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Review of Breeding Field Crops, 5th Ed.

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possible germination inhibitors. The closing segment, Link between coat-imposed dormancy and longevity, relates the influences on rate of aging with storage temperature, seed moisture content and seed quality.

Henk Hilhorst's wide-ranging coverage, Definitions and Hypotheses of Seed Dormancy, is another relevant review, since wild *Sesamum* species show strong latency. Dormancy is classified; then hormonal and environmental signaling in dormancy regulation, are illustrated. Phil Allen et al present Modeling of Seed Dormancy, first defining the Types and phenology of seed dormancy, and the Environmental controls of dormancy: Temperature, After-ripening, Stratification, Light.

Leónie Bentsink et al review Genetic Aspects of Seed Dormancy, addressing key issues of dormancy and shattering, the defining changes that occur with plant domestication. Lipid Metabolism in Seed Dormancy by Steven Penfield et al focuses on the biochemical pathways required for the catabolism of seed storage reserves and the specific role these might play in the control of seed dormancy and germination. Nitric Oxide in Seed Dormancy and Germination, by Paul Bethke et al, treats the reactive, gaseous free radical that functions as a potent signaling molecule. The data presented here support the hypotheses that NO promotes seed germination either by reducing dormancy or by minimizing the effects of environmental conditions that inhibit germination.

Abscisic Acid and Hormonal Cross-talk in the Control of Seed Dormancy Maintenance and Alleviation, by J. Allan Feurtado and Allison R. Kermode, is one of three chapters that review the roles of plant hormones on seed dormancy, germination and development. Regulation of ABA and GA Levels during Seed Development and Germination in *Arabidopsis* by Shinjiro Yamaguchi et al, and Camille Steber's look at De-repression of Seed Germination by GA Signaling, complete that trio. Mechanisms and Genes Involved in Germination *Sensu Stricto* by Editors Hiro Nonogaki and Kent Bradford, with Feng Chen, the book's penultimate chapter, introduces readers to the many definitions of germination. Bas Dekkers and Sjef Smeekens article, Sugar and Abscisic Acid Regulation of Germination and Transition to Seedling Growth, closes the volume. Sugar signaling is related intimately to hormone signaling.

Seed Development, Dormancy and Germination provides a comprehensive overview of seed biology from the viewpoint of developmental and regulatory processes. It identifies current challenges and questions remaining for future research. Most of the chapters investigate *Arabidopsis*, indicating how prevalent this plant species has become as the *Drosophila* equivalent of higher plants. Editors Kent Bradford (Director, Seed Biotechnology Center, University of California, Davis) and Hiroyuki Nonogaki (Department of Horticulture, Oregon State University, Corvallis) have assembled captivating chapters by an international pool of distinguished authors, from Canada, France, Japan, the Netherlands, the United Kingdom and the USA. They also provided this volume with some unique features. Exploring the book's 38-page Index, I discovered that even entries in the chapters' bibliographies are included, for example, the term 'turgor.' Additionally, the Table of Contents provides an outline of each chapter.

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Breeding Field Crops 5th ed. Sleper, D. A. and J. M. Poehlman. 2006. ISBN 0-8138-2428-1 (Cloth US$ 84.99) 424 pp. Blackwell Publishing, P.O. Box 570, Ames, IA 50010-0570.

Breeding Field Crops, first published almost fifty years ago, quickly became a staple text for undergraduate and graduate students and for field breeders and, throughout its editions, it has maintained its standing as one of the premier plant breeding textbooks worldwide. It achieved this distinction not simply because of its original clarity, but because subsequent editions have evolved in step with advances in our knowledge of basic genetics and reproductive mechanisms, the critical importance of international breeding programs and germplasm preservation repositories, database recording and exchange technologies, and the expansion of cell and tissue culture techniques and molecular manipulation strategies and capabilities.

I first became familiar with this text when it was in its third edition (published twenty years ago) when I was teaching a combined, upper-level undergraduate/M.S.-level course on the breeding of agronomic and horticultural crops. There were several attributes of this textbook (which have continued through this current edition) that have made it particularly enjoyable to use.

As stated in the Preface, it was written with the beginning student of plant breeding in mind. It begins, therefore, by addressing the obvious first

question, namely "What is plant breeding?" and very concisely describes the importance of plants, the disciplines critically associated with the process of plant improvement, and highlights the contributions of a few noteworthy plant breeders from Mendel to the present. It then provides a review chapter on basic botany, but focusing on how it relates to reproduction, including flower morphology, microsporogenesis and megasporogenesis, chromosome numbers of selected cultivated species, and self vs. cross-pollinating species. The third chapter describes how Mendelian genetics and chromosomal genetics complement and support one another and provide the foundation for traditional, directed, field breeding efforts. This chapter, along with the previous two, provides a critical base from which to describe the specifics of more detailed plant breeding strategies and considerations, introduced and described in later chapters.

One of the most useful features of this book, particularly as a student reference text, is the collection of Tables and Figures found throughout its chapters. For example, Figure 5.4 illustrates the genomic relationships between naturally-occurring *Brassica* species, a very important, but often confusing concept for some students to grasp. Although conventional in its visual appeal, it is the best illustration of this topic I have ever encountered.

In the third edition, chapter eight was entitled Plant Cell and Tissue Culture: Applications in Plant Breeding. In the following edition it was changed to Molecular Biology: Applications in Plant Breeding, while in this current edition it is entitled Biotechnology and Plant Breeding. Much of the same information, however, has been retained. This chapter is well written, but could be expanded in a future edition with additional recent references.

The fourth section devotes individual chapters to breeding methods and objectives for self-pollinated and for cross-pollinated and clonally propagated crops. This section, in my opinion, contains the singularly most important and remarkable feature of this book, namely the individual diagrams illustrating selection methods. Using a consistent format, the procedures for pedigree, bulk-population, single-seed descent, double-haploid, backcross, phenotypic recurrent, half-sib, full-sib, S_1 progeny, polycross progeny, and clonal selection methods are illustrated and very clearly defined. These figures are what initially drew me to this text, and are what cause me to return to this text year after year. Although the quantity of information presented on clonally propagated crops is brief and includes only one figure, it may improve the flow of this section if it were expanded and placed in its own chapter in the next edition, rather than being placed at the end of the chapter on cross-pollinated species.

Section Five begins with a discussion of genetic diversity and germplasm conservation. The authors include a very clear illustration of Vavilov's Center of Origin for the major crop species worldwide, with a tabular description of some of the more economically important crops found in each area. To emphasize the ecological, political, and environmental issues associated with conserving these priceless reserves of wild germplasm for future breeding efforts, the inclusion of a parallel figure illustrating human population numbers and political borders would provide a clear justification and a powerful incentive to increase international germplasm conservation efforts. In addition, the inclusion of contact information (with worldwide web addresses) for each repository would further increase the utility of this chapter, as would an example of an actual database record for an accession. Also, a separate chapter focusing specifically on established and emerging technologies for long-term protection, collection, maintenance, preservation, and distribution of germplasm would improve this text's usefulness as reference tool.

The next four sections provide information on the breeding of crop species of particular economic importance: wheat, rice, soybean, maize, sorghum, cotton, forage crops, potato, and sugarcane. Each chapter includes specific examples of breeding programs and objectives and each chapter includes numerous photographs and diagrams. These chapters would obviously be of benefit to plant breeders, but they also highlight the applied strategies and concerns unique to each crop. Perhaps an additional chapter detailing the methods used for selected horticultural crops (*e.g.* tomato, lettuce, cucurbits, berries, fruit trees) would make this text more comprehensive. The final chapter details seed production techniques, such as seed certification procedures and patent protection.

The fifth edition of *Breeding Field Crops* has retained much of its original format, content, and artwork from its two previous editions. When I first received this new edition, I noticed that it is about one third thinner (and seventy pages shorter) than the fourth edition (which is 230 pages shorter than the third edition). After examining it, however, I realized that much of these reductions are due to smaller and more efficient margins and font sizes which reproduce well on the glossy pages of the newest edition. Of course, the photographs would have more appeal if they were in color instead of monochrome, but this probably was a decision of

the publisher and relates to the smaller audience of a specialized text.

In summary, I would recommend this text to the audience for which it was originally written; namely, to advanced undergraduate students and graduate students, as well as to commercial plant breeders and researchers wishing to learn more about the important, and indeed essential "field" of plant breeding.

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Medicinal Plants: Chemistry and Properties. M. Daniel. Science Publishers. ISBN 1-57808-395-8

In order to understand the biological activity of a plant - - be it medicinal, poisonous, or nutritive - - we need to know its chemical constituents. Thus, it is plant secondary and primary metabolites that organize Medicinal Plants. For example, after a general introduction to the structure, characteristics, and general pharmacological activities of alkaloids, the author goes on to further distinguish among fifteen different alkaloid types (tropane alkaloids, isoquinoline alkaloids, indole alkaloids, etc.). Under each chemical grouping, the author describes one to several plant species especially known for those components. In addition to alkaloids, the author covers the many different chemical classes of Terpenoids and Phenolics, includes a section on Gums and Mucilages, and also discusses primary metabolites like carbohydrates, amino acids, proteins, fatty acids, and glycolipids. I found the chemical-related information clear-cut and easy to follow, although a figure or two would have helped increase comprehension.

Of the 350 plants covered in this book, 110 are European or American. The remaining species are from India (the author's home), Southeast Asia or China. So while there are many unfamiliar plant species discussed, the book offers a more global perspective of medicinal plants. An entry typically begins with a brief description of the plant, including its native country, and continues with a list of chemical components. Instead of listing every individual chemical, the author wisely lists only the major active components and the plant organ where they are found.

While chemical contents are adequately covered, most species entries only include a brief and general listing of plant uses (e.g. cathartic, emetic, carminative, stimulant, antihelmitic, expectorant, etc.). And while a few plant entries mention specific actions like anti-mitotic activity or pupil constriction, M. Daniel generally includes very little information on how the individual plant species acts medicinally. For example, the section on *Catharanthus roseus* mentions the indole alkaloids in the plant and its effectiveness against leukemia, but fails to mention how they cause depolymerization of protein microtubules during mitosis. There are, however, general discussions of biological activity under the main chemical headings (e.g. volatile oils inhibit cancer cells or act on the Central Nervous System), as well as sections that briefly discuss topics such as antioxidant therapy or aromatherapy.

Legal issues are not always mentioned in a plant's description. The section for Kava Kava (*Piper methysticum*) mentions its health-related controversies, although there are no such caveats for Ephedra (*Ephedra sinica*). This most likely represents the greater European influence in India.

As a quick reference, this book contains an excellent listing of a plant's chemical constituents, and for that alone I would recommend Medicinal Plants: Chemistry and Properties. However, for anything more than cursory information on medicinal activity, it needs to be used in conjunction with other resources.

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Practical Plant Identification. Cullen, James. 2006. ISBN-13 978-0-521-86152-6 (hardback) ISBN-13 978-0-521-678773 (paperback). xi + 357 pp. Cambridge University Press, Cambridge

Reviewing Professor Cullen's guide for *Practical Plant Identification* provided me with an interesting opportunity to revisit the fundamentals of plant taxonomy that I covered more than 30 years ago as a graduate student at Rutgers University. Since then my field studies have been in the semi-arid grasslands, shrublands, and high elevation forests