Review
Reviewed Work(s): Photosynthesis. Volume 2: Development, Carbon Metabolism, and Plant Productivity by Govindjee
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Source: *The Quarterly Review of Biology*, Vol. 58, No. 4 (Dec., 1983), pp. 568-569
Published by: The University of Chicago Press
Stable URL: http://www.jstor.org/stable/2829367
Accessed: 09-12-2016 14:08 UTC

who will find the rigorous mathematical relationships useful in developing models of water loss from vegetation.

The second chapter effectively summarizes world-wide information on the water relations of cotton. Cotton is one of the most economically important and widespread crops and the authors make an attempt to generalize to other agronomic plant species as well. This chapter will become a valuable reference on the water relations of phenological stages and effects of water deficits on photosynthesis and water-use efficiency. There are small editorial problems in the inconsistent usage of stomatal resistance and conductance and also the usage of both MPa and bars for units of leaf water potential.

The third chapter deals adequately with the difficult task of coalescing the diffuse information on the water relations of small edible fruits. It is a good reference work on the anatomy, morphology and water relations of blueberries and strawberries and comes to the general conclusion that the drought tolerance of woody small fruit species is intermediate between that of tree crops and herbaceous annuals. This chapter also suffers from the same editorial problems that occur in the preceding chapter.

The fourth chapter relates grapevine water status with vine physiology, including interactions between photosynthesis, growth, microclimate, fruit yield and quality. The authors comprehensively present responses of vines in the field to water supply, thus making this chapter an important reference for viticulturists throughout the world.

The final chapter on water relations of peach trees and orchards draws heavily on the authors' own research in southern Australia. They discuss processes that regulate water use in peaches and some interesting unique aspects of fruit growth and water relations that influence source-sink relationships. This is a good contribution to the literature on tree fruit crops.

In general, readers involved in the formulation of land-use objectives and those working in each of the crop communities discussed will find this book a valuable source of background information as well as a source of information in important research areas that deserve additional attention.

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PHYSIOLOGICAL DETERMINANTS OF CROP GROWTH. *By D. A. Charles-Edwards. Academic Press, Sydney and New York.* $26.00. xiii + 161 p.; ill.; index. 1982.

The goal of this book is succinctly stated on page 132: to analyze ". . . the vegetative and reproductive crop growth phases, and more particularly . . . the production of above-ground dry matter during these phases." The physiological determinants refer to mathematical coefficients of the crop that describe efficiency of light use; light interception; partitioning of dry matter; rate of loss of dry matter; and duration of growth. The author develops simple mathematical equations relating these determinants to the rate of growth and yield of crops, and presents examples of specific applications concerning the effects of plant density, water stress, and nutrient status.

Additionally, these determinants are derived in terms of measurable quantities, such as leaf-area index, leaf photochemical efficiency, and light-saturated rate of photosynthesis per unit leaf area. Clear and detailed derivations are given for the light dependence of crop photosynthesis and the factors affecting the partitioning of dry matter. However, derivations concerning the temperature dependence of crop growth, respiration, and loss of dry matter are lacking.

The mathematics is kept sufficiently simple for the derived equations to be easily applied and modified for a wide range of problems related to crop growth analysis. This hardbound book is of good quality and all figures and tables have a uniform format. In these respects, the book would be an excellent reference for a course in crop growth analysis.

Some drawbacks should be noted. Several examples are taken from studies of greenhouse crops without mention of this fact, whereas the general emphasis of the book is on field crops. Generally, growth in these two situations is sufficiently different to warrant some comment. Equations are presented for variation of integrated irradiance and mean temperature, as a function of latitude and season. The temperatures do not apply to the continental interior regions.

In summary, I recommend this book as a reference for those interested in quantitative analysis of plant growth.

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PHOTOSYNTHESIS. *Volume 2: Development, Carbon Metabolism, and Plant Productivity. Cell Biology: A Series of Monographs.*

Edited by Govindjee; Series Editors: D. E. Buetow et al. Academic Press, New York. $59.00. xxv + 580 p.; ill.; index. 1982.

Govindjee has assembled here a substantial two-volume work with the intention of advancing the fundamental understanding of photosynthesis. One justification for this effort is that many

human attempts at increasing the yield of food and biomass from primary producers depend at least in part on improving rates of photosynthesis. The emphasis of the book has been squarely placed on green plants (because of agronomic importance) and photosynthetic bacteria (because of the potential for genetic engineering).

The first volume of the series (*Photosynthesis: Energy Conversion by Plants and Bacteria,* Vol. I, Academic Press, 1982) covered the light reactions of photosynthesis from the absorption of light through the production of reducing power and ATP. The second volume deals primarily with the fixation of CO_2 and the disposition of photosynthate within the plant. However, several topics relevant to the experimental manipulation of photosynthesis or crop yield are also presented. A mini-debate on the role of bicarbonate in photosynthetic light reaction II is included at the end of the volume: it makes interesting reading, but would be more at home in Volume I.

Each major chapter is a comprehensive review of a well-defined area of research, thorough enough to be a valuable reference for researchers in related fields, and broad enough in scope to be a good source of material for graduate education. The suitability of the book for introductory graduate courses in the plant sciences is problematic, however, because a good deal of specialized background information is required to follow the lines of inference developed in some chapters.

Some of the information on subjects not closely related to the fixation of CO_2 is presented in an encyclopedic fashion, rather short on synthesis, presumably because such basic science has yet to be exploited extensively by researchers in other specialties. Many of the contributions are exceptionally well crafted, however, including historical perspectives, insightful comments on the significance of individual findings, and critical appraisals of experimental methods. Current controversies are often addressed in no uncertain terms: the authors' positions on the issues are clearly presented and contrasted with opposing views. No doubt some would have hoped for an opportunity to rebut.

Within the book, the point is made that specialists in plant science must be aware of how their results integrate with the accumulated knowledge on the functions of whole plants. Furthermore, it is emphasized that information from all aspects of photosynthesis research must be brought together to understand the environmental control of photosynthesis. To some extent, Govindjee's volume furthers these noble but difficult-to-realize goals: integrative thought is amply represented. However, several areas of pertinent research were excluded from the scope of the book. In particular, little reference is made to the physiology of the algae (with the exception of *Chlorella*) and primary production in aquatic environments. Germane topics that might have been discussed include sun-shade adaptation by phytoplankton, environmental effects on the partitioning of photosynthate by unicellular algae, β-carboxylations by marine algae (a controversial subject), and the mass culture of algae. In addition, the chapters on prediction of photosynthesis and crop productivity could have benefited from some consideration of the literature on modeling total primary production beneath unit surface area in aquatic environments. Finally, the contribution on global photosynthesis could have included at least a section on the marine environment.

Nonetheless, this volume, together with its companion, goes a long way toward meeting the editor's goal of furthering the understanding of photosynthesis. It is a solid and useful contribution, deserving of a place in most science libraries. The scope of the two volumes is appropriate for inclusion in the personal libraries of many researchers. Unfortunately, the price is about average for a biological monograph.

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PLANT CARBOHYDRATES I: INTRACELLULAR CARBOHYDRATES. *Encyclopedia of Plant Physiology: New Series, Volume 13A.*

Edited by F. A. Loewus and W. Tanner; Series Editors: A. Pirson and M. H. Zimmermann. Springer-Verlag, Berlin and New York. $139.00. xxii + 918 p.; ill.; author, species, and subject indexes. 1982.

The physiology and biochemistry of intracellular plant carbohydrates are extremely well covered by this volume. Although the treatment is encyclopedic, as expected, the degree of integration and synthesis makes the book a pleasure to read. The detailed coverage is welcomed since the reader can go to the book with assurance that information on even relatively minor topics will be presented.

The volume is divided into three major sections. The first, on monosaccharides and oligosaccharides, contains nine chapters that cover hexoses and uronic acids, polyhydroxy acids, amino sugars, branched-chain sugars, sugar alcohols, cyclitols, sucrose and other disaccharides, oligosaccharides based on sucrose, and glycosides. The second, on macromolecular carbohydrates, contains seven chapters that cover starch, reserve polysaccharides other than starch in higher plants, reserve carbohydrates of algae, fungi, and lichens, plant glycoproteins, membrane glycoproteins, glycolipids, and steryl glycosides. A final section discusses five physiological