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Spatial Pattern Analysis in Plant Ecology. M.R.T. DALE, Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211. 1999. Hardback, 326 pp., \$69.95, ISBN 0-521-45227-0. Paperback, 326 pp., \$35.95. ISBN 0-521-70437-4.

The subject of how best to describe and quantify the spatial patterns of individual plants and species populations within communities has been chronically an untidy corner of plant ecology. Dale's book has reviewed the situation and provided clearer definitions, plus a framework for making better decisions on use of extant methods. He also gives considerable guidance to the next generation of researchers by giving leads on how to build stronger approaches to addressing this topic in the future. The first two chapters cover the basic concepts and definitions and illustrate commonly used methods with a lot of easy to understand graphics. Those with neither much previous exposure to plant ecology nor statistical analysis will find these two chapters of pivotal value. From Chapter 3 (where single species are considered in one dimension only) onward, those without considerable exposure to statistical analysis, topology, and set theory will encounter heavy going. Abundant use of simple data sets, usually from high altitude or high latitude vegetation (where Dale and his students have most often worked), are included to illustrate how the equations can turn into interpretable results. The progression from Chapter 4 is from two species in one dimension, then to two species in two dimensions, and finally multiple species in multiple dimensions. This reviewer particularly appreciated the minimal typographical errors and the several places where the convergence of thinking on fractals, landscape ecology, remote sensing, and GIS are acknowledged. Because the logical framework rightfully dominates, the reader shouldn't expect to find a thorough review of all the previous applications of tools for spatial analysis of vegetation. This book is, however, a must have item if one intends to employ the most sophisticated analyses available to address problems of deciphering spatial patterns of plants living together in a given place.

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Vegetable Seed Production. 2nd Edition. R.A.T. GEORGE. CABI Publishing, 10E 40th St., Suite 3203, New York, NY 10016. 1999. Hardback, 328 pp., \$90.00. ISBN 0-85199-336-2.

Vegetable seed production is often very challenging because of strict requirements to maintain genetic integrity of the variety being multiplied, to produce seed of vigor that does not carry seed-borne diseases, and to obtain a seed yield sufficient to make the crop economical for the seed producer. This difficulty is exacerbated by the fact that traits associated with vegetable production and quality, rather than seed production, are selected for in varietal development programs. This book is directed toward undergraduate students and to technicians and practitioners involved in vegetable seed production and should serve as a helpful initial reference in studying and surveying problems encountered in vegetable seed production.

The first six chapters of the book provide a general review

of vegetable seed production. Chapter 1 considers the role of seed companies, government institutions and plant breeders in seed production and in the seed trade. Chapter 2 introduces the reader in a cursory manner to the basic principles of seed production, types of hybrids, and to effects of moisture and nutrient deficiencies on seed yield and quality. Chapter 3 looks at issues relating to field production of seed vegetables with environmental effects, crop rotation, population, need for isolation, roguing, and seed treatments being discussed. Chapter 4 reviews harvest, threshing, seed cleaning, seed processing, and drying. Chapter 5 addresses the essentials of seed storage and preservation. Chapter 6 deals with keeping records, packaging, and distribution of seeds.

The remainder of the book (Chapters 7 through 16) provides more specific information for seed production of 45 of the more important vegetable species. The species are grouped according to their botanical classification, so that each chapter addresses one family (i.e., Chenopodiaceae, Compositae, Cruciferae, Cucurbitaceae, Leguminosae, Solanaceae, Umbelliferae, Alliaceae, Gramineae, Amaranthaceae and Malvaceae—the last two being in one chapter). Each section for an individual species starts by providing general information on its origin and uses. This is followed by a list of criteria for cultivar description. For each species, subsections on soil pH and nutrition, agronomy, flowering and pollination, isolation requirements, roguing, harvesting, threshing, seed yield and 1000-seed-weight, and pathogens are provided.

The strength of this book lies in its broad scope covering a range of aspects for seed production of many different vegetables. The reader looking for exhaustive information on any one topic may be disappointed; however, the work is referenced so the reader has direction as to where to seek more information, and there are not, to my knowledge, other texts available that would provide more exhaustive information on as broad a range of topics. The text will serve well its intended purpose as an initial reference for technicians and workers in vegetable seed production, and it should serve well as a text for vegetable seed production at the undergraduate level. The author includes information from both developing as well as industrialized countries, so the book will be of interest to those working on small-scale programs emphasizing hand labor, as well as those working in large-scale mechanized enterprises.

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Photosynthesis: A Comprehensive Treatise. Edited by A.S. RAGHAVENDRA. Cambridge University Press, 40 West 20th Street, New York, NY 10011-4211. 1998. Paperback, 373 pp., \$47.95. ISBN: 0-521-58444-1. Hardcover, \$120.00. ISBN: 0-521-57000-X.

This volume was intended as an advanced comprehensive textbook on photosynthesis and its relationship to other fields, namely agriculture, horticulture, and biotechnology. The book is divided into four sections, including (i) cell and molecular biology of chloroplasts, (ii) physiology and biochemistry, (iii) agronomy and environmental factors, and (iv) special topics and applications. The goal is to present a state-of-the-art picture of photosynthesis. In fact, many chapters have sections presenting the author's vision and future areas of research that are needed. The authors are a cross section of internationally recognized names with regard to photosynthesis and related physiological functions. The first section examines the chloro-

plast as the functioning three-dimensional site of light capture and its conversion to chemical energy for utilization in biosynthesis. It covers all aspects of chloroplasts including, structure and development, the photosystems, photosynthetic pigments, protein synthesis and degradation, energy transduction, and gene expression and regulation. I personally gained much from the presentation of thylakoidal organization of the photosystems. Physiology and biochemistry is the thrust of the second section and includes chapters on C₃, C₄, C₃-C₄ intermediate, crassulacean acid, and photorespiratory metabolism. There are also chapters tying photosynthesis to other biosynthetic functions, including carbohydrate assimilation, non-carbohydrate biosynthesis, respiration, and nitrogen metabolism. These chapters are extremely important because they connect photosynthesis with other more distant yet essential metabolic functions which can be loosely understood by some students. Environmental interactions with photosynthesis are addressed in the third section, starting with the interaction with light, canopy structure, leaf photosynthesis, and crop productivity. This section then moves into the interaction of photosynthesis with environmental extremes including low temperatures, water stress, salt stress, acclimation to sun/shade, and global climate change.

The last section is somewhat eclectic, yet significant, because of the importance of the subjects presented. These areas include evolution of photosynthesis, modeling, leaf fluorescence as a diagnostic tool, action of modern herbicides, and the role of biotechnology. This section deals with some of the fastest changing aspects of photosynthesis, which is a strength of the book as a whole.

This book would be a valuable resource for both basic and applied oriented students and scientists. The scope is all encompassing from basic chloroplast structure and function to views of evolution and environmental interactions. It would also be a good textbook for graduate courses in photosynthesis and, at \$47.95 for the paperback version, it is relatively affordable. Libraries with an interest in the life sciences would be remiss if this volume was absent from its holdings.

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Nutrient Deficiencies and Toxicities of Plants CD-ROM. APS Press. 2000. Requires Windows 95, Windows 98, or Windows NT; 486/25 Mhz processor or higher; 8 MB of RAM minimum, VGA monitor set to 65,536 colors or higher. Double speed CD-ROM drive. APS Press, 3340 Pilot Knob Road, St. Paul, MN 55121-2097. Single copy \$59.00.

Nutrient Deficiencies and Toxicities of Plants is a digital image collection containing 600 nutrient deficiency and toxicity symptoms of 37 agronomic and horticultural crops. Common agronomic crops such as corn, soybean, and wheat are included, as are stone fruit, rose, and rhododendron. The program includes all of the essential nutrients except C, although not all are shown for every species. For example, there are a total of 23 images for corn, but only three for barley. Multiple images of most symptoms are present on a variety of crops, as illustrated by the 59 images for N, 65 for K, and

60 for B. Symptoms of other elements that can be problematic in specific crops are also included, as indicated by Si deficiency in rice and sorghum; Cd, Co, Cr, Se, and Sr toxicity in sorghum; and Al toxicity in tomato and sorghum. Six images of salt toxicity on various species are included as are eight images of ammonia toxicity. The program permits the user to browse and look at each image, to search by nutrient or crop, or to search for all toxicity or all deficiency symptoms. Initially the user is shown a thumbnail sketch of the symptom, which is enlarged when the image is clicked. Each thumbnail image contains a brief caption which includes the image number, species, and a label indicating the specific deficiency or toxicity. The enlarged image indicates the species, image number, source of the image, nutrient being displayed, and a caption explaining if it is a deficiency or toxicity symptom. Since this is a solely digital image collection, the program does not provide any details about crop management or the recommended ways of preventing or correcting the deficiency or toxicity.

The search feature is extremely easy to use. Another strength of the program is the ease with which one can select specific images for use in a slide show to be used through the program or to export for incorporation into a PowerPoint presentation, a MS Word or WordPerfect document, or to print. Images are exported as jpeg files.

The user is given permission to use the images for "personal, noncommercial work and teaching" and to export the images into other computer applications. Exported images cannot be used "as is," but must be incorporated into an application that the licensed user develops. Use of images on the Internet or "other external network" is prohibited, but images may be used on local area networks and on "restricted access Intranet." This makes the program ideal for teaching presentations and presumably for use on websites that are restricted to use by students enrolled in specific courses.

The software is easy to install. Installation puts a programmatic icon on the desktop which is clicked to initiate the program. The CD includes a note which warns that an error message will appear on the screen, but can be removed by clicking one of the two options shown as part of the error message. A minor nuisance occurs when a search is conducted for pH in that the three available images of pH appear along with the 43 images of phosphorus. The same 46 images appear when phosphorus is searched. Another weakness of the program is that it lumps some plants under the category of cucurbits, flowering potted plants, ornamental foliage plants, ornamental palms, stone fruit, tropical fruits, or turfgrass and the label does not specify the particular species being shown in the digital image. However, these are only seven of the possible 37 options listed under the crop portion of the search feature and the remaining 30 list individual species.

The strengths of the software far outweigh its weaknesses. The digital collection would make a welcome addition to teaching and extension programs and the ease of use enables the user to fully utilize all features of the software immediately after installation and without the need of assistance or tutorials. In fact, all instructions for the CD are contained on the inside of the jacket that slides into the CD case.

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