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This volume is aimed at offering an insight into the present knowledge of the vast domain of Medicinal and Aromatic Plants with a focus on North America. In this era of global climate change the volume is meant to provide an important contribution to a better understanding of the diverse world of Medicinal and Aromatic Plant research, production and utilization.

Medicinal Plants: Culture, Utilization and Phytopharmacology covers over 400 species. Each chapter gathers valuable information from a wide variety of sources, and supplies it to the user in convenient table format, arranged alphabetically by scientific name, followed by the common name. Data topics include: major constituents (active ingredients) and medicinal values of plants; toxicity or hazardous components; essential oils; value-added products and possible uses; cultivation and harvesting; diseases and insects found in medicinal plants. Three appendices (alphabetical listing of plants by common name, followed by the scientific name; essential oils and their derivation; active ingredients and their sources) provide handy cross-references to the Tables.

The book entitled "Cultivation and Uses of Medicinal Plants" is an effort to provide systematic description of 175 medicinal plants of India. Description is given in very simple language that even a farmer can also understand cultivation practices and important points to be undertaken during their farming. There is increased demand of Amla, Harde, Baheda, Ashwagandha, Vinca and other medicinal plants by pharmacy companies but sources are very few. Major reason behind this factor is that farmers are not aware about medicinal plant farming and their useful properties. However, many national research institutes such as National Botanical Research Institute (NBRI), Central Institute of Medicinal and Aromatic Plants (CIMAP), Directorate of Medicinal and Aromatic Plants (DMAP) along with Agricultural Universities and traditional universities are working on the same aspect. But still in comparison with Allopathic medicines, traditional medicine is still not as successful; although literature showed their significance since ancient times of Vedas. Systematic literature regarding utility and cultivation of medicinal plants is not easily available. This book will be highly useful for researchers and students of botany, horticulture, pharmacy, ayurveda and agriculture.

This volume contains 28 chapters on biotechnology of medicinal

and aromatic plants, and deals with the distribution, economic importance, conventional propagation, micropropagation, review of tissue culture work, and the in vitro production of pharmaceutical compounds in various species of Ammi, Bergenia, Canavalia, Capsicum, Cassia, Cephaelis, Cornus, Cucurbita, Elettaria, Eupatorium, Genipa, Gentiana, Gypsophila, Hygrophila, Leontopodium, Nerium, Picrasma, Polygonum, Ptelea, Rheum, Scopolia, Silene, Solanum, Strophanthus, Tagetes, Thymus, and Uncaria. The potential role of biotechnology for industrial production is pointed out. This book is tailored to the need of advanced students, teachers and the research scientists in the area of plant biotechnology and bioengineering, pharmacy, botany and tissue culture.

In Indian context.

After the 1988 and 1989 volumes, this is the third volume on Medicinal and Aromatic Plants. Each of the 29 chapters contributed by international scientists deals with one individual plant genus, namely Atropa, Ageratina, Ailanthus, Aconitum, Apium, Aloe, Akebia, Bidens, Carthamus, Chamomilla, Carum, Citrus, Cymbopogon, Dysosma, Euphorbia, Fritillaria, Glycyrrhiza, Lavandula, Nigella, Pelargonium, Perilla, Podophyllum, Rosa, Scutellaria, Securinega, Solanum, Swertia, Symphytum, Syringa. Their distribution, economic importance, conventional propagation, in-vitro propagation and production of metabolites through tissue culture are treated in detail. Special emphasis is laid on the potential of industrial in-vitro production of plant compounds of medicinal and pharmaceutical relevance using tissue culture.

27 chapter cover the distribution, economic importance, conventional propagation, micropropagation, tissue culture, and in vitro production of important medicinal and pharmaceutical compounds in various species of Ajuga, Allium, Ambrosia, Artemisia, Aspidia, Atractylodes, Callitris, Choisya, Cinnamomum, Coluria, Cucumis, Drosera, Daucus, Eustoma, Fagopyrum, Hibiscus, Levisticum, Onobrychis, Orthosiphon, Quercus, Sanguinaria, Solanum, Sophora, Stauntonia, Tanacetum, Vetiveria, and Vitis. Like the previous volumes 4, 7, 15, and 21 in the Medicinal and Aromatic Plants series, the volume is tailored to the need of advanced students, teachers, and research scientists in the area of plant biotechnology and bioengineering, pharmacy, botany and biochemistry.

This book, Medicinal and Aromatic Plants IX, like the previous

eight volumes published in 1988, 1989, 1991, 1993, 1994, and 1995, is unique in its approach. It comprises twenty-four chapters dealing with the distribution, importance, conventional propagation, micropropagation, tissue culture studies, and the in vitro production of important medicinal and pharmaceutical compounds in various species of Agave, Anthemis, Aralia, Blackstonia, Catha, Catharanthus, Cephalocereus, Clerodendron, Coronilla, Gloeophyllum, Liquidambar, Marchantia, Mentha, Onosma, Paeonia, Parthenium, Petunia, Phyllanthus, Populus, Portulaca, Sandersonia, Serratula, Scoparia, and Thapsia. It is tailored to the needs of advanced students, teachers, and research scientists in the field of pharmacy, plant tissue culture, phytochemistry, biochemical engineering, and plant biotechnology in general.

Aromatic plants have essential or aromatic oils naturally occurring in them. They help heal mental ailments and other diseases. India is endowed with a rich wealth of medicinal plants. Aromatic (Aroma Producing) plants are those plants which produce a certain type of aroma. Their aroma is due to the presence of some kind of essential oil with chemical constituents that contain at least one benzene ring in their chemical configuration. The chemical nature of these aromatic substances may be due to a variety of complex chemical compounds. These plants have made a good contribution to the development of ancient Indian material medica. In recent years, there has been a tremendous growth of interest in plant based drugs, pharmaceuticals, perfumery products, cosmetics and aroma compounds used in food flavors and fragrances and natural colors in the world. There is a definite trend to adopt plant based products due to the cumulative derogatory effects resulting from the use of antibiotic and synthetics and except for a few cultivated crops, the availability of plant based material is mainly from the natural sources like forests and wastelands. There is a need to introduce these crops into the cropping system of the country, which, besides meeting the demands of the industry, will also help to maintain the standards on quality, potency and chemical composition. During the past decade, demand for aromatic plants and its products has attracted the worldwide interest, India being the treasure house of biodiversity, accounts for thousands of species which are used in herbal drugs. 90% of herbal industry requirement of raw material is taken out from the forests. Some fundamentals of this book are botanical description of the plant, genetic improvement, harvesting, intercropping, transplantation, irrigation and weeding, vanilla cultivation in India, commercial cultivation of vanilla, distillation of herbage for essential oil, effect of growth hormones, jasmine crop improvement & agrotechniques, efforts for new variety of *Jasminum auriculatum*, essential oils of agarwood, *Cinnamomum tamala* leaves, *Eucalyptus citriodora* and *Caultheria fragrantissima*, past and future of sandal wood oil industry, by product development from turmeric and ginger rhizomes, isolation of essential oils and its flavour profile etc. This book contains most of the important aspects related to aromatic plants. It is being published for those who are interested in growing, processing and trading of aromatic plants.

Medicinal and aromatic plants (MAPs) have accompanied mankind from its very early beginnings. Their utilization has co-evolved with *Homo sapiens* itself bringing about a profound increase in our scientific knowledge of these species enabling them to be used in many facets of our life (e.g. pharmaceutical products, feed- and food additives, cosmetics, etc.). Remarkably, despite the new renaissance of MAPs usage, ca. 80 % of the world's population is relying on natural substances of plant origin, with most of these botanicals sourced from the wild state. This first volume and ultimately the series, provides readers with a wealth of information on medicinal and aromatic plants.

Like the previous nine volumes published between 1988 and 1996, Medicinal and Aromatic Plants X is unique in its approach. It comprises 22 chapters dealing with the distribution, importance, conventional propagation, micropropagation, tissue culture studies, and the in vitro production of important medicinal and pharmaceutical compounds in various species of Actinidia, Alkanana, Arnebia, Campanula, Catharanthus, Centella, Chenopodium, Cornus, Cyanara, Ephedra, Euglena, Haplophyllum, Morus, Oenothera, Otacanthus, Oxalis, Polypodium, Rosmarinus, Sesamum, Solanum, Taxus, and Tephrosia. This book is tailored to the needs of advanced students, teachers, and research scientists in the field of pharmacy, plant tissue culture, phytochemistry, biochemical engineering, and plant biotechnology in general.

"This booklet is intended to promote and create awareness about MAPs [medicinal aromatic plants] as a feasible diversification enterprise for small-scale farmers. It highlights the challenges and opportunities associated with MAPs as a diversification enterprise, and presents small-scale cultivation options, processing, marketing and selling strategies to achieve a successful livelihood diversification option for small-scale farmers"--Introduction.

This book presents the opinions of an international panel of specialists that explored the agricultural, commercial, ecological, legal, pharmacological and social future of medicinal and aromatic plants. It represents a wide collection of views, reflecting the diversity of disciplines and interests of the panel members. It highlights the necessity of continued and integrated research on plant sources, conservation, bioactivity, analysis and marketing in examining future scenarios for application and sale of medicinal and aromatic plants. It shows the need for proof of efficacy and safety in drug development and the need to recognize societies contributing plant materials. The development of safe and effective medicinal and aromatic plant products depends upon the collaborative efforts of growers, collectors, conservationists, processors and businesses along with those of educators, sociologists, researchers and investors in developed and developing societies. Papers presented at the National Seminar on Conservation and Utilization of Medicinal and Aromatic Plants, held at Bhubaneswar during 4-6 December 2001; in Indian context.

This book provides readers a fundamental understanding of the science and applications of medicinal and aromatic plant materials. Chapters of this handbook covers the basics of ethnobotany, (bio)active compounds and their natural sources. Information about the cosmetic, nutritional, medicinal and industrial uses (dyes, tannins and biocides) is also presented. Readers will also learn about concepts central to quality control processes, sustainable management, wild harvesting and the economic valuation of the industrial impact of endemic plants. The volume also presents a case study of the wormwood (*Artemisia absinthium* L.), which is helpful in explaining the above concepts. This book is intended as a handbook for undergraduate students and teaching professionals in research and higher education institutions involved in agricultural engineering, pharmacy, forestry, natural product chemistry. Non experts interested in aromatic and medicinal plant agriculture, transformation and commercialization will also find the content informative.

Sage, the genus *Salvia* is one of the most famous and used herbs in the world. This volume, containing twenty chapters written by the leading experts in the field, presents a comprehensive coverage on all aspects of *Salvia*. Topics covered include the presentation of the (approximately 400) most known *Salvia* species; the distribution of the genus; its chemotaxonomy, ecophysiology, cultivation technology and breeding methods; information on the extraction, isolation, characterisation and structure of a large number of bioactive components the various pharmacological proper-

ties of the species; the share of *Salvia* products in the aromatherapy and natural cosmetics market; biotechnological techniques; and commercial aspects. This comprehensive volume on *Salvia* should be of interest to everyone involved in medicinal and aromatic plant applications and research.

27 chapters cover the distribution, economic importance, conventional propagation, micropropagation, tissue culture studies, and in vitro production of important medicinal and other pharmaceutical compounds in various species of *Anchusa*, *Brucea*, *Catharanthus*, *Chrysanthemum*, *Coleus*, *Corydalis*, *Coreopsis*, *Emilia*, *Ginkgo*, *Gloriosa*, *Hypericum*, *Inonotus*, *Leucosceptrum*, *Lilium*, *Linum*, *Mosses*, *Nandina*, *Penstemon*, *Prunus*, *Pteridium*, *Quassia*, *Ribes*, *Senecio*, *Taraxacum*, *Thermopsis*, *Vanilla*, and *Vitiveria*. Like the previous five volumes on medicinal and aromatic plants (Volumes 4, 7, 15, 21, and 24), this book contains a wealth of useful information for advanced students and researchers in the field of plant biotechnology and chemical engineering, pharmacy, botany and tissue culture.

In Recent Years, There Has Been A Tremendous Growth Of Interest In Plant-Based Drugs, Pharmaceuticals, Perfumery Products, Cosmetics And Aromatic Compounds Used In Food Flavours, Fragrances, And Natural Colours. An Attempt Has Been Made In This Book To Provide All Possible Pooled Information Including The Research Findings That Have Been Generated By The Division Of Horticultural Sciences, The University Of Agricultural Sciences, The Indian Institute Of Horticultural Research, The Central Institute Of Medicinal And Aromatic Crops, The National Botanical Research Institute, The Regional Research Laboratories, Icar, And Others.

The agricultural sector of medicinal (including plant stimulants) and aromatic plants is characterized by an enormous number and diversity of species. Only a few of them can be considered cultivated crops in which significant breeding efforts are made. For most species, however, breeding is performed in short-term projects only. Therefore, basic knowledge about these species is still fragmentary. Our intention is to compile and organize the available information on the most commonly utilized plant species into one publication, thereby providing a standardized resource for the researchers and the grower community. This book therefore provides reference source materials for a wide variety of plant species used for human consumption due to their flavor, medicinal or recreational properties. It is divided into a section of general topics on genetic resources, breeding adaptation of analytic methods and a compilation of basic data for DNA content, chromosome number and mating system followed by a section of 20 monographs on a species or species groups.

The current volume, "Medicinal and Aromatic Plants of the Middle-East" brings together chapters on selected, unique medicinal plants of this region, known to man since biblical times. Written by leading researchers and scientists, this volume covers both domesticated crops and wild plants with great potential for cultivation. Some of these plants are well-known medicinally, such as opium poppy and khat, while others such as *apharsemon* and *citron* have both ritual and medicinal uses. All have specific and valuable uses in modern society. As such, it is an important contribution to the growing field of medicinal and aromatic plants. This volume is intended to bring the latest research to the attention of the broad range of botanists, ethnopharmacists, biochemists, plant and animal physiologists and others who will benefit from the information gathered therein. Plants know no political boundaries, and bringing specific folklore to general medical awareness can only be for the benefit of all.

Medicinal and Aromatic Plants XII comprises 18 chapters. It deals with the distribution, importance, conventional propagation, mi-

cropropagation, tissue culture studies, and the in vitro production of important medicinal and pharmaceutical compounds in the following plants: *Artemisia annua*, *Coriandrum sativum*, *Crataegus*, *Dionaea muscipula*, *Hyoscyamus reticulatus*, *Hypericum canariense*, *Leguminosae*, *Malva*, *Ocimum*, *Pergularia tomentosa*, *Phellodendron amurense*, *Sempervivum*, *Solanum aculeatissimum*, *S. chrysotrichum*, *S. kasianum*, *Stephania*, *Trigonella*, and *Vaccinium*. It is tailored to the needs of advanced students, teachers, and research scientists in the fields of pharmacy, plant tissue culture, phytochemistry, biomedical engineering, and plant biotechnology in general.

Medicinal and aromatic plants (MAPs), as open-field crops, play an important role in multifunctional and sustainable agriculture as a result of their low energy requirements for cultivation and their many avenues of use, from the production of nutraceuticals, phytonutrients, and phytotherapy to land valorization. This Special Issue of Agriculture, "Medicinal and Aromatic Plants in Agricultural Research when Considering Multifunctionality and Sustainability Criteria", aims to illustrate the role of MAPs in agriculture in low-impact farming practices, and the benefits they can generate in terms of functional products. This Special Issue covers all research aspects related to MAPs, including a number of scientific macro-areas, such as agronomy, chemistry and pharmacy, ethnobotany and ethnopharmacology, food and nutrition, and ecology. Key topics in this Special Issue include, but are not limited to, the following: Sustainable agricultural practices of MAPs; Breeding and germplasm preservation of MAPs; The biodiversity of MAPs; The conservation of cultivated and wild MAPs; Ethnobotany and ethnopharmacology; Phytotherapy, phytochemistry, and phytopharmacology; Essential oils and secondary metabolites; Functional foods and MAPs; MAPs and degraded and marginal land recovery; The global marketing of MAPs; The legislation of MAPs.

Make sure your crops are market-ready with the aid of harvest and post-harvest mechanization Medicinal and Aromatic Crops presents harvest and post-harvest mechanization methods for the profitable production of market-ready medicinal crops. This practical handbook includes photos, detailed figures, and schematic drawings of machines that will help bring existing design ideas to life and inspire new ones for use in harvesting and primary processing. The book also includes general information on medicinal and aromatic plants, current production trends, and "how-to" instructions for improving the production process. Even though the use of mechanization contributes not only to a marked increase in production, but also enables uniform quality and a decrease in drudgery for everyone involved, there's a distinct lack of material available of the subject. Medicinal and Aromatic Crops fills in the gap, providing a thorough, comprehensive look at every aspect of the mechanism of growing, harvesting, and processing, including production steps and procedures, safety and quality, plant drying, the use of renewable energy sources, dry processing, extraction, industrial usage, financial analysis, and software usage. Medicinal and Aromatic Crops examines: environmental concerns manual and semi-mechanized harvesting transport the use of solar energy and solid biomass energy pre- and post-drying processes plant parts removal cutting, crushing, and milling post-drying separation and classification water and steam distillation and much more! Medicinal and Aromatic Crops is an invaluable guide to harvest and post-harvest mechanization for anyone involved in plant production and for agriculture educators and students.

This volume contains twenty-six chapters on the biotechnology of medicinal and aromatic plants. It deals with the distribution, economic importance, conventional propagation, micropropagation, tissue culture studies, and the in vitro production of important

medicinal and pharmaceutical compounds in various species of *Achillea*, *Anethum*, *Aquilaria*, *Arnica*, *Aspergillus*, *Astragalus*, *Catalpa*, *Chelidonium*, *Eremophila*, *Eucalyptus*, *Eucommia*, *Geranium*, *Heterocentron*, *Hypericum*, *Maclura*, *Morinda*, *Mortierella*, *Nicotiana*, *Phaseolus*, *Pinellia*, *Piqueria*, *Psorales*, *Rhodiola*, *Sanguisorba*, *Valeriana*, and *Vancouveria*.

Medicinal plant research is an evergreen subject. There is a tremendous increase in popularity of herbal medicine in traditional medicine, ethnomedicine, modern medicine and as over the counter food supplements. Even after this increased demand, supply is neither uniform nor assured as most of these plants are collected from wild. In developing countries of tropical and subtropical regions where majority of herbal drugs are produced, this is not organised sector making it vulnerable to several malpractices, hence standardization of all aspects required. This has also negative impact on biodiversity and conservation of plants as well as supply of uniform material. This book is aimed to provide up to date information about sustainable use of selected medicinal plants, their active ingredients and efforts made to domesticate them to ensured uniform supply. Development of agrotechnology, biotechnology and cultivation practices using conventional and non-conventional methods are presented. Where these efforts will lead the medicinal plant research and future perspective are discussed. The chapters are written by well recognised group leaders in working in the field. The book contains topics on general biology of medicinal plants, their sustainable use and, cultivation and domestication efforts. A uniform chapter structure has been designed to keep consistency. The book will be useful for academicians, agriculturists, biotechnologists and researcher, and industries involved in manufacturing herbal drugs and supplementary products.

The field of medicinal/aromatic plant breeding is growing and changing?this resource will help you stay up to date! In this essential book, researchers from large and small laboratories and institutions throughout Europe and the Mediterranean region explore recent developments in the selection and breeding of aromatic and medicinal plants. They take varied approaches?from traditional breeding to the use of molecular markers?and complement them with up-to-date information on biodiversity and resource conservation. From the editors: ?It is widely recognized that a strategy of `conservation through use,? by which plant collection via wild harvesting is replaced by controlled cultivation, is the best way forward if we are to balance human demands with the necessary conservation of the biodiversity represented by these species. That provides one major driving force for research in this field. Another concerns the very real need for improving the quality control of products on the market, both to satisfy consumer demand and to conform with the (justifiably) increasing requirements for standardization and precise identification of the composition of the plant materials being sold for human use. We hope that this volume will give readers a taste of the exciting developments in the field.? Breeding Research on Aromatic and Medicinal Plants examines: breeding for resistance and abiotic factors manipulating natural product accumulation through genetic engineering biochemical and molecular regulation of essential oil accumulation economic and legal considerations that breeders will encounter the ethical aspects of breeding these plants

This policy note summarizes an evaluation of public investment options for Egypt's agri-food system conducted by the International Food Policy Research Institute in collaboration with the Ministry of Agriculture and Land Reclamation of the Government of Egypt and Cairo University. We quantitatively assess the expected economy-wide impacts of investing in four promising agricultural value-chains: dates, poultry, olives, and medicinal and aromatic

plants (MAP). As part of the analysis, a range of agriculture-related public investments along the value-chains are considered, including spending to expand farm production and promotion of downstream agri-processing and marketing. We use two IFPRI structural models. The Rural Investment and Policy Analysis (RIAPA) economywide model is used to capture linkages between economic sectors, households, and rural-urban economies and to measure changes in economic growth, household welfare, and employment within and beyond the agri-food system. RIAPA is linked to the Agricultural Investment and Data Analysis (AIDA), the second model, which tracks investment impacts and costs over time. Inter alia, we find that: Investments into each of the four agricultural value chains enhance growth, create additional employment opportunities, improve household welfare, and reduce poverty. The MAP and poultry value chains are the most promising value chains with regard to all four evaluation criteria. However growth generation is largest if investment is concentrated in the MAP value chain, while investment into the poultry value chain has the strongest impacts on job creation and poverty reduction. Investments into primary production and processing, besides having a strong direct impact on the value chain growth, generate significant indirect effects inside and outside the agri-food system. These indirect effects are largest for the MAP value chain.

This volume in the series deals with the major Medicinal and Aromatic Plants (MAPs) of South America, providing information on major aspects of this specific group of plants on that continent (botany, traditional usage, chemistry, production/collection practices, trade and utilization). Brazil, in particular, offers an immense amount of biodiversity, including plants with great pharmacological interest and ethno-medicinal importance. Contributions are from internationally recognized professionals, specialists of the Medicinal and Aromatic Plant domain and have been invited mostly from the members of the International Society for Horticultural Science and International Council for Medicinal and Aromatic Plants.

Before the concept of history began, humans undoubtedly acquired life benefits by discovering medicinal and aromatic plants (MAPs) that were food and medicine. Today, a variety of available herbs and spices are used and enjoyed throughout the world and continue to promote good health. The international market is also quite welcoming for MAPs and essential oils. The increasing environment and nature conscious buyers encourage producers to produce high quality essential oils. These consumer choices lead to growing preference for organic and herbal based products in the world market. As the benefits of medicinal and aromatic plants are recognized, these plants will have a special role for humans in the future. Until last century, the production of botanicals relies to a large degree on wild-collection. However, the increasing commercial collection, largely unmonitored trade, and habitat loss lead to an incomparably growing pressure on plant populations in the wild. Therefore, medicinal and aromatic plants are of high priority for conservation. Given the above, we bring forth a comprehensive volume, "Medicinal and Aromatic Plants: Healthcare and Industrial Applications", highlighting the various healthcare, industrial and pharmaceutical applications that are being used on these immensely important MAPs and its future prospects. This collection of chapters from the different areas dealing with MAPs caters to the need of all those who are working or have interest in the above topic.

This volume in the series is devoted to Africa, a continent that possesses a vast treasure of medicinal plants and has produced some exclusive materials for the world market. This volume is expected to strengthen the medicinal plant sector in African coun-

tries by making comprehensive information on medicinal and aromatic plants available to policy-makers and entrepreneurs. It can be used to frame effective policies and create an environment conducive to the growth of the plant-based medicine industry, bringing economic benefit to African nations. It will help health or-

ganizations to improve the health of their people by using their own resources and a less expensive system of medicine, which is accepted by African society. It could also lead scientific communities to increase R&D activities in the field.