Anirudh Kumar
Rakesh Kumar
Pawan Shukla
Hitendra K. Patel *Editors*

Omics Technologies for Sustainable Agriculture and Global Food Security (Vol II)

Springer

Editors
Anirudh Kumar
Department of Botany
Indira Gandhi National Tribal University
Amarkantak, Madhya Pradesh, India

Rakesh Kumar
Department of Life Science
Central University of Karnataka, School of Life Science
Gulbarga, Karnataka, India

Pawan Shukla
Ministry of Textile
Central Silk Board, Ministry of Textile,
Pampore, Jammu and Kashmir, India

Hitendra K. Patel
Plant-Pathogen Interactions lab
Centre for Cellular and Molecular Biology
Habsiguda, Telangana, India

ISBN 978-981-16-2955-6 ISBN 978-981-16-2956-3 (eBook)
https://doi.org/10.1007/978-981-16-2956-3

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Social Acceptance and Regulatory Prospects of Genomics in Addressing Food Security

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S. J. S. Rama Devi and Supriya Babasaheb Aglawe

Abstract

The global population is expected to raise 9 billion by 2050 and 10 billion by 2100 or may exceed up to 13 billion. Ensuring food security for the growing global population is a big challenge for the breeders and agricultural scientists on the face of global warming and climate change. In order to achieve this, it is essential to fulfill the three factors like availability, accessibility, and adequacy. Plant breeding has been playing a great role in crop improvement and food security. Green Revolution was one of the important landmarks in this aspect. As a result of green revolution, tremendous gains in wheat productivity occurred between the 1960s and 1970s. After the 1980s molecular breeding and genomics assisted breeding contributed in this direction. Further plant tissue culture and genetic engineering overcome the barriers associated with conventional and molecular plant breeding and took crop improvement to the new heights. The intervention of genomics and molecular biology has revolutionized the field of crop improvement; however, there was a huge rejection for genetically modified (GM) or genome edited crops across the globe due to different regulatory policies adopted by countries. Also, the factors like willingness to purchase, taste, and nutrition aspects from consumer's perception coupled with the questions raised by the environmentalists about the impact of the GM on the existing genetic pool or cross species have discouraged the GM/technology driven crops or their derived products for commercial cultivation. Here we have discussed the social acceptance of the GM or genome edited food crops and their derived products; its

S. J. S. R. Devi (✉)
Center for Cellular and Molecular Biology (CCMB), Hyderabad, India

S. B. Aglawe
Professor Jaya Shankar Telangana State Agriculture University, Hyderabad, India

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A. Kumar et al. (eds.), *Omics Technologies for Sustainable Agriculture and Global Food Security (Vol II)*, https://doi.org/10.1007/978-981-16-2956-3_13

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Preface

Increasing global population and unpredictable climate change have forced for sustainable growth in crop production. An exploration of various challenges and their possible solution to improve yield and securing food for all, this book entitled "Omics Technologies for Sustainable Agriculture and Global Food Security (Vol I and Vol II)" comprehensively and coherently reviews the application of various aspect of rapidly growing omics technology including genomics, proteomics, transcriptomics, and metabolomics for crop development. It provides a detailed examination of how omics can help crop science and introduces the benefits of using these technologies to enhance crop production, resistance, and other values. In the first volume, we have discussed the recent advances in omics technology, bioinformatics, and database management for crop sciences, plant defense and disease control, application of omics tools in plant tissue culture, improving nitrogen use efficiency, and abiotic stress tolerance in crop plants. In addition, some informative chapters on understanding microbial systems through integrated omics approaches, microbial-mediated environmental contaminants remediation, genome editing for plant improvement, metabolomics-assisted breeding, and safety and ethics in omics biology were also part of the first volume.

Importantly, in the second volume, 13 chapters, which were not included in the first volume such as the use of nanotechnology in agriculture, manipulation of plant–microbe interaction signals for yield enhancement, systems biology approach to understand plant physiology and designing future crop, molecular farming, RNAi engineering for crop improvement, biofuel production, and public acceptance for hybrids and transgenic products are covered. The upcoming challenges are also covered, which will surely increase the interest of the readers. There are very few books available, which are mostly covering single topics such as abiotic stress, biotic stress, breeding or having two to three topics, but surely not all the above-mentioned topics. This book provides all the important topics with updated information in the area of crop breeding, abiotic and biotic stress resistance, nanotechnology, RNAi technology, system biology, and biofuel production. These two volumes can be useful for graduate and postgraduate students of life science including researchers who are keen to know about the application of omics technologies in the different areas of plant science/agriculture sciences/botany/life sciences. This book can also be an asset to modern plant breeders and agriculture biotechnologists. The book

represents an advancement in technologies that have revolutionized the process and understanding of the whole plant system. The book represents chapters from well-known scientists and pioneer researchers from various research organizations, plant breeders, and agriculture scientists. Both Vol I and Vol II present a broad view of how omics would help crop scientists to meet the challenges of food security.

Conclusively, it is an exploration of the challenges and conceivable solutions to improve yields of the food crops. It also provides a platform to ponder upon the integrative approach of omics to deal with complex biological problems. All the chapters are supplemented with diagram and discussion and arguments are supported by data table with valid references.

Sincerely!

Dr. Anirudh Kumar

Corresponding Editor

Amarkantak, India — Anirudh Kumar
Gulbarga, India — Rakesh Kumar
Pampore, India — Pawan Shukla
Hyderabad, India — Hitendra K. Patel

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About the Editors

Anirudh Kumar is a research faculty member in the Department of Botany, Indira Gandhi National Tribal University (IGNTU), Amarkantak, MP, India. He has 10 plus year career as a researcher in the area of plant molecular biology and plant pathology. During 2015–2016, he was working at CCMB, Hyderabad as DBT-Research Associate. He received M.Sc. and Ph.D. from University of Hyderabad, India. His current research interests span from antioxidants studies of medicinal plants to plant pathology. He is author and co-author of several papers on different aspects of plant biology. He also teaches courses for B.Sc., M.Sc., and Ph. D. degree. For the past few years, his research group is trying to study phytochemical profiles of native plants traditionally used by tribal healers of Amarkantak, MP, India.

Rakesh Kumar is a plant biologist and researcher, currently working as assistant professor at School of Life Sciences, University of Karnataka, India. He has obtained his PhD in plant sciences from University of Hyderabad and is an alumnus of International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India. During his past 11 years of research, he has worked in the area of molecular plant biotechnology and crop improvement. His expertise includes genomics and OMICS approaches such as mutagenesis, TILLING, Eco-TILLING, transcriptomics, sequencing, QTL-seq, trait and gene discovery, and LC-MS and GC-MS based proteomics and metabolomics. He has published several high-impact research papers, reviews, book chapters and obtained research grants from both national and international funding agencies.

Pawan Shukla is scientist in Central Silk Board, Ministry of Textile, Govt. of India, Bangalore since 2015. He obtained his M.Sc. and Ph.D. from the University of Hyderabad. He was Dr. D. S. Kothari postdoctoral fellow at University of Hyderabad during 2014–2015. He is having 12 years of experience working in the area of plant molecular biology and genetic engineering. During his Ph.D., he developed a plant gene-based pollination control system which has practical implication in hybrid seed production. In addition to this, he worked on the development of transgenic plants tolerance to different abiotic and biotic stresses. At present, he is associated with the biotechnology division of Central Sericultural Research and

Training Institute (CSR&TI), Central Silk Board, Pampore, Kashmir, J&K (UT) and his laboratory is working on the development of cold-tolerant mulberry variety. He has published several research papers in reputed international and national Journals and is an editor of three books published by CSR&TI, Central Silk Board Pampore.

Hitendra Kumar Patel completed his master degree in biotechnology from Guru Ghasidas Central University, Chhattisgarh and PhD in molecular life sciences from International Centre for Genetic Engineering and Biotechnology, Trieste, Italy. He is currently leading the rice functional genomics group at CSIR-Centre for Cellular and Molecular Biology (CSIR-CCMB), Hyderabad, India. His research activities are focused on developing novel rice varieties and also on understanding the mechanisms of the interactions between plants and their pathogens. He was involved in the identification and characterization of several virulence functions including EPS, LPS, cell wall degrading enzymes (CWDEs), and T3SS effector proteins of bacterial pathogen *Xanthomonas oryzae* pv. *oryzae*. He was involved in popularization and licensing of improved Samba Mahsuri rice, a bacterial blight disease resistant and low GI (diabetic-friendly) rice for which the team has won prestigious CSIR Technology award and DBT award. He is an associate editor for Science India portal and recognizing his contribution, he has been selected as Associate Fellow of Telangana, India.