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Molecular Breeding for Sustainable Crop Improvement

Volume 2

Molecular Breeding For Sustainable Crop Improvement

Volume 2 Sustainable Development And Biodiversity

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Molecular Breeding For Sustainable Crop Improvement Volume 2 Sustainable Development And Biodiversity:

Molecular Breeding for Sustainable Crop Improvement Vijay Rani Rajpal, S. Rama Rao, S.N. Raina, 2016-02-02 The world population is estimated to reach to more than 10 billion by the year 2050. These projections pose a challenging situation for the agricultural scientists to increase crops productivity to meet the growing food demands. The unavailability and/or inaccessibility to appropriate gene pools with desired traits required to carry out genetic improvement of various crop species make this task formidable for the plant breeders. Incidentally, most of the desired genes reside in the wild genetic relatives of the crop species. Therefore, exploration and characterization of wild genetic resources of important crop species is vital for the efficient utilization of these gene pools for sustainable genetic improvements to assure food security. Further understanding the myriad complexities of genic and genomic interactions among species, more particularly of wild relatives of crop species and/or phylogenetically distant germplasm, can provide the necessary inputs to increase the effectiveness of genetic improvement through traditional and/or genetic engineering methods. This book provides comprehensive and latest insights on the evolutionary genesis of diversity, access and its utilization in the evolution of various crop species. A comprehensive account of various crops, origin, exploitation of the primary, secondary and tertiary gene pools through breeding, biosystematics, cytogenetics and molecular phylogenetic relationships and genetic enhancement through biotechnological interventions among others have been provided as the necessary underpinnings to consolidate information on the effective and sustainable utilization of the related genetic resources. The book stresses upon the importance of wild germplasm exploration, characterization and exploitation in the assimilation of important crop species. The book is especially intended for students and scientists working on the genetic improvement of crop species. Plant Breeders, Geneticists, Taxonomists, Molecular Biologists and Plant Biotechnologists working on crop species are going to find this book very useful.

Biotechnologies of Crop Improvement, Volume 3 Satbir Singh Gosal, Shabir Hussain Wani, 2018-08-09 During the past 15 years, cellular and molecular approaches have emerged as valuable adjuncts to supplement and complement conventional breeding methods for a wide variety of crop plants. Biotechnology increasingly plays a role in the creation, conservation, characterization and utilization of genetic variability for germplasm enhancement. For instance, anther microspore culture, somaclonal variation, embryo culture and somatic hybridization are being exploited for obtaining incremental improvement in the existing cultivars. In addition, genes that confer insect and disease resistance, abiotic stress tolerance, herbicide tolerance and quality traits have been isolated and re-introduced into otherwise sensitive or susceptible species by a variety of transgenic techniques. Together, these transformative methodologies grant access to a greater repertoire of genetic diversity as the genes may come from viruses, bacteria, fungi, insects, animals, human beings, unrelated plants or even be artificially derived. Remarkable achievements have been made in the production, characterization, field evaluation and commercialization of transgenic crop varieties worldwide. Likewise, significant advances have been made

towards increasing crop yields improving nutritional quality enabling crops to be raised under adverse conditions and developing resistance to pests and diseases for sustaining global food and nutritional security The overarching purpose of this 3 volume work is to summarize the history of crop improvement from a technological perspective but to do so with a forward outlook on further advancement and adaptability to a changing world Our carefully chosen case studies of important plant crops intend to serve a diverse spectrum of audience looking for the right tools to tackle complicated local and global issues

Biotechnology Innovations and Sustainability for Zero Hunger Ranbir Chander Sobti, 2025-07-30 This reference book extensively examines the important role of biotechnology in tackling the global challenge of achieving zero hunger The book delves into cutting edge advancements and challenges in food biotechnology crop improvement genetic engineering and the utilization of genetically modified organisms GMOs in sustainable agriculture It provides a detailed examination of biotechnological interventions aimed at enhancing the nutritional content of crops increasing agricultural productivity and ensuring food security Furthermore the book explores the application of biotechnological techniques in improving animal based foods including advancements in animal breeding genetics and disease resistance The chapters also address the integration of traditional breeding approaches with biotechnology for developing healthier and more productive crops Additionally the book introduces approaches for reduction of food waste through technological solutions and the use of automation and robotics in food processing This book is useful for researchers academicians and professionals of biotechnology agriculture food science and sustainability Key Features Covers cutting edge biotechnological technologies for sustainable agriculture providing solutions to address global hunger and achieve the goal of zero hunger Discusses various crop improvement techniques including genetic engineering and genetically modified organisms Focuses on biotechnological interventions for enhancing crop productivity and nutritional value to improve food availability and quality Presents a detailed discussion of crop protection strategies and disease resistance mechanisms Provides a thorough examination of advanced technologies for improving animal based foods and technology based artificial meat Examines the application of biotechnological techniques in developing innovative food systems for reducing food waste

Genomic Prediction of Complex Traits Nourollah Ahmadi, Jérôme Bartholomé, 2022-04-22 This volume explores the conceptual framework and the practical issues related to genomic prediction of complex traits in human medicine and in animal and plant breeding The book is organized into five parts Part One reminds molecular genetics approaches intending to predict phenotypic variations Part Two presents the principles of genomic prediction of complex traits and reviews factors that affect its reliability Part Three describes genomic prediction methods including machine learning approaches accounting for different degree of biological complexity and reviews the associated computer packages Part Four reports on emerging trends such as phenomic prediction and incorporation into genomic prediction models of omics data and crop growth models Part Five is dedicated to lessons learned from cases studies in the fields of human health and animal and plant breeding and to methods for analysis of

the economic effectiveness of genomic prediction Written in the highly successful Methods in Molecular Biology series format the book provides theoretical bases and practical guidelines for an informed decision making of practitioners and identifies pertinent routes for further methodological researches Cutting edge and thorough Complex Trait Predictions Methods and Protocols is a valuable resource for scientists and researchers who are interested in learning more about this important and developing field Chapters 3 9 13 14 and 21 are available open access under a Creative Commons Attribution 4.0 International License via link [springer.com](https://www.springer.com)

Beyond the Blueprint - Decoding the Elegance of Gene Expression Kenji Ikehara, Morteza Seifi, 2024-12-19 *Beyond the Blueprint* Decoding the Elegance of Gene Expression is a captivating exploration into the fundamental processes that underpin the intricate workings of life itself Delving deep into the realm of genetics this book unveils the mesmerizing world of gene expression the remarkable mechanism by which the information encoded in our DNA is translated into functional proteins and ultimately shapes every aspect of our being With a keen focus on the crucial players in this symphony of life readers will embark on a journey to uncover the core elements of gene expression From the orchestration of transcription factors and RNA polymerases at promoter regions to the influence of epigenetic modifications on gene regulation the book paints a comprehensive and accessible picture of this dynamic process As the narrative unfolds readers will be captivated by the role of non coding RNA in gene regulation and how environmental factors can subtly alter gene expression patterns Moreover the book delves into the interplay of gene expression during embryonic development illuminating the incredible transformations that occur as cells differentiate into specialized tissues Embracing the forefront of scientific advancements *Beyond the Blueprint* Decoding the Elegance of Gene Expression also examines the revolutionary realm of genetic engineering showcasing how we can now manipulate gene expression for potential therapeutic applications and reshape the course of human evolution With clarity and enthusiasm this book seeks to demystify the complexities of gene expression appealing to both seasoned researchers and curious minds alike *Beyond the Blueprint* Decoding the Elegance of Gene Expression promises to inspire a profound appreciation for the elegance of gene expression and its profound impact on the unfolding story of life

Achieving sustainable cultivation of sugarcane
Volume 2 Prof. Philippe Rott, 2018-03-05 Covers key advances in breeding including conventional marker assisted and transgenic breeding techniques Summarises key advances in understanding bacterial fungal and viral diseases of sugarcane Assesses best practice in integrated disease pest and weed management

Genomics Assisted Breeding of Crops for Abiotic Stress Tolerance, Vol. II Vijay Rani Rajpal, Deepmala Sehgal, Avinash Kumar, S.N. Raina, 2019-07-01 The abiotic stresses like drought temperature cold salinity heavy metals etc affect a great deal on the yield performance of the agricultural crops To cope up with these challenges plant breeding programs world wide are focussing on the development of stress tolerant varieties in all crop species Significant genomic advances have been made for abiotic stress tolerance in various crop species in terms of availability of molecular markers QTL mapping genome wide association studies GWAS

genomic selection GS strategies and transcriptome profiling The broad range of articles involving genomics and breeding approaches deepens our existing knowledge about complex traits The chapters are written by authorities in their respective fields This book provides comprehensive and consolidated account on the applications of the most recent findings and the progress made in genomics assisted breeding for tolerance to abiotic stresses in many important major crop species with a focus on applications of modern strategies for sustainable agriculture The book is especially intended for students molecular breeders and scientists working on the genomics assisted genetic improvement of crop species for abiotic stress tolerance

Routledge Handbook of Agricultural Biodiversity Danny Hunter, Luigi Guarino, Charles Spillane, Peter C.

McKeown, 2017-10-03 The world relies on very few crop and animal species for agriculture and to supply its food needs In recent decades there has been increased appreciation of the risk this implies for food security and quality especially in times of environmental change As a result agricultural biodiversity has moved to the top of research and policy agendas This Handbook presents a comprehensive overview of our current knowledge of agricultural biodiversity in a series of specially commissioned chapters It draws on multiple disciplines including plant and animal genetics ecology crop and animal science food studies and nutrition as well as social science subjects which explore the socio economic cultural institutional legal and policy aspects of agricultural biodiversity It focuses not only on the core requirements to deliver a sustainable agriculture and food supply but also highlights the additional ecosystem services provided by a diverse and resilient agricultural landscape and farming practices The book provides an indispensable reference textbook for a wide range of courses in agriculture ecology biodiversity conservation and environmental studies

Integrating Advanced High-throughput Technologies to Improve Plant Resilience to Environmental Challenges Freddy Mora-Poblete, Sigfredo Fuentes, Parviz Heidari, 2023-06-28 High throughput technologies are those that allow the generation of large scale data related to omic analysis such as genomics transcriptomics proteomics phenomics and metabolomics Currently the development and use of these technologies has gone hand in hand with the development of bioinformatics tools which have allowed the integration of omics based data to understand crucial knowledge about the molecular systems that underlie the various functions of the plants In recent years there has been a huge development in the field of high throughput biology which is attributed to an era of tech startups Genomics studies in plants for instance have benefited from advances in high throughput technologies such as high throughput genotyping which have allowed us to investigate the regulation and function of thousands of genes and genomic regions involved in a novel adaptation In fact with current high throughput technologies it is possible to recover substantial portions of the plant diversity which is a key input for genetic improvement programs food security and conservation programs The integration of multilevel biological data involving investigations at the molecular level in genomics transcriptomics proteomics and metabolomics among others have allowed more comprehensive studies which broadens the opportunities to clarify key molecular aspects involved in the physiological responses to abiotic stresses

Gene Pool Diversity and Crop Improvement Vijay Rani Rajpal, S. Rama Rao, S.N. Raina, 2016-02-02 The world population is estimated to reach to more than 10 billion by the year 2050 These projections pose a challenging situation for the agricultural scientists to increase crops productivity to meet the growing food demands The unavailability and or inaccessibility to appropriate gene pools with desired traits required to carry out genetic improvement of various crop species make this task formidable for the plant breeders Incidentally most of the desired genes reside in the wild genetic relatives of the crop species Therefore exploration and characterization of wild genetic resources of important crop species is vital for the efficient utilization of these gene pools for sustainable genetic improvements to assure food security Further understanding the myriad complexities of genic and genomic interactions among species more particularly of wild relatives of crop species and or phylogenetically distant germplasm can provide the necessary inputs to increase the effectiveness of genetic improvement through traditional and or genetic engineering methods This book provides comprehensive and latest insights on the evolutionary genesis of diversity access and its utilization in the evolution of various crop species A comprehensive account of various crops origin exploitation of the primary secondary and tertiary gene pools through breeding biosystematical cytogenetical and molecular phylogenetical relationships and genetic enhancement through biotechnological interventions among others have been provided as the necessary underpinnings to consolidate information on the effective and sustainable utilization of the related genetic resources The book stresses upon the importance of wild germplasm exploration characterization and exploitation in the assimilation of important crop species The book is especially intended for students and scientists working on the genetic improvement of crop species Plant Breeders Geneticists Taxonomists Molecular Biologists and Plant Biotechnologists working on crop species are going to find this book very useful

North American Crop Wild Relatives, Volume 2 Stephanie L. Greene, Karen A. Williams, Colin K. Khoury, Michael B. Kantar, Laura F. Marek, 2019-03-14 The plant species that humans rely upon have an extended family of wild counterparts that are an important source of genetic diversity used to breed productive crops These wild and weedy cousins are valuable as a resource for adapting our food forage industrial and other crops to climate change Many wild plant species are also directly used especially for revegetation and as medicinal and ornamental plants North America is rich in these wild plant genetic resources This book is a valuable reference that describes the important crop wild relatives and wild utilized species found in Canada the United States and Mexico The book highlights efforts taken by these countries to conserve and use wild resources and provides essential information on best practices for collecting and conserving them Numerous maps using up to date information and methods illustrate the distribution of important species and supplement detailed description on the potential value these resources have to agriculture as well as their conservation statuses and needs There is broad recognition of the urgent need to conserve plant diversity however a small fraction of wild species is distinguished by their potential to support agricultural production Many of these species are common even weedy and are easily overshadowed by

rare or endangered plants Nevertheless because of their genetic proximity to agriculturally important crops or direct use they deserve to be recognized celebrated conserved and made available to support food and agricultural security This comprehensive two volume reference will be valuable for students and scientists interested in economic botany and for practitioners at all levels tasked with conserving plant biodiversity

Achieving sustainable cultivation of wheat
Volume 2 Prof. Peter Langridge, 2017-07-31 Reviews advances in cultivation practice such as seed establishment and more efficient irrigation techniques Summarises developments in climate smart agriculture such as conservation tillage and organic wheat cultivation Discusses ways of supporting smallholders improve wheat cultivation in North Africa and other regions in the developing world *Plant Stress Tolerance* Kareem A. Mosa, Ahmed Ismail, Mohamed Helmy, 2017-06-24 Providing a comprehensive overview of cutting edge research on Omics applications in plant sciences field *Plant Stress Tolerance* focuses on different approaches towards plant stress tolerance including both biotic stresses and abiotic stresses This book outlines the challenges facing this area of research with solid up to date information for graduate students academic scientists and researchers on using the recent advances of Omics technologies on plant stresses *Biodiversity and Genetic Improvement of Herbs and Spices* Jameel M. Al-Khayri, Shri Mohan Jain, Suprasanna Penna, 2025-04-12 The herbs and spices plants have immensely benefited humankind since ancient times for therapeutic cosmetic and nutritional properties The wealth of information on genetic resources breeding conservation propagation cultivation and biotechnological strategies is crucial for plant improvement This volume consists of 19 chapters covering research advances in conventional and modern breeding technologies of various important herbs and spices individually including Basil Bay leaf Cinnamon Coriander Dill Lemongrass Long pepper Nutmeg Onion Oregano Parsley Pepper Saffron Sage Sesame Tarragon Thyme Common turmeric and Scentless turmeric Chapters are written by globally renowned scientists and subjected to a rigorous review process to ensure quality presentation and scientific precision Each chapter has an introduction covering related backgrounds and provides an in depth discussion of the subject supported with high quality color photos illustrations and relevant data The chapter concludes with future research directions and pertinent references to facilitate further reading The book is an excellent reference source for plant breeders biotechnologists and geneticists engaged in breeding and improvement The book is suitable for both advanced undergraduate and postgraduate students specializing in agriculture biotechnology and molecular breeding as well as for seed companies

The Date Palm Genome, Vol. 2 Jameel M. Al-Khayri, S. Mohan Jain, Dennis V. Johnson, 2021-06-12 This book is the first comprehensive assemblage of contemporary knowledge relevant to genomics and other omics in date palm Volume 2 consists of 11 chapters Part I Nutritional and Pharmaceuticals Properties covers the utilization of date palm as an ingredient of various food products a source of bioactive compounds and the production of nanomaterials Part II Omics Technologies addresses omics resources proteomics and metabolomics Part III Molecular Breeding and Genome Modification focuses on genetic improvement technologies based on

mutagenesis quantitative traits loci and genome editing Part IV Genomics of Abiotic and Biotic Stress covers metagenomics of beneficial microbes to enhance tolerance to abiotic stress and the various genomics advances as they apply to insect control This volume represents the efforts of 34 international scientists from 12 countries and contains 65 figures and 19 tables to illustrate presented concepts Volume 1 is published under the title **Phylogeny Biodiversity and Mapping Omics Approaches for Sugarcane Crop Improvement** Rajarshi Kumar Gaur,2022-12-30 In this book the information encompasses various researchable biotechnology aspects of sugarcane its genomic structure diversity comparative and structural genomics data mining etc This book explores both the theoretical and practical aspects of sugarcane crops focusing on innovative processes This book argues in favor of developing an integrated research and development system to strengthen the research and development capabilities of all the areas of sugarcane Further it covers the recent trends of sugarcane biotechnology especially in the next generation sequencing NGS era This book will be very useful for professors and scientists who are working in the area of sugarcane crops by using molecular biology and bioinformatics It is also useful for students to use as a reference for their classes or thesis projects Key features Discusses an integral part of molecular biology and pivotal tools for molecular breeding enables breeders to design cost effective and efficient breeding strategies for sugarcane Discusses the harnessing genomics technologies for genetic engineering and pathogen characterization and diagnosis of sugarcane Provides new examples and problems added where needed Provides insight from contributors drawn from around the globe

Plant Molecular Breeding in Genomics Era Jameel M. Al-Khayri,Krishnananda Pralhad Ingle,Shri Mohan Jain,Suprasanna Penna,2024-12-21 Advances in plant genomics plant molecular biology and genome editing have revolutionized opportunities for more efficient plant breeding Successful application requires a concrete understanding of the concepts Molecular Plant Breeding is an interface of issues from basic concepts to applications to crop improvement The tools include molecular marker technology gene mapping genetic transformation precise gene editing and climate smart agriculture This book provides a comprehensive coverage of molecular tools and methodologies that should be integrated within plant breeding programs for the improvement of crop plants The book covers all relevant areas of molecular breeding in plants with concepts and tools of relevance to plant genomics research and advanced molecular breeding Chapters comprehensively review the contemporary literature on the subject and reflect the experiences of the authors Each chapter emphasizes introduction covering related backgrounds and provides in depth discussion of the subject supported with high quality color illustrations and relevant data Chapters conclude with future research perspective and a comprehensive list of pertinent references

Achieving sustainable cultivation of grain legumes Volume 1 Dr Shoba Sivasankar,Dr David Bergvinson,Dr Pooran Gaur,Dr Shiv Kumar Agrawal,Dr Steve Beebe,Dr Manuele Tamò,2018-03-12 Reviews key developments in understanding crop physiology and genetic diversity and how they have informed advances in breeding new varieties Coverage of advances across the value chain for grain legume cultivation from variety selection to

post harvest storage Discusses the latest trends in disease insect pest and weed management **Sustainable Horticulture Development and Nutrition Security (Vol. 3)** Prem Nath,2018-01-01 We all are indebted to nature for providing us food and its resources for our subsistence and survival In the food domain cereal and legume grains occupy the front line whereas horticultural crops have occupied the second line of defense For healthy diet cereals and legumes provide us with carbohydrates and protein whereas fruits and vegetables provide us minerals and vitamins Both macro and micro nutrients are essential for human growth and development The fruits and vegetables are the major source of micro nutrients It is estimated that up to 2.7 million lives could potentially be saved each year if fruit and vegetable production was sufficiently increased Both at national and international levels food and agriculture horticulture development plans and estimates are basically developed framed and implemented and narrowed down to cereal production In the present context of attaining nutrition security this mode of thinking on food needs to be changed to nutrients which will include necessarily all those crops including fruit and vegetables which provide all macro and micro nutrients to ensure balanced nutrition needed for good human health The present publication has attempted to reflect and discuss the above views and ideas on the subject of sustainable horticulture development and nutrition security in nine chapters with 32 articles by 32 authors **Epilogue, Vol 2, Issue 4 ,**

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