustainability by providing biofertilizers bioprotectants and biostimulants in addition to mitigating various types of abiotic stress in plants This book focuses on plant microbe interactions the biodiversity of soil and plant microbiomes and their role in plant growth and soil health Accordingly it will be immensely useful to readers working in the biological sciences especially microbiologists biochemists and microbial biotechnologists

**Aluminum Stress Adaptation in Plants** Sanjib Kumar Panda, František Baluška, 2015-10-21 This book is an overview of our current understanding of aluminium toxicity and tolerance in plants It covers all relevant aspects from molecular and cellular biology to genetic approaches root biology and plant physiology The contribution of arbuscular mycorrhizal fungi to alleviating aluminium toxicity is also discussed Over 40% of total agricultural land resources are acidic in nature with aluminium being the major toxicant Plant roots are particularly susceptible to aluminium stress but much of the complex mechanism underlying its toxicity and tolerance is unknown and aluminium stress perception in plants remains poorly understood The diverse facets of aluminium stress adaptation covered in this book are relevant to plant biology students at all levels as well researchers and it provides a valuable contribution to our understanding of plant adaptation to the changing environment

*Plant Phenolics in Sustainable Agriculture* Rafiq Lone, Razia Shuab, Azra N. Kamili, 2020-08-28 This book presents the latest research on plant

phenolics offering readers a detailed yet comprehensive account of their role in sustainable agriculture. It covers a diverse range of topics including extraction processes, the role of plant phenolics in growth and development, plant physiology, post-harvesting technologies, food preservation, environmental biotic and abiotic stress, as well as nutrition and health. Further, the book provides readers with an up-to-date review of this dynamic field and sets the direction for future research. Based on the authors' extensive experience and written in an engaging style, this highly readable book will appeal to scholars from various disciplines. Bringing together work from leading international researchers, it is also a valuable reference resource for academics, researchers, students, and teachers wanting to gain insights into the role of plant phenolics in sustainable agriculture.

**The Plant Microbiome in Sustainable Agriculture** Alok Kumar Srivastava, Prem Lal Kashyap, Madhumita Srivastava, 2020-11-12. 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.

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