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Plants, Genes, and Crop Biotechnology Tailoring Genes for Crop Improvement Genetic Engineering of Crop Plants Genes, Crops and the Environment Genetic Engineering of Plants Genome Engineering for Crop Improvement Plants, Genes, and Agriculture Gene Flow Between Crops and Their Wild Relatives Molecular Approaches to Crop Improvement Safety of Genetically Engineered Foods Alien Gene Transfer in Crop Plants, Volume 1 Genetically Engineered Crops Genes in the Field Genetic Resources, Chromosome Engineering, and Crop Improvement Plants, Genes and Crop Biotechnology People, Plants & Genes Transgenic Crop Plants Genetic Enhancement of Crops for Tolerance to Abiotic Stress: Mechanisms and Approaches, Vol. I Applications of Genetic Engineering to Crop Improvement Crop Improvement Dictionary of Plant Breeding PLANT BREEDING METHODS Crop Biotechnology: Genetic Modification And Genome Editing Tailoring Genes for Crop Improvement Plants, Genes and Crop Biotechnology Advancement in Crop Improvement Techniques Principles of Plant Genetics and Breeding Disease Resistance in Crop Plants Alien Gene Transfer in Crop Plants, Volume 2 Genetic Transformation of Plants Plant Genetics and Molecular Biology Managing Global Genetic Resources Cotton Precision Breeding Broadening the Genetic Base of Crop Production Targeted Genome Editing in Crops Genetically Modified Crops Genetically Modified Crops in Agriculture Genetically Modified Crops Molecular Plant Breeding Oil Crop Genomics

Plants are an important source of fats and oils, which are essential for the human diet. In recent years, genomics of oil biosynthesis in plants have attracted great interest, especially in high oil-bearing plants, such as sesame, olive, sunflower, and palm. Considering that, genome sequencing projects of these plants have been undertaken with the help of advanced genomics tools such as next generation sequencing. Several genome sequencing projects of oil crops are in progress and many others are en route. In addition to genome information, advanced genomics approaches are discussed such as transcriptomics, genomics-assisted breeding, genome-wide association study (GWAS), genotyping by sequencing (GBS), and CRISPR. These have all improved our understanding of the oil biosynthesis mechanism and breeding strategies for oil production. There is, however, no book that covers the genomes and genomics of oil crops. For this reason, in this volume we collected the most recent knowledge of oil crop genomics for researchers who study oil crop genomes, genomics, biotechnology, pharmacology, and medicine. This book covers all genome-sequenced oil crops as well as the plants producing important oil metabolites. Throughout this book, the latest genomics developments and discoveries are highlighted as well as open problems and future challenges in oil crop genomics. In doing so, we have covered the state-of-the-art of developments and trends of oil crop genomics. Genetic transformation is a key technology, in which genes are transferred from one organism to another in order to improve agronomic traits and ultimately help humans. However, there is concern in some quarters that genetically modified crops may disturb the ecosystem. A number of non-governmental organizations continue to protest against GM crops and foods, despite the fact that many organisms are genetically modified naturally in the course of evolution. In this context, there is a need to educate the public about the importance of GM crops in terms of food and nutritional security. This book provides an overview of various crop plants where genetic transformation has been successfully implemented to improve their agronomically useful traits. It includes information on the gene(s) transferred, the method of gene transfer and the beneficial effects of these gene transfers and the agronomic improvements compared to the wild plants. Further, it discusses the commercial prospects of these GM crops as well as the associated challenges. Given its scope, this book is a valuable resource for agricultural and horticultural scientists/experts wanting to explain to the public, politicians and non-governmental organizations the details of GM crops and how they can improve crops and the lives of farmers. It also appeals to researchers and postgraduate students. This volume focuses on the transgenics of mungbean, cowpea, chickpea, cotton, mulberry, Jatropha, fingermillet, papaya, citrus plants and cassava. It also discusses CRISPR edited lines. This book focuses on the previously neglected interface between the conservation of plant genetic resources and their utilization. Only through utilization can the potential value of conserved genetic resources be realized. However,

as this book shows, much conserved germplasm has to be subjected to long-term pre-breeding and genetic enhancement before it can be used in plant breeding programs.The authors explore the rationale and approaches for such pre-breeding efforts as the basis for broadening the genetic bases of crop production. Examples from a range of major food crops are presented and issues analyzed by leading authorities from around the world. Genetic Engineering of Crop Plants is a proceeding of The 49th Nottingham Easter School in Agricultural Science, which was held at Sutton Bonington on April 17-21, 1989. This symposium discussed progress in the generation of crop species resistant to herbicides, viruses, and insects. The book discusses topics such as the genetic manipulation in plants; genetic engineering of crops for insect and herbicide resistance; the expression of heat shock gene in transgenic plants; and tuber-specific gene expression. The book also covers topics such as regulation of gene expression in transgenic tomato plants; the molecular biology of pea seed development; and the regulatory elements of maize storage protein genes. The text is recommended for experts in the field of botan agriculture, and genetics who would like to know more about the improvement of crop plants through genetics. The contributions of plant genetics to the production of higher yielding crops of superior quality are well documented. These successes have been realized through the application of plant breeding techniques to a diver array of genetically controlled traits. Such highly effective breeding procedures will continue to be the primary method employed for the development of new crop cultivars; however, new techniques in cell and molecular biology will provide additional approaches for genetic modification. There has been considerable speculation recently concerning the potential impact of new techniques in cell and molecular biology on plant improvement. These genetic engineering techniques should offer unique opportunities to alter the genetic makeup of crops if applied to existing breeding procedures. Many questions must be answered in order to identify specific applications of these new technologies. This search for applications will require input from plant scientists working on various aspects of crop improvement. This volume is intended to assess the interrelationships betwee conventional plant breeding and genetic engineering. Reviewing the relevant scientific and technical literature, this work summarizes the current state-of-the-art knowledge related to gene flow and introgression (the permanent incorporation of genetic information from one set of differentiated populations into another) between genetically modified crops and their wild relatives. They analyze the biological framework for protecting the genetic integrity of indigenous wild relatives of crops in centers of crop origin and diversity, focusing on the issues of emission, dispersal, and deposition of pollen and/or seed; the likelihood and extent of gene flow from crops to wild relatives; and stabilization and the spread of traits in wild species. The material is organized into crop chapters, each of which covers general biological information of the crop; the most important crop wild relatives together with information about their ploidy levels, diverse genomes, centers of origin, and geographic distribution; the crop's potential for hybridization with its wild relatives; pollen flow studies related to pollen dispersal distances and hybridization rates; the current state of the genetic modification technology regarding that crop; and research gaps. The crop chapters discuss banana and plantain; barley; canola and oilseed rape; cassava, manioc, and yucca; chickpea; common bean; cotton; cowpea; finger millet; maize and corn; oat; peanut and groundnut; pearl millet; pigeonpea; potato; rice; sorghum; soybean; sweet potato, batata, and camote; and wheat and bread wheat. The productivity of agricultural systems is the result of human alteration of originally wild organisms over millennia. The availability of germplasm, particularly from wild relatives of crop plants, is vitally important in the development of new and improved crops for both agriculture and horticulture. The handling of these genetic resources for both immediate and future human benefits has resulted in the decades of interdisciplinary scientific research described in this book. The applications of this work and the associated operational programmes in all parts of the world are discussed in the light of their impact on the conservation of biodiversity, ecosystem rehabilitation and the future health of our planet. Whilst genetic transformation of plants is commonly viewed as a means of bringing about plant improvement, it has not so readily been recognised as a tool for analysing the function of plant genes. This book is unusual in that it focuses on the genetic transformation of a range of plants using a number of different methods. Many plants have been found to be quite difficult to transform, and so various techniques were developed. These techniques include: Agrobacterium suspension drops, electroporation, PEG, "whiskers", and various biolistic methods. A chapter on intellectual and property rights is included. One of the oldest scientific traditions, plant breeding began in Neolithic times with methods as simple as saving the seeds of desirable plants and sowing them later. It was not until the re-encounter with

Mendel’s discoveries thousands of years later, the genetic basis of breeding was understood. Developments following have provided further insight into how genes acting alone or in concert with other genes and the environment, result in a particular phenotype. From Abaxial to Zymogram, the third edition of Dictionary of Plant Breeding contains clear and useful definitions of the terms associated with plant breeding and related scientific/technological disciplines. It defines jargon; provides helpful tables, examples, and breeding schemes; and includes a list of crop plants with salient details. Packed with data and organized to make that data easy to access, this revised and expanded reference provides comprehensive coverage of the latest discoveries in cytogenetics, molecular genetics, marker-assisted selection, experimental gene transfer, CRISPR technology, see sciences, crop physiology, and genetically modified crops. Features: Provides a comprehensive list of technical terms used in plant breeding Explores the historical development of crop improvement Discusses applications of molecular genetics and biotechnology Includes numerous figures, drawings, tables, and schemes supplementing the glossary A complex subject, plant breeding draws from many scientific and technological disciplines, often making it difficult to know the precise meanings of many terms and to accurately interpret specific concepts. As in the previous editions, this dictionary unifies concepts by including the specific terms of plant breeding and terms that are adjusted from other disciplines. Drawing on Rolf Schlegel’s 50 years of experience, the book provides an encyclopedic list of commonly used technical terms that reflect the latest developments in the field. Advancement in Crop Improvement Techniques presents updates on biotechnology and molecular biological approaches which have contributed significantly to crop improvement. The book discusses the emerging importance of bioinformatics in analyzing the vast resources of information regarding crop improvement and its practical application and utilization. Throughout this comprehensive resource, emphasis is placed on various techniques used to improve agricultural crops, providing a common platform for the utility of these techniques and their combinations. Written by an international team of contributors, this book provides an in-depth analysis of existing tools and a framework for new research. Reviews techniques used for crop improvement, from selection and crossing over, to microorganismal approaches Explores the role of conventional biotechnology in crop improvement Summarizes the combined approaches of cytogenetics and biotechnology for crop improvement, including the importance of molecular techniques in this process Focuses on the emerging role of bioinformatics for crop improvement Jones and Bartlett and the American Society of Plant Biologists have teamed up for the second edition. This book integrates many fields to help students understand the complexity of the basic science that underlies crop and food production. It is truly an interdisciplinary text that brings together aspects of genetics and plant breeding, molecular biology and genetic engineering, population increases and the difficulty of eradicating hunger, pest control practices and their environmental consequences, the role of biotechnology in modern crop production, and much more. Cotton, the most important natural fiber crop, has been improved by conventional breeding—largely through planned hybridization of different cotton genotypes, since the discovery of Mendelian genetics. All these efforts resulted in the development of resilient high yielding cotton varieties. However, the progress through conventional breeding procedures is slow because of long lag periods for developing a variety, little control over the new genetic combinations, unwanted traits and lack of foolproof performance testing system. Genomic assays discovered over the last two decades have made it possible to understand the “language” of the genome by associating the genes with specific traits. Together with the more recently established gene-editing tools like CRISPR-Cas9, the cotton genome can be tailored much more precise than ever before. In this regard, genetic information has been harnessed, through (i) sequencing of the progenitor and cultivated cotton species, (ii) ongoing mega pan-genome sequencing projects, (iii) genetic and physical mapping, and (iv) introgression of genes from alien sources, that resulted in the development of resilient cotton cultivars. These technologies have been deployed or are attempting to overcome the challenges of water shortag excessive heat in most cotton growing regions, infectious diseases and infestation of insect pests, as well as risin production cost, for sustainable cotton production beyond 2030. In this book, new knowledge generated by the cotton research community and its application for developing resilient cotton are comprehensively summarized. This book contributed by well-known cotton researchers is a timely collection of the challenges and successes of precision cotton breeding in a changing environment. Plant molecular biology came to the fore in the early 1980s and there has been tremendous growth in the subject since then. The study of plant genes and genomes, coupled with the development of techniques for the incorporation of novel or modified genes into plants, eventually led to

the commercialisation of genetically modified (GM) crops in the mid-1990s. This was seen as the start of a biotechnological revolution in plant breeding. However, plant biotechnology became one of the hottest debates of the age and, in Europe at least, has been mired in controversy and over-regulation. Nevertheless, recent years have seen further technological innovation in the development of a range of techniques that enable scientists to make specific changes to target genes. Through a detailed history and development of the science and technique that underpin crop biotechnology, this title is concise, comprehensive and readable. As well as new sections on genome editing, this edition includes expanded sections on current GM crops and future developments in plant biotechnology, and updated sections on techniques, legislation and the GM crop debate. The previous edition of this book, titled Genetically Modified Crops, 2nd Edition, was published in November 2011. Contents: DNA, Genes, Genomes and Plant BreedingThe Techniques of Plant Genetic Modification and Genome EditingThe Use of Genetically Modified (GM) and Genome-edited Crops in AgricultureLegislation Covering Genetically Modified (GM) Crops and FoodsIssues that Have Arisen in the GM Crop and Food Debate Readership: It is accessible to a general readership with a scientific background but also provides useful information for the specialist, particularly those interested in the production of genetically modified (GM) and genome edited crops, the use of GM and genome edited crops in commercial agriculture. Keywords: Agriculture;Agricultural Sciences;Biology;Biotechnology;Botany;Crop Science;Environment;Food;Genes;Genetics; Genetic Engineering;Genetic Modification;Genetic Manipulation;GM Crops;Plant Breeding;PlantsReview: Key Features: Written by an acknowledged expert in the fieldNow includes genome edited as well as GM cropsGreatly expanded sections on current GM and genome edited crops and future developments in plant biotechnologyUpdated sections on legislation and the GM crop debateA concise reference with all the important facts in one placeA readable treatise of an issue with implications for science in society that go well beyond plant breeding and crop science Assists policymakers in evaluating the appropriate scientific methods for detecting unintended changes in food and assessing the potential for adverse health effects from genetically modified products. In this book, the committee recommended that greater scrutiny should be given to foods containing new compounds or unusual amounts of naturally occurring substances, regardless of the method used to create them. The book offers a framework to guide federal agencies in selecting the route of safety assessment. It identifies an recommends several pre- and post-market approaches to guide the assessment of unintended compositional changes that could result from genetically modified foods and research avenues to fill the knowledge gaps. This anchor volume to the series Managing Global Genetic Resources examines the structure that underlies efforts to preserve genetic material, including the worldwide network of genetic collections; the role of biotechnology; and a host of issues that surround management and use. Among the topics explored are in situ versus ex situ conservation, management of very large collections of genetic material, problems of quarantine, the controversy over ownership or copyright of genetic material, and more. Human population is escalating at an enormous pace and is estimated to reach 9.7 billion by 2050. As a result, there will be an increase in demand for agricultural production by 60–110% between the years 2005 and 2050 at the global level; the number will be even more drastic in the developing world. Pathogens, animals, and weeds are altogether responsible for between 20 to 40 % of global agricultural productivity decrease. As such, managing disease development in plants continues to be a major strategy to ensure adequate food supply for the world. Accordingly, both the public and private sectors are moving to harness the tools and paradigms that promise resistance against pests and diseases. While the nex generation of disease resistance research is progressing, maximum disease resistance traits are expected to be polygenic in nature and controlled by selective genes positioned at putative quantitative trait loci (QTLs). It has also been realized that sources of resistance are generally found in wild relatives or cultivars of lesser agronomic significance. However, introgression of disease resistance traits into commercial crop varieties typically involves many generations of backcrossing to transmit a promising genotype. Molecular marker-assisted breeding (MAB) has been found to facilitate the pre-selection of traits even prior to their expression. To date, researchers have utilized disease resistance genes (R-genes) in different crops including cereals, pulses, and oilseeds and other economically important plants, to improve productivity. Interestingly, comparison of different R genes that empower plants to resist an array of pathogens has led to the realization that the proteins encoded by these gene have numerous features in common. The above observation therefore suggests that plants may have co-evolved signal transduction pathways to adopt resistance against a wide range of divergent pathogens. A better

understanding of the molecular mechanisms necessary for pathogen identification and a thorough dissection of the cellular responses to biotic stresses will certainly open new vistas for sustainable crop disease management. This book summarizes the recent advances in molecular and genetic techniques that have been successfully applied to impart disease resistance for plants and crops. It integrates the contributions from plant scientists targeting disease resistance mechanisms using molecular, genetic, and genomic approaches. This collection therefore serves as a reference source for scientists, academicians and post graduate students interested in or ar actively engaged in dissecting disease resistance in plants using advanced genetic tools. Genetic engineering an biotechnology along with conventional breeding have played an important role in developing superior cultivars by transferring economically important traits from distant, wild and even unrelated species to the cultivated varieties which otherwise could not have been possible with conventional breeding. There is a vast amount of literature pertaining to the genetic improvement of crops over last few decades. However, the wonderful results achieved by crop scientists in food legumes' research and development over the years are scattered in different journals of the World. The two volumes in the series 'Alien Gene Transfer in Crop Plants' address this issue and offer a comprehensive reference on the developments made in major food crops of the world. These volumes aim at bringing the contributions from globally renowned scientists at one platform in a reader-friendly manner. The second volume entitled, "Alien Gene Transfer in Crop Plants: Achievements and Impact" will deal more with the practical aspects. This volume will cover achievements of alien gene transfer in major food crops of the world and their impact on development of newer genetic variability and additional avenues for selection; development of superior cultivars for increased yield, resistance to biotic and abiotic stresses, improved nutritional and industrial quality; innovation of new techniques and positive as well as negative environmental implications. This volume has been divided into four groups with an aim to cover all major cereals, pulses, oilseeds and other crops (vegetable and horticultural crops) which are of economic importance. "The book...is, in fact, a short text on the many practical problems...associated with translating the explosion in basic biotechnological research into the next Green Revolution," explains Economic Botany. The book is "a concise and accurate narrative, that also manages to be interesting and personal...a splendid little book." Biotechnology states, "Because of the clarity with which it is written, this thin volume makes a major contribution to improving public understanding of genetic engineering's potential for enlarging the world's food supply...and can be profitably read by practically anyone interested in application of molecular biology to improvement of productivity in agriculture." Development of transgenic crop plants, their utilization for improved agriculture, health, ecology and environment and their socio-political impacts are currently important fields in education, research and industries and also of interest to policy makers, social activists and regulatory and funding agencies. This work prepared with a class-room approach on this multidisciplinary subject will fill an existing gap and meet the requirements of such a broad section of readers. Volume 1 with ten chapters contributed by 31 eminent scientists from nine countries deliberates on the basic concepts, strategies and tools for development of transgenic crop plants, including topics such as: explants used for the generation of transgenic plants, gene transfer methods, organelle transformation, selection and screening strategies, expression and stability of transgenes, silencing undesirable genes, transgene integration, biosynthesis and biotransformation and metabolic engineering of pathways and gene discovery. Genetically engineered (GE) crops were first introduced commercially in the 1990s. After two decades of production, some groups and individuals remain critical of the technology based on their concerns about possible adverse effects on human health, the environment, and ethical considerations. At the same time, others are concerned that the technology is not reaching its potential to improve human health and the environment because of stringent regulations and reduced public funding to develop products offering more benefits to society. While the debate about these and other questions related to the genetic engineering techniques of the first 20 years goes on, emerging genetic-engineering technologies are adding new complexities to the conversation. Genetically Engineered Crops builds on previous related Academies reports published between 1987 and 2010 by undertaking a retrospective examination of the purported positive and adverse effects of GE crops and to anticipate what emerging genetic-engineering technologies hold for the future. This report indicates where there are uncertainties about the economic, agronomic, health, safety, or other impacts of GE crops and food, and makes recommendations to fill gaps in safety assessments, increase regulatory clarity, and improve innovations i and access to GE technology. This book integrates many fields to help students understand the complexity of the

basic science that underlies crop and food production. Recent advances in plant genomics and molecular biology have revolutionized our understanding of plant genetics, providing new opportunities for more efficient and controllable plant breeding. Successful techniques require a solid understanding of the underlying molecular biology as well as experience in applied plant breeding. Bridging the gap between developments in biotechnology and its applications in plant improvement, Molecular Plant Breeding provides an integrative overview of issues from basic theories to their applications to crop improvement including molecular marker technology, gene mapping, genetic transformation, quantitative genetics, and breeding methodology. Human Population Growth: Lessons from Demography; Agricultural R&D, Productivity and Global Food Prospects; Development, Productivity and Sustainability of Crop Production Food Security: Why Do Hunger and Malnutrition Persist in a World of Plenty?; Developing Food Production Systems in Sub-Saharan Africa; The Molecular Basis of Genetic Modification and Improvement of Crops; Plants in Human Nutrition and Animal Feed The Genetic Basis of Growth and Development; Seeds: Biology, Technology and Role in Agriculture; Converting Solar Energy into Crop Production; Plant Nutrition and Crop Improvement in Adverse Soil Conditions; Life Together in the Underground; Ten Thousand Years of Crop Evolution; From Classical Plant Breeding to Modern Crop Improvement; Crop Diseases and Strategies for Their Control; Strategies for Controlling Insect, Mite and Nematode Pests; Weeds and Weed Control Strategies; Toward a Greener Agriculture; Plants as Chemical and Pharmaceutical Factories; Urban Myths and Real Concerns about Genetically Modified (GM) Crops; Pioneer Hi-Bred International. This comprehensive book provides a detailed account of the plant breeding methodology, covering particularly pre- and post-Green Revolution era. It elaborates on plant breeding and gene manipulation, utilization of self-incompatibility in developing hybrids, different plant breeding methods for development of crop varieties and hybrids in self- and cross-pollinated crops, nature of gene action and genotype–environment interaction. The text discusses gene manipulation in the crop plant and transfer of genes from wild species to cultivated crops, application of biotechnology in plant breeding, and genetic engineering and transgenic molecular markers as breeding tools and their limitations. It concludes with a discussion on physiologic breeding approach and new plant ideotype concepts which are new and emerging areas of interest in plant breeding research. The book will be of immense use to undergraduate and postgraduate students of Agricultural Sciences and Botany for their course study. Besides, research scholars and professionals will also find the book as an excellent source of reference. The revised edition of the bestselling textbook, covering both classical and molecular plant breeding Principles of Plant Genetics and Breeding integrates theory and practice to provide an insightful examination of the fundamental principles and advanced techniques of modern plant breeding. Combining both classical and molecular tools, this comprehensive textbook describes the multidisciplinary strategies used to produce new varieties of crops and plants, particularly in response to the increasing demands to of growing populations. Illustrated chapters cover a wide range of topics, including plant reproductive systems, germplasm for breeding, molecular breeding, the common objectives of plant breeders, marketing and societal issues, and more. Now in its third edition, this essential textbook contains extensively revised content that reflects recent advances and current practices. Substantial updates have been made to its molecular genetics and breeding sections, including discussions of new breeding techniques such as zinc finger nuclease, oligonucleotide directed mutagenesis, RNA-dependent DNA methylation, reverse breeding, genome editing, and others. A new table enables efficient comparison of an expanded list of molecular markers, including Allozyme, RFLPs, RAPD, SSR, ISSR, DAMD, AFLP, SNPs and ESTs. Also, new and updated “Industry Highlights” sections provide examples of the practical application of plant breeding methods to real-world problems. This new edition: Organizes topics to reflect the stages of an actual breeding project Incorporates the most recent technologies in the field, such as CRSPR genome edition and grafting on GM stock Includes numerous illustrations and end-of-chapter self-assessment questions, key references, suggested readings, and links to relevant websites Features a companion website containing additional artwork and instructor resources Principles of Plant Genetics and Breeding offers researchers and professionals an invaluable resource and remains the ideal textbook for advanced undergraduates and graduates in plant science, particularly those studying plant breeding, biotechnology, and genetics. The improvement of crop species has been a basic pursuit since cultivation began thousands of years ago. To feed an ever increasing world population will require a great increase in food production. Wheat, corn, rice, potato and few others are expected to lead as the most important crops in the

world. Enormous efforts are made all over the world to document as well as use these resources. Everybody knows that the introgression of genes in wheat provided the foundation for the “Green Revolution”. Later also demonstrated the great impact that genetic resources have on production. Several factors are contributing to high plant performance under different environmental conditions, therefore an effective and complementary use of all available technological tools and resources is needed to meet the challenge. The study of plant genetics helps in understanding the structure and functions of genes in plants. These studies are used in crop biotechnology to modify plants and crops. Crop biotechnology uses the techniques of tissue culture, molecular markers and genetic engineering to produce desired traits in crops. The modification of crops aims to improve characteristics like disease resistance, flavor, size, color, etc. This book explores all the important aspects of plant genetics and crop biotechnology. It attempts to understand the multiple branches that fall under these disciplines and how such concepts have practical applications. Researchers, experts and students in these fields will be assisted by this book. This book reviews the latest advances in multiple fields of plant biotechnology and the opportunities that plant genetics, genomics and molecular biology have offered for agriculture improvement. Advanced technologies can dramatically enhance our capacity in understanding the molecular basis of traits and utilizing the available resources for accelerated development of high yielding, nutritious, input-use efficient and climate-smart crop varieties. In this book, readers will discover the significant advances in plant genetics, structural and functional genomics, trait and gene discovery, transcriptomics, proteomics, metabolomics, epigenomics, nanotechnology and analytical & decision support tools in breeding. This book appeals to researchers, academics and other stakeholders of global agriculture. Genetic engineering and biotechnology along with conventional breeding have played an important role in developing superior cultivars by transferring economically important traits from distant, wild and even unrelated species to the cultivated varieties which otherwise could not have been possible with conventional breeding. There is a vast amount of literature pertaining to the genetic improvement of crops over last few decades. However, the wonderful results achieved by crop scientists in food legumes’ research and development over the years are scattered in different journals of the World. The two volumes in the series ‘Alien Gene Transfer in Crop Plants’ address this issue and offer a comprehensive reference on the developments made in major food crops of the world. These volumes aim at bringing the contributions from globally renowned scientists at one platform in a reader-friendly manner. The 1st volume entitled, ‘Alien Gene Transfer in Crop Plants: Innovations, Methods and Risk Assessment” will deal exclusively with the process and methodology. The contents of this volume have been designed to appraise the readers with all the theoretical and practical aspects of wide hybridization and gene transfer like processes and methods of gene transfer, role of biotechnology with special reference to embryo rescue, genetic transformation, protoplast fusion and molecular marker technology, problems such as cross incompatibility and barriers to distant hybridization and solutions to overcome them. Since wild and weedy relatives of crop plants may have negative traits associated with them, there are always possibilities of linkage drag while transferring alien alleles. Therefore, problems and limitations of alien gene transfer from these species will also be discussed in this series. Further, the associated risks with this and assessment of risks will also be given due weightage. Plant molecular biology came to the fore in the early 1980s and there has been tremendous growth in the subject since then. The study of plant genes and genomes and the development of techniques for the incorporation of novel or modified genes into plants eventually led to the commercialisation of genetically modified (GM) crops in the mid-1990s. This was seen as the start of a biotechnological revolution in plant breeding. However, plant biotechnology has become one of the hottest debates of the age and, in Europe at least, one of the greatest challenges that plant scientists have ever faced. Th book covers the history and development of the science and techniques that underpin plant biotechnology. It describes the GM crops that are or have been grown commercially around the world, including failures as well as successes, and the new varieties that are being developed. The safety record of GM crops is reviewed together with the legislation that has been adopted to cover their use. The book also deals with the concerns of consumers the GM crop debate and the prospects for the technology. In the second edition, sections on current GM crops and future developments in plant biotechnology have been greatly expanded, while those on techniques, legislation and the GM crop debate have also been updated. The book is a concise, comprehensive and readable study that is accessible to a general readership with a scientific background but also provides useful information for the specialist. Genetically modified crops are plants used in agriculture, the DNA of which has been modified

using genetic engineering methods. In most cases, the aim is to introduce a new trait to the plant which does not occur naturally in the species. Examples in food crops include resistance to certain pests, diseases, or environmental conditions, reduction of spoilage, or resistance to chemical treatments, or improving the nutrient profile of the crop. Recently rapid advances in the development and commercialization of transgenic crops across the world have been witnessed both in terms increased crop coverage and economic benefits. Genetically modified foods are foods derived from genetically modified organisms have had specific changes introduced into their DNA by genetic engineering techniques. The main aim of genetically modified crops is to produce a food that is able to survive even if any harmful chemicals or pesticides or herbicides are sprayed. Other benefit of genetically modified crops is to make food stay fresh for a long time. Some of genetically modified crops and food are corn, tomato, beets, potatoes, sprouts and alfalfa. It involves the insertion or deletion of genes. Examples in non-food crops include production of pharmaceutical agents, biofuels, and other industrially useful goods, as well as for bioremediation. This book covers those facets, from the source of the gene, compositions of a gene construct, method of gene delivery, and result of gene integration and expression, to effects of the transgene on plants and the ecology. In August. 1982. a conference was held at the University of Califor nia. Davis. to discuss both molecular and traditional approaches to plant genetic analysis and plant breeding. Papers presented at the meeting were published in Genetic Engineering of Plants: An Agricultural Perspective. A second conference. entitled "Tailoring Genes for Crop Improvement." spon sored by the UC-Davis College of Agricultural and Environmental Sciences and the College's Biotechnology Program. was held at Davis in August. 1986. to discuss the notable advances that had been made during the intervening years in the technology for gene modification. transfer. and expression in plants. This volume contains papers that were presented at this meeting and provides readers with examples of how the new experimental strategies are being used to gain a clearer understanding of the biology of the plants we grow for food and fiber; it also discusses how molecular biology approaches are being used to introduce new genes into plants for plant breeding programs. We are grateful to the speakers for their excellent presentations for the conference and extend our sincere thanks to those who contributed manuscripts for this volume. Genes in the Field provides an interdisciplinary foundation for an important new conservation program: maintaining biological resources of crop plants within the systems where they have evolved. The book offers a truly global vision of the on-farm conservation movement and, like no other before it, provides a comprehensive review of the issues and challenges of on-farm conservation of genetic resources. The book's chapters are written by a collection of outstanding scholars and academics from a variety of disciplines; they include biologists, agronomists, anthropologists, economists, lawyers and agricultural development specialists. Genes in the Field is truly global in scope and multidisciplinary in character. It will appeal to a large, varied and international audience. Its most general appeal will be to professionals in the fields of conservation and agricultural development, particularly those who are involved in planning or implementing conservation programs. For course work, the book will be appropriate for graduate programs in agricultural development and conservation. Although plant genes were first isolated only some twelve years ago and transfer of foreign DNA into tobacco cells first demonstrated some eight years ago, the application and extension of biotechnology to agricultural problems has already led to the field-testing of genetically modified crop plants. The promise of tailor-made plants containing resistance to pests or diseases as well as many other desirable characteristics has led to the almost compulsory incorporation of molecular biology into the research programs of chemical and seed companies as well as Governmental agricultural agencies. With the routine transformation of rice and the early evidence of transformation of maize the possibility of the world's major cereal crops being modified for improved nutritional value or resistance characteristics is now likely in the next few years. The increasing number of cloned plant genes and the increasing sophistication of our knowledge of the major developmental and biochemi cal pathways in plants should eventually allow us to engineer crop plants with higher yields and with less detrimental impact on the environment than now occurs in our current high input agricultural systems. This book draws together many of the expanding areas of plant molecular biology and genetic engineering that will make a substantial contribution to the development of the more productive and efficient crop plants that the world's farmers will be planting in the next decade. This book links the latest advances in molecular genetics with the science and history of plant domestication, the evolution of plant breeding, and the implications of our new knowledge for the agriculture of today and the future. Abiotic stresses such as drought (water deficit), extreme

temperatures (cold, frost and heat), salinity (sodicity) and mineral (metal and metalloid) toxicity limit productivity of crop plants worldwide and are big threats to global food security. With worsening climate change scenarios, these stresses will further increase in intensity and frequency. Improving tolerance to abiotic stresses, therefore, has become a major objective in crop breeding programs. A lot of research has been conducted on the regulatory mechanisms, signaling pathways governing these abiotic stresses, and cross talk among them in various model and non-model species. Also, various 'omics' platforms have been utilized to unravel the candidate genes underpinning various abiotic stresses, which have increased our understanding of the tolerance mechanisms at structural, physiological, transcriptional and molecular level. Further, a wealth of information has been generated on the role of chromatin assembly and its remodeling under stress and on the epigenetic dynamics via histones modifications. The book consolidates outlooks, perspectives and updates on the research conducted by scientists in the abovementioned areas. The information covered in this book will therefore interest workers in all areas of plant sciences. The results presented on multiple crops will be useful to scientists in building strategies to counter these stresses in plants. In addition, students who are beginners in the areas of abiotic stress tolerance will find this book handy to clear their concepts and to get an update on the research conducted in various crops at one place In recent years, significant advancements have been made in the management of nutritional deficiency using genome engineering—enriching the nutritional properties of agricultural and horticultural crop plants such as wheat, rice, potatoes, grapes, and bananas. To meet the demands of the rapidly growing world population, researchers are developing a range of new genome engineering tools and strategies, from increasing the nutraceuticals in cereals and fruits, to decreasing the anti-nutrients in crop plants to improve the bioavailability of minerals and vitamins. Genome Engineering for Crop Improvement provides an up-to-date view of the use of genome editing for crop bio-fortification, improved bioavailability of minerals and nutrients, and enhanced hypo-allergenicity and hypo-immunogenicity. This volume examines a diversity of important topics including mineral and nutrient localization, metabolic engineering of carotenoids and flavonoids, genome engineering of zero calorie potatoes and allergen-free grains, engineering for stress resistance in crop plants, and more. Helping readers deepen their knowledge of the application of genome engineering in crop improvement, this book: Presents genetic engineering methods for developing edible oil crops, mineral translocation in grains, increased flavonoids in tomatoes, and cereals with enriched iron bioavailability Describes current genome engineering methods and the distribution of nutritional and mineral composition in important crop plants Offers perspectives on emerging technologies and the future of genome engineering in agriculture Genome Engineering for Crop Improvement is an essential resource for academics, scientists, researchers, agriculturalists, and students of plant molecular biology, system biology, plant biotechnology, and functional genomics. Summarizing landmark research, Volume 3 of this essential series furnishes information on the availability of germplasm resources that breeders can exploit for producing high-yielding vegetable crop varieties. Written by leading international experts, this volume offers the most comprehensive and up-to-date information on employing genetic resources to increase the yield of those vegetable crops that provide a main source of minerals, vitamins, and antioxidants. In eleven succinct chapters, Genetic Resources, Chromosome Engineering, and Crop Improvement: Vegetable Crops, Volume 3 focuses on potato, tomato, brassicas, okra, capsicum, alliums, cucurbits, lettuce, eggplant, and carrot. An introductory chapter outlines the cytogenetic architecture of vegetable crops, describes the principles and strategies of cytogenetics and breeding, and summarizes landmarks in current research. This sets the stage for the ensuing crop-specific chapters. Each chapter generally provides a comprehensive account of the crop, its origin and taxonomy, wild relatives, exploitation of genetic resources diversity in the primary, secondary, and tertiary gene pools through breeding and cytogenetic manipulation, and genetic enrichment using the tools of molecular genetics and biotechnology. Certain to become the standard reference for improving the yields of these critical vegetable crops, this book is the definitive source of information for plant breeders, gene-bankers, cytogeneticists, taxonomists, molecular biologists, biotechnologists, and graduate students, researchers, agronomists, horticulturists, farmers and consumers in these fields.

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