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Nanotechnology and Plant Sciences

Nanoparticles and Their Impact on
Plants

Nanotechnology And Plant Sciences Nanoparticles And Their Impact On Plants

Lauren Gardner



Nanotechnology And Plant Sciences Nanoparticles And Their Impact On Plants:

Nanotechnology and Plant Sciences Manzer H. Siddiqui, Mohamed H. Al-Whaibi, Firoz Mohammad, 2015-01-27 This book presents a holistic view of the complex and dynamic responses of plants to nanoparticles the signal transduction mechanisms involved and the regulation of gene expression Further it addresses the phytosynthesis of nanoparticles the role of nanoparticles in the antioxidant systems of plants and agriculture the beneficial and harmful effects of nanoparticles on plants and the application of nanoparticles and nanotubes to mass spectrometry aiming ultimately at an analysis of the metabolomics of plants The growing numbers of inventions in the field of nanotechnology are producing novel applications in the fields of biotechnology and agriculture Nanoparticles have received much attention because of the unique physico chemical properties of these compounds In the life sciences nanoparticles are used as smart delivery systems prompting the Nobel Prize winner P Ehrlich to refer to these compounds as magic bullets Nanoparticles also play an important role in agriculture as compound fertilizers and nano pesticides acting as chemical delivery agents that target molecules to specific cellular organelles in plants The influence of nanoparticles on plant growth and development however remains to be investigated Lastly this book reveals the research gaps that must be bridged in the years to come in order to achieve larger goals concerning the applications of nanotechnology in the plants sciences In the 21st century nanotechnology has become a rapidly emerging branch of science In the world of physical sciences nanotechnological tools have been exploited for a broad range of applications In recent years nanoparticles have also proven useful in several branches of the life sciences In particular nanotechnology has been employed in drug delivery and related applications in medicine

Nanoscience in Food and Agriculture 1 Shivendu Ranjan, Nandita Dasgupta, Eric Lichtfouse, 2016-08-18 Nanotechnology is a fast evolving discipline that already produces outstanding basic knowledge and industrial applications for the benefit of society Whereas the first applications of nanotechnology have been developed mainly in material sciences applications in the agriculture and food sectors are still emerging Due to a rapid population growth there is a need to produce food and beverages in a more efficient safe and sustainable way Here nanotechnology is a promising way to improve crop production water quality nutrition packaging and food security There are actually few comprehensive reviews and clear textbooks on nanotechnology in agriculture water and food In this book there are 10 chapters describing the synthesis and application of nanomaterials for health food and agriculture are presented Nanomaterials with unique properties will dramatically improve agriculture and food production Applications will include nanofertilisers to enhance plant growth and nanosensors to detect food contamination An overall view of nanotechnology applications in agriculture food water and environment are described in the first two chapters by Dasgupta et al and Singh Health and environmental applications of nanotechnology are presented in chapters 3 5 Shukla and Iravani review green methods to synthesize metal nanoparticles and give applications to water purification in chapter 3 The removal of up to 95% of contaminants by nanoparticles nanotubes and nanostructured

membranes is described by Naghdi et al in chapter 4 Yoti et al then review nanosensors for the detection of pathogenic bacteria in chapter 5 Those nanosensors can be used as biodiagnostics to control food and water quality Food applications of nanoscience are presented in chapters 6 and 7 by Kuswandi and Sarkhar et al Kuswandi explain in chapter 6 that nanomaterials can improve packaging quality and that nanosensors can detect freshness and contaminants The use of nanoparticles to protect ingredients such as vitamins flavours and antimicrobials is reviewed by Sarkhar et al in chapter 7

Nanoscience in Food and Agriculture 2 Shivendu Ranjan,Nandita Dasgupta,Eric Lichtfouse,2016-08-18 This book is the second volume on this topic within the series With unique properties nanomaterials are rapidly finding novel applications in many fields such as food medicine agriculture and pollution Such applications include to treat cancer nanosensors to detect food contamination nanomaterials for food packaging nanoencapsulation to preserve nutraceuticals and nanofertilisers for advanced agriculture After an introductory chapter on property rights of nanomaterials readers will discover the applications of nanotechnology in food health environment ecotoxicology and agriculture

Sustainable Agriculture Systems and Technologies Pavan Kumar,A. K. Pandey,Susheel Kumar Singh,S. S. Singh,V. K. Singh,2022-03-14 Sustainable Agriculture Systems and Technologies A robust treatment of traditional and new techniques in sustainable agriculture In Sustainable Agriculture Systems and Technologies a team of distinguished researchers delivers an up to date and comprehensive exploration of sustainable agriculture and its relationship to the drivers of climate change Along with robust examinations of food security and the agrarian livelihood the book covers the impact of climate change and variability on agriculture water management in agricultural systems and precision agriculture This book represents a significant contribution to the scientific understanding of the application of technologies that address food insecurity and climate change through sustainable productivity system diversification irrigation practices crop modeling data analytics and agricultural policy It also explores the risks and benefits of different agricultural systems under changing climate scenarios The book also offers A thorough introduction to agriculture and food security including the diversification of ecosystems and the impact of Covid 19 lockdowns on food security and smallholder agricultural systems Comprehensive explorations of crop diversification and the impacts of climate variability on food security in Indonesia Practical discussions of water conservation agriculture and the quality of irrigation water for sustainable agriculture development in India In depth examinations of geoinformatics artificial intelligence sensor technology and big data Perfect for academics scientists environmentalists and environmental consultants Sustainable Agriculture Systems and Technologies will also earn a place in the libraries of computing experts working in the field of agricultural science

Agricultural and Environmental Nanotechnology Fabian Fernandez-Luqueno,Jayanta Kumar Patra,2023-01-05 This book highlights the best practices regarding nanoscience and nanotechnology for agriculture and environmental sectors to shape sustainable development thought to improve the quality and quantity of the agriculture products and to decrease the collateral effect of nanotechnology in the ecosystems

Besides leading nanotechnologies are showed and discussed to guarantee their proper management in lands and ecosystems Therefore nanotechnologies such as agronanobiotechnology nanofertilization pest control magnetofection for plant breeding plant molecular farming OMICs technologies phytonanotechnology nanoremediation etc are described in five sections and 21 chapters Undoubtedly it is an ideal and updated book for undergraduate or postgraduate students and scientists or researchers involved in nanoscience nanotechnology crop production and remediation technologies as well as for those researchers that solving technical problems regarding the crop management and the human and environmental health without hampering the pursuit of sustainable development goals

Toxicity of Nanoparticles in Plants Vishnu D.

Rajput,Tatiana Minkina,Svetlana Sushkova,Saglara S. Mandzhieva,Christopher Rensing,2022-04-22 Toxicity of Nanoparticles in Plants An Evaluation of Cyto Morpho physiological Biochemical and Molecular Responses Volume Five in the Nanomaterial Plant Interactions series reviews the latest research on toxicological effects of using nanotechnology in plants Key themes include analyzing plant exposure to nanomaterials mechanisms of toxicity of nanoparticles to plants and effects uptake and translocation of various different nanoparticles This will be an essential read for any scientist or researcher looking to assess and understand the potential toxicological risks associated with plant nanotechnology To date nanotechnology is considered one of the most promising areas of research due to the widespread applications of nanomaterials in plant science and agriculture However extensive use of nano based products raises concerns regarding their toxicity in crop plants their environmental impact and potential consequences to humans via the food chain Discusses environmental concerns raised by the extensive use of nanotechnology Highlights the impact of plants treated with nanoparticles on nutritional status Reviews major challenges for assessing the toxicity of nanomaterials in plants

Nanomaterials in Plants, Algae, and

Microorganisms Durgesh Kumar Tripathi,Parvaiz Ahmad,Shivesh Sharma,Devendra Kumar Chauhan,Nawal Kishore Dubey,2017-11-20 Nanomaterials in Plants Algae and Microorganisms Concepts and Controversies Volume One discusses the vast amount of nanomaterials that have been released into the environment in a relatively short amount of time There is a need to understand what the implications to the health of our biota and ecosystems are as the earth is increasingly inundated with these materials Not all of the effects are negative but their impacts are increasing exponentially due to their size quantity and other factors Covers the issues of nanoparticles on more simple organisms and their ecosystems Presents issues that are specific to terrestrial ecosystems Contains contributions from global experts who help increase understanding at the physiological biochemical molecular and even genomic and proteomic levels Provides a critical assessment of the progress taking place on this topic and sheds light on future research needs

Plant Nanotechnology Chittaranjan Kole,D. Sakthi Kumar,Mariya V. Khodakovskaya,2016-10-13 This book highlights the implications of nanotechnology in plant sciences particularly its potential to improve food and agricultural systems through innovative eco friendly approaches and as a result to increase plant productivity Topics include various aspects of nanomaterials biophysical and biochemical properties

methods of treatment detection and quantification methods of quantifying the uptake of nanomaterials and their translocation and accumulation in plants In addition the effects on plant growth and development the role of nanoparticles in changes in gene and protein expression and delivery of genetic materials for genetic improvement are discussed It also explores how nanotechnology can improve plant protection and plant nutrition and addresses concerns about using nanoparticles and their compliances This book provides a comprehensive overview of the application potential of nanoparticles in plant science and serves as a valuable resource for students teachers researchers and professionals working on nanotechnology *Nanotechnology Applications and Innovations for Improved Soil Health* Rajput, Vishnu D.,2024-07-12

Traditional agricultural practices face escalating environmental challenges and struggle to meet global food demands while ensuring soil health and sustainability Soil degradation exacerbated by factors like industrialization and urbanization significantly threatens crop productivity and food security Conventional remediation methods often need to be revised requiring innovative approaches to restore soil health and fertility *Nanotechnology Applications and Innovations for Improved Soil Health* presents a groundbreaking solution to this pressing issue offering a comprehensive guide to leveraging nanotechnology for sustainable agriculture This pioneering book explores the transformative potential of nanomaterials in enhancing soil quality and crop production By harnessing the unique properties of nanomaterials such as their high surface area and reactivity researchers and practitioners can develop novel strategies to address soil degradation and improve nutrient availability By systematically examining nanotechnology s role in soil health this book equips readers with the knowledge and tools needed to revolutionize agricultural practices and ensure food security for future generations

Agricultural Nanobiotechnology Fernando López-Valdez,Fabián Fernández-Luqueño,2018-11-09 Nanobiotechnology in agriculture is a new knowledge area that offers novel possibilities to achieve high productivity levels at manageable costs during the production and merchandising of crops This book shows us how we can use the cutting edge knowledge about agriculture nanotechnology and biotechnology to increase the agricultural productivity and shape a sustainable future in order to increase the social welfare in rural areas and preserve the environmental health Specialists from several countries will provide their feedback on a range of relevant topics such as environment friendly use of nanofertilisers nanodevices nano food packaging nanocoating and nanocarriers and their relationship with the modern agriculture *Nanotoxicology for Agricultural and Environmental Applications* Mahendra Rai,Indarchand Gupta,2024-03-19 Published as part of Elsevier s series *Nanobiotechnology for Plant Protection* *Nanotoxicology for Agricultural and Environmental Applications* provides an introduction to nanotechnology and its applications in agriculture and the environment Divided into five parts this book addresses nanotechnology and regulations nanotoxicity nanotoxicity to agriculture and food nanotoxicity to the environment and risk management measures to avoid exposure Students practitioners and researchers working in plant science agricultural science nanoscience and environmental chemistry alike will benefit from this necessary reference Highlights the

factors contributing to toxic effects of nanoparticles including shape size structure surface charge and dosage Explores the mode of action and entry of nanoparticles methods of toxicity evaluation and the associated challenges Describes recent developments in nanotoxicity to soil ecosystems crop plants and food systems Emphasizes the impact of nanoparticles and their detoxification by plants on the nutritional quality of food and plants Discusses the impact of toxicity of nanoparticles released in air soil and water and methods to reduce their effects

Protective Chemical Agents in the Amelioration of Plant Abiotic Stress Aryadeep Roychoudhury, Durgesh Kumar Tripathi, 2020-07-07 A guide to the chemical agents that protect plants from various environmental stressors Protective Chemical Agents in the Amelioration of Plant Abiotic Stress offers a guide to the diverse chemical agents that have the potential to mitigate different forms of abiotic stresses in plants Edited by two experts on the topic the book explores the role of novel chemicals and shows how using such unique chemical agents can tackle the oxidative damages caused by environmental stresses Exogenous application of different chemical agents or chemical priming of seeds presents opportunities for crop stress management The use of chemical compounds as protective agents has been found to improve plant tolerance significantly in various crop and non crop species against a range of different individually applied abiotic stresses by regulating the endogenous levels of the protective agents within plants This important book Explores the efficacy of various chemical agents to eliminate abiotic stress Offers a groundbreaking look at the topic and reviews the most recent advances in the field Includes information from noted authorities on the subject Promises to benefit agriculture under stress conditions at the ground level Written for researchers academicians and scientists Protective Chemical Agents in the Amelioration of Plant Abiotic Stress details the wide range of protective chemical agents their applications and their intricate biochemical and molecular mechanism of action within the plant systems during adverse situations

Copper Nanostructures: Next-Generation of Agrochemicals for Sustainable Agroecosystems Kamel A Abd-Elsalam, 2022-01-13 Copper Nanostructures Next Generation of Agrochemicals for Sustainable Agroecosystems considers the impact of copper based nanostructures on agri food sectors Sections highlight the green synthesis of copper nanoparticles production mechanisms eco safety and future perspectives discuss the increasing importance of copper nanomaterials in plant protection applications describe the use of copper nanostructures in plant science applications cover antimicrobial applications explore copper nanostructure applications and summarize current applications in agroecosystems such as copper nanoparticles as nanosensors their negative ecological effects estimation risks and more Assesses the impact of a large variety of copper based nanostructures on the agri food sector Discusses how the properties of a variety of copper based nanomaterials make them effective for agricultural applications Explains the challenges surrounding the mass production of copper based nanomaterials

Advances in Phytonanotechnology Mansour Ghorbanpour, Shabir Hussain Wani, 2019-05-21 Advances in Phytonanotechnology From Synthesis to Application guides readers through various applications of nanomaterials on plants by presenting the latest research related to nanotechnology

and nanomaterials on plant systems The book focuses on the effects of these applications on plant morphology physiology biochemistry ecology and genetics Sections cover the impact on plant yield techniques a review of positive and negative impacts and an overview of current policies regarding the use of nanotechnology on plants Additionally the book offers insights into the appropriate application of nanoscience to plants and crops for improved outcome and an exploration of their bioavailability and toxicity in the environment Discusses the morphological physiological and biochemical responses of plants to nanomaterials and the ability of the nanomaterials in modifying the genetic constitution of plants Emphasizes new applications of nanomaterials including nanosensors technology and nanomaterials as nanocarriers based antimicrobial phytochemicals Presents the role of nanotechnology as a novel technique for the remediation of heavy metals by plants

Molecular Impacts of Nanoparticles on Plants and Algae Huseyin Tombuloglu, Guzin Tombuloglu, Ebtesam

Al-Suhaimi, Abdulhadi Baykal, Khalid Rehman Hakeem, 2024-03-26 Molecular Impacts of Nanoparticles on Plants and Algae covers molecular mechanisms of plants algae related to cellular uptake and translocation of nanoparticles and genome transcriptome proteome and metabolome responses against it The book introduces readers to state of the art developments and trends of nanoparticles and plants algae including interaction of nanoparticles with biological compounds in vitro Nanoscience and nanotechnology have rapidly been developed in the last few decades and they have a wide range of applications in industry medicine food and agriculture In agriculture nanoparticles NPs have successfully been used for growth regulation crop protection and improvement They are also employed to cope with plant nutrient deficiencies A predicted significant increase in the output of NPs will cause the discharge of a remarkable number of NPs to ecosystems creating a need to understand how to optimize or mitigate their impact depending on their potential impact These include serious health concerns for living organisms in aquatic terrestrial and atmospheric environments as well as human health through their potential existence in plant based foods The impact of NPs on living organisms including plants and algae and uptake translocation and molecular response mechanisms should be carefully considered before producing and using nanoparticles in large amounts as NPs when entered to the body induce changes in gene expressions related to the photosystem water transport cell wall formation and cell division Further recent studies have showed that NPs are potential agents or stressors to alter proteome transcriptome genome and metabolome responses Impacts of nanoparticles on molecular mechanisms of plants and algae presents the most recent findings on nanoparticle and plant algae interaction by focusing to molecular response mechanisms at genome transcriptome proteome and metabolome levels In addition uptake and translocation mechanism of nanoparticles will be assessed both in plant and algae Throughout this book the latest developments and discoveries will be highlighted as well as open problems and future challenges in molecular mechanisms of plants algae as a response of nanoparticles Presents genome transcriptome proteome and metabolome responses in plants algae along with cellular uptake and translocation mechanisms Illustrates nano particle plant algae interactions Covers both

simple and higher organisms addressing both algae and plant Plant Response to Gold Nanoparticles Azamal Husen, 2024-12-01 In this book overall plant and soil system are examined exclusively in terms of gold nanoparticles Au NPs exposure Au NPs influence plant growth and yield performance They also affect plant and soil system interactions Au NPs responses are primarily depends on the concentration plant species or cultivars exposure time shape and size of NPs Investigation have shown that the lower concentrations of Au NPs increase seed germination beneficial biochemical components rate of photosynthesis and overall growth however at higher concentrations all these responses are declined in different plant species At higher concentration Au NPs induce stress in plant create phytotoxicity and produce reactive oxygen species which leads to the disruption of cellular metabolism Further at higher concentration Au NPs hampered the physico chemical process of plant and soil system Moreover the molecular and physiological performance showed that the exposure of Au NPs resulted in oxidative stress and induced antioxidative and defense responses The energy production related to metabolic pathways were also influenced by Au NPs exposure Au NPs exposure accelerated the number of chromosomal aberrations micronuclei and decreased the mitotic index in plant root tip cells Proteomic study has shown that the exposure Au NPs resulted in an accumulation of protein precursors indicative of the dissipation of a proton motive force Au ions were noticed in roots and shoots while Au NPs were absorbed only in the plant root tissues Au NPs exposure also influence flowering process and seed germination Beside the terrestrial plants these particles have also influenced the growth of some wetland and aquatic plants It was also noticed that the addition of Au NPs into the culture medium had also influence the in vitro development and multiplication of plants Studies have begun to examine how arbuscular mycorrhizal fungi might affect the uptake of specific nanoparticles include Au and how these particles might influence the plant mycorrhizal relationships The impact of Au NPs on the size and structure of microbial communities in soil and soil enzymatic activities for glucosidase urease alkaline phosphatase and dehydrogenase has been examined In the present book environmental safety and ethical issues related to use of Au NPs in plant and soil system has been also explored Overall this book is provide an up to date most important and selected information associated with the plant response to Au NPs This book will be a good resource for upper level students faculty scientists and researchers working specially on plant biology plant nanobiotechnology plant biochemistry plant microbiology agricultural and other allied subjects and or science

Nanosensors for Environment, Food and Agriculture Vol. 1 Vineet Kumar, Praveen Guleria, Shivendu Ranjan, Nandita Dasgupta, Eric Lichtfouse, 2021-03-15 Nanosensors enable us to specifically detect pollutants that can adversely affect the quality of life This book covers the design application and safety aspects of nanomaterial based sensors The focus is on nanosensors useful for application in Environment Food and Agriculture It discusses in detail the advances in nanosensor design and application It also emphasizes on the strategies for toxicity assessment and safe use of nanosensors

Nanoformulations for Agricultural Applications Radhakrishnan Edayileveetil Krishnankutty, Aswani R., Visakh P.

M.,2025-02-11 This book is a comprehensive guide to nanoformulations revolutionizing agriculture enhancing sustainability and advancing agrochemical applications This book examines state of the art research emerging challenges and new opportunities in the field of nanoformulations for agriculture applications Detailed discussions include the development and use of nanopesticides nanoformulations for promoting plant growth and nanotechnology for effective crop disease management Furthermore it covers recent trends in the design and production of nano based formulations and nanocarriers for the efficient delivery of agrochemicals The book is divided into three sections The first section introduces readers to agricultural applications and methods for nanoparticle synthesis their applications and types of biomasses It examines the benefits of agriculture and the role of nanotechnology in the agriculture sector The second section focuses on nanoformulations for plant growth promotion It covers topics on types of nanoparticles synthesis methods of nanoparticles and applications of nanoparticles in the agricultural field The third section discusses trends various other applications and the benefits of using nanocarriers in agriculture Audience This book is aimed at researchers engineers and scientists working in agrochemicals crops soil biotechnology chemistry microbiology nano chemistry technology materials formulations in agriculture applications **Nanobiotechnology** Jameel M. Al-Khayri,Mohammad Israil Ansari,Akhilesh Kumar

Singh,2021-07-22 This book provides up to date knowledge of the promising field of Nanobiotechnology with emphasis on the mitigation approaches to combat plant abiotic stress factors including drought salinity waterlog temperature extremes mineral nutrients and heavy metals These factors adversely affect the growth as well as yield of crop plants worldwide especially under the global climate change Nanobiotechnology is viewed to revolutionize crop productivity in future The chapters discuss the status and prospects of this cutting edge technology toward understanding tolerance mechanisms including signaling molecules and enzymes regulation in addition to the applications of Nanobiotechnology to combat individual abiotic stress factors **Growth Regulation and Quality Improvement of Vegetable Crops** Golam Jalal

Ahammed,Jie Zhou,2025-04-15 This book compiles the latest advancements in vegetable crop growth development and quality improvement with potential implications for sustainable crop production It covers aspects of light quality regulation CO₂ enrichment beneficial microorganisms epigenetic regulation and perspectives on carbon neutral protected vegetable production Through this book readers will gain new insights into the mechanisms of growth regulation quality improvement and stress tolerance in vegetable crops encompassing the most recent biochemical physiological and molecular studies The chapters cover topics such as seed germination processes root trait regulation for defense mechanisms essential nutrient management for optimal growth stomatal function dynamics in vegetables fruit development pathways secondary metabolism roles in quality enhancement abiotic stress response strategies biotic stress resistance mechanisms and post harvest physiology in vegetable crops The book provides a thorough examination of climate smart technologies aimed at ensuring sustainable vegetable production amidst global climate change challenges It addresses critical topics like food safety through

detoxification of pesticide residues and explores innovative approaches such as hormonal regulation techniques nanotechnology the use of growth regulators biostimulants and grafting to enhance growth and stress tolerance in vegetables This volume is an indispensable resource for professionals in olericulture horticulture and plant sciences Researchers and advanced university students will find it particularly valuable for its comprehensive coverage of vegetable crop growth and quality improvement The book s focus on sustainable agricultural practices makes it a must read for anyone committed to addressing global food security challenges in the context of climate change

Embracing the Song of Expression: An Emotional Symphony within **Nanotechnology And Plant Sciences Nanoparticles And Their Impact On Plants**

In a world taken by monitors and the ceaseless chatter of immediate conversation, the melodic beauty and emotional symphony created by the published word often fade in to the back ground, eclipsed by the relentless sound and disruptions that permeate our lives. Nevertheless, situated within the pages of **Nanotechnology And Plant Sciences Nanoparticles And Their Impact On Plants** a wonderful literary treasure full of raw emotions, lies an immersive symphony waiting to be embraced. Crafted by a wonderful musician of language, this charming masterpiece conducts viewers on a mental trip, skillfully unraveling the hidden melodies and profound affect resonating within each carefully constructed phrase. Within the depths of this poignant assessment, we shall discover the book is key harmonies, analyze their enthralling writing model, and surrender ourselves to the profound resonance that echoes in the depths of readers souls.

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