Phytochemistry, 1972, Vol. 11, pp. 877 to 879. Pergamon Press. Printed in England.

BOOK REVIEW

Plant Photosynthetic Production—Manual of Methods: edited by Z. ŠESTÁK, J. ČATSKÝ and P. G. JARVIS, Dr. W. JUNK N.V., Publishers, The Hague, 1971. xxvi + 822 pp. Dutch guilders 175.

THIS BOOK, produced with the moral but presumably not financial support of the International Biological Programme Production Processes Photosynthesis Sub-Committee, is a reference work; it is doubtful if any one person, besides the editors, the publisher's reader and the proof reader will read the whole of its 822 plus xxvi printed pages. I at any rate have not done so and the following assessment is based on samples; these were not selected at random but largely on the basis of my personal interests and partly from a sense of duty; they are not therefore free from bias and may not be truly representative.

The overall impression, the sample mean as it were, is of a monumental task ably carried out. A total of 35 authors is listed but the three editors, in various combinations, have themselves written many sections. It is stated in the Preface that "The majority of the authors read, commented and frequently supplemented the chapters of other authors" and some chapters were also reviewed by other scientists, of whom there were 13. A considerable effort of co-operation, and of co-ordination by the editors, has therefore been needed. The book will certainly be useful to large numbers of research workers and it should be in the library of every institution where research is concerned with photosynthesis and growth in dry matter of green plants. Not many individual workers are likely to buy it, for 175 Dutch guilders is about £20 at the current rate of exchange which is not only a lot of money, but gives the high price per page of 2½p.

The scope of the book is best indicated by the headings of the 19 chapters, viz: 1, Criteria for the selection of suitable methods; 2, General principles of gasometric methods and the main aspects of installation design; 3, IR gas analysers and other physical analysers; 4, Physico-chemical measurement of pCO_2 and chemical determination of carbon dioxide; 5, Manometric method of plant photosynthesis determination; 6, Volumetric methods; 7, Methods of measuring rates of photosynthesis using ^{14}C dioxide; 8, Methods for measuring photorespiration in leaves; 9, Use of leaf tissue samples in ventilated chambers for long term measurements of photosynthesis; 10, Methods of growth analysis; 11, Indirect estimation of primary values used in growth analysis; 12, Radiation and crop structure; 13, Measurement of carbon dioxide exchange in the field; 14, Assessment of leaf area and other assimilating plant surfaces; 15, Determination of stomatal aperture; 16, The estimation of resistances to carbon dioxide transfer; 17, Leaf temperature measurement; 18, Determination of chlorophylls *a* and *b*; 19, Measurement of radiant energy.

Two of the most fundamental methods of estimating rate of photosynthesis are judged unsuitable for production studies and receive brief mention only, in Chap. 1. One of these is the measurement of light energy absorbed by the plant minus heat given out, to estimate the energy fixed, and involves very difficult and elaborate calorimetry. The other is to estimate the total energy fixed by subjecting samples, taken at the beginning and end of a period, to combustion in a bomb calorimeter. This is preferable, on theoretical grounds, to determination of dry weight increase because the energy content of plant dry matter varies with its chemical composition. The authors state ". . . the analysis for energy content . . . is more time-consuming and requires sensitive calorimeters. For this reason it is not used routinely in plant production studies and is not included in this manual." However, nearly all 'new' methods for estimating photosynthesis arise as modifications or combinations of previous ones and for a book such as this to be of the greatest use it should include examples of all methods that differ in principle, whether or not they are at present considered too 'time-consuming' or even out of date.

In studies of plant production it is the net rate of photosynthesis that is of practical interest, that is the difference between photosynthetic production and respiratory destruction. This is fortunate, as the net rate is yielded by the five available measures that can be used without isotopic markers, namely: uptake of carbon dioxide, output of oxygen, gain of dry matter or of chemical products, total energy fixed, light energy absorbed minus heat emitted. However, for more detailed and physiological analysis it is desirable to estimate gross photosynthesis, as for example in trying to explain the difference in production rates of two species, and the time is past when it can be considered adequate to add the respiration rate as measured in darkness to the net rate of photosynthesis. Attempts to measure respiration rates in light with isotopes of carbon or oxygen have proved to be by no means without uncertainties; the same can be said of various attempts either based on extrapolation to give the output of carbon dioxide into carbon dioxide-free air or on the measurement of transient changes following darkening of an illuminated leaf. Chapter 8 gives a suitably cautious account of the various methods used in the attempt to measure so-called photorespiration.

Too many photosynthetic studies are still made in ignorance of the behaviour of the leaf stomata which may provide the principal, and varying, resistance to the entry of carbon dioxide. Chapter 15 consists of a table, occupying five and a half pages, which lists nearly all the available methods with columns for: "Methods; What is measured; Procedure; Equipment; Advantages and usefulness; Disadvantages and limitations; and References". It may be doubted whether the information given here is sufficient for a decision to be reached without a very long course of reading, but there is a useful discussion of methods of estimating stomatal diffusive resistance in Chap. 16. In Chap. 15, the omission from "Transpiration porometry" of the simple cobalt chloride paper method which can be used in the field is regrettable, and the inclusion of the Meidner and Spanner (1959) "Differential transpiration porometer" under the same procedure as that used by Gaastra (1959) is erroneous. Other errors noted in connection with stomata are in Chap. 16, where it is stated wrongly that Gregory *et al.* (1950) used a diffusion porometer and that Gregory and Armstrong (1936) and Louguet (1965) determined the hydrogen in their diffusion porometers with a thermal conductivity meter. Some such errors are inevitable in a book of this kind and if the reader looks up the original papers no great harm is done.

In contrast to the extreme brevity of Chap. 15, which covers the determination of stomatal aperture by any method, Chap. 3 has sixty pages on the measurement of carbon dioxide with IR gas analysers. This very comprehensive treatment, including a section on

repair of defects, will be welcomed by any workers who have used this important method at high sensitivity, all of whom have probably suffered varying degrees of frustration at times.

The book is excellently produced, on clay loaded paper which makes it very heavy (1·71 kg). For the latter reason, but also because it is likely to be in frequent use, it should not be placed too high on the library shelves.

University of Reading O. V. S. Heath