Preface

“Improvement of Crops in the Era of Climatic Changes” Volume 2

Climate change is an unprecedented threat to the food security for hundreds of millions of people who depend on small-scale agriculture for their livelihoods. Abiotic stress is the prime cause for deteriorating the average yield of major crops by more than 50 %, which cause losses worth hundreds of millions of dollars each year. Plants are exposed to rapid, unpredicted, and diverse environmental disturbances, resulting in stressful conditions. Stress signal is first perceived by the receptors present on the membrane of plant cells. The signal information is then transduced downstream, resulting in an activation of various stress-responsive genes. The products of these stress genes, ultimately lead to stress tolerance response and enable the plant to survive and surpass the unfavourable conditions. Recent trends in population growth suggest that global food production is unlikely to gratify the future demands under predicted climate change scenarios, unless rates of crop improvement are accelerated or sweeping changes occur in patterns of human food consumption. The situation is generally more staid in less developed countries, where agro-ecosystems are already fragile, investment in agriculture is limited, and climate change is predicted to have its most devastating effects. Global climate change is likely to increase the problems of food insecurity, hunger and malnutrition for millions of people, particularly in south Asia and sub-Saharan Africa, and further exacerbate the problem by remarkably restricting the plant growth and development.

The potential yield of economically important crops is drastically coming down every year just because of abiotic stresses. It has been projected that global food production must increase by 70 % by 2050 to meet the ever-increasing demand caused by burgeoning human population, increasing incomes and consumption. Several factors are contributing to high plant performance under different environmental conditions, therefore an effective and complementary use of all the available technological tools and resources is needed to meet the challenge. The mechanisms underlying endurance to environmental stress factors have long been the focus of intense research. The progress in biotechnology, genomic research, and molecular marker applications have brought to the forefront an interdisciplinary science that is revolutionizing twenty-first century crop improvement. Many novel genomics technologies like next generation sequencing and omics have emerged as powerful tools for understanding the genomic variation among crop species at different molecular levels. Climate change is no more an illusion, its ruinous impact is globally witnessed and interventions must be highly addressed at international, regional and national levels. In this context, the book "***Improvement of Crops in the Era of Climatic Changes" Volume 2*** will serve as avant-garde resource for researchers and students who are immersed in developing the improved crop cultivars and management methods. Written by a varied group of internationally distinguished experts, "***Improvement of Crops in the Era of Climatic Changes" Volume 2*** is a concise, yet comprehensive resource for researchers, students and others seeking knowledge expansion in this burning area of research and will lead them to new pondering on the subjects of climate changes and crop improvement.

In this book, we present a collection of 14 chapters written by 51 reputed experts in the fields of plant abiotic stress tolerance, induced mutagenesis and crop improvement. It is a well-timed and painstakingly compiled contribution of the topics that are of vast scientific eminence. Chapter one (1) throws light on Brassicas: responses and tolerance to heavy metal stress. In this chapter, the authors stated that there is a great scope for understanding methodically the genetics and genomics of *Brassica* species and the mechanisms of actions underlying the metal-induced toxicities and the tolerances developed therein. Chapter two (2) addresses the recent advances in rapid and sensitive screening for abiotic stress tolerance, wherein the authors have elaborated the development and identification of molecular markers associated with tolerance response and their value in sensitive indirect selection among few crop species. Chapter three (3) is about transcriptomics of heat stress in plants. This chapter primarily provides the current understanding on the role of regulatory genes (transcription factors), heat shock protein genes, metabolic genes, signaling compounds, osmolytes, reactive oxygen species and role of miRNAs as well as small RNAs of plants under high temperature. In addition, it gives a brief account of various transcriptome approaches to study the expression profiling of genes during the heat stress. Chapter four (4) is about biotic stress and crop improvement, wherein the authors fussily tried to identify the most widespread plant viruses in Azerbaijan, using different molecular techniques and precisely evaluated some characteristics of plant responses to viral stress. Chapter five (5) is regarding the salt stress and sugar beet improvement: challenges and opportunities. In this chapter, the authors present the comprehensive discussion on the challenges and opportunities for improvement of salt tolerance in sugar beet and emphasized that future research should chiefly focus on physiological, molecular and metabolic dimensions to facilitate the development of such crops with inherent stress tolerance capacity.

Chapter six (6) describes the genotypic variation for drought tolerance in wheat plants. In this chapter, a rich gene pool, comprising of thousands of wheat genotypes with contrasting photosynthetic traits, productivity and tolerance to drought stress, and introduced from world gene pool, particularly, CIMMYT and ICARDA was created in Azerbaijan which could be of great help for monitoring the environmental stresses in field grown plants and in the selection of stress-resistant varieties. Chapter seven (7) deals with soil contaminants: sources, effects and approaches for remediation. Here, the authors authoritatively stated that the remediation of heavy metal contaminated soils is necessary to reduce the associated risks, make the land resource available for agricultural production, enhance the food security, and scale down the land tenure problems arising from the changes in land use pattern. Chapter eight (8) describes the role of macronutrients in plant growth and acclimation: recent advances and future prospective. This chapter deals with the recent progress made in finding out the roles of macronutrients in plant growth and acclimation processes as well as future prospective of elemental research in plants. Chapter nine (9) is concerned with mutation breeding: a novel technique for genetic improvement of pulse crops particularly chickpea (*Cicer arietinum* L.). This chapter compresses various facets of contemporary knowledge for pulse crop varietal improvement, particularly chickpea, through induced mutagenesis with special thrust on qualitative as well as yield attributing traits. Chapter ten (10) deals with organic farming: the return to nature. In this chapter, the authors enumerated that organic foods have more plant secondary metabolites, higher micronutrient content and more conjugated fatty acids for better human health, including lower incidences of non-communicable diseases. Additionally, they stated that organic agriculture merges modernism, custom and science to manage the shared surroundings by encouraging the fair relationship and high quality of life for everyone involved. Chapter eleven (11) is about the role of cytological aberrations in crop improvement through induced mutagenesis. In this chapter, the authors scrupulously revealed the impact of mutagens on cytological behaviour and their overall role in crop improvement. Chapter twelve (12) deals with the wheat improvement: historical perspective and mutational approach-a review. This review enfolds various historical aspects, in addition to contemporary knowledge of wheat crop improvement programs through induced mutagenesis. Chapter thirteen (13) is about the cotton leaf curl virus disease predictive model based on environmental variables. This chapter was initiated to develop a disease predictive model to characterize the epidemiological factors conducive for disease spread and severity. The authors also envisaged that such models would be highly helpful in forecasting the diseases and subsequently help to decide the correct timing of pesticide applications.

Chapter fourteen (14) deals with transcription factors in abiotic stress responses -their potentials in crop improvement. In this chapter, the authors summarized contemporary understanding about TF activities in plants under adverse stress conditions and their use in crop improvement.

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