

# **In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture**

Mulberry (*Morus* spp.) is an important horticultural plant in the sericulture industry. It belongs to the family Moraceae. The leaf of mulberry is used to feed the silkworm *Bombyx mori* L. It is also used as a fodder. Due to its economic and agricultural importance, mulberry is cultivated in many parts of the world. An estimated 60% of the total cost of silk cocoon production is for production and maintenance of mulberry plants. Therefore, much attention is needed to improve the quality and quantity of mulberry leaves. It is vital to increase the production of superior quality mulberry leaves with high nutritive value for the sericulture industry. Although a lot of research is going on in mulberry, very little effort has been made to compile the results of this research in a single book. This book provides an update of recent research works going on in this plant. It describes the taxonomy, conservation of germplasm, genetic diversity of various mulberry species, application of breeding techniques to improve the quality of mulberry, in vitro conservation, application of tissue culture techniques to improve mulberry species, production of haploids and triploids in mulberry and improvement of abiotic stress adaptive traits in mulberry with relevance to adaptiveness to global warming.

This manual provides all relevant protocols for basic and applied plant cell and molecular technologies, such as histology, electron microscopy, cytology, virus diagnosis, gene transfer

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

and PCR. Also included are chapters on laboratory facilities, operation and management as well as a glossary and all the information needed to set up and carry out any of the procedures without having to use other resource books. It is especially designed for professionals and advanced students who wish to acquire practical skills and first-hand experience in plant biotechnology.

The importance of haploids is well known to geneticists and plant breeders. The discovery of anther-derived haploid *Datura* plants in 1964 initiated great excitement in the plant breeding and genetics communities as it offered shortcuts in producing highly desirable homozygous plants. Unfortunately, the expected revolution was slow to materialise due to problems in extending methods to other species, including genotypic dependence, recalcitrance, slow development of tissue culture technologies and a lack of knowledge of the underlying processes. Recent years have witnessed great strides in the research and application of haploids in higher plants. After a lull in activities, drivers for the resurgence have been: (1) development of effective tissue culture protocols, (2) identification of genes controlling embryogenesis, and (3) large scale and wide spread commercial up-take in plant breeding and plant biotechnology arenas. The first major international symposium on "Haploids in Higher Plants" took place in Guelph, Canada in 1974. At that time there was much excitement about the potential benefits, but in his opening address Sir Ralph Riley offered the following words of caution: "I believe that it is quite likely that haploid research will contribute cultivars to agriculture in several crops in the future. However, the more extreme claims of the enthusiasts for haploid breeding must be treated with proper caution. Plant breeding is subject from time to time to sweeping claims from enthusiastic proponents of new procedures.

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

Since the beginning of agricultural production, there has been a continuous effort to grow more and better quality food to feed ever increasing populations. Both improved cultural practices and improved crop plants have allowed us to divert more human resources to non-agricultural activities while still increasing agricultural production. Malthusian population predictions continue to alarm agricultural researchers, especially plant breeders, to seek new technologies that will continue to allow us to produce more and better food by fewer people on less land. Both improvement of existing cultivars and development of new high-yielding cultivars are common goals for breeders of all crops. In vitro haploid production is among the new technologies that show great promise toward the goal of increasing crop yields by making similar germplasm available for many crops that was used to implement one of the greatest plant breeding success stories of this century, i. e. , the development of hybrid maize by crosses of inbred lines. One of the main applications of anther culture has been to produce diploid homozygous pure lines in a single generation, thus saving many generations of backcrossing to reach homozygosity by traditional means or in crops where self-pollination is not possible. Because doubled haploids are equivalent to inbred lines, their value has been appreciated by plant breeders for decades. The search for natural haploids and methods to induce them has been ongoing since the beginning of the 20th century.

Breeding Oilseed Crops for Sustainable Production: Opportunities and Constraints presents key insights into accelerating the breeding of sustainable and superior varieties. The book explores the genetic engineering/biotechnology that has played a vital role in transforming economically important traits from distant/wild species to cultivated varieties, enhancing the quality and quantity of oil and seed yield production. Integrated nutrient management, efficient

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

water management, and forecasting models for pests diseases outbreaks and integrated pest and pest management have also added new dimensions in breeding for sustainable production. With the rise in demand, the scientific community has responded positively by directing a greater amount of research towards sustainable production both for edible and industrial uses. Covering the latest information on various major world oil crops including rapeseed mustard, sunflower, groundnut, sesame, oilpalm, cotton, linseed/flax, castor and olive, this book brings the latest advances together in a single volume for researchers and advanced level students. Describes various methods and systems to achieve sustainable production in all major oilseed crops Addresses breeding, biology and utilization aspects simultaneously including those species whose information is not available elsewhere Includes information on modern biotechnological and molecular techniques and production technologies Relevant for international government, industrial and academic programs in research and development

Plant Protoplasts covers the techniques involved with, and uses of, protoplast technology. The book discusses isolation, fusion, and culture of higher plant protoplasts, lower plant protoplasts, and blue-green algal protoplast. The text also describes the production of haploid protoplasts from developing pollen grains; the use of protoplasts in mutant selection schemes, and the development of protoplast systems for use with monocotyledonous plants. The book will be invaluable to plant technologists, botanists, biochemists, research workers as well as advanced students interested in gaining a background knowledge of the field.

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

In Vitro Haploid Production in Higher Plants Volume 2: Applications Springer Science & Business Media

Production of food to meet the demands of an ever-increasing human population in the world is the major task and challenge to agriculture today. The conventional methods of plant breeding alone can no longer cope with the situation. The success of any crop improvement program depends on the extent of genetic variability in the base population, but due to denuding of forests and agricultural land, the naturally occurring pool of germplasm is being depleted. An urgent need is therefore apparent to create new variability and increase the genetic base of agricultural crops. Agricultural biotechnology has progressed to a stage in the production of plants where specific characteristics to improve their yield, appearance, disease-resistance, nutritional quality and adaptation to adverse soil conditions can be built into the seed. This concept of built-in quality implies a continuous scientific endeavour to improve plant characters using a wide range of possibilities, and it also implies a scrutiny of the materials and methods available in the world today.

Since the beginning of agricultural production, there has been a continuous effort to grow more and better quality food to feed ever increasing populations. Both improved cultural practices and improved crop plants have allowed us to divert more human resources to non-agricultural activities while still increasing agricultural production. Malthusian population predictions continue to alarm agricultural researchers, especially

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

plant breeders, to seek new technologies that will continue to allow us to produce more and better food by fewer people on less land. Both improvement of existing cultivars and development of new high-yielding cultivars are common goals for breeders of all crops. In vitro haploid production is among the new technologies that show great promise toward the goal of increasing crop yields by making similar germplasm available for many crops that was used to implement one of the greatest plant breeding success stories of this century, i. e. , the development of hybrid maize by crosses of inbred lines. One of the main applications of anther culture has been to produce diploid homozygous pure lines in a single generation, thus saving many generations of backcrossing to reach homozygosity by traditional means or in crops where self-pollination is not possible. Because doubled haploids are equivalent to inbred lines, their value has been appreciated by plant breeders for decades. The search for natural haploids and methods to induce them has been ongoing since the beginning of the 20th century.

Covers research achievements in the fields of developmental biology, physiology, and pathology. Chapters discuss sericulture techniques, cocoons, dormancy and hormones, clones, the apple biting silkworm, the sable mutation, separation of male and female eggs, and genetic engineering. An appendix explains the technical terminology.

Numerous illustra

Deals with the historical perspectives and the current status of doubled haploid

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

production along with its practical implications in basic and applied research. It highlights various haploid production methods with a comprehensive discussion on their pros and cons, bottlenecks, and embryogenic pathways. The review also describes in detail the results of molecular and genomic studies conducted to investigate the underlying principles of this spectacular technique that has changed the status of many species from recalcitrant to responsive over the last ninety years. ?

Progress in the field of plant cell and tissue culture has made this area of research one of the most dynamic and promising not only in plant physiology, cell biology and genetics but also in agriculture, forestry, horticulture and industry. Studies with plant cell cultures clearly have bearing upon a variety of problems as yet unsolved in basic and applied research. This was the compelling reason for assembling such a comprehensive source of information to stimulate students, teachers, and research workers. This book comprises 34 articles on regeneration of plants, vegetative propagation and cloning; haploids; cytology, cytogenetics and plant breeding; protoplasts, somatic hybridization and genetic engineering; plant pathology; secondary products and a chapter on isoenzymes, radiobiology, and cryobiology of plant cells. Particular attention has been paid to modern , fast-growing and fascinating disciplines - e.g. the induction of haploids, somatic

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

hybridization and genetic manipulation by protoplast culture, which possess an enormous potential for plant improvement.

The production of doubled haploids has become a necessary tool in advanced plant breeding institutes and commercial companies for breeding many crop species. However, the development of new, more efficient and cheaper large scale production protocols has meant that doubled haploids are also recently being applied in less advanced breeding programmes. This Manual was prepared to stimulate the wider use of this technology for speeding and opening up new breeding possibilities for many crops including some woody tree species. Since the construction of genetic maps using molecular markers requires the development of segregating doubled haploid populations in numerous crop species, we hope that this Manual will also help molecular biologists in establishing such mapping populations. For many years, both the Food and Agriculture Organization of the United Nations (FAO) and the International Atomic Energy Agency (IAEA) have supported and coordinated research that focuses on development of more efficient doubled haploid production methods and their applications in breeding of new varieties and basic research through their Plant Breeding and Genetics Section of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture. The first FAO/IAEA scientific



## Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

network (Coordinated Research Programme - CRP) dealing with doubled haploids was initiated by the Plant Breeding and Genetics Section in 1986. Biotechnology and Plant Breeding includes critical discussions of the newest and most important applications of biotechnology in plant breeding, covering key topics such as biometry applied to molecular analysis of genetic diversity, genetically modified plants, and more. This work goes beyond recombinant DNA technology to bring together key information and references on new biotech tools for cultivar development, such as double-haploids, molecular markers, and genome-wide selection, among others. It is increasingly challenging for plant breeders and agricultural systems to supply enough food, feed, fiber and biofuel for the global population. As plant breeding evolves and becomes increasingly sophisticated, a staggering volume of genetic data is now generated. Biotechnology and Plant Breeding helps researchers and students become familiar with how the vast amounts of genetic data are generated, stored, analyzed and applied. This practical resource integrates information about plant breeding into the context of modern science, and assists with training for plant breeders including those scientists who have a good understanding of molecular biology/biotechnology and need to learn the art and practice of plant breeding. Plant biologists, breeding technicians, agronomists, seed technologists, students,

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

and any researcher interested in biotechnologies applied to plant breeding will find this work an essential tool and reference for the field. Presents in-depth but easy-to-understand coverage of topics, so plant breeders can readily comprehend them and apply them to their breeding programs Includes chapters that address the already developed and optimized biotechnologies for cultivar development, with real-world application for users Features contributions by authors with several years of experience in their areas of expertise

Overview of Haploidy.-Pathways to Microspore Embryogenesis.-The Role of Stress in the Induction of Haploid Microspore Embryogenesis.-Microspore Embryo Induction and Development in Higher Plants: Cytological and Ultrastructural Aspects.- Biochemical and Molecular Aspects of Haploid Embryogenesis.-Storage Product Metabolism in Microspore-Derived Cultures of Brassicaceae.-Chromosome Doubling and Recovery of Doubled Haploids.-Utilization of Microspore-Derived Embryos.- Haploids in the Improvement of Solanaceous Species.-Haploids in the Improvement of Crucifers.-Haploids in the Improvement of Poaceae.-Haploids in the Improvement of Woody Species.-Haploids in the Improvement of Miscellaneous Crop Species (Cucurbitaceae, Liliaceae, Asparageceae, Chenopodiaceae, Araceae and Umbelliferae).-Haploids in the Improvement of Numbers of the Linaceae and

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

## Asteraceae.-Challenges and Limitations to the Use of Haploidy in Crop Improvement

Forty chapters deal with various aspects of tissue culture, in vitro manipulation, and other biotechnological approaches to the improvement of maize. They are arranged in eight sections: - In Vitro Technology, Callus Cultures and Regeneration of Plants, Somatic Embryogenesis. - Wide Hybridization, Embryo, Ovule, and Inflorescence Culture, in Vitro Fertilization. - Production of Haploids and Double Haploids, Anther and Pollen Culture. - Protoplast Culture, Genetic Transformation. - Somaclonal Variation and Mutations. - Molecular Biology and Physiological Studies. - Proteins and Nutritional Improvement. Pollen Storage, Cryopreservation of Germplasm.

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 --.

Plant development and productivity are negatively regulated by various environmental stresses. Abiotic stress factors such as heat, cold, drought, and salinity represent key elements limiting agricultural productivity worldwide. Thus, developing crop plants with the ability to

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

tolerate abiotic stresses is a critical need which demands modern novel strategies for the thorough understanding of plant response to abiotic stresses. Crop Improvement under Adverse Conditions will serve as a cutting-edge resource for researchers and students alike who are studying plant abiotic stress tolerance and crop improvement. The book presents the latest trends and developments in the field, including the impact of extreme events on salt tolerant forest species of Andaman & Nicobar Islands, the overlapping horizons of salicylic acid in different stresses, and fast and reliable approaches to crop improvement through In Vitro haploid production. Written by renowned experts and featuring useful illustrations and photographs, Crop Improvement under Adverse Conditions is a concise and practical update on plant abiotic stress tolerance and crop improvement.

The 18 chapters making up In Vitro Haploid Production in Higher Plants are divided into two sections. Section 1 (eight chapters) covers historical and fundamental aspects of haploidy in crop improvement. Section 2 deals with methods of haploid production, including anther culture, micropore culture, ovary culture, pollination with irradiated pollen, in vitro pollination, and special culture techniques, including polyhaploid production in the Triticeae by sexual hybridization, the influence of ethylene and gelling agents on anther culture, conditional lethal markers, and methods of chromosome doubling.

Haploid plants have the gametophytic number of chromosomes. They are of great importance, especially in studies on the induction of mutations and also for the production of homozygous plants, they are needed in large numbers. The conventional methods employed by plant breeders for their production are cumbersome, time-consuming, laborious and rather inefficient. Sometimes it may take years to produce a pure line. However, with the introduction

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

of in vitro techniques, especially anther culture for the induction of androgenesis, it has become increasingly evident that these methods considerably accelerate the production of haploids for plant breeding programs. During the last decade, in vitro-produced haploids have been incorporated into breeding programs of many agricultural crops, and positive results have been obtained especially with rice, wheat, potato, barley, maize, asparagus, sunflower, brassica, tobacco, etc. Among these, rice and wheat are the best examples in which a number of improved varieties have been released. In wheat, the breeding cycle can be shortened by three or four generations when the pollen haploid breeding method is used instead of conventional cross-breeding. The release of the wheat varieties Jinghua 1 and Florin is a typical example of what can be achieved with other crops. Taking these developments into consideration, the present volume, Haploids in Crop Improvement I, was compiled. Doubled haploid technology is an important tool for plant breeding. It allows for significant time reduction in the achievement of homozygous breeding lines of value in crop improvement. This volume provides an excellent overview of haploid induction and the application of doubled haploids. The authors emphasize advances made in the understanding of microspore embryogenesis, but treat also advances in gynogenesis and the manipulation of parthenogenetic haploid development. The text contains a thorough discussion of the application of haploidy to the improvement of a number of species from various families, including Brassicaceae, Poaceae, and Solanaceae. The various methods applicable to these species are described in detail. Each chapter contains critical evaluation of the scientific literature and an extensive list of references.

## Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

This volume is ideally suited for plant breeders, geneticists, and plant cell biologists. Since the beginning of agricultural production, there has been a continuous effort to grow more and better quality food to feed ever increasing populations. Both improved cultural practices and improved crop plants have allowed us to divert more human resources to non-agricultural activities while still increasing agricultural production. Malthusian population predictions continue to alarm agricultural researchers, especially plant breeders, to seek new technologies that will continue to allow us to produce more and better food by fewer people on less land. Both improvement of existing cultivars and development of new high-yielding cultivars are common goals for breeders of all crops. In vitro haploid production is among the new technologies that show great promise toward the goal of increasing crop yields by making similar germplasm available for many crops that was used to implement one of the greatest plant breeding success stories of this century, i. e. , the development of hybrid maize by crosses of inbred lines. One of the main applications of anther culture has been to produce diploid homozygous pure lines in a single generation, thus saving many generations of backcrossing to reach homozygosity by traditional means or in crops where self-pollination is not possible. Because doubled haploids are equivalent to inbred lines, their value has been appreciated by plant breeders for decades. The search for natural haploids and methods to induce them has been ongoing since the beginning of the 20th century.

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

Doubled haploids (DHs) are powerful tools to reduce the time and costs needed to produce pure lines to be used in breeding programs. DHs are also useful for genetic mapping of complex qualitative traits, to avoid transgenic hemizygotes, for studies of linkage and estimation of recombination fractions, for screening of recessive mutants. These are just some of the advantages that make DH technology one of the most exciting fields of present and future plant biotechnology. All of the DH methods have model species where these technologies have been developed, or that respond every efficiently to their corresponding induction treatment. However, not all the species of economical/agronomical interest respond to these methodologies as they should be in order to obtain DHs on a routine basis. Indeed, many of them are still considered as low-responding or recalcitrant to these treatments, including many of the most important crops worldwide. Although many groups are making significant progresses in the understanding of these intriguing experimental pathways, little is known about the origin, causes and ways to overcome recalcitrancy. It would be very important to shed light on the particularities of recalcitrant species and the special conditions they need to be induced. In parallel, the knowledge gained from the study of basic aspects in model species could also be beneficial to overcome recalcitrancy. In this e-book, we present a compilation of different approaches leading to the generation of DHs in model and in recalcitrant species, and different studies on new and relevant aspects of this process, useful to extract common traits and features, to know better these processes, and

# Get Free In Vitro Haploid Production In Higher Plants Volume 1 Fundamental Aspects And Methods Current Plant Science And Biotechnology In Agriculture

eventually, to elucidate how to make DH technology more efficient.

Jointly published with INRA, Paris. The use of haploid plants is of increasing importance in plant biology and plant breeding. This book illustrates how the advances in plant molecular and cell biology provide an exciting means for the analysis of androgenesis in terms of pollen development and the initiation of embryogenesis. It provides both an appraisal of techniques and their practical application, and is the most up-to-date source of information about the biology of gametophytes.

[Copyright: 657fb328755d375b6ddf7c9b4d25ac47](https://www.researchgate.net/publication/328755d375b6ddf7c9b4d25ac47)