

ADVANCES IN VEGETABLE SCIENCE

*Cultivating
Knowledge
for a Healthier
Tomorrow*

Dr. Abdul Majid Ansari
Dr. Ekhlague Ahmad
Dr. Tajwar Izhar



PRODUCTION
IMPROVEMENT
BIOTECHNOLOGY
SUSTAINABILITY
NUTRITION
FOOD SECURITY



SCIENCE
FOR SUSTAINABLE
VEGETABLE PRODUCTION

Advances in Vegetable Science



**India | UAE | Nigeria | Uzbekistan | Montenegro | Iraq |
Egypt | Thailand | Uganda | Philippines | Indonesia**
www.parabpublications.com

Advances in Vegetable Science

Authored By:

Dr. Abdul Majid Ansari

Junior Scientist-cum-Assistant Professor (Horticulture),
Zonal Research Station (BAU, Ranchi), Chianki, Jharkhand, India

Dr. Ekhlaque Ahmad

Junior Scientist-cum-Assistant Professor (PBG),
Zonal Research Station (BAU, Ranchi), Chianki, Jharkhand, India

Dr. Tajwar Izhar

Assistant Professor-cum-Junior Scientist
Forage Breeder, RVC, BAU, Ranchi, Jharkhand, India

Copyright 2020 by Dr. Abdul Majid Ansari, Dr. Ekhlaque Ahmad and Dr. Tajwar Izhar

First Impression: April 2020

Advances in Vegetable Science

ISBN: 978-93-48959-07-2

DOI: <https://doi.org/10.5281/zenodo.22891338>

Rs. 1000/- (\$80)

No part of the book may be printed, copied, stored, retrieved, duplicated and reproduced in any form without the written permission of the editor/publisher.

DISCLAIMER

Information contained in this book has been published by Parab Publications and has been obtained by the authors from sources believed to be reliable and correct to the best of their knowledge. The authors are solely responsible for the contents of the articles compiled in this book. Responsibility of authenticity of the work or the concepts/views presented by the author through this book shall lie with the author and the publisher has no role or claim or any responsibility in this regard. Errors, if any, are purely unintentional and readers are requested to communicate such error to the author to avoid discrepancies in future.

Published by:
Parab Publications

Preface

Vegetables constitute an indispensable component of a healthy and balanced diet and play a vital role in ensuring nutritional security, livelihood generation and sustainable agricultural development. With the growing population, changing dietary preferences, increasing pressure on natural resources, and emerging biotic and abiotic stresses, there is an urgent need to enhance the productivity, quality, resilience, and profitability of vegetable crops. Advances in plant breeding, molecular biology, biotechnology and production technologies have opened new avenues for achieving these objectives.

The book **Advances in Vegetable Science** has been conceived to provide comprehensive and contemporary information on important aspects of vegetable science, with particular emphasis on crop improvement, biotechnology, hybrid development, seed production and production technology. It brings together fundamental concepts and recent developments that are relevant to students, researchers, teachers, extension professionals, breeders, and vegetable growers.

The book begins with an overview of **vegetable crops**, highlighting their importance, diversity, nutritional value and contribution to agricultural and economic development. The chapters on **transgenics in vegetable crops** and **genetically modified vegetable crops for resistance to biotic stresses** discuss the principles and applications of biotechnology in developing improved cultivars with enhanced resistance to pests and diseases. These approaches have considerable potential for reducing crop losses and improving the efficiency and sustainability of vegetable production.

Modern molecular approaches have transformed conventional breeding programmes. The chapter on **molecular markers and their application in vegetable improvement** provides an insight into the use of molecular markers for genetic diversity assessment, characterization of germplasm, marker-assisted selection, and the identification and transfer of desirable traits. Such technologies can

significantly accelerate the development of superior vegetable varieties.

Hybrid technology is another important area addressed in this volume. The chapters on **development of hybrids and hybrid seed production of solanaceous vegetable crops**, **recent techniques of hybrid seed production in capsicum (*Capsicum annuum* L.)**, and **production technology for hybrid vegetables** describe contemporary approaches for producing high-quality hybrid seed and exploiting heterosis for improved yield, quality, uniformity, and adaptability. Special emphasis on capsicum provides practical and crop-specific information on efficient hybrid seed production techniques.

The concluding chapter on **breeding of vegetable crops** presents the principles and methodologies involved in the genetic improvement of vegetables, integrating conventional breeding with modern tools and technologies. Collectively, the chapters provide a broad perspective of the rapidly evolving field of vegetable science and demonstrate how conventional knowledge and modern innovations can complement one another.

It is hoped that **Advances in Vegetable Science** will serve as a useful reference and teaching resource for academic institutions, research organizations, agricultural professionals, and all those engaged in vegetable production and improvement. Author believe that this volume will contribute to a better understanding of emerging technologies and encourage their effective application for developing productive, nutritious, climate-resilient, and sustainable vegetable production systems.

Acknowledgment

The successful completion of this book, *Advances in Vegetable Science*, has been made possible through the support, guidance, and encouragement of many individuals. We take this opportunity to express our sincere gratitude to all those who have contributed directly or indirectly to its preparation.

First and foremost, we express our profound gratitude to the Almighty for granting us the strength, wisdom, and perseverance to undertake and complete this academic endeavour.

We are deeply indebted to the authorities of Birsa Agricultural University, Kanke, Ranchi, for providing an academic environment conducive to teaching, research, and the advancement of agricultural sciences. We are especially grateful to our respected teachers, colleagues, and fellow researchers for their valuable suggestions, constructive criticism, and continuous encouragement during the preparation of this book.

We sincerely acknowledge the contributions of the authors and researchers whose pioneering work and scientific publications have enriched the subject matter presented in this book. Their valuable research has served as an important foundation for compiling and presenting the recent advances in vegetable science.

We extend our heartfelt thanks to the reviewers, and publishing staff for their meticulous efforts, scholarly guidance, and cooperation in bringing this book to its present form. Their valuable contributions have greatly enhanced the quality and usefulness of this publication.

We are also grateful to our family members for their patience, understanding, and unwavering support throughout the preparation of this book. Their encouragement has been a constant source of inspiration.

Finally, we express our sincere appreciation to all those names may not have been mentioned individually but whose assistance and goodwill have contributed to the completion of this work.

We hope that this book will serve as a useful reference for students, teachers, researchers, extension workers, and professionals in the field of vegetable science and contribute to the advancement of knowledge and sustainable vegetable production.

Dr. Abdul Majid Ansari
Dr. Ekhlague Ahmad
Dr. Tajwar Izhar

About the Authors



Dr. Abdul Majid Ansari, Ph.D., devoted his academic career to Agriculture, particularly in the field of Horticulture as a Research and Extension worker. Dr. Ansari has been working as a Junior Scientist-cum-Assistant Professor (Horticulture) at ZRS, Chianki, Birsa Agricultural University, Ranchi. Dr. Ansari did his Doctorate in Vegetable Science (2012) from G.B. Pant University of Agri & Tech., Pantnagar. He has contributed significantly in the field of vegetable breeding and developed a large number of advance lines of eggplant, tomato and vegetable peas. He has been maintaining a large number of germplasms of different vegetable and fruit crops at the station. He has also made a vibrant link with farmers by advising them to promote scientific management of horticultural crops. He has 36 research papers, three review articles, 24 oral/poster presentation, three lead papers presentation, five books, four book chapters, 12 popular articles, four leaflet/folder, reviewed several research papers of three international journals viz., *Scientia Horticulturae*, *Fruits Journal* and *Agronomy Journal* and delivered 74 lectures in the different seminar/symposia/conference/workshop. Dr. Ansari has been associated with many externally funded projects in different capacities and Nodal Officer {EAP} in the multi crore World Bank-ICAR funded project named NAHEP-CAAST-IFS, BAU, Ranchi. He has a life membership of 10 scientific societies. He is working as a member of editorial board in the 8 National/International Journal of Agricultural and Allied Sciences and participated in the 9 refresher courses of horticultural importance.



Dr. Ekhlague Ahmad has completed B.Sc. (Ag.) in 1998 and M.Sc. (Ag.) in 2001 from Birsa Agricultural University (BAU), Ranchi. He has qualified ICAR-NET in 2002 and in the same year he engaged as Research Associate in NATP (MM, Wheat) at BAU, Ranchi. He has appointed as Junior Scientist-cum-Assistant Professor at BAU in 2004. He awarded PhD degree in Genetics & Plant Breeding from GBPUA&T, Pantnagar in 2012 as in-service. He has actively engaged in breeding of different cereals, pulses and oilseeds crops. He has associated with development and released of various crops variety *viz.*, Rice-4, Wheat-1, Gram-1, Groundnut-1, and Linseed-2 and under process of release are Finger millet-2, Pigeonpea-1, Maize-2. He has trained in molecular technology for crop improvement from National Research Centre for Plant Biotechnology, New Delhi and attended for advance refresher courses from leading institutes. He is life member of eleven professional societies and member of editorial advisory board of six national & international Journals. He is also reviewer of various national/international journals. He has published more than 35 research papers in reputed journals, one book chapter, two short communication, four popular article and more than 45 abstracts in national and seven in international conferences. He delivered three invited lectures and presented 10 research papers (oral/poster) in different seminars, symposiums and conferences. He has felicitated by various professional societies *viz.*, Agri-innovation award-2015, Young scientist award-2015, outstanding achievement award-2016, and distinguished scientist award-2017. He has actively participated in transfer of technology activities like delivering lectures for officers/extension personnel who engaged in extension and development of agriculture, TV talk, Radio talk, Krishak Gosthi, Kisan Mela etc. for the farmers.



Dr. (Mrs.) Tajwar Izhar is an Assistant Professor-cum-Scientist in the Forage Breeding Department, Livestock Production and Management, at Ranchi College of Veterinary Sciences and Animal Husbandry, Birsa Agricultural University (BAU), Ranchi. She was awarded the INSPIRE Fellowship by the Department of Science and Technology, Government of India for her PhD programme and received the Chancellor's Gold Medal for excellence in PhD research. Specializing in Forage breeding and Fodder production. She has published 28 research papers in reputed national and international journals. She is actively engaged in breeding programmes aimed at developing improved forage varieties to enhance livestock productivity. Dr. Izhar was also the recipient of the prestigious JSPS Fellowship in Tokyo, Japan. She participated in the 5th HOPE Meeting with Nobel Laureates held in Tokyo (26th February – 2nd March, 2013), where she was nominated by the Department of Science and Technology, Government of India. Her outstanding contributions to Livestock and forage science have earned her multiple national and international awards from various organizations. Her area of expertise is Forage breeding, Forage production and livestock nutrition.

Table of Contents

Title of Chapters	Page No.
CHAPTER - 1	1 – 41
<i>Vegetable Crops</i>	
CHAPTER - 2	42 – 80
<i>Transgenic In Vegetable Crops</i>	
CHAPTER - 3	81 – 113
<i>Molecular Markers and its Application in Vegetable Improvement</i>	
CHAPTER - 4	114 – 121
<i>Genetically Modified Vegetable Crops for Resistance to Biotic Stresses</i>	
CHAPTER - 5	122 – 147
<i>Development of Hybrid and Hybrid Seed Production of Solanaceous Vegetable Crops</i>	
CHAPTER 6	148 – 169
<i>Recent Techniques of Hybrid Seed Production in Capsicum (Capsicum Annuum L.)</i>	
CHAPTER - 7	170 – 183
<i>Production Technology for Hybrid Vegetables</i>	
CHAPTER - 8	184 – 237
<i>Breeding of Vegetable Crops</i>	
<i>References</i>	238 – 262

ABOUT THE AUTHORS



Dr. Abdul Majid Ansari

Junior Scientist-cum-Assistant Professor (Horticulture),
Zonal Research Station (BAU, Ranchi), Chianki, Jharkhand, India



Dr. Ekhlaque Ahmad

Junior Scientist-cum-Assistant Professor (PBG),
Zonal Research Station (BAU, Ranchi), Chianki, Jharkhand, India



Dr. Tajwar Izhar

Assistant Professor-cum-Junior Scientist
Forage Breeder, RVC, BAU, Ranchi, Jharkhand, India



India | UAE | Nigeria | Malaysia | Montenegro | Iraq | Egypt | Thailand | Uganda | Philippines | Indonesia

Parab Publications || www.parabpublications.com || info@parabpublications.com