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# Biotechnology in Agriculture and Forestry

Edited by Toshiyuki Nagata  
Horst Lörz and Jack M. Widholm

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## **63** Molecular Genetic Approaches to Maize Improvement

Alan L. Kriz and Brian A. Larkins *Editors*

 Springer

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# Molecular Genetic Approaches To Maize Improvement Biotechnology In Agriculture Forestry

**Karin Nielsen-Saines**



## **Molecular Genetic Approaches To Maize Improvement Biotechnology In Agriculture Forestry:**

**Molecular Genetic Approaches to Maize Improvement** Alan L. Kriz, Brian A. Larkins, 2008-11-14 During the past decade there has been tremendous progress in maize biotechnology This volume provides an overview of our current knowledge of maize molecular genetics how it is being used to improve the crop and future possibilities for crop enhancement Several chapters deal with genetically engineered traits that are currently or soon will be in commercial production Technical approaches for introducing novel genes into the maize genome the regeneration of plants from transformed cells and the creation of transgenic lines for field production are covered Further the authors describe how molecular genetic techniques are being used to identify genes and characterize their function and how these procedures are utilized to develop elite maize germplasm Moreover molecular biology and physiological studies of corn as a basis for the improvement of its nutritional and food making properties are included Finally the growing use of corn as biomass for energy production is discussed *Molecular Genetic Approaches to Maize Improvement* Alan L. Kriz, Brian A. Larkins, 2008-11-04 During the past decade there has been tremendous progress in maize biotechnology This volume provides an overview of our current knowledge of maize molecular genetics how it is being used to improve the crop and future possibilities for crop enhancement Several chapters deal with genetically engineered traits that are currently or soon will be in commercial production Technical approaches for introducing novel genes into the maize genome the regeneration of plants from transformed cells and the creation of transgenic lines for field production are covered Further the authors describe how molecular genetic techniques are being used to identify genes and characterize their function and how these procedures are utilized to develop elite maize germplasm Moreover molecular biology and physiological studies of corn as a basis for the improvement of its nutritional and food making properties are included Finally the growing use of corn as biomass for energy production is discussed **Genetics, Genomics and Breeding of Maize** Ramakrishna Wusirika, Martin Bohn, Jinsheng Lai, Chittaranjan Kole, 2014-08-05 Sequencing of the maize genome has opened up new opportunities in maize breeding genetics and genomics research This book highlights modern trends in development of hybrids analysis of genetic diversity molecular breeding comparative and functional genomics epigenomics and proteomics in maize The use of maize in biofuels phytoremediation and pharmaceuticals is also highlighted Current research trends future research directions and challenges are discussed by a panel of experts from all over the world The Molecular and Physiological Basis of Nutrient Use Efficiency in Crops Malcolm J. Hawkesford, Peter Barraclough, 2011-06-20 Efforts to increase efficient nutrient use by crops are of growing importance as the global demand for food fibre and fuel increases and competition for resources intensifies The Molecular and Physiological Basis of Nutrient Use Efficiency in Crops provides both a timely summary of the latest advances in the field as well as anticipating directions for future research The Molecular and Physiological Basis of Nutrient Use Efficiency in Crops bridges the gap between agronomic practice and molecular biology by linking underpinning

molecular mechanisms to the physiological and agronomic aspects of crop yield. These chapters provide an understanding of molecular and physiological mechanisms that will allow researchers to continue to target and improve complex traits for crop improvement. Written by leading international researchers, *The Molecular and Physiological Basis of Nutrient Use Efficiency in Crops* will be an essential resource for the crop science community for years to come. *Special Features* coalesces current knowledge in the areas of efficient acquisition and utilization of nutrients by crop plants with emphasis on modern developments, addresses future directions in crop nutrition in the light of changing climate patterns including temperature and water availability, bridges the gap between traditional agronomy and molecular biology with focus on underpinning molecular mechanisms and their effects on crop yield, includes contributions from a leading team of global experts in both research and practical settings.

*Doubled haploid technology in maize breeding: theory and practice*, *Technological Interventions in Management of Irrigated Agriculture* Megh R. Goyal, Susmitha S. Nambuthiri, Richard Koech, 2018-01-31

With a roster of international contributors, this volume offers an abundance of solutions to address agricultural water management challenges in today's water scarce areas of the world. The authors present studies on farmer friendly irrigation scheduling methods, model based analysis of crop water requirements, ways to optimize surface irrigation systems and hydraulic design and management of surface water systems. The book goes on to highlight ways to improve soil properties by taking into account spatial, temporal and spectral variability in soil properties. The volume also covers various innovative research studies on soil and water productivity of vegetable cultivation under water stressed areas, application of coir geotextiles and the role of biofertilizers in controlling soil degradation and maintaining fertile topsoil. Crop management strategies to enhance the efficient use of marginal and saline lands for nonconventional crops are also discussed. The book is divided into four sections covering engineering interventions in irrigation management, technological interventions in management of soil properties, technological inventions for soil and water conservation, crop management for non conventional use. This volume will serve as an invaluable resource for academicians, researchers, engineers, agronomists, extension officers, students and farmers in the broad discipline of agricultural and biological engineering.

*Crop Production for Agricultural Improvement* Muhammad Ashraf, Münir Öztürk, Muhammad Sajid Aqeel Ahmad, Ahmet Aksoy, 2012-06-02

In the recent years, the looming food scarcity problem has highlighted plant sciences as an emerging discipline committed to devise new strategies for enhanced crop productivity. The major factors causing food scarcity are biotic and abiotic stresses such as plant pathogens, salinity, drought, flooding, nutrient deficiency or toxicity, which substantially limit crop productivity world wide. In this scenario, strategies should be adopted to achieve maximum productivity and economic crop returns. In this book, we have mainly focused on physiological, biochemical, molecular and genetic bases of crop development and related approaches that can be used for crop improvement under environmental adversities. In addition, the adverse effects of different biotic diseases, pathogens etc. and abiotic salinity, drought, high temperatures, metals etc. stresses on crop

development and the potential strategies to enhance crop productivity under stressful environments are also discussed

*Next-Generation Plant Breeding Approaches for Stress Resilience in Cereal Crops* Mallana Gowdra Mallikarjuna, S. Chandra Nayaka, Tanushri Kaul, 2022-09-15 This edited book highlights the gravity and efficacy of next generation breeding tools for the enhancement of stress resilience in cereals especially in the context of climate change pests diseases and abiotic stresses The content of the book helps in understanding the application of emerging genetic concepts and neoteric genomic approaches in cereal breeding It collates all the latest information about enhancing the stress resilience in cereal crops for overcoming food security issues Cereals have predominantly been used as a staple food since time immemorial and contribute more than 50% of the caloric requirement of the global population However in cereals the yield losses due to various stresses are very high considering the crop growth stage and stress sensitivity Therefore to feed and nourish the generations in the era of climate change it is imperative to develop stress resilient cereal cultivars This book explores newly developed next generation breeding tools viz genome wide association studies genomic prediction genome editing and accelerated generation advancement methodologies which revealed promising outcomes by enhancing the stress resilience in cereals with yield potential This book is useful for postgraduate students specializing in plant breeding plant stress physiology plant genomics agriculture and agronomy It is of immense value to scientific community involved in teaching research and extension activities related to cereal cultivation

*Rice Research for Quality Improvement: Genomics and Genetic Engineering* Aryadeep Roychoudhury, 2020-07-29 This book focuses on the conventional breeding approach and on the latest high throughput genomics tools and genetic engineering biotechnological interventions used to improve rice quality It is the first book to exclusively focus on rice as a major food crop and the application of genomics and genetic engineering approaches to achieve enhanced rice quality in terms of tolerance to various abiotic stresses resistance to biotic stresses herbicide resistance nutritional value photosynthetic performance nitrogen use efficiency and grain yield The range of topics is quite broad and exhaustive making the book an essential reference guide for researchers and scientists around the globe who are working in the field of rice genomics and biotechnology In addition it provides a road map for rice quality improvement that plant breeders and agriculturists can actively consult to achieve better crop production

**Plant Speed Breeding and High-throughput Technologies** Jen-Tsung Chen, 2024-08-26 The research field of plant speed breeding is promising to meet the future demand for crop improvement in an efficient and effective manner The process accelerates breeding and research programs through the shortening of the generation time of crops Plant Speed Breeding and High Throughput Technologies explores and analyzes a range of innovations from CRISPR Cas9 based genome editing to state of the art controlled environment growth chambers The book integrates achievements of plant speed breeding technologies with an emphasis on the fundamental and advanced systems for genome editing functional genomics controlled environment growth chambers genomic and phenotypic selection methods and high throughput technologies It examines the applications

of technologies across major model plants and key crops such as cereals vegetables and fruit trees The book explores high throughput genotyping using next generation sequencing systems enabling precise single nucleotide polymorphism markers quantitative trait loci mapping and genome wide association studies These tools are used in identifying candidate genes that will revolutionize crop breeding as they are capable of tolerating complex abiotic and biotic stresses induced by global climate change Serving as an ideal reference on plant speed breeding technologies this book is for graduate students teachers researchers and experts in the fields of plant sciences and plant breeding as well as agronomy and agriculture

Genomics and Breeding for Climate-Resilient Crops Chittaranjan Koley, 2013-06-18 Climate change is expected to have a drastic impact on agronomic conditions including temperature precipitation soil nutrients and the incidence of disease pests to name a few To face this looming threat significant progress in developing new breeding strategies has been made over the last few decades The first volume of Genomics and Breeding for Climate Resilient Crops presents the basic concepts and strategies for developing climate resilient crop varieties Topics covered include conservation evaluation and utilization of biodiversity identification of traits genes and crops of the future genomic and molecular tools genetic engineering participatory and evolutionary breeding bioinformatics tools to support breeding funding and networking support and intellectual property regulatory issues social and political dimensions

**Multiple abiotic stresses: Molecular, physiological, and genetic responses and adaptations in cereals** Sindhu Sareen, Nabin Bhusal, Ranjeet Ranjan Kumar, Pradeep Sharma, 2023-04-05 Plant Breeding Reviews, Volume 39 Jules Janick, 2015-08-20 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 The emphasis of the series is on methodology a fundamental understanding of crop genetics and applications to major crops It is a serial title that appears in the form of one or two volumes per year

Methods of Hybrid Seed Production in Major Crops Sajad Hussain Dar, 2018-05-30 Methods of Hybrid Seed Production in Major Crops discusses how heterocyst or hybrid vigor can play a major role in improving crop productivity and quality in order to feed the ever increasing human population particularly in developing countries Plant breeders agronomists seed producers and farmers will discover why the development of hybrids in the world s major food crops and why the methods of hybrid seed production are critical for achieving this goal This landmark book deals with methods of hybrid seed production of major crops such as rice maize wheat sorghum and pearl millet barley Mustard and vegetable crops Further this book will provide valuable information regarding the recent techniques utilized for hybrid development and various latest approaches that can be an essential tool for heterocyst Through Methods of Hybrid Seed Production in Major Crops you will discover valuable information on hybrid seed production methods This unique book contains relevant and essential information about important procedures to help increase crop yield

including Methods for hybrid seed production in rice Possibilities for hybrid seed production in wheat Techniques of hybrid maize seed production Techniques of hybrid sorghum seed production Techniques of hybrid barley seed production Methods of hybrid seed production in Pearl millet Methods of hybrid seed production in oil seed mustard Methods of hybrid seed production in vegetables Recent techniques for crop improvement in cereal crops Advanced genetic tools and heterocyst

*Plant Biotechnology for Sustainable Production of Energy and Co-products* Peter N. Mascia, Jürgen Scheffran, Jack M. Widholm, 2010-09-15 This book is a collection of chapters concerning the use of biomass for the sustainable production of energy and chemicals an important goal that will help decrease the production of greenhouse gases to help mitigate global warming provide energy security in the face of dwindling petroleum reserves improve balance of payment problems and spur local economic development Clearly there are ways to save energy that need to be encouraged more These include more use of energy sources such as among others manure in anaerobic digesters waste wood in forests as fuel or feedstock for cellulosic ethanol and conservation reserve program CRP land crops that are presently unused in the US The use of biofuels is not new Rudolf Diesel used peanut oil as fuel in the first engines he developed Chap 8 and ethanol was used in the early 1900s in the US as automobile fuel Songstad et al 2009 Historical perspective of biofuels learning from the past to rediscover the future In Vitro Cell Dev Biol Plant 45 189 192 Brazil now produces enough sugar cane ethanol to make up about 50% of its transportation fuel needs Chap 4 The next big thing will be cellulosic ethanol At present there is also the use of Miscanthus x giganteus as fuel for power plants in the UK Chap 2 bagasse sugar cane waste to power sugar cane mills Chap 4 and waste wood and sawdust to power sawmills Chap 7 **Plant Nutrient Dynamics in Stressful Environments** Urs

Feller, Stanislav Kopriva, Valya Vassileva, 2018-09-20 This book is a printed edition of the Special Issue Plant Nutrient Dynamics in Stressful Environments that was published in Agriculture **Plant Breeding in the Omics Era** Rodomiro Ortiz Ríos, 2015-09-16 The field of plant breeding has grown rapidly in the last decade with breakthrough research in genetics and genomics inbred development population improvement hybrids clones self pollinated crops polyploidy transgenic breeding and more This book discusses the latest developments in all these areas but explores the next generation of needs and discoveries including omics beyond genomics cultivar seeds and intellectual and property rights This book is a leading edge publication of the latest results and forecasts important areas of future needs and applications Advances in breeding techniques for cereal crops Prof Frank Ordon, Prof. Wolfgang Friedt, 2019-06-28 Assesses performance of conventional techniques such as backcross and hybrid breeding in introducing new traits Maps current progress in methods to identify quantitative trait loci QTL linking phenotypic traits with genetic information for selection Shows comparative strengths and weaknesses of marker assisted selection MAS techniques such as genome wide association studies GWAS and nested association mapping NAM *Genetically Modified Food and Global Welfare* Colin Carter, Ian Sheldon, GianCarlo Moschini, 2011-07-25 This volume brings together fresh insights from top agricultural economists in the areas of consumer

attitudes environmental impacts policy and regulation trade investment food security and development in an attempt to provide a new perspective on the most pressing policy questions facing GM technology     *Harsh Environment and Plant Resilience* Azamal Husen, 2021-04-02 In the recent past threats from climate change and unforeseeable environmental extremes to plant growth and productivity have consistently increased The climate change driven effects especially from unpredictable environmental fluctuations can result in an increased prevalence of abiotic and biotic stresses in plants These stresses have slowed down the global yields of crop plants On the other hand food security for the rapidly growing human population in a sustainable ecosystem is a major concern of the present day world Thus understanding the core developmental physiological and molecular aspects that regulate plant growth and productivity in a challenging environment is a pivotal issue to be tackled by the scientific community dealing with sustainable agricultural and horticultural practices Plants are influenced by the adverse environmental conditions at various levels their different and diverse responses play a significant role in determining their growth production and the overall geographical distribution The chapters in this book focus on the biological mechanisms and fundamental principles that determine how different plant species grow perform and interact with a challenging environment This book covers a broad range of topics in plant science including gene function molecules physiology cell biology and plant ecology to understand the functioning of plants under harsh environmental conditions The book elucidates the physiological and molecular mechanisms in different plant species ecophysiological interactions of plants interplay between plant roots arbuscular mycorrhizal fungi and plant growth promoting rhizobacteria biosensors for monitoring stress production of secondary metabolites stress alleviation processes and more



## Unveiling the Power of Verbal Beauty: An Emotional Sojourn through **Molecular Genetic Approaches To Maize Improvement Biotechnology In Agriculture Forestry**

In a world inundated with screens and the cacophony of quick connection, the profound energy and psychological resonance of verbal artistry usually disappear in to obscurity, eclipsed by the constant barrage of noise and distractions. Yet, nestled within the musical pages of **Molecular Genetic Approaches To Maize Improvement Biotechnology In Agriculture Forestry**, a charming perform of literary elegance that pulses with organic feelings, lies an memorable trip waiting to be embarked upon. Written with a virtuoso wordsmith, that magical opus books visitors on a mental odyssey, delicately exposing the latent possible and profound impact embedded within the intricate internet of language. Within the heart-wrenching expanse of this evocative analysis, we will embark upon an introspective exploration of the book is key themes, dissect their charming publishing fashion, and immerse ourselves in the indelible effect it leaves upon the depths of readers souls.

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