

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
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Herbicide Damage to Tea

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Outline of Disease Control

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Root Diseases

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Pesticide Specifications for Tea

Pesticides: Applications and Management

Management of Pesticide Residues

Strategies in Pest Management

Outline of Pest Control

Mite Damage

Insect Attacks

Young Tea Sick or Dying

New Flush Stunted

19. BENEFICIAL IN CANCER

Lifestyle and Diet in Cancer

Effect of Tea in Animal Systems

Prevention of Cancer in Man

Effects of Tea on the Incidence of Human Cancer

Interaction of Genetic Actions in Carcinogenesis in Humans

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Cancer and the Intrinsic Defense Machinery of the Host: A Tug-of-War

Why Cancer Therapy Fails

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Why Tea?

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(2) Indirect Effect of Tea in Cancer Prevention: Tea-induced Tumor Regression by Rejuvenation

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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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Analysis of Theaflavins and Thearubigins

Determination of Total Tannin

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25. TEA PROCESSING

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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
Tea Manufacturing Process
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Oolong Tea
Oolong Tea Process
White Tea
Source of Technology
Machinery and Equipment
CTC Tea Processing

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Green Tea Processing (Moroccan Type)

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Process of Tea Bag Manufacturing
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Technical Data
Direct Fired Oil/Gas Heaters
2. Rolling
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Technical Data
Sifter-CTC Machines
Technical Data

Balanced Green Leaf Sifter

'Rotomax' Rolling Tables for Orthodox Tea

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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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