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Nutrient Use Efficiency: from Basics to Advances

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Nutrient Use Efficiency From Basics To Advances:

Nutrient Use Efficiency: from Basics to Advances Amitava Rakshit, Harikesh Bahadur Singh, Avijit Sen, 2014-12-26
This book addresses in detail multifaceted approaches to boosting nutrient use efficiency NUE that are modified by plant interactions with environmental variables and combine physiological microbial biotechnological and agronomic aspects. Conveying an in depth understanding of the topic will spark the development of new cultivars and strains to induce NUE coupled with best management practices that will immensely benefit agricultural systems safeguarding their soil water and air quality. Written by recognized experts in the field the book is intended to provide students scientists and policymakers with essential insights into holistic approaches to NUE as well as an overview of some successful case studies. In the present understanding of agriculture NUE represents a question of process optimization in response to the increasing fragility of our natural resources base and threats to food grain security across the globe. Further improving nutrient use efficiency is a prerequisite to reducing production costs expanding crop acreage into non competitive marginal lands with low nutrient resources and preventing environmental contamination. The nutrients most commonly limiting plant growth are N P K S and micronutrients like Fe Zn B and Mo. NUE depends on the ability to efficiently take up the nutrient from the soil but also on transport storage mobilization usage within the plant and the environment. A number of approaches can help us to understand NUE as a whole. One involves adopting best crop management practices that take into account root induced rhizosphere processes which play a pivotal role in controlling nutrient dynamics in the soil plant atmosphere continuum. New technologies from basic tools like leaf color charts to sophisticated sensor based systems and laser land leveling can reduce the dependency on laboratory assistance and manual labor. Another approach concerns the development of crop plants through genetic manipulations that allow them to take up and assimilate nutrients more efficiently as well as identifying processes of plant responses to nutrient deficiency stress and exploring natural genetic variation. Though only recently introduced the ability of microbial inoculants to induce NUE is gaining in importance as the loss immobilization release and availability of nutrients are mediated by soil microbial processes.

Achieving sustainable crop nutrition Prof Zed Rengel, 2020-02-18 Focus on integrating research on nutrient cycling crop nutrient processing and the environmental impact of fertiliser use to identify ways of improving nutrient use efficiency NUE in the use of particular fertilisers. Includes research on a range of secondary macronutrients and micronutrients including calcium magnesium zinc boron manganese and molybdenum. Reviews a wide range of options for reducing optimising current levels of fertiliser use.

Biodiversity, Functional Ecosystems and Sustainable Food Production Charis M. Galanakis, 2022-10-12 In recent decades practices like the cultivation of a few high yielding crop varieties on a large scale the application of heavy machinery and continued mechanization of agriculture the removal of natural habitats and the application of pesticides and synthetics have resulted in the simplification of agro ecosystems. This has enabled a substantial increase in food production but has at the same time

transformed landscapes Indeed there is a concern that a decline in biodiversity has affected microbiome activities that support processes across soils plants animals the marine environment and humans Although they have increased food production the above practices cannot be considered sustainable in long term applications Biodiversity Functional Ecosystems and Sustainable Food Production explore ecosystems in terms of crop and animal production pest and disease control nutrient cycling and soil fertility Chapters range from agro biodiversity to antimicrobial use in animal food production to microbiome applications for sustainable food systems and the impacts of environment friendly unit operations on the functional properties of bee pollen By examining such topics about each other the text emphasizes how food production ecosystem function food quality and consumer health are all interconnected

Exogenous Priming and Engineering of Plant Metabolic and Regulatory Genes Manish Kumar Patel,Lam-Son Phan Tran,Sonika Pandey,Avinash Mishra,2025-01-30 Exogenous Priming and Engineering of Plant Metabolic and Regulatory Genes Stress Mitigation Strategies in Plants provides insights into metabolic adjustment their regulation and the regulatory networks involved in plants responding to stress situations It contains comprehensive information combining mechanistic priming and engineering approaches from the conventional to those recently developed In addition the book addresses seed priming tolerance mechanisms pre and post treatment as well as sensory response and genetic manipulation From basic concepts to modern technologies and prevailing policies readers will find this book useful in enhancing their understanding of the area as well as helping in identifying approaches for future research Provides detailed information on developing stress tolerant crop varieties using two distinct approaches Highlights advancements in OMICS approaches for different crops Assists readers in designing and evaluating plan for future research

Metabolomics, Proteomics and Gene Editing Approaches in Biofertilizer Industry Sukhminderjit Kaur,Vagish Dwibedi,Pramod Kumar Sahu,2024-06-26 Biofertilizer refers to the live or latent microbial inoculants capable of enhancing plant growth through direct and indirect mechanisms This book covers strategies for harnessing the integrated technologies omics proteomics and metabolomics for the development of potential novel biofertilizers Modern techniques for enhancing the efficacy and quality of biofertilizers has been discussed in detail Increasing crop productivity poses a great challenge due to increasing global population and researchers are looking for solutions to this using sustainable approaches Biofertilizers play an imperative role in enhancing yield production in crops and this book covers detailed account of biofertilizers on a single platform It also provides guidance on sustainable ways of increasing crop production and helps in generating ideas to formulate collaboration between public and private sectors for future innovation in the field of biofertilizers This book is especially designed for the research graduates young researchers and scholars who are directly involved in the research related activities of the biofertilizers It can also be useful to professors lecturers biotechnologists biofertilizer production specialists and other stakeholders associated with strain improvement for biofertilizer development

Biotechnological Advances in Biorefinery Komal Agrawal,Pradeep Verma,2024-10-03 This

book is unique as it will cover the latest technological advancements in the field of biorefinery and how it is a major futuristic component of global biofuel research Initially the role of bio based waste materials microorganisms and their bioactive metabolites in biorefinery will be focused Further recent advances and emerging topics that are related to industrially important products such as biofuels hydrogen production will also be elaborated The book addresses the lack of understanding of recent technological advancement such as life cycle assessment LCA and techno economic assessment TEA as well The systems for biorefineries demand a methodical approach to identifying effects and evaluating their long term viability Thus a futuristic paradigm focusing on in silico studies will also be incorporated enabling us to understand the developments and impacts of bio based materials towards a circular and sustainable economy Additionally the proposed book will also discuss various strategies such as the analysis of cost effectiveness nanotechnology value sensitive design VSD and also emphasize the economic technical and environmental aspects that affect their production as well as the future perspective in terms of the market scenario Thus the book will provide cumulative information on various dimensions of biorefinery and its role as a major bio economic industry of the future for researchers industrialists entrepreneurs career starters and policymakers The shift towards a bioeconomy not only promises innovative solutions to pressing global challenges but also opens up new avenues for various industries and policymakers Thus biorefinery is regarded as a crucial aspect of biobased economy ultimately leading the path towards sustainability

Nanotechnology and Nanomaterials in the Agri-Food Industries Pardeep Singh,Puja Khare,Disha Mishra,Muhammad Bilal,Mika Sillanpää,2023-09-16 Nanotechnology and Nanomaterials in the Agri Food Industries Smart Nanoarchitectures Technologies Challenges and Applications brings together the latest advances in the utilization of advances nanotechnology nanoarchitectures and nanomaterials in the agricultural and food sectors The book begins by discussing recent trends towards sustainable synthesis and application covering green nanomaterials and biodegradable nanomaterials and composites Subsequent chapters focus on key application areas of engineered nanomaterials in both agriculture and food processing such as crop production and protection delivery vehicles detection of contaminants nanobionic and genetic engineering in plants active food packaging and preservation enhanced food formulations and nutrients nanoscale additives for freshness and nanosensors This is followed by a section that addresses key challenges relating to the application of nanostructures and nanodevices in these sectors including global market considerations health and environmental concerns and intellectual property and socio economic issues Finally policy implications and future perspective for the field are reviewed in detail Presents cutting edge applications of nanotechnology across agriculture and food processing Highlights the latest developments in green or biodegradable nanomaterials for increased sustainability Considers key challenges relating to market health and environment regulations and policy

Recent Advances on Nitrogen Use Efficiency in Crop Plants and Climatic Challenges Hamada AbdElgawad,2023-08-25 Nitrogen N is a mineral nutrient that is essential for the normal growth and

development of plants that is required in the highest quantity It is an element of nucleic acids proteins and photosynthetic metabolites therefore crucial for crop growth and metabolic processes Recently it was estimated that N fertilizers could meet the 48% demand of the world s population However overuse and misuse of N fertilizers raised environmental concerns associated with N losses by nitrous oxide N_2O emissions ammonia NH_3 volatilization and nitrate NO_3 leaching For instance NH_3 is a pollutant in the atmosphere N_2O is a greenhouse gas that has a warming potential 298 times higher than CO_2 and contributes to ozone depletion and NO_3 causes eutrophication of water bodies Agricultural practices account for about 90% of NH_3 and 70% of N_2O anthropogenic emissions worldwide The efficient use of N chemical fertilizers can be attained through cultural and agronomic practices Nitrogen use efficiency NUE is an important trait that has been studied for decades in different crops The grain production or economic return from the per unit supply of N fertilizer simply explained the NUE Several definitions were suggested by different researchers NUE can be defined as the product of N uptake efficiency NUpE and N utilization efficiency NUE An increase in NUE increases the yield biomass quality and quantity of crops N is generally applied as chemical fertilizer to the soil whereas a small amount is added to some crops like grain legumes through the fixation process On the other hand crop plants take N through the root system in the form of nitrate or ammonium which is thereby used in different metabolic processes A number of studies have been conducted to increase the NUE in different crops and it has been indicated that NUE can be improved by agronomic physiological biochemical breeding as well as molecular approaches Nitrogen is the main limiting nutrient after carbon hydrogen and oxygen for the photosynthetic process phyto hormonal and proteomic changes and the growth development of plants to complete their lifecycle Excessive and inefficient use of N fertilizer results in enhanced crop production costs and atmospheric pollution Atmospheric nitrogen 71% in the molecular form is not available for the plants For the world s sustainable food production and atmospheric benefits there is an urgent need to upgrade nitrogen use efficiency in the agricultural farming system Nitrogen losses are too high due to excess amount low plant population poor application methods etc which can go up to 70% of total available nitrogen These losses can be minimized up to 15 30% by adopting improved agronomic approaches such as optimal dosage of nitrogen application of N by using canopy sensors maintaining plant population drip fertigation and legume based intercropping Therefore the major concern of modern days is to save economic resources without sacrificing farm yield as well as the safety of the global environment i e greenhouse gas emissions ammonium volatilization and nitrate leaching

Environment, Climate, Plant and Vegetation Growth Shah Fahad, Shah Saud, Taufiq Nawaz, Liping Gu, Mushtaq Ahmad, Ruanbao Zhou, 2024-09-26 The book provides currently available information on the changing climate and its impact on functional and adaptive features of plants The book also cover cutting edge research on key determinants of plant growth that provides a direction towards execution of programs and practices that will assist resilience of crop production systems to the changing climate This book will represent the updated scientific information regarding soil and

plant productivity under changing climate which will be beneficial to academics and researchers working on climate change agronomy stress physiology biotechnology It provides an in depth discussion on the latest techniques to enhance plant responses to new environmental conditions that can be directly applied on field **Encyclopedia of Soil Science** Rattan Lal,2006 Upholding the high standard of quality set by the previous edition this two volume second edition offers a vast array of recent peer reviewed articles It showcases research and practices with added sections on ISTIC World Soil Information root growth and agricultural management nitrate leaching management podzols paramos soils water repellent soils rare earth elements and more With hundreds of entries covering tillage irrigation erosion control ground water and soil degradation the book offers quick access to all branches of soil science from mineralogy and physics to soil management restoration and global warming Publisher's website *Soil Science: Fundamentals to Recent Advances* Amitava Rakshit,S.K Singh,P.C. Abhilash,Asim Biswas,2021-07-30 This compilation has been designed to provide a comprehensive source of theoretical and practical update for scientists working in the broad field of soil science The book explores all possible mechanisms and means to improve nutrient use efficiencies involving developing and testing of nanofertilizers developing consortia based microbial formulations for mobilization of soil nutrients and engineering of nutrient efficient crops using molecular biology and biotechnological tools This is an all inclusive collection of information about soil science This book is of interest to teachers researchers soil scientists capacity builders and policymakers Also the book serves as additional reading material for undergraduate and graduate students of soil science quantitative ecology earth sciences GIS and geodetic sciences as well as geologists geomorphologists hydrologists and landscape ecology National and international agriculture and soil scientists policy makers will also find this to be a useful read **Advances in Plant Physiology (Vol.14)** A. Hemantaranjan,2013-11-01 In view of changes in the global environment it is important to determine and developing technologies to ameliorate metabolic limitations by biological processes most sensitive to abiotic stress factors warning crop productivity It is reaffirmed that publishing the important Treatise Series has been undertaken with a view to identify the inadequacies under varied environments and to scientifically extend precise and meaningful research so that the significant outcomes including new technologies are judiciously applied for requisite productivity profitability and sustainability of agriculture Besides this meticulous research in some of the very sensible and stirring areas of Plant Physiology Plant Molecular Physiology are indispensably needed for holistic development of agriculture and crop production in different agro climatic zones Ardently this is also to focus upon excellent new ideas ensuring the best science done across the full extent of modern plant biology in general and plant physiology in particular In Volume 14 with inventive applied research attempts have been made to bring together much needed eighteen remarkable review articles distributed in three appropriate major sections of Nutriophysiology and Crop Productivity Plant Responses to Changing Environment and Environmental Stresses and Technological Innovations in Agriculture written by thirty four praiseworthy contributors of eminence in unequivocal

fields mainly from premier institutions of India and abroad In reality the Volume 14 of the Treatise Series is wealth for interdisciplinary exchange of information particularly in the field of nutriophysiology and abiotic stresses for planning meaningful research and related education programmes in these thrust areas Apart from fulfilling the heightened need of this kind of select edition in different volumes for research teams and scientists engaged in various facets of research in Plant Physiology Plant Sciences in traditional and agricultural universities institutes and research laboratories throughout the world it would be tremendously a productive reference book for acquiring advanced knowledge by post graduate and Ph D scholars in response to the innovative courses in Plant Physiology Plant Biochemistry Plant Molecular Biology Plant Biotechnology Environ mental Sciences Plant Pathology Microbiology Soil Science Agricultural Chemistry Agronomy Horticulture and Botany

Advances in sustainable dairy cattle nutrition Professor Alexander N. Hristov, 2023-03-14 Reviews advances in our understanding of key nutritional requirements carbohydrate protein lipids and their utilisation in dairy cattle production Considers how a greater understanding of dairy cattle nutrition could improve the sustainability of the dairy sector and reduce its contribution of GHG emissions to the atmosphere Assesses the development of alternative feed sources from agricultural co products including sources of fibre from fruit pulp protein from distillers grains and starch from cereals

INTERNATIONAL JOURNAL OF ADVANCE RESEARCH IN BIOTECHNOLOGY AND NANOBIOTECHNOLOGY IJARBN, 2021-07-01 INTERNATIONAL JOURNAL OF ADVANCE RESEARCH IN BIOTECHNOLOGY AND NANOBIOTECHNOLOGY

Meeting the Triple-H Challenge: Advanced Crop-Soil-Fertilizer Management Strategies to Maximize Crop Yield, Quality, and Nutrient Efficiency Laichao Luo , Muhammad Farooq, 2025-02-19 The growing global population and the increasing vulnerability of agriculture have made many challenges of modern agricultural production One of the main challenges is to produce and provide sufficient quantities of healthy and nutritionally valuable food on the basis of not excessive fertilizer resources consumption To meet the challenge new knowledge solutions and innovative agricultural practices must be acquired in research and appropriately implemented into agricultural green development Many new sustainable practices were adopted in order to increase crop productivity nutritional and safety quality as well as reduce the impact on the environment high nutrients efficiency These practices basically include the introduction and integration of strategies from different disciplines from plant science crop science microbiology to soil science such as crop physiology physio biochemistry plant nutrition and fertilizer science soil management rhizosphere ecology crop root soil interactions and management environmental microbial technology recombinant microorganisms techniques PGPR etc Innovative management strategies have been used to clarify the matching mechanisms underlying crop soil fertilizer systems in order to achieve the triple H namely high yield high quality and high nutrient efficiency

Advance in Barley Sciences Guoping Zhang, Chengdao Li, Xu Liu, 2012-12-31 Advance in barley sciences presents the latest developments in barley sciences It collects 39 papers submitted to the 11th International Barley

Genetics Symposium and covers all presentation sessions of the conference i e barley development and economy utilization of germplasm genetic resources and genetic stocks end uses biotic stress tolerance abiotic stresses new and renewed breeding methodology barley physiology breeding success stories barley genomics and all other omics Th e information will be useful for barley breeders brewers biochemists molecular geneticists and biotechnologists Th is book may also serve as reference text for students and scientists engaged in barley research Dr Guoping Zhang is a barley breeder and crop physiologist at the Department of Agronomy Zhejiang University China Dr Chengdao Li is a senior molecular geneticist and barley breeder at the Department of Agriculture and Food Western Australia Australia He is also an adjunct professor at Murdoch University of Australia and Zhejiang University Dr Xu Liu a member of the China Academy of Engineering is a plant resources researcher at the Chinese Academy of Agricultural Sciences

Bio-prospecting of Novel Microbial Bioactive Compounds for Sustainable Development Kartika Sharma,2025-04-26 This book discusses current developments and upcoming trends in the microbial synthesis of various bioactive compounds from waste product which have a very good market worldwide The extraction of biologically active compounds from microorganisms is still essential for the creation of novel pharmaceuticals and agricultural chemicals and has underpinned their application as drugs and functional food ingredients The demand of pharmaceuticals nutraceuticals and agrochemicals is rising globally for the multi billion dollar market of human disease prevention and treatment However the limitations and issues associated with the extraction of these bioactive compounds from natural resources such as plants animals or fungi limit the large scale use of pharmaceuticals nutraceuticals and agrochemicals The microbial production of agrochemicals nutraceuticals and pharmaceuticals by utilizing by utilizing waste product is now thought to be an environmentally benign process The major goal of this book is to draw attention to excellent original research and review articles that contain cutting edge characterization techniques and novel bioactive chemicals production that make important contributions to the field with many prospective applications In this book the potential for using microbial bioactive compounds which have positive health effects in their entirety is highlighted This book is written by eminent scientists from around the world and seasoned researchers thoroughly discusses current developments and patterns in the microbial synthesis of bioactive compounds Academicians scientists researchers graduate and post graduate students who work in the highly dynamic and competitive fields of pharmaceuticals nutraceuticals and agrochemicals discovery will find this book to be ideal

Science Breakthroughs to Advance Food and Agricultural Research by 2030 National Academies of Sciences, Engineering, and Medicine,Division of Behavioral and Social Sciences and Education,Board on Environmental Change and Society,Health and Medicine Division,Food and Nutrition Board,Division on Earth and Life Studies,Water Science and Technology Board,Board on Life Sciences,Board on Atmospheric Sciences and Climate,Board on Agriculture and Natural Resources,Committee on Science Breakthroughs 2030: A Strategy for Food and Agricultural Research,2019-04-21 For nearly a century scientific advances have fueled progress in U S agriculture to enable American

producers to deliver safe and abundant food domestically and provide a trade surplus in bulk and high value agricultural commodities and foods Today the U S food and agricultural enterprise faces formidable challenges that will test its long term sustainability competitiveness and resilience On its current path future productivity in the U S agricultural system is likely to come with trade offs The success of agriculture is tied to natural systems and these systems are showing signs of stress even more so with the change in climate More than a third of the food produced is unconsumed an unacceptable loss of food and nutrients at a time of heightened global food demand Increased food animal production to meet greater demand will generate more greenhouse gas emissions and excess animal waste The U S food supply is generally secure but is not immune to the costly and deadly shocks of continuing outbreaks of food borne illness or to the constant threat of pests and pathogens to crops livestock and poultry U S farmers and producers are at the front lines and will need more tools to manage the pressures they face Science Breakthroughs to Advance Food and Agricultural Research by 2030 identifies innovative emerging scientific advances for making the U S food and agricultural system more efficient resilient and sustainable This report explores the availability of relatively new scientific developments across all disciplines that could accelerate progress toward these goals It identifies the most promising scientific breakthroughs that could have the greatest positive impact on food and agriculture and that are possible to achieve in the next decade by 2030 Advances in Agronomy ,2025-02-19

Advances in Agronomy Volume 190 the latest release in this leading reference on agronomy contains a variety of updates and highlights new advances in the field each written by an international board of authors Includes numerous timely state of the art reviews on the latest advancements in agronomy Features distinguished well recognized authors from around the world Builds upon this venerable and iconic review series Covers the extensive variety and breadth of subject matter in the crop and soil sciences **Improving Water and Nutrient-Use Efficiency in Food Production Systems** Zed

Rengel,2013-01-03 Improving Water and Nutrient Use Efficiency in Food Production Systems provides professionals students and policy makers with an in depth view of various aspects of water and nutrient use in crop production The book covers topics related to global economic political and social issues related to food production and distribution describes various strategies and mechanisms that increase water and nutrient use efficiency and review the current situation and potential improvements in major food producing systems on each continent The book also deals with problems experienced by developed countries separately from problems facing developing countries Improving Water and Nutrient Use Efficiency emphasizes judicious water and nutrient management which is aimed at maximising water and nutrient utilisation in the agricultural landscape and minimising undesirable nutrient losses to the environment

Unveiling the Magic of Words: A Report on "**Nutrient Use Efficiency From Basics To Advances**"

In a global defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their capability to kindle emotions, provoke contemplation, and ignite transformative change is really awe-inspiring. Enter the realm of "**Nutrient Use Efficiency From Basics To Advances**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve in to the book is central themes, examine its distinctive writing style, and assess its profound impact on the souls of its readers.

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