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.

Contents

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
   Dinochloa Buse
   Drepanostachyum Keng
   Gigantochloa Kurz
   Himalayacalamus Keng
   Indocalamus Nakai
   Melocanna Trin.
   Ochlandra Thw.
   Oxytenanthera Munro
   Phyllostachys Sieb. and Zucc.
   Pleioblastus Nakai
   Pseudosasa Nakai
   Pseudoxyenanthera Soderstrom and Ellis
   Schizostachyum Nees
   Semiarundinia Makino
   Sinarundinaria Nakai
   Sinobambusa Makino
   Thamnocalamus Munro
   Thrysostachys 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
Women Empowerment
Potential in India
22. BAMBOO CUISINE
Sungsi
Sayur Rebung
Garang Asam
Gulai Manis Rebung
Gulai Rebung Masam
Gulai Rebung Teri Basah
Beko
23. GROWTH YIELD AND ECONOMICS
Productivity
Demand and Supply Position
Market
Price-Trend
Employment Generation
Economic Analysis
Resource Survey
Trade
Socio-economics
24. BAMBOO PRODUCTS
Strength Properties and Other Parameters
Characteristic Uses
Seasoning of Bamboo
Seasoning Behaviour of Round Bamboo
Air Seasoning
Kiln Seasoning
Chemical Seasoning
Shrinkage Behaviour of Round Bamboo
Inter Section Point (I.S.P.)
Electrical Resistance of Bamboo
Preservation of Bamboo
Preservative Treatment of Bamboos
Methods of Treatment of Bamboos
Treatment of Dry Bamboos
Treatment of Green Bamboos
Performance of Treated Bamboos
Specialised Technological Uses of Bamboo
Building Boards from Bamboo
Properties of the Boards
Packaging Purpose Boxes
Structural Applications of Bamboo
Technology of Bamboo constructions and Erection Aspects
Erection of Truss

25. CHEMICAL ANALYSIS OF BAMBOO TISSUES
   Experimental

26. OPTIMUM DIGESTION CONDITIONS FOR
    PRODUCTION OF STRONG BAMBOO PULPS
    —A PRELIMINARY STUDY
   Experimental Procedure
   Results
   Conclusion

27. ANATOMICAL FEATURES OF BAMBOO USED
    FOR PAPER MANUFACTURE
   Growth of Bamboo Culm
   Structural Topography of Internode

28. STUDIES ON COLOUR REVERSION OF BAMBOO
    PULP BLEACHED WITH C-E-H SEQUENCE
   Introduction
   Literature Review
   Experimental
   Set 1- Effect of Delignification
   Set 2 – Effect of Over and Underchlorination
   Set 3 – Effect of Alkali Charge in Alkali Extraction
   Set 4 – Effect of Temperature in Alkali Extraction
   Set 5 – Effect of Hypochlorite Charge in Hypo Stage
   Set 6– Effect of pH (Buffer) in Hypo Stage
   Set 7 – Effect of Temperature in Hypo Stage
   Observations and Discussion
   Conclusion

29. EFFECT OF BEATING ON THE CELL MECHANICS
    OF THE INDIVIDUAL BAMBOO FIBRE
   Elementary Fibril
   Cell Wall Mechanics of Wood Fibres
   Cell Wall Structure
   Force Distribution Across the Cell Wall
   Internal Fibrillation
   External Fibrillation
   Bamboo Fibres

30. STUDIES ON THE FINES OF BAMBOO PULP
    Experimental
    Fractionation of Pulp
    Isolation of Fines
    Chemical Composition of Fines & Coarse Fractions
    Evaluation of Whole Pulp and Fractionated Pulp in Valley Beater
    Evaluation of Recombined Pulps
    Discussion of Results
    Fractionation of Pulp
    Chemical Composition of Fines and Coarse Fibre Fractions
Influence of Fines on Some Pulp and Sheet Properties
Properties of Recombined Pulps
Conclusions
31. PULP AND PAPER MANUFACTURE
Chemistry and Morphology
Hemicelluloses
Fibre Morphology
Proximate Chemical Composition
Chemical Pulping
First Stage Digestion
Bleaching of Chemical Pulps
High Yield Pulping
Bleaching of High Yield Pulps
Rayon Grade Pulp
Fibre Morphology and Sheet Properties
Beating Characteristics
Decay on Storage and Its Effect on Pulp Properties
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
Stem Infection
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 Australialia
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

NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.


NPCS also publishes varies process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

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.

NIIR PROJECT CONSULTANCY SERVICES, 106-E, Kamla Nagar, New Delhi-110007, India. Email: npcs.india@gmail.com Website: NIIR.org