

# **The Complete Book on Coconut & Coconut Products (Cultivation and Processing)**

**Author:-** NIIR Board of Consultants & Engineers

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Coconut is one of the oldest crops grown in India and presently covers 1.5 million hectares in this country. Found across much of the tropic and subtropical area, the coconut is known for its great versatility as seen in the many domestic, commercial, and industrial uses of its different parts. Coconuts are part of the daily diet of many people. Its endosperm is initially in its nuclear phase suspended within the coconut water. As development continues, cellular layers of endosperm deposit along the walls of the coconut, becoming the edible coconut flesh. When dried, the coconut flesh is called copra. The oil and milk derived from it are commonly used in cooking and frying; coconut oil is also widely used in soaps and cosmetics. The clear liquid coconut water within is a refreshing drink and can be processed to create alcohol. The husks and leaves can be used as material to make a variety of products for furnishing and decorating. It also has cultural and religious significance in many societies that use it. India stands third in the production of coconut in the world. There are only two distinguishable varieties of coconut; the tall and the dwarf. As a result of cross pollination in the tails, a wide range of variations occur within the same variety. Coconut based cropping/farming systems promote on farm diversity and strengthens ecological base of coconut farming. Coconut husk is the raw material for the coir industry. It is also used as a domestic fuel and as a fuel in copra kilns. Coconut oil comes under edible/industrial group, is used as cooking oil, hair oil, massage oil and industrial oil. It is dominated by saturated fats and high percentage of lauric acid. India accounts for the 18% of total coconut production in the world and it is the third largest coconut producing country in the world. Coconut processing adds value, and a number of products like coconut oil, desiccated coconut, coir fibre, pith, mattresses, desiccated coconut (DC), coconut cream, coconut milk, spray dried coconut milk powder, coconut shell products, shell charcoal, shell powder, virgin coconut oil are obtained. The demand for coconut oil increases 15 to 20 % during the festival season. Coconut oil for edible purposes is now being claimed to be the second best edible oil in the world, after Olive oil. Coconut shell charcoal is most widely used as domestic and industrial fuel.

Some of the fundamentals of the book are product diversification in coconut, future of coconut oil, scope for product diversification, varieties of coconut, farming systems in coconut, organic farming of coconut, spices and herbs, establishment and maintenance of organic coconut plantations, production of organic spices, medicinal and aromatic plants along with coconut, crop improvement, green manuring in coconut garden organic recycling in coconut, soil moisture conservation in coconut garden, harvest and post harvest technology, integrated farming in coconut holdings for productivity improvement, machinery and processing of desiccated coconut, coconut processing sector in India, etc.

Coconut plays an important role in the economic, social and cultural activities of millions of people in our country. India is a major producer of coconut in the world. Coconut provides food, edible oil, industrial oil and health drink to humanity. All parts of coconut tree is useful in one way or other and the crop profoundly influences the socio economic security of millions of farm families. The present book contains the methods of cultivation and processing of coconut. This book is very beneficial for agriculturist, researchers, professionals, entrepreneurs, agriculture universities etc.

## 1. PRODUCT DIVERSIFICATION IN COCONUT

Future of Coconut Oil

Scope for Product Diversification

Philippines

Sri Lanka

India

Other Uses

Conclusion

## 2. VARIETIES OF COCONUT

Tall Variety

West Coast Tall

East Coast Tall

Lakshadweep Ordinary

Lakshadweep Micro

Andaman Ordinary

Andaman Giant

Kappadam

Laguna

San Ramon

Macapuno

Spicata

Performance of exotic cultivars under Indian conditions

Dwarf Variety

Ghowghat Green Dwarf

Chowghat Orange Dwarf

Malyan Dwarf

Gangabondam

Ayiramkachi

Thembili (King Coconut)

Coonino

Mangipod

Niuleka

## 3. FARMING SYSTEMS IN COCONUT

Rooting Pattern

Crown Structure And Light Transmission

Water Use Efficiency

Nutrients

Choice of Inter / Mixed Crops

Criteria For Selection Of Inter/

Mixed Crops

#### 4. ORGANIC FARMING OF COCONUT, SPICES AND HERBS

Organic Coconut Scenario

Scope For Organic Production of Coconut In India

Characteristics of A Typical Organic

Coconut Farm

Establishment And Maintenance of Organic Coconut Plantations

Conversion Period

Buffer Zone

Choice of Varieties

Raising Nursery

Land Preparation

Preparations for Planting

Aftercare of the Young Plantation

Nutrient Management

Green Manuring and Cover Cropping

Utilization of Waste from Coconut Palm

Improving Soil Conditions

Plant Protection

Biopesticides

Contamination Control

Soil and Water Conservation

Bee Keeping

Animal Husbandry

Conversion of Established Plantations

Conversion Period

Choice of Cultivars/Varieties

Composting of On-farm Crop Residues/

Farm Wastes

Nutrition Management

Weed Management

Processing of Organic Coconut

Production of Organic Spices, Medicinal And Aromatic

Plants Along With

Coconut

Certification of Organic Products

#### 5. PLANTING MATERIAL

Collection of Seednuts

Raising Nursery

Nursery Care

Seedling Selection

Polybag Nursery

Care of Polybag Nursery

#### 6. GARDEN ESTABLISHMENT

Site Selection

Time of Planting

Planting System

Land Preparation And Preparation of Pits For Planting

Replacement of Unproductive Palms  
Replanting  
Under Planting  
After Care

## 7. CROP IMPROVEMENT

Varieties

Tall Group

West Coast Tall

East Coast Tall

Lakshadweep Ordinary

Lakshadweep Micro

Andaman Ordinary

Kappadam

VPM-3

ALR (CN) 1

Dwarf Group

Dwarf Green

Dwarf Orange

Malayan Dwarf

Gangabondan

Choughat Orange Dwarf

Tall And Dwarf Hybrids

VHC 1

VHC 2

VHC 3

## 8. CROP PROTECTION

Insect Pests

Rhinoceros Beetle, *Oryctes rhinoceros* L.

Management

Red Palm Weevil, *Rhynchophorus ferrugineus* Oliv. (Curculionidae: Coleoptera)

Management

Black Headed Caterpillar, *Opisina arenosella* Meyr. (Cryptophasidae: Lepidoptera)

Management

Termite, *Odontotermes obesus* Ramb. (Termitidae: Isoptera)

Management

Lacewing Bug, *Stephanitis typicus* Dist. (Tingidae: Hemiptera)

Scale Insect, *Aspidiotus destructor* Sign. (Diaspididae: Hemiptera)

Management

Mealybug, *Pseudococcus longispinus* (T.),

*P. citriculus* G., *Palmicultor palmarum* (Eh.) (Pseudococcidae : Hemiptera)

Management

Slug Caterpillar, *Latoia lepida* Cram (Cochliidiidae: Lepidoptera)

Slug Caterpillar, *Contheyla rotunda* H.,

(Cochliidiidae: Lepidoptera)

Slug Caterpillar, *Macroleptra nararia* M.

(Cochliidiidae: Lepidoptera)

Management

White Leaf Roller, *Gangara thyrasis* M.

(Hesperiidae: Lepidoptera)

Green Leaf Roller, *Suastus gremius* F.

(Hesperiidae: Lepidoptera)

Long Green Caterpillar, *Turnaca acuta* W.

(Notodontidae: Lepidoptera)

Bag Worm, *Manatha albipes* M.

(Psychidae: Lepidoptera)

Management

Nut Borer, *Cyclodes omma* V.H.

(Noctuidae: Lepidoptera)

Lesser Coconut Spike Moth, *Batrachedra*

*arenosella* Wlk. (Cosmopterygidae: Lepidoptera)

Flower Caterpillar, *Syntomis passalis* Fab. (Cosmopterygidae: Lepidoptera)

Ash Weevil, *Mylocherus curvicornis* Fab.

(Curculionidae: Coleoptera)

Stem and Bark Weevil, *Diocalandra*

*stigmaticollis* G. (Curculionidae: Coleoptera)

Management

Shot Hole Borer, *Xyleborus perforans* W.

(Scolytidae: Coleoptera)

Management

Coreid Bug, *Paradasynus rostratus* Dist.

(Coreidae: Heteroptera)

Management

Root Grub, *Leucopholis coneophora* Burm. (Melolonthidae: Coleoptera)

Management

Ant, *Dorylus orientalis* W.

(Formicidae: Hymenoptera)

Red Ant, *Oecophylla smaragdina* F.

(Formicidae: Hymenoptera)

Non Insect Pests

Mites

Management

Package of Recommendations

Management

Nematodes

The Burrowing Nematode,

*Radopholus Similis*

Management

The Coconut Nematode,

*Rhadinaphelenchus Cocophilus*

Rodent Pests

Management

Management

Squirrel, *Funambulus Palmarum*

Monkeys

Storage Pests

Management

Diseases

Bud Rot, *Phytophthora palmivora* Butler

Management

Thanjavur Wilt, *Ganoderma lucidum* (Leyss)

Karst and *G. applanatum*

Management

Stem Bleeding. *Thielaviopsis paradoxa*

Management

Leaf Blight, *Pestalotia palmarum*

Management

Pencil Point " (Tapering Wilt)

Management

Tatipaka Disease

Management

Crown Choke Disease

Management

Button Shedding

Management

Root Wilt

Management

Leaf Rot, *Colletotrichum gloeosporioides*,

*Exserohilum rostratum*, *Fusarium solani*

Management

Mahali (Fruit Rot and Nut Fall),

*Phytophthora palmivora*

Management

Preparation Of 1% Bordeaux Mixture

Bordeaux Paste

## 9. INTEGRATED DISEASE MANAGEMENT

Bud Rot Causal Organism

Symptom

Control

Preparation Of 1% Bordeaux Mixture

Bordeaux Paste

Root Disease

Symptoms

Management

Leaf Rot

Causal Organisms

Symptom

Control

Stem Bleeding Disease

Causal Organism

Symptom

Control

Thanjavur Wilt/Ganoderma Disease

Causal Organism

Symptom

Management

Mahali (Fruit Rot And Nut Fall)

Causal organism

Symptom

Control

Leaf Blight Or Grey Leaf Spot

Symptom

Control

Tatipaka Disease

Symptom  
Management  
Crown Choke Disease  
Symptom  
Control

## 10. GARDEN MANAGEMENT

Intercultivation  
Fertilizer Recommendations For  
Coconut - A Summary  
Deficiency Of Nutrients  
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Potassium  
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Boron  
Sulphur  
Chlorine  
Green Manuring In Coconut Garden  
Organic Recycling In Coconut  
Organic Recycling in Coconut Based  
Farming System  
Leguminous Green Manure Plants for  
Sustaining Coconut Yields  
Basin Management with Legume Cover Crops  
Growing of Gliricidia as green leaf manure crop  
in coconut garden under littoral sandy soil  
Recycling of organic wastes from coconut palm  
Direct utilization of coconut wastes as mulch  
Vermicomposting  
Coir pith composting  
Water Management  
Automatic Irrigation System  
Drainage  
Weed Control  
Soil Moisture Conservation In Coconut Garden  
Coconut Based Cropping Systems  
Rooting Pattern  
Canopy Structure And Light Utilization  
Criteria For Selection Of Subsidiary Crops  
Intercropping Systems  
Tuber Crops  
Rhizome Spice Crops  
Cereals  
Vegetables  
Pulses  
Oil Seeds  
Fruit Crops  
Floriculture  
Medicinal And Aromatic Plants  
Mixed Cropping  
Cocoa  
Pepper

Clove  
Nutmeg  
Cinnamon  
High Density Multispecies Cropping  
System  
Coconut Based Mixed Farming System  
Coconut Based Sericulture System  
Economic Aspects Of Coconut  
Cultivation

## 11. HARVEST AND POST HARVEST TECHNOLOGY

Harvesting  
Storage And Seasoning  
Post Harvest Processing  
Husking  
Copra Processing  
Sun Drying  
Solar Dryer  
Indirect Drying  
Small Holder's Copra Dryer  
Smoke Free Copra Dryer For  
Medium Holdings  
Large Holder's Copra Dryer  
Electrical Copra Dryer  
Ball Copra  
Copra Grading  
Copra Moisture Meter  
Coconut Products And Byproducts  
Desiccated Coconut  
Tender Coconut Water  
Snow Ball Tender Nut (Sbtn)  
Matured Coconut Water  
Nata-De-Coco  
Coconut Milk And Milk Products  
Coconut Cream  
Coconut Spray Dried Milk Powder  
Toddy  
Coconut Byproducts  
Byproducts From Husk  
Coconut Shell Charcoal  
Activated Carbon  
Shell Flour  
Coir And Coir Products  
Handicrafts From Coconut  
Coconut Wood Processing  
Mushroom Cultivation Using Coconut Byproducts

## 12. INTEGRATED FARMING IN COCONUT HOLDINGS FOR PRODUCTIVITY IMPROVEMENT



## 13. FINANCIAL ASSISTANCE TO PROCESSING INDUSTRIES

### 14. COCONUT HUSK

Coir

Coir Geotextile

Coir Pith

### 15. COCONUT OIL

Properties Of Coconut Oil

Extraction Of Coconut Oil

Coconut Oil Based Oleochemicals

Coconut oil based Oleochemicals:

Coconut Oil Cake

### 16. MACHINERY AND PROCESSING OF DESICCATED COCONUT

Abstract

Introduction

Desiccated Coconut

Processing Of Desiccated Coconut

Plant & Machinery For Desiccated  
Coconut

Drying Of Desiccated Coconut

The Pilot Plant

Results And Observations

Scale-Up

Quality Of Desiccated Coconut

Conclusions

### 17. QUALITY STATUS OF DESICCATED COCONUT

Abstract

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Materials And Methods

Results And Discussion

### 18. COCONUT PROCESSING SECTOR IN INDIA

Trend In Area, Production And

Productivity

Coconut Industry Vs Indian Economy

Present Status Of The Coconut

Processing Sector

Traditional Coconut Products

And Technological Innovations

Copra

Sun drying

Kiln drying

Indirect hot air drier

Solar drying

Improvement in drying

- Coconut Oil
- Desiccated Coconut
- Coir and Coir Products
- Emerging Technologies In The Processing Sector
- Wet Processing of Coconut
- Coconut Cream
- Coconut Milk Based Consumer Products
- Coconut Shell Based Products
- Coconut Shell Charcoal
- Activated Carbon
- Methods of Processing
- Destructive Distillation of Shells
- Coconut Shell Powder
- Miscellaneous Uses of Shells
- Coconut Water
- Coir Pith and Miscellaneous Products
- Problems And Constraints
- Future Strategy

## 19. VINEGAR FERMENTATION WITH SPECIAL EMPHASIS ON POSSIBILITIES OF UTILIZATION OF MATURED COCONUT WATER

- Production And Volume
- Raw Materials
- Production Of Vinegar
- Acetification Methods
- The Orleans Process or Slow Process or French Process
- Quick Process or German Process
- Submerged Method
- Other Modern Processes
- Coconut Water As Possible Substrate For Vinegar Fermentation
- Preparation of Coconut Water Medium
- Pfa Specifications For Vinegar
- Standards
- Problems In Vinegar Manufacture
- Ageing Of Vinegar

## 20. ACTIVATED CARBON FROM COCONUT SHELLS: SIGNIFICANCE AND PROSPECTS

- Protection Against Toxic Gases
- Air Purification And Recovery
- Purification Of Various Gases
- Filters For War Gases/ Nuclear Fall-Outs
- Purifying Working Environments And Elimination Of Odours
- Recovery Of Solvents And Other Vapours
- Typical Plants where Such Solvents are Recovered
- Separation Of Hydrocarbon Mixtures

Purification Of Fermentation  
Carbon Dioxide  
Recovery Of Gold  
Carbon Batteries  
Miscellaneous Applications  
Activated Carbon As Catalyst  
And Catalyst Carriers  
Impregnated Carbons  
Activated Carbon In Pollution  
Control  
Conclusion

## 21. COMMERCIAL EXPLOITATION OF COCONUT PITH

Introduction  
Coconut Pith  
Utilisation Of Pith : Problems  
Utilisation Of Pith : Prospects  
Pith Fuel Briquettes Briquetting With Binders  
Pith As An Ingredient In Agricultural/  
Horticultural Farms  
Pith As A Heat Insulating Material  
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## 22. MODERN SEMI AUTOMATIC COPRA MANUFACTURING UNIT USING WASTE HEAT RECOVERY SYSTEM

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Present Uses Of Coconut Shell In India  
Charcoal Manufacture And Waste  
Heat Recovery Unit  
Chemical Analysis And Calorific Value  
Whu And Pyrolysis Process  
Modern Semi-Automatic Copra  
Drying Unit  
Economic Of A Modern Copra  
Drying Unit  
Inference

## 23. COCONUT KERNEL PRODUCTS

Virgin Coconut Oil  
Desiccated Coconut  
Coconut Milk  
Spray Dried Coconut Milk Powder

## 24. FOOD PRODUCTS

The Wet Meat Or Kernel  
Coconut Milk and Related Products  
Coconut Skim Milk And Related  
Products  
Coconut Protein And Edible Oil

Krauss-Maffei/C.F.T.R.I. Process  
Texas A & M University Process  
The TPI Process  
The Modified Solvol Process  
Desiccated Coconut  
Removal of the Kernels and Paring  
Washing  
Sterilising  
Disintegrating and Desiccating  
Edible Copra  
Coconut Water  
Foods uses of Coconut Water  
Other Miscellaneous Uses  
Toddy And Toddy Products  
Tapping  
The yield of Toddy  
Suitability of Dwarf Palms  
Tapping and Subsequent Yield of Nuts  
Composition and Uses of Fresh Toddy  
Jaggery  
Refined Sugar  
Treacle  
Fermented Toddy  
Arrack  
Coconut Vinegar  
Miscellaneous Products Of Food Value

## 25. COMMERCIAL PRODUCTS

Milling Copra  
Preparation of Coconuts before Drying  
Copra Drying Process and Methods  
Sun Drying  
Smoke Drying or Drying by Direct Heat in Kilns  
Drying by Indirect Heat  
The Quality of Copra  
Oil Content of Copra  
Storage of Copra  
Deterioration of Copra  
Grading of Copra  
Moisture Determination  
Coconut Oil  
Oil Milling  
Yield Of Oil From Copra  
Physical Properties  
Chemical Properties  
Rancidity  
Ensuring the Quality of Oil  
Quality Standards for Coconut Oil  
Uses of Coconut Oil  
Consumption Of Coconut Oil And Heart Ailments  
Coconut Cake  
Use Of Coconut Cake

- Coir Or Coconut Fibre
- Natural Retting
- Mechanical and Chemical Methods of Retting
- Extraction of White Fibre
- Extraction of Brown Fibre
- Yield Of Fibre From Husk
- Varieties Of Fibre And Grades
- Chemical Composition
- Spinning of Coir Yarn
- Utilisation of Coir Fibre and Yarn
- Rubberised Coir
- Coir Pith Or Coir Dust

## 26. COCONUT SHELL AND MISCELLANEOUS PRODUCTS

- Coconut Shell Charcoal
- Covered Pit Method
- Modified Pit Method
- The Drum Method
- Uses
- Properties
- Distillation Of Coconut Shells
- Activated Carbon
- Coconut Shell Flour
- Other Uses
- Miscellaneous Products

## 27. BY-PRODUCTS UTILISATION

- Commercial Exploitation Of
- Coconut Pith
- Pith as a Heat Insulating Material
- Coconut Oil
- Coconut Product Diversification
- Copra Making
- White Copra Production
- Ball Copra
- Vinegar Making
- Bio-Confectionaries from Coconut Water
- Benefits from Bio-Sweets
- Desiccated Coconut
- Canning of Coconut Haustorium
- Coconut Cream
- Coconut Shell Powder
- Coconut Milk
- Coconut Oil Derivatives
- Coconut Oil as an Edible Oil
- Production Of Cocopeat
- Granulated Charcoal
- Biodiesel Plant-Oleochemical
- Rubberised Coir Fibre Cushions
- Coir Industry
- Coconut Shell Based Products

Shell Charcoal  
Coconut Shell and Wood Handicrafts  
Activated Carbon from Coconut Shells  
Protection against Toxic Gases  
Purification of Various Gases  
Recovery of Solvents and Other Vapours  
Typical Plants Where Such Solvents are Recovered  
Separation of Hydrocarbon Mixtures  
Purification of Fermentation Carbondioxide  
Recovery of Gold  
Carbon Batteries  
As Catalyst and Catalyst Carriers  
Impregnated Carbons  
Global Competitiveness Of Coconut  
Industry  
Exports  
Competition from Other Oilseed Crops  
Low Profitability  
Fluctuating Prices  
Inconsistent Supplies of Product  
Strategies For Future

## 28. MATURE COCONUT

Optimum Stage For Harvesting  
Coconuts  
Dehusking  
Home Preservation Of Split Coconuts  
Mature Coconut Water Products  
Coconut Water Beverages  
Coconut Vinegar  
Nata-De-Coco  
Other Products

## About NIIR

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Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

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**NIIR PROJECT CONSULTANCY SERVICES**, 106-E, Kamla Nagar, New Delhi-110007, India.

**Email:** [npcs.india@gmail.com](mailto:npcs.india@gmail.com) **Website:** [NIIR.org](http://NIIR.org)

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