

Plant Physiology

(For UG & PG Students in Indian Universities)

Syam Prasad Sura

Plant Physiology

Syam Prasad Sura

Department of Botany, Kakatiya Government
College (Autonomous), Hanumakonda, Telangana,
INDIA-506001



DeepScience

Published, marketed, and distributed by:

Deep Science Publishing, 2025
USA | UK | India | Turkey
Reg. No. MH-33-0523625
www.deepscienceresearch.com
editor@deepscienceresearch.com
WhatsApp: +91 7977171947

ISBN: 978-93-7185-946-2

E-ISBN: 978-93-7185-227-2

<https://doi.org/10.70593/978-93-7185-227-2>

Copyright © Syam Prasad Sura, 2025.

Citation: Sura, S. P. (2025). *Plant Physiology*. Deep Science Publishing. <https://doi.org/10.70593/978-93-7185-227-2>

This book is published online under a fully open access program and is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License (CC BY-NC 4.0). This open access license allows third parties to copy and redistribute the material in any medium or format, provided that proper attribution is given to the author(s) and the published source. The publishers, authors, and editors are not responsible for errors or omissions, or for any consequences arising from the application of the information presented in this book, and make no warranty, express or implied, regarding the content of this publication. Although the publisher, authors, and editors have made every effort to ensure that the content is not misleading or false, they do not represent or warrant that the information-particularly regarding verification by third parties-has been verified. The publisher is neutral with regard to jurisdictional claims in published maps and institutional affiliations. The authors and publishers have made every effort to contact all copyright holders of the material reproduced in this publication and apologize to anyone we may have been unable to reach. If any copyright material has not been acknowledged, please write to us so we can correct it in a future reprint.

Preface

Plant physiology is a fundamental field of botany which studies the life processes and critical functions of plants. It assists us in knowing the development, growth and adaptation of plants under the environment which is of paramount importance to agriculture, horticulture, forestry and environment management. Good knowledge of plant physiology is a necessity not only to students but also to the researchers and educators who are interested in plant sciences.

The book, Plant Physiology, is a well-designed textbook that will meet the demands of the undergraduate (UG) and postgraduate (PG) students in Indian universities, as well as, research scholars and faculty. The materials are arranged in a unique and detailed way that demonstrates the basic and complex plant physiological functions.

In unit I, the topic is presented with an introduction on the importance of the topic, its scope and fundamental concepts of plant physiology.

Unit II (Part-A) deals with the basic physiology processes or the concepts such as: water relations, mineral nutrition, enzymes, photosynthesis and translocation of organic matter. The chapters focus on the way in which plants take up water and other nutrients, develop energy and allocate metabolites effectively in order to maintain growth and development.

Part-B of Unit III deals with complex topics of respiration, nitrogen and lipid metabolism, growth and development, and stress physiology. It helps in the understanding of energy production, nutrient assimilation, growth regulation by hormones, and plants response to the biotic stress and abiotic stresses.

The purpose of the book is to explain exploration of plant physiology in a simple, rational, and easily comprehensible way, and the descriptions of plant physiology capable of proving helpful in classroom studies, exam preparation, and research instrument. It is constructed to reinforce lower level of knowledge besides sustaining a greater level of comprehension among research scholars and teachers.

I believe that the book can be a great tool to various students, researchers, and educators that allows them to discover this exciting world of plant physiology.

Dr Sura Shyam Prasad

Content

Unit	Title / Subtopics	Page Numbers
Unit I	Introduction to Plant Physiology	1 – 4
Unit II	Plant Physiology (Part A)	
1. Plants – Water Relations	<ul style="list-style-type: none">• Introduction to water in plants• Water potential & components• Absorption & transport of water• Transpiration & significance• Mechanisms of water movement	5 – 57
2. Mineral Nutrition	<ul style="list-style-type: none">• Essential macro & micronutrients• Functions of minerals• Deficiency symptoms• Mechanisms of mineral uptake• Soil–plant interactions	58 – 84
3. Enzymes	<ul style="list-style-type: none">• Nature & classification• Mechanism of enzyme action• Factors affecting enzyme activity• Coenzymes & cofactors• Enzyme regulation in plants	85– 105
4. Photosynthesis	<ul style="list-style-type: none">• Introduction & historical background• Light & dark reactions• Photopigments• C3, C4 & CAM pathways• Factors affecting photosynthesis	106 – 156
5. Translocation of Organic Substances	<ul style="list-style-type: none">• Phloem structure & function• Mechanism of translocation• Source–sink relationship• Factors influencing translocation• Experimental evidence & models	157 – 174
Unit III	Plant Physiology (Part B)	
6. Respiration	<ul style="list-style-type: none">• Introduction to respiration• Glycolysis, Krebs cycle, ETC• Anaerobic respiration• Respiratory quotient (RQ)• Regulation of respiration	175 – 198
7. Nitrogen Metabolism	<ul style="list-style-type: none">• Nitrogen fixation (biological & non-biological)• Nitrate & ammonium assimilation• Amino acid & protein synthesis• Ureide & amide pathways• Regulation of nitrogen metabolism	199 – 250

8. Lipid Metabolism	<ul style="list-style-type: none"> • Structure & functions of lipids • Fatty acid biosynthesis • Lipid degradation & β-oxidation • Lipids in storage & signalling • Enzymes in lipid metabolism 	251 – 265
9. Growth and Development	<ul style="list-style-type: none"> • Plant growth regulators (Auxin, GA, Cytokinin, Ethylene, ABA) • Seed germination & dormancy • Photoperiodism & vernalization • Flowering & fruit development • Senescence & abscission 	266 – 313
10. Stress Physiology	<ul style="list-style-type: none"> • Abiotic & biotic stresses • Responses to drought, salinity, temperature • Stress hormones & metabolites • Oxidative stress & antioxidants • Stress tolerance mechanisms 	314 – 325