

# Bamboo Plantation and Utilization Handbook

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Bamboo is an important non wood forest product. In India, bamboo, which is traditionally considered the Poor man wood, and labelled as Green Gold is being considered a major export item by the centre for the global market. Bamboo is perfectly suited to agro forestry as a woody grass. Bamboo has been exploited from natural stands from time immemorial. Bamboo is increasingly being cultivated like other agricultural crops, that is, in professionally managed plantations. The growth of industries utilizing bamboo requires the sustainable cultivation and management of bamboo resources. India is blessed with very rich bamboo resources. Bamboo can play an important role in raising forest cover and a major role in stabilization of the environmental problems. The annual yield in tonnes/ha depends on the environment as well as the species. It is estimated that almost 25% of the biomass in the tropics and 20% in the subtropics, come from bamboo. The cultivation of bamboo as a wood substitute helps to offset depletion of the rain forest. Its rapid growth ensures an effective reconstruction of damaged eco systems. Bamboo is one of many sustainable non wood resources that can generate income for a large forest dependent rural population and it needs to take further steps to realize its full potential. In India, the North East has the largest stock and diversity of bamboos. Though India has the largest area under bamboo, the yield per hectare is very low compared to other countries. Bamboo plantation rising should be encouraged & promoted due to their high value, productivity, uniformity of crop, choice of species linked to peoples' need and industrial need. Bamboo forest constitutes about 13% of the total forest area of the country. About 50% of bamboo produced in India grows in North Eastern region and West Bengal. India has the second largest bamboo reserves in the world after China.

This book basically deals with bamboos in India, the bamboo plant harvesting, cultivating, silviculture and management, collection of material and preparation of cuttings treatment for root induction in cuttings,

preparation of nursery and planting nursery management transplanting, pattern of biomass allocation in growing bambusa bamboos, biochemical characteristics of plantation bamboo leaf (bambusa bambos) with reference to organic productivity, economic analysis, bamboo plantation, problems and prospects, need for bamboo plantation, consumption pattern of bamboos in India, working and finishing qualities of bamboo, bamboos for structural use, pipe water supply system and drainage, bamboo furniture weaving industry etc.

This book provides a complete detail on Bamboo plantation and its utilization. This book contains chapters like types of bamboo in India, taxonomy, cultivation, harvesting, growth management, bamboo utilization, Bamboo products and many more. This book will be very helpful to all its readers, environmentalists, agronomists, entrepreneurs, industrialists, or anyone

with a special interest in bamboo cultivation.

## 1. INTRODUCTION

## 2. DISTRIBUTION OF BAMBOOS IN THE WORLD

Bamboos in Asia

Bangladesh

China

India

Indonesia

Japan

Korea

Loas

Malaysia

Myanmar

Papua New Guinea

Phillippines

Singapore

Sri Lanka

Thailand

Vietnam

Africa

America

## 3. BAMBOOS IN INDIA

*Arundinaria Michaux s.s.*

*Bambusa Schreber*

The Chinese Bamboo

*Chimonobambusa Makino*

*Dendrocalamus Nees*

*Dinorchloa Buse*

*Drepanostachyum Keng*

*Gigantochloa Kurz*

*Himalayacalamus Keng*

*Indocalamus Nakai*

*Melocanna Trin.*

*Ochlandra Thw.*

*Oxytenanthera Munro*

*Phyllostachys Sieb. and Zucc.*

*Pleioblastus Nakai*

*Pseudosasa Nakai*

*Pseudoxyenantha Soderstrom and Ellis*

*Schizostachyum Nees*

*Semiarundinaria Makino*

*Sinarundinaria Nakai*

*Sinobambusa Makino*

*Thamnocalamus Munro*

*Thyrsostachys Gamble*

## 4. THE ENVIRONMENT

The Bamboo Plant

Culm

Rhizome

Flower

Flowering

## 5. CULTIVATION

Soil

Preparation for Plantations

Fertilizers

Regeneration

Propagation

Silviculture and Management

## 6. HARVESTING

Yield

Production

## 7. TAXONOMY

## 8. ECOLOGICAL REQUIREMENTS

## 9. GROWTH CHARACTERISTICS

Development of Bud

Clump and Culms

Rhizomes

Flowering

In Vitro Flowering of Bamboo

## 10. ESTABLISHMENT AND MANAGEMENT

Direct Sowing of Seeds

Seed Characters

Direct Sowing

Transplanting

By Culm With Roots and Rhizome

By Stock With Roots and Rhizome

By Rhizome With Roots

By Offset Planting

By Culm Cutting

Collection of Material and Preparation of Cuttings

Treatment for Root Induction in Cuttings

Preparation of Nursery and Planting

Nursery Management

Transplanting

Precautions

By Branch Cuttings

By Tissue Culture and Macroproliferation

Tissue Culture of Bamboo

Collection of the Bud Materials

Sterilisation of Explants

Preparation of Media

Sub Culture

Rooting and Outplanting

Transplanting

Production of Culms

Macroproliferation

Season of Planting

Number Under Planting

Method of Planting

Guidelines for Management

## 11. GROWTH AND DEVELOPMENT

Growth of Seedlings

Development of Rhizome

Culm Growth and Development

Annual Recruitment of Culms

Culm Height and Diameter

Monthly Recruitment of Culm

Daily Height Growth

Pattern of Biomass Allocation in Growing Bambusa Bambos

## 12. BIOMASS AND YIELD

Biomass Production

Total Biomass

Below Ground and Above Ground Ratio

Biochemical Characteristics of Plantation Bamboo Leaf (Bambusa Bambos) With Reference to Organic Productivity

Economic Analysis

Bambusa Bambos

Dendrocalamus Strictus

Expenditure

Income

## 13. CYCLE AND FERTILIZER APPLICATION

Felling Cycle

Fertilizer Application

Three Elements (Nitrogen, Phosphorus and Potassium)

Amount of the Three Elements to be Applied

Effect of the Various Kind of Nitrogen Fertilizers

Other Elements (Silicate)

Season of Fertilizer Application

## 14. INTRODUCTION IN SOCIAL FORESTRY

Strip Plantation

Community Forestry/Programme

Degree of Local Participation

Local Institutions

Land Allocation

Procedure of Working

Requirements/Rule of Working

Resource Sharing

Monitoring of Works

Limitations

The Problem of Land Use Conflicts

Lack of Identity of Interests

Scope for Community Forestry

Agroforestry Plantation

Bamboo with Horticulture Crops

Rehabilitation of Degraded Forest

Afforestation

Reclamation of Wastelands

## 15. NEED FOR BAMBOO PLANTATION

Present State of Pulp and Paper Industries

Raw Material

Raw Material Status

Guidelines for Raising Bamboo Plantation

Preparation of Nursery and Planting

Transplantation

Production of Culms

Research Work on Selecting Bamboo Species for Paper-making

Comparison of Pulp and Paper Making Characteristics of Plantation Bamboo with some Tree

Species

Establishment of a Bamboo Plantation by Paper Industry Bamboo

## 16. BAMBOO PLANTATION—PROBLEMS AND PROSPECTS

Cultivation Techniques

Projection of Culms

Problems of Cultivation

Seed Collection

Vegetative Propagation

Soil Moisture Conservation

Plant Protection

Weeds

Grazing and Fire

Clump Congestion

Socio-economic Constraints

Prospects of Bamboo Cultivation

Economic Analysis

Employment Generation

## 17. UTILIZATION

Consumption Pattern of Bamboos in India

Other Recent Uses

Bamboo Parquet (Block Flooring)

Laminated Bamboo

Bamboo Strip for Air Craft

Bamboo - Reinforced Concrete

Artificially - Shaped Bamboo

Bamboo, New Raw Material for Phytoserol

## 18. MASS PROPAGATION

Materials and Methods

Results and Discussions

## 19. NON-LINEAR MODELS IN BAMBOO SEEDLINGS

Materials and Methods

Results and Discussion

Conclusion

## 20. PROPERTIES AND PRESERVATION

Natural Durability of Bamboo

Preservative Treatment of Harvested Bamboos

Prophylactic Treatment of Bamboos during Storage

Drying or Curing and Seasoning

## 21. BAMBOO AND ITS USES

Bamboo Shoots

Seeds

Leaves

Fruits

Rhizomes

Banslochan, Tabashir or Tabasheer

Culms

Working and Finishing Qualities of Bamboo

Bamboos for Structural Use

Pipe Water Supply System and Drainage

Bamboo Furniture

Weaving Industry

Bamboo Board

Bamboo Reinforcement in Concrete  
Bamboo-reinforced Mud Walls  
Light Bamboo Wall  
Paper Pulp  
Rayon Pulp  
Bamboo as Fuel  
Bamboo as Charcoal  
Conservation of Soil  
Bamboo as a Saviour of Environment  
Phytoremediation of Polluted Environment  
A Renewable Resource for Agro-forestry Production  
Bamboos as Ornament  
Artificially Shaped Bamboo  
Bamboo for Alleviation of Poverty  
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Potential in India

## 22. BAMBOO CUISINE

Sungsi  
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Gulai Rebung Masam  
Gulai Rebung Teri Basah  
Beko

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Preservative Treatment of Bamboos  
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Evaluation of Recombined Pulps  
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## 31. PULP AND PAPER MANUFACTURE

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Fibre Morphology

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Bleaching of High Yield Pulps

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Industrial Experiences on Paper Making From Bamboo

## 32. PESTS OF BAMBOO

Seed Pests

Control

Nursery Pests

Termites

Control Measures

Plantation and Natural Stands of Bamboos

Culm and Shoot Borers

Defoliators

Witches Broom

Sap Suckers

Felled and Stored Bamboos

Termites

Protection Strategies

Protection of Bamboo Seeds

Nursery Pests

Plantations and Natural Stands

(a) Defoliators

(b) Sap Suckers

(c) Culm and Shoot Borers

Felled and Dried Bamboos

## 33. DISEASES AND DECAY OF BAMBOO

Microflora of Stored Bamboo Seeds

Nursery Diseases

Damping-off

Foliage Diseases

Witches' Broom

Diseases of Bamboo in Plantations and Natural Forests

Bamboo Blight

Rhizome Bud Rot

Rhizome Rot

Basal Culm Rot

Culm Rot

Culm Sheath Rot

Rhizome and Root Rot

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Foliage Infection

Decay in Bamboo



## 34. ASSOCIATIONS AND INSTITUTIONS

The Forest Research Institute, Dehra Dun

The State Forest Research Institutes (SFRIs)

Support to Craft and Artisan Related Activities: Training, Extension and Marketing

Industry and Related Applications

Integrated Rural Bamboo (IRB) Project

Bamboo Information Centre (BIC-India)

American Bamboo Society

The Bamboo Society of Australia

European Bamboo Society

The International Bamboo Foundation & The Environmental Bamboo Foundation of Indonesia, Indonesia

International Bamboo Association (IBA) and the

International Network for Bamboo and Rattan (INBAR)

## About NIIR

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