

# **The Complete Book on Spices & Condiments (with Cultivation, Processing & Uses) 2nd Revised Edition**

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The term spices and condiments applies to such natural plant or vegetable products and mixtures thereof, used in whole or ground form, mainly for imparting flavor, aroma and piquancy to foods and also for seasoning of foods beverages like soups. Usually spices are an ingredient used to season a dish in the meal during its preparation and condiments are for using at the table to enhance the dish as each individual's tastes prefer. The great mystery and beauty of spices is their use, blending and ability to change and enhance the character of food. Spices and condiments have a special significance in various ways in human life because of its specific flavours, taste, and aroma. Spices and condiments play an important role in the national economies of several spice producing, importing and exporting countries. India is one of the major spice producing and exporting countries. Most of the spices and herbs have active principles in them and development of these through pharmacological and preclinical and clinical screening would mean expansion of considerable opportunities for successful commercialization of the product. Spices can be used to create these health promoting products. The active components in the spices phthalides, polyacetylenes, phenolic acids, flavanoids, coumarines, triterpenoids, serols and monoterpenes are powerful tools for promoting physical and emotional wellness.

Some of the fundamentals of the book are definition of spices and condiments nomenclature or classification of spices and condiments, Indian central spices and cashew nut committee, origin, properties and uses of spices, forms, functions and applications of spices, trends in the world of spices, yield and nutrient uptake by some spice crops grown in sodic soil, tissue culture and in vitro conservation of spices, in vitro responses of piper species on activated charcoal supplemented media, soil agro climatic planning for sustainable spices production, potentials of biotechnology in the improvement of spice crops, medicinal applications of spices and herbs, medicinal properties and uses of seed spices, effect of soil solarization on chillies, spice oil and oleoresin from fresh/dry spices etc.

The present book contains cultivation, processing and uses of various spices and condiments, along with photographs of machinery/equipments with addresses of their manufacturers. The book is an invaluable resource for new entrepreneurs, agriculturists, agriculture universities and technocrats.

## **1. DEFINITION OF SPICES AND CONDIMENTS**

Nomenclature or Classification of Spices and Condiments

Brief History of Spices

First International Search for Indian Spices  
Role of the ICAR in Spice Development in India  
Spices Enquiry Committee  
Indian Central Spices and Cashewnut Committee  
Review of Researches on Cashewnut and 14 Spices  
Setting-Up of the Central Plantation Crops Research Institute (CPCRI), Kasaragod  
All-India Co-Ordinated Spices and Cashewnut Improvement Project (AICSCIP), Segregated to -  
All-India Co-Ordinated Improvement Project for Spices (AICIPS)  
Main Attainments of the Project (AICSCIP)  
Segregation of AICSCIP into 2 Projects on Cashew and Spices  
National Research Centre for Spices (NRCS, ICAR 1986)  
The Indian Institute of Spices Research (1995), Calicut  
Krishi Vigyan Kendra  
Other Organizations Involved in Spices Development.  
Division of Plant Introduction (IARI) and National Bureau of Plant Genetic Resources  
Role of Department of Agriculture and Co-Operation, Ministry of Agriculture, Government of  
India  
Directorate of Arecanut and Spices Development  
Spices Development Council, Department of Agriculture and Co-operation  
Agmark Laboratories and Directorate of Marketing and Inspection (DMI)  
Role of the Cftri and other CSIR National Laboratories in the Technological Spice Development  
Programmes  
Spices Export Promotion Council, Cochin  
Cardamom Board  
Functions of the Cardamom Board  
Spices Board, Govt of India  
Spices Cess Act  
Indian Cardamom Research Institute  
International Spices Development Activities  
International Pepper Community (IPC), Jakarta, Indonesia  
International Working Group on Spices (IWGS)  
Development of International ISO Standards for Spices and Condiments and their Processed  
Products as well as their Methods of Test (ISO : TC 34/SC 7)  
World Trade Organization (WTO)  
Recommended Action Plans  
Importance of Individual Spice Requirements  
Trends in Individual World Markets  
Forms of Spices and Spice Products Traded  
Concluding Remarks : The Challenges for the Indian Spice Industry  
Productivity Challenge  
Quality Challenge  
Value-Addition Challenge  
Equity Challenge

## 2. ORGIN, PROPERTIES AND USES OF SPICES

Ajowan  
Ajowan Contains Calcium and Iron  
Allspice  
Anise/Aniseed  
Annatto  
Asafoetida/Asafetida  
Basil  
Bay/Laurel Leaf  
Other • Bay Leaves

Indian Bay Leaf  
West Indian Bay Leaf  
Indonesian Bay Leaf  
Boldo Leaves  
Caper  
Caraway  
Cardamom/Cardamon  
Celery  
Chervil  
Chile Peppers  
Chives  
Cinnamon  
Cloves  
Coriander  
Cumin and Black Cumin  
Dill and Dillweed  
Epazote  
Fagara/Szechwan Pepper  
Fennel Seed  
Fenugreek  
Galangal/Galangale/Galingale  
Garlic  
Ginger  
Juniper  
Kaffir Lime (Leaf, Fruit)  
Kari Leaf  
Lemon Balm  
Lemon Verbena  
Lemongrass  
Lovage  
Mace  
Marjoram  
Mints: Spearmint and Peppermint  
Mustard  
Myrtle  
Nigella  
Nutmeg  
Onion  
Oregano  
Paprika  
Parsley  
Peppers: Black, White, Green, Long/Pippali, CUBEB  
Poppy Seed  
Rosemary  
Saffron  
Sage  
Sassafras  
Savory  
Screw-Pine Leaf/Pandanus Leaf  
Sesame  
Sorrel  
Star Anise  
Sumac

Tamarind  
Tarragon  
Thyme  
Turmeric/Tumeric  
Wasabi  
Zeodary

### 3. FORMS, FUNCTIONS AND APPLICATIONS OF SPICES

Introduction  
Spice Forms and Composition  
Fresh whole Spices  
Dried Spices  
Spice Extractives  
Essential (Volatile) Oils  
Oleoresins (Non-Volatiles and Volatiles)  
Other Extractives  
The Functions of Spices  
Primary function of Spices  
Flavor, Aroma and Texture  
Coloring Properties  
Secondary Functions of Spices  
Spices as Preservatives  
Emerging Secondary Function of Spices  
Spices as Medicines  
Spice Preparation  
Global Equipment used in Spice Preparation  
Spice Applications  
Marinades, rubs and Glazes  
Spice Blends, Seasonings and Condiments  
Spice Quality and Specifications  
International Standards and Specifications  
Maintaining Spice Quality  
Fumigation  
Controlled Atmosphere Storage  
Sterilization

### 4. TRENDS IN THE WORLD OF SPICES

Trends in foods and spices  
Understanding and Effectively Meeting the Growing Demand for Authenticity  
Authentic Ethnic Ingredients  
Spices and Flavorings of Popular Authentic Ethnic Cuisines  
Authentic Ethnic Flavorings  
Authentic Preparation and Cooking Techniques  
Presentation Styles  
Fusion and Regional American Flavorings  
Fusion Flavors  
Regional American Flavors

### 5. YIELD AND NUTRIENT UPTAKE BY SOME SPICE CROPS GROWN IN SODIC SOIL

Introduction  
Materials and methods  
Results  
Effect of Fertilizer  
Nutrient Concentration and Uptake  
Amelioration of Sodic Soil

## 6. TISSUE CULTURE AND IN VITRO CONSERVATION OF SPICES

Introduction

Cardamom

Clonal Multiplication

Regeneration of Plantlets from Callus

Inflorescence Culture

Black Pepper

Clonal Multiplication

Callus Cultures and Regeneration of Plantlets

Micropropagation of related species of Piper

Ginger

Clonal Multiplication

Regeneration of Plantlets from Callus

In Vitro Selection

Turmeric

Micropropagation

Plant Regeneration from Callus

Vanilla

Micropropagation

Saffron

Micropropagation

Tree spices

Micropropagation

In Vitro Proliferation of Mace and Synthesis of Flavour Components in Culture

Seed and herbal spices

Production of secondary metabolites

Synseed technology

In vitro Conservation of Spices Germplasm

Protoplast Isolation and Culture

Genetic Transformation

Isolation of DNA and Studies on Biochemical/molecular Markers

Conclusion

## 7. IN VITRO PROPAGATION OF BLACK PEPPER (PIPER NIGRUM L.)

Introduction

Materials and methods

Results

## 8. IN VITRO RESPONSES OF PIPER SPECIES ON ACTIVATED CHARCOAL SUPPLEMENTED MEDIA

Introduction

Materials and methods

Results and Discussion

## 9. TISSUE CULTURE STUDIES ON TREE SPICES

Introduction

Materials and methods

Results

Clove

## 10. MICROPROPAGATION OF SOME IMPORTANT HERBAL SPICES

Introduction

Materials and methods

Explants

Results

In Vitro Seed Germination

## 11. SOIL-AGRO CLIMATIC PLANNING FOR SUSTAINABLE SPICES PRODUCTION

Introduction

Agro-climatic Zonations-concepts and Backgrounds

Delineations of Agro Eco Region (AER) and Agro Eco Sub Regions (AESR)

Characteristics of Spice Growing Soils in Different Agro Eco Sub Regions

Bengal Basin-hot, Moist Subhumid Eco sub Region (Q8Cm7).

Sustainability of Agriculture

Potentials

Future Strategy

Water Management

Nutrient Management

## 12. WATER MANAGEMENT OF SPICE CROPS

Introduction

Irrigation

Rain Water Management (Conservation and Storage)

Irrigation Water Management

How to Get Water for Irrigation

How to Irrigate and Manage the Water

Summary

## 13. POTENTIALS OF BIOTECHNOLOGY IN THE IMPROVEMENT OF SPICE CROPS

The Potentials of Techniques Related to tissue culture

Somatic Embryogenesis

Organogenesis

Micropropagation

Secondary metabolites from cell cultures

In Vitro Germplasm Conservation

The Potentials of Genetic Engineering : Gene and Genome Analysis Techniques

Genetic Manipulation by Gene Technology

Agrobacterium Mediated Gene Transfer

Gene Transfer by Electroporation

Gene Transfer by Micro projectile Bombardment

Gene Marker and Genome Analysis Techniques

Non-PCR Based Marking Technique: Restriction Fragment Length Polymorphism

Arbitrary/semiarbitrary Primer Based PCR Techniques

Site Target PCR Technique

Marker Assisted Selection

## 14. SPICES IN AYURVEDA

Ayurvedic concept of Tri-Dosha

Dosha Related Elements

Effect of Spices on Tridosha

Tips from Grandmas remedies using spices

Cardamom

Turmeric

Asafoetida

Chilli

Cinnamon Bark

Dry Ginger

Mustard

Seed Spices

## 15. MEDICINAL APPLICATIONS OF SPICES AND HERBS

## 16. THE HEALING TOUCH OF SELECT SPICES

Garlic

Mustard

Cassia  
Capsicum  
Caraway  
Asafoetida  
Pepper Mint  
Basil  
Fennel  
Kokam  
Opium poppy  
Aniseed  
Tamarind

#### 17. MEDICINAL PROPERTIES AND USES OF SEED SPICES

Coriander  
Fenugreek  
Fennel  
Cumin  
Ajwain  
Celery  
Dill (Sowa)

#### 18. IN VITRO MICRORHIZOME PRODUCTION IN FOUR CULTIVARS OF TURMERIC (CURCUMA LONGA L.) AS REGULATED BY DIFFERENT FACTORS

Abbreviation

Introduction

Materials and methods

In Vitro Shoot Culture

Results

In Vitro Shoot Culture and Plant Regeneration

Role of sucrose, BA and photoperiod and their interaction in microrhizome formation

Harvesting, Storage and Germination of Microrhizome

#### 19. ENHANCEMENT OF GENETIC VARIABILITY IN CHILLI (CAPSICUM ANNUUM L.)

Introduction

Materials and methods

Result

#### 20. BREEDING OF INDIAN PAPRIKA FOR HIGH-VALUE ADDITIONS • ÆORGANIC COLOUR • AND ÆOLEORESIN •

Introduction

Materials and methods

Results

#### 21. USE OF COIR COMPOST AS A COMPONENT OF NURSERY MIXTURE FOR SPICES

Introduction

Materials and methods

Results

Experiment -I Effect of Terra Care as Substitute for Soil/Sand/ EYM in Conventional Potting

Mixture on Growth of Black Pepper Cuttings

#### 22. EFFECT OF SOIL SOLARIZATION ON CHILLIES (CAPSICUM ANNUUM L.)

Introduction

Materials and methods

Results

#### 23. SUPERCRITICAL FLUID EXTRACTION OF SPICES

#### 24. INDIAN SPICE EXTRACTION TECHNOLOGY

Introduction

Indigenous Technology

Steam Distillation

Solvent Extraction

25. SPICE OIL AND OLEORESIN FROM FRESH/DRY SPICES

26. ONFARM POST HARVEST TECHNOLOGY FOR PLANTATION SPICES

(a) Cardamom

(b) Large cardamom

(c) Vanilla

(d) Pepper

(e) Cloves

(f) Nutmeg and Mace

(g) Cinnamon

Conclusion

27. BULBOUS SPICES

Onion

Indian Names

Description, Distribution and Economic Importance

Types of Onions

Varieties

Quality Parameters of a Good Variety

New Varieties Released

Crop Management

Climate

Soil and its Preparation

Rotation

Propagation

Irrigation

Interculture and Weeding

Roguing

Manuring

Importance of Nutritional Elements

Harvesting

Yield

Seed Production

Plant Protection

Marketing

Preparation for Market

Grading

Composition

Storage

Packaging

Post-harvest Handling

Marketing Within the Country

Factors Affecting Efficient Storage

How to Reduce Storage Losses in Onions

Processed Products

Quality Parameters of White Onions for Dehydration Purposes

Dehydration of Onion

Onion Powder

Onion Salt

Uses

28. GARLIC

Indian Names

Description and Distribution

Varieties



Quality Parameters for Garlic Bulbs for Breeding/  
Production  
New Varieties  
Crop Management  
Soil and Climate  
Manurial Requirements  
Seed Rate and Sowing Methodology

Harvesting  
Yield  
Diseases and Insect Pests  
Tissue Culture of Garlic  
Marketing  
Smoking  
Packaging  
Grading  
Curing, Packaging and Storage  
Curing  
Packaging  
Storage  
Control Measures for Rubbering, Sprouting and Bulb Splitting Disorders  
Composition  
Commercial Forms of Dehydrated Garlic  
Garlic Powder-An Improved Patented Process  
Odourless Garlic Powder  
Garlic Salt  
Oil of Garlic  
Garlic Oleoresin  
Transport  
Uses  
Garlic as Condiment  
Garlic Oil as Insecticide  
Garlic Paste/Mixture as Biofungicide  
Garlic Oil as an Adhesive  
Garlic Residue with Antibacterial Properties  
Garlic in Medicine  
Garlic Use for Cancer  
In Human Nutrition  
Leek/ Stone Leek Welsh Onion  
Indian Names  
Description and Distribution  
Soil and Climate  
Varieties  
Crop Management  
Raising Nursery/Transplanting  
Manuring  
Seed Production  
Harvesting  
Plant Protection  
Composition  
Post-Harvest Technology/Processing  
Uses  
Shallot

Indian Names

Description and Distribution

Crop Management

Uses

## 29. SEED SPICES

International Trade

More Recent International Trade

Future Prospects

Ajowan or Bishop s Weed

Indian Names

Description and Distribution

Area, Production and Export

Varieties/Selections

Crop Management

Climate and Soil

Cultural Practices

Diseases and Pests

Post-Harvest Technology

Grading

Composition

Adulterants

Packaging and Storage

Processed Products

Essential Oil

In Medicine

Comparative Antimicrobial Activity of Seed Spice Essential Oils

Aniseed

Indian Names

Description and Distribution

Varieties

Crop Management

Post-Harvest Technology

Composition/Quality

Quality Standards

Packaging

Storage and Transport

Processed Products

Distillation of Oil

Caraway, Black Caraway or Siah Zira

Indian Names

Description and Distribution

Caraway

Black Caraway

Area, Production and International Trade

Crop Management

Soil and its Preparation

Manuring/Fertilization

Methods and Time of Sowing

Intercropping

Interculture

Irrigation

Harvesting and Threshing

Yield

Plant Protection  
Harvesting  
Post - Harvest Technology  
Packaging and Storage  
Composition  
Adulteration  
Quality Standards (PFA/BIS/ISO)  
Processed Products  
Volatile Oil  
Decarvonized Oil  
Caraway Chaff Oil  
As Food Flavourant  
Medicinal Uses  
30. A. CELERY SEED  
Indian Names  
Description and Distribution  
Varieties  
Crop Management  
Land Preparation  
Sowing Method  
Fertilizers  
Irrigation  
Plant Protection  
Tissue Culture  
Harvesting and Threshing  
Yield  
Post - Harvest Technology  
Cleaning/Preparation for the Market  
Composition/Quality  
Grading  
Packaging and Storage  
Contaminants Tolerance Limits  
Processed Products  
Seed-based Processed Products  
Processed Products from Celery Leaves/Stalks  
How to Handle and Store Celery Seed and its Products  
As a Food Flavourant  
In Medicine  
In Perfumery  
Fatty Oil  
Celery Root Use  
B.Celeriac  
Description and Distribution  
Crop Management  
Composition  
31. CORIANDER  
Indian Names  
Description and Distribution  
Origin and Brief History  
Botanical Description  
Crop Management  
Climate  
Soil

Preparation of Land  
Manuring and Application of Fertilizers  
Varieties  
Rotation and Mixture  
Sowing Time  
Seed Rate and Method of Sowing  
Increasing Seed Germination  
Irrigation  
Weeding and Hoeing  
IISR (ICAR) recommendations for crop management of coriander  
Plant Protection  
Tissue Culture  
Harvesting and Threshing  
Yield  
International Quality Specifications for Seed Spices  
Post-Harvest Technology  
Preparation for the Market  
Quality Grading  
Composition of Seeds and Coriander Leaves  
Packaging and Storage  
Processed Products  
Volatile Oil  
Fatty Oil (Non-Volatile Oil)  
Coriander Herb Oil  
Coriander Oleoresin  
Coriander Dal-an Improved CFTRI Process  
Seasoning from Coriander Roots  
As Flavourant  
In Medicine  
In Perfumery  
Oleoresin-other Uses  
Soluble Coriander (Superesin)

32. TREE SPICES

A. Aromatic Tree Spices  
B. Acidulant Tree Spices

Cassia and Cinnamon

Nomenclature  
Species of Cinnamomum Grown in India  
I. Jangli-Darchini (CASSIA) or Karuva  
Indian Names  
Description and Distribution  
Crop Management / Propagation  
Propagation of Cassia  
Air Layering in Cassia  
II. Tejpat or Tamal Patra or Indian Cassia Lignea  
Indian Names  
Description and Distribution  
Crop Management  
Harvesting and Collection of Tamala Leaves  
Preparation for Marketing  
Yield  
Essential Oil from Tamala Leaf  
Leaf Oil

Bark Oil

III. Tezpat

Indian Names

Description and Distribution

Brief Description of Commercial Types and Classification or Grades of Cassia

China Cassia (*Cassia Lignea*)

Indonesia Cassia (Batavia Cassia, Java Cassia, Padang Cassia or Korintje Cassia, Cassia Vera)

Vietnam Cassia

Commercial Grades of Cassia in World Market

Physico-Chemical/Specification of Cassia Types

Packing

Storage

Transportation

33. FENNEL

Indian Names

Description and Distribution

Major Types of Fennel Seed in the World Market

Crop Management

Climate

Soil

Varieties

Land Preparation

Sowing Time

Seed Treatment, Seed Rate and Sowing Methods

Raising Seedlings in the Nursery

Transplanting of Seedlings

Intercropping

Manuring and Top-dressing with Fertilizers

Interculture Operations

Irrigation

Package of Practices Recommended

Tissue Culture

Plant Protection

Phased Harvesting and Threshing

Yield

Post-Harvest Technology

Commercial Classification/Grading

Composition

Packaging and Storage

Processed Products

Volatile Oil

Fixed Oil

As Food Flavourant

In Medicine

Residue (case) as Cattle Feed

Fenugreek

Indian Names

Description and Distribution

Area, Production and Exports

Crop Management

Climate and Soil

Preparation of Land

Manuring  
Varieties  
Package of Practices  
Propagation  
Seed Rate  
Irrigation and Interculture  
Tissue Culture  
Plant Protection  
Harvesting - Desi Methi  
Production of Seed  
Yield  
Post-Harvest Technology  
Packing and Storage  
Composition  
Marketing  
Grades and Specifications  
Processed Products  
Fixed Oil  
Volatile Oil  
Effect of Roasting and Cooking on Nutritive Value  
Oleoresin  
Methi Leaves  
As Food or Food Flavourant  
In Medicine  
As Cattle Feed, Veterinary Medicine  
In Cosmetics; Dye/Hair Tonic and Cure for Baldness!  
Leaves as a Vegetable Curry  
Fixed Oil: Uses

#### 34. CINNAMON OR TRUE CINNAMON

Indian Names  
Description and Distribution  
World Trade in Cinnamon  
World Outlook/Prospects  
Crop Management  
Soil and Climate  
Propagation  
Manuring and Intercultivation  
Weeding  
Pruning/Cropping  
Crop Improvement  
Variability Studies  
Plant Protection  
Harvesting  
Post-Harvest Technology  
Preparation and Curing of Bark Spice for Marketing  
Curing of Barks  
Cutting and Peeling  
Preparation of Quills  
Drying  
Utilization of Leaves and Twigs  
Yield  
Economics of Cultivation  
Govt Incentives for Cinnamon Production and Marketing

Grading  
Composition  
World Types and Commercial Classification/Grades of Cinnamon  
Type Sri Lanka (Ceylon)  
Type Seychelles  
Type Madagascar  
Packaging of Different Commercial Classes of Cinnamon Bark and Powder  
Packing of Cassia and Cinnamon and their Products  
Storage of Cinnamon and Fumigation  
Transport of Cinnamon  
Processed Products  
Cinnamon/Cassia Bark Oil  
Cinnamon-Leaf Oil  
Cinnamon and Cassia Oleoresins  
Other Products  
Packaging and Storage  
Stem Bark  
Stem Bark Oil  
Cinnamon-Leaf Oil  
Root Bark Oil  
Seed Oil  
Cinnamon Buds  
Cinnamon Wood  
35. CLOVE  
Indian Names  
Description, Distribution and Economic Importance  
Constraints in Large-scale Cultivation/Production of Cloves in India  
Crop Management  
Site for Clove Cultivation  
Climate and Soil  
Varieties  
Propagation  
Mixed Cropping  
Soil-working  
Weeding  
Support  
Manuring  
Interculture/Pruning, Thinning  
Irrigation  
Soil-and -Moisture Conservation Works  
Water Management  
Crop Management and Breeding Strategy  
Crop Improvement: The Breeding Strategy Adopted at the IISR (ICAR)  
Harvesting and Curing  
Plant Protection  
Yield  
Economics of Cultivation  
Constraints in Clove Cultivation  
Central and State Govt Incentives for Production and Marketing of Cloves  
Post-Harvest Technology  
Preparation of Cloves for the Market  
Grading  
Storage

Transport  
Defective Cloves  
Composition  
Adulteration  
Quality Standards  
Packing of Cloves  
Packaging of Clove Oil  
Packaging of Clove Oleoresin  
Processed Products  
Clove-bud Oil  
Clove-stem Oil  
Clove-leaf Oil  
Oil of Mother Cloves  
Clove-root Oil  
As Food Flavourant  
In Medicine  
In Perfumery and Cosmetics  
Other Uses

### 36. JUNIPER

Indian Names  
Description and Distribution  
Crop Management  
Soil and Climate  
Propagation  
Flowering and Fruiting  
Harvesting of Berries  
Post-Harvest Technology  
Drying of Fruits (Berries)  
Grading  
Composition of Juniper Berries/Fruits  
Adulteration  
Juniper Berry Essential Oil (Volatile Oil)  
Composition of Juniper Volatile Oil  
Manufacturing Alcoholic Beverages  
As Food and Food Flavourant  
Juniper Oil  
Other Parts of the Tree  
In Medicine  
Volatile Oil  
Juniper Wood  
Other Uses/by-Products  
Exhausted Fruits/Berries  
Juniper Needles  
Roots  
Wood  
Juniper Wood Oil  
Mace and Nutmeg  
Indian Names  
Mace  
Indian Names  
Description and Distribution  
Crop Management  
Climate and Soil



Propagation by Nursery Technique  
Transplanting of Seedlings in the Field  
Mixed Cropping  
Manuring  
Mulching  
Interculture/Weeding  
Plant Protection  
Constraints in Nutmeg Cultivation  
Crop Improvement  
Sex Determination-Past, Present and Future  
Harvesting and Curing  
Yield  
Economics of Cultivation  
Central and State Govt Incentives for Production and Marketing  
Post-Harvest Technology  
Packaging of Mace and Nutmeg  
Grading  
Quality/Composition of Mace and Nutmeg  
Processed Products  
Mace Products  
Nutmeg Products  
Variations in Aroma/Flavour of Nutmeg and Mace Accessions  
Nutmeg  
Mace

### 37. PIMENTO OR ALLSPICE OR PIMENTA

Indian Names  
Description and Distribution  
Description  
Distribution  
Area, Production and Exports/Imports  
Crop Management  
Soil and Climate  
Propagation  
Transplanting of Seedlings  
Weeding/After-Care  
Aftercare : Fertilizer Schedule  
Manuring  
Successful Fruiting in Allspice-A Recent Achievement of NRCS (IISR, Calicut .)  
Harvesting and Yield  
Major Types of Allspice (Pimento)  
Crop Improvement Strategy or Breeding Strategy  
Yield of Berries  
Plant Protection  
Post-Harvest Technology  
Grades/Types  
The ISO Grades of Pimento (Whole and Ground)  
Physical Requirements for Whole Pimento  
Chemical Requirements of Whole Pimento  
Storage of Pimento  
Transport of Pimento  
Composition  
Packaging and Storage  
Processed Products

Pimenta Berry Oil  
Pimenta-leaf Oil  
Pimenta Oleoresin and Oil  
As Food Flavourant  
Use in Medicine  
Berry Oil  
Leaves  
Pimenta Bark and Wood  
A. Star-Anise  
Indian Names  
Description and Distribution  
Area and Production  
Crop Management  
Soil and Climate  
Propagation  
Raising Nursery and Transplanting  
Weeding  
After-care Mulching  
Manuring and Fertilization  
Maturation and Flowering  
Fruit Development  
Harvesting of Fruits  
Yield of Fruit  
Post-Harvest Technology  
Drying of Fruit  
Processing Technology and Products  
Manufacturing Essential Oil  
Native vs Modern Distillation of Oil  
Yield of Oil  
Quality of Star-anise Oil  
Quality Grading of Star-anise Oil  
Leaf Oil  
Fatty Oil  
Star-anise as Flavourant  
In Medicine  
Star-anise Oil  
B. Japanese star-Anise  
Description and Distribution  
Area, Production and Exports  
Crop Management  
Post-Harvest Technology  
Processing Technology  
38. BALM OR LEMON BALM  
Indian Names  
Description and Distribution  
Crop Management  
Soil and Climate  
Propagation  
Cultural Practices  
Harvesting  
Yield  
Post-Harvest Technology  
Processing Technology

Manufacturing Essential Oil  
Physico-chemical Properties of Oil  
As Food Flavourant  
In Medicine  
Basil or Sweet Basil (Tulsi)  
Indian Names  
Description and Distribution  
Major Types of Basil  
American Basil  
Area, Production and Exports  
Crop Management  
Varieties  
Soil and Climate  
Breeding  
Propagation  
Plant Protection  
Harvesting  
Yield  
Post-Harvest Technology  
Packaging and Storage  
Composition  
Processed Products  
Distillation of Oil  
As Food Flavourant  
In Perfumery and Cosmetics  
In Medicine  
As Insecticide, Insect-Repellent and Bactericidal  
Use of Basil Seeds  
Bay or Laurel Leaves  
Indian Names  
Description and Distribution  
Post-Harvest Technology  
Drying  
Composition  
Processing Technology  
Essential Oil Recovery  
Physico-chemical Properties of Volatile Oil  
Bay Leaves for Flavouring  
Fat from Bay or Laurel Berries  
Laurel Wood Utilization  
39. CURRY LEAF  
Indian Names  
Description and Distribution  
Area, Production  
Crop Management  
Curry Leaf Cultivation in Homesteads of South Kerala  
Raising Nursery  
Manuring  
Harvesting  
Weeding  
Prophylactic Measures for Plant Protection  
Cost of Cultivation  
Cultivars and their Sensitivity to Winter Temperature

Plant Protection  
Termites  
Post-Harvest Technology  
Packing and Storage  
Composition  
Processed Products  
Volatile Oil  
Dehydrated Curry Leaves  
As Food Flavourant  
In Indigenous Medicine  
In Perfume and Cosmetics  
Fruits  
Wood  
Hyssop  
Description and Distribution  
Area, Production and Exports  
Crop Management  
Soil and Climate  
Planting and Cultivation  
Harvesting  
Yield  
Post-Harvest Technology  
Composition  
Processing Technology  
Distillation of Essential Oil  
Yield of Essential Oil  
Physico-chemical Properties of Volatile Oil  
As Condiment  
In Medicine  
Volatile Oil Uses  
Marjoram  
Indian Names  
Description and Distribution  
Crop Management  
Soil and Climate  
Propagation  
Influence of Growth Regulators on Growth, Herbage and Essential Oil Yields  
Harvesting  
Flowering  
Post-Harvest Technology  
Drying, Packing and Storage  
Composition  
Processed Products  
Volatile Oil  
As Food Flavourant  
In Perfumery and Cosmetics  
In Medicine  
40. PEPPERMINT  
Indian Names  
Description and Distribution  
Crop Management  
Processed Procucts  
Volatile Oil

In Medicine/Pharmaceuticals  
Waste Utilization  
Spearmint  
Indian Names  
Description and Distribution  
Crop Management  
Important Steps in its Successful Cultivation in India  
Composition  
Processed Products  
Volatile Oil  
Origanum  
Indian Names  
Description and Distribution  
Crop Management  
Soil and Climate  
Propagation  
Sowing  
After-care  
Harvesting  
Post-Harvest Technology  
Drying  
Composition  
Processed Products  
Volatile Oil  
As Food Flavourant  
In Medicine  
Other Uses  
Parsley  
Indian Names  
Description and Distribution  
Area, Production and Trade  
Crop Management  
Climate and Soil  
Direct Sowing/Sowing in Nursery Beds  
Transplanting of Seedlings  
Manuring/Fertilizers  
Harvesting  
Yield  
Post-Harvest Technology  
Composition  
Processed Products  
Dehydrated Parsley  
Volatile Oil  
Fatty Oil  
As Food Flavourant  
In Medicine  
41. ROSEMARY  
Indian Names  
Description and Distribution  
Crop Management  
Climate and Soil  
Propagation  
Planting

Harvesting  
Yield  
Post-Harvest Technology  
Drying and Packing  
Composition  
Processed Products  
Volatile Oil  
As Food Flavourant  
In Perfumery and Cosmetics  
In Medicine  
Sage  
Indian Name  
Description and Distribution  
Major Types of Sage in World Trade  
Different Forms of Sage  
Crop Management  
Climate and Soil  
Propagation  
Planting  
Harvesting  
Yield  
Post-Harvest Technology  
Drying  
Composition  
Marketing/Trading  
How to Handle and Store  
Processed Products  
Volatile Oil  
As Food Flavourant  
In Medicine  
Use in Perfumery  
As Anti-oxidant  
Use of Residue  
Uses of Seeds  
Clary Sage (*Salvia sclarea* Linn.) or Garden Sage  
Introduction  
Savory  
Indian Names  
Description and Distribution  
Area, Production and Exports  
Crop Management  
Soil and Climate  
Propagation  
Seed Rate, Method of Sowing and Weeding  
Harvesting  
Yield  
Post-Harvest Technology  
Processing Technology  
Essential Oil of Savory  
Composition of Dried Herb  
Composition of Fresh Herb  
Volatile Oil  
Tarragou

Indian Names  
Description and Distribution  
Crop Management  
Soil and Climate  
Propagation  
Planting Season  
Harvesting  
Post-Harvest Technology  
Composition  
Processing Technology  
Essential Oil  
Physico-chemical Properties of Oil  
Precautions in the Storage of Oil  
As Food Flavourant

In Medicine  
In Perfumery  
Thyme

Indian Names  
Description and Distribution  
Major Types of Thyme  
Crop Management  
Climate and Soil  
Propagation  
Post-Harvest Technology  
Commercial Quality  
Composition  
Handling and Storage of Thyme  
Processed Products  
Thyme Extractives-Volatile Oil and Oleoresin  
Thymol  
As Food Flavourant

In Medicine

#### 42. ASAFOETIDA OR ASAFETIDA

Indian Names  
Description and Distribution  
Types or Varieties of Asafoetida Imported into India  
Method of Collection of Gum-resin  
Crop Management  
Varieties of Asafoetida  
Types/Varieties of Asafoetida of Commerce  
Quality Evaluation  
Composition  
Processed Products  
Oil of Asafoetida  
Oil of Galabanum  
Compounded Asafoetida Powder and Tablets : A Simple CFTRI Process  
As Food Flavourant

In Medicine

Calamus or Sweet Flag

Indian Names  
Description and Distribution  
Crop Management  
Climate and Soil Requirements

Preparation of Land  
Planting Method  
Planting Time  
Irrigation  
Weeding  
Manuring  
Harvesting  
Yield  
Plant Protection  
Post-Harvest Technology  
Preparation for the Market  
Adulteration  
Composition  
Processed Products  
Volatile Oil  
In Medicine  
In Perfumery  
As an Insecticide  
In Foods Beverages and Liquors

#### 43. GALANGAL

Description and Distribution  
Economic Importance  
Crop Management  
Varieties/Races of Galangal  
Planting  
Plant Protection  
Application of Manures/Fertilizers  
Harvesting  
Yield  
Post-Harvest Technology  
Composition  
Volatile Oil  
Oleoresin Content  
Galangal Rhizomes  
Galangal Oil  
Galangal Oleoresin  
Horse-Radish  
Description and Distribution  
Crop Management  
Post-Harvest Processing Technology  
Volatile Oil  
Composition of Horse-radish  
Adulteration  
As Condiment  
Horse-Radish Cream, Sauce or Relish  
In Medicine  
Long Pepper or Pipli  
Indian Names  
Description and Distribution  
Crop Management  
Soil and Climate  
Propagation  
Manuring



Harvesting  
Yield  
Plant Protection  
Post-Harvest Technology  
Drying and Packaging.  
Composition  
Processed Products  
Volatile Oil  
As Food Flavourant  
In Medicine  
44. SAFFRON  
Indian Names  
Description and Distribution  
Crop Management  
Soil  
Climate  
Land Preparation and Planting  
Manures and Fertilizers  
Irrigation  
Interculture  
Crop Rotation  
Effect of Plant Density on Flower, Yield and Corm Production  
Variation in Floral Characteristics of Saffron in different Kashmir Locations  
Harvesting or Picking of Flowers and obtaining Saffron  
Yield  
Cost of Cultivation of Saffron  
Economic Viability of Saffron Cultivation  
Pests and Diseases  
Recent Studies on Crop Management of Saffron in Iran  
Effect of Fertilizers (NPK)  
Post-Harvest Technology  
Sun-Drying of Saffron in Kashmir  
Effect of Different Processing (Different Drying and Dehydration Techniques)  
Composition  
Adulteration  
Packaging and Storage  
Marketing  
Processed Products  
As Flavourant and Colourant for Foods  
Medicinal Properties  
45. VANILLA  
Indian Names  
Description and Distribution  
Commercial Forms of Vanilla  
General Characteristics of Vanilla Forms  
Qualitative Classification of Vanilla Pods  
Crop Management  
Climate  
Soil  
Preparation of Land  
Providing Supports (Posts) for Vines  
Planting  
Manuring

After-care  
Flowering and Natural Pollination  
Hand-pollination  
Pod Development  
Vanilla Production Plan by Tissue-Culture Technique  
Vegetative Propagation of Vanilla  
Yield  
Plant Protection  
Diseases  
Post-Harvest Technology  
Curing  
Vanilla Bean Packing and Storage  
Composition  
Adulteration/Substitution  
Processed Products  
Vanilla Extracts/Essences  
Vanilla Sugar  
Vanilla Oleoresin  
Vanilla powder, Vanilla absolute and Vanilla Tincture  
As Food Flavourant and in Perfumery  
Vanillin

46. Machinery & Equipments

## About NIIR

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