

Book Reviews

***In vitro* Embryogenesis in Plants**

Trevor A. Thorpe (ed.)

Kluwer Academic Publishers Group, Dordrecht.
1995.

vii+558 pp. Hardback, Dfl.400.00; US\$264.00;
UK£164.00. ISBN 0-792-3-314-94.

In vitro Embryogenesis of Plants is volume 20 of the book series *Current Plant Science and Biotechnology in Agriculture*. This series is intended for a broad range of readers from advanced students to senior research scientists. Volume 20 addresses the topic of *in vitro* embryogenesis more in width than in depth. It gives a wealth of references, mostly from lists of species of regenerated plants, which together represent 70% of the book. Chapters are devoted to zygotic, asexual, haploid and somatic embryos, their culture, morphogenetic, physiological, histochemical and molecular biological aspects. Most chapters are a summing-up of explant choices, media manipulation, physical environmental conditions and case studies. The book does not add much to needed insight in the relevant processes of morphogenesis and its manipulation and leaves the reader with the feeling that the field is still in trial and error.

A.M.C. EMONS

Belowground Responses to Rising Atmospheric CO₂: Implications for Plants, Soil Biota, and Ecosystem Processes

Peter S. Curtis, Elizabeth G. O'Neill, James A. Teeri, Donald R. Zak and Kurt S. Pregitzer (eds)
Kluwer Academic Publishers Group, Dordrecht.
1995.

vii+169 pp. Hardback, Dfl.135.00; US\$89.00;
UK£55.50. ISBN 0-7923-2901-5.

This book presents the contributions given at a workshop with the goal of increasing the integration of aboveground and belowground perspectives in elevated CO₂ concentrations. A broad range of disciplines discusses the current understanding of belowground plant responses to elevated atmospheric CO₂ and considers the implications for whole plants, soil biota and ecosystem processes. The book is divided into four sections: root biology, soil biota, ecosystem processes and modelling, and integrates approaches that differ greatly in scale and design. Results of experiments using pot-grown plants are presented together with large-scale field studies.

All sections but one begin with extended reviews followed by reports on case studies. A valuable

review is given by Norby on issues and perspectives in studies on the effects of elevated atmospheric carbon dioxide on root behaviour. He asks critical questions about the relevance of root data from short-term studies under controlled conditions when scaling to responses of plants in the field. He also stresses the need for better questions in order to link ecosystem responses to a changing CO₂ environment with responses below the ground.

Atmospheric CO₂ enrichment may cause changes in ecosystem processes, which will be constrained by belowground reactions and mediated by responses of soil biota. The current state of knowledge regarding responses of soil biota, including adaptive reactions of mycorrhiza, N-fixing bacteria and actinomycetes, soil microbiota, plant pathogens and soil fauna are thoroughly reviewed by Elizabeth O'Neill. This contribution completes the section on soil biota together with case studies on microbial responses in tallgrass prairie, mycorrhizal colonization in Pine seedlings and an application of a model rhizodeposition technique to separate root and microbial respiration in soil.

The section on ecosystem processes consists of four chapters that all report on studies carried out in the United States. Unfortunately, this section lacks a general review paper that summarizes the main section of the information already published. Only a small selection of subjects available in the field of ecosystem responses to elevated CO₂ levels is presented. However, this section at least provides the access to the complicated area of this type of ecosystem research. In order to obtain an overview of the state of the art the reader not only has to read the papers themselves, but also has to focus on the lists of references. My main criticism on this section is that it does not include a consideration about future research.

The final section is on modelling. This is a fascinating part of the book. The only remark I can make is that this section only contains two chapters. One chapter describes a deformable geometric model of root growth for the simulation of root architecture, which may be sensitive to carbon allocational changes due to rising CO₂. The main conclusion is that carbon allocation differs strongly between architectures, which means that in simple root systems volume and length density measurements are insufficient for the calculation of carbon costs associated with phosphorus acquisition. The other chapter highlights not less than five condensed examples of how models can be used to understand the response of ecosystems to changes in the global climate by incorporating experimental results into conceptual or quantitative frameworks. The authors, Wullschlegel,

Lynch and Berntson, conclude that models on changing ecosystem processes due to rising CO₂ and associated climate change are appropriate tools for the identification of new hypotheses for future research.

After finishing the final section of the book the reader should return to the first section. In that chapter the editors attempt to synthesize all contributions by considering the primary objectives of all sections. The book aims to highlight how below-ground processes might constrain responses to CO₂ enrichment at the ecosystem level. In their synthesis the editors summarize key areas of uncertainty and evaluate methodologies. They finish with four research recommendations: the need for quantifying C input into the soil, via the determination of effects on interactions of biota and the measurements of microbially mediated nutrient transformations to the recommendation to investigate interactions of increased CO₂ with other environmental variables.

All chapters are already published as separate papers in *Plant and Soil*. The extra value of publishing these papers in one volume is limited, especially because there is no subject index, which makes this book less attractive than it could be.

This book is published to the well-known *Plant and Soil* standard and is on the whole, worthwhile reading.

C.W.P.M. BLOM

Principles and Practice of Plant Conservation

David R. Given

Chapman & Hall, London. 1995.

viii + 289 pp. Hardback, UK£27.50.

ISBN 0-412-61270-4.

This book is the result of joint investments of IUCN (World Conservation Union) and WWF, who aim to balance the emphasis on conservation of plant and animal diversity. After the instalment of a common Plant Advisory Group, consecutively chaired by Dr Peter Raven and Dr Arturo Gomez Pompa, the framework of this book was developed, guided by the leading theme: 'building the capacity to conserve'. The result is a very attractive and comprehensive overview of very many aspects of conservation projects focusing on plants, the species as well as the population and vegetation level.

Of course, the initial chapters present and discuss the obvious reasons for the conservation of plants and sum up a series of causes that threaten plant life almost worldwide. In subsequent chapters different aspects of conservation, practical as well as fundamental, are dealt with. There are chapters on the

building and handling of databases, the design and management of reserves, and also an extensive chapter on the historic and possible future role of *ex situ* conservation in botanical gardens and different kinds of gene banks.

There is also a well-elaborated chapter on the population level approach. Here, the need for thorough studies of at least some species per plant community is emphasized. The suggestions include (among others) the gathering of demographic data as well as information on the reproductive biology (breeding system, relations with pollinators and dispersers), and on the level of genetical variation.

In particular, this plea for a fundamental analysis of the functioning of key species is important because it is too frequently neglected, as many conservation practitioners seem afraid of the apparently time-consuming procedures for gaining these insights. I hope this book will help to create unceasing support for this sort of approach, because there are good arguments for biologists to invest money and time in following the suggestions for a population and demography orientated monitoring strategy, as done in this chapter.

Following chapters on biological aspects, extensive attention has been given to the field of socio-economics. Developing public awareness and support is indeed very important for any long-term conservation strategy. In this respect it is useful to find a chapter on the economic valuation of plant life on a broader scale.

Especially worth mentioning is the contribution by Dr Cyrille de Klemm, a well-known expert on the legal aspects of conservation, who has written a separate chapter on legislation. Particularly when this book is used as an introduction for students into the field of (plant) conservation—a recommendation that I would strongly like to put forward—a survey of the international laws and their pitfalls is of great value, as in the large majority of biology departments expertise in this specialist field will be lacking.

A list could be made of comments for minor improvements of parts of the text, but the overall approach leads the reader easily through the complex field. The chapters presenting the segments of the field are clear, albeit somewhat superficial. However, the large body of case studies from all continents, presented as additional items scattered throughout the main text, give many clues for species- or trait-orientated further reading.

In conclusion, this volume should be required reading in every biology curriculum that touches conservation biology, and will hopefully be successful in drawing more particular attention to plants in the discussion and teaching of conservation.

HANS C.M. DEN NIJS

Growth of Tropical Rain Forest Trees as Dependent on Phosphorus Supply

D. Raaimakers

Backhuys Publishers, Oestgeest. 1995.

ix+97 pp. Paperback, Dfl.45.00.

ISBN 90-5113-023-6.

The photograph on the cover awakens nostalgic feelings in an old hand from the Guyanas, remembering those white sand landscapes from Saint-Laurent-du-Maroni and South of Paramaribo. Combining an all but sterile soil with a true forest, these ecosystems were a mystery to botanists for a long time, leading for instance to a classic experiment by Schultz & Boerboom and articles in *Bois et Forêts de Tropiques*. White sand ecosystems evoke basic biological questions and scientific dilemmas. The high forest on sterile soil, the strange and fuzzy tree behaviour—neither clearly 'pioneer' nor 'climax', neither 'shrub' nor 'tree', or the ultra-flat architecture of the root zone have fascinated scientists. Forest managers described these white-sand formations as delicate, either useless for correct—i.e. sustainable—management, or to be used in unconventional ways. Wood mining, of course, is not forest management.

Before us lies the book by D. Raaimakers. She has done a very thorough job in the field, compiling innumerable data, which took place at the TROPENBOS site of Mabura Hill (Republic of Guyana). The study had some truly ecological qualities developed as a matter of routine within TROPENBOS. Never again will a forest be considered in TROPENBOS as a mere collection of trees. Ms Raaimakers has considered mycorrhizae as a matter of course in all nutrient studies, a habit introduced by Smits from TROPENBOS Kalimantan (Indonesia). The data gathered by the author and her colleagues were then analysed by current analytical software packages such as ANOVA and more straightforward statistics, indispensable tools to process such monstrous quantities of data. The conclusions indeed fill lacunae in our understanding of the nutrient budgets of tropical forests on poor soils.

This book therefore has enough merit to wish it on the Guyanologist's bookshelf as a reference to nutrients and trees of that region. However, no book is perfect and several serious issues must be raised. First, who is scientifically responsible for the contents? If this had not been a Doctoral thesis at Utrecht University, it would have been referred to as 'Raaimakers (ed.)', because of the heavy contribution by others. In this light, should the spreading habit, driven by scientists' demands for long citation lists, of assembling Doctoral theses from collective pieces, become a reason to doubt the regular quality of today's Doctor's degrees as

guarantee of free individual research? From Raaimakers' group of scientists, no new basic concepts have emerged. The introduction contains a summary of commonplaces from traditional rain forest books. Should the concepts used ('pioneer', 'nutrient deficits', 'factors' and others) not have been submitted to serious criticism? Their venerable origins are merely cited, whereas the experiments could have been used for testing them. Do new kinds of 'graduate schools' with their 'esprit de corps' educate followers of recognized scientific leaders? Why, in such an old field of study, is there no single CELOS-report from Surinam cited, nor authors on that country (De Graaf, Jonkers, particularly Poels, articles by Boerboom)? Why has the extensive literature from French Guyana, for instance the fine-tuned nutrient studies at the Piste de Saint Elie, been omitted? And why was a vacuous page on forest management implications (!) included without even one reference to silvicultural systems and Guyanese experimental studies? What a pity that such potentially excellent work remained merely an average 'good'. Is this due to intellectual isolation of the team in basic English citationland to lack of freedom to throw scientific sparks around, it is perhaps a loss of awe of that miraculous, overwhelming natural rain forest that can not be truly captured with the eye of a bookkeeper collecting and processing digits so as to visualize the forest as a set of numbers on a balance sheet? Interesting? Sure. Fascinating? Sorry.

ROELOF A.A. OLDEMAN

Ethnobotany, Evolution of a Discipline

R.E. Schultes and S. von Reis (eds)

Chapman & Hall, London. 1995.

414 pp. Hardback, UK£29.99.

ISBN 0-412-72270-4.

The use of medicinal plants is probably as old as mankind. Ethnobotany is nowadays a distinct branch of natural sciences and important for future drug development based on natural sources. This book offers a comprehensive overview of the history of ethnobotany as well as of current developments in the field. It contains 36 articles (with references), written by 43 authorities from all over the world.

The book is divided into 10 distinct sections: General Ethnobotany (definition and scope, aims, contemporary and future potential, current developments, methodologies used in ethnobotanical research); Socioethnobotany (the case of Mexico); Historical Ethnobotany (ancient Near East, Aztecs, Greek mythology); Ethnobotanical Conservation (tropical forests, rain forests); Ethnobotany in Education (methods and importance); Ethnobotanical Contributions to General Botany, Crop Improvement and Ecology (collection of germ plasm of

potentially useful plants, domesticated plants, artificial selection); Ethnobotany and Geography (Colombia, Africa, North America, India, Malaysia); Ethnopharmacology (history and future, arrow poisons, hallucinogens and psychoactive compounds from plants); Ethnomycology (psychoactive fungi and mushrooms); and Archaeoethnobotany (archaeological remains of the use of wild and cultivated plants). Each section is preceded by a general introduction on the topic from the editors. Several clear and illustrative black and white photographs are included. An index of scientific names, consisting of about 900 species, completes the work.

The book is well edited and gives excellent value for money. It is not only of interest for people involved in one of the many aspects of ethnobotany, e.g. ethnopharmacology, medicine or anthropology, but it is also warmly recommended for the lay reader who wants to know more of this fascinating discipline.

H.J. WOERDENBAG

Selection Methods in Plant Breeding

Izak Bos and Peter Caligari
Chapman & Hall, London. 1995.
x+347 pp. Hardback, UK£59.00
ISBN 0-412-55330-9.

This book is the second in a series on Plant Breeding, the first being *Principles and Prospects* by M. D. Hayward, N. O. Bosemark and I. Romagosa. Population genetics, quantitative genetics and, finally, field trials for selection purposes are dealt with in this new book. While population genetics and quantitative genetics are discussed in much the same way as in other textbooks, the inclusion of problems associated with field trials is new. Unfortunately, this book does not even mention the large number of other textbooks and important papers relevant in this field of work: H. C. Becker (1993: plant breeding), W. A. Becker (1984: quantitative genetics), M. G. Bulmer (1980: quantitative genetics and selection), W. G. Cochran (1951: multistage selection), W. T. Federer (1955: field experiments), A. Gallais (1989: selection and plant breeding), O. Mayo (1980: plant breeding), N. W. Simmonds (1979: breeding methods), H. N. Turner and S. S. Y. Young (1969: multitrait selection) and G. Wricke and W. E. Weber (1986: quantitative genetics and selection for different variety types).

The textbook by D. S. Falconer (1989) has by far the largest circulation and every other textbook has to compete with it. Falconer's textbook is mainly written from the viewpoint of an animal breeder having diploid outcrossing species in mind, but a book on plant breeding must also deal with self-fertilization, polyploidy, self incompatibility, male

sterility, vegetative propagation and the regeneration of plants from cells. Plant breeders therefore have several options which are only partially covered in this book, perhaps because further volumes with overlapping topics are in preparation in this series.

After short introductions, Chapters 2–7 cover population genetics, including random mating, inbreeding, sex expression, finite population size and selection. The inbreeding coefficient is defined not on the basis of relatedness, but as deviation from a Hardy-Weinberg condition. Using this procedure, the authors circumvent the usual problem that the inbreeding coefficient is zero in the F_2 of a cross between pure lines, though the alleles are identical by descent at homozygous loci. Defining the inbreeding coefficient in this way makes sense only for populations, but not for individuals. Otherwise, the discussion of population genetics follows the usual lines.

Chapters 8–12 deal with quantitative genetics, selection for single traits being presented in Chapter 11 and for multiple traits in Chapter 12. The quantitative genetic theory is mainly based on populations derived from crosses of pure lines. There is correspondence to the books of Mather and Jinks, although the notation is different. For such populations the F-metric is given preference. Cross-fertilizing crops play a minor role in this book.

The response to selection, often claimed as the most important contribution of quantitative genetics to breeding, is handled somewhat gingerly. The authors reason that estimates of variances and covariances differ considerably from population to population and depend strongly on the specific conditions of the experiment. Eventually, the authors develop the usual theory due to a lack of any alternative. In these chapters the different possibilities for breeders to vary selection procedures are not discussed in detail. Diallel analysis is included, but not experiments using factorial and hierarchical designs. The diallel is critically discussed and the authors note that many procedures proposed by Mather and Jinks to analyse diallels are not helpful for plant breeders.

The discussion of multitrait selection is very brief. There is no systematic treatment of the different procedures and for more information the reader is referred to Baker (1988). Nothing is said about multistage selection. Genotype-environment interaction (Chapter 13) receives minimal treatment. The selection approach of Bechofer is included in this chapter although it has nothing to do with interaction.

The last part of the book, starting with Chapter 14, deals with the design and analysis of selection experiments in early generations, when only a limited amount of plant material for each candidate is available but a large number of candidates must be

tested. This very important phase within each breeding programme is seldom discussed in textbooks on selection theory, but parts can be found in more biometrically oriented textbooks like Federer (1955). However, a lot of papers exist which investigate competition, spatial variation and special designs to even out such influences in theory and in practice, especially from the schools of Wageningen and Aberystwyth. This book discusses testing under field conditions and at a very low density, the most extreme being the honeycomb design by Fasoulas. Adjustment for soil heterogeneity by control plots, fixed and moving grids, moving averages, the optimum number of candidates for a fixed test capacity and intra- and interpopulation competition are discussed in detail. The book ends with a few comments on the size and shape of plots and the optimum generation stage to begin selection in line breeding.

In all, this book connects the theories of population genetics and quantitative genetics with breed-

ing programmes. It is well known that the quantitative genetic model is only a working model but, as such, it is very helpful for finding optimum breeding strategies. Theories also include interactions of gene effects between loci (epistasis), linkage and, in polyploids, interaction between three and four alleles at one locus but these complicating factors are only touched on in this book. Problems with heterosis are not discussed in detail; for example the effect often observed in cross-fertilizing crops that the level of completely inbred lines is less than 50 per cent and the hybrid is more than 100 per cent of the parental mean. Also, only a very few remarks are made about marker-assisted selection. Although the book could be more complete in the areas mentioned above, it does give a lot of useful information about the application of theory in breeding programmes and can still be recommended as an additional textbook for students and research workers.

W.E. WEBER