

The Complete Book on Cultivation and Manufacture of Tea (2nd Revised Edition)

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Tea is one of the most popular beverages that are being consumed all over the world. Tea is known as a soothing drink and a way of life. Owing to its increasing demand, tea is considered to be one of the major components of world beverage market. Tea is very beneficial for health and is also known as anticarcinogenic properties. Green tea acts as an antiviral agent. Growing tea requires sufficient amount of work and there is additional level of work that must be incorporated to harvest it. Tea is cultivated in tropical and sub tropical regions. There are various kinds of tea such as black tea, green, oolong tea that can be obtained from real tea plant, *Camellia sinensis*. The making of different varieties of tea mainly depends upon plucking and rolling, spreading, storing process.

The handbook describes aspects of tea cultivation, ranging from the history of old crop, machinery & equipment for various Tea, biological control, organic tea- and many more. This is a sincere attempt to open up the world of this wonderful beverage, its cultivation methods, types of tea available worldwide, manufacturing process, to the common man.

Some of the fundamentals of the book are growth of tea in other countries, tea in Indian economy, biochemical constituents, pharmacological properties, selection, pollination and propagation, nutritional requirements, growth, photosynthesis and respiration, nursery management, water theory, oxidative degradation of protein, biological effect of polyphenols, analysis of tea, tea processing, green tea processing, tea bag production etc.

This book will be a mile stone for its readers who are new to this sector, will also find useful for entrepreneurs, tea scientists and tea research establishments.

1. HISTORICAL EVIDENCES

Tea in India

Growth of Tea in Other Countries

Tea in Indian Economy

2. RELATION WITH HEALTH

The Core Compounds

Flavonoids in Tea Infusion

Antioxidant Activity of Tea Flavonoids

Tea Flavonoids and Cancer

Caveats

3. IMPORTANCE OF THERAPEUTIC COMPOUNDS

Polyphenols

Caffeine

Vitamins
Carbohydrates
Lipids
Triterpenoids
Carotenoids and Pigments
Minerals
Overall Distribution of Compounds
4. PRODUCTION OF THERAPEUTIC COMPOUNDS

Polyphenols
Variations in Specific Compounds
Changes During Processing
Theaflavins and Thearubigins
Discussion

5. BIOCHEMICAL CONSTITUENTS

Biochemical Constituents
Enzymes
Polyphenolic Compounds
Amino-acids
Phosphate Esters, Nucleotides and Caffeine
Carbohydrates
Lipids
Chlorophyll and Carotenoids
Volatile Compounds
Biochemical Changes during Leaf Processing
Withering
Rolling
Fermentation
Development of Aroma
Changes in Carotenes and Fatty Acid
Firing
Biochemical Basis of Tea Quality

6. PHARMACOLOGICAL PROPERTIES

Pharmacological Actions
Pharmacological Aspects Associated with Tea Consumption
Cardiovascular System
Cancer
Tea and Dental Health
Tea and Fluid Replenishment
Gastrointestinal System
Skin and Topical wound Healing Activity
Antimicrobial Action
Angiogenesis Inhibition
Absorption of Tea Flavonoids
Potential Health Concerns Associated with Tea Consumption
Tea and Iron Absorption
Conclusion

7. IMPORTANCE OF BLACK TEA

Composition and Chemistry of Tea
Pharmacological Properties of Tea
Antioxidative Effects of Tea
Modulation of Metabolizing/Detoxifying Enzymes
Modulation of Immune Function
Antimutagenic Activity

Anticarcinogenic Activity
Prevention of Coronary Heart Disease
Germicidal and Antiviral Activity
Regulation of Intestinal Microflora
Prevention of Dental Caries
Conclusion

8. TAXONOMICAL PROPERTIES

Tea Varieties
(1) The China variety
(2) The Assam Variety
(3) The Cambod Variety
Biology of the Plant
Phasic and Vegetative Growth
Tea Flowers and Reproductive Phase
Dormancy
Longevity
Tea Gene Pool
Cytotaxonomy and Chromosome Numbers
Wild Populations of Tea
Germplasm Collection

9. SELECTION, POLLINATION AND PROPAGATION

Development of Seed Varieties
Vegetative Propagation and Development of Clones
Selection for Yield and Quality
Hybridisation
Interspecific Hybridisation
Polyploid Breeding
Mutation Breeding
Tissue Culture and Genetic Engineering
Breeding Strategies
Seed and Clone
Techniques of Vegetative Propagation and Clonal Selection
The Nucleus Plot
Manuring of Mother Bushes
Type of Cuttings
Time of Taking Cuttings
Nursery Bed and Shade
Use of Hormone in V.P.
Clonal Selection Procedure
Mother Bush Selection
Technique of the Seed Bari and Grafting
Bringing into Bearing
Collection
Sorting
Storage and Transport
Upgrading a Seed Bari (Seed Nursery)
Vegetative Propagation (V.P.)
The Mother Bush
The Nucleus Plot
Taking Cuttings
Setting the Cutting

10. CHARACTERISTICS OF SOIL BIOLOGY

Origin and Characteristics of Tea Soils

Soil: Physical Properties

The Basis of Soil Nutrition

Soil Acidity

Soil Physical Properties

Soil Texture

Soil Aggregate

Soil Compactness

Soil Management for Tilt

(a) Drainage

(b) Land Levelling

(c) Cultivation

(d) Lime or Dolomite Applications

(e) Soil Improvement

Soil Biology

Physical Environment

Rainfall

Temperature

Humidity

Wind Speed

Day Length

11. NUTRITIONAL REQUIREMENTS

Nutrient Composition of the Tea Plant

Assimilation of Various nutrients by Parts of the Plant

Individual Nutrients

Nitrogen

Basis of Nitrogen Absorption and Uptake

Sources of Nitrogen

Determination of Quantity for N: K ratio

Phosphorus

Increasing Phosphate Efficiency

Phosphate Uptake and Mycorrhiza

Phosphate Solubilising Microorganisms

Rock Phosphate: Amendments

Interactions of Phosphorus with Other Nutrients

Fertiliser with Soluble Phosphorus

Potash

Potassium Reactions in the Soil

Potassium in Growth Stages of Tea

Factors Affecting Potassium Uptake

Potassium Interactions

Nitrogen: Potash interactions

Interaction with Other Nutrients

Collateral Effects of Potassium

Sulphur

Sulphur Containing Fertilisers

Zinc

Other Micronutrients

Organic Fertilizers

Nutrition and Crop Quality

Deficiency Symptoms

12. GROWTH, PHOTOSYNTHESIS AND RESPIRATION

Carbon Input; Sink Source Ratio

Limitation of CO₂ Assimilation

CO₂ Assimilation and Light Limitation

Regulation of Photosynthesis

Regulation of Photosynthesis by Transport and Partitioning

Effect of Leaf Age on Photosynthesis

Photorespiration and Dark Respiration

Dry Matter Partitioning and Productivity

13. NURSERY MANAGEMENT

Nursery Management

Planting

Land Preparation

Planting Density

Field Planting

Planting Operations

Bringing up of Young Tea and Bush Formation

14. THEORY OF PRUNING, PLUCKING AND

MAINTENANCE FOLIAGE

Theory of Pruning

Types of Pruning

Collar Pruning

Medium Pruning

Top or Light Pruning

Lung Pruning

Skiffing

Choice of Pruning System

Tipping

Shoot Growth

Leaf and Bud Dynamics

Plucking

Plucking System

Plucking Standard

Plucking Interval

Plucking and Maintenance Foliage

(1) Pruning: definitions

(2) Requirements before Pruning

(3) Pruning Administration

(4) Factors Affecting Pruning Time

(5) Crop Distribution

(6) Pruning Cycles

15. HISTORICAL PERSPECTIVE OF SHADE TREES

Historical Perspective of Shade Problem

The Genesis of Shade Problem

Effect of Shade per se

Shade and Light Intensity

Shade and Tea Leaf Temperature

Effect of Shade Trees on Light Climate

Shade and Partition of Growth

Shade Effect on Quality of Made Tea

Current Perspective

Sylviculture of Shade Trees

Mixture of Shade Tree Species

Intimate Mixtures

(a) Square Planting

(b) Triangular Planting

Non-Intimate Mixtures

(1) Tea and Shade Square Planted

Spacing of Shade

(i) Suggested Spacings

(ii) Planting of Shade Trees

Propagation of Shade Trees

16. WATER THEORY

Theory of Drainage

Approach to Drainage Problem

Problems in Tea Areas

Models of Drainage Systems and Water-table

Objective of Drainage

Diagnosis of Drainage Problems

A. Growth Pattern

B. Physical Indicators of Waterlogging

Outline of the Drainage

Designing the Main Drain

The Field Drains and Removal of Surface Water

The Drainage System

Construction of Drains

Pipe Drainage

Rationale of Irrigation

Parameters of Irrigation

Irrigation Requirement: Net and Gross Irrigation Requirements

Irrigation Frequency

Scheduling of Irrigation

Rainfall Deficit

Types of Irrigation

Irrigation Efficiency

Significance of Irrigation in Total Water Management

Soil Conservation

Criteria for Water Relation Between Soil and Tea Plants

Moisture

Soil Water

Moisture Extraction Pattern by Tea Roots

Effect of Drainage and Irrigation

Weed Effect

Effects of Weeds on Tea

Biology of Weeds

Weed Reproduction

Weed Density

Growth

Dispersal of Weeds

Weed Dispersal

Methods of Weed Control: The Manual Aspect

Chemical Weed Control

Herbicides in Tea

Herbicide Mixtures

Application Technology

Perspectives on Weed Management

Common Weeds of Tea

A. Dicotyledonous or Broad Leaved Weeds

B. Monocotyledonous and Grass Weeds

Outline of Weed Control
Manual Control
Mechanical Control
Chemical Weed Control
Preplanting Control of Thatch
Additives for Herbicides
Herbicide Mixtures 'Cocktails'
Weed Control Outside the Tea Area
Equipment
Climatic Factors Affecting Weedicide Application
Safety Precautions
Herbicide Damage to Tea

17. DISEASES OF SEEDS AND CUTTINGS

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Leaf Diseases
Stem Diseases
Root Diseases
Strategies for Controlling Diseases
Outline of Disease Control

Leaf Diseases
Root Diseases
Secondary Stem Diseases
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Crop Losses
Mite Phytophagy
Defoliators
Sap Feeding Insects
Root Damaging and Soil-borne Pests
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Stem Borers
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Pesticides: Applications and Management
Management of Pesticide Residues
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Outline of Pest Control
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19. BENEFICIAL IN CANCER

Lifestyle and Diet in Cancer
Effect of Tea in Animal Systems
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Effects of Tea on the Incidence of Human Cancer
Interaction of Genetic Actions in Carcinogenesis in Humans

20. CANCER PREVENTION

Cancer—an Overview
Cancer and the Intrinsic Defense Machinery of the Host: A Tug-of-War
Why Cancer Therapy Fails
Dietary Therapy
Why Tea?

Tea and Its Constituents - A Historic view

Hypothesis

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Conclusion

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Results

Discussion

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24. ANALYSIS OF TEA

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Polyphenols

Determination of Total Polyphenols

Separation and Identification of the Individual Polyphenols

Determination of Flavonol Glycosides

Determination of Flavylogens

Determination of Phenolic Acids

Amino Acids

Carbohydrates

Chlorophyll

Carotenoids

Minerals

Enzymes

Analysis of Manufactured Black Tea

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Polyphenols

Separation of the Polyphenols

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Determination of Total Tannin

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Brief Outline of Tea Manufacturing Process

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Rolling

Fermentation/Oxidation

Drying

Sorting and Grading

Storage and Packaging
Tea Manufacturing Process Flow Diagram-CTC
CTC
Orthodox
Withering
Rolling
Fermentation/Oxidation
Drying
Sorting and Grading
Storage and Packaging
Tea Manufacturing Process Flow Diagram-Orthodox
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Oolong Tea Process
White Tea
Source of Technology
Machinery and Equipment
CTC Tea Processing
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Technical Data
Centrifugal Fans (Hot Air, Induced Draft and Fermenting Fans)
Technical Data
Direct Fired Oil/Gas Heaters
2. Rolling

Rotovanes (Rolling Solutions For CTC Tea)

Technical Data

Sifter-CTC Machines

Technical Data

Balanced Green Leaf Sifter

'Rotomax' Rolling Tables for Orthodox Tea

3. Fermenting/Oxidation

Continuous Fermenting Machines (The Ideal Fermenting Solution)

Technical Data

4. Drying

Fluidized Bed Tea Dryers

Technical Specification

Advanced Conventional Tea Dryers

Technical Specifications

Indirect Fired Coal/LECO/Firewood Heaters

(The Most Efficient Solid Fuel Based Indirect Fired Heaters for the Tea Industry)

Technical Specifications

Chain Grate Stokers

Technical Specification

Ghoogie

5. Sorting & Grading

'Fibro' Slow Speed Fibre Extractor

(Horizontal Design Vibratory Sifter & Grader for Tea)

Vibro Screen Sorter

(Vertical Design Vibratory Sifter & Grader for Tea)

Pulverizer

Powdering Machine for Tea

6. Packaging

Range of Packaging Machine (Menu Driven Computerized Pneumatically Controlled)

Vertical Form-Fill-Seal Machines

Pillow Pack FFS Machines for Granules

Technical Specification

Tea Bag Packaging Machine

Technical Specification

28. MACHINERY & EQUIPMENT FOR CTC TEA/TEA/ OOLONG TEA/ TEA BAGS

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