Plant Responses To Drought And Salinity Stress Volume 57 Developments In A Post Genomic Era Advances In Botanical Research

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.

This book presents the state-of-the-art in plant ecophysiology. With a particular focus on adaptation to a changing environment, it discusses ecophysiology and adaptive mechanisms of plants under climate change. Over the centuries, the incidence of various abiotic stresses such as salinity, drought, extreme temperatures, atmospheric pollution, metal toxicity due to climate change have regularly affected plants and, and some estimates suggest that environmental stresses may reduce the crop yield by up to 70%. This in turn adversely affects the food security. As sessile organisms, plants are frequently exposed to various environmental adversities. As such, both plant physiology and plant ecophysiology begin with the study of responses to the environment. Provides essential insights, this book can be used for courses such as Plant Physiology, Environmental Science, Crop Production and Agricultural Botany. Volume 1 provides up-to-date information on the impact of climate change on plants, the general consequences and plant responses to various environmental stresses.

New evidence this year corroborates the rise in world hunger observed in this report last year, sending a warning that more action is needed if we aspire to end world hunger and malnutrition in all its forms by 2030. Updated estimates show the number of people who suffer from hunger has been growing over the past three years, returning to prevailing levels from almost a decade ago. Although progress continues to be made in reducing child stunting, over 22 percent of children under five years of age are still affected. Other forms of malnutrition are also growing: adult obesity continues to increase in countries irrespective of their income levels, and many countries are coping with multiple

forms of malnutrition at the same time – overweight and obesity, as well as anaemia in women, and child stunting and wasting.

Advances in Botanical Research publishes in-depth and up-to-date reviews on a wide range of topics in plant sciences. Currently in its 57th volume, the series features a wide range of reviews by recognized experts on all aspects of plant genetics, biochemistry, cell biology, molecular biology, physiology and ecology. This thematic volume describes developments in understanding of plant responses to drought and salinity in post-genomic and are evaluated by world wide- known experts. Multidisciplinary reviews written from a broad range of scientific perspectives For over 40 years, series has enjoyed a reputation for excellence Contributors internationally recognized authorities in their respective fields

World population is growing at an alarming rate and is anticipated to reach about six billion by the end of year 2050. On the other hand, agricultural productivity is not increasing at a required rate to keep up with the food demand. The reasons for this are water shortages, depleting soil fertility and mainly various abiotic stresses. The fast pace at which developments and novel findings that are recently taking place in the cutting edge areas of molecular biology and basic genetics, have reinforced and augmented the efficiency of science outputs in dealing with plant abiotic stresses. In depth understanding of the stresses and their effects on plants is of paramount importance to evolve effective strategies to counter them. This book is broadly dived into sections on the stresses, their mechanisms and tolerance, genetics and adaptation, and focuses on the mechanic aspects in addition to touching some adaptation features. The chief objective of the book hence is to deliver state of the art information for comprehending the nature of abiotic stress in plants. We attempted here to present a judicious mixture of outlooks in order to interest workers in all areas of plant sciences.

This book presents various aspects of salt and drought stress signaling in crops, combining physiological, biochemical, and molecular studies. Salt and drought stress are two major constraints on crop production worldwide. Plants possess several mechanisms to cope with the adverse effects of salt and drought. Among these mechanisms, stress signaling is very important, because it integrates and regulates nuclear gene expression and other cellular activities, which can help to restore cellular homeostasis. Accordingly, understanding the signaling cascades will help plant biologists to grasp the tolerance mechanisms that allow breeders to develop tolerant crop varieties. This book is an essential resource for researchers and graduate students working on salt and drought stress physiology and plant breeding.

This book addresses the importance woody plants have in agriculture, forestry, and the environment and how various stresses affect their performance. It reviews physiological and molecular responses of woody plants to major environmental stresses and focuses on the mechanisms involved in imparting resistance to stress. Chapters cover basics of plant physiology including plant structure and plant growth, photosynthesis, respiration, plant growth regulation, abiotic and biotic plant stresses including drought, water logging, nutrient deficiency, salinity, chilling, freezing, heat, oxidative stress, and heavy metal toxicity.

Plant Signaling Molecule: Role and Regulation under Stressful Environments explores tolerance mechanisms mediated by signaling molecules in plants for achieving sustainability under changing environmental conditions. Including a wide range of potential molecules, from primary to secondary metabolites, the book presents the status and future prospects of the role and regulation of signaling molecules at physiological, biochemical, molecular and structural level under abiotic stress tolerance. This book is designed to enhance the mechanistic understanding of signaling molecules and will be an important resource for plant biologists in developing stress tolerant crops to achieve sustainability under changing environmental conditions. Focuses on plant biology under stress conditions Provides a compendium of knowledge related to plant adaptation, physiology, biochemistry and molecular responses Identifies treatments that enhance plant tolerance

to abiotic stresses Illustrates specific physiological pathways that are considered key points for plant adaptation or tolerance to abiotic stresses

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

Photosynthesis and the Environment examines how photosynthesis may be influenced by environmental changes. Structural and functional aspects of the photosynthetic apparatus are examined in the context of responses to environmental stimuli; particular attention being given to the processing of light energy by thylakoids, metabolic regulation, gas exchange and source-sink relations. The roles of developmental and genetic responses in determining photosynthetic performance are also considered. The complexity of the responses to environmental change is demonstrated by detailed analyses of the effects of specific environmental variables (light, temperature, water, CO2, ozone and UV-B) on photosynthetic performance. Where appropriate attention is given to recent developments in the techniques used for studying photosynthetic activities. The book is intended for advanced undergraduate and graduate students and a wide range of scientists with research interests in environmental effects on photosynthesis and plant productivity.

Understanding how plants tolerate drought, with a view to plant breeding, is a difficult challenge. Before considering the variability of drought and adaptation strategies, interdisciplinary approaches are necessary to identify mechanisms acting from the molecule to the species level leading to drought adaptation. Coordinating results obtained at different levels of perception into a global analysis allows the identification of the emergent properties of drought tolerance. In this book which is specially targeted at post-graduate students, teachers and scientists, 11 reviews present the state of the art in this subject. After defining drought and drought tolerance in the wild and in crops, responses and adaptations to drought are analysed at different levels of organisation (molecule, cell, organ and whole plant). The strategies and difficulties of drought tolerance breeding are described and the possibilities of improvement using new tools are proposed. This book is the first compilation of Genetics (and Plant Breeding), Physiology and Molecular Biology reviews and recent developments on drought tolerance in higher plants. Resulting from the INTERDROUGHT 1995 meeting in Montpellier (France), its objectives are to promote communication between researchers in different fields, and to facilitate integration of the understanding of drought tolerance.

This timely work is a collection of papers presented at the XIth international congress of the International Association of Plant Tissue Culture & Biotechnology. It continues the tradition of the IAPTC&B in publishing the proceedings of its congresses. The work is an up-to-date report on the most significant advances in plant tissue culture and biotechnology as presented by leading international scientists. It will be crucial reading for agricultural scientists, among others.

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.

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 book Vegetables - Importance of Quality Vegetables to Human Health provides useful and interesting information on the nutritional qualities of different vegetables and their roles in disease prevention. Quality vegetable production through hydroponic cultivation techniques is also included. The first few chapters discuss the importance of quality vegetables to human diet and health, and noncommunicable disease prevention. Nutritional qualities and bioactive compounds in freshly grown vegetables through hydroponics and soilless cultures are discussed in the middle part of the book. The final chapter describes methods of sea vegetable utilization in food formulation. This book mainly focuses on the nutritional quality of vegetables and disease prevention, their production methods, preparation, and cooking methods, making it a complete and useful resource to readers.

In this ready reference, a global team of experts comprehensively cover molecular and cell biology-based approaches to the impact of increasing global temperatures on crop productivity. The work is divided into four parts. Following an introduction to the general challenges for agriculture around the globe due to climate change, part two discusses how the resulting increase of abiotic stress factors can be dealt with. The third part then outlines the different strategies and approaches to address the challenge of climate change, and the whole is rounded off by a number of specific examples of improvements to crop productivity. With its forward-looking focus on solutions, this book is an indispensable help for the agro-industry, policy makers and academia.

Water stress and heat stress are considered to be two primary factors that limit crop production in many parts of the world. Global warming appears to be increasing the water requirements of plants. Understanding the impact of water deficit on plant physiological processes and efficient water management are of great concern in maintaining food production to meet ever increasing world food demand. The book addresses various climatic soil and plant factors that contribute to the water use efficiency in plants subjected to water stress. It covers all issues related to soil, plant and climatic factors that contribute to the crop responses to water stress. The books advances the knowledge in improving and sustaining crop yields in ever increasing unpredictable climatic fluctuations This book uses crop simulation models for response of crops to limited water under various management and climatic conditions.

With near-comprehensive coverage of new advances in crop breeding for drought and salinity stress tolerance, this timely work seeks to integrate the most recent findings about key biological determinants of plant stress tolerance with modern crop improvement strategies. This volume is unique because is provides exceptionally wide coverage of current knowledge and expertise being applied in drought and salt tolerance research.

Environmental abiotic stresses, such as extreme temperatures, drought, excess light, salinity, and nutrient deficiency, have detrimental effects on plant growth, development, and yield. Plants are equipped with various adaptation mechanisms to cope with such unfavorable conditions. Our understanding of plants' abiotic stress responses is crucial to maintaining efficient plant productivity. This book on the responses of plants to environmental stresses is an attempt to find answers to several basic questions related to their adaptation and protective mechanisms against abiotic stresses. The following chapters of the book describe examples of plants' protective strategies, which cover physiological, cellular, biochemical, and genomic mechanisms. This book is aimed for use by advanced students and researchers in the area of stress biology, plant molecular biology and physiology, agriculture, biochemistry, as well as environmental sciences.

Plant hormone signaling plays an important role in many physiological and developmental processes including stress response. With the advent of new post-genomic molecular techniques, the potential for increasing our understanding of the impact of hormone signaling on gene expression and adaptive processes has never been higher. Unlocking the molecular underpinnings of these processes shows great promise for the development of new plant biotechnologies and improved crop varieties. The topics included in this book emphasize on genomics and functional genomics aspects, to understand the global and whole genome level changes upon particular stress conditions. With the functional genomics tools, the mechanism of phytohormone signaling and their target genes can be defined in a more systematic manner. The integrated analysis of phytohormone signaling under single or multiple stress conditions may prove exceptional to design stress tolerant crop plants in the field conditions. Bringing together the latest advances, as well as the work being done to apply these findings to plant and crop science, Mechanism of Plant Hormone Signaling Under Stress will prove extremely useful to plant and stress biologists, plant biotechnology researchers, as well as students and teachers.

This book provides a comprehensive overview of the multiple strategies that plants have developed to cope with drought, one of the most severe environmental stresses. Experts in the field present 17 chapters, each of which focuses on a basic concept as well as the latest findings. The following major aspects are covered in the book: · Morphological and anatomical adaptations · Physiological responses · Biochemical and molecular responses · Ecophysiological responses · Responses to drought under field conditions The contributions will serve as an invaluable source of information for researchers and advanced students in the fields of plant sciences, agriculture, ecophysiology, biochemistry and molecular biology.

Transgenic crops are the basis of modern agricultural biotechnology. Traits impossible to introduce by conventional breeding techniques are tailored in crops using genetic manipulation and transformation approaches. Using the technology, agronomic and medicinal traits have been developed in plants. The pace of -omics with robust methods for gene discovery and genome sequencing and more recently the use of CRISPR/Cas and gRNA/Cas technologies have widened this field to improve the genetic makeup of crops. Identification of transformation events and biosafety assessment of the introduced traits are vital for stewardship and acceptability of transgenic crops.

The same amount of water has been present on our planet for about 4 billion years, since shortly after the Earth was formed. Since then it has cycled through evaporation, condensation, precipitation and surface runoff multiple times. Water scarcity as an abiotic factor ranging from moderate to severe stress levels, accompanied by loss of moisture in the soil, is extremely hard for most organisms to cope with, particularly terrestrial plants and their food-chain dependents. Because of the potential for increasing temporary, or posssibly permanent, drought conditions in the future, there is intense focus on improving plant resistance to drought and increasing yield performance in water- limited environments through genotype selection in important crops. This book aims to contribute to understanding of how plants and other

organisms respond to water stress conditions, and the various survival strategies adopted under differing moisture levels.

The study of air pollution effects on vegetation has made rapid progress in the last five years. Growing concerns about effects of future increases in temperature and carbon dioxide (C0) levels on plant life have altered 2 the perspective of plant biologists in the field of pollutant-plant inter actions. In many cases, it is anticipated that crops and trees will increasingly experience multiple stresses in an altered environment: an environment in which physiological processes will no longer be matched to climate. Because of this problem, a major part of the focus of the air pollution effects research has shifted since 1987. Moreover, recent advances in our understanding of plant metabolic and molecular responses to stress have made it clear that many abiotic stresses elicit similar fundamental mechanisms. Adaptation responses to drought, extremes of temperature, xenobiotics and air pollutants are now known to involve the response of both specific and common resistance mechanisms, which often include altered gene expression. The field of air pollution effects on vegetation has benefitted greatly from this unification since results obtained and advances made in allied fields are now directly relevant. The advent of molecular genetics has made possible the production of transgenic plants containing altered amounts of resistance gene products which enables the posing of experimental questions which could not be addressed only five years ago. Hypotheses concerning the relevance of specific metabolites and processes to known responses to air pollution stress can now be tested.

No other disjunct pieces of land present such striking similarities as the widely sepa 1 rated regions with a mediterranean type of climate, that is, the territories fringing the Mediterranean Sea, California, Central Chile and the southernmost strips of South Mrica and Australia. Similarities are not confined to climatic trends, but are also reflected in the physiognomy ofthe vegetation, in land use patterns and frequently in the general appearance of the landscape. The very close similarities in agricultural practices and sometimes also in rural settlements are dependent on the climatic and edaphic analogies, as well as on a certain commonality in qdtural history. This is certainly true for the Mediterranean Sea basin which in many ways represents a sort of ecological-cultural unit; this is also valid for CaUfornia and Chile, which were both settled by Spaniards and which showed periods of vigorous commercial and cultural interchanges as during the California gold rush. One other general feature is the massive interchange of cultivated and weed species of plants that has occurred between the five areas of the world that have a mediterranean-type climate, with the Mediterranean basin region itself as a major source. In spite of their limited territorial extension, probably no other parts of the world have played a more fundamental role in the history of mankind. Phoenician, Etruscan, Hellenic, Jewish, Roman, Christian andArab civilizations, among others,haveshapedmanyofman's present attitudes, including his position and perception vis-a-vis nature.

A close examination of current research on abiotic stresses in various plant species The unpredictable environmental stress conditions associated with climate change are significant challenges to global food security, crop productivity, and agricultural sustainability. Rapid population growth and diminishing resources necessitate the development of crops that can adapt to environmental extremities. Although significant advancements have been made in developing plants

through improved crop breeding practices and genetic manipulation, further research is necessary to understand how genes and metabolites for stress tolerance are modulated, and how cross-talk and regulators can be tuned to achieve stress tolerance. Molecular Plant Abiotic Stress: Biology and Biotechnology is an extensive investigation of the various forms of abiotic stresses encountered in plants, and susceptibility or tolerance mechanisms found in different plant species. In-depth examination of morphological, anatomical, biochemical, molecular and gene expression levels enables plant scientists to identify the different pathways and signaling cascades involved in stress response. This timely book: Covers a wide range of abiotic stresses in multiple plant species Provides researchers and scientists with transgenic strategies to overcome stress tolerances in several plant species Compiles the most recent research and up-to-date data on stress tolerance Examines both selective breeding and genetic engineering approaches to improving plant stress tolerances Written and edited by prominent scientists and researchers from across the globe Molecular Plant Abiotic Stress: Biology and Biotechnology is a valuable source of information for students, academics, scientists, researchers, and industry professionals in fields including agriculture, botany, molecular biology, biochemistry and biotechnology, and plant physiology.

Plants are subjected to a variety of abiotic stresses such as drought, temperature, salinity, air pollution, heavy metals, UV radiations, etc. To survive under these harsh conditions plants are equipped with different resistance mechanisms which vary from species to species. Due to the environmental fluctuations agricultural and horticultural crops are often exposed to different environmental stresses leading to decreased yield and problems in the growth and development of the crops. Drought stress has been found to decrease the yield to an alarming rate of some important crops throughout the globe. During last few decades, lots of physiological and molecular works have been conducted under water stress in crop plants. Water Stress and Crop Plants: A Sustainable Approach presents an up-to-date in-depth coverage of drought and flooding stress in plants, including the types, causes and consequences on plant growth and development. It discusses the physiobiochemical, molecular and omic approaches, and responses of crop plants towards water stress. Topics include nutritional stress, oxidative stress, hormonal regulation, transgenic approaches, mitigation of water stress, approaches to sustainability, and modern tools and techniques to alleviate the water stress on crop yields. This practical book offers pragmatic guidance for scientists and researchers in plant biology, and agribusinesses and biotechnology companies dealing with agronomy and environment, to mitigate the negative effects of stress and improve yield under stress. The broad coverage also makes this a valuable guide enabling students to understand the physiological, biochemical, and molecular mechanisms of environmental stress in plants.

This book highlights some of the most important biochemical, physiological and molecular aspects of plant stress,

together with the latest updates. It is divided into 14 chapters, written by eminent experts from around the globe and highlighting the effects of plant stress (biotic and abiotic) on the photosynthetic apparatus, metabolites, programmed cell death, germination etc. In turn, the role of beneficial elements, glutathione-S-transferase, phosphite and nitric oxide in the adaptive response of plants under stress and as a stimulator of better plant performance is also discussed. A dedicated chapter addresses research advances in connection with Capsicum, a commercially important plant, and stress tolerance, from classical breeding to the recent use of large-scale transcriptome and genome sequencing technologies. The book also explores the significance of the liliputians of the plant kingdom (Bryophytes) as biomonitors/bioindicators, and general and specialized bioinformatics resources that can benefit anyone working in the field of plant stress biology. Given the information compiled here, the book will offer a valuable guide for students and researchers of plant molecular biology and stress physiology alike.

Respiration in plants, as in all living organisms, is essential to provide metabolic energy and carbon skeletons for growth and maintenance. As such, respiration is an essential component of a plant's carbon budget. Depending on species and environmental conditions, it consumes 25-75% of all the carbohydrates produced in photosynthesis – even more at extremely slow growth rates. Respiration in plants can also proceed in a manner that produces neither metabolic energy nor carbon skeletons, but heat. This type of respiration involves the cyanide-resistant, alternative oxidase; it is unique to plants, and resides in the mitochondria. The activity of this alternative pathway can be measured based on a difference in fractionation of oxygen isotopes between the cytochrome and the alternative oxidase. Heat production is important in some flowers to attract pollinators; however, the alternative oxidase also plays a major role in leaves and roots of most plants. A common thread throughout this volume is to link respiration, including alternative oxidase activity, to plant functioning in different environments.

This unique book covers the molecular aspects of plant stress and the various industrial applications. Chapters cover many important topics in the biology of plant stress, including morphological and physiological changes of plants due to accumulation of pollutants; the types of stress for enhanced biofuel production from plant biomass; plant adaptation due to different types of environmental stresses; potential applications of microRNAs to improve abiotic stress tolerance in plants; plant resistance to viruses and the molecular aspects; photosynthesis under stress conditions; plant responses to weeds, pests, pathogens, and agrichemical stress conditions; and plant responses under the stress of drought. Key features: • Describes the different types of plant stress • Details the current and possible applications of plant stress biology • Presents several case studies that include applications of plant stress • Explores plant stress biology for applications in biofuel science Plant Stress Biology: Progress and Prospects of Genetic Engineering will be useful for

researchers in diverse fields as well as for plant biologists, environmental biologists, faculty, and students. The book will also be helpful for further advancement of research in the area of plant stress biology.

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

Abiotic stress cause changes in soil-plant-atmosphere continuum and is responsible for reduced yield in several major crops. Therefore, the subject of abiotic stress response in plants - metabolism, productivity and sustainability - is gaining considerable significance in the contemporary world. Abiotic stress is an integral part of “climate change,” a complex phenomenon with a wide range of unpredictable impacts on the environment. Prolonged exposure to these abiotic stresses results in altered metabolism and damage to biomolecules. Plants evolve defense mechanisms to tolerate these stresses by upregulation of osmolytes, osmoprotectants, and enzymatic and non-enzymatic antioxidants, etc. This volume deals with abiotic stress-induced morphological and anatomical changes, abberations in metabolism, strategies and approaches to increase salt tolerance, managing the drought stress, sustainable fruit production and postharvest stress treatments, role of glutathione reductase, flavonoids as antioxidants in plants, the role of salicylic acid and trehalose in plants, stress-induced flowering. The role of soil organic matter in mineral nutrition and fatty acid profile in response to heavy metal stress are also dealt with. Proteomic markers for oxidative stress as a new tools for reactive

oxygen species and photosynthesis research, abscisic acid signaling in plants are covered with chosen examples. Stress responsive genes and gene products including expressed proteins that are implicated in conferring tolerance to the plant are presented. Thus, this volume would provides the reader with a wide spectrum of information including key references and with a large number of illustrations and tables. Dr. Parvaiz is Assistant Professor in Botany at A.S. College, Srinagar, Jammu and Kashmir, India. He has completed his post-graduation in Botany in 2000 from Jamia Hamdard New Delhi India. After his Ph.D from the Indian Institute of Technology (IIT) Delhi, India in 2007 he joined the International Centre for Genetic Engineering and Biotechnology, New Delhi. He has published more than 20 research papers in peer reviewed journals and 4 book chapters. He has also edited a volume which is in press with Studium Press Pvt. India Ltd., New Delhi, India. Dr. Parvaiz is actively engaged in studying the molecular and physio-biochemical responses of different plants (mulberry, pea, Indian mustard) under environmental stress. Prof. M.N.V. Prasad is a Professor in the Department of Plant Sciences at the University of Hyderabad, India. He received B.Sc. (1973) and M.Sc. (1975) degrees from Andhra University, India, and the Ph.D. degree (1979) in botany from the University of Lucknow, India. Prasad has published 216 articles in peer reviewed journals and 82 book chapters and conference proceedings in the broad area of environmental botany and heavy metal stress in plants. He is the author, co-author, editor, or co-editor for eight books. He is the recipient of Pitamber Pant National Environment Fellowship of 2007 awarded by the Ministry of Environment and Forests, Government of India.

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.

Drought (hydrological, meteorological, and/or agronomical) disturbs water balance in certain domains and limits green/blue water resources for our basic needs, including food and energy production. This book presents the most recent insights related to drought types, their detection, and their effects on food, energy, and municipal water supplies. It also examines some novel approaches to drought management.
Plant Responses to Drought StressFrom Morphological to Molecular FeaturesSpringer Science & Business Media
Water Deficits and Plant Growth, Volume IV: Soil Water Measurement, Plant Responses, and Breeding for Drought Resistance explores the physiological effects of water deficits on plants and their implications on crop yield, water use, and drought resistance. This book also considers drought-resistance measurements and their application to breeding programs. This volume is organized into eight chapters and begins with an overview of measurement of soil water content and the state of water in soils. Particular emphasis is placed on methods developed from technological advances. The next two chapters focus on the structure and functioning of stomata and stomatal conductance in control of gas exchange. The discussion then shifts to the effects of water supply on photosynthesis, leaf shedding, flow of latex, and nitrogen-fixing root nodules. The final chapter is a comprehensive treatment of plant breeding for drought resistance, emphasizing breeding and testing methods as well as parameters and application to breeding programs of drought resistance. This book is a valuable resource for scientists and investigators in fields such as botany, agronomy, forestry, agriculture, and biology.