

Darjeeling Tea Research and Development Centre, Kurseong

Darjeeling Tea Research & Development Centre (DTR&DC) was established at Kurseong in 1977 to provide Research & Development support to Darjeeling tea industry on demand of the State Government and Tea Associations. The Laboratory Building was formally inaugurated in 1981 by Shri Pranab Mukherjee, the then Hon'ble Minister of Commerce, Steel & Mines. It has been functioning as a Research Institute with 21 ha of farm land for research and had 4 divisions namely Farm Management, Soil Science, Biochemistry and Plant Protection.

This year the structure of DTR&DC has been reorganized (after bifurcation of Farm Management division) the divisions are as follows :

- 1. Agro-Botany** (including plant improvement), **2. Soil Science**, **3. Plant Protection**, **4. Tea Quality and Manufacturing (TQ & M)** and **5. Farm**

➤ Major Achievements made in last few years.

1. Package of practices developed/commercialized.

- Management strategies to conserve soil erosion in Darjeeling (Technical bulletin is under publication)

2. Cultivar developed / under pipeline.

- In- situ conservation plot (Seed Bari) has been established at Makaibari Tea Estate, Kurseong and Rohini Tea Estate, Rohini during the year of 2016 to produce seeds from quality section of old jats. Consequently seeds collected from In-situ conservation plot of DTR&DC were packaged for study on viability of seeds.
- In situ conservation plot at DTRDC: 6500 (6957.67gm) seeds collected during 2016.
- In situ conservation plot at Tumsung Tea Estate: 2400 (2500.00gm) number of seeds collected during the year of 2016.

- Clonal blocks: clonal blocks of Darjeeling recommended clones established at DTR&DC with six numbers of clones namely T-78, P-312, AV-2, Bheemey, RR- 17/144 and B-157 (till date).
- Collection, evaluation and utilization of china type of tea germplasm in the field gene bank : total number of 311 accessions established (till date) at DTR&DC, Kurseong

3. Other Research contribution:

- Studies on Pruning litter degradation in Darjeeling conditions
- Studies on seasonal change in soil respiration in Darjeeling tea plantation area
- Effect of herbicides on soil respiration in Tea plantation.
- Survey of Thorny Blight at Tea plantation in Darjeeling
- Soil/Leaf/Organic manure sample analytical services rendered to tea industry by soil science division
- Recommendations made to tea industry after soil testing .

b. Important Experiments carried out along with important deliverable in terms of scientific achievement in last 2 years is as follows:

I. FARM MANAGEMENT DIVISION

1. **Effect of aqueous plant extracts in supplementing plant nutrients, optimization of yield and quality of tea.**

Deliverable: Soil fertility in the gardens can be maintained when nutrients are efficiently recycled through the soil plant web. Some local herbs which are rich in nutrient content may be a better option to supplement the nutrient to the tea bushes during growing period for instant supply of nutrient through aqueous extract in general and organic farming in particular.

2. Studies on organic and inorganic nutrient management in tea since planting to bearing based on growth, yield and soil health on long term basis

Deliverable: Vermicompost and Farm yard manure can be a better option to substitute the inorganic form of nutrient for better establishment of plant/ bringing up since planting in the area of organic tea farming.

3. Weed dynamics of tea [*Camellia sinensis* (L)] field in mid elevation of Kurseong Sub-Division of Darjeeling Dist.

Deliverable: *Chrysopogon aciculatus* closely followed by *Drymaria cordata*, *Polygonum runcinetum*, *Ageratum conyzoides* were observed as major weed . Maximum density of the weeds was recorded during the month of July to October. Optimum time for de weeding to decrease crop loss was thus established

4. Determination of suitable pruning cycle of Chinary tea at DTRDC, Kurseong (Mid altitude) and Darjeeling (high altitude)

Deliverable: Pruning cycle are often extended at higher altitude by Planters (more than 5 years) without any scientific rationale. Scientific data did not exist in the area. Initial results show highest annual yield of made tea was recorded in Gopaldhara (Inorganic Tea Garden) and lowest yield (in Sungma TE, an Organic garden and at DTRDC). Final results will be available only after the experiment is completed, i.e. completion of at 1 round of pruning cycle.

5. Effect of environmental factors on the physiological and biochemical attributes of different tea clones.

Deliverable: Data generated here helped in understanding of the influence of climatic variables on photosynthesis and related parameters, biochemical characteristics and crop productivity for developing physiological and chemical criteria for identity of superior genotypes in relation to yield and quality.

The study generated a considerable amount of important information on the effect of cloud and shade tree on the photosynthetic rates and pigment concentration in tea leaves.

6. **Classical and molecular approaches for the tea improvement programme in Darjeeling**

A. Establishment of Long Term Trial (LTT):

Deliverable: Suitable planting materials for Darjeeling tea industry was developed by carrying out Clonal Selection Programme in various gardens in different valleys of Darjeeling hill. Experiment were performed to produce seeds from quality section of old jats with the preservation of old china seed jat .1e, in situ conservation with the objective of preserving the existing invaluable old jats as land races for future use, reference, experimentation and utilization.

B. Nursery grafting for selection of suitable root stocks.

Deliverable: Nursery grafting was performed with different combinations of stocks and Scions using TRA/Garden series and TV clones . Maximum survival percentage was observed in TV-19(Root Stock) and AV-2(Scion). Although performance of field grafting was very poor, perhaps it may be due to incompatibility of scion and stocks as its plays a

crucial role in the success of such technique. The trial needs to be repeated.

C. Establishment of Clonal Block at DTR&DC, Tea Board, Kurseong

Deliverable: To preserve these selected genetic diversities for future experimentation and utilization, the recommended clones were planted in the field gene bank at DTR & DC, Kurseong.

II. SOIL SCIENCE DIVISION

1. Studies on the effect of integrated plant nutrient supply (IPNS) on the yield of Darjeeling tea and soil health.

Deliverable: The results reveal that sustainable production and increasing crop yield may obtain through integrated approach of nutrient supply to plants. Application of nutrients through organic sources stimulated the activity of soil microorganisms, improved the structure/texture of soil, plant nutrients holding capacity and increased the availability of major plant nutrients. Results have indicated that optimum supply of nutrient to the plant and sustaining the productivity is possible through organic manures in combination with inorganic micronutrients.

2. Development of Phosphate Solubilizing Biofertilizer for Tea (*Camellia sinensis* L.) in acid soils of North Bengal

Deliverable: Commercial phosphate solubilizing cultures often fail to prove beneficial in adverse soil condition due to their poor adaptability in acid soils of tea garden. This problem can be alleviated by isolating and screening efficient phosphate solubilizing microorganisms which can

perform well in tea rhizosphere. This study has been indicated that the application of phosphate solubilizing biofertilizer with rock phosphate produces maximum yield and improves soil nutrients availability to plant.

III. BIOCHEMISTRY DIVISION

1. Extraction, Isolation and Characterization of Volatile Flavoury Compounds in Darjeeling tea.

Deliverable: Hand handled E-Nose (HEN) deployed at DTRDC by C-DAC Kolkata was used for testing Aroma Index/Aroma score of various clones released for the Darjeeling Tea Industry. Only 15 percent of orthodox black tea samples complied with the results indicating requirement of more training to the HEN with the score of Professional Darjeeling tea tasters or otherwise some modification to the HEN.

2. Preparation of biochemical data base of clones available in germplasm bank at DTRDC garden .

Deliverable: Preparation of database for Darjeeling tea industry is of prime importance.

3. Integrated tea quality determination program

Deliverable: Documentation was done on physical quality descriptors like taste, colour, flavour of Darjeeling black tea. Correlations between physical quality descriptors like taste, colour, flavour and chemical compositions of Darjeeling tea established

4. Molecular and Biochemical Documentation of elite tea varieties of Darjeeling

Deliverable: Molecular documentation of elite tea varieties of Darjeeling using Molecular Markers were done. Biochemical constituents responsible for unique quality of Darjeeling tea are being explored.

5. Relation of flushes of tea cultivars with Moisture, withering and fermentation.

Deliverable: Some of the cultivars are grown in Darjeeling hills exhibited early flush and early fermentation. In case of withering few clones requires long period of withering under the same condition while the other requires early withering .Early withering varieties are AV2, B157, and Ttv1 and delayed are K1/1, HV 39 and B/5/63 simultaneously early fermenting clones are T135 and Nanda Devi.

6. Miniature Manufacture Unit:

Deliverable: Clonal samples manufactured for testing.

IV. PLANT PROTECTION DIVISION

1. Evaluation of aqueous plant extracts for controlling the Tea

Mosquito Bug, Jassid and Thrips infesting tea in Darjeeling.

Deliverable: The efficacy of aqueous plant extract formulation on sucking insects has been carried out and the bio-agent could be used in place of synthetic pesticide.

➤ **New experiments initiated in 2016 -2017**

- 1. Study on Pest, Diseases and Natural enemies (Predators) of Darjeeling Organic / Commercial Tea Garden. (In house Project).**

Objective:

1. Survey of major pest and diseases at different garden at varying elevation level.
2. Survey of seasonal change natural enemies of the pest (lady birds beetle, spider, *Chrysopa sp.*, dragon fly etc).
3. To evaluate the intensity of pest activity in relation to local weather conditions.
4. To preserve and maintain collected natural enemies of tea pest
5. Soil biomass/ Soil microfauna etc

Expected Deliverable: The study will enable the evaluation of the extent and magnitude of the problems and enable the planning of experiment for efficient control. The efficacy of aqueous plant extract and other formulation on specific insect will be workout and bio-agent could be used in place of synthetic pesticide if It,s economically feasible. Different type of work will be implemented.

2. Study on non chemical methods of pest management in Darjeeling.

Objective:

1. Field and laboratory study on botanical preparation on tea on Darjeeling
2. Use of Trichoderma in soil
3. Use of entomopathogen and culture

Expected Deliverable: The efficacy of aqueous plant extract and other formulation on specific insect will be workout and bio-agent could be used in place of synthetic pesticide if It's economically feasible. Organic Product will be prepared for tea industry purpose. Different type of work will be implemented.

3. Study on seasonal change in soil microbial activity in Darjeeling.

Objective:

1. To determine the amount of soil respiration.
2. To determine the seasonal variation of soil micro flora/ soil respiration.

Expected Deliverable: To know the microbial activity in soil month wise. It helps in which month the microbial activity will be more as compare to other month.

4. Pruning litter degradation rate of Darjeeling Tea (Organic).

Objective:

1. To determine the seasonal decomposition rate of tea pruning litter decomposition rate.
2. Study on respiration rate

Expected Deliverable: To know the decomposition rate of pruning litter in Darjeeling. This study will reveal the high seasonal variation in the rate of tea pruning litter decomposition.

5. Comparative study of different weed management strategies and its impact on the productivity of Darjeeling tea plantation.

Objective:

1. To determine the loss of productivity as influenced by unmanaged weeds.
2. To find out the comparative impact of different weed management strategies in relation to yield in Darjeeling conditions.
3. To determine the appropriate interval of sickling in comparison to chemical weed control.
4. To evaluate the cost effectiveness of the treatments.

Expected Deliverable: Findings of the experiment will be useful to planters to take the decision on weeding interval and minimise the economic loss through minimising manpower.

6. Integrated Tea Improvement Programme. Development of new clones through integration of conventional and non conventional breeding for productivity, quality and stress tolerance: (XII Plan Coordinated projects)

Objective:

1. Collection, evaluation and utilization of china type of tea germplasm to develop quality clones and bi-clonal seed stocks.
2. Establishment of field gene bank, primarily of China type teas at DTRDC, Kurseong
3. In-situ conservation of old seed jats and their seed production.
4. Bush selection from old seed grown sections in Tea Estates to develop quality clones.
5. Field grafting for early establishment of experimental hybridization plots and nursery grafting to produce composite plants.
6. Hybridization to produce quality bi-clonal seed stocks and clones
7. Molecular analysis for study of genetic diversity in Darjeeling tea.
8. Establishment of commercial blocks of Darjeeling recommended released clones as nucleus plots to supply cuttings to T. Es. in Darjeeling hills as well as for experimental use.
9. Conservation of old seed jats by developing the seed baries for future use, reference, experimentation and utilization.

Expected Deliverable:

- A number of quality clones with high yield potential are expected to be released to the Darjeeling tea industry, on the completion of above trials.
- The field gene bank of China type tea will serve as a National Depository of genetic diversity for future use in tea improvement programmes.
- The In-situ conservation and production of seed of old jats will serve as a source of planting materials to maintain the Darjeeling tea character and at the same time will conserve the land races which are getting lost very fast due to uprooting and replanting.

➤ **Projects**

a. XII Plan coordinated project:

Development of new clones through integration of conventional and nonconventional methods of breeding for productivity, quality and stress tolerance.

b. NTRF coordinated project

Tea genome sequencing

➤ **Staff strength**

Sl no	Name	Designation
1.	Shri P Chhetri	Project Director (I/C)
Scientific Staff		
2.	Dr.A.Basu Majumdar	Research Officer
3.	Shri Mritunjay Chaubey	Sr Sc Officer(Agro Botany)
4.	Mr. Ripen Rai	Jr Sc Officer (Tea Quality and Manufacture)
5.	Mr. Rakesh Kumar	Jr Sc Officer(Agro Boatny)
6.	Mr. R.K. Chauhan	Jr Sc Officer (Sol Sci)
7.	Mr. Anup Kumar Das	Farm supervisor (cont)
8.	Mr. Asit Ray	Project Scientist (cont)
9.	Mr. Avinash Bhujel	Research Fellow (Plant protection)
10.	Mr.Koushik Mahanta	Project Assistant (Contractual)
Administrative staff		
11.	Smt Sima Lahiri	AAO
12	Mr. Pema Yalmo	Sr Asst
13	Smt Sumita Rai	Asst
14.	Mr. Sandip Roy	JSA
15.	Mr. Sudip Dutta	Acct (cont)
16	Mr. Sumanta Karmkar	Driver
16.	Smt Padma Bhutia	MTS

