In Vitro Plant Breeding

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.

This book offers a detailed overview of both conventional and modern approaches to plant breeding. In 25 chapters, it explores various aspects of conventional and modern means of plant breeding, including: history, objective, activities, centres of origin, plant introduction, reproduction, incompatibility, sterility, biometrics, selection, hybridization, methods of breeding both self- and cross-pollinated crops, heterosis, synthetic varieties, induced mutations and polyploidy, distant hybridization, quality breeding, ideotype breeding, resistance breeding, breeding for stress resistance, G x E interactions, tissue culture, genetic engineering, molecular breeding, genomics, gene action and varietal release. The book’s content addresses the needs of students worldwide. Modern methods like molecular breeding and genomics are dealt with extensively so as to provide a firm foundation and equip readers to read further advanced books. Each chapter discusses the respective subject as comprehensively as possible, and includes a section on further reading at the end. Info-boxes highlight the latest advances, and care has been taken to include nearly all topics required under the curricula of MS programs. As such, the book provides a much-needed reference guide for MS students around the globe.

The purpose of this book is to provide the advances in plant in vitro culture as related to perennial fruit crops and medicinal plants. Basic principles and new techniques, now available, are presented in detail. The book will be of use to researchers, teachers in biotechnology and for individuals interested to the commercial application of plant in vitro culture.

Biotechnology revolutionized traditional plant breeding programs. This rapid change produced new discussions on techniques and opportunities for commerce, as well as a fear of the unknown. Plant Development and Biotechnology addresses the major issues of the field, with chapters on broad topics written by specialists. The book applies an informal style that addresses the major aspects of development and biotechnology with minimal references, without sacrificing information or accuracy. Divided into five primary parts, this volume explores how the field emerged from its early theoretical base to the technical discipline of today. It also covers progress being made with genetically engineered plants, providing a snapshot of the field's controversial present. Part III discusses methods for preparing media, creating solutions and dilutions, and accomplishing sterile culture work. It investigates common methods for visualizing and documenting studies, and quantifying responses of tissue culture in research. Part IV delivers the essential foundation of plant tissue culture, introducing the three types of commonly used culture regeneration systems. Part V integrates propagation techniques with other methodologies for the modification and manipulation of germplasm. Part VI concludes with special sections. Subjects include in vitro plant pathology, recent research into genetic and phenotypic variation, the mechanics of commercial plant production, and the importance of clean cultures and problems associated with maintaining in vitro cultures. The final chapter analyzes entrepreneurship in the field and outlines the do's and don'ts to consider when launching an enterprise.

Micropropagation of Orchids

Plant Biotechnology

Plant Protoplasts and Genetic Engineering IV

Basic and Applied

Volume 4: Cereals

This book summarises various aspects of plant biotechnology and is divided into 27 chapters. This edition discusses: plant cell culture and development, plant tissue culture, micropropagation, germplasm storage, haploid plants, triploid plants, in vitro pollination and fertilisation, protoplast isolation and culture, somatic cell hybridisation, synthetic seeds, plant breeding, plant derived vaccines, genetically modified foods, improving photosynthesis and crop yield, insect resistant plants, fungus resistant plants, virus resistant plants, ornamental plants, medicinal plants, recombinant DNA, molecular markers, intellectual property rights. Chapters on nanotechnology for micronutrients in soil-plant systems are a unique feature of the book.

Create improved crops with these techniques for plant cell culture! This comprehensive book presents the basic concepts and applied techniques of plant cell and tissue culture. More and more, commercial plant breeding and development employs these methods to protect crops from weather, pests, and disease. Covering the history of in vitro breeding as well as emerging research trends, In Vitro Plant Breeding offers specific techniques for crop improvement and breeding. Designed as a text for undergraduate students, In Vitro Plant Breeding presents the theory of tissue culture as well as practical techniques. Its step-by-step instructions and clear illustrations facilitate learning and laboratory work. In Vitro Plant Breeding gives in-depth information and the latest research on the vital concepts and techniques of in vitro breeding, including: applications of plant tissue culture morphogenesis and organogenesis micropropagation producing haploid plants in vitro in vitro pollination and fertilization problems of embryo culture somatic hybridization protoplast technology selection of desirable traits cryopreservation and plant breeding micrografting This helpful book is plentifully illustrated with examples, schematic descriptions, and tables to make the concepts clear and easy to learn. In Vitro Plant Breeding is an essential resource.

Application of Mutation Breeding Methods in the Improvement of Vegetatively Propagated Crops: An Interpretive Literature Review summarizes advances in the use of artificially induced mutations to improve cultivated plants, particularly those that are vegetatively propagated. It brings together all available and accessible references that examine the advantages, drawbacks, and possibilities of the mutation breeding method, as well as the challenges that prevent it from being applied to various crops. Comprised of eight chapters, this volume begins with an overview of various aspects of mutagenic treatment using chemical and physical mutagens. It then discusses the structure and functioning of shoot apices and their behavior after irradiation; adventitious bud techniques and

other in vivo or in vitro methods of asexual propagation; and breeding of root and tuber crops, such as cassava and potato, ornamental crops such as foliage plants and cut flowers, fruit crops, and other crops. Plant breeders who want to better understand how to apply mutation breeding to their crops will find this book extremely helpful.
This comprehensive book presents the basic concepts and applied techniques of plant cell and tissue culture. Covering the history of in vitro breeding as well as emerging research trends, In Vitro Plant Breeding offers specific techniques for crop improvement and breeding. This helpful book is written in clear language illustrated with examples, schematic descriptions, and tables to make the concepts clear. To view an excerpt online, find the book in our QuickSearch catalog at www.HaworthPress.com.
In vitro Plant Breeding towards Novel Agronomic Traits
Volume 1: Fundamental Aspects and Methods
Plant Tissue Culture

PLANT BREEDING: Classical to Modern

In Vitro Plant BreedingCRC Press
This book presents a comprehensive overview of plant stresses caused by salt, drought, extreme temperatures, oxygen and toxic compounds, which are responsible for huge losses in crop yields. It discusses the latest research on the impact of salinity and global environment changes, and examines the advances in the identification and characterization of the mechanisms that allow plants to tolerate biotic and abiotic stresses. Further it presents our current understanding of metabolic fluxes and the various transporters that collectively open the possibility of applying in vitro technology and genetic engineering to improve stress tolerance. Exploring advanced methods that augment traditional plant tissue culture and breeding techniques toward the development of new crop varieties that can tolerate biotic and abiotic stresses to achieve sustainable food production, this book is a valuable resource for plant scientists and researchers.
Since the beginning of agricultural production, there has been a continuous effort to grow more and better quality food to feed ever increasing popula tions. Both improved cultural practices and improved crop plants have al lowed 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.
Divided into three volumes, Micropropagation of Orchids Third Edition retains the exhaustive list of micropropagation protocols for many genera and updates each section to include new and/or revised information about: Culture media and vessels Techniques and procedures for both orchids which were previously cultured and for those which were not Plant hormones and growth regulators Media components Methods for tissue decontamination Historical information Procedures for the cultivation for plantlets which have been removed from flasks Sources of light and illumination methods Written by two globally acknowledged experts in the field, the third edition of this definitive text on the micropropagation of orchids is a detailed and comprehensive collection of procedures and methods for multiplying orchids, including organ, tissue, and cell culture techniques in vitro and is intended for researchers in plant science and propagation, professional and amateur orchid growers, and plant breeding professionals. Much of the general information about techniques and procedures can be applied to plants other than orchids.
Introduction to Plant Tissue Culture
Proceedings Symposium 10-14 Nov. 1990
Plant Breeding Advances and in Vitro Culture
Somaclonal Variation and Induced Mutations in Crop Improvement
From Fundamentals to Quantum Computing
Introduction and techniques; Introductory history; Laboratory organisation; Media; Aseptic manipulation; Basic aspects; Cell culture; Cellular totipotency; Somatic embryogenesis; Applications to plant breeding; Haploid prodution; Triploid production; In vitro pollination and fertilization; Zygotic embryo culture; Somatic hybridisation and cybridisation; Genetic transformation; Somaclonal and gametoclonal variant selection; Application to horticulture and forestry; Production of disease-free plants; clonal propagation; General applications; Industrial applications: secondary metabolite production; Germplasm conservation.
The experiment was conducted at Advanced Plant Breeding Laboratory, Department of Genetics and Plant Breeding and Tissue Culture Laboratory, Department of Horticulture, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Bangladesh. Dehusked seeds of five aromatic rice varieties viz. Radhunipagol, Benaful, Guamuri, Thakurbhog, Padmabhog and Pokkali (used as a control rice variety) were placed on MS media supplemented with three salts (NaCl, Na2SO4 and KCl) at four different levels (0, 2.5, 4.5 and 6.5 g/l). About 3-6 weeks after, the calli were transferred to MS media for regeneration. Out of six varieties, Radhunipagol showed better performance for callusing at NaCl salt and the highest plant regeneration was recorded in Padmabhog with Na2SO4 salt. The value of parameters declined with the increase of salinity levels. Radhunipagol (97%) performed best for callus induction with NaCl salt at 2.5 g/l but Padmabhog (65.36%) showed best regeneration with Na2SO4 salt at 4.5 g/l. So, it is stated that Radhunipagol is more potential variety for callusing against NaCl salt at 2.5 g/l and Padmabhog is most potential variety for regeneration against Na2SO4 at 4.5 g/l.
Since the beginning of agricultural production, there has been a continuous effort to grow more and better quality food to feed ever increasing popula tions. 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.

The aim of this book is to gather together, in an integrated manner, information on the physiology and technology of contemporary plant breeding. The approach is multidisciplinary, with special emphasis being placed on the application of theoretical knowledge to the solution of practical problems concerned with the improvement of crop yield through the breeding of plants better suited to their environment. The role of modern techniques, such as tissue culture and induced mutation are discussed in detail

Variability and Stability

Plant Breeding

Applications and Approaches for Developing Improved Cultivars

In Vitro Application in Crop Improvement

In Vitro Culture of Higher Plants

Since the beginning of agricultural production, there has been a continuous effort to grow more and better quality food to feed ever increasing popula tions. Both improved cultural practices and improved crop plants have alIowed 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 alI 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.

In Vitro Culture of Higher Plants presents an up-to-date and wide- ranging account of the techniques and applications, and has primarily been written in response to practical problems. Special attention has been paid to the educational aspects. Typical methodological aspects are given in the first part: laboratory set-up, composition and preparation of media, sterilization of media and plant material, isolation and (sub)culture, mechanization, the influence of plant and environmental factors on growth and development, the transfer from test-tube to soil, aids to study. The question of why in vitro culture is practised is covered in the second part: embryo culture, germination of orchid seeds, mericloning of orchids, production of disease-free plants, vegetative propagation, somaclonal variation, test-tube fertilization, haploids, genetic manipulation, other applications in phytopathology and plant breeding, secondary metabolites.

Proceedings of a symposium organized by the IAEA and FAO, Vienna, 19-23 August 1985. The symposium examined the usefulness for plant breeding purposes of somaclonal variation, i.e. the occurrence of mutations during in vitro culture with or without the application of ionizing radiation or other mutagens. Another issue was finding ways and means of maintaining the genetic integrity of plants under in vitro conditions, such integrity being of vital importance if in vitro techniques are to be used to propagate virus-free clones of economically important plants, or to preserve germplasm in gene banks. In vitro culture techniques considerably accelerate the plant breeding cycle. This factor and the advantage of using haploids derived from another culture were also discussed at the symposium.

Plant Tissue Culture In One Form Or Another Has Become One Of The Most Promising Branches Of Plant Science. Arising From The Totipotency Of Plant Cells, It Now Occupies A Key Position In Plant Breeding, Plant Propagation And Plant Biotechnology.Plant Tissue Culture - Basic And Applied Brings To The Student Accessible, Up-To-Date Information On This Subject. Basic Knowledge Of Tissue Culture Methods Such As Isolation Of Suitable Tissues From The Mother Plant, Maintenance Of The Tissues Under In Vitro Condition In An Undifferentiated Or De-Differentiated Stage, Methods Of Genetic Engineering And Gene Transfer, Chromosomal Studies And The Handling Of In Vitro Micro Plants Are Described In Detail In This Book. Similarly, Application Aspects Of Micropropagation, Haploid Cell Culture, Protoplast Culture, Embryo Culture, Somatic Embryogenesis And Artificial Seeds Are Also Discussed.

In Vitro Plant Regeneration

In Vitro Haploid Production in Higher Plants

Symposium ; Proceedings

Haploids in Crop Improvement I

Studies on in Vitro Plant Regeneration and Genetic Transformation in Cotton (Gossypium Spp.).

In continuation of Volumes 8, 9, and 22 on in vitro manipulation of plant protplasts, this new volume deals with the regeneration of plants from protoplasts and genetic transformation in various species of Actinidia, Amoracia, Beta, Brassica, Cicer, Citrus, Cucumis, Duboisia, Fragaria, Glycine, Ipomoea, Lactuca, Lotus, Lycopersicon, Manihot, Medicago, Nicotiana, Petunia, Phaseolus, Pisum, Prunus, Psophocarpus, Saccharum, Solanum, Sorghum, Stylosanthes, and Vitis. These studies reflect the far-reaching implications of protoplast technology in genetic engineering of plants. They are of special interest to researchers in the field of plant tissue culture, molecular biology, genetic engineering, and plant breeding.

Haploid plants have the gametophytic number of chromosomes. They are of great importance, especially in studies on the induction of muta tions 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 of in vitro techniques, especially anther culture for the induction of androgenesis, it has become increasingly evi dent that these methods considerably accelerate the production of haploids for plant breeding programs. During the last decade, in vitro-produced haploids have been incor porated 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 considera tion, the present volume, Haploids in Crop Improvement I, was compil ed.

During the past decade, Plant Tissue Culture (PTC) has attracted considerable attention because of its vital role in plant biotechnology. PTC offers novel approaches to plant production, propagation, and preservation. Some in vitro techniques are being applied on a commercial scale while many others hold great potential. Consequently, the literature in this area has grown rapidly. This book deals with recent developments in plant tissue culture, and presents a critical assessment of the proven and potential applications of the various in vitro techniques, it also highlights current problems limiting the application of tissue culture, and projects the future lines of research in this field.

Plant Improvement and Somatic Cell Genetics includes all but one of the papers presented at two symposia held during the XIII International Botanical Congress in Sydney, Australia, on August 21-28, 1981. ""Frontiers in Plant Breeding"" and ""Cell Culture and Somatic Cell Genetics in Plant Biology"" highlight the ways in which plant breeding techniques can improve crops. The book explores the potentials as well as the limitations of plant breeding, and cellular and molecular techniques in plant improvement. Comprised of 14 chapters, this volume begins with an overview of the potential applications of exotic germplasm for tomato and cereal crop improvement. It continues with a discussion of multiline breeding, breeding of crop plants that can tolerate soil stresses, combining genomes by means of conventional methods, use of embryo culture in interspecific hybridization, use of haploids in plant improvement, and somaclonal variation and somatic hybridization as new techniques for plant improvement. The reader is also introduced to plant cell culture, as well as somatic cell genetics of cereals and grasses, somatic cell fusion for inducing cytoplasmic exchange, uses of cell culture mutants, genetic transformation of plant cells by experimental procedures in the context of plant genetic engineering, and use of molecular biology techniques for recognition and modification of crop plant genotypes. This book will be a useful resource for scientists and plant breeders interested in applying somatic cell genetics for crop improvement.

Indigenous Aromatic Rice Under Salt Stress Conditions

Volume 2: Applications

Volume 5 — Oil, Ornamental and Miscellaneous Plants

Integration of in Vitro Techniques in Ornamental Plant Breeding

In Vitro Plant Breeding

In continuation of Volumes 8 and 9 (1989) on in vitro manipulation of plant protoplasts, this new volume deals with the regeneration of plants from protoplasts and genetic transformation in various species of Agrostis, Arabidopsis, Atropa, Brassica, Catharanthus, Datura, Cucumis, Daucus, Digitalis, Duboisia, Eustoma, Festuca, Helianthus, Hordeum, Kalanchoe, Linum, Lobelia, Lolium, Lotus, Lycium, Lycopersicum,Mentha, Nicotiana, Pelargonium, Pisum, Pyrus, Salvia, Scopolia, and Solanum.These studies reflect the far reaching implications of protoplast technologyin genetic engineering of plants. They are of special interest to researchers in the field of plant tissue culture, molecular biology, genetic engineering, and plant breeding.

Genetic variability is an important parameter for plant breeders in any con ventional crop improvement programme. Very often the desired variation is un available in the right combination, or simply does not exist at all. However, plant breeders have successfully recombined the desired genes from cultivated crop gerrnplasm and related wild species by sexual hybridization, and have been able to develop new cultivars with desirable agronomie traits, such as high yield, disease, pest, and drought resistance. So far, conventional breeding methods have managed to feed the world's ever-growing population. Continued population growth, no further scope of expanding arable land, soil degradation, environ mental pollution and global warrning are causes of concern to plant biologists and planners. Plant breeders are under continuous pressure to improve and develop new cultivars for sustainable food production. However, it takes several years to develop a new cultivar. Therefore, they have to look for new technologies, which could be combined with conventional methods to create more genetic variability, and reduce the time in developing new cultivars, with early-maturity, and improved yield. The first report on induced mutation of a gene by HJ. Muller in 1927 was a major mi1estone in enhancing variation, and also indicated the potential applica tions of mutagenesis in plant improvement. Radiation sources, such as X-rays, gamma rays and fast neutrons, and chemical mutagens (e. g. , ethyl methane sulphonate) have been widely used to induce mutations.

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

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.

Recent Advances in Plant in vitro Culture

In Vitro Culture in Plant Breeding

Proceedings of the Eucarpia Plant Genetic Manipulation Section Meeting held at Cork, Ireland from September 11 to September 14, 1994

Biotechnology and Plant Breeding
Principles and prospects

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, 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

Our requirement for plant breeders to be successful has never been greater. However one views the forecasted numbers for future population growth we will need, in the immediate future, to be feeding, clothing and housing many more people than we do, inadequately, at present. Plant breeding represents the most valuable strategy in increasing our productivity in a way that is sustainable and environmentally sensitive. Plant breeding can rightly be considered as one of the oldest multidisciplinary subjects that is known to humans. It was practised by people who first started to carry out a settled form of agriculture. The art, as it must have been at that stage, was applied without any formal underlying framework, but achieved dramatic results, as witnessed by the forms of cultivated plants we have today. We are now learning how to apply successfully the results of yet imperfect scientific knowledge. This knowledge is, however, rapidly developing, particularly in areas of tissue culture, biotechnology and molecular biology. Plant breeding's inherent multifaceted nature means that alongside obvious subject areas like genetics we also need to consider areas such as: statistics, physiology, plant pathology, entomology, biochemistry, weed science, quality, seed characteristics, repro ductive biology, trial design, selection and computing. It therefore seems apparent that modern plant breeders need to have a grasp of wide range of scientific knowledge and expertise if they are successfully to a exploit the techniques, protocols and strategies which are open to them.

A range of novel techniques is available to the plant breeder today to complement classical breeding methods. The new options are based on the integration of advances in plant cell biology with those in plant molecular biology. Plant cell, tissue and organ cultures provide efficient systems for transformation, for the achievement of wide crosses and for the production of variation through spontaneous and induced mutation, while permitting effective isolation of desired genotypes by in vitro selection. This book presents a critical appraisal of the methodologies of plant genetic manipulation for advanced undergraduates, postgraduates, researchers and plant breeders, and provides guidance on the choice of breeding options. The latter depends on the breeding system of the crop, the breeding objective and the tissue culture systems applicable to the target genotype(s). Now available only in paperback, this book has been described as ``...by far the most comprehensive book on plant tissue culture...few publications in this field can compare with this book in terms of subject matter covered and literature surveyed. Overall, the book is a fine achievement for Drs. Bhojwani and Razdan. It also serves the authors' avowed purpose of integrating the theoretical and practical aspects of plant tissue culture. If you like a text and a laboratory manual on plant tissue culture combined, this is obviously a book to be considered seriously.'' (Plant Science Bulletin). Plant tissue culture has become an invaluable aid in the field of experimental botany and has many practical applications in agriculture and horticulture. In recognition of its importance in basic and applied areas of plant science, many universities have included this subject in undergraduate and postgraduate courses but find that they lack a suitable introductory text. This book has been written primarily to fill that need. Starting with an introductory history, the book covers such practical aspects as laboratory requirements and media preparation. The authors go on to discuss fundamental aspects of cellular totipotency (e.g. production of haploids, diploids and triploids, and raising new genotypes through single cell culture), in vitro approaches to plant breeding, raising high health plants, micropropagation, and techniques of in vitro storage of germplasm. Profusely illustrated with line drawings and original photographs, the book is further enhanced by the inclusion of a complete bibliography.

Nuclear Techniques and in Vitro Culture for Plant Improvement
Volume 3: Important Selected Plants
In Vitro Selection In Plant Breeding
Biotic and Abiotic Stress Tolerance
Applications and Limitations