Abiotic Stresses Plant Resistance Through Breeding And Molecular Approaches Crop Science

Crop growth and production is dependent on various climatic factors. Both abiotic and biotic stresses have become an integral part of plant growth and development. There are several factors involved in plant stress mechanism. The information in the area of plant growth and molecular mechanism against abiotic and biotic stresses is scattered. The up-to-date information with cited references is provided in this book in an organized way. More emphasis has been given to elaborate the injury and tolerance mechanisms and growth behavior in plants against abiotic and biotic stresses. This book also deals with abiotic and biotic stress tolerance in plants, molecular mechanism of stress resistance of photosynthetic machinery, stress tolerance in plants: special reference to salt stress - a biochemical and physiological adaptation of some Indian halophytes, PSII fluorescence techniques for measurement of drought and high temperature stress signal in crop plants: protocols and applications,

salicylic acid: role in plant physiology & stress tolerance, salinity induced genes and molecular basis of salt tolerance mechanism in mangroves, reproductive stage abiotic stress tolerance in cereals, calorimetry and Raman spectrometry to study response of plant to biotic and abiotic stresses, molecular physiology of osmotic stress in plants and mechanisms, functions and toxicity of heavy metals stress in plants, submergence stress tolerance in plants and adoptive mechanism, Brassinosteroid modulated stress responses under temperature stress, stress tolerant in plants: a proteomics approach, Marker-assisted breeding for stress resistance in crop plants, DNA methylation associated epigenetic changes in stress tolerance of plants and role of calcium-mediated CBL-CIPK network in plant mineral nutrition & abiotic stress. Each chapter has been laid out with introduction, up-to-date literature, possible stress mechanism, and applications. Under abiotic stress, plant produces a large quantity of free radicals, which have been elaborated. We hope that this book will be of greater use for the post-graduate students, researchers, physiologist and biotechnologist to sustain the plant

growth and development.
Abiotic Stress and Legumes: Tolerance and Management is the first book to focus on the ability of legume plants to adapt effectively to environmental challenges. Using the -omic approach, this book takes a targeted approach to understanding the methods and means of ensuring survival and maximizing the productivity of the legume plant by improving tolerance to environmental /abiotic stress factors including drought, temperature change, and other challenges. The book presents a comprehensive overview of the progress that has been made in identifying means of managing abiotic stress effects, specifically in legumes, including the development of several varieties which exhibit tolerance through high yield using transcriptomic, proteomic, metabolomic and ionomic approaches. Further, exogenous application of various stimulants such as plant hormones, nutrients, sugars, and polyamines has emerged as an alternative strategy to improve productivity under these environmental challenges. Abiotic Stress and Legumes: Tolerance and Management examines these emerging strategies and serves as an important resource for researchers, academicians and scientists, enhancing their knowledge and

aiding further research. Explores the progress made in managing abiotic stress, specifically with high yield legumes Highlights the molecular mechanisms related to acclimation Presents proven strategies and emerging approaches to guide additional research

This book presents abiotic stresses that cause crop damage in the range of 6-20%. Understanding the interaction of crop plants to the abiotic stresses caused by heat, cold, drought, flooding, submergence, salinity, acidity, etc., is important to develop resistant crop varieties. Knowledge on the advanced genetic and genomic crop improvement strategies including molecular breeding, transgenics, genomic-assisted breeding, and the recently emerging genome editing for developing resistant varieties in cereal crops is imperative for addressing FPNEE (food, health, nutrition, energy, and environment) security. Whole genome sequencing of these crops followed by genotyping-by-sequencing has facilitated precise information about the genes conferring resistance useful for gene discovery, allele mining, and shuttle breeding which in turn opened up the scope for 'designing' crop genomes with resistance to abiotic stresses. The nine

chapters each dedicated to a cereal crop in this volume are deliberate on different types of abiotic stresses and their effects on and interaction with crop plants; enumerate on the available genetic diversity with regard to abiotic stress resistance among available cultivars; illuminate on the potential gene pools for utilization in interspecific gene transfer; are brief on the classical genetics of stress resistance and traditional breeding for transferring them to their cultivated counterparts; elucidate on the success stories of genetic engineering for developing abiotic stress-resistant crop varieties; discuss on molecular mapping of genes and QTLs underlying stress resistance and their marker-assisted introgression into elite varieties; enunciate on different emerging genomics-aided techniques including genomic selection, allele mining, gene discovery, and gene pyramiding for developing adaptive crop varieties with higher quantity and quality, and also elaborate some case studies on genome editing focusing on specific genes for generating abiotic stress-resistant crops. In nature, plants are constantly challenged by various abiotic and biotic stresses that can restrict their growth,

development and yields. In the course of their evolution, plants have evolved a variety of sophisticated and efficient mechanisms to sense, respond to, and adapt to changes in the surrounding environment. A common defensive mechanism activated by plants in response to abiotic stress is the production and accumulation of compatible solutes (also called osmolytes). This include amino acids (mainly proline), amines (such as glycinebetaine and polyamines), and sugars (such as trehalose and sugar alcohols), all of which are readily soluble in water and non-toxic at high concentrations. The metabolic pathways involved in the biosynthesis and catabolism of compatible solutes, and the mechanisms that regulate their cellular concentrations and compartmentalization are well characterized in many important plant species. Numerous studies have provided evidence that enhanced accumulation of compatible solutes in plants correlates with increased resistance to abiotic stresses. New insights into the mechanisms associated with osmolyte accumulation in transgenic plants and the responses of plants to exogenous application of osmolyte, will further enhance our understanding of the mechanisms by which

compatible solutes help to protect plants from damage due to abiotic stress and the potential roles compatible solutes could play in improving plants growth and development under optimal conditions for growth. Although there has been significant progress made in understanding the multiple roles of compatible solute in abiotic stress tolerance, many aspects associated with compatible solute-mediated abiotic stress responses and stress tolerance still require more research. As well as providing basic up-to-date information on the biosynthesis, compartmentalization and transport of compatible solute in plants, this book will also give insights into the direct or indirect involvement of these key compatible solutes in many important metabolic processes and physiological functions, including their antioxidant and signaling functions, and roles in modulating plant growth, development and abiotic stress tolerance. In this book, Osmoprotectant-mediated abiotic stress tolerance in plants: recent advances and future perspectives, we present a collection of 16 chapters written by leading experts engaged with compatible solute-induced abiotic stress tolerance in plants. The main objective of this volume

is to promote the important roles of these compatible solutes in plant biology, by providing an integrated and comprehensive mix of basic and advanced information for students, scholars and scientists interested in, or already engaged in, research involving osmoprotectant. Finally, this book will be a valuable resource for future environmental stress-related research, and can be considered as a textbook for graduate students and as a reference book for front-line researchers working on the relationships between osmoprotectant and abiotic stress responses and tolerance in plants.

Role of Phytoprotectants

Plant Genomics

Stress Tolerance in Horticultural Crops

Abiotic Stresses: Plant Resistance Through Breeding And Molecular Approaches Indian Reprint

Engineering Tolerance in Crop Plants Against Abiotic Stress

Plants are frequently exposed to unfavorable and adverse environmental conditions known as abiotic stressors. These factors can include salinity, drought, heat, cold, flooding, heavy metals, and UV radiation which pose serious threats to the sustainability of crop yields. Since abiotic stresses are major constraints for crop production, finding the approaches to enhance stress tolerance is

crucial to increase crop production and increase food security. This book discusses approaches to enhance abiotic stress tolerance in crop plants on a global scale. Plants scientists and breeders will learn how to further mitigate plant responses and develop new crop varieties for the changing climate.

The assimilation of sulfur in higher plants and its reduction in metabolically important sulfur compounds are crucial factors determining plant growth and vigor and resistance to stresses. The present book discusses the aspects of sustainable crop production with sulfur, the importance of sulfur metabolites and sulfur metabolizing enzymes in abiotic stress management in plants. The book provides the most up-to-date reference on sulfur assimilation in plants.

Presents a multidisciplinary analysis of the integration among reactive oxygen species (ROS), reactive nitrogen species (RNS), and reactive sulfur species (RSS). Since plants are the main source of our food, the improvement of their productivity is the most important task for plant biologists. In this book, leading experts accumulate the recent development in the research on oxidative stress and approaches to enhance antioxidant defense system in crop plants. They discuss both the plant responses to oxidative stress and mechanisms of abiotic stress tolerance, and cover all of the recent approaches towards understanding oxidative stress in plants, providing

comprehensive information about the topics. It also discusses how reactive nitrogen species and reactive sulfur species regulate plant physiology and plant tolerance to environmental stresses. Reactive Oxygen, Nitrogen and Sulfur Species in Plants: Production, Metabolism, Signaling and Defense Mechanisms covers everything readers need to know in four comprehensive sections. It starts by looking at reactive oxygen species metabolism and antioxidant defense. Next, it covers reactive nitrogen species metabolism and signaling before going on to reactive sulfur species metabolism and signaling. The book finishes with a section that looks at crosstalk among reactive oxygen, nitrogen, and sulfur species based on current research done by experts. Presents the newest method for understanding oxidative stress in plants. Covers both the plant responses to oxidative stress and mechanisms of abiotic stress tolerance Details the integration among reactive oxygen species (ROS), reactive nitrogen species (RNS) and reactive sulfur species (RSS) Written by 140 experts in the field of plant stress physiology, crop improvement, and genetic engineering Providing a comprehensive collection of up-to-date knowledge spanning from biosynthesis and metabolism to signaling pathways implicated in the involvement of RONSS to plant defense mechanisms, Reactive Oxygen, Nitrogen and Sulfur Species in Plants: Production, Metabolism, Signaling and Defense Mechanisms is

an excellent book for plant breeders, molecular biologists, and plant physiologists, as well as a guide for students in the field of Plant Science. Transcription Factors for Abiotic Stress Tolerance in Plants highlights advances in the understanding of the regulatory network that impacts plant health and production, providing important insights for improving plant resistance. Plant production worldwide is suffering serious losses due to widespread abiotic stresses increasing as a result of global climate change. Frequently more than one abiotic stress can occur at once, for example extreme temperature and osmotic stress, which increases the complexity of these environmental stresses. Modern genetic engineering technologies are one of the promising tools for development of plants with efficient yields and resilience to abiotic stresses. Hence deciphering the molecular mechanisms and identifying the abiotic stress associated genes that control plant response to abiotic stresses is a vital requirement in developing plants with increased abiotic stress resilience. Addressing the various complexities of transcriptional regulation, this book includes chapters on cross talk and central regulation, regulatory networks, the role of DOF, WRKY and NAC transcription factors, zinc finger proteins, CRISPR/CAS9-based genome editing, C-Repeat (CRT) binding factors (CBFs)/Dehydration responsive element binding factors (DREBs) and factors impacting salt, cold and phosphorous stress

levels, as well as transcriptional modulation of genes involved in nanomaterial-plant interactions. Transcription Factors for Abiotic Stress Tolerance in Plants provides a useful reference by unravelling the transcriptional regulatory networks in plants. Researchers and advanced students will find this book a valuable reference for understanding this vital area. Discusses abiotic stress tolerance and adaptive mechanisms based on the findings generated by unlocking the transcriptional regulatory network in plants Presents various kinds of regulatory gene networks identified for drought, salinity, cold and heat stress in plants Highlights urgent climate change issues in plants and their mitigation using modern biotechnological tools including genome editing.

Abiotic Stress and Legumes

Biochemical and Molecular Perspectives

Volume 1: Responses and Adaptations

Breeding and Biotechnology

Understanding Abiotic Stresses

The impact of global climate change on crop production has emerged as a major research priority during the past decade. Understanding abiotic stress factors such as temperature and drought tolerance and biotic stress tolerance traits such as insect pest and pathogen resistance in combination with high yield in plants is of paramount importance to counter climate change related adverse effects on the productivity of crops. In this multi-authored

book, we present synthesis of information for developing strategies to combat plant stress. Our effort here is to present a judicious mixture of basic as well as applied research outlooks so as to interest workers in all areas of plant science. We trust that the information covered in this book would bridge the much-researched area of stress in plants with the much-needed information for evolving climate-ready crop cultivars to ensure food security in the future. We are currently experiencing a climate crisis that is associated with extreme weather events worldwide. Some of its most noticeable effects are increases in temperatures, droughts, and desertification. These effects are already making whole regions unsuitable for agriculture. Therefore, we urgently need global measures to mitigate the effects of climate breakdown as well as crop alternatives that are more stress-resilient. These crop alternatives can come from breeding new varieties of well-established crops, such as wheat and barley. They can also come from promoting underutilized crop species that are naturally tolerant to some stresses, such as quinoa. Either way, we need to gather more knowledge on how plants respond to stresses related to climate breakdown, such as heat, water-deficit, flooding high salinity, nitrogen, and heavy metal stress. This Special Issue provides a timely collection of recent advances in the understanding of plant responses to these

stresses. This information will definitely be useful to the design of new strategies to prevent the loss of more cultivable land and to reclaim the land that has already been declared unsuitable.

Plant Abiotic Stress Physiology, 2-volume set highlights the various innovative and emerging techniques and molecular applications that are currently being used in plant abiotic stress physiology. Volume 1: Responses and Adaptations focuses on the responses and adaptations of plants to stress factors at the cellular and molecular levels and offers a variety of advanced management strategies and technologies. With contributions from specialists in the field, the volume discusses how plants have developed diverse physiological and molecular adjustments to safeguard themselves under challenging conditions and how emerging new technologies can utilize these plant adaptations to enhance plant resistance. Topics in this volume include redox homeostasis managers in plants, oxidative damage and antioxidative defense mechanism, photosynthesis and respiration under challenging environments, salinity-induced changes, genetics approaches for improving abiotic stress tolerance in crop plants, CRISPR/CAS-mediated genome editing technologies, and more. Agriculture today faces countless challenges to meet the rising need for sustainable food supplies and guarantees of high-

quality nourishment for a quickly growing population. To assure sufficient food production, it is necessary to address the difficult environmental circumstances that are causing cellular oxidative stress in plants due to abiotic factors, which play a defining role in shaping yield of crop plants. This volume, in conjunction with Plant Abiotic Stress Physiology: Volume 2: Molecular Advancements, helps to meet these challenges by providing a rich source of information on plant abiotic stress physiology and effective management techniques.

This book focuses on multiple plant stresses and the molecular basis of adaptation, addressing the molecular mechanism and adaptation for both abiotic and biotic stresses. Ensuring the yield of crop plants grown under multiple individual and/or combined stresses is essential to sustaining productivity. In this regard, the development of broad-spectrum stress-tolerant plants is important. However, to date information has largely been compiled only on the individual stress tolerance mechanisms, and the mechanisms behind plants' tolerance to two or more individual or simultaneous stresses are not fully understood. Especially combinatorial stress, a new stress altogether, has only recently been made the object of systematic study. Now several research groups around the world have begun exploring the concurrent stress tolerance mechanisms under both biotic and abiotic stress

combinations. This book presents contributions from various experts, highlighting the findings of their multiple individual and concurrent stress tolerance dissection studies.

Plant Tolerance to Environmental Stress

Priming-Mediated Stress and Cross-Stress Tolerance in Crop Plants

Physiology and Biochemistry

Plant Breeding for Biotic Stress Resistance

Abiotic Stresses in Plants

Priming-Mediated Stress and Cross-Stress Tolerance in Crop Plants provides the latest, in-depth understanding of the molecular mechanisms associated with the development of stress and cross-stress tolerance in plants. Plants growing under field conditions are constantly exposed, either sequentially or simultaneously, to many abiotic or biotic stress factors. As a result, many plants have developed unique strategies to respond to ever-changing environmental conditions, enabling them to monitor their surroundings and adjust their metabolic systems to maintain homeostasis. Recently, priming mediated stress and cross-stress tolerance (i.e., greater tolerance to a second, stronger stress after exposure to a different, milder primary stress) have attracted considerable interest within the scientific community as potential means of stress management and for producing stress-resistant crops to aid global food security. Priming-Mediated Stress and Cross-Stress Tolerance in Crop Plants comprehensively reviews the physiological, biochemical, and molecular basis of cross-

tolerance phenomena, allowing researchers to develop strategies to enhance crop productivity under stressful conditions and to utilize natural resources more efficiently. The book is a valuable asset for plant and agricultural scientists in corporate or government environments, as well as educators and advanced students looking to promote future research into plant stress tolerance. Provides comprehensive information for developing multiple stress-tolerant crop varieties Includes in-depth physiological, biochemical, and molecular information associated with cross-tolerance Includes contribution from world-leading cross-tolerance research group Presents color images and diagrams for effective communication of key concepts This book provides a valuable insight into how the area of plant adaptation to abiotic stresses has progressed through the application of the new technologies. The book consists of eight chapters written by outstanding scientists across the world, who carry out research at the cutting edge of their disciplines. The topics, addressed in up-to-date specific chapters, include effects and responses of plants to stresses caused by such factors as: 1) high temperature, 2) low temperature (chilling and freezing), 3) salt, 4) drought, 5) flooding, 6) heavy metals, 7) elevated carbon dioxide, 8) ozone.

This book discusses progress made toward the major goal of uncovering the plant resistance mechanisms to biotic and abiotic stresses; the purpose being to utilise this knowledge in genetic modification of plants for achieving improved stress resistance.

Plant growth and productivity are limited in many areas of the world by a wide variety of environmental stresses. This book discusses progress made toward the major goal of uncovering the plant resistance mechanisms to biotic and abiotic stresses; the purpose being to utilise this knowledge in genetic modification of plants for achieving improved stress resistance. This volume achieves a new synthesis in considering the mechanisms of resistance at various levels of organisation -- from individual cells and tissues, through whole plants, to communities. Chapters are written by internationally acknowledged experts, who have a wealth of research and teaching experience. With comprehensive and up-to-date coverage, this book analyses many outstanding problems and poses important questions for future research.

Phytomicrobiome Interactions and Sustainable Agriculture

Mechanisms of Environmental Stress Resistance in Plants

Protective Chemical Agents in the Amelioration of Plant Abiotic Stress

Tolerance and Management

Production, Metabolism, Signaling and Defense Mechanisms

Plant genomics aims to sequence, characterize, and study the genetic compositions, structures, organizations, functions, and interactions/networks of an entire plant genome. Its development

and advances are tightly interconnected with proteomics, metabolomics, metagenomics, transgenomics, genomic selection, bioinformatics, epigenomics, phenomics, system biology, modern instrumentation, and robotics sciences. Plant genomics has significantly advanced over the past three decades in the land of inexpensive, high-throughput sequencing technologies and fully sequenced over 100 plant genomes. These advances have broad implications in every aspect of plant biology and breeding, powered with novel genomic selection and manipulation tools while generating many grand challenges and tasks ahead. This Plant genomics provides some updated discussions on current advances, challenges, and future perspectives of plant genome studies and applications.

The basic concept of this book is to examine the use of innovative methods augmenting traditional plant breeding towards the development of new crop varieties under different environmental conditions to achieve sustainable food production. This book consists of two volumes: Volume 1 subtitled Breeding,

Biotechnology and Molecular Tools and Volume 2 subtitled Agronomic, Abiotic and Biotic Stress Traits. This is volume 2 which contains 18 chapters highlighting breeding strategies for specific plant traits including improved nutritional and pharmaceutical properties as well as enhanced tolerance to insects, diseases, drought, salinity and temperature extremes expected under predicted global climate change.

Abiotic stresses have become an integral part of crop production. One or other persist either in soil, water or in atmosphere. The information in the areas of injury and tolerant mechanisms, variability for tolerance, breeding and biotechnology for improvement of crop plants against abiotic stresses are lying unorganized in different articles of journals and edited books. This information is presented in this book in organized way with up-to-date citations, which will provide comprehensive literatures of recent advances. More emphasis has been given to elaborate the injury and tolerance mechanisms, and development of improved genotypes against stress environments. This book

also deals with the plants' symptoms of particular abiotic stress, reclamation of soil and crop/cropping pattern to over come the effect of adverse condition(s). Each has been laid out with systematic approaches to develop abiotic stress tolerant genotypes using biotechnological tools. Use of molecular markers in stress tolerance and development of transgenic also have been detailed. Air pollution and climate change are the hot topic of the days. Thus, the effect of air pollution and climate change on crop plants have been detailed in the final three s of this book. Under abiotic stress, plant produces a large quantity of free radicals (oxidants), which have been elaborated in a separate 'Oxidative Stress'. This book has been divided into seven major parts- physical stress (salt), water stresses (drought and waterlogging), temperature stresses (heat and cold), metal toxicities (aluminium, iron, cadmium, lead, nickel, chromium, copper, zinc etc) and non-metal toxicities (boron and arsenic), oxidative stress, and finally atmospheric stresses (air pollution, radiation and climate change).

Hope, this book will be of greater use for the students and researchers, particularly Plant Breeders and Biotechnologists as well as the Botanists, to understand the injury and tolerance mechanisms, and subsequently improvement of crop genotypes for abiotic stresses.

A guide to the role microbes play in the enhanced production and productivity of agriculture to feed our growing population Phytomicrobiome Interactions and Sustainable Agriculture offers an essential guide to the importance of 'Phytomicrobiome' and explores its various components. The authors – noted experts on the topic – explore the key benefits of plant development such as nutrient availability, amelioration of stress and defense to plant disease. Throughout the book, the authors introduce and classify the corresponding Phytomicrobiome components and then present a detailed discussion related to its effect on plant development: controlling factors of this biome, its behaviour under the prevailing climate change condition and beneficial effects. The book covers the newly emerging

technical concept of Phytomicrobiome engineering, which is an advanced concept to sustain agricultural productivity in recent climatic scenario. The text is filled with comprehensive, cutting edge data, making it possible to access this ever-growing wealth of information. This important book: Offers a one-stop resource on phytomicrobiome concepts Provides a better understanding of the topic and how it can be employed for understanding plant development Contains a guide to sustaining agriculture using phytomicrobiome engineering Presents information that can lead to enhanced production and productivity to feed our growing population Written for students, researchers and policy makers of plant biology, Phytomicrobiome Interactions and Sustainable Agriculture offers a clear understanding of the importance of microbes in overall plant growth and development.

Plant Abiotic Stress Physiology

Molecular Stress Physiology of Plants

Genomic Designing for Abiotic Stress Resistant Cereal Crops

Abiotic Stresses

Climate change is a serious problem influencing agricultural production worldwide and challenging researchers to investigate plant responses and to breed crops for the changed growing conditions. Abiotic stresses are the most important for crop production, affecting about 96.5% of arable land worldwide. These stress factors include high and low temperature, water deficit (drought) and flooding, salinity, heavy metals, UV radiation, light, chemical pollutants, and so on. Since some of the stresses occurred simultaneously, such as heat and water deficit, causing the interactions of physiological processes, novel multidisciplinary solutions are needed. This book provides an overview of the present state in the research of abiotic stresses and molecular, biochemical, and whole plant responses, helping to prevent the negative impact of global climate change.

Gain a better understanding of the genetic and physiological bases of stress response and stress tolerance as part of crop improvement programs Abiotic Stresses: Plant Resistance Through Breeding and Molecular Approaches explores innovative methods for breeding new varieties of major crops with resistance to environmental stresses that limit crop production worldwide. Experts provide you with basic principles and techniques of plant breeding as well as work done in relation to improving resistance in specific important world food crops. This book supplies extensive bibliographies at the end of each chapter, as well as tables and figures that illustrate the research findings. Abiotic Stresses is divided into two sections. In the first section, you will find: the general principles of breeding crops for stress resistance genetic engineering and molecular biology procedures for crop improvement for stress environments data on genome mapping and its implications for improving stress

resistance in plants information about breeding for resistance/tolerance to salinity, drought, flooding, metals, low nutrient availability, high/low temperatures The second section of this timely resource focuses on the efforts of acknowledged specialists who concentrated their efforts on important individual crops, such as: wheat barley rice maize oilseed crops cotton tomato This book fills a niche and interface in the available literature as it deals with all of the major stresses from a perspective of crop breeding, covering the latest advances in molecular breeding technology. Abiotic Stresses will help scientists and academics in botany, plant breeding, plant environmental stress studies, agriculture, and horticulture modify and improve breeding programs globally.

Despite significant progress in increasing agricultural production, meeting the changing dietary preferences and increasing food demands of future populations remains a significant challenge. Salinity, drought, water logging, high temperature and toxicity are abiotic stresses that affect the crop yield and production. Tolerance for stress is a important characteristic that plants need to have in order to survive. Identification of proper techniques at a proper time can make it easy for scientists to increase crop productivity and yield. In Engineering Tolerance in Crop Plants against Abiotic Stress we have discussed the possible stresses and their impact on crops and portrayed distinctive abiotic stress tolerance in response to different techniques that can improve the performance of crops. Features of the Book: Provide a state-of-the-art description of the physiological, biochemical, and molecular status of the understanding of abiotic stress in plants. Address factors that threaten future food production and provide potential solution to these factors. Designed to cater to the needs of the students engaged in the field of environmental

sciences, soil sciences, agricultural microbiology, plant pathology, and agronomy. New strategies for better crop productivity and yield. Understanding new techniques pointed out in this book will open the possibility of genetic engineering in crop plants with the concomitant improved stress tolerance.

Abiotic stress adversely affects crop production worldwide, decreasing average yields for most of the crops to 50%. Among various abiotic stresses affecting agricultural production, drought stress is considered to be the main source of yield reduction around the globe. Due to an increasing world population, drought stress will lead to a serious food shortage by 2050. The situation may become worse due to predicated global climate change that may multiply the frequency and duration and severity of such abiotic stresses. Hence, there is an urgent need to improve our understanding on complex mechanisms of drought stress tolerance and to develop modern varieties that are more resilient to drought stress. Identification of the potential novel genes responsible for drought tolerance in crop plants will contribute to understanding the molecular mechanism of crop responses to drought stress. The discovery of novel genes, the analysis of their expression patterns in response to drought stress, and the determination of their potential functions in drought stress adaptation will provide the basis of effective engineering strategies to enhance crop drought stress tolerance. Although the in-depth water stress tolerance mechanisms is still unclear, it can be to some extent explained on the basis of ion homeostasis mediated by stress adaptation effectors, toxic radical scavenging, osmolyte biosynthesis, water transport, and long distance signaling response coordination. Importantly, complete elucidation of the physiological, biochemical, and molecular mechanisms for

drought stress, perception, transduction, and tolerance is still a challenge to the plant biologists. The findings presented in volume 1 call attention to the physiological and biochemical modalities of drought stress that influence crop productivity, whereas volume 2 summarizes our current understanding on the molecular and genetic mechanisms of drought stress resistance in plants.

Molecular Mechanisms and Genetics of Plant Resistance to Abiotic Stress

Advances in Plant Breeding Strategies: Agronomic, Abiotic and Biotic Stress Traits

Osmoprotectant-Mediated Abiotic Stress Tolerance in Plants

Abiotic and Biotic Stress in Plants

Recent Advances and Future Perspectives

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.

Plants under abiotic stress are those suffering from drought, extreme temperatures, flood and other natural—but non-living—factors. Abiotic stress is responsible for reduced yields in several major crops, and climate change is focusing research in this area. To minimize cellular damage cause by such stresses, plants have evolved complex, well-coordinated adaptive responses that operate at the transcriptional level. Understanding these processes is key to manipulating plant performance to withstand stress. This book deals with the role of gene silencing in the adaptation of plants to these stresses, and documents the molecular regulatory systems for the abiotic response.

Plant Abiotic Stress Physiology highlights the various innovative and emerging techniques and

molecular applications that are currently being used in plant abiotic stress physiology. Volume 2 of this 2-volume set focuses on state-of-the-art molecular advances for the mitigation of abiotic stress in plants. With contributions from specialists in the field, the volume discusses how plants have developed diverse physiological and molecular adjustments to safeguard themselves under challenging conditions and how emerging new technologies can utilize these plant adaptations to enhance plant resistance. These include using plant-environment interactions in develop crop species that are resilient to climate change, taking genomics and phenomics approaches for the study of abiotic stress tolerance, employing methyl jasmonate and salicylic acid, harnessing the CRISPR/CAS system to strengthen plant stress resistance, and more. Agriculture today faces countless challenges to meet the rising need for sustainable food supplies and guarantees of high-quality nourishment for a quickly mounting population. To assure sufficient food production, it is necessary to address the challenging environmental circumstances that are causing cellular oxidative stress in plants due to abiotic factors, which play a defining role in shaping yield of crop plants. This volume, along with Plant Abiotic Stress Physiology: Volume 1: Responses and Adaptations, helps to meet these challenges by providing a rich source of information on plant abiotic stress physiology and effective management techniques.Click here for Volume 1: Responses and

AdaptationsSee information on the complete set here: Plant Abiotic Stress Physiology, 2-Volume Set, Volume 1: Responses and Adaptations / Volume 2: Molecular Advancements

Since recent years, the population across the globe is increasing expeditiously; hence increasing the agricultural productivity to meet the food demands of the thriving population becomes a challenging task. Abiotic stresses pose as a major threat to agricultural productivity. Having an adequate knowledge and apprehension of the physiology and molecular biology of stress tolerance in plants is a prerequisite for counteracting the adverse effect of such stresses to a wider range. This book deals with the responses and tolerance mechanisms of plants towards various abiotic stresses. The advent of molecular biology and biotechnology has shifted the interest of researchers towards unraveling the genes involved in stress tolerance. More effort is being made to understand and pave ways for developing stress tolerance mechanisms in crop plants. Several technologies including Microarray technology, functional genomics, on gel and off gel proteomic approaches have proved to be of utmost importance by helping the physiologists, molecular biologists and biotechnologists in identifying and exploiting various stress tolerance genes and factors for enhancing stress tolerance in plants. This book would serve as an exemplary source of scientific information pertaining to abiotic stress responses and tolerance mechanisms towards

various abiotic stresses. Note: T&F does not sell or distribute the Hardback in India, Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka.

Abiotic Stress Tolerance Mechanisms in Plants

Improving Crop Resistance to Abiotic Stress

Approaches for Enhancing Abiotic Stress Tolerance in Plants

Transcription Factors for Abiotic Stress Tolerance in Plants

Plant Breeding for Abiotic Stress Tolerance

Plants are subjected to numerous environmental stresses, which can be classified into two broad areas: abiotic and biotic stresses. While the first is considered the damage done to an organism by other living organisms, the latter occurs as a result of a negative impact of non-living factors on the organisms. In this scenario, the current most accepted opinion of scientists is that both biotic and abiotic factors in nature and agroecosystems are affected by climate change, which may lead to significant crop yield decreases worldwide. We should take into consideration not only this environmental concern but also the fact that 20 years from now the earth's population will need 55% more food than it can produce now. Therefore, it is crucial to address such concerns and bring about possible solutions to future plant stress-related outcomes that might affect global agriculture. This book intends to provide the reader with a comprehensive overview of both biotic and abiotic stresses through 10 chapters that include case studies and literature reviews about these topics. There will be a particular focus on understanding the physiological, biochemical, and molecular changes observed in stressed plants as well as the mechanisms underlying stress

tolerance in plants.

Abiotic stresses such as drought, flooding, high or low temperatures, metal toxicity and salinity can hamper plant growth and development. Improving Abiotic Stress Tolerance in Plants explains the physiological and molecular mechanisms plants naturally exhibit to withstand abiotic stresses and outlines the potential approaches to enhance plant abiotic stress tolerance to extreme conditions. Synthesising developments in plant stress biology, the book offers strategies that can be used in breeding, genomic, molecular, physiological and biotechnological approaches that hold the potential to develop resilient plants and improve crop productivity worldwide. Features · Comprehensively explains molecular and physiological mechanism of multiple abiotic stress tolerance in plants · Discusses recent advancements in crop abiotic stress tolerance mechanism and highlights strategies to develop abiotic stress tolerant genotypes for sustainability · Stimulates synthesis of information for plant stress biology for biotechnological applications · Presents essential information for large scale breeding and agricultural biotechnological programs for crop improvement Written by a team of expert scientists, this book benefits researchers in the field of plant stress biology and is essential reading for graduate students and researchers generating stress tolerant crops through genetic engineering and plant breeding. It appeals to individuals developing sustainable agriculture through physiological and biotechnological applications.

The rapid population growth and the increase in the per capita income, especially in the group of emerging countries referred to as BRIC countries (Brazil, Russia, India, China and South

Africa) has created huge pressure for the expansion of the agricultural growing area and the crop yields to meet the rising demand. As a result, many areas that have been considered marginal for growing crops, due to their low fertility, drought, salinity, and many other abiotic stresses, have now been incorporated in the production system. Additionally, climate change has brought new challenges to agriculture to produce food, feed, fiber and biofuels. To cope with these new challenges, many plant breeding programs have reoriented their breeding scope to stress tolerance in the last years. The authors of this book have collected the most recent advances and discoveries applied to breeding for abiotic stresses in this book, starting with new physiological concepts and breeding methods, and moving on to discuss modern molecular biological approaches geared to the development of improved cultivars tolerant to most sorts of abiotic stress. Written in an easy to understand style, this book is an excellent reference work for students, scientists and farmers interested in learning how to breed for abiotic stresses scenarios, presenting the state-of-the-art in plant stresses and allowing the reader to develop a greater understanding of the basic mechanisms of tolerance to abiotic stresses and how to breed for them.

Stress Tolerance in Horticultural Crops: Challenges and Mitigation Strategies explores concepts, strategies and recent advancements in the area of abiotic stress tolerance in horticultural crops, highlighting the latest advances in molecular breeding, genome sequencing and functional genomics approaches. Further sections present specific insights on different aspects of abiotic stress tolerance from classical breeding, hybrid breeding, speed breeding,

epigenetics, gene/quantitative trait loci (QTL) mapping, transgenics, physiological and biochemical approaches to OMICS approaches, including functional genomics, proteomics and genomics assisted breeding. Due to constantly changing environmental conditions, abiotic stress such as high temperature, salinity and drought are being understood as an imminent threat to horticultural crops, including their detrimental effects on plant growth, development, reproduction, and ultimately, on yield. This book offers a comprehensive resource on new developments that is ideal for anyone working in the field of abiotic stress management in horticultural crops, including researchers, students and educators. Describes advances in whole genome and next generation sequencing approaches for breeding climate smart horticultural crops Details advanced germplasm tolerance to abiotic stresses screened in the recent past and their performance Includes advancements in OMICS approaches in horticultural crops

Biotic Stress Resistance in Millets

Sulfur Assimilation and Abiotic Stress in Plants

Plant, Abiotic Stress and Responses to Climate Change Challenges and Mitigation Strategies

Plant Tolerance to Individual and Concurrent Stresses

Biotic Stress Resistance in Millets presents an important guide to the disease and pest-related challenges of this vital food crop. Biotic stresses are one of the major constraints for millet production, but newly emerging and forward-thinking problems with disease and insect pests are likely to increase as a result of changing weather, making this an imperative book on best practices. Current strategies are mainly through the development of

resistant cultivars, as the use of chemicals is cost-prohibitive to many of those producing millet in developing countries where it is of most value as a food source. This book explores non-chemical focused options for improving plant resistance and protecting crop yield. This single-volume reference will be important for researchers, teachers and students in the disciplines of Agricultural Entomology, Plant protection, Resistance Plant Breeding and Biotechnological pest management. Establishes basic concepts of host resistance providing foundational insight Synthesizes past biotic stress resistance research with the latest findings to orient research for future strategies for plant protection Focuses exclusively on host plant resistance on all major diseases and pests of millets Presents data and strategies that are globally applicable as millets gain importance as a health food

Experience shows that biotic stresses occur with different levels of intensity in nearly all agricultural areas around the world. The occurrence of insects, weeds and diseases caused by fungi, bacteria or viruses may not be relevant in a specific year but they usually harm yield in most years. Global warming has shifted the paradigm of biotic stresses in most growing areas, especially in the tropical countries, sparking intense discussions in scientific forums. This book was written with the idea of collecting in a single publication the most recent advances and discoveries concerning breeding for biotic stresses, covering all major classes of biotic challenges to agriculture and food production. Accordingly, it presents the state-of-the-art in plant stresses caused by

all microorganisms, weeds and insects and how to breed for them. Complementing Plant Breeding for Abiotic Stress Tolerance, this book was written for scientists and students interested in learning how to breed for biotic stress scenarios, allowing them to develop a greater understanding of the basic mechanisms of resistance to biotic stresses and develop resistant cultivars.
Abiotic StressesPlant Resistance Through Breeding and Molecular ApproachesCRC Press
Global climate change affects crop production through altered weather patterns and increased environmental stresses. Such stresses include soil salinity, drought, flooding, metal/metalloid toxicity, pollution, and extreme temperatures. The variability of these environmental conditions pared with the sessile lifestyle of plants contribute to high exposure to these stress factors. Increasing tolerance of crop plants to abiotic stresses is needed to fulfill increased food needs of the population. This book focuses on methods of improving plants tolerance to abiotic stresses. It provides information on how protective agents, including exogenous phytoprotectants, can mitigate abiotic stressors affecting plants. The application of various phytoprotectants has become one of the most effective approaches in enhancing the tolerance of plants to these stresses. Phytoprotectants are discussed in detail including information on osmoprotectants, antioxidants, phytohormones, nitric oxide, polyamines, amino acids, and nutrient elements of plants. Providing a valuable resource of information on phytoprotectants, this book is useful in diverse areas of life sciences including

agronomy, plant physiology, cell biology, environmental sciences, and biotechnology.

Plant Resistance Through Breeding and Molecular Approaches

Molecular Approaches in Plant Abiotic Stress

Vol. 1

Volume 2: Molecular Advancements

Reactive Oxygen, Nitrogen and Sulfur Species in Plants

In the current scenario, frequently changing environmental variables such as salinity, excess or insufficient water availability, cold or high-temperature extremes, heavy metal toxicity, and nutrient imbalance have become an unpredictable and severe menace to the worldwide agricultural output. The abiotic stress factors restrict crop plants from reaching their full genetic potential and cause significant loss to agricultural productivity across the globe. In general, the stress factors are complex and multigenic features, affecting plant performance by severely reducing plant growth, development, and ultimately the produce. Plants have evolved efficient defense mechanisms in response to the onset of unfavorable environmental conditions to tolerate stresses through physical adaptation and/or integrated molecular and cellular responses. The detection of stress signals and their transmission is a critical stage in triggering adaptive responses and ensuring plant life. According to transcriptomic and genomic research, abiotic stresses induce

many genes with varied functions, and various transcription factors are involved in regulating stress-inducible genes. Abiotic stressors are predicted to exacerbate the severity of plant problems in the coming years. In this book, "Understanding Abiotic Stresses," the editors compiled nine chapters written by subject experts in the field of abiotic stress and plant resistance. This book provides an up-to-date summary of current research on plant abiotic stress signaling. The various chapters in the book provide a state-of-the-art account of the information available. This book also explores how the resulting increase in abiotic stress factors can be dealt with. The result is a must-have hands-on handbook for agricultural biotechnology, abiotic stress tolerance/resistance, academia, and researchers. For the convenience of readers, the whole book is divided into ten chapters. Chapter 1 deals with an overview of the understanding of abiotic stresses responses in plants. Chapter 2 focuses on the new insights on plants against salt resistance strategies. Chapter 3 covers physiological and molecular adaptation strategies on plants during salinity stress. Chapter 4 discusses the role of temperature on physiological responses and adaptation mechanisms in plants. Chapter 5 summarizes the impact of abiotic stress on the nutritional quality of germinated cereal grains. Chapter 6 covers the function of agronomic interventions to

combat abiotic stresses in field crops. Chapter 7 mainly covers the role of hydrophilins (boiling-soluble proteins) in abiotic stress resistance capacity in plants. Chapter 8 deals with the influence of waterlogging on the physiology and molecular biology of plants. Chapter 9 discusses the adaptive mechanisms of plants during water-deficit conditions, and Chapter 10 summarizes the impact of plant growth hormones on plants during environmental stresses.

This two-volume set highlights the various innovative and emerging techniques and molecular applications that are currently being used in plant abiotic stress physiology. Volume 1: Responses and Adaptations focuses on the responses and adaptations of plants to stress factors at the cellular and molecular levels and offers a variety of advanced management strategies and technologies. Volume 2: Molecular Advancements introduces a range of state-of-the-art molecular advances for the mitigation of abiotic stress in plants. With contributions from specialists in the field, Volume 1 first discusses the physiology and defense mechanisms of plants and the various kinds of stress, such as from challenging environments, climate change, and nutritional deficiencies. It goes on to discuss trailblazing management techniques that include genetics approaches for improving abiotic stress tolerance in crop plants along with CRISPR/CAS-mediated genome editing

technologies. Volume 2 discusses how plants have developed diverse physiological and molecular adjustments to safeguard themselves under challenging conditions and how emerging new technologies can utilize these plant adaptations to enhance plant resistance. These include using plant-environment interactions to develop crop species that are resilient to climate change, applying genomics and phenomics approaches from the study of abiotic stress tolerance and more. Agriculture today faces countless challenges to meet the rising need for sustainable food supplies and guarantees of high-quality nourishment for a quickly increasing population. To ensure sufficient food production, it is necessary to address the difficult environmental circumstances that are causing cellular oxidative stress in plants due to abiotic factors, which play a defining role in shaping yield of crop plants. These two volumes help to meet these challenges by providing a rich source of information on plant abiotic stress physiology and effective management techniques.

Drought Stress Tolerance in Plants, Vol 1

Abiotic Stress Tolerance in Crop Plants

Improving Abiotic Stress Tolerance in Plants