About the Editors

Krashankant Sharma *born in Parwana village in the Bulandshahr district of Uttar Pradesh. He began his academic journey in his village with our schooling and went on to pursue higher education in Agronomy. He completed his graduation and post-graduation from Amar Singh P.G. College, Lakhaoti, affiliated with Chaudhary Charan Singh University, Meerut. Currently, he is pursuing a Ph.D. in Agronomy in Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut has successfully qualified several national-level examinations, including ASRB-NET (Agronomy), UGC-NET, and JRF (Environmental Science). With a deep passion for agricultural sciences and sustainability, Mr. Sharma has published numerous research papers and review articles in reputed Scopus-indexed journals. In addition to his academics, he is actively involved in practical farming activities, bringing scientific principles to the grassroots level. His work reflects a commitment to bridging the gap between research and real-world agricultural practices.*

Mr. Vaibhav Parmeshwar Gulwane *is a dedicated agricultural researcher currently pursuing a Ph.D. (Agri.) in Genetics and Plant Breeding, holding an M.Sc. (Agri.) in the same field from the Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra. His expertise includes in drought stress tolerance, crop improvement, and innovative agricultural practices aimed at enhancing sustainability and productivity. He has authored and contributed to multiple NAAS-rated Research Papers, Book Chapters, and Popular Articles. He was honoured with the "Excellent Agri Student Award-2018" at National-Level Krishithon Exhibition, Nashik. Mr. Gulwane has also served as an Assistant Professor at K. K. Wagh College of Agriculture, Nashik. He is committed to advancing agricultural science through research and educational writing, with a focus on climate-resilient agriculture.*

Dr. Mandhata Singh *working as Senior Scientist-cum-Head of ICAR-KVK Deoria Uttar Pradesh. Dr Singh completed MSc (Ag) in Agronomy from ANDUAT Kumarganj Ayodhya in 2005 and Ph.D in Agronomy from Banaras Hindu University Varanasi in 2009. He has more than 15 years of experience in the field of Agronomy. He has visited IRRI, Philippines and CIMMYT, Mexico and handled several national and international project. Dr. Singh published more than 40 Research articles, 15 book chapters, 4 book and attended more than 25 seminar, symposium and conference. Dr. Singh received several national awards and recognition. Associated for development of 3 rice varieties.*

Mr.R.K.M.Harish Kumar *is an Assistant professor working in Erode Sengunthar Engineering College, Perundurai, Erode, Tamilnadu. With profound excellence and meritorious academic record, he had completed Bachelor of science in Agriculture at Annamalai University, Chidambaram, Tamilnadu. By All India Entrance Examinations for Agriculture (AIEEA) with overall top 20 ranks, he completed Master of Science in Plant Biotechnology from the Department of Genetics and Plant Breeding at Banaras Hindu University, Varanasi, Uttar Pradesh. He had done various researches in environmental aspects and published many research articles, review papers, books, book chapters and popular articles. He is currently working in the aspect of Automation In agriculture for Smart Farm Management and Crop Production.*

Dr. Sandeep Rout *holds a B.Sc. in Forestry from the College of Agriculture, OUAT, Bhubaneswar, M.Sc. in Forestry (Forest Products) from the College of Forestry, OUAT, Bhubaneswar, and a Ph.D. in Forestry from SHUATS (Formerly Allahabad Agriculture Institute), Prayagraj, Uttar Pradesh. He has also qualified for the ICAR-NET in Agroforestry and the ICAR-SRF in Forestry. During his academic journey, Dr. Rout was awarded the University PG Scholarship during his M.Sc. and the prestigious DST Inspire Fellowship during his doctoral studies. Currently, Dr. Rout serves as an Assistant Professor (Forestry) at the Faculty of Agriculture, Sri Sri University, Cuttack, Odisha. His research interests include medicinal and aromatic plants, non-wood forest products (NWFP), and tree propagation. Dr. Rout has an impressive record of scholarly contributions, including- 200 research papers, 59 conference papers, 42 book chapters and 17 books authored. He is actively involved in academic publishing, serving as an Editor, Associate Editor, Editorial Board Member, and Reviewer for numerous NAAS and Scopus-indexed national and international journals. Dr. Rout is a life member and fellow of 19 scientific societies/associations. His achievements include 10 Indian patents, 5 Australian patents (granted), and 2 copyrights. He has been honored with 20 awards from prestigious academic societies across India in recognition of his contributions to forestry research and education.*

Ms. Shreejaya Sivadas *is a dedicated researcher and Ph.D. scholar in the Department of Post-Harvest Process and Food Engineering at G.B. Pant University of Agriculture and Technology (GBPUAT), Pantnagar, Uttarakhand. Her academic journey reflects a strong foundation in food technology and engineering, having completed her M.Tech in Food Process Engineering from Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, and a B.Tech in Food Technology from Jaipur National University. She also holds her secondary education from CBSE institutions—R.A.N. Public School, Bilaspur (HSC), and Lakes International School, Bhimtal (SSC).*
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PREFACE

Agriculture has been the foundation of human civilization since ancient times. For millennia, we have cultivated the land to feed and clothe ourselves. And yet, as our global population continues to grow and the pressures on our food systems mount, agriculture faces unprecedented challenges in the 21st century. Climate change, environmental degradation, water scarcity, and the need to feed an estimated 9 billion people by 2050 necessitate a transformation in how we grow our food.

This book, "Modern Innovations in Agricultural Science and Technology," aims to showcase the cutting-edge developments that are ushering in a new era of sustainable, efficient, and resilient agriculture. From precision farming techniques that harness big data, to biotechnology breakthroughs in crop breeding, to novel approaches in vertical farming and aquaponics, the innovations covered in these pages represent the diverse and exciting ways science and technology are being leveraged to revolutionize agriculture.

Through research insights, case studies, and expert analysis, the authors explore how these modern innovations are being applied to tackle the most pressing issues facing agriculture today - increasing yields, minimizing inputs and waste, adapting to a changing climate, and ensuring food security and safety, all while protecting the environment and supporting farmer livelihoods. Whether it's the use of drones and sensors for optimized irrigation and nutrient management, CRISPR gene editing to develop drought-tolerant crops, or AI-driven platforms for supply chain traceability, the technologies and practices highlighted here offer a compelling vision of a more sustainable and prosperous agricultural future.

However, this book goes beyond just presenting technological solutions. It also grapples with the complex social, economic, and policy dimensions that will determine how these innovations are ultimately adopted and scaled. Issues of access, equity, ethics, and governance are woven throughout the chapters, acknowledging that realizing the full potential of agricultural innovation requires more than just scientific advances alone.

Aimed at researchers, practitioners, policymakers, and anyone passionate about the future of food and farming, this book provides a timely and comprehensive look at the current landscape of agricultural science and technology innovation, and the promising directions it is headed. As we confront the monumental task of nourishing humanity in the face of growing constraints, embracing and augmenting the vital innovations detailed here will be essential.

Happy reading and happy gardening!

Editors……

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