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An introduction to cultivation of Darjeeling tea (*Camellia sinensis* L.)

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ABSTRACT

Darjeeling tea is very special and famous beverage not only in India but throughout the world. The seasonal yield distribution of Darjeeling tea varies primarily as a result of seasonal changes in temperature and the development of soil moisture stress during the dry season. However, in Darjeeling, 50% of the annual crop is produced in the wet season (June to August). The yearly harvested green leaf production is approximately 2750-3250 kg/ha. The annual average yield of made/processed tea is 600-700 kg/ha and varies with times of pruning and pruning cycle. The basic level of knowledge about cultivation of Darjeeling tea needed by agricultural graduates, farmers and other concerned people has not been fulfilled so far although there have been many forays in this direction. The author hopes that this article succeeds in its mission of illustrating the basic Darjeeling tea cultivation practices and manufacturing processes to agriculture students, teachers, researchers, extension workers, farmers and all those related to tea industry.

Key words : Darjelling tea, *Camellia sinensis* L., green tea, growth, pruning, varieties

INTRODUCTION

Darjeeling tea is normally made from the small-leaved Chinese variety of *Camellia sinensis* var. *sinensis* (Fig. 1) rather than the large-leaved Assam plant (*C. sinensis* var. *assamica*). Two main varieties (sub-species) of *C. sinensis* are used for tea production–Assam variety (*C. sinensis* var. *assamica*, also known as *C. assamica*) and Chinese variety (*C. sinensis* var. *sinensis*). The Chinese variety is native to south-east China and was used to produce tea as long as 4,000 years ago. Sometimes a third variety is distinguished, the Cambodian variety (*C. sinensis* var. *parvifolia*). Since its growth characteristics are intermediate between the Assam and Chinese varieties**,** it is usually considered as a hybrid of these two. There are 100-250 recognized *Camellia* species. The wide range in the number of recognized species reflects the considerable disagreement among taxonomists about the status of many *Camellia* species. Members of the *Camellia* genus are mostly evergreen shrubs and small trees native to south and east Asia. Tea a popular beverage made from the leaves of evergreen shrub or tree. Under natural conditions, a tea plant grows to a small tree but it is configured into a bush by sequential pruning and other silvicultural practices viz., tipping, plucking and by harvesting the optimum vegetative produce. Tea plants are three distinctive types viz., Assam, China and Camboid. The first two are distinct varieties, *assamica* and *sinensis*, while the third form is known as southern or Camboid form. Cultivated tea plants are usually pruned to a height of around 1-1.5 m to make crop maintenance and harvesting (plucking) easier and to increase yield. However, in their natural state, tea plants will grow to small trees. The Assam variety can grow into a loosely branched tree about 15 m tall. It is a lowland plant and requires high rainfall and good drainage. The Chinese variety grows to a much smaller size, reaching a height of 3-5 m (Mair and Hoh, 2009).

Botanical Description of Tea Plant (Singh, 2005)

(i) Scientific name : *Camellia sinensis* (L.)
(ii) Family : The tea plant belongs to the genus *Camellia* of the family Theaceae.
(iii) Morphology, cytology and breeding

Fig. 1. Growing tea plants of mall-leaved Chinese variety of *Camellia sinensis* var. *sinensis.*

system : Tea is an evergreen shrub or small tree. The China type tea is dwarf, with small, dark green, narrow, serrated leaves. The Assam type tea is a larger plant, with green, less ser-rated leaves.

Leaves	:	Simple, alternate, serrate
Flowers	:	Bisexual, regular
Sepals and petals	:	Usually five
Stamens	:	Many, anthers, two-celled
Ovary	:	Superior, 2-4 loculars
Ovary	:	2-4, rarely solitary, axile
Fruit	:	A capsule
Seed	:	Recalcitrant (Losses viability on drying)
Chromosomes	:	2n=30, diploid
Breeding system	:	Cross-pollinated self-incompatible
Extent of selfing	:	6-40%, lowest in Assam type and highest in China type
Inbreeding depression	:	Very high, leads to loss of vigour and quality. Hence, self seeds for raising plants to be avoided.

Leaves : The leaves are 4-15 cm long and 2-5 cm wide. Leaves from the Assam variety are normally larger (Fig. 2) than those of the Chinese variety. Usually the new leaves are harvested for tea production. They are light green in colour and have short white hairs on the underside. Older leaves are darker green.

Flowers : The flowers are white with a yellow center, 2.5-4 cm in diameter, with 7 or 8 petals (Fig. 3). The flowers are scented and occur singly or in clusters of two to four. Flowers are pollinated by insects and the wind. Tea is mostly self-sterile and almost entirely cross-pollinated.

Fruits and seeds : The fruits are 2-3 cm in diameter, brownish-green in colour when mature, and contain one to four spherical or flattened, brown seeds (Fig. 4). The fruit ripens in 9-12 months, after which the seeds fall to the ground. Seeds are only capable of germination for 2-3 weeks.

Roots : Tea plants from seedlings have a strong taproot (Fig. 5) with a dense network of feeder roots. Most feeder roots are located in the top 30 cm of soil. Taproots reach a depth of 1.5-3 m and provide good anchorage for the

Fig. 2. Tea leaves of Chinese variety.

Fig. 3. Tea flowers of Chinese variety.

plants. The taproot is also important because it stores starch from the sugars produced in the leaves. The more starch stored in the taproot, the faster the plant can recover from pruning and plucking.Tea plants grown from cuttings (clones) generally lack a taproot. Seedlings form a tap root, whereas plants propagated by cuttings may have up to five main roots. Lateral roots form a fibrous mat, they are the primary roots involved in water and nutrient uptake.

Climate

Tea plants are adapted to high altitudes

Fruits **Seeds**

Fig. 4. Tea fruits and seeds of Chinese variety.

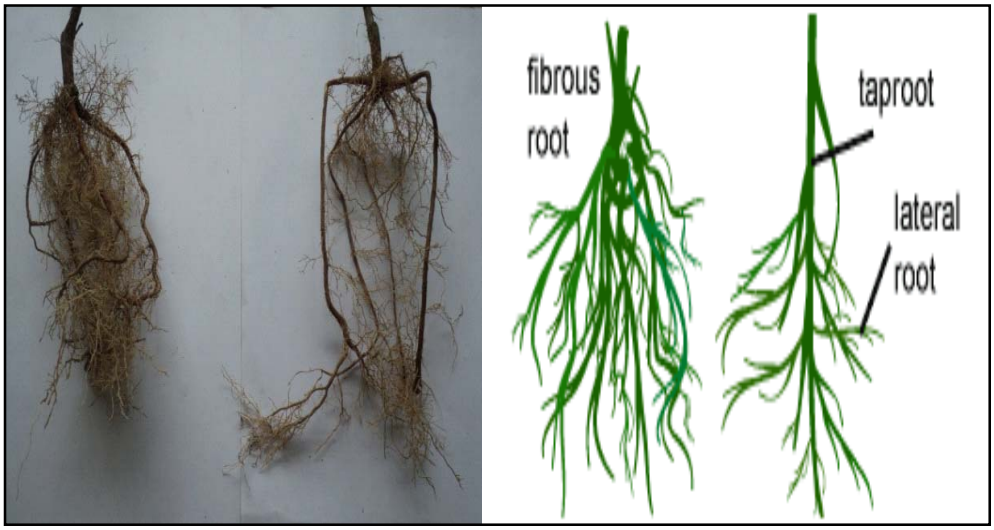

Fig. 5. Tea seedlings showing taproot system.

in tropical areas and lowland areas of the sub-tropics.

(i) Altitude : The altitude is 200 metres to more than 2,000 metres above sea level. Many high quality teas are grown at high elevations, where rainfall is less than 2,000 mm. In these areas, the plants generally grow more slowly which result in a better flavour.

(ii) Latitude : The latitude is 26°31′ to 27°13′ North.

(iii) Longitude : The longitude is 87° 59′ to 88°53′ East.

(iv) Rainfall : The average annual rainfall ranges from 1500 to 3000 millimetres.

(v) Humidity (RH) : Relative humidity is very high, with fog, mist and occasional snow.

(vi) Temperature : The ambient temperature is 1°C to 11°C with a maximum of 27°C. The ideal temperature for growth is 18-30°C. Growth is limited by temperatures above 32-35°C and below 12-13°C. Strong winds, frequent frost, hail and excessive rainfall are also detrimental to the production of high quality tea.

(vii) Day length : Tea requires long hours of sunshine for good production. The ideal day length for vegetative growth is 11¼ hours. This means that tea can be harvested year round within 15-18° of the Equator.

(viii) Sunshine : The average of sunshine is 2 to 4 h per day in Darjeeling hills.

(ix) Relative humidity : Optimum shoot growth occurs between 75 and 90% relative humidity. When the air is too dry, shoots form dormant buds and the plant stops growing.

(x) Slope : The slop is Gradient of 60° to 70°. These steep slopes provide natural drainage for the generous rainfall received in the seasonal monsoons.

Soil

The topography comprises moderate slopes (25-30%). The top-soil is about 45 cm in depth and the sub-soil is stony. The soil is an Umbric Dystrochrept, moderately permeable and moderately well drained having sandy loam texture. The pH of the soil should be between 4.5 to 5.5 pH.

Tea Nursery

A nursery is a place used for germinating seeds and propagating plants by vegetative means. Is a place used to raise young plants? Vegetative propagation is the production of new plants from the vegetative parts of a selected plant.

Importance of Nursery Establishment

- To conveniently obtain seedlings of required quality, quantity and characteristics.
- To know the plants cost of production and hence the profit or loss for the industry.

Soil Test before Use in the Nursery

- Sandy loam fertile soil of good tilth.
- Never use sub-soil for nursery.
- Soil should have good crumb structure.
- Undistributed jungle soil is good for this purpose.
- The pH of the soil should be between 4.5 to 5.5 pH.
- Eelworm count should not be more than 6 per 10 g of soil. If it is more, the soil should be treated with Furadon 3G @ 2 g per sleeve in two doses at monthly intervals.
- Prepare soil bed/polythene sleeves, one and two months before planting cuttings (Fig. 6).

Propagation

Tea plants are propagated both vegetatively (mostly by cuttings, but grafting and layering are also possible) and from seeds (Singh, 2005). Therefore, in the main commercial tea production area in the world, the use of cuttings has in recent times replaced the use of seeds for propagation. However, many small farmers in countries such as China and Vietnam still use seed and this is one of the reasons for the relative low average yield in these countries.

Fig. 6. Filling of soil in the tube after sheaving and tubes ready to cutting.

Mother Bush for Cutting

- First, mother bushes are carefully selected based on health, vigour and yield (Fig. 7).
- After pruning, these bushes should be left to re-grow freely without plucking.
- Extra fertilizer should be applied.
- Cuttings can be taken 4-9 months after pruning.
- The best time to make cuttings is when the weather is cool and cloudy.
- Take cuttings from the new shoots. Cuttings should be severed with a sharp knife, hand pruners, or razor blade.

Single node cuttings : Take the stems from bushes pruned 4 to 6 months earlier. The good material is now made into individual cuttings of a single leaf with an axillary bud and 3 to 4 cm of stem below the leaf (Fig. 8). Cut off any extra length of stem if necessary. Keep the cutting soaked in a solution of fungicide for 30 min.

Planting of cuttings : Soil in the polythene tubs should be wet watered at the

(a) **(b)**

Fig. 7. Ready mother tea bush (a) for cuttings and tea shoot (b).

Fig. 8. Individual cuttings of a single tea leaf with an axillary bud.

planting of cuttings and gently pressed prior to inserting cuttings. Only one cutting should be planted per beg inserting vertically down into the soil (Fig. 9). Planting of cuttings should be done in the manner the leaves are oriented in one direction at an angle to the row. The soil around the cutting should be gently pressed by fingers to ensure firm anchorage. Ready tea clone plants are shown in Fig. 10.

Fig. 9. Planting of tea cuttings vertically in bags filled with soil.

Fig. 10. Ready tea clone plants.

Clones : Some important Darjeeling tea clones are given Table 1.

Propagation by seed plants : Use only fresh seed with a dark seed coat from mature fruit. Do not dry or store seeds for more than a few days because tea seeds quickly lose their viability.

Table 1. Important Darjeeling tea clones (Tea Planters' Handbook, 2015)

(a) Standard	
High elevation	
Standard	
AV2	Balasun 7/1A/76
Balasun 9/3/76	Bannockburn 157
Lingia 12	TV 14
Tukdah 78	Tukdah 135
Teesta Valley 1	Phoobsering 312
Phoobsering 1258	Rungli Rungliot 17/144
Sikkim 1	Thurbo 3
Thurbo 9	
Low elevation	
Badamtam 15/263	Phoobsering 1404
Tukdah 78	Tukdah 246
(b) Yielded clones	
Happy Valley 39	CPI
Rungli Rungliot 4/5	Kopati 1/1
TV 19	Sundaram (B/5/63)
Tukdah 253	
(c) Quality clones	
AV2	Bannockburn 688
Bannockburn 777	Phoobsering 312

Immediately before planting, the seeds should be soaked in water for 24 h, after which all floaters should be skimmed off and germinated separately. Seeds should be planted with their "eyes" down and covered with about 2.5 cm of moist potting soil. Keep the container shaded and well watered.

Most seeds will germinate within 4-8 weeks after sowing. Gradually move the plants into full sun to prepare them for transplanting (Fig. 11). Trans-plant them into the ground when the plants are 20-30 cm tall with well established leaves, which usually take 18-24 months from seed.

Released Biclonal Seed Stocks

1. **TS 378 (NANDA DEVI) : (14/5/35 x 14/6/28) :** This is the first biclonal seed stock, exclusively bred for Darjeeling areas, was released by TRA in 1986. The stock is fairly resistant to drought.
2. **TS 379 : (14/12/16 x 14/5/35) :** This is the second biclonal seed stock after TS 378 exclusively bred for Darjeeling areas, was released by TRA in 1989. the stock is fairly resistant to drought. Stock is superior to TS 378 in yield and quality.
3. **TS 557 (AV2 x Teen Ali 17/1/54) :** TS 557 is a China hybrid stock resulting from the cross between a

(a) **(b)** **(c)**

Fig. 11. Tea seeds (a), germinating seeds (b) and ready tea seed plant (c).

popular quality clone AV2 and China hybrid clone Teen Ali 17/1/54 for Darjeeling hill.

4. **TS 569 (AV2 x T 78) :** TS 569 is a China hybrid stock resulting from the cross between a popular quality clone AV2 and a popular high yielding clone T78 for Darjeeling hill.

Spacing and Planting of Tea Plants

Tea is normally planted in single or double rows. The spacing would be 1.2 × 0.75 m for a single hedge and 1.35 × 0.75 × 0.75 m for a double hedge. These spacings give 10,800 and 13,200 plants/ha, respectively. On sloping land, tea should be planted along the contour to help reduce erosion.

Now-a-days in Darjeeling : The spacing for planting (Fig. 12) was 90 x 60 x 60 cm and the distance from hedge to hedge was 90 cm, row to row 60 cm, and plant to plant 60 cm with a population load of 17,000 to 18,000 plants per hectare. Planting holes of 20-30 cm wide and 40-60 cm deep are recommended. The bottom and the walls of the holes should be broken up to avoid root spiraling where the soil is very heavy or compacted.

Growth and Development

I. Young plant stage : This stage begins when the seed or cutting is planted and ends

Fig. 12. Planting of tea clones.

when the young plant is pruned for the first time (Fig. 13). For plants grown from seed, this lasts until the end of 2nd year or the beginning of 3rd year. For cuttings, this is often at the end of first year. The appropriate time of the first pruning is nor-mally when the diameter of the main stem is greater than 7 mm, and the height of the plant is more than 70 cm.

Fig. 13. First pruning stage attained by young tea plants.

II. Branch formation stage : This stage begins at the first pruning and ends at the last "formation" pruning, which is the last pruning made to shape the frame of the tea bush. Tea plants grown from seeds are usually pruned three times during the formation stage, while plants grown from cuttings are pruned twice. Plants with many strong, healthy branches have high productivity and good quality. During the branch formation stage, the purpose of pruning is to develop a strong frame of branches. The plucking table should be formed at a height of 70 cm.

III. Commercial stage : This stage begins after the last formation of pruning and continues for as long as the tea is economically productive (often 40-50 years or longer). In commercial stage (Fig. 14) the main frame of the tea bush has already been established. However, the plucking table continues to rise from season to season.

IV. Pruning and skiffing activities of Darjeeling tea (Kumar *et al.*, 2015a)

1. Collar prune (CP) : All above ground portion cut leaving a maximum of 10 cm when bush frame becomes unproductive (Kumar, 2016) but still having good root system.

Fig. 14. Tea leaves plucking stage.

Time of pruning : December-middle January.

2. Heavy prune/rejuvenation prune (RP) : RP is a heavy type pruning and the basic objective is to rejuvenate the frame of old tea by removing almost all the knots in the frame along with dead and diseased woods by pruning right up to the clean wood (Fig. 15).

Fig. 15. China hybrid tea bushes at 15-30 cm and Assam hybrid tea bushes at 25-40 cm above the ground.

3. Medium prune (MP) : This pruning is done at a higher height than the rejuvenation prune to rectify the tall and knotty frames with congested top hamper, but with a reasonably better frame below. For top frame renewal and height reduction.

Time of pruning : December-middle January.

4. Height : China/China hybrid bushes at 30-35 cm and Assam/Assam hybrid bushes at 50-60 cm above the ground.

Time of pruning : Dec.-middle Jan.

5. Light prune (LP) : This is a normal prune done at a regular interval at the end of a pruning cycle. LP is for cleaning out the bush and removal of wood for new branches, 4-5 cm or 1½-2 inches above last prune.

Time of pruning : December-middle January. The pruning height may vary depending on the level of knots and availability of healthy and sizeable sticks (Fig. 16).

Fig. 16. Demonstration and training photographs to small tea growers.

6. Deep skiff (DS) : Height is determined according to earlier operation and sequence (Table 2).

Time of skiffing : Last week of November-December

Table 2. Deep skiff, tipping height and pruning/skiffing sequence

DS height above last LP (cm)	Tipping height in LP (cm)	Pruning/ skiffing sequence
7-10	20	LP-DS
10-12	23-26	Irrespective of sequence
12-15	Irrespective	LP -UP/LOS-DS

7. Medium skiff (MS) : Medium skiff just below majority of crow's feet, to remove congestion in the bush frame. Cleaning out is not required.

Height of skiffing : China/China hybrid bushes at 10 - 12 cm above last LP level and low deep scale.

Time of skiffing : Last week of December-January.

8. Light skiff (LS) : Cut through the red wood of the plucking table. Light skiff is a cut given at or one cm above the previous tipping level.

Time of skiffing : December- January.

Manures and Fertilizer Management in Tea (Kumar and Choubey, 2016)

The following composition and doses of fertilizers are applied using urea, rock phosphate and muriate of potash as base materials to DTRDC farm.

(i) Mature tea–N : P : K :: 120 : 45 : 120 kg/ha.
(ii) Mature tea–N : P : K :: 90 : 45 : 90 kg/ha.
(As per availability of nitrogen in the soil).
(iii) Young tea–N : P : K :: 60 : 30 : 60 kg/ha.

(a) Chemical fertilizer (inorganic) : A term generally applied to a nutrient carrying material of mineral like appearance (Table 3).

Application of chemical fertilizers 90 : 45 : 90 kg/ha basal through urea (Nitrogen – 46%), Rock phosphate (RP) (P_2O_5 – 20% and Sulphur – 2.3%), Muriate of potash (MOP) (K_2O – 50% and chlorine 47%).

(b) Manure (organic) : Material originating from plant or animal which is added to the soil to improve fertility.

(i) Application of vermicompost (VC) : Nitrogen–1.6%, Phosphoric acid (P_2O_5)–2.2%, Potash (K_2O)–0.67%, Calcium (Ca)–0.99%, Magnesium (Mg)–0.15%.

Table 3. Sources of mineral nutrients supply to tea plants

Fertilizers	Urea	MRP	MOP	CAN	SOA	SSP	Remarks
Nutrients (%)	46% N	20% P_2O_5	60% K	25% N	20.6% N	16% P_2O_5	

(ii) Application of farm yard manure (FYM) : Nitrogen–0.6%, Phosphoric acid (P_2O_5)–0.17% and Potash–0.5%.

It is observed that under organic farming practice, yield of crops does not decrease. The basic fact is that crop requires 16 nutrients for plant growth. When one applies chemical fertilizer then the assurance is only for one, two, or three nutrients. When the application of organic manure is done, the availability of all the 16 nutrients is assured. It has been observed that vermicompost is a rich source of macro and micro nutrients, vitamins, enzymes, anti-biotic and growth hormones. Besides nutrients, in case of organic farming, the activity of micro-organisms increases manifold, whereas in case of chemical farming it is ceased.

Weed and Insect-Pests Management of Tea

Weeds compete with tea for nutrients and moisture; grasses take away large quantities of nutrients. Many of the weeds serve as alternate hosts for insect-pests (Figs. 17, 18 and 19) of tea. The chemical control of blister blight in tea is given in Table 4. Weeds are problematic mainly in the new clearing, young tea and pruned fields and it is necessary to control them till the tea bushes cover the field.

Fig. 17. Tea thrips.

Fig. 18. Bunch caterpillar.

Fig. 19. Blister blights of tea.

Manual Control

- Hand removal of weeds is warranted in specific situations of thorny and hardy weeds, creeper, etc. Care should be taken at the time of planting to remove all possible weed propagules present near the plantlet.
- Obnoxious weeds like fern, *Mikania,* etc should be uprooted along with the roots and taken out from the tea area to the nearby roads or put in compost pits.
- Use “Cheel hoe” with a half-moon shaped blade in freshly planted areas for scraping the aboveground parts of the weeds and levelling the local depressions in the ground.
- Cut the top growth of weeds in young tea areas with sickles. But perennial grasses like *Imperata*, *Saccharum,* etc. should be removed with roots.
- Since mulching cannot be done near to the

Table 4. Chemical control of blister blight

S. No.	Fungicides	Doses	Per cent reduction of blister blight infected leaf	Cultivation
1.	Triadimefon	200 g/h (fortnightly)	55-60	Inorganic
2.	Copper oxichloride (50% cu w/w)	650 g/h (fortnightly)	35	Organic
3.	Copper oxichloride (50% cu w/w)	650 g/h (Weekly)	65-70	Organic

collar of the plant, removal of sporadic weed growth is necessary.

- Weeds removed from the field should be taken outside the cropped area and put in compost pits. Parasitic weeds like *Cuscuta*, growing on shade trees and hedges should be removed along with the entire host branch and burnt.

While practising strip weeding in slopes (Fig. 20) the uncontrolled strip should be subjected to manual slashing.

Fig. 20. Weeds in tea fields and their sickling.

Harvesting/Plucking of Tea Shoots

Harvesting is an operation in which the tender tea shoots are picked, which generally are termed as 'plucking' (Fig. 21). A tea shoot at the correct maturity for the manufacture of high quality made tea comprising an unfurled bud is with two or three soft leaves (Kumar *et al.,* 2015b). After producing the fish leaf, the terminal bud produces normal flush leaves (Fig. 22).

- 1L+b (One leaf and a bud)
- 2L+b (Two leaves and a bud)
- 3L+b (Three leaves and a bud)

Manufacturing of Darjeeling Tea

Darjeeling tea is manufactured using conventional orthodox industrial technique which was developed in the 1800's and is called

Fig. 21. Tender tea shoots ready for harvesting.

Fig. 22. Harvesting of normal flush leaves.

in its amalgamation as "Orthodox Production". The inherent Darjeeling tea aroma is maintained by this method and the teas are produced without the procedure of "Cut, Tear and Crush" (CTC) of tender tea leaves. The stages are uniform even though a different variety of different leaves requires a very delicate and intricate variation in processing. Since quality is the pivotal focus, it is never compromised upon by the tea planters in Darjeeling to produce quantity rather than quality. Recently, the trend has started where few gardens manufacture green tea during rainy season, hitherto producing the finest

Fig. 23. Orthodox black tea leaves.

quality of green and flavoury tea.

Orthodox black teas (Fig. 23) go through a complex system as under :

- **Withering :** The leaves are spread out for 14-20 h to allow the moisture to evaporate.

- **Rolling :** Rotating and pressing the leaves to release their inherit chemicals and prepare for oxidation.

- **Oxidation :** The leaves spend 1-3 h in a controlled environment, allowing the air to react with the chemicals. During this process, the leaves turn dark brown.

- **Firing :** A heater is used to arrest oxidation and dry the leaves before they are sorted for grading. The other style of manufacturing black tea of orthodox tea is CTC tea (Crush, Tear, Chop), which is machine-processed in a way that chops the leaves into uniformly-sized bits that are typically used for low-grade teabags.

- **Darjeeling organic green tea :** Darjeeling tea is also becoming popular because of the Green Tea (Fig. 24) variant produced by several estates in Darjeeling. Green tea is not fermented at all. It is steamed to stop oxidation before it starts, which preserves most of the polyphenols. It has 60% more polyphenol (antioxidants) content than black tea, and has a less bitter taste. Only China type tea leaves are used to produce green tea because Assam type tea leaves produce a bitter flavour. The leaves may be steam or pan heated. Darjeeling green leaf tea, with its sweet aroma and eternally fresh taste has been approved and drunk since its introduction to Japan centuries ago. Modern research has finally put up why as a functional food green tea is indispensable and should prove a popular beverage for the health conscious generation. It is indeed as researchers say “A miraculous medicine with an extraordinary power to prolong”.

- **Oolong tea :** Darjeeling oolong teas are made from finely plucked leaves, usually two leaves and a bud, and are sometimes withered naturally in sun and air. The withered leaves get hand-rolled and pan-fired at certain temperatures. This can also be done in machine : withered in trough, lightly rolled in a rolling machine and fired at 220°C in a quality dryer

(a) **(b)**

Fig. 24. Green leaves production (a) and green tea (b).

(a) (b)

Fig. 25. Darjeeling processed (a) and Oolong tea (b) leaves.

Fig. 26. White or silver or silver needle tea leaves.

with faster run-through, depending on the leaves used. Darjeeling oolong is lighter than usual Darjeeling black tea during first flush, as it is semi-oxidized. The cup looks light orange and infusion remains green. Darjeeling oolong (Fig. 25) in second flush is more accepted worldwide.

- **Silver tea/white tea :** To make white tea, it has to pluck super fine tea leaves. Withering is going to be little bit harder. The fermentation time is between 60 to 90 min. Other procedures will be same as per clone-wise. White tea (Fig. 26) is also sold as trade name Silver tips, Silver needle, etc.

- **Green leaf production and yield of processed tea :** In the Darjeeling hills, flushing of the tea crop starts at the end of March and after a sequence of production of normal leaves in April the shoot goes dormant for a short period during May. Thereafter, harvesting of the tea crop continues until September, declines considerably towards the end of October and then ceases during November until flushing starts again at the end of March. The seasonal yield distribution varies primarily as a result of seasonal changes in temperature and the development of soil moisture stress during the dry season. However, in Darjeeling 50% of the annual crop is produced in the wet season (June to August). The yearly harvested green leaf production is approximately 2750-3250 kg/ha. The annual average yield of made/ processed tea is 600-700 kg/ha and varies with times of pruning and pruning cycle.

Preparation of different teas : The colours of different ready-to-drink teas are shown in Fig. 27.

Fig. 27. Colours of different ready-to-dink teas.

REFERENCES

Kumar, R. (2016). *Technical Bulletin on Pruning and Other Cultural Practices of Darjeeling Tea.* pp. 1-4.

Kumar, R., Bisen, J. S., Singh, Mahipal and Bera, B. (2015a). Effect of pruning and skiffing on growth and productivity of Darjeeling tea. *Int. J. Tech. Res. and Applic.* **3** : 28-34.

Kumar, R. and Choubey, M. (2016). Effect of farm yard manure, vermicompost and chemical fertilizers on productivity of Darjeeling tea (*Camellia sinensis* L.) cultivation. Proc. Workshop on Organic Tea Cultivation of DTRDC, Darjeeling, July 25. pp. 24.

Kumar, R., Mahipal Singh and Bera, B. (2015b). Bush physiology, growth analysis and productivity of Darjeeling tea plantation. *Int. J. Trop. Agric.* **33** : 3083-91.

Mair, Victor H and Hoh, Erling (2009). *The True History of Tea.* Thames & Hudson. ISBN 978-0-500-25146-1.

Singh, I. D. (2005). *The Planter's Guide to Tea Culture and Manufacture.* N. B. Modern Agencies, Siliguri, West Bengal.

Tea Planters' Handbook (2005). Digitised and published by Tocklai Experimental Station, Tea Research Association, Jorhat, Assam.