Concise Encyclopedia of Crop Improvement

As the human population expands, food and energy resources are becoming limited. It is urgent to provide enough food and it is becoming increasingly necessary to supply a greater percentage of energy needs from renewable resources. Crop improvement and breeding is one of the most important ways to achieve these two goals simultaneously. To obtain improved cultivars, both traditional breeding methods and modern biotechnologies are indispensable. This book presents an excellent, comprehensive resource for the development of traditional breeding methodology as well as new techniques for crop improvement. The book discusses theories, disputes, experiments, methods, achievements, and influential individuals and institutions in the field of crop improvement, breeding, and genetics.

The book covers a concise history of crop improvement. It discusses the “pre-Mendelian” crop domestication and improvement, post-Mendelian plant breeding, and modern biotechnologies. The “pre-Mendelian” domestication happened as early as 10,000 BC up to the 19th century, from the initial unconscious selection to the conscious selection of the best (“the art of breeding”). The book includes achievements in domestication in the Old World, Asia, Ancient America, the Greek and Roman World, and Europe during the Medieval and Renaissance.

The post-Mendelian plant breeding, i.e., the advances of genetics and plant breeding in the twentieth century are extensively explored in the book. The rediscovery of Mendel’s laws initiated the second stage in plant breeding—“the science of breeding.” Various different breeding methods and techniques were developed in this stage. The book discusses the methods of pure-line selection, mass selection, pedigree selection, bulk selection, backcross breeding, single-seed descent, hybrid breeding, synthetics, etc. It also discusses achievements in cytology, which led to chromosome manipulation as a tool for crop breeding, especially in polyploidy crops such as wheat. Spontaneous, induced, and somaclonal mutations have been widely used for breeding new cultivars. As an important tool for crop breeding and agronomy, the development of statistical methods and experimental designs is also covered in this book.

With the publication of the DNA structure in 1953 by J. Watson and F. Crick, a new era of crop improvement began. New techniques and methods were combined with traditional breeding methods to speed up breeding cycles, make selections, improve crops, and introduce new traits into crops. The book presents biotechnological approaches in two categories: in vitro techniques and molecular techniques. The in vitro techniques section mainly covers embryo rescue, doubled haploid production, somatic hybridization, virus freeing, and micropropagation. The author also presents a short overview of genetic marker development and its application in crop breeding. The development and application of transgenic plants and methods for gene transformation are outlined. I found the future perspectives about transgenic plants and genetic engineering in this book very interesting, for example, “farmercultural” production by plants and biodiesel production, just to name a few.

This book is “a handy reference for knowing our past and understanding our present times” (P. Stephen Baenziger) in crop improvement, genetics, and breeding. It discusses the advances in genetics and crop improvement in the context of both social and scientific ranges; moreover, it not only covers the “right,” major path of science, but also the deviations that masked the major path at one time, which reflects the actual, spiral development of science. This book is a valuable source of information for understanding the evolution of biology, genetics, crop improvement, breeding, biotechnology, and agriculture. At times, I found some topics to be too short; however, the extensive list of references provided in the book can serve as a good source for further, detailed reading for specific subjects. I would recommend the book to students, teachers, breeders, agronomists, and anyone interested in the history and development of genetics, plant breeding, biotechnology, agriculture, or biology.

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