



Plant Breeding

Mendelian to
Molecular
Approaches

Editors

H.K. Jain

M.C. Kharkwal



Alpha Science

Plant Breeding Mendelian To Molecular Approaches

**Jameel M. Al-Khayri, Shri Mohan
Jain, Dennis V. Johnson**



Plant Breeding Mendelian To Molecular Approaches:

Plant Breeding H.K. Jain, M.C. Kharkwal, 2012-12-06 The Indian Society of Genetics and Plant Breeding was established in 1941 in recognition of the growing contribution of improved crop varieties to the country's agriculture. Scientific plant breeding had started in India soon after the rediscovery of Mendel's laws of heredity. The Indian Agricultural Research Institute set up in 1905 and a number of Agricultural Colleges in different parts of the country carried out some of the earliest work mostly in the form of pure line selections. In subsequent years hybridization programmes in crops like wheat, rice, oilseeds, grain legumes, sugarcane and cotton yielded a large number of improved cultivars with significantly higher yields. A turning point came in the 1960s with the development of hybrids in several crops including inter-specific hybrids in cotton. And when new germplasm with dwarfing genes became available in wheat and rice from CIMMYT and IRRI respectively, Indian plant breeders quickly incorporated these genes into the genetic background of the country's widely grown varieties with excellent grain quality and other desirable traits. This was to mark the beginning of modern agriculture in India as more and more varieties were developed characterized by a high harvest index and response to modern farm inputs like the inorganic fertilizers. India's green revolution which has led to major surpluses of food grains and other commodities like sugar and cotton has been made possible by the work of one of the largest groups of plant breeders working in a coordinated network.

Plant Breeding Mendelian to Molecular Approaches Jani H K., Kharlail M C., 2004 Advances in Plant Breeding Strategies: Breeding, Biotechnology and Molecular Tools Jameel M. Al-Khayri, Shri Mohan Jain, Dennis V. Johnson, 2016-02-02 The basic concept of this book is to examine the use of innovative methods augmenting traditional plant breeding towards the development of new crop varieties under different environmental conditions to achieve sustainable food production. This book consists of two volumes. Volume 1 subtitled *Breeding, Biotechnology and Molecular Tools* and Volume 2 subtitled *Agronomic, Abiotic and Biotic Stress Traits*. This is Volume 1 which consists of 21 chapters covering domestication and germplasm utilization, conventional breeding techniques and the role of biotechnology. In addition to various biotechnological applications in plant breeding, it includes functional genomics, mutations and methods of detection and molecular markers. In vitro techniques and their applications in plant breeding are discussed with an emphasis on embryo rescue, somatic cell hybridization and somaclonal variation. Other chapters cover haploid breeding, transgenics, cryogenics and bioinformatics.

Plant Breeding Reviews, Volume 25 Jules Janick, 2010-04-07 *Plant Breeding Reviews* presents state-of-the-art reviews on plant genetics and the breeding of all types of crops by both traditional means and molecular methods. Many of the crops widely grown today stem from a very narrow genetic base. Understanding and preserving crop genetic resources is vital to the security of food systems worldwide.

Accelerated Plant Breeding, Volume 1 Satbir Singh Gosal, Shabir Hussain Wani, 2020-05-23 Plant improvement has shifted its focus from yield, quality and disease resistance to factors that will enhance commercial export such as early maturity, shelf life and better processing.

quality Conventional plant breeding methods aiming at the improvement of a self pollinating crop such as wheat usually take 10-12 years to develop and release of the new variety. During the past 10 years significant advances have been made and accelerated methods have been developed for precision breeding and early release of crop varieties. This work summarizes concepts dealing with germplasm enhancement and development of improved varieties based on innovative methodologies that include doubled haploidy, marker assisted selection, marker assisted background selection, genetic mapping, genomic selection, high throughput genotyping, high throughput phenotyping, mutation breeding, reverse breeding, transgenic breeding, shuttle breeding, speed breeding, low cost high throughput field phenotyping etc. It is an important reference with special focus on accelerated development of improved crop varieties.

Advances in Plant Breeding Strategies: Fruits Jameel Al-Khayri, Shri Mohan Jain, Dennis V. Johnson, 2018-07-20. This book examines the development of innovative modern methodologies towards augmenting conventional plant breeding for the production of new crop varieties under the increasingly limiting environmental and cultivation factors to achieve sustainable agricultural production and enhanced food security. Two volumes of *Advances in Plant Breeding Strategies* were published in 2015 and 2016 respectively: Volume 1 *Breeding Biotechnology and Molecular Tools* and Volume 2 *Agronomic Abiotic and Biotic Stress Traits*. This is Volume 3 *Fruits* which is focused on advances in breeding strategies for the improvement of individual fruit crops. It consists of 23 chapters grouped into three parts according to distribution classification of fruit trees: Part I Temperate Fruits, Part II Subtropical Fruits and Part III Tropical Fruits. Each chapter comprehensively reviews the modern literature on the subject and reflects the authors' own experience.

Advances in Plant Breeding Strategies: Vegetable Crops Jameel M. Al-Khayri, S. Mohan Jain, Dennis V. Johnson, 2021-08-25. Plant breeders and geneticists are under constant pressure to sustain and expand food production by using innovative breeding strategies and introducing minor crops which are well adapted to marginal lands, provide a source of nutrition and have abiotic and biotic stress tolerance to feed an ever increasing human population. The basic concept of this book is to examine the use of innovative methods augmenting traditional plant breeding towards the improvement and development of new crop varieties under the increasingly limiting environmental and cultivation factors to achieve sustainable agricultural production and enhanced food security. Three volumes of the book series *Advances in Plant Breeding Strategies* were published in 2015, 2016 and 2018 respectively: Volume 1 *Breeding Biotechnology and Molecular Tools*, Volume 2 *Agronomic Abiotic and Biotic Stress Traits* and Volume 3 *Fruits*. In 2019 the following four volumes were published: Volume 4 *Nut and Beverage Crops*, Volume 5 *Cereals*, Volume 6 *Industrial and Food Crops* and Volume 7 *Legumes*. In 2021 three volumes are being concurrently published: Volume 8 *Vegetable Crops: Bulbs, Roots and Tubers*, Volume 9 *Vegetable Crops: Fruits and Young Shoots* and Volume 10 *Vegetable Crops: Leaves, Flowerheads, Green Pods, Mushrooms and Truffles*. This Volume 10 subtitled *Vegetable Crops: Leaves, Flowerheads, Green Pods, Mushrooms and Truffles* consists of 14 chapters focusing on advances in breeding strategies using both traditional and modern approaches for the improvement

of individual vegetable crops Chapters are arranged in 4 parts according to the edible vegetable parts Part I Leaves Chicory *Cichorium intybus* L Chinese cabbage *Brassica rapa* L var *pekinensis* Rocket salad *Eruca vesicaria* ssp *sativa* Mill Spring onion *Allium fistulosum* L Water spinach *Ipomoea aquatica* Forsk and Watercress *Nasturtium officinale* R Br Pat II Flowerheads and Green Pods Cauliflower *Brassica oleracea* var *botrytis* L Globe artichoke *Cynara cardunculus* var *scolymus* L Garden pea *Pisum sativum* L and Yardlong bean *Vigna unguiculata* L Walp ssp *sesquipedalis* L Verdc Part III Mushrooms Enoki mushroom *Flammulina velutipes* Curtis Singer and Shiitake mushroom *Lentinula edodes* Berk Sing Part IV Truffles Desert truffles *Terfezia* spp and White truffle *Tuber magnatum* Picco and *T. borchii* Vittad Each chapter comprehensively reviews the contemporary literature on the subject and reflects the experiences of the authors Chapters are written by internationally reputable scientists and subjected to a review process to assure quality presentation and scientific accuracy Each chapter begins with an introduction covering related backgrounds and provides in depth discussion of the subject supported with high quality color photos illustrations and relevant data The chapter concludes with recommendations for future research directions a comprehensive list of pertinent references to facilitate further reading and appendixes of genetic resources and concerned research institutes This book series is a valuable resource for advanced students researchers scientists commercial producers and seed companies as well as consultants and policymakers interested in agriculture particularly in modern breeding technologies

Plant Mutation Breeding and Biotechnology Q. Y. Shu, Brian P. Forster, H. Nakagawa, Hitoshi Nakagawa, 2012 Abstract This book presents contemporary information on mutagenesis in plants and its applications in plant breeding and research The topics are classified into sections focusing on the concepts historical development and genetic basis of plant mutation breeding chapters 1 6 mutagens and induced mutagenesis chapters 7 13 mutation induction and mutant development chapters 14 23 mutation breeding chapters 24 34 or mutations in functional genomics chapters 35 41 This book is an essential reference for those who are conducting research on mutagenesis as an approach to improving or modifying a trait or achieving basic understanding of a pathway for a trait

Biotechnologies and Genetics in Plant Mutation Breeding Tariq Ahmad Bhat, Khalid Rehman Hakeem, 2023-06-30 An indispensable source for researchers teachers and graduate and postgraduate students interested in mutation breeding and genetic engineering It introduces readers to contemporary knowledge and state of the art technologies in the field of mutation breeding including fundamental mechanisms and applications It will provide new directions and avenues for enhancement of food security and food quality by using the latest techniques for the mutation as breeding approach From Prof Jameel M Al Khayri King Faisal University Saudi Arabia This comprehensive three volume set book aims to help combat the challenge of providing enough food for the world by the use of advanced genetic processes to improve crop production both in quantity and quality Volume 1 Mutagenesis and Crop Improvement discusses mutagenesis cytotoxicity and crop improvement covering the processes mutagenic effectiveness and mechanisms The volume emphasizes the improvement of agronomic characteristics by

manipulating the genotype of plant species resulting in increased productivity Volume 2 Revolutionizing Plant Biology covers the use of mutagenesis and biotechnology to explore the variability of mutant genes for crop improvement The chapters deal with in vitro mutagenesis to exploit the somaclonal variations induced in cell culture and highlight the importance of in vitro mutagenesis in inducing salt resistance heat resistance and drought resistance Volume 3 Mechanisms for Genetic Manipulation of Plants and Plant Mutants reviews the genetic engineering techniques used to mutate genes and to incorporate them into different plant species of cereals pulses vegetables and fruits Also discussed are the principles of genetic engineering by which desired genes can be transferred from plants to animals to microorganisms and vice versa

Plant Mutagenesis Nitish Kumar, 2024-04-22 This book emphasizes recent developments in the use of mutation technologies for crop plant improvement and ultimately sustainable development Plant breeders use genetic variation which is created by plant induced mutation to create new and improved cultivars The development of improved cultivars is a productive and optimistic agricultural strategy for economic and environmental sustainability since it ensures high yield stability enhances soil health and poses no environmental risks Understanding mutation induction and exploring its uses have paved the road for improving genetic diversity for different plants and agronomic features and advanced gene discovery for diverse qualities that aid in sustainable development Plant mutation breeding imitates spontaneous mutation the primary force driving evolution by using a plant's own genetic resources instead of genetic transformation In order to develop beneficial agricultural features this strategy focuses on the application of various chemical and physical mutagens in conjunction with biotechnologies In order to survive in challenging environments increase nutritional value fight diseases and pests grow in salty soils and utilize water and nutrients more effectively new varieties of plants are developed This approach has significantly boosted the economies of nations like China India Japan Pakistan and the USA As of right now the strategy has produced and disseminated more than 3600 mutant types in the majority of crop plants having a significant economic impact This book discusses several mutation induction techniques mutant screening genome editing the haploid breeding system for mutations as well as genomic developments and mutant gene identification Plant breeders researchers and students in the fields of plant sciences agriculture and food science will find this instructive book to be of great help

The Indian Journal of Genetics & Plant Breeding, 2007 **Plant Genetic Resources** B. S. Dhillon, 2006 Food is the basic need of human beings The increasing population and enhanced standard of living are placing greater demands on food related requirements in terms of quantity quality and diversity The Green Revolution which significantly enhanced productivity of important food crops nevertheless resulted in certain fallouts as genetic erosion soil degradation chemical pollution and aquifer depletion Amongst these decrease in plant genetic diversity is an irreversible loss As the basic raw material for future plant breeding plant genetic resources of foodgrains are the key to future food security Though plant breeding has attracted the attention of many authors plant genetic resources remain somewhat neglected This book gives an

overall perspective current status of genetic resource of important foodgrain crops wheat rice maize barley sorghum millets pulses and legumes and underutilized crops It provides a comprehensive compilation on current status of information on origin taxonomy diversity collection exchange evaluation utilization molecular characterization and conservation for food grain crops Eminent scientists and crop specialists have critically analyzed the information in view of the present and future research priorities In addition management issue related to plant genetic resources are also discussed At present such information on these crops is lacking and this book fills in the void It shall serve as reference for genetic resource managers researchers teachers students and policy makers in biology and agriculture *Cisgenic Crops: Potential and Prospects*

Anurag Chaurasia,Chittaranjan Kole,2022-07-17 This book is the first attempt for in depth compilation of current knowledge on cisgenic crops and their potential prospects as a sustainable substitute for the controversial genetically modified crops Innovative methodologies for the development of cisgenic crops for disease resistance improved nutritional contents suitability for organic farming survival under climate change and their role in conservation of plant genetic resources have been highlighted Combined with molecular markers and genome editing an advanced approach for crop improvement is reported The book has 14 chapters authored by globally leading experts on the subject This book is useful to the students teachers researchers and policy planners working across the disciplines of classical plant breeding up to the recent genetically modified and genome edited crops **Industrial Crop Plants** Nitish Kumar,2024-04-22 Industrial crops offer farmers new market opportunities to increase their revenue by producing high value products focusing on fiber forest and energy crops industrial oilseeds rubber and resins pharmaceuticals and more Technological innovations in agriculture have facilitated higher yields but conserving crop genetic resources and diversity remains crucial for sustainable agricultural production This poses a challenge that can be addressed through modern tools of biotechnology and genomics utilizing the wealth of sequenced plant genomes This book addresses the need for knowledge in managing the risks and conservation of genetic diversity associated with advanced technology It provides comprehensive coverage of plant genomics and biotechnology catering to post graduate students researchers employees of seed and biotechnology companies as well as instructors in plant genetics breeding and biotechnology fields *Advances in Plant Breeding Strategies: Agronomic, Abiotic and Biotic Stress Traits* Jameel M. Al-Khayri,Shri Mohan Jain,Dennis V. Johnson,2016-03-29 The basic concept of this book is to examine the use of innovative methods augmenting traditional plant breeding towards the development of new crop varieties under different environmental conditions to achieve sustainable food production This book consists of two volumes Volume 1 subtitled Breeding Biotechnology and Molecular Tools and Volume 2 subtitled Agronomic Abiotic and Biotic Stress Traits This is volume 2 which contains 18 chapters highlighting breeding strategies for specific plant traits including improved nutritional and pharmaceutical properties as well as enhanced tolerance to insects diseases drought salinity and temperature extremes expected under predicted global climate change **Breeding, Biotechnology and Seed**

Production of Field Crops Bidhan Roy, 2013-01-15 In modern days crop improvement is a multidisciplinary division of agriculture In this book entitled Breeding Biotechnology and Seed Production of Field Crops emphasis has been given on principles methods and practices in plant breeding biotechnology in crop improvement and seed production of field crops The book has been written for all sections of learners educators and staff members of seed industries Particular importance has been underlined for postgraduate students who specialize in plant breeding and seed science Each chapter of the book has been designed as per the recommended syllabus of Indian Council of Agricultural Research for the postgraduate students of various Agricultural Universities in our country This book has been divided into two major parts i Principles of crop breeding and ii Methods and practices of crop improvement and seed production of individual field crop The book contains total of 18 chapters First three chapters are related to shed light on the basic principles and remaining chapters deal with methods and practices of individual crop for improvement and seed production We hope that the book will be ready to lend a hand to the advanced undergraduate students doing plant breeding in elective postgraduate students who opted plant breeding teachers researchers and staff members of private seed companies of this field of specialization

Mutagenesis: exploring novel genes and pathways N.B. Tomlekova, M.I. Kozgar, M.R. Wani, 2023-08-07 Current successes in omics research have accelerated the production of high quality foods Various mutation methodologies have been developed to achieve this progress showing the importance of mutagenesis for food security Mutagenesis exploring novel genes and pathways describes the latest achievements in induced mutagenesis with a particular focus on the development of crops The book details experimental studies on functions of particular genes of interest the mechanisms involved in physiological processes and occurring chemical reactions Also the creation of new mutants and lines by use of genomic data banks is discussed The book will be of mutual interest to end users in modern breeding programs as well as to scientific research

Plant Breeding and Cultivar Development D. P. Singh, A. K. Singh, A. Singh, 2021-01-21 Plant Breeding and Cultivar Development features an optimal balance between classical and modern tools and techniques related to plant breeding Written for a global audience and based on the extensive international experience of the authors the book features pertinent examples from major and minor world crops Advanced data analytics machine learning phenomics and artificial intelligence are explored in the book's 28 chapters that cover classical and modern plant breeding By presenting these advancements in specific detail private and public sector breeding programs will learn about new effective and efficient implementation The insights are clear enough that non plant breeding majoring students will find it useful to learn about the subject while advanced level students and researchers and practitioners will find practical examples that help them implement their work Bridges the gap between conventional breeding practices and state of the art technologies Provides real world case studies of a wide range of plant breeding techniques and practices Combines insights from genetics genomics breeding science statistics computer science and engineering for crop improvement and cultivar development

Rediscovery of Genetic

and Genomic Resources for Future Food Security Romesh Kumar Salgotra, Sajad Majeed Zargar, 2020-01-28 This book describes how the latest genomic resources techniques can be efficiently used in plant breeding programmes to achieve food security in the future It also shares insights on how to utilize the untapped and unexplored genetic diversity of wild species wild relatives and landraces for crop improvement Moreover the book offers an impressive array of balanced analyses fresh ideas and perspectives and thoughtful and realistic proposals regarding the sustainable utilization of plant genetic resources with modern biotechnological techniques The first book to address the importance of plant genetics and genomic resources for food security it brings together a group of plant breeders and biotechnologists to investigate the use of genomic resources techniques in plant breeding programmes Providing essential information on the efficient utilization of genomic resources in precision breeding it offers a valuable asset for undergraduate and graduate students teachers and professionals engaged in related fields

Mutagenesis, Cytotoxicity and Crop Improvement Tariq Ahmad Bhat, 2021-01-11 Induced mutagenesis is a common and promising method for the screening of new crops with improved production methods and has made a tremendous contribution to crop improvement Now as the techniques of molecular biology become more widely adopted by plant breeders this comprehensive summary sets mutation breeding within a contemporary context and relates it to other breeding techniques This book opens a new chapter of inducing mutations at the gene level and details techniques that can be used to harvest and exploit such mutation to improve the productivity of crops particularly cereals grains and vegetables The chapters within this volume are supported by diagrams tables and graphs to make the content more comprehensible The book will be extremely useful for advanced undergraduates graduates postgraduate students and research scientists of botany agriculture horticulture genetics biotechnology biochemistry and agronomy

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