Book reviews

Journal of Agricultural Science (2007), **145**.
doi:10.1017/S0021859607006909,

Physiology of Crop Yield, 2nd edn, by R. HAY & J. R. PORTER. 328 pp. Oxford, UK: Blackwell Publishing (2006). £39.99 (US$59·99, AUS$115·00). ISBN 9781405108591 (Paperback).

The first edition of this book, authored by R. K. M. Hay & A. J. Walker, was published in 1989. It soon became an essential student text, because it presented the many advances in crop physiology integrated through a theme of resource capture and use.

This second edition is long overdue. The intervening years have seen an amazing expansion of our knowledge and in some cases of our understanding of plants at the molecular level. The crop scientist, however, needs a much broader perspective, and must be able to interpret the knowledge arising from molecular studies to the responses of individual plants to their environment, to the responses of populations of plants (growing crops) to environment and management options, and increasingly, to the environmental consequences of cropping systems.

This book emphasizes the population level of crop responses (e.g. yield per unit area, leaf area index) and interprets this as an energy transformation process. Recent developments in our knowledge of crop phenology are given in chapter 2. Chapter 3 deals with canopy interception of solar radiation and includes canopy architecture and canopy management. Chapter 4 deals with photosynthesis and photorespiration, with particular emphasis on photosynthetic efficiency, and considers photosynthesis as a cellular biochemical process as well as a leaf diffusive process and a crop canopy process. The C4 pathway is described. The impacts of water shortage, nitrogen and ozone of photosynthesis are also dealt with. Chapter 5 deals with respiration as the loss of CO_2 and the split between respiration associated with maintenance of the structure and that associated with growth. What determines the partitioning of dry matter to the harvested parts of plants is not as well understood as might be expected and is covered in chapter 6. The concepts of harvest index and limitations by source or sink are considered. The contrasts between historic trends in harvest index and yield components in wheat, barley and maize are described to illustrate the diverse pathways to achieving high yields. Grass swards provide a difficult subject for physiological research and interpretation because (a) the canopy 'source' is also the harvested 'sink' and (b) because the 'crop' is usually a mixture of genotypes, species and types of plant. The authors include a useful section on assimilate partitioning in grassland which deals with the implications for management and the overwintering and growth of white clover. A brief section compares assimilate partitioning in diseased plants. In chapter 7, the limitations imposed by water supply and nitrogen are discussed from the stance of resource use efficiency. The physiology of crop quality is dealt with in the short chapter 8. A new feature in this second edition is the coverage of simulation modelling of crops (chapter 9) with detailed descriptions of the AFRC2 wheat model, the CROPGRO soybean model and a maize model. The final chapter, chapter 10, is titled 'Crop physiology: the future'. It deals with the understanding which crop physiologists can bring to policy imperatives such as lowering inputs (especially nitrogen), crop quality, new crops (including the domestication of biomass crops) as well as the potentials for increasing photosynthesis and yield.

This is a thoughtful and well-written book. It presents a sound synopsis of what we currently understand about how crops grow, how they produce the portions or components we want to harvest and how much we can manipulate the productive system. The subject matter has implications for the development of more sustainable crop production systems through increased resource utilization. The environmental impacts of crop residues might have deserved a brief mention as might quality in oil crops. However, these are matters of detail in what is a successful volume. I would hope that this would become a widely used textbook for advanced undergraduates.

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Journal of Agricultural Science (2007), **145**.
doi:10.1017/S0021859607006983

Statistics Explained: An Introductory Guide for Life Scientists by S. MCKILLUP. 280 pp. Cambridge: Cambridge University Press (2005). £19.99 (Paperback), £45.00 (Hardback). ISBN 0521543169 (Paperback), 052183550X (Hardback).

Statistics is ultimately about extracting relatively simple messages from more complex sets of data.

Unfortunately, for many life-scientists, the extraction process can seem dauntingly impenetrable, often because there are many issues to consider but probably more often because statistical texts are often presented rather mathematically. McKillup deserves to be congratulated on having produced a clear and accessible statistics book pitched at the uninitiated or the unsure. The slightly panicky should relax and take a quiet dose of a couple of chapters at a time and pretty soon all should seem much less awful. For the novice, confident or not, *Statistics Explained* offers an excellent primer that does not purport to be fully comprehensive yet manages to cover most things one really *needs* to know. While McKillup does not avoid mathematics altogether, he primarily relies on verbal and pictorial explanations. For instance, his comment on his schematic representation of Analysis of Variance (ANOVA), one of the most important analytical techniques, reads 'this approach is remarkably simple and does represent what happens. By contrast, a look at the equations in many statistics texts makes ANOVA seem very confusing indeed'; how true!

The ground covered by the book is more or less what one might expect: hypothesis testing, different types of data, sampling, experimental design, probability and statistical inference and Type I and II errors, statistical distributions and the like. He then works through increasingly complex ANOVAs in five chapters; the most detail devoted to any particular topic, but justifiably so. He is wise to end the discussion where he does, noting that there is much more that could be said but more advanced books are the best place to find such information: McKillup recommends Quinn & Keough (2002) and I would agree. The discussion of *a posteriori* testing after finding a significant result in ANOVA is useful. McKillup's emphasis is on the Tukey test, while the method I favour is to progressively aggregate factors levels within the ANOVA as this provides a seamless integration of model simplification techniques. There are two chapters on correlation and regression. While I appreciate the advantage of keeping things at an introductory level, I think that multiple regression and Analysis of Covariance (ANCOVA) should have been discussed as there is no major conceptual difficulty in introducing these once the stepping stones of ANOVA and regression have been tackled: a second edition should consider adding two chapters here. There follow some useful chapters on non-parametric techniques which link back nicely to the parametric techniques discussed earlier. In my opinion McKillup's approach of using non-parametric tests when data are not normally distributed about the regression line (p. 202) may often prove to be an overreaction as there are more powerful (semi-)parametric techniques, such as log-linear and logistic analyses, that can often be used and there should be no real bar to discussing these in an introductory book in a visual and intuitive way. The book ends with a brief discussion of ethics in experimental design, practice and interpretation and some charts to guide the reader in their choice of test.

My overall opinion of this book is captured by the fact that this is the introductory text that I shall be recommending to the students on the statistical analysis module that I teach next semester. McKillup's students deserve the final mention for apparently telling him, 'Hey Steve, you should write an introductory stats book!' Many will be relieved he took their advice.

Quinn, G. P. & Keough, M. J. (2002). *Experimental Design and Data Analysis for Biologists*. Cambridge: Cambridge University Press.

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