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### Handbook of Plant and Crop Physiology, Second Edition, Revised and Expanded

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formly well written. The figures were of high quality and the editing job was masterful. Whereas many topics were covered in multiple chapters of the text, they were generally discussed from different perspectives, making the information complementary, rather than redundant. The text should be understandable to a broad audience and will be an invaluable resource in graduate courses. My only quibble concerns the rationale for placement of many of the chapters into a given section, which seemed to me rather arbitrary in many cases. Considered overall, I strongly recommend this text as a paradigm of an integrated approach to tackle an important, multidisciplinary topic in crop science.

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**Application of Physiology in Wheat Breeding.** Edited by M.P. REYNOLDS, J.I. ORTIZ-MONASTERIO, and A. McNAB. International Maize and Wheat Improvement Center (CIMMYT), Apdo. Postal 6-641, 06600 Mexico, D.F., Mexico. Paperback, 240 pp., \$20.00 developing countries, \$50.00 developed countries. ISBN 970-648-0773.

Wheat breeding has long been considered as much art as science. This publication is an admirable attempt to complement the art with physiological concepts and methods. Its intended audience is breeders in developing countries, but all wheat scientists will find it a useful compilation of principles and practices.

The 52 authors include wheat scientists at CIMMYT and many national programs around the world. They are all recognized authorities in their subjects. Their contributions are thorough, well written, and nicely illustrated.

The text is divided into three broad areas: *General Considerations in Physiological Breeding*, *Breeding for Adaptation to Environmental Factors*, and *Breeding for Nutritional and Soil Factors*. Each section contains five to eight chapters. The chapters generally begin with a statement of the principles followed by a description of the various procedures.

The section, *General Considerations in Physiological Breeding*, addresses the need and evaluation for physiological criteria, genetic resources for improving traits, the genetic basis of physiological traits, managing field trials, some modern methods, and the economics of breeding for physiological traits. All of the chapters are highly informative. The chapter on genetic basis, for instance, covers the subject from the structure of DNA to use of molecular markers, and the one on economics contains benefit/cost analyses that should interest all wheat scientists.

*Breeding for Adaptation to Environmental Factors* properly recognizes that much of the world's wheat is produced under less-than-ideal conditions. The section contains chapters on breeding for resistance to drought, salinity, cold, heat, waterlogging, and preharvest sprouting as well as ones on selection traits for yield and manipulating plant development for adaptation. All of the chapters list plant characteristics that are associated with resistance to the various stresses as well as methods for measuring them.

*Breeding for Nutritional and Soil Factors* considers acid soils and Al toxicity; N, P, and Zn efficiency; measuring genetic diversity in roots; and micronutrients. The chapters discuss the importance of the subjects, their genetics, and methods of improving them.

Some attention might have been given to physiological considerations in grain quality. Wheat is mainly a food crop, and the quality of the grain is as much a physiological phenomenon as the yield. Otherwise, the topics are covered admirably well.

Several clear impressions were gained from the book in addition to its practical utility. The progress in understanding the factors that affect growth and productivity of wheat and in methodology for measuring the numerous processes that occur in the plant stands out. These advances indicate that the pace of improvement in wheat yields will increase in the years ahead, particularly in marginal areas. At the same time, however, it is evident that much remains to be learned about the factors that determine productivity of wheat. Productivity of wheat is sink limited, i.e., by processes that occur in the grain. Yet, as an excellent table of selection criteria in the book illustrates, we give most attention to processes in the source (leaves), possibly because all yield components except one have a zero to low correlation with yield potential. Identifying the factors that regulate the number and size of kernels will be essential for moving yields off of the putative plateau and gaining the full benefits of molecular techniques.

Physiology will be even more important for breeding wheat for higher yields in the future than in the past. This book, with its excellent combination of theoretical information and practical application, will be useful for everyone involved in the effort.

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**Handbook of Plant and Crop Physiology, Second Edition, Revised and Expanded.** Edited by M. PESSARAKLI. Marcel Dekker, Inc., 270 Madison Avenue, New York, NY 10016. 2002. Hardcover, 973 pp., \$225.00. ISBN 0-8247-0546-7.

This book, as the title states, is an updated and expanded edition of a 1995 book with a similar title and the same editor. The first thing that may strike the reader of the *Handbook* is the physical size of this volume. Although the second edition is a few pages shorter than the original (973 vs. 1003 pages), the print size was reduced in this revised edition allowing the expanded text to be presented in a similar number of pages. In revising the book, the editor and authors have rearranged the sections, updated almost all chapters, and added chapters on topics not covered in the original edition. The editor states that between 65 to 80% of the material in this edition is new material. In reading the chapters and comparing selected passages between the two editions, this claim maybe a bit of an exaggeration, but rest assured that a great quantity of new material and information was added. In some cases, authors of chapters that occur in both editions have also changed.

One important assessment that must be provided by any book reviewer is the intended use and audience for the book under review. Dr. Pessarakli states in the Preface to the book, "The concepts have been presented to allow both beginning students and specialists of this discipline an opportunity to expand and refine their knowledge." My training and experience in the broad range of topics covered in this book encompasses the full range of expertise defined by the editor, from beginning students to specialist. In reading chapters dealing with areas where I have little or no knowledge, the presentation of information was too advanced to fully comprehend. Conversely, in areas where I have greater knowledge and

practical experience, I found some of the chapters lacking detail and nuance. Stating these contrasting impressions is not meant to commend or condemn the text. This statement likely indicates that the authors have, in general, achieved their goal, challenging the novice and validating the expert.

I was impressed (in some cases astounded) by the number of references cited in many chapters of the book. Most of the chapters are between 10 and 20 pages long and have well over 100 citations. In fact several chapters are supported by over 300 citations. The abundant references should aid the novice in gathering the additional information needed to appreciate fully concepts introduced with insufficient detail for complete comprehension. Likewise, data, discussion, and alternative concepts in cited references will expand on a briefly explained topic for the expert. One point of inconsistency was observed in comparing reference sections of the various chapters. In some chapters, the complete citation (author, title, source, volume, pages, and year) was used; in others, a shorter format for listing references was used (the paper title was eliminated). In addition, in a few chapters, both methods of listing references were used. Even though I much prefer that titles of cited references be listed because of the additional information that gives the reader about the reference, the lack of consistency within and among chapters is more disconcerting than the lack of titles listed for a number of references.

A notable shortcoming of several chapters is a lack of informative figures. We are aware that students, at all levels, use different learning styles. Some are characterized as verbal learners; they are well served by the text in all chapters. Unfortunately, visual learners are not as well served. I contrast the *Handbook of Plant and Crop Physiology, Second Edition* (this volume) with *Biochemistry and Molecular Biology of Plants* by Buchanan et al. (2000). In the latter, it is difficult to find a page without a table, figure, illustration, or photograph to assist the learner in understanding concepts or processes. In addition, a few of the figures in the *Handbook* would have benefitted from use of color. If the reader does not already know the concept or property depicted by the chart or illustration, it is difficult to discern the attribute being illustrated from the text and figure. Admittedly, the volume by Buchanan et al. (2000) was designed as a text and therefore has the purpose of relating new concepts to the reader. In fairness to the *Handbook*, it has vastly more references listed than the book by Buchanan et al. (2000). This lack of illustrations may limit the usefulness of the *Handbook* as a basic textbook. The extensive citations in the *Handbook* may serve to offset this limitation.

The title of the book lists "plant" before "crop." This listing is fitting in that a number of the topics covered in this book are more appropriate for a compendium of plant physiology review articles, but are not of the practical, yield-oriented nature generally associated with crop physiology. An example of a chapter that may have limited appeal to crop scientists is *Developmental Genetics of Lower Plants*. In contrast, the chapter entitled *Photosynthetic Efficiency and Crop Yield* should interest both plant and crop physiologist.

The *Second Edition*, like the initial volume, is constructed as a series of review articles, chapters, written by authors knowledgeable in the various areas of plant and crop physiology covered by the book. As one must expect with a work produced by a large number of authors, these chapters vary in length, coverage, depth and breath, and readability, but in general each chapter provides a detailed review of current knowledge of the topic covered.

The book is divided into 12 parts with one to nine chapters within each of the parts. Parts are entitled: *Plants/Crops Growth Responses to Environmental Factors and Climatic*

*Changes; Physiology of Plant/Crop Growth and Development Stages; Cellular and Molecular Aspects of Plant/Crop Physiology; Plant/Crop Physiology and Physiological Aspects of Plant/Crop Production Processes; Plant Growth Regulators: The Natural Hormones (Growth Promoters and Inhibitors) and Plant Genes; Physiological Responses of Plants/Crops Under Stressful (Salt, Drought, and Other Environmental Stresses) Conditions; Physiological Responses of Plants/Crops to Heavy Metal Concentration and Agrichemicals; Physiological Relationships Between Lower and Higher Plants; Physiology of Lower-Plant Genetics and Development; Physiology of Higher-Plant/Crop Genetics and Development; Using Computer Modeling in Plant Physiology; and Plant/Crop Physiology Under Controlled Conditions, in Space, and on Other Planets.* Compared with the original volume, these Parts, and the chapters within, have been changed extensively. Few, if any, topics in the original were removed; many topics have been added, almost all chapters have been expanded or updated to include discoveries and literature published since the original chapters were completed.

In summary, the *Handbook of Plant and Crop Physiology, Second Edition* is a massive compendium of detailed current reviews on 48 topics in plant and crop physiology ranging in topics from molecular and cellular functions and processes to canopy responses to environmental conditions and change. The number of literature citations in all chapters is very impressive and should serve as a rich source of background or additional information for the reader. Although this volume may serve as a supplementary text for students in crop or plant physiology, the chapters are not written with sufficient background information to serve as a primary text. The writing style will make this volume most useful for advanced plant or crop physiology students or researchers attempting to improve and expand their knowledge in new areas of interest. Linking the many citations and details offered in this volume with a more instructive text on underlying principles and processes of physiology should make a valuable combination for those wanting to advance their knowledge though self study.

Buchanan, B.B., W. Gruissen, and R.L. Jones. 2000. *Biochemistry and Molecular Biology of Plants*. American Society of Plant Physiologists, Rockville, MD.

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## OTHER NEW BOOKS

**Food Security and Environmental Quality in the Developing World.** Edited by R. LAL, D.O. HANSEN, N. UPHOFF, and S. SLACK. CRC Press, 2000 N.W. Corporate Blvd., Boca Raton, FL 33431-9868. 2002. 384 pp., \$139.95 ISBN 1-56670-594-0.

With a focus on India, this book reviews the state of natural resources, fertilizer and energy needs, and the potential importance of biotechnology as they affect all developing countries.

**Plant Reproduction.** Edited by S. O'NEIL and J.A. ROBERTS. CRC Press, 2000 N.W. Corporate Blvd., Boca Raton, FL 33431-9868. 2002. 320 pp., \$139.95. ISBN 0-8493-9791-X.

This book covers physiological and molecular control of the floral transition, floral organ development, embryogenesis, pollination and senescence.