INNOVATIONS IN MODERN HORTICULTURE

INNOVATIONS IN MODERN HORTICULTURE

Dr. Tejraj Singh Hada
Assistant Professor (Horticulture)
Balwant Vidyapeeth Rural Institute, Bichpuri, Agra, U.P

Dr. Mohammad Faisal
Professor, Department of Botany & Microbiology
King Saud University, Saudi Arabia

Dr. Richa Pyasi
Ph.D. Department of Vegetable Science
RVSKVV, Gwalior

Dr. Bharti Gautam
Assistant Professor
Department of Agriculture Maharishi Markandeshwar
(Deemed to be University) Mullana, Ambala, Haryana



VITAL BIOTECH PUBLICATION
Kota, Rajasthan, India
http://www.vitalbiotech.org/bookpublication/

An International Publishers

VITAL BIOTECH get Accredited by following International organization

ITHAKA ARTSTOR ITHAKA S|R JSTOR PORTICO

https://www.portico.org/publishers/vital/
101 Greenwich Street, 18th Floor
New York, NY 10006

Copyright © 2026 VITAL BIOTECH PUBLICATION
Published by Vital Biotech Publication
First Edition: 2026

All Rights Reserved
No part of this book may be reproduced in any form, by photostat, microfilm, xerography, or any other means, or incorporated into any information retrieval system, electronic or mechanical, without the written permission of the publisher.

Product Form:
Digital download, online and hard bound

Edition:
ISBN: 978-93-48793-16-4

Head, Production (Higher Education and Professional) & Publishing Director
Dr. Jitendra Mehta

Product Manager
Aman Saxena

General Manager
Jaya Mehta

Graphic Designer
Kritika Lohomi

Information contained in this work has been obtained by Vital Biotech Publication (India), from sources believed to be reliable. However, neither Vital Biotech Publication (India) nor its authors guarantee the accuracy or completeness of any information published herein, and neither Vital Biotech Publication (India) nor its authors shall be responsible for any errors, omissions, or damages arising out of use of this information. This work is published with the understanding that Vital Biotech Publication (India) and its authors are supplying information but are not attempting to render engineering or other professional services. If such services are required, the assistance of an appropriate professional should be required.

Office Address:

VITAL BIOTECH PUBLICATION
772, Basant Vihar, Kota,
Rajasthan-324009 India
Visit us at: http://www.vitalbiotech.org
Contact No. +91-9784677044
Printed at: Vital Biotech Publication, Kota

Preface

Horticulture has emerged as one of the most dynamic and rapidly advancing fields within agricultural sciences. With increasing global demand for nutritious food, improved crop quality, sustainable production systems, and efficient resource management, modern horticulture is undergoing significant transformations driven by scientific innovations and technological advancements. The integration of advanced cultivation practices, biotechnology, precision agriculture, protected cultivation, and post-harvest management techniques is reshaping the way horticultural crops are produced, processed, and marketed.

The book *"Innovations in Modern Horticulture"* aims to present recent developments, emerging technologies, and innovative practices that are revolutionizing horticultural science. It highlights the role of modern tools such as tissue culture, genetic improvement, smart irrigation systems, vertical farming, protected cultivation, and digital agriculture in enhancing productivity, sustainability, and profitability of horticultural crops. The chapters included in this book also discuss climate-resilient horticulture, sustainable nutrient management, pest and disease management strategies, and value addition in horticultural produce.

This book is designed to serve as a comprehensive resource for students, researchers, academicians, horticulturists, and professionals engaged in the horticulture sector. The contributors have made sincere efforts to present updated information, practical insights, and scientific perspectives that will support learning, research, and field application.

We hope that this book will contribute to strengthening knowledge in modern horticultural innovations and inspire further research and technological adoption for sustainable horticultural development.

Dr. Tejraj Singh Hada
Dr. Mohammad Faisal
Dr. Richa Pyasi
Dr. Bharti Gautam

Dated - 20 Feb., 2026

CONTENTS

S. NO.		PAGE NO.
1.	**Emerging Trends and Technological Advances in Modern Horticulture** *Tejraj Singh Hada, Mohammad Faisal, Richa Pyasi, Bharti Gautam*	1-14
2.	**Precision Horticulture: Sensors, IoT, and Data-Driven Crop Management** *Mohammad Faisal, Tejraj Singh Hada, Richa Pyasi, Bharti Gautam*	15-28
3.	**Protected Cultivation Systems: Greenhouses, Polyhouses, and Vertical Farming** *Richa Pyasi, Bharti Gautam, Tejraj Singh Hada, Mohammad Faisal*	29-44
4.	**Hydroponics, Aeroponics, and Soilless Production Technologies** *Bharti Gautam, Richa Pyasi, Mohammad Faisal, Tejraj Singh Hada*	45-58
5.	**Climate-Smart Horticulture and Sustainable Production Practices** *Bhawna*	59-72
6.	**Biotechnology and Genome Editing in Fruit, Vegetable, and Ornamental Crops** *Bhawna*	73-88
7.	**Smart Irrigation and Fertigation Strategies for Resource Efficiency** *Rohit, Ankit Singh, P. Maneela, T. Manvitha, Raj Ankesh*	89-102
8.	**Post-Harvest Innovations: Cold Chain, Packaging, and Value Addition** *Rohit, Luxmi, Chasin, Ravindra Kumar Yadav, Raj Shree*	103-118

9.	**Urban Horticulture and Rooftop Gardening Technologies** *Tejraj Singh Hada, Mohammad Faisal, Richa Pyasi, Bharti Gautam*	**119-132**
10.	**Artificial Intelligence, Robotics, and Automation in Horticultural Systems** *Bhawna, Akash*	**133-146**
11.	**Advances in Soilless Culture and Hydroponics in Horticulture** *Bhawna*	**147-160**
12.	**Precision Horticulture in Fruit Production** *Bhawna*	**161-174**
13.	**High-Density Planting and Canopy Management in Fruit Crops** *Shobharam Anjanawe, Basant Kachouli*	**175-188**
14.	**Seed Vigor and Invigoration Techniques** *Kumari Punam Sinha, Kodidhala Vaishnavi, Anjali Kumar Jha*	**189-206**
15.	**Seed-Borne Pathogens and their Management** *Kumari Punam Sinha, Kodidhala Vaishnavi, Anjali Kumar Jha*	**207-220**
16.	**Climate-Resilient Vegetable Varieties for Sustainable Production** *Nallabothula Harika, Eshu Sahu, Ritika Samrath* *V. Sanjivkumar, A. Sai Aganitha*	**221-240**
17.	**Biotechnology and Tissue Culture Applications in Vegetable Crops** *Piyusha Sharma, Naval Kishore Meena, Satish Kumar Sharma*	**241-258**
18.	**Genome Editing and CRISPR Technologies in Vegetables** *Ojaswitha Rao, Shashiprabha Verma, Veenu Singh Lahade Janabai Sursen, Korani Harini*	**259-278**
19.	**Biofortification and Nutritional Quality Enhancement of Vegetables** *Varun Tripathi, Mayank Mehra, Satish Kumar Sharma, Rachel Rashika Lohia, Naval Kishore Meena*	**279-300**

20. Breeding for Biotic Stress Resistance in Vegetable Crops **301-318**
Pragya Singh, Naval Kishore Meena

21. Breeding for Abiotic Stress Tolerance in Vegetables **319-338**
Ritesh Prasad Mehta, Hanmant Nana Langute Soumadeep Putatunda, Naval Kishore Meena

22. Impact of Climate Change on Fruit Crop Phenology and Yield **339-350**
Pujarani Rath, Durgashankar Meena, Nidarshana Baruah NS Prashanthi, Aditya Kumar

23. High-Density Planting Systems and Canopy Management in Fruit Crops **351-364**
Pujarani Rath, Lokesh Kumar, Nidarshana Baruah, Kunzang Lamo, V. Sanjivkumar

24. Floriculture for Sustainable Development: Production, Value Addition and Entrepreneurship **365-376**
Mandas Banjare, Janhavi Sinha, Prawindra, Sonia Thiyam Swathi E S

25. Protected Cultivation of Vegetables: Technologies Challenges and Future Prospects **377-390**
Neeraj, Vinod Kumar, Shivam, Deepika Sahu Anup Pratap Singh

26. Genome Editing and CRISPR Technologies for Improvement of Ornamental Crops **391-404**
Vikas Taya, Iqra Farooq, Harshita Rathore, S. Suresh Ayush Gulia

27. Advances in Genome Editing and Molecular Breeding for Fruit Crop Improvement **405-418**
S. Suresh, D. Malathi, Aksh, Debashis Saren, S Thirumalraj

28. Sustainable Vegetable Production through Soil Health Management Bioinputs and Precision Nutrient Management **419-432**
Rewangini Ranjha, Ritu Rani Minz, Deepak Yadav, Puneet Twinkal Sinha

29. Postharvest Innovations in Vegetable Science: Extending Shelf Life, Reducing Food Losses and Improving Marketability **433-448**
Omesh Thakur, Sunidhi Mishra, Versha Kumari, Mamta Patel

30. Soil Health, Root-Zone Management and Microbiome-Based Nutrition in Perennial Fruit Crops **449-464**
Mounik. A, Poonam I. Jetpara, V Madan Mohan Rao Vaibhav Sharma, Ajay yadav