

ADVANCES IN
AGRICULTURAL
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Advances in Agricultural Sciences: Volume-2

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Preface

Agriculture is undergoing a remarkable transformation driven by scientific innovation, technological advancements, and the growing need to ensure global food and nutritional security while conserving natural resources. In this rapidly evolving landscape, continuous research and knowledge dissemination play a pivotal role in addressing the complex challenges posed by climate change, resource degradation, emerging pests and diseases, and the increasing demand for sustainable agricultural production.

Advances in Agricultural Sciences – Volume 2 has been compiled with the objective of presenting recent developments, innovative technologies, and emerging research trends across diverse disciplines of agricultural sciences. This volume brings together scholarly contributions from researchers, academicians, scientists, and professionals, highlighting both fundamental concepts and practical applications that are shaping the future of agriculture.

The chapters included in this volume cover a broad spectrum of topics such as sustainable crop production, horticultural advancements, soil and water management, precision agriculture, climate-smart farming, agricultural biotechnology, integrated pest and disease management, digital agriculture, post-harvest technology, agricultural engineering, extension education, and emerging innovations that contribute to resilient and productive farming systems. The multidisciplinary nature of this volume reflects the interconnectedness of agricultural sciences and emphasizes integrated approaches for sustainable development.

This book is intended to serve as a valuable reference for undergraduate and postgraduate students, researchers, scientists, extension professionals, policymakers, and practitioners seeking updated information on contemporary agricultural research and technological progress. We hope that the knowledge presented in this volume will inspire further research, promote scientific collaboration, and facilitate the adoption of innovative practices for improving agricultural productivity, profitability, and environmental sustainability.

The editors express their sincere gratitude to all the contributing authors for their scholarly efforts and commitment in preparing high-quality chapters. We also extend our appreciation to the reviewers for their valuable suggestions, which greatly enhanced the scientific quality of this volume. Our heartfelt

thanks are due to the publisher and the editorial team for their continuous support and dedication throughout the publication process.

We believe that **Advances in Agricultural Sciences – Volume 2** will make a meaningful contribution to agricultural literature and serve as a useful resource for the scientific community. We welcome constructive feedback and suggestions from readers that will help improve future editions.

Dr. Nazreenbanu Tahasildar

Dr. Sudha Darbha

Parvi Garg

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Dr. Neet Upasana Lakra

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Chapter 18

Soil Moisture Dynamics and Water Management in Crop Production

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1. Introduction

Water is one of the most essential natural resources for agricultural production and plays a vital role in the growth, development, and productivity of crops. It is often referred to as the "lifeblood of agriculture" because every physiological and biochemical process in plants depends directly or indirectly on the availability of water. Soil acts as the primary reservoir of water for plants, storing rainfall and irrigation water and supplying it to crop roots throughout the growing season. The amount, movement, and availability of water in the soil collectively determine crop performance, nutrient uptake, and final yield.

Soil moisture is the water present within the pore spaces of the soil. It serves as the main source of water for plants and influences several soil processes such as nutrient dissolution, microbial activity, seed germination, root development, and soil temperature regulation. Adequate soil moisture ensures continuous water availability to plants, while excessive or insufficient moisture adversely