

Abiotic Stresses Plant Resistance Through Breeding And Molecular Approaches Crop Science

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Abiotic Stress Tolerance in Crop Plants - Bidhan Roy 2009

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.

Abiotic Stress Tolerance Mechanisms in Plants - Gyanendra Kumar Rai 2021-02-15

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.

Advances in Plant Breeding Strategies: Agronomic, Abiotic and Biotic Stress Traits - Jameel M. Al-Khayri 2016-03-29

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.

Plant Tolerance to Individual and Concurrent Stresses - Muthappa Senthil-Kumar 2017-01-21

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.

Approaches to Plant Stress and their Management - R.K. Gaur 2013-12-02

Plant stresses are serious threats to the sustainability of crop yields accounting for more crop productivity losses than any other factor in rainfed agriculture. Post-harvest losses mean surplus crops do not reach market, affecting the livelihoods of farming families, and too often these families are left with no other option than to eat contaminated stored food. These constraints impact the food security of these farming families as well as the communities and countries in which they live. This book is the demonstration of a clear synergistic effect of stresses, an effect that was unexpectedly as important as either stress applied alone. This book will add to our current knowledge of abiotic stress response in plants and will provide the groundwork necessary to build future strategies for crop enhancement. The fundamental principles that underpin all biotechnology are explained and a full range of examples discussed to show how these principles are applied; from starting substrate to final product. It will be beneficial to both plant breeders and molecular biologists, because it combines the topics of physiology, tolerance genes, and breeding methods. When these topics are presented together, it is easy to compare all aspects of tolerance mechanisms and breeding methods for abiotic stresses. These comparisons are useful to understand which pathways or which genes are

important for rendering more tolerance to a certain abiotic stress, and to bring forward new ideas for improving the tolerance.

Features •Cover both plant biotic and abiotic stresses •Important factors in managing crops for water stress conditions •Substantially increase the sustainable productivity of smallholder farmers in developing countries •Genetic and biochemical approaches – if those approaches constitute a substantial improvement on current practices.

Plant Breeding for Abiotic Stress Tolerance - Roberto Fritsche-Neto 2012-06-05

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.

Rice Research for Quality Improvement: Genomics and Genetic Engineering - Aryadeep Roychoudhury 2020-10-31

This book focuses on the conventional breeding approach, and on the latest high-throughput genomics tools and genetic engineering / biotechnological interventions used to improve rice quality. It is the first book to exclusively focus on rice as a major food crop and the application of genomics and genetic engineering approaches to achieve enhanced rice quality in terms of tolerance to various abiotic stresses, resistance to biotic stresses, herbicide resistance, nutritional value, photosynthetic performance, nitrogen use efficiency, and grain yield. The range of topics is quite broad and exhaustive, making the book an essential reference guide for researchers and scientists around the globe who are working in the field of rice genomics and biotechnology. In addition, it provides a road map for rice quality improvement that plant breeders and agriculturists can actively consult to achieve better crop production.

Abiotic Stresses: Plant Resistance Through Breeding And Molecular Approaches Indian Reprint - Muhammad Ashraf 2006-01-01

Genomic Designing for Abiotic Stress Resistant Cereal Crops - Chittaranjan Kole 2021-08-31

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.

Plant Abiotic Stress - Matthew A. Jenks 2008-04-15

Over the past decade, our understanding of plant adaptation to environmental stress has grown considerably. This book focuses on stress caused by the inanimate components of the environment associated with climatic, edaphic and physiographic factors that substantially limit plant growth and survival. Categorically these are abiotic stresses, which include drought, salinity, non-optimal temperatures and poor soil nutrition. Another stress, herbicides, is covered in this book to highlight how plants are impacted by abiotic stress originating from anthropogenic sources. The book also addresses the high degree to which plant responses to quite diverse forms of environmental stress are interconnected, describing the ways in which the plant utilizes and integrates many common signals and subsequent pathways to cope with less favorable conditions. The book is directed at researchers and professionals in plant physiology, cell biology and molecular biology, in both the academic and industrial sectors.

Advances in Rice Research for Abiotic Stress Tolerance - Mirza Hasanuzzaman 2018-11-12

Advances in Rice Research for Abiotic Stress Tolerance provides an important guide to recognizing, assessing and addressing the broad range of environmental factors that can inhibit rice yield. As a staple food for nearly half of the world's population, and in light of projected population growth, improving and increasing rice yield is imperative. This book presents current research on abiotic stresses including extreme temperature variance, drought, hypoxia, salinity, heavy metal, nutrient deficiency and toxicity stresses. Going further, it identifies a variety of approaches to alleviate the damaging effects and improving the stress tolerance of rice. Advances in Rice Research for Abiotic Stress Tolerance provides an important reference for those ensuring optimal yields from this globally important food crop. Covers aspects of abiotic stress, from research, history, practical field problems faced by rice, and the possible remedies to the adverse effects of abiotic stresses Provides practical insights into a wide range of management and crop improvement practices Presents a valuable, single-volume sourcebook for rice scientists dealing with agronomy, physiology, molecular biology and biotechnology **Recent Approaches in Omics for Plant Resilience to Climate Change** - Shabir Hussain Wani 2019-08-13

This edited volume summarizes the recent advancements made in plant science including molecular biology and genome editing , particularly in the development of novel pathways tolerant to climate change-induced stresses such as drought, extreme temperatures, cold, salinity, flooding, etc. These stresses are liable for decrease in yields in many crop plants at global level. Till date conventional plant breeding approaches have resulted in significant improvement of crop plants for producing higher yields during adverse climatic conditions. However, the pace of improvement through conventional plant breeding needs to be accelerated in keeping with the growing demand of food and increasing human populationl, particularly in developing world. This book serves as a comprehensive reference material for researchers, teachers, and students involved in climate change-related abiotic stress tolerance studies in plants.

Transcription Factors for Abiotic Stress Tolerance in Plants - Shabir Hussain Wani 2020-08-05

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 in Plants - Shah Fahad 2021-07-21

Environmental insults such as extremes of temperature, extremes of water status, and deteriorating soil conditions pose major threats to agriculture and food security. Employing contemporary tools and techniques from all branches of science, attempts are being made worldwide to understand how plants respond to abiotic stresses with the aim to manipulate plant performance that is better suited to withstand these stresses. This book searches for possible answers to several basic questions related to plant responses towards abiotic stresses. Synthesizing developments in plant stress biology, the book offers strategies that can be used in breeding, including genomic, molecular, physiological, and biotechnological approaches that have the potential to develop resilient plants and improve crop productivity worldwide.

Biotechnologies of Crop Improvement, Volume 3 - Satbir Singh Gosal 2018-08-09

During the past 15 years, cellular and molecular approaches have emerged as valuable adjuncts to supplement and complement conventional breeding methods for a wide variety of crop plants. Biotechnology increasingly plays a role in the creation, conservation, characterization and utilization of genetic variability for germplasm enhancement. For instance, anther/microspore culture, somaclonal variation, embryo culture and somatic hybridization are being exploited for obtaining incremental improvement in the existing cultivars. In addition, genes that confer insect- and disease-resistance, abiotic stress tolerance, herbicide tolerance and quality traits have been isolated and re-introduced into otherwise sensitive or susceptible species by a variety of transgenic techniques. Together these transformative methodologies grant access to a greater repertoire of genetic diversity as the gene(s) may come from viruses, bacteria, fungi, insects, animals, human beings, unrelated plants or even be artificially derived. Remarkable achievements have been made in the production, characterization, field evaluation and commercialization of transgenic crop varieties worldwide. Likewise, significant advances have been made towards increasing crop yields, improving nutritional quality, enabling crops to be raised under adverse conditions and developing resistance to pests and diseases for sustaining global food and nutritional security. The overarching purpose of this 3-volume work is to summarize the history of crop improvement from a technological perspective but to do so with a forward outlook on further advancement and adaptability to a changing world. Our carefully chosen "case studies of important plant crops" intend to serve a diverse spectrum of audience looking for the right tools to tackle

complicated local and global issues.

Abiotic and Biotic Stress in Plants - Arun Shanker 2016-02-17

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.

Abiotic and Biotic Stress in Plants - Alexandre De Oliveira 2019-10-23

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 in Wheat - Mohd. Kamran Khan 2023-01-27

Abiotic Stresses in Wheat: Unfolding the Challenges presents the current challenges, possibilities, and advancements in research-based management strategies for the adaptation of wheat crops under abiotic-stressed growth conditions. This book comprehensively discusses different abiotic stress conditions in wheat, and also covers current trends in their mitigation using advanced tools to develop resilience in wheat crops. Chapters provide insight into the genetic, biochemical, physiological, molecular, and transgenic advances and emerging frontiers for mitigating the effects of wheat abiotic stresses. This text is the first resource to include all abiotic stresses in one volume, providing important translational insights and efficient comparison. Describes advances in conventional and modern breeding approaches in countering the effect of wheat abiotic stresses Highlights the role of physiological, biochemical and OMICS strategies Includes coverage of biotechnological tools such as whole genome sequencing, nanotechnology, and genome editing

Improving Crop Resistance to Abiotic Stress - Narendra Tuteja 2012-04-30

The latest update on improving crop resistance to abiotic stress using the advanced key methods of proteomics, genomics and metabolomics. The wellbalanced international mix of contributors from industry and academia cover work carried out on individual crop plants, while also including studies of model organisms that can then be applied to specific crop plants

Drought Stress Tolerance in Plants, Vol 2 - Mohammad Anwar Hossain 2016-08-24

Drought is one of the most severe constraints to crop productivity worldwide, and thus it has become a major concern for global food security. Due to an increasing world population, droughts could lead to serious food shortages by 2050. The situation may worsen due to predicated climatic changes that may increase the frequency, duration and severity of droughts. Hence, there is an urgent need to improve our understanding of the complex

mechanisms associated with drought tolerance and to develop modern crop varieties that are more resilient to drought. Identification of the genes responsible for drought tolerance in plants will contribute to our understanding of the molecular mechanisms that could enable crop plants to respond to drought. The discovery of novel drought related genes, the analysis of their expression patterns in response to drought, and determination of the functions these genes play in drought adaptation will provide a base to develop effective strategies to enhance the drought tolerance of crop plants. Plant breeding efforts to increase crop yields in dry environments have been slow to date mainly due to our poor understanding of the molecular and genetic mechanisms involved in how plants respond to drought. In addition, when it comes to combining favourable alleles, there are practical obstacles to developing superior high yielding genotypes fit for drought prone environments. **Drought Tolerance in Plants, Vol 2: Molecular and Genetic Perspectives** combines novel topical findings, regarding the major molecular and genetic events associated with drought tolerance, with contemporary crop improvement approaches. This volume is unique as it makes available for its readers not only extensive reports of existing facts and data, but also practical knowledge and overviews of state-of-the-art technologies, across the biological fields, from plant breeding using classical and molecular genetic information, to the modern omic technologies, that are now being used in drought tolerance research to breed drought-related traits into modern crop varieties. This book is useful for teachers and researchers in the fields of plant breeding, molecular biology and biotechnology.

Molecular Mechanisms and Genetics of Plant Resistance to Abiotic Stress - Jill M. Farrant 2020-03-05

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 Breeding for Biotic Stress Resistance - Roberto Fritsche-Neto 2012-10-01

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.

Priming-Mediated Stress and Cross-Stress Tolerance in Crop Plants - Mohammad Anwar Hossain 2020-01-22

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

Breeding For Resistance To Abiotic Stresses Textbook Student Edition - Dhan Pal Singh 2002-01-01

Abiotic Stress and Legumes - Vijay Pratap Singh 2021-08-22

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

Genomics Assisted Breeding of Crops for Abiotic Stress Tolerance, Vol. II - Vijay Rani Rajpal 2019-07-01

The abiotic stresses like drought, temperature, cold, salinity, heavy metals etc. affect a great deal on the yield performance of the agricultural crops. To cope up with these challenges, plant breeding programs world-wide are focussing on the development of stress tolerant varieties in all crop species. Significant genomic advances have been made for abiotic stress tolerance in various crop species in terms of availability of molecular markers, QTL mapping, genome-wide association studies (GWAS), genomic selection (GS) strategies, and transcriptome profiling. The broad-range of articles involving genomics and breeding approaches deepens our existing knowledge about complex traits. The chapters are written by authorities in their respective fields. This book provides comprehensive and consolidated account on the applications of the most recent findings and the progress made in genomics assisted breeding for tolerance to abiotic stresses in many important major crop species with a focus on applications of modern strategies for sustainable agriculture. The book is especially intended for students, molecular breeders and scientists working on the genomics-assisted genetic improvement of crop

species for abiotic stress tolerance.

Abiotic Stresses - M. Ashraf 2005-04-07

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.

Drought Stress Tolerance in Plants, Vol 1 - Mohammad Anwar Hossain 2016-05-25

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.

Abiotic Stress Adaptation in Plants - Ashwani Pareek 2009-12-12

Environmental insults such as extremes of temperature, extremes of water status as well as deteriorating soil conditions pose major threats to agriculture and food security. Employing contemporary tools and techniques from all branches of science, attempts are being made worldwide to understand how plants respond to abiotic stresses with the aim to help manipulate plant performance that will be better suited to withstand these stresses. This book on abiotic stress attempts to search for possible answers to several basic questions related to plant responses towards abiotic stresses. Presented in this book is a holistic view of the

general principles of stress perception, signal transduction and regulation of gene expression. Further, chapters analyze not only model systems but extrapolate interpretations obtained from models to crops. Lastly, discusses how stress-tolerant crop or model plants have been or are being raised through plant breeding and genetic engineering approaches. Twenty three chapters, written by international authorities, integrate molecular details with overall plant structure and physiology, in a text-book style, including key references.

Molecular Stress Physiology of Plants - Gyana Ranjan Rout 2013-02-12

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.

Improving Crop Resistance to Abiotic Stress - Narendra Tuteja 2012-03-30

Abiotic stress, such as high salinity and drought is the most common challenge for sustainable food production in large parts of the world, in particular in emerging countries. The ongoing and expected global climate change will further increase these challenges in many areas, making improved stress resistance of crops a key topic for the 21st Century. Proteomics, genomics and metabolomics are methods allowing for the rapid and complete analysis of the complete physiology of crop plants. This knowledge in turn, is the prerequisite for improvements of crop resistance against abiotic stress through genetic engineering or traditional breeding methods. *Improving Crop Resistance to Abiotic Stress* is a double-volume, up-to-date overview of current progress in improving crop quality and quantity using modern methods such as proteomics, genomics and metabolomics. With this particular emphasis on genetic engineering, this text focuses on crop improvement under adverse conditions, paying special attention to such staple crops as rice, maize, and pulses. It includes an excellent mix of specific examples, such as the creation of nutritionally-fortified rice and a discussion of the political and economic implications of genetically engineered food. The result is a must-have hands-on guide, ideally suited for Agricultural Scientists, Students of Agriculture, Plant Physiologists, Plant Breeders, Botanists and Biotechnologists. Sections include: PART I Climate Change and Abiotic Stress Factors PART II Methods to Improve Crop Productivity PART III Species-Specific Case Studies: Graminoids, Leguminosae, Rosaceae

Abiotic Stress Response in Plants - Narendra Tuteja 2016-05-02

Understanding abiotic stress responses in plants is critical for the development of new varieties of crops, which are better adapted to harsh climate conditions. The new book by the well-known editor team Narendra Tuteja and Sarvajeet Gill provides a comprehensive overview on the molecular basis of plant responses to external stress like drought or heavy metals, to aid in the engineering of stress resistant crops. After a general introduction into the topic, the following sections deal with specific signaling pathways mediating plant stress response. The last part covers translational plant physiology, describing several examples of the development of more stress-resistant crop varieties.

In vitro Plant Breeding towards Novel Agronomic Traits -

Manoj Kumar 2019-11-23

This book presents a comprehensive overview of plant stresses caused by salt, drought, extreme temperatures, oxygen and toxic compounds, which are responsible for huge losses in crop yields. It discusses the latest research on the impact of salinity and global environment changes, and examines the advances in the identification and characterization of the mechanisms that allow plants to tolerate biotic and abiotic stresses. Further it presents our current understanding of metabolic fluxes and the various transporters that collectively open the possibility of applying in vitro technology and genetic engineering to improve stress tolerance. Exploring advanced methods that augment traditional plant tissue culture and breeding techniques toward the development of new crop varieties that can tolerate biotic and abiotic stresses to achieve sustainable food production, this book is a valuable resource for plant scientists and researchers.

Stress Tolerance in Horticultural Crops - Ajay Kumar 2021-05-28

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

Principles of Plant Genetics and Breeding - George Acquah

2020-09-28

The revised edition of the bestselling textbook, covering both classical and molecular plant breeding **Principles of Plant Genetics and Breeding** integrates theory and practice to provide an insightful examination of the fundamental principles and advanced techniques of modern plant breeding. Combining both classical and molecular tools, this comprehensive textbook describes the multidisciplinary strategies used to produce new varieties of crops and plants, particularly in response to the increasing demands to of growing populations. Illustrated chapters cover a wide range of topics, including plant reproductive systems, germplasm for breeding, molecular breeding, the common objectives of plant breeders, marketing and societal issues, and more. Now in its third edition, this essential textbook contains extensively revised content that reflects recent advances and current practices. Substantial updates have been made to its molecular genetics and breeding sections, including discussions of new breeding techniques such as zinc finger nuclease, oligonucleotide directed mutagenesis, RNA-dependent DNA methylation, reverse breeding, genome editing, and others. A new table enables efficient comparison of an expanded list of molecular markers, including Allozyme, RFLPs, RAPD, SSR, ISSR, DAMD, AFLP, SNPs and ESTs.

Also, new and updated "Industry Highlights" sections provide examples of the practical application of plant breeding methods to real-world problems. This new edition: Organizes topics to reflect the stages of an actual breeding project Incorporates the most recent technologies in the field, such as CRISPR genome edition and grafting on GM stock Includes numerous illustrations and end-of-chapter self-assessment questions, key references, suggested readings, and links to relevant websites Features a companion website containing additional artwork and instructor resources **Principles of Plant Genetics and Breeding** offers researchers and professionals an invaluable resource and remains the ideal textbook for advanced undergraduates and graduates in plant science, particularly those studying plant breeding, biotechnology, and genetics.

Translational Genomics for Crop Breeding - Rajeev Varshney

2013-09-13

Genomic Applications for Crop Breeding: Abiotic Stress, Quality and Yield Improvement is the second of two volumes looking at the latest advances in genomic applications to crop breeding.

This volume focuses on advances improving crop resistance to abiotic stresses such as extreme heat, drought, flooding as well as advances made in quality and yield improvement. Chapters examine advances in such key crops as rice, maize, and sugarcane, among others. **Genomic Applications for Crop Breeding: Abiotic Stress, Quality and Yield Improvement** complements the earlier volume on biotic stressors and will be an essential purchase for those interested in crop science and food production.

Mapping Abiotic Stress-Tolerance Genes in Plants - Richard R.-C.

Wang 2020-12-02

This book presents the latest research results on plant genes controlling tolerance to abiotic stresses including heat, cold, drought, salt, nitrogen, metals, irradiation, and exogenous phytohormones. The authors report the expression profiles, function/roles in physiological pathways, and chromosomal locations of tolerance genes. The studies involve cytogenetics, genomics, proteomics, and bioinformatics. The information is critical for food security in an environment experiencing global climate changes. Therefore, this book provides a useful reference to students and professionals in plant sciences encompassing genetics, physiology, chemistry, and breeding.

Genomic Designing for Abiotic Stress Resistant Oilseed

Crops - Chittaranjan Kole 2022-04-05

This book presents deliberations on molecular and genomic mechanisms underlying the interactions of crop plants to the abiotic stresses caused by heat, cold, drought, flooding, submergence, salinity, acidity, etc., 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 oilseed crops is imperative for addressing FHNEE (food, health, nutrition, energy, and environment) security. Whole genome sequencing of these crops followed by genotyping-by-sequencing has provided precise information regarding 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 eight chapters each dedicated to a oilseed crop in this volume elucidate on different types of abiotic stresses and their effects on and interaction with the crop; 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; present brief on classical genetics of stress resistance and traditional breeding for transferring them to their cultivated counterparts; depict 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 genomics-aided techniques including genomic selection, allele mining, gene discovery, and gene pyramiding for developing adaptive crop varieties with higher quantity and quality of yields, and also elaborate some case studies on genome editing focusing on specific genes for generating abiotic stress-resistant crops.

Molecular Breeding in Wheat, Maize and Sorghum - Mohammad

Anwar Hossain 2021-06-30

The global population is projected to reach almost 10 billion by 2050, and food and feed production will need to increase by 70%. Wheat, maize and sorghum are three key cereals which provide nutrition for the majority of the world's population. Their production is affected by various abiotic stresses which cause significant yield losses. The effects of climate change also increase the frequency and severity of such abiotic stresses. Molecular breeding technologies offer real hope for improving crop yields. Although significant progress has been made over the last few years, there is still a need to bridge the large gap between yields in the most favorable and most stressful conditions.

Genes for Plant Abiotic Stress - Matthew A. Jenks 2009-09-17
Abiotic stresses caused by drought, salinity, toxic metals, temperature extremes, and nutrient poor soils are among the major constraints to plant growth and crop production worldwide. While crop breeding strategies to improve yields have progressed, a better understanding of the genetic and biological mechanisms underpinning stress adaptation is needed. *Genes For Plant Abiotic Stress* presents the latest research on recently examined genes and alleles and guides discussion of the genetic and physiological determinants that will be important for crop improvement in the future.