

# The Genesis of Tea Cultivation and Other Cultural Practices in Uttarakhand State

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**Abstract** – Uttarakhand is one of the promising states for Tea cultivation. The Agro-climatic condition of Uttarakhand state is highly favorable for Tea cultivation. Most of the plantations of Uttarakhand are organic & cultural practices are traditionally different compared to other state/ regions. Here is an elaborate study emphasizing on all aspects of Tea cultivation in Uttarakhand with its genesis. The yearly harvested green leaf production is approximately 1500 to 2000 kg/ha and an annual average yield of processed tea is 300- 400 kg/ha that vary with the cold weather practices and pruning cycles.

**Keywords** – Genesis, Tea Cultivation, Other Cultural Practices.

## I. INTRODUCTION

Tea is one among the economically important plantation crops predominantly grown in the humid tropical and subtropical area. The yield of tea comprises of tender young shoots with a terminal bud and two to three young leaves harvested at regular intervals.

In 1824, Bishop Haber, the British writer, in book ‘History of tea cultivation in Uttarakhand vol-I’ wrote, “Here tea plants were found in forest but these were never used as agricultural product”. In 1834, Lord William Bantik constituted a tea committee for developing tea industry in Kumoun & Garhwal region.

Uttarakhand tea production dates back to 18<sup>th</sup> century, as old as that of Darjeeling & Assam, when first time in 1835, 2000 tea saplings from Kolkata were brought in Almora & Nainital under British rule to start nurseries. In 1842, a team of tea experts from British government found Uttarakhand tea better than that of Assam. Organic tea samples sent to Britain and reports of Kolkata commerce chamber found market potential and high value in Uttarakhand tea. By 1880, the then British trade and commerce industry with strategic commercial ends developed 1.5 lakhs tea plants for tea production covering approximately 2000 hac. area in 63 small and big gardens spread in different parts of Uttarakhand which earned huge revenue and ensured employment for about 5000 Uttarakhand people. Tea produced in Uttarakhand during British rule and even at present is world famous and used to be epitomized as ‘Golden Himalayan Liquor’ during British rule which, unfortunately, lost the ground of production and development after independence due to lack of developmental & promotional schemes that ensured huge revenue and employments, however Berinag tea continued to be most favored brand in London tea house upto 1965 till the production of tea continued at Berinag tea factory.

Gone are the days when the reality of tea flavor, taste and quality was on par and excelled Darjeeling Tea in 19<sup>th</sup> century. The graded tea from Uttarakhand was recognized all over the world with huge influx of tea tourism. Berinag tea was a highly sought after tea in London tea house as documented by William McKay Aitken and Laurie Baker, the connoisseur of tea. If we can believe on the fact that ‘History repeats itself, then certainly golden opportunity is waiting to be rewritten’ in Uttarakhand with its glorious past. Before we think of developing area prospered with tea production, we have to ponder over some basic peculiarities of tea

production which even was not ignored by British in 19<sup>th</sup> and 20<sup>th</sup> century. If we have hopes, policies, plan and execution in place then certainly a golden future of tea is awaiting in Uttarakhand with a prosperous perspective in tea sector.

Tea plantation in Uttarakhand comprises to 1200 hac. in Kumaon & Garhwal hills (of which more than 1000 hac. are of new plantation, Old plantations of 39 hac. in Cheerapani (Champawat) and Vijaypur (Bageshwar) were revived) and 758.00 hac. In Doon valley which were planted in British era. In 1990 tea plantation was again invigorated on a large scale covering seven hill districts (Almora, Champawat, Chamoli, Bageshwar, Pithoragarh, Nainital & Rudraprayag) of Kumaon and Garhwal under flagship of Uttarakhand tea development board.

In Uttarakhand, the extension growth stops at monthly mean maximum and minimum temperatures of 19°C and 11°C respectively in November and it start flushing at the end of March when maximum and minimum temperature exceed 21°C and 14°C respectively (Table No. 1).

Table 1. Weather data of Uttarakhand (mean data).

Parameters	Months											
	Jan	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Max. Temp. (°C)	11.0	14.0	19.0	31.0	32.0	34.0	30.0	28.8	26.6	24.5	21.6	15.5
Mini. Temp. (°C)	3.5	8.0	11.5	15.0	23.0	20.0	18.0	117.5	14.8	14.3	11.3	5.2
Total Rainfall (mm)	51	96	16	48.7	49.8	70	250	283	276	28	196	52

(Source: Uttarakhand Tea Development Board)

The cultivation practices followed in Uttarakhand are different due to agro-climatic & topographical condition of the area. The tea garden even experience 2-3 spells of snow in winters, which leads to late bud break than rest of India (i.e. Last week of March), but on other hand the quality of first flush is enhanced by this peculiar climatic condition.

Likewise other cultivation practices are bit different from rest of tea cultivating states, which are discussed below:

## II. TEA CULTIVATIONS PRACTICES FOLLOWED IN UTTARAKHAND

### 1. Method of Propagation of Tea

Tea plants are propagated both vegetatively and from seeds (Singh, 2005). Therefore, in the main commercial tea production area in the world, the use of cutting has in recent times replaced the use of seeds for propagation. However, many small tea farmers in countries such as China and Vietnam still use seed, as seed plants does not have high yields, this is one of the reasons for the relative low average yield in these countries.

#### A. Vegetative Propagation

For vegetative propagation mother bush is required, Preparation of Mother bush is discussed as under,

- i. First, mother bushes are carefully selected based on the health, vigor and yield.
- ii. After pruning, these bushes should be left to re-grow freely without plucking.
- iii. Extra fertilizers (Organic and inorganic) should be applied.
- iv. Cutting can be taken 5-9 months after pruning.

The best time to make cuttings from mother bush is when the weather is cool and cloudy. Best time for this is August to November. A Vegetative propagation nursery is different from seed nursery but the same type of land and soil are essential. This nursery consists of sleeve stacking beds and rooting beds constructed similarly. Rooting beds are prepared carefully and compacted hard. A high over head shade is built over the nursery. Propagation is done by planting cutting made from semi mature stems of tea shoots, called “scions”. A standard tea cutting consists of a leaf with a dormant or enlarging auxiliary bud and 2.5 cm. of stem below it with parallel slanting cuts above and below the leaf. The cutting can be planted directly in the soil pots or in rooting beds prepared one month before hand. The rooted cuttings are then transferred in the soil pots in nurseries located at elevation above 1400mtr.



The cutting in the rooting beds and transplanted cuttings in sleeve beds are covered with air-tight polythene tents made of 150 gauze transparent polythene sheet. The polythene tents are opened periodically for watering, weeding, manuring and closed immediately after completion of work. These are removed gradually when the clone plants complete second flush growth and go dormant. The site shades are removed two weeks after removal of polythene tents. The clonal plants are shifted to the beds in a hardening nursery or the HO shade is removed for two to three months before transplanting in the field. Clonal plants taller than 30 cm. and having adequate foliage are taken to field for transplanting.

### **B. Seed Propagation**

A successful tea seed nursery should be established in a suitable site, preferably at low elevation in the hills. It should be in a sunny site on raised land and should be easily approachable and drainable. The soil should be sandy loam with adequate organic matter content, and have pH level of 4.5 to 5.8. Eelworm population should be less than 6 per 10 grams of soil. The soil is sieved through a Mo. 4 wiremesh for filling the polythene sleeves. The polythene sleeves are filled up and stacked neatly on the sleeves stacking, at least, one month before sowing the germinated seeds. 1 hac. land is required for 3,00,000 plants. Sleeve size used in seed nursery is 25 cm. long and 12.5 cm. lay flat. Tea seeds are procured from tea seed- baris certified by TRA. December March is time for sowing seeds in the nursery. The nursery consists of germination pits and sleeve stacking beds. The sleeves are

filled at least one month before sowing seeds and arranged on the beds. Standard sleeve bed is 12.46 mtr long, 1.52 mtr wide and raised 20 cm. above the ground level. Seeds are first germinated in sand and sown in soil pots when they germinate.



A light high shade is provided over the sleeve beds to protect the seedlings from bright sun and hail damage. Nitrogen 10% is applied on the sleeves when the seedlings have developed four to five leaves and repeated three four times at monthly interval. When the tap roots start going down into the ground, the position of the plants should be shifted in the beds once a month periodical grading of the plants should also be done and those taller than 35 cm. should be taken to field in the hills (Uttarakhand). It takes 12 to 18 month for the plants to become plan-table.

## *2. Planting and Management of Young Tea*

Ideal time for planting is from March to October excluding mid may to mid June during draught weather. However planting may be done round the year with more care during July August. The period of continuous heavy rain should be avoided.

### *A. Selecting Suitable Land*

Select land with gentle to moderate slope or wide terraces with few trees or treeless having soil depth of at least one meter with sandy loam and friable soil rich in organic matter and aggregates, and strongly acidic (pH 5 to 5.8) in reaction. At least 90% of the available land should be below 1900 mtr.

### *B. Selecting Planting Material*

Between 1600 – 2000 m. elevation: Clones: T78, T383, AV.2, P.312 and RR.17/144.

Between 1400 - 1600 M. elevation: Biclona seed stock : BSS.379, RR 17/144, Upasi-9.

Below 1400 m. elevation: Clone Upasi -9, TS (BSS)449, TS(BSS) 462, 378, TS(BSS) 379.

### *C. Land Preparation Procedure*

Ideal period for this is from Oct. to June. Clear the weeds, tree stumps and loosed stones and level up the surface during digging out stumps and cheeling weeds, do not draw the soil down the slope. Lay out the drainage system and inspection paths on barren terraces dig the ground to a depth of 45 cm. pulverize the soil clods and level up properly. Stake out the lines of tea at the following spacing.

- a) At elevation at 1500 meter: 105x 60 cmx60 cm in RDH and 105x60 cm in RSH.
- b) At elevation of 1300 meter to 1500 meter: 105 cmx60 cm RSH.
- c) At elevation below 1300 meter : 120cmx 60 cmx60 cm RDH.

RSH- Row Single Hedge, RDH- Row Double Hedge

On terraces lay out the first contour line 60 cm away from the lower edge. On slope lay out the contour master line about one third distances from the top of the plot and vertical master line down along its greatest length.

### 3. *Planting Procedure*

Select healthy plants at least 30 to 35 cm tall with adequate foliage and robust stems. Avoid damaging the leaves soil pots during transportation to the planting site. Dig planting pits between the stakes along the contour rows 45 cm deep 45 cm diameter and loosen the bottom soil to a further 15 cm depth. Mix planting mixture with 8% nitrogen and 1 to 2 % P<sub>2</sub>O with the excavated soil, return half of it into the pit and compact with feet. Place the plants in the centre of the pits such that the top of the soil pot is 1 cm below the ground level, remove the polythene sleeve and return the remaining soil all around the “Bheti” with uniform compaction. Compact hard at the top of the pit and; level upto the ground level.



### 4. *Post Planting Care*

Clean up the planted area and level up immediately and spray solution mixture of approved insecticides + acaricide + fungicide on the young tea at the recommended solution as soon as possible. In Uttarakhand as most of the plantations are organic in nature, only the spray of COC is done. Sow green crops in drills along the middle of the “working gullies” and plant sapling of temporary and permanent shade trees in the line of tea. Mulch thickly always keep the plot neat and clean and remove the blockades in the drains after heavy rain, if any. Control pest and disease attack immediately when seen. Regularly apply with manures. Rate of manuring depend upon soil test report. Any vacancy caused by death of young tea plant should be in filled immediately with vigorous plants bringing into bearing of young tea. In earlier plantation, a new tea section used to come into economic bearing about 12 years after planting but the present trend is to achieve this in 4 to 5 years after

planting. This has become possible due to new technology. The major cultural practices contributing to this early economic bearing are mentioned below.

### 5. *Weed Control*

Weeds constitute major limiting factor in tea production. And their elimination becomes a very expensive task of tea cultivation. Maximum weed competition with tea plants take during April to October hence weed should be controlled during this period. In organic plantations of Uttarakhand hand weeding is mostly preferred and adopted.

Weed control method in organic plantations.

1. Hand weeding done preferably in nurseries.
2. Cheeling done to remove shallow rooted weeds in tea sections when weed density is very high.
3. Fork tilling done to remove deeper rooted weeds in the vicinity in the tea bush collar not approved in newly planted clonal tea section.
4. Sickling done to control densely growing tall weeds when herbicide use is restricted like in organic cultivation of Uttarakhand.

(Note: - all weed control measures should be completed before the onset of monsoon.)

### *Insect and Mite Control*

The common pests encountered on tea in Uttarakhand are thrips, green flies, grass hoppers, aphides, red slug caterpillar and purple mites. Spray the following recommended organic insecticides i.e. culture of *verticilliumlegharni* at the rate of 1 to 2 kg. per Hac. Keep close watch on incidence of pest, and commence control measures when pest population builds up.

### 6. *Disease Control*

Blister blight and red spot are the common disease observed. As soon as few white blisters are seen on a few leaves, commence spraying with any recommended copper- oxychloride @ 1 : 800 dilutions (maximum 2 kg per hac.) at 7 to 10 days interval repeatedly until the disease is controlled along with this, thin down the shade and pluck back during treatment period. Heavily damaged bushes are uprooted and burnt as a common control method in Uttarakhand to stop further spread of the disease.



### 7. Drainage System

Tea plants are very susceptible to standing water in their root zone. Besides, strong surface flow of water down the slope causes soil erosion. To avoid these problems establish a good drainage system in the tea section both on slope and terraces. Isolation drains prevent water from outside entering the tea section. Interceptor drains draw out subsoil water, preventing water logging in the tea root zone. Contour or feeder drains prevent soil erosion. The natural drains down the slope serve as the main drains. Herring-bone drains are dug to remove water from a water logged depression.

### 8. Irrigation

Under the agro-climatic condition of Uttarakhand, young teas do not require irrigation for survival. However irrigating the tea section in dry period of May & June can increase the crop. Irrigating by over head sprinklers is the best method. Supplying even 50% of the soil moisture deficit gives adequate crop returns.

### 9. Pruning and Skiffing of Young Tea

Six to 12 month after planting, prune the young tea plants to give them spreading frames for production of crop that is green leaf. The following pruning, skiffing and tipping, plucking schedule is suggested in an average type of young tea section of Uttarakhand.

Year of Planting	Pruning/ Skiffing	Tipping ht. in cm	Plucking System
0	DC7- 15 CM (2.75") + CA 30 CM. GM. (11.8")	55 CM. GM. (21.65")	TO JANAM
1	LOS (level of skiff)	-----	---DO---
2	LS (light skiff)	-----	----DO---
3	LS (light skiff)	-----	----DO---
4	CA 35 CM. (13.77") +RC+ KCO	55 CM. GM.	-----DO----
5	LOS	-----	----DO.....

CA35 cm. +RC+ KCO given in year 4, is the FFP (final frame forming prune). In year 5, “canopy closure” will be attained, and thereafter section is deemed to be mature. From year 4, the tea section is brought under suitable pruning cycle depending on the health and variety of the tea plants, altitude of the section, crop quality and quantity requirement, and drought- susceptibility of the soil.

### 10. Pruning of Tea Bush (Kumar R. et al 2018)

Pruning is the most important operations in tea with a primary objective to replace the old set of maintenance foliage by a fresh one, so that tea bushes remain healthy and continue to provide succulent shoots to manufacture tea having good quality. Repeated pruning and skiffing under certain intervals keep the tea bushes under vegetative phase and thus encourage shoot growth for optimum harvest. As such, pruning almost becomes imperative to provide a fresh stimulus to the bushes to restart its vegetative growth.



Why to prune/ Objectives:

- i. To divert stored energy to production of fresh shoots.
- ii. To regulate the crop distribution and quality.
- iii. To remove dead/ unproductive wood and renew the actively growing branches which can support sufficient volume of maintenance foliage on it.
- iv. To minimize banjhi formation, remove knots, control crop during rush periods and reduce incidence of pests/diseases.
- v. To control height for efficient and economic plucking.

Types of pruning:

- i. Collar Prune (CP): All above ground portion cut leaving a maximum of 10 cm when bush frame becomes unproductive but still having good root system.

Time of Pruning: December – middle January.

- ii. Heavy Prune/ Rejuvenation prune (RP): R.P. 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.

Height : China/ China hybrid bushes at 15 – 30 cm and Assam /Assam hybrid bushes at 25 – 40 cm above the ground. Time of Pruning: December – middle January.

- iii. 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.

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

Time of Pruning: December – middle January.

- iv. 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.

- v. Deep Skiff (DS): Height determined according to earlier operation and sequence.

DS Height Above Last LP	Tipping Height in LP	Pruning/Skiffing Sequence
7 - 10 cm 20 cm	LP - DS	
10 -12 cm	23 -26 cm	Irrespective of sequence
12 -15 cm	Irrespective	LP -UP/LOS –LS - DS

Time of skiffing: Last week of November – December.

- vi. Medium Skiff (MS): Just below majority of crow’s feet, to remove congestion in the bush frame. 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 November – December.

- vii. Light Skiff (LS): Cut to the through the red wood of the plucking table.

Time of skiffing: January.

- viii. Level-Off-Skiff (LOS): Cut to the through the green wood of the plucking table.

Time of skiffing: January.

### Pruning Cycle

An average type of section may be put under a 7 year pruning cycle, such as: LP (Light Pruning) - LOS-LS-LS- DS (Deep Skiff ) - LS-LS-LP.

A vigorous section may be put under a 6- year pruning cycle: LP-LOS-LS-DS-LS-LS-LP.

OR, a section in drought prone area may be put under a 5 year pruning cycle: LP-LOS-LS-DS-LS-LP.

### 11. Plant Nutrition

Normally young tea section is manured with NPK 2:1:2 mixture commencing one month after completion of planting. Depending upon the fertility status of soil NPK ratio of 2:1:3 and 3:2:4 are also applied. When tea bushes exhibit, symptoms of nutrient deficiency, they are sprayed with dilute solution of concerned nutrient. In Uttarakhand tea plantations, organic fertilizers certified by APEDA are recommended.

### 12. Shade Trees

In the hills where ultra violet incidence is very strong, it is very essential to grow shade trees to protect the tea plants from excessive isolation and leaf heating. Sow green crop seed @ 10 to 12 kg. per Hac. in drills along middle of “working gully” immediately after planting tea. Soon after this, plant temporarily shade trees and permanent shade trees in the lines of tea. Keep the shade trees lopped regularly. Remove the temporary shade tree in the sixth year from planting. The permanent shade tree will remain in the section as long as they remain in good condition. The temporary and permanent shade tree species recommended for Uttarakhand are *Indigoferateysmanii*, *Albizzia Chinensis* and *Grevillearobusta*.

### 13. Plucking

After two to three years of planting, tipping of the centre is done in young tea. Tipping is done at 22 inches. From next year onwards, plucking is done. Plucking table is maintained at a height of 22 to 28 inches.

#### i. Method of Plucking

In Uttarakhand, two leaves and a bud concept of tea plucking is strictly followed. Plucking is done using thumb and index finger, so that injury is less.



#### ii. Bhanji Period

Between first and second flush in month of April to June, there is a Bhanji period. Bhanji's are broken so that the second flush (monsoon flush) may come out properly. Bhanji's are removed by hand so that injury is less and recovery is fast.

### 14. Production

The annual green tea leaf (1590 Kg/ha) showed during the pruning cycle variation and this may be due to the age of plants / clone to clone. 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. 50% of the annual crop is produce in the wet season (June to August) but the highest yield was observed in June and high yield in July and August when precipitation was maximal.

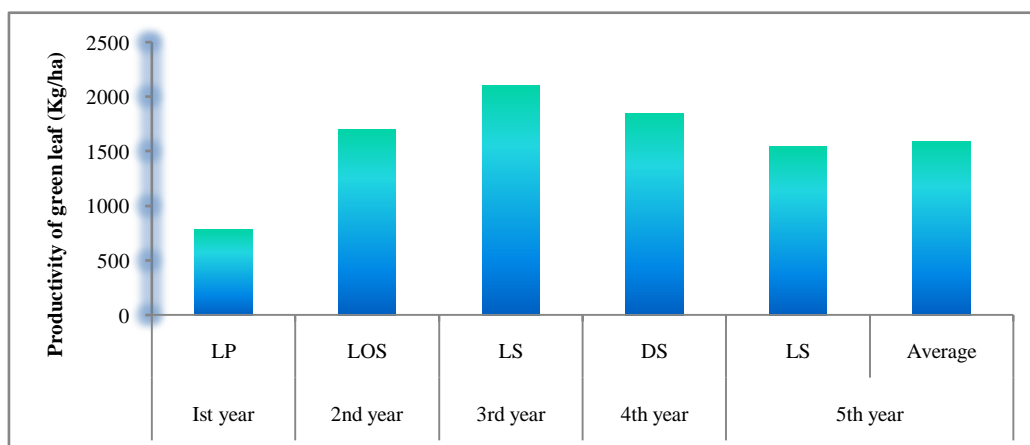


Fig. 1. Yearly mean average productivity of green leaf in Uttarakhand tea cultivation, (Source: Uttarakhand Tea Development Board).

### 15. Tea Grades

On Basis of physical appearance of the made tea different grades are maintained in Uttarakhand. The type of different grade and its description are given below:

1. OP – Orange Pekoe.
2. FOP -Flowery Orange Pekoe.
3. GFOP- Golden Flowery Pekoe.
4. TGFOP- Tippy Golden Flowery Orange Pekoe.
5. TGFOP1- Tippy Golden Flowery Orange Pekoe.
6. FTGFOP- Finest Tippy Golden Flowery Orange Pekoe.

### III. CONCLUSION

Tea cultivation in Uttarakhand is now gearing up; best cultivation practices if practiced in Uttarakhand will certainly boost tea cultivation in Uttarakhand. The author has endeavored to write best picture of contemporary tea production practices, varieties of tea saplings, propagation methodologies with scientific evaluations including data available with the departments. This article has thrown light with vivid description of the golden history of tea in Uttarakhand which aims to inspire innovative farmers and stake holders to come forward for the development of tea gardens all across Uttarakhand so that the cause of environmental protection, eco and tea tourism, livelihood of farmers, dilapidated tea gardens, barren land could be addressed. The information contained in the article will attract the brew lover and saviors. The authors hopes that this article succeeds in the missions of illustrating the basic knowledge of Uttarakhand tea cultivation practices to agriculture students, teachers, researchers, extension workers, farmers and all those related to tea industry.

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### AUTHOR'S PROFILE



#### First Author

**Meenakshi Tiwari**, The author has done BSc (Ag.) in year 2004 and MSc (Horticulture) in the year 2006 from GBPUA & T, Pantnagar, Uttarakhand. She has also done MBA (marketing management) from Uttarakhand Open University. She has served in CPCRI (ICAR) for two and half years in Assam. She has many paper published on various topics related to agriculture practices. She has been serving in tea board India for the last 08 years as development officer. At present, she is the officer in-charge SRO, Tea Board Almora for Uttarakhand. She is striving hard to bring back the pristine glory of Uttarakhand tea by reviving age old dilapidated tea gardens. She is also developing Self Help Groups of Small Tea Farmers thus making them self-reliant for their livelihood. The author is implementing best tea garden development and production practices prevalent in tea growing states of India to maximize benefits and production in tea industries of Uttarakhand.



#### Second Author

**Rakesh Kumar** joined as assistant teacher in 1989. Obtained B. Ed. (Ag) in 1992 from Regional College of Education Centre, Ajmer, Rajasthan (NCERT). Joined as a Scientific Assistant (Farm Management) in October, 1992 at Tea Board India, Darjeeling Tea Research and Development Centre (DTRDC), Kurseong, Darjeeling, and West Bengal. Now working on plant physiology as a Scientific Officer at DTRDC since 2009. He has published more than 40 (forty) Scientific papers in National and International reputed journals, and attended more than 10 (Ten) National and International Conferences, and trained 100 (one hundred) Small Tea Growers of Darjeeling tea Industry, and contributed two technical bulletins of young tea management and other cultural practices of Darjeeling tea, and contributed one Book Chapter on "Tea Research for Darjeeling Tea Industry". Recently, have visited to Uttarakhand and Himachal Pradesh and given the training to Tea planters through different workshop. He is also Life time member of "Journal of Crop and Weed". email id: rkjayantdtrdc65@gmail.com