PRECISION HORTICULTURE

PRECISION HORTICULTURE

Dr. Narendra Singh Bhandari
Assistant Professor (Horticulture) Shree Guru Gobind Singh Tricentenary University, Gurgaon - Badli Road, Chandu, Budhera, Gurugram, Haryana – 122505

Dr. Ashok Kumar
Principal Scientist (Horticulture) ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok, Sikkim-737102

Dr. Amit Kumar
Scientist (Agronomy)ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok, Sikkim-737102

Dr. Sunil Kumar
Assistant Professor (Floriculture and Landscaping) College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Pradesh-224229

Dr. Gaurav Verma
Subject Matter Specialist (Agronomy) Krishi Vigyan Kendra, Kasganj, CSAUA&T, Kanpur-208002

VITAL BIOTECH PUBLICATION

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

An International Publishers

VITAL BIOTECH get Accredited by following International organization

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: 978-93-48793-45-4

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

The field of horticulture is undergoing a remarkable transformation with the integration of advanced technologies, data-driven decision-making, and innovative crop management practices. *Precision Horticulture* emerges as a modern approach that combines digital tools, automation, remote sensing, artificial intelligence, Internet of Things (IoT), Geographic Information Systems (GIS), drones, and sensor-based technologies to enhance productivity, quality, sustainability, and resource-use efficiency in horticultural crops.

This book has been designed to provide students, researchers, academicians, extension workers, and professionals with comprehensive knowledge of precision technologies and their applications in fruits, vegetables, plantation crops, floriculture, and protected cultivation systems. The chapters included in this book cover fundamental concepts, technological advancements, smart irrigation and nutrient management, precision pest and disease monitoring, climate-smart horticulture, post-harvest management, and future innovations in smart farming.

The rapid challenges of climate change, shrinking natural resources, labor scarcity, and increasing food demand have made precision horticulture an essential component of sustainable agricultural development. By adopting precise and site-specific management practices, growers can optimize inputs, reduce environmental impacts, and improve economic returns.

The editors sincerely hope that this book will serve as a valuable academic and practical resource for readers interested in modern horticultural technologies and sustainable crop production systems. We express our gratitude to all contributors, researchers, and institutions whose support and expertise made this publication possible. It is our expectation that this book will inspire further research, innovation, and adoption of precision-based horticultural practices worldwide.

Dr. Narendra Singh Bhandari **Dated - 15 April, 2026**
Dr. Ashok Kumar
Dr. Amit Kumar
Dr. Sunil Kumar
Dr. Gaurav Verma

CONTENTS

S. NO.		PAGE NO.
1.	**Foundations of Precision Horticulture: Concepts, Scope, and Technological Evolution** *Narendra Singh Bhandari*	1-12
2.	**Geospatial Technologies in Horticulture: GIS, GPS, and Remote Sensing Applications** *Ashok Kumar*	13-26
3.	**Soil Health Mapping and Site-Specific Nutrient Management** *Amit Kumar*	27-40
4.	**Precision Irrigation Systems and Smart Water Management** *Sunil Kumar*	41-52
5.	**Sensor-Based Monitoring of Crop Growth and Microclimate** *Gaurav Verma*	53-64
6.	**Internet of Things (IoT) and Smart Greenhouse Technologies** *Vinnakota Yesubabu, Satyanshu Singh, Manish Kumar, Moinuddin, Satish Kumar Sharma*	65-78
7.	**Artificial Intelligence and Machine Learning in Horticultural Decision-Making** *Durgashankar Meena, Satyanshu Singh, Seema Mahlawat, Satish Kumar Sharma, Prashant Chauhan*	79-90
8.	**Drone Technology and UAV-Based Crop Surveillance** *S. Sivasaravanan, Shahin khan, Seema, Abhishek Ranjan, Shivam Maurya*	91-102
9.	**Automation, Robotics, and Smart Harvesting Systems** *Durgashankar Meena, S. Vijayan, Kalyani Ashok Jadhav, Neeraj Kotwal, Satish Kumar Sharma*	103-118

10. Data Analytics, Big Data, and Future Trends in Precision Horticulture **119-132**
Durgashankar Meena, Chiranjit Mazumder, Firdusur Rahman, Ashima Choudhary, Mounik. A

11. Precision Pest and Disease Management in Horticultural Crops **133-144**
Narendra Singh Bhandari, Ashok Kumar

12. Precision Postharvest Management and Supply Chain Optimization **145-156**
Amit Kumar, Sunil Kumar, Gaurav Verma

13. Climate-Resilient Vegetable Production: Strategies, Innovations and Future Perspectives for Sustainable Agriculture **157-168**
Asha Dhaka, Shivam, Sai Ramesh Dhanekula, P. Srikala Anup Pratap Singh

14. Biotechnology in Floriculture: Modern Approaches for Genetic Improvement of Ornamentals **169-180**
Kota Meghana, Deepika Sahu, Sanket Kumar Maurya, Shivam Nishant Thakur

15. Future Trends in Floriculture and Landscaping: Innovation Sustainability and Smart Technologies **181-192**
Shivaraj Kumar Verma, Shivam, Sannidhi Sampagavi Jadhav Amol, Pallavi Bharati

16. Genomics-Assisted Improvement of Vegetable Crops **193-208**
Akhilesh Raturi, Pooja A. Dabholkar, Sakshi Verma Tanisha jain, Bhavesh Verma

17. Hybrid Breeding and Heterosis in Vegetable Crops **209-224**
Dinesh Kumar

18. Nutraceutical Potential of Underutilized Vegetables: Bioactive Constituents, Health Promoting Properties and Future Prospects **225-238**
Akhilesh Raturi, Shivam, Debi Archana Nayak Anurag Kushwaha, Shruthy O N

19. Modern Breeding Strategies for Climate Resilient and Nutrient-Rich Fruit Crops **239-252**
Oindrila Biswas, Dhanashri Pradip Waghmare, Geetanjali Vijay Kumar, Mounik. A

20.	**Micropropagation: An Advanced Biotechnology Approach for the Rapid Propagation of Horticultural Crops** *Yogendra Singh, Sonam Upadhyay, Varsha Upadhyay A. B. Singh, Siddhi Maheshwari*	**253-272**
21.	**Role Of Rootstocks in Canopy Management in Fruit Crops** *Gangaram Rana, Roshan Lal Sahu*	**273-284**
22.	**Biodiversity-Driven Landscaping: Native Ornamentals, Pollinator Conservation and Urban Ecological Resilience** *Shivam, V Madan Mohan Rao, Dinkal Chaudhary, Tanisha Jain Vinay Dansena*	**285-300**
23.	**Vertical Farming, Hydroponics and Soilless Culture for High-Value Vegetable Production** *Nandini Sarathi, Aastha Raut, Naval Kishor, Ranjit Chatterjee Neelima Rawat*	**301-316**
24.	**Post-harvest Innovations for Extending Shelf Life and Reducing Vegetable Food Losses** *Sammetla Anusha, Deepak Yadav, Shivam Suresh Kumar Wakre, Pradeep Kumar Sahu*	**317-332**
25.	**Water-Efficient Landscaping: Xeriscaping, Native Plants and Smart Irrigation Technologies** *Iqra Farooq, V Madan Mohan Rao, Dinesh Kumar Vaibhav Sharma, Ajay yadav*	**333-346**