

ANNUAL REPORT 2019



BANGLADESH TEA RESEARCH INSTITUTE
SRIMANGAL-3210, MOULVIBAZAR

An organ of

BANGLADESH TEA BOARD

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ANNUAL REPORT 2019

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DIRECTOR'S REPORT STAFF

The report of the technical staff shows the position as on 31 December 2019

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PGD (India), Ph.D

TECHNICAL DIVISIONS

1. DEPARTMENT OF CHEMISTRY

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A. SOIL SCIENCE DIVISION

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B. BIOCHEMISTRY DIVISION (Vacant)

2. DEPARTMENT OF CROP PRODUCTION

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M.S in Crop Botany & Ph.D. (BAU)

A. BOTANY DIVISION

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Dipl. (China), Ph.D. (RU)
Scientific Officer : Md. Riyadh Arefin
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B. AGRONOMY DIVISION

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M.S. (BAU), Ph.D. (Sri Lanka)
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Scientific Officer : Sultan Md. Monwarul Islam
B.Sc.Ag. (Hons), M.S. (BAU)
Farm Supervisor : Roni Debnath
M.Sc.Ag. (Hons), M.S. (SAU)
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Dip.-in-Agric. (ABKC)

3. DEPARTMENT OF PEST MANAGEMENT

Chief Scientific Officer : Vacant

A. ENTOMOLOGY DIVISION

Scientific Officer (Ph.D. Deputation) : Shovon Kumar Paul
B.Sc.Ag. (Hons.) (KU), M.S. (BSMRAU)
Scientific Officer : Md. Jahangir Alam
B.Sc.Ag.(Hons), M.S. (BAU)
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Dip.-in-Agric. (Dhaka)

B. PLANT PATHOLOGY DIVISION

Senior Scientific Officer : Mohammed Syeful Islam
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Scientific Officer : Raihan Mujib Himel
B.Sc.Ag. (Hons.), M.S. (BSMRAU)

TECHNOLOGY DIVISION

Scientific Officer (Deputation in Bandarban) : Dulal Chandra Dey
B.Sc. Engg. Mech. (BUET)
Senior Tea Maker (Deputation in Bandarban) : Md. Amir Ali
B.Sc. (RU)
Assistant Engineer (Civil) : Md. Naion Hossain
B.Sc. Engg. Civil (DUET)

STATISTICS & ECONOMICS DIVISION

Senior Scientific Officer : Dr. Shefali Boonerjee
B.Sc. (Hons), M.Sc. (RU) Ph.D. (DU)

BTRI SUB-STATION, FATIKCHARI, CHATTOGRAM

Scientific Officer & Officer in-charge : Md. Moshir Rahman Akonda
B.Sc.Ag. (Hons), M.S. (BAU)
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Senior Farm Assistant : Ajit Chandra Chowdhury
B.A. (NU)

BTRI SUB-STATION, KALITI, KULAURA

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Senior Scientific Officer & Officer in-charge : Dr. Mohammad Shameem Al Mamun
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PGD (India), Ph.D (SUST)
Assistant Farm Superintendent : Mohammad Sayadul Huq
M.Sc (NU)
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Dip.-in-Agric. (Rangpur)

BILASHCHERRA EXPERIMENTAL FARM

Officer in-charge : A.K.M Ashraful Haq
M.Sc (NU)
Field Assistant : Ajit Kumar Sarker
Dip.- in-Agric. (Mymensingh)
Field Assistant : Zobayer Ahamed
Dip.- in-Agric. (Rangpur)
Field Assistant : Md. Sabbir Mahedi Joy
Dip.- in-Agric. (Rangpur)

RESEARCH

This report reflects the research and other activities of the institute for the year 2019 starts from 1st January to 31rd December.

During the year under report, a total of 61 experiments on different aspects of tea culture were in progress in different disciplines research divisions. The main features are briefly enumerated below:

Soil Science Division carried out researches on two major fields in respect of fertilizer efficiency and improvement of soil properties. Experiments on effect of vermicompost on soil properties, growth and yield of mature tea; status of micronutrients in tea soils and its effects on the growth and yield of young and mature tea, performance of bio-char as a soil amendment and its effect on tea soil properties was started during the reporting year. Research on present status of toxic heavy metals (Pb, Cd, Cr, Ni) in tea soils, green leaves & made tea and determination of critical values of nutrients in tea soil and plant leaf in Sylhet, Chattogram and Panchagarh region were also initiated during the reported year. Besides, the most useful advisory services on planting, replanting, manuring, soil rehabilitation, extension and other aspects of tea husbandry were rendered to the tea industry through soil analyses. A total of 2561 advisory soil, paid soil, fertilizer, compost and others samples were analyzed during 2019.

Plant improvement received top priority as usual amongst the research activities of Botany Division. Several new test clones were under different stages of long term yield and quality trials. Hybridization between clones and genotypes, collection and preservation of germplasm of tea from home and exotic sources were continued.

Agronomy Division carried out research activities on various cultural practices e.g. Planting, pruning, tipping, plucking and related agro-techniques in tea field and effect of different type of composts on growth and development of tea plant. Labour crisis is becoming a problem in many of the tea growing area of Bangladesh as well as in many of the tea estates. To cope up the upcoming problem of the tea industry, it may be needed to adopt with the mechanization of tea. Experiments on mechanization of tea was going on to adopt this technology.

The Research of Entomology Division includes cultural and mechanical control of insect pests, bio-control of insect pests, and screening of pesticides, host plant resistance and pesticide residue analysis in tea. This Division also rendered all sorts of advisory services to tea estates on problems arising out of pests of tea and analyzed soil and water for nematode count. This Entomology Division also engaged in analyzing made tea samples for the detection of pesticide residue received from different tea estates, companies and organizations.

Plant Pathology Division was mainly concerned with the isolation, culture & identification of major disease causing organisms of tea and ancillary crops, Screening of different fungicides & herbicides, Use of Plant Growth Promoting Rhizospheric (PGPR) Microbes in controlling different tea diseases, Identification of potential source of infection of tea disease for disease development were the new areas of research of the division.

Statistics and Economics division engaged on the economic efficiency of the test clones of BTRI and adoption of BTRI Innovated Technologies and its Extension to Bangladesh Tea Industry. The division also assisted in designing experiments and related statistical analyses of data of other research divisions as and when required.

Normal manufacture of tea in the factory from the green leaves harvested from its Main station and Bilashcherra experimental farm was conducted by Technology Division.

The supply of improved planting materials in the form of fresh as well as rooted cuttings and biclonal seeds were continued from BTRI and sub-stations (including CHT project) during 2019. A total of 27,52,433 fresh cuttings, 58935 rooted cuttings and 1858 kg bi-clonal seeds were distributed to different tea estates in the year 2019. Technology disseminations through seminars, workshops and advisory visits were continued in the Main station and Sub-stations during the year.

TEA TASTING SESSIONS

As a regular annual feature and group exercise, five valley tea tasting and one group tea tasting sessions were conducted for the tea planters to improve further the manufacturing of quality tea from the tea factories.

VISITS

Scientific personnel of the institute and sub-stations paid a total of 248 experimental and 109 advisory visits to different tea estates in order to solve various local problems connected with tea culture and experimental purposes during the period under report.

PUBLICATIONS

Annual Report 2018 was published in 2019 and Circular no. 144 was published in April 2019.

ANNUAL COURSE/ SEMINAR/ WORKSHOP

The 54th Annual course (6 day-duration) was held on 'Tea Culture' at the Institute for the covenanted staff of Tea Estates of greater Sylhet. In this courses, Managers, Assistant Managers, Proprietors of different Tea Estates, small tea growers, Scientific Officers of BTRI and Officers of PDU were participated.

MANAGEMENT TRAINING COURSE

Scientists of BTRI conducted a series of Management Training Modules on nursery, young and mature tea management, pruning, pest management, soil management, etc. organized by MTC of Bangladesh Tea Board for the management executives and staffs of different Tea Estates during the period under report.

LIBRARY

BTRI Library contained 4,936 books and 9,150 Journals, Annual Report, Pamphlets, Circulars, Newsletter, Proceedings and Research highlights, etc.

(Dr. Mohammad Ali)

Director, BTRI.

SOIL SCIENCE DIVISION

Ashim Kumar Saha
Senior Scientific Officer

STAFF

Mr. Ashim Kumar Saha, Senior Scientific Officer transferred from BTRI-Substation, Fatikcherry, Chattogram to Bangladesh Tea Research Institute, Srimangal on 03 June 2019. Mr. Md. Arifur Rahman Bhuiyan, Scientific Officer left the job on 04 September 2019. There was no other change in the personnel position of the division during the period under report.

RESEARCH

A total of six experiments were conducted during the year 2019 by Soil Science Division. Progress of the experiments is given below.

SS 1: EFFECT OF VERMICOMPOST ON SOIL PROPERTIES, GROWTH AND YIELD OF MATURE TEA (2016-2020)

The long term (2016-2020) experiment has been undertaken to observe the effect of vermicompost on soil properties, growth and yield of mature tea at Bilashcherra Experimental Farm. Evaluation of the dose and efficiency of vermicompost on tea production as well as minimize the use of chemical fertilizer is the prime goal of this experiment. Dolomitic lime and NPK were applied on the soil after a good shower, simultaneously vermicompost was also applied and mixed with the soil by light forking. Usual cultural practices and pest control measures were taken as and when needed. Regular weekly plucking data were recorded during the plucking season of the year 2019. The experiment will be continued up to 2020. There are eight treatments in a Randomized Block Design with three replications. The unit plot size was 13.40 m². The treatment combinations are presented below.

T ₁ = Control	T ₅ = Vermicompost (6.0 tons/ha)
T ₂ = 100% Recommended fertilizer dose	T ₆ = Vermicompost (1.5tons/ha) + 100% Recommended fertilizer dose
T ₃ = 80% Recommended fertilizer dose	T ₇ = Vermicompost (3.0tons/ha) + 80% Recommended fertilizer dose
T ₄ = 60% Recommended fertilizer dose	T ₈ = Vermicompost (6.0tons/ha) + 60% Recommended fertilizer dose

(Recommended Fertilizer dose: N¹⁰⁰, P³⁰, K⁶⁰ kg/ha)

Table 1. Fertility status of the initial soil of the experimental field

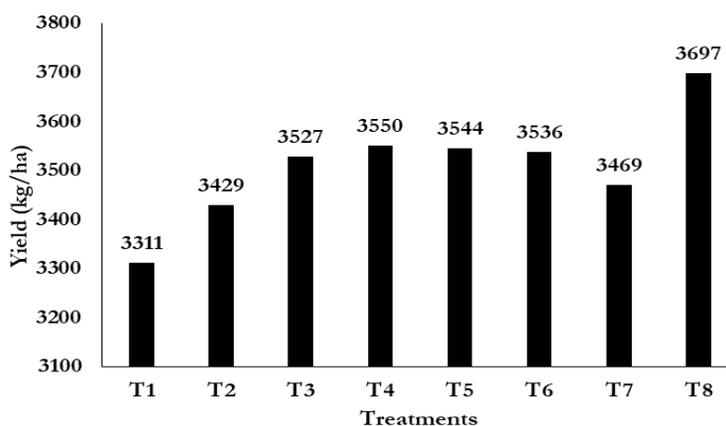
Location	Texture	pH	O.C %	Total N %	Av. P ppm	Av. K ppm	Av. Ca ppm	Av. Mg ppm
BEF	SCL	4.5	1.01	0.120	5.49	48.31	49.26	9.52
Critical value	SL – L	4.5-5.5	1.0	0.1	10	80	90	25

SCL- Sandy Clay Loam, SL- Sandy Loam L- Loam, O.C-Organic Carbon

Table 2. Soil analytical results at the end of the year 2019

Treatment	Texture	pH	O.C %	Total N %	Av. P ppm	Av. K ppm
T ₁	SCI	4.5	1.10	0.114	6.15	53.30
T ₂	SCI	4.7	1.05	0.111	30.13	80.23
T ₃	SCI	4.7	1.07	0.110	24.92	79.21
T ₄	SCI	4.8	1.10	0.113	20.22	75.65
T ₅	SCI	4.6	1.36	0.133	24.23	73.22
T ₆	SCI	4.7	1.23	0.121	40.08	131.52
T ₇	SCI	5.1	1.31	0.132	38.29	98.05
T ₈	SCI	4.8	1.30	0.129	41.18	84.21

The result shows that, increase of yield was recorded in every treatment over the control. The highest made tea (3697 kg/ha) was recorded in treatment T₈ where 6.0 tons/ha vermicompost with 60% of the recommended doses of chemical fertilizers were applied (Fig. 1). The rate of increase over the control was 11.66% in case of treatment T₈. The increase of yield due to different treatment was statistically significant at 1% level ($F = 2.81$).

**Fig 1.** Effect of vermicompost on the yield of tea (BEF, 2019)

SS 2: STATUS OF MICRONUTRIENTS (B, Mo, Zn, Mn, Fe & Cu) IN SOME SELECTED TEA SOILS & ITS EFFECTS ON THE GROWTH AND YIELD OF YOUNG TEA AND MATURE TEA.

Micronutrients are very important for plants to complete their life cycles but need only in a small amount. Micronutrients such as Fe, Mn, Cu, Zn etc function in the enzyme systems in tea plant. They also play an important role in chlorophyll production, oxidation- reduction system, co-enzymatic factor etc. which is ultimately influence on growth, yield and quality of tea. Though very small application of micronutrient may produce dramatic result but the effects of micronutrient deficiency may be severe in term of stunted growth, low yield, dieback and even plant death.

So, it is very important to know the status of micronutrients (B, Mo, Zn, Mn, Fe & Cu) in tea soils of Bangladesh which will be helpful for the proper nutrient management.

Methodology: Soil samples were collected randomly from tea sections of BTRI and BEF and analyzed accordingly to estimate the status of micronutrients. The treatments of the experiment will be fixed after knowing the status of micronutrients. Both pot and field experiments will be done.

Duration: 2017-2022

Location: BTRI, BEF and different tea gardens of Sylhet, Chattogram and Panchagarh.

Progress: Micronutrient analysis of the collected 50 (fifty) soil samples of BTRI farm, Bilashcherra Experimental farm and Luskerpore Tea Estate has been done. Zinc, Iron, Manganese and copper analysis of the soil samples has been completed. Minimum content of Zn, Fe and Cu were 0.053, 0.14 and 0.015 ppm respectively. Among 50 soil samples Manganese content of 19 soil samples were in Below Detection Level (BDL). Maximum content of Zn, Fe, Mn and Cu were 1.64, 16.99, 6.54 and 0.47 ppm respectively. In the reporting year, 651 soil samples from 47 tea estates have been collected and analysis is going on.

SS 3: STUDIES ON PHYSICAL PROPERTIES OF SOME SELECTED TEA SOILS OF BANGLADESH AND THEIR INFLUENCE ON CHEMICAL PROPERTIES AND YIELD OF TEA

The life cycle of tea plant is long, yields tend to decline after four or five decades and plant death or stunted growth is a common occurrence in above 40-yr-old tea fields. The decline in yield, as well as the increase in plant mortality or stunted growth under long-term tea cultivation, however, may also reflect degradation of soil health. So this research will help to assess the long-term impact of growing tea on soil physical properties and how it correlates with crop yield.

Methodology:

This research is conducted by selecting some tea gardens with old, mature and young tea plantation randomly. The following physical properties of soils of those selected gardens are assessed by using standard methods:

- a) Texture
- b) Structure
- c) Bulk Density
- d) Particle Density
- e) Compaction
- f) Hydraulic Conductivity

Chemical properties are determined also. All the data are statistically analyzed by using standard statistical packages.

Location: BTRI, Bilashcherra Experimental Farm and different tea gardens of Bangladesh

Duration: 2017-2022

Progress: Most of the soil samples were collected from July to February. Soil Texture, Color, Moisture percentage & Bulk density is determined shown in the following table. More soil samples from different tea estates will be collected to estimate the Physical Properties. Soil sample collection and analysis is going on.

Table 3. Analytical results of the soil physical parameters at the end of the year 2019

Area/ Tea Estate	Section	Texture	Color	Moisture%	Bulk Density%
BTRI	A2 Area	SCL	Pale green	30.15%	1.84%
	PhD Area	SCL	Greenish Gray	16.00%	1.77%
	D1 Area	SCL	Greenish Gray	-	1.73%
	C Area	SCL	Dark Gray	12.03%	1.91%
	Project Area	SCL	Light Greenish Gray	-	1.94%
	Cylon	SCL	Greenish Gray	10.45%	1.80%
	66	SCL	Pinkish Gray	-	1.94%
Bilashcherra Experimental Farm	11	SCL	Gray	25.75%	1.88%
	5	SCL	Light reddish brown	28.23%	1.86%
	3	SCL	Greenish Gray	19.87%	1.85%
	12	SCL	Pale Yellow	21.23%	1.94%
	1	SCL	Reddish gray	18.56%	1.92%
Monipur T.E	9	SCL	Pale Yellow	18.82%	1.71%
	16B	SCL	Light Brownish Gray	15.93%	1.78%
	26	SCL	Light Brownish Gray	18.09%	1.73%
Luskerpore T.E	1	SCL	Greenish Gray	6.14%	1.69%
	5	SCL	Greenish Gray	4.33%	1.80%
Oodaleah T.E	8	SCL	Gray	13.41%	1.73%
	9	SCL	Light Olive Gray	17.03%	1.75%
BTRI Sub Station, Fatickcherry	5	CL	Light Brown	13.64%	1.87%
	New Ext.	CL	Gray	11.74%	1.57%

SS 4: PRESENT STATUS OF TOXIC HEAVY METALS (Pb, Cd, Cr, Ni) IN TEA SOILS, GREEN LEAVES AND MADE TEA IN BANGLADESH.

Tea is rich in many trace inorganic elements. In addition to many essential elements required for human health, some toxic elements may also be present in tea leaves. This could be due to polluted soil, application of pesticides, fertilizers of industrial activities. There is often little information available about the safety of tea leaves and finished products with respect to heavy metal contamination. Due to the significant amount of tea consumed, it is important to know the toxic metal contents.

Location: BTRI, Bilashcherra Experimental Farm and different tea gardens of Sylhet, Chattogram and Panchagarh.

Duration: 2018-2022

Progress: Collections of 104 soil samples, 76 green leaves and 27 made tea samples from six commercial tea gardens of Sylhet division and three commercial tea gardens of Chattogram division was completed. Sample preparation of Chattogram division is going on. Some physico-chemical properties and heavy metals content of the collected 61 soil samples from different tea estates of Sylhet division were determined. Heavy metals content of the collected 53 leaf samples and 18 made tea samples of Sylhet division were also determined.

SS 5: PERFORMANCE OF BIO-CHAR AS A SOIL AMENDMENT AND IT'S EFFECT ON TEA SOIL PROPERTIES.

Bio-char is the porous carbonaceous solid produced by thermochemical conversion of organic materials in an oxygen depleted atmosphere which has physicochemical properties suitable for the safe and long-term storage of carbon in the environment and, potentially, soil improvement. A good portion of the carbon so produced will remain in soils for hundreds and, possibly, thousands of years. Hence, bio-char can be an important component of a global response to carbon abatement, though the challenges of achieving such a large-scale utilization of bio-char would be considered. Some possible reasons which help to account for the impacts of bio-char on soils are: 1) increase in pH of acid soils, 2) increase in water retention, especially sandy and silty soils, 3) provision of nutrients in the ash contained within the bio-char, 4) enhancement of the cation exchange capacity (CEC) of the soil, so increasing nutrient use efficiency, 5) enhancement of microbial communities including bacteria, mycorrhizae and fungal hyphae and 6) benefits to soil physical properties. The long term (2018-2021) experiment has been undertaken to observe the effect of bio-char on soil properties, growth and yield of mature tea at BTRI Farm. The experiment was laid out in a RBD having four treatments and three replications. Bio-char was applied in 1st week of July, 2019. The experiment was laid out in the year 2018 and will be continued upto 2021. Each plot size was 28.43 m². Usual cultural operations and pest control measures were taken as and when needed. Regular weekly harvesting data were recorded during the cropping season. Treatment combinations are as follows:

T ₁ = Control (Recommended fertilizer dose)	T ₃ = 1.5 t/ha Bio-char + Recommended fertilizer dose
T ₂ = 1.0 t/ha Bio-char + Recommended fertilizer dose	T ₄ = 2.0 t/ha Bio-char + Recommended fertilizer dose

Table 4. Fertility status of the initial soil of the experimental field

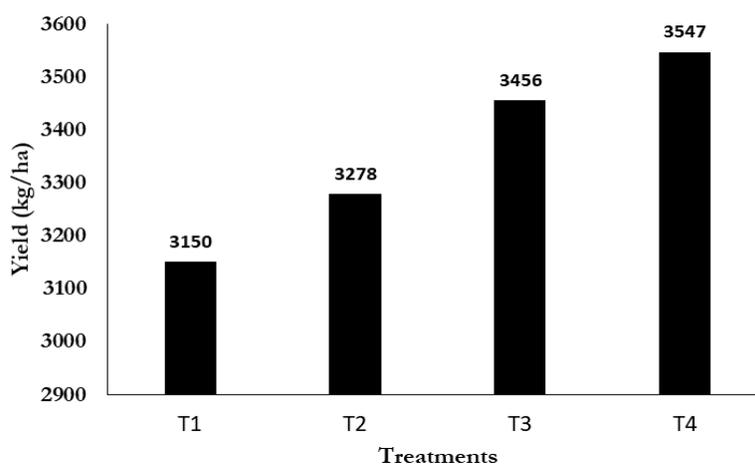
Location	Texture	pH	O.C %	Total N %	Av. P ppm	Av. K ppm
BTRI	SCL	4.88	1.25	0.127	29.72	71.43
Critical value	SL – L	4.5-5.5	1.0	0.1	10	80

SCL- Sandy Clay Loam, SL- Sandy Loam L- Loam, O.C-Organic Carbon

Table 5. Soil analytical results at the end of the year 2019

Treatment	Texture	pH	O.C %	Total N %	Av. P ppm	Av. K ppm
T ₁	SCL	4.7	1.28	0.131	46.65	50.89
T ₂	SCL	4.8	1.34	0.138	51.89	53.66
T ₃	SCL	4.8	1.39	0.143	54.89	58.45
T ₄	SCL	4.9	1.40	0.144	69.17	69.58

The result shows that, increase of yield was recorded in every treatment over the control. The highest made tea yield (3547 kg/ha) was recorded in treatment T₃ where 1.5 t/ha bio-char with basal doses of chemical fertilizers were applied (Fig. 2). The rate of increase over the control was 12.60% in case of treatment T₄, and the increase of yield due to different treatment was statistically significant at 1% level ($F = 17.41$).

**Fig 2.** Effect of bio-char on the yield of tea (BTRI, 2019)

SS 6: DETERMINATION OF CRITICAL VALUES OF NUTRIENTS IN TEA SOIL AND PLANT LEAF IN SYLHET, CHATTOGRAM AND PANCHAGARH REGION.

Critical values of nutrients in tea soil and plant leaf are very important for proper fertilizer management. Critical values of some nutrients in tea soils of Bangladesh were optimized earlier. But soil fertility status is changing day by day. So, now it's a crucial time to estimate critical values of essential elements in tea soil as well as tea plant leaves on the basis of present scenario of tea soils of Bangladesh.

Location: Different tea gardens of Sylhet, Chattogram and Panchagarh.

Duration: 2018-2021

Progress: Compilation of the last five years soil analytical data of different valley circles as a primary work of the research of 1st year has been completed. 651 soil samples from 47 tea estates have been collected and analysis is going on.

Advisory services

The advisory work is comprised of analysis of soil, water, fertilizer, lime, compost etc. collected or received from different tea estates. Soil samples were analyzed to find out their suitability for proposed new extension, replanting, rehabilitation and also to diagnose the cause of poor growth or failure of existing tea, to recommend appropriate fertilizer requirement and to study the suitability of establishing seed or V.P nursery. During the year under report a total of 2494 soil samples (26 advisory and 2468 paid) and 67 other samples from 82 tea estates were analyzed for different purposes, the breakup of which is presented in table 6.

Table 6. Number of samples analyzed

Year	Advisory Soil	Soil	Fertilizer	Lime/Dolomite	Water	Compost	Total (others)	(Soil & others)
2019	26	2468	54	00	00	13	67	2561

Table 7. List of Tea Estates from where soil and other samples were received or collected and analyzed during the year 2019

Aasia	Deundi	Jagadishpur	Marina	Rajkie
Allynugger	Dildarpur	Jagcherra	Mazdehee	Rajnagar
Ameenabad	Dilkusha	Jhemai	Mertinga	Rampore
Amo	Dinarpur	Junglebari	Mirzapore	Rasidpur
Amtali	Etah	Kaiyacherra Dalu	Monipur	Sagurnal
Ayeshabagh	Fatehbagh	Kalikabari	Moulvi	Saif
Balisera	Fyzabad	Kapnapahar	Nahar	Sathgaon
Baramasia	Ghazipore	Karimpore	Nalua	Shumshernugger
Bawani	Grand Sultan Tea Resort & Golf	Karnafuli	Noyapara	Silloah
Bidyabheel	Greenleaf	Khadarmara	Oodalia	Sreebari
Boban	Habibnagar	Khan	Parkul	Srigobindpur
Chandbagh	Hafiz	Kodala	Patrakhola	Surma
Chundeecherra	Hajinagar	Lalchand	Phulbari	Tea Resort & Museum
Clevedon	Hatimara	Luayani-Holicherra	Phulcherra	Zarreen
Dantmara	Hooglicherra	Lungla	Pooteacherra	
Daragaon	Horincherra	Luskerpore	Rahman Agro Farming	
Deanston	Hossainabad	Madhupur	Rahmania	

OTHER ACTIVITIES

Advisory correspondence

A total of 197 advisory letters to different tea estates on soil, fertilizers, dolomite, compost and other soil related aspects were sent during the year 2019.

Tours

During the year under report officers of the division paid a total 66 visits to different tea estates and other related places for experimental, advisory and official purposes.

Courses on tea culture

Comprehensive lectures on different aspects of soil management were presented by the scientific personnel of the division at the annual course and workshops organized by BTRI for the covenanted staff of tea estate during 2019. Scientists of this division also delivered lectures as resource speakers at the Management Training centre (MTC) for Post Graduate Diploma Course organized by Project Development Unit (PDU) of Bangladesh Tea Board.

BOTANY DIVISION
Dr. Md. Ismail Hossain
 Chief Scientific Officer

STAFF

Mr. Md. Riyadh Arefin, Scientific Officer was transferred to BTRI main station from BTRI Fatickcharri substation on 31 March 2019. The post of one Scientific Officer, one Senior Scientific Officer and one Field Assistant were vacant. There were no other changes in personnel position of the division during the period under report.

RESEARCH

Thirty eight experiments in four programme areas namely –

Prog. Area-1: Preliminary selection of vegetative clones,

Prog. Area-2: Long term yield and quality trial of provisionally selected clones,

Prog. Area-3: Tea breeding & establishment of germplasm bank and

Prog. Area-4: Short term/mid term experiments were carried out by the division.

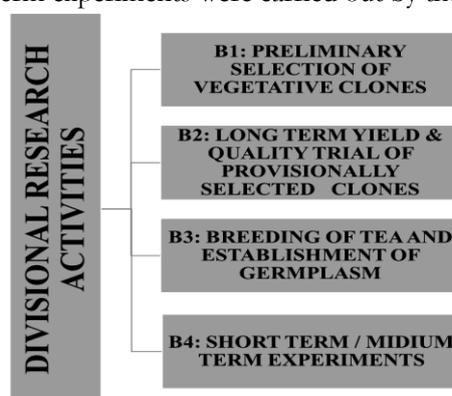


Fig 1. Divisional Activities of Botany Division (2019)

Results are briefly described below:

B1: PRELIMINARY SELECTION OF VEGETATIVE CLONES (NO. OF EXPERIMENTS-3)

B1-27-7: Selection of Vegetative Clones at Shumshernugger T. E., Section Main Div. Sec. No. 9 (1993-2020).

16 new bushes have been selected during the period under report. The selected bushes have been pruned for collecting cuttings for rooting trial. A total of 2,725 cuttings from 16 selected bushes from Shumshernugger T.E. were collected and put into the rooting trial.

B1-28: Selection of Vegetative Clones at Amo T. E., Section No. 8 (1993-2020).

Nineteen new bushes have been selected during the period under report. The selected bushes have been pruned for collecting cuttings for rooting trial. A total of 2,954 cuttings from previously selected 19 bushes of section no. 1 of Amo Tea Estate were collected and planted in the nursery.

B1-31: Selection of Vegetative Clones at Baraoorah T. E., Section No. 8 (2007-2020).

Eleven new bushes have been selected during the period under report. The selected bushes have been pruned for collecting cuttings for rooting trial. A total of 2,109 cuttings from 11 bushes of section no. 1 of Baraoorah Tea Estate were collected and planted in the nursery.

Progress:

- Preliminary selection of desirable mother bushes is continued at Shumshernugger, Amo and Baraoorah Tea Estates.
- A total of 16, 19 and 11 mother plants from variable seedling population of Amo, Shumshernugger and Baraoorah tea estates respectively have been selected.
- 26 plants are also selected from BTRI C2 area.
- Collection of cutting is going on from the selected plants for rooting trial in nursery in order to find out their rooting ability.

B2: LONG TERM YIELD & QUALITY TRIAL OF PROVISIONALLY SELECTED CLONES (NO. OF EXPERIMENTS-21)**B2-36: Yield and Quality Trial of Test clones Selected from Amo T. E. Test clones A/8/01, A/17/22, A/22/27 and A/22/40 against Control BT1 (BTRI, 1996-2020).**

The plants of this trial were deep skiffed at 79 cm in 2019. There were 26 plucking rounds in 2019. The yield data were analyzed and presented in Table-1.

Table 1. Yield of green leaves (g/plant)

Clone	A/8/01	A/17/22	A/22/27	A/22/40	BT1
Treatment mean	850.4	812.8	803.4	865.3	836.8

Treatment difference: Non Significant

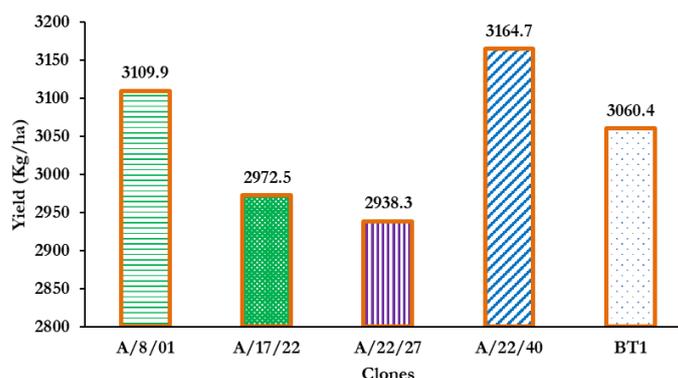


Fig. 2. Comparative yield of clones made tea (kg/ha)

The analytical results revealed that all test clones are comparable in terms of yield. The estimated made tea production in kg/ha is presented in Fig. 2. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 2.

Table 2. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
A/8/01	7.54	7.61	7.24	7.33	2.36	32.17	AA
A/17/22	7.54	7.55	7.16	7.35	2.49	32.09	AA
A/22/27	7.44	7.39	7.29	7.12	2.14	31.81	A
A/22/40	7.52	7.53	7.45	7.37	2.87	32.74	AA
BT1	7.54	7.73	7.47	7.45	2.91	33.21	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the test clones excepting A/17/22 were comparable with the control BT1 in case of quality, Test clone A/17/22 was inferior in cup than that of control.

B2-38: Yield and Quality Trial of Test clones Selected from Chandpore, Shumshernugger and Amo T. Es.; Test clones C/J1/10, Sh/B/6/59, Sh/B/6/62 and A/8/24 against Control BT2 (BTRI, 1997-2021).

The plants of this trial were light pruned at 69 cm in 2019. There were 26 plucking rounds in 2019. The yield data were analyzed and presented in Table-3 and the estimated made tea production in kg/ha presented in Fig. 3.

Table 3. Yield of green leaves (g/plant)

Clones	CHA/J1/10	Sh/B/6/59	Sh/B/6/62	A/8/24	BT2
Treatment mean	923.5	953.1	832.5	1243.7	766.6

Level of significance: Significant. (LSD value at 5% level of significance= 162.9)

The analytical results revealed that all the test clones CHA/J1/10, Sh/B/6/59, Sh/B/6/62 and A/8/24 significantly showed higher yield against Control BT2. The cup quality of made tea for all the test clones were assessed through organoleptic test and the average scores are presented in Table 4.

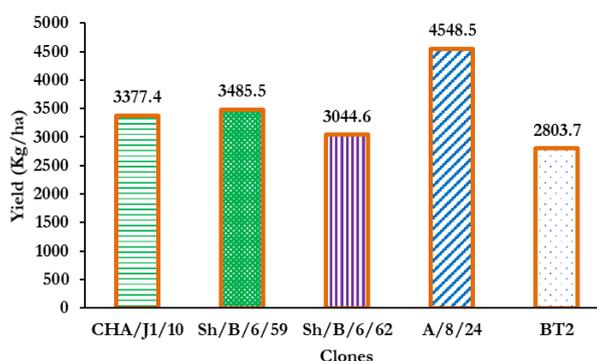


Fig. 3. Comparative yield of clones made tea (kg/ha)

Table 4. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
CHA/J1/10	7.47	7.33	7.25	7.49	2.84	32.41	AA
Sh/B/6/59	7.23	7.22	7.18	7.19	2.41	31.43	A
Sh/B/6/62	7.37	7.41	7.82	7.57	2.87	33.27	AA
A/8/24	7.34	7.41	7.27	7.38	2.62	31.93	A
BT2	7.54	7.48	7.38	7.34	2.96	32.74	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the test clones excepting Sh/B/6/59 have got comparable cup quality with test clone BT2 excepting the test clone's unique flavoury character. Test clone Sh/B/6/59 was inferior to the control BT2 in case of cup quality.

B2-39: Yield and Quality Trial of Four Test clones Selected from Shumshernugger T.E.; Test clones Sh/B/6/36, Sh/B/6/38, Sh/B/6/55 and Sh/B/6/67 against Standard BT1 (BTRI, 1998-2022).

The plants of this trial were light skiffed at 83 cm in 2019. There were 24 plucking rounds in 2019. The yield data were analyzed and presented in Table-5. The estimated made tea production in kg/ha is presented in Fig. 4.

Table 5. Yield of green leaves (g/plant)

Clone	Sh/B/6/36	Sh/B/6/38	Sh/B/6/55	Sh/B/6/67	BT1
Treatment mean	731.5	979.2	904.6	954.9	768.3

Treatment difference- Significant. (LSD value at 5% level of significance= 156.5)

The analytical results revealed that test clones Sh/B/6/38, Sh/B/6/55 and Sh/B/6/67 showed significantly higher yield against Standard BT1, while Sh/B/6/36 showed lower yield against Control BT1.

The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 6.

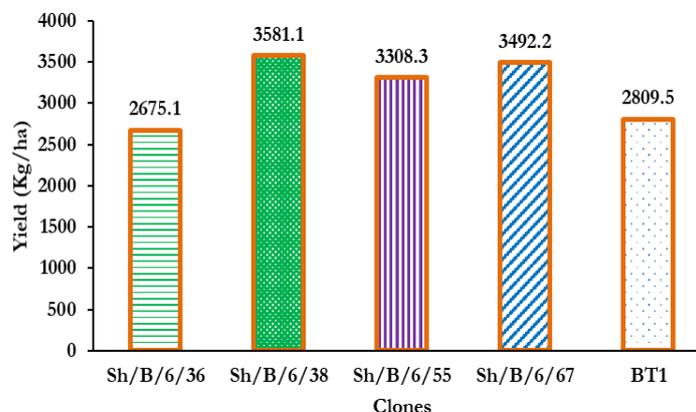


Fig. 4. Comparative yield of clones made tea (kg/ha)

Table 6. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
Sh/B/6/36	7.22	7.35	7.85	7.18	2.85	32.45	AA
Sh/B/6/38	7.31	7.46	7.57	7.35	2.65	32.33	AA
Sh/B/6/55	7.16	7.26	7.14	7.11	2.78	31.23	A
Sh/B/6/67	7.67	7.47	7.25	7.34	2.81	32.54	AA
BT1	7.36	7.33	7.48	7.37	2.96	32.51	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the Test clones excepting Sh/B/6/55 were comparable in cup with the control BT1. Test clone Sh/B/6/55 was inferior to the control BT1 in the case of cup quality.

B2-40: Yield and Quality Trial of Six Test clones – MZ/39, E/4, D/13, B2T1, BR2/97 and SDL/1 against Standard BT2 (BTRI, 2000-2020).

The plants of this trial were deep skiffed 73 cm in 2019. There were 27 plucking rounds in 2019. The yield data were analyzed and presented in Table-7.

Table 7. Yield of green leaves (g/plant)

Clone	MZ/39	E/4	D/13	B2T1	BR2/97	SDL/1	BT2
Treatment mean	1068.4	939.1	840.8	821.7	808.7	1035.0	902.1

Treatment difference- Significant (LSD value at 5% level of significance= 180.55)

The analytical results reveal that yield difference was highly significant (at 5% level of significance) in 2019. Test clones MZ/39, E/4 and SDL/1 were comparable in terms of yield with the control BT2 while the test clone D/13, B2T1 and BR2/97 performed lower yield than the control. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 8. The estimated made tea production in kg/ha is presented in Fig. 5.

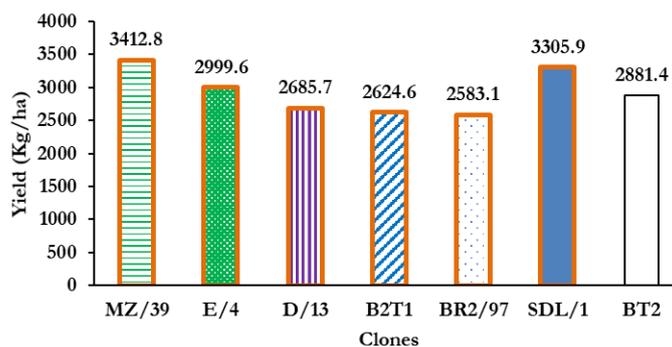


Fig. 5. Comparative yield of clones made tea (kg/ha)

Table 8. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
MZ/39	7.57	7.35	7.59	7.44	2.69	32.69	AA
E/4	7.59	7.59	7.38	7.43	2.62	32.61	AA
D/13	7.52	7.44	7.52	7.51	2.83	33.82	AA
B2T1	7.38	7.27	7.24	7.32	2.61	31.82	AA
BR2/97	7.49	7.49	7.38	7.47	2.71	32.54	AA
SDL/1	7.41	7.41	7.41	7.37	2.57	32.17	AA
BT2	7.52	7.49	7.41	7.39	2.66	32.47	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the Test clones were comparable in cup with the control BT2. However, the unique flavoury character of BT2 was not considered in the case of assessing cup quality.

B2-41: Yield and Quality Trial of Four Test clones Selected from Amo T. E.; Test clones – A/8/37, A/8/55, A/8/62 and A/8/66 against Standard BT2 (BTRI, 2000-2020).

The plants of this trial were deep skiffed at 73 cm in 2019. There were 27 plucking rounds in 2019. The yield data were analyzed and presented in Table-9.

Table 9. Yield of green leaves

Clone	A/8/37	A/8/55	A/8/62	A/8/66	BT2
Treatment mean	1020.2	786.8	795.5	1095.3	1090.1

Treatment difference- Significant (LSD value at 5% level of significance= 179.68)

The analytical results revealed that all test clones except A/8/66 are comparable in terms of yield. The estimated made tea production in kg/ha is presented in Fig. 6. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 10.

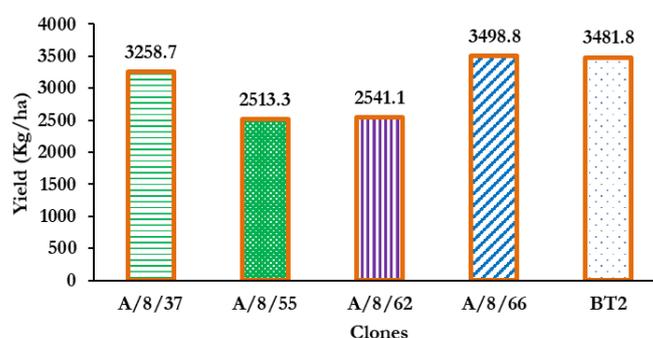


Fig. 6. Comparative yield of clones made tea (kg/ha)

Table 10. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
A/8/37	7.42	7.47	7.69	7.71	2.82	33.11	AA
A/8/55	7.31	7.35	7.36	7.31	2.25	31.58	A
A/8/62	7.41	7.56	7.63	7.42	2.82	32.64	AA
A/8/66	7.49	7.43	7.37	7.64	2.71	32.64	AA
BT2	7.47	7.69	7.45	7.46	2.64	32.71	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the test clones excepting A/8/55 were comparable in terms of cup quality. The test clone A/8/55 was found inferior to the control. The flavoury character of BT2 was not considered in the case of assessing cup quality.

B2-42: Yield and Quality Trial of Four Test clones Selected from Phulcherra, Amo and Shumshernugger T. Es.; Test clones – A/17/16, Ph/9/1, Ph/9/9 and Sh/B/6/46 against Standard BT1 (BTRI, 2001-2020).

The plants of this trial were light pruned at 66 cm in 2019. There were 27 plucking rounds in 2019. The yield data were analyzed and presented in Table-11

Table 11. Yield of green leaves (g/plant)

Clone	A/17/16	Ph/9/1	Ph/9/9	Sh/B/6/46	BT1
Treatment mean	977.5	733.9	892.5	958.3	827.9

Level of significance: Insignificant.

The analytical results revealed that all test clones are comparable in terms of yield. The estimated made tea production in kg/ha is presented in Fig. 7. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 12.

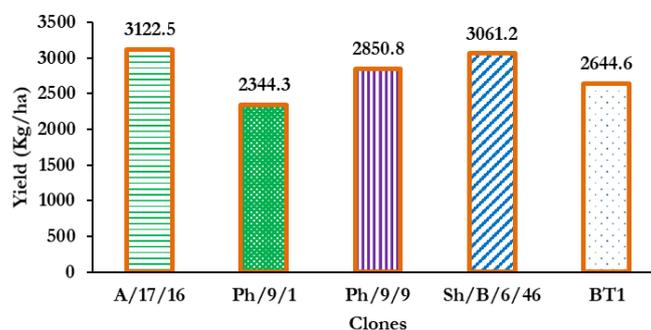


Fig. 7. Comparative yield of clones made tea (kg/ha)

Table 12. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
A/17/16	7.48	7.29	7.32	7.37	2.89	32.35	AA
Ph/9/1	7.23	7.38	7.23	7.27	2.48	31.59	A
Ph/9/9	7.32	7.51	7.68	7.41	2.55	32.43	AA
Sh/B/6/46	7.57	7.35	7.36	7.31	2.75	32.34	AA
BT1	7.48	7.49	7.58	7.39	2.85	32.89	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the test clones excepting Ph/9/1 were comparable in cup with the control. The Test clone Ph/9/1 was found inferior to the control BT1.

B2-43: Yield and Quality Trial of Four Test clones Selected from Phulcherra and Hybrid Progeny; Test clones– Ph/9/4, Ph/9/25, Ph/9/40 and BS/67 against Standard BT5 (BTRI, 2001-2020).

The plants of this trial were light pruned at 66 cm in 2019. There were 27 plucking rounds in 2019. The yield data were analyzed and presented in Table-13. The estimated made tea production in kg/ha is presented in Fig. 8.

Table 13. Yield of green leaves (g/plant)

Clone	Ph/9/4	Ph/9/25	Ph/9/40	BS/67	BT5
Treatment mean	806.58	491.59	857.64	803.62	629.14

Treatment difference- Significant. (LSD value at 5% level of significance= 159.80)

The statistical results reveal that yield difference was significant (at 5% level of significance) in 2019. The yield performance of test clone Ph/9/4, Ph/9/40 and BS/67 were higher than the control BT5. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 14.

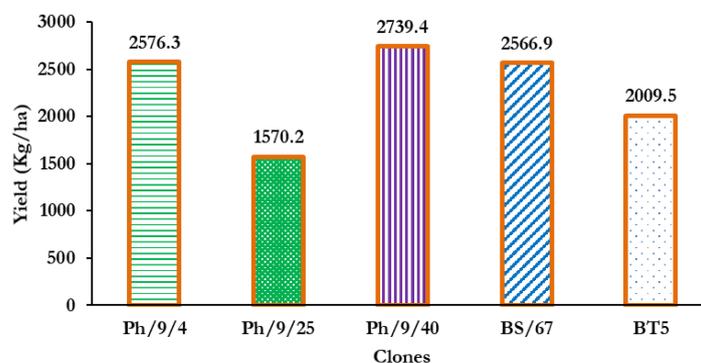


Fig. 8. Comparative yield of clones made tea (kg/ha)

Table 14. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
Ph/9/4	7.24	7.41	7.47	7.42	2.71	32.25	AA
Ph/9/25	7.29	7.46	7.32	7.41	2.45	32.93	AA
Ph/9/40	7.33	7.34	7.15	7.21	2.66	31.59	A
BS/67	7.46	7.68	7.47	7.56	2.77	32.94	AA
BT5	7.57	7.45	7.57	7.41	2.62	32.62	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the test clones were comparable in terms of cup quality with the control BT5 excepting Ph/9/40 which was inferior to the control.

B2-44: Yield and Quality Trial of Three Test clones Selected from Amo and Phulcherra T. Es.; Test clones– A/8B/1, Ph/9B/1, Ph/9/11 and against Standard BT1 (BTRI, 2003-2020).

The plants of this trial were medium skiffed at 76 cm in 2019. There were 26 plucking rounds in 2019. The yield data were analyzed and presented in Table-15.

Table 15. Yield of green leaves (g/plant)

Clone	A/8B/1	Ph/9B/1	Ph/9/11	BT1
Treatment mean	1094.20	1167.30	1300.2	974.4

Treatment difference- Significant. (LSD value at 5% level of significance= 168.6)

The analytical results revealed that all test clones are significantly produce higher yield against control. The estimated made tea production in kg/ha is presented in Fig. 9. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 16.

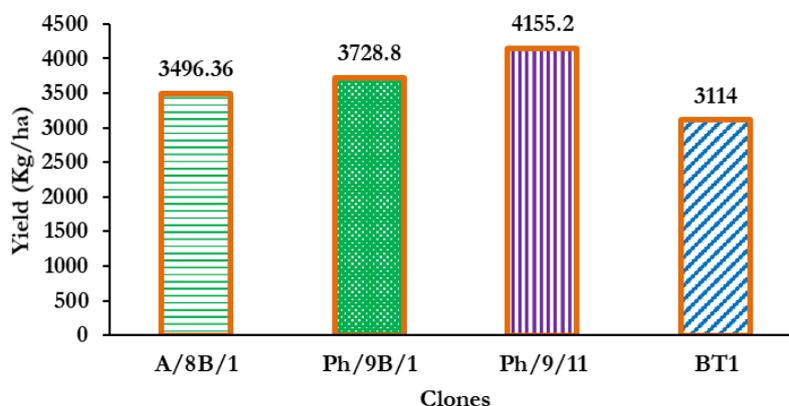


Fig. 9. Comparative yield of clones made tea (kg/ha)

Table 16. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
A/8B/1	7.21	7.61	7.34	7.21	2.28	31.65	A
Ph/9B/1	7.39	7.22	7.33	7.46	2.81	32.81	AA
Ph/9/11	7.61	7.48	7.16	7.24	2.87	32.36	AA
BT1	7.62	7.73	7.59	7.46	2.82	33.22	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

All the Test clones were comparable in terms of cup quality with the control BT1 excepting A/8B/1 which performed average cup quality with the control.

B2-45: Yield and Quality Trial of Three Test clones Selected from Amo, Phulcherra and Shumshernugger T. Es.; Test clones- A/8/61, Ph/9/68A, Sh/D/11/18 (retrial from Expt. B2-26) and One Introduced Clone SC/12/28 against Standard BT2 (BTRI, 2005-2022).

The plants of this trial were light pruned at 60 cm in 2019. There were 26 plucking rounds in 2019. The yield data were analyzed and presented in Table-17.

Table 17. Yield of green leaves (g/plant)

Clone	Ph/9/68A	Sh/D/11/18	A/8/61	SC/12/28	BT2
Treatment mean	721.50	884.90	862.55	850.50	592.15

Treatment difference- Significant. (LSD value at 5% level of significance= 148.31)

The statistical results reveal that yield difference was significant (at 5% level of significance) in 2019. The yield performances of all the test clones were higher than the control BT2. The estimated made tea production in kg/ha is presented in Fig. 10. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 18.

Table 18. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
A/8/61	7.43	7.31	7.42	7.39	2.84	32.39	AA
Ph/9/68A	7.46	7.38	7.64	7.28	2.61	32.37	AA
Sh/D/11/18	7.21	7.39	7.66	7.27	2.82	32.35	AA
SC/12/28	7.21	7.21	7.35	7.49	3.01	32.27	AA
BT2	7.26	7.46	7.67	7.72	2.71	32.82	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

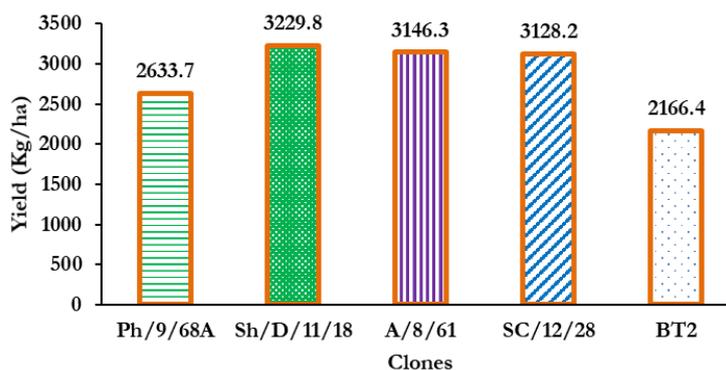


Fig. 10. Comparative yield of clones made tea (kg/ha)

All the test clones were comparable in terms of cup quality. However, the flavoury character of BT2 was not considered in the case of assessing cup quality.

B2-46: Yield and Quality Trial of Four Test clones Selected from BTRI Farm (Dulia Section); Test clones – D1/18, D/6, D/10 and D/12 against Standard BT5 (BTRI, 2005-2022).

The plants of this trial were light pruned at 66 cm in 2019. There were 26 plucking rounds in the reporting year. The yield data were analyzed and presented in Table-19.

Table 19. Yield of green leaves (g/plant)

Clone	D1/18	D/6	D/10	D/12	BT5
Treatment mean	856.70	891.10	716.30	773.50	672.70

Treatment difference- Significant. (LSD value at 5% level of significance= 145.54)

The statistical results reveal that yield difference was significant (at 5% level of significance) in 2019. The yield performance of test clone D1/18 and D/6 were higher than the control BT5. The estimated made tea production in kg/ha is presented in Fig. 11.

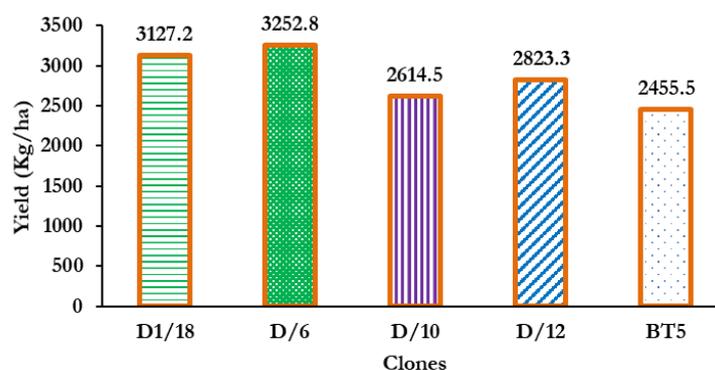


Fig. 11. Comparative yield of clones made tea (kg/ha)

The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 20.

Table 20. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
D1/18	7.61	7.51	7.65	7.51	2.77	33.05	AA
D/6	7.44	7.41	7.59	7.83	2.85	33.12	AA
D/10	7.24	7.46	7.41	7.62	2.64	32.37	AA
D/12	7.15	7.24	7.26	7.32	2.34	31.31	A
BT5	7.26	7.21	7.43	7.64	2.78	32.22	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

Test clones (except D/12) are comparable with the control while D/12 is inferior to the control.

B2-47: Yield and Quality Trial of Four Test clones Selected from Phulcherra T. E. and BTRI Germplasm Bank; Test clones-Ph/9/92, BS/3, Ph/9/108 and G/61/8 against Standard BT15 (BTRI, 2006-2023).

The plants of this trial were light skiffed at 79 cm in 2019. There were 26 plucking rounds in 2019. The yield data were analyzed and presented in Table-21.

Table 21. Yield of green leaves (g/plant)

Clone	Ph/9/92	BS/3	Ph/9/108	G/61/8	BT15
Treatment mean	1184.40	1095.50	1122.30	1211.40	1044.50

Treatment difference- Significant. (LSD value at 5% level of significance = 78.43)

The statistical results reveal that yield difference was significant (at 5% level of significance) in 2019. The yield performances of all the test clones were higher than the control BT5. The estimated made tea production in kg/ha is presented in Fig. 12. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 22.

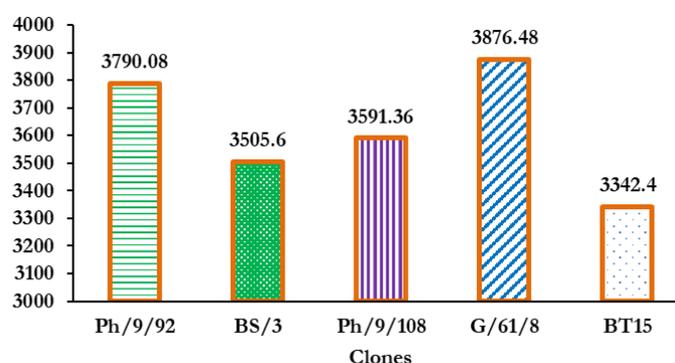


Fig. 12. Comparative yield of clones made tea (kg/ha)

Table 22. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
Ph/9/92	7.51	7.35	7.49	7.43	2.69	32.47	AA
BS/3	7.31	7.31	7.14	7.13	2.26	31.15	A
Ph/9/108	7.59	7.51	7.38	7.42	2.75	32.65	AA
G/61/5	7.56	7.54	7.61	7.73	2.82	33.27	AA
BT15	7.72	7.88	7.79	7.71	3.47	34.57	E

(A: Average, AA: Above Average, E: Excellent cup quality)

The test clones Ph/9/92, Ph/9/108 and G/61/5 gave above average cup quality while the control BT15 gave excellent cup quality. The test clone BS/3 gave average cup quality with the control.

B2-48: Yield and Quality Trial of Four Test clones Selected from Shumshernugger and Amo T. Es. Test clones – A/8/124, Sh/10/2, A/8/125 and A/11/38 against Standard BT2 (BTRI, 2009-2026).

The plants of this trial were deep skiffed at 66 cm in 2019. There were 25 plucking rounds in 2019. The yield data were analyzed and presented in Table-23.

Table 23. Yield of green leaves (g/plant)

Clone	A/8/124	Sh/10/2	A/8/125	A/11/38	BT2
Treatment mean	711.48	895.20	960.60	908.20	685.40

Treatment difference- Significant. (LSD value at 5% level of significance= 162.19)

The statistical results reveal that yield difference was significant (at 5% level of significance) in 2019. The yield performance of all test clones were higher than the control BT2. The estimated made tea production in kg/ha is presented in Fig. 13. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 24.

Table 24. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
A/8/124	7.53	7.41	7.31	7.48	2.82	32.55	AA
Sh/10/2	7.43	7.52	7.67	7.39	2.75	32.76	AA
A/8/125	7.67	7.74	7.74	7.42	2.77	33.14	AA
A/11/38	7.43	7.24	7.28	7.47	2.81	32.24	AA
BT2	7.61	7.54	7.43	7.58	2.72	32.88	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

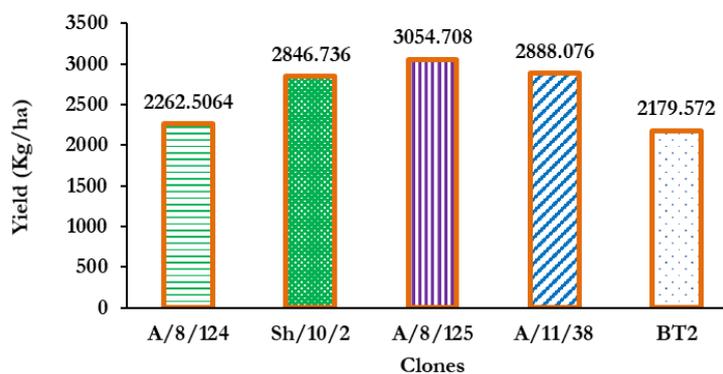


Fig. 13. Comparative yield of clones made tea (kg/ha)

All the test clones were similar to the control BT2 in respect of cup quality. However, the flavoury character of BT2 was not considered in the case of assessing cup quality.

B2-49: Yield and Quality Trial of Four Test clones Selected from Shumshernugger T.E. (Sh/10/5, Sh/D/13/4 and Amo T. Es. Test clones – A/8/128, BS/91/6, against Standard BT2 (BTRI, 2011-2028).

The plants were deep skiffed at 66 cm in 2109 and there were 25 plucking round during the cropping period. The yield data were analyzed and presented in Table-25.

Table-25. Yield of green leaves (g/plant)

Clone	Sh/D/13/4	BS/91/6	Sh/10/5	A/8/128	BT2
Treatment mean	810.20	679.1	730.50	866.2	674.8

Treatment difference- Significant (LSD value at 5% level of significance= 192.27)

The analytical results revealed that all test clones are comparable in terms of yield. The estimated made tea production in kg/ha is presented in Fig. 14. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in Table 26.

Table 26. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
Sh/D/13/4	7.41	7.24	7.37	7.76	2.64	32.42	AA
BS/91/6	7.43	7.37	7.29	7.35	2.73	32.17	AA
Sh/10/5	7.51	7.61	7.46	7.36	2.72	32.66	AA
A/8/128	7.31	7.51	7.31	7.23	2.72	32.08	AA
BT2	7.37	7.43	7.38	7.33	2.77	32.28	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

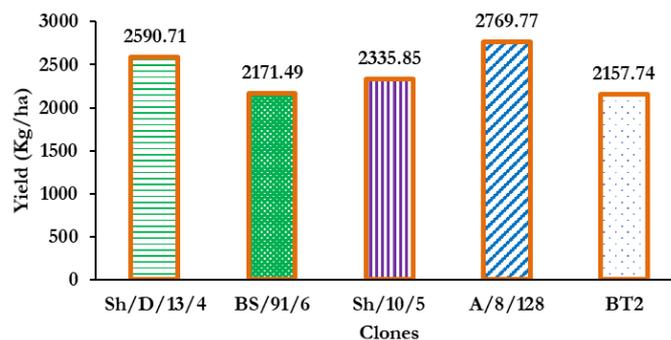


Fig. 14. Comparative yield of clones made tea (kg/ha)

All the test clones were similar to the control BT2 in respect of cup quality. However, the flavoury character of BT2 was not considered in the case of assessing cup quality.

B2-50: Yield and Quality Trial of Three Test Clones Selected from Baraoorah T.E. and Shumshernugger T.E. Test Clones – B/8/79, Sh/9/43 and B/8/93 against Standard BT2 and BT17 (BTRI, 2014-2032).

The plants were FFP-2 pruned at 45 cm in 2018 and there were 20 plucking round during the cropping period. The yield data were analyzed and presented in Table 27.

Table 27. Yield of green leaves

Clone	BT17	B/8/79	Sh/9/43	B/8/93	BT2
Treatment mean	661.8	675.8	561.9	532.8	514.7

Treatment difference- Significant (LSD value at 5% level of significance= 55.7)

The analytical results revealed that all the test clones gave significantly higher yield than the control. The estimated made tea production in kg/ha is presented in Fig. 15.

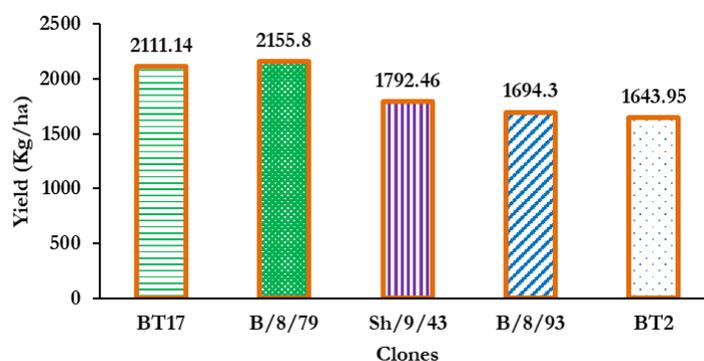


Fig. 15. Comparative yield of clones made tea (kg/ha)

B2-51: Yield and Quality Trial of Two Test Clones Selected from Amo T.E., and Shumshernugger T.E. Test Clones – A/8/194 and Sh/9/65 against Standard BT2, BT17 and BTS1. (BTRI, 2015-2032).

The plants were skiffed at 70 cm in 2019 and there were 25 plucking round during the cropping period. The yield data were analyzed and presented in Table 28.

Table 28. Yield of green leaves

Clone	BTS1	A/8/194	Sh/9/65	BT17	BT2
Treatment mean	432	462.4	487.5	435.3	448.7

Treatment difference- Non Significant

The estimated made tea production in kg/ha is presented in Fig. 16.

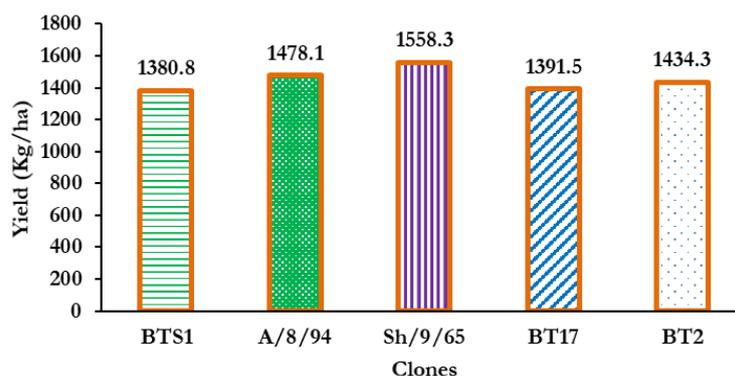


Fig. 16. Comparative yield of clones made tea (kg/ha)

B2-52: Yield and Quality Trial of Four Test Clones Selected from Amo T.E., Baraoorah T.E., and Shumshernugger T.E. Test Clones–T2, T3, T4 and T5 against Standard BT2 (BTRI, 2017-2034).

The trial was initiated in May 2017 at BTRI farm under Latin Square Design with 105cm x 60cm spacing. Normal cultural practices are being followed. The plants were FFP-one pruned at 16 inches (40 cm) in 2019. The plants are kept under observation.

Table 29. Yield of green leaves

Clone	T2	T3	T4	T5	BT2
Treatment mean	377.32	361.44	385.13	335.3	292.7

Treatment difference- LSD at 5%=43.19

B2-53: Yield and Quality Trial of Four Test Clones Selected from Amo T.E., Baraoorah T.E., and Shumshernugger T.E. Test Clones–D1, D2, D3 and D4 against Standard BT2 (BTRI, 2017-2034).

The trial was initiated in May 2017 at BTRI farm under Latin Square Design with 105cm x 60cm spacing. Normal cultural practices are being followed. The plants were FFP-one pruned at 16 inches (40 cm) in 2019. The plants are kept under observation.

Table 30. Yield of green leaves

Clone	D1	D2	D3	D4	BT2
Treatment mean	361.09	351.67	335.16	374.43	301.8

Treatment difference- LSD at 5%=40.15

B2-54: Yield and Quality Trial of Four Test Clones Selected from Bidyabil T.E. (Rajghat T.E.), Amrail T.E., and Madhabpur T.E. Test Clones–A2, A3, A4 and A5 against Standard BT2 (BTRI, 2019-2036).

A long term experiment was initiated at Bilashcherra Farm in 2019 under Latin Square Design with 105cm x 60cm spacing of plants. Normal cultural practices and timely operations were carried out. Growth of the plants was satisfactory. This experiment was initiated under NATP-2 sub project titled as “Germplasm conservation and farm productivity enhancement through the interaction of shade trees and tea based Agroforestry system to mitigate the climate change”.

Table 31. Information about the experiment

Accession No	Germplasm collected from-	Plantation Year	Spacing
A2	Bidyabil T.E. (Rajghat T.E.)	2019	105cm x 60cm
A3	Bidyabil T.E. (Rajghat T.E.)		
A4	Amrail T.E.		
A5	Madhabpur T.E.		

B2-55: Yield and Quality Trial of Four Test Clones Selected from Bidyabil T.E. (Rajghat T.E.), Kurmah T.E., and Champarai T.E. Test Clones–C1, C2, C3 and C4 against Standard BT2 (BTRI, 2019-2032).

A long term experiment was initiated at Bilashcherra Farm in 2019 under Latin Square Design with 105cm x 60cm spacing of plants. Normal cultural practices and timely operations were carried out. Growth of the plants was satisfactory. This experiment was initiated under NATP-2 sub project titled as “Germplasm conservation and farm productivity enhancement through the interaction of shade trees and tea based Agroforestry system to mitigate the climate change”.

Table 32. Information about the experiment

Accession No	Germplasm collected from-	Plantation Year	Spacing
A2	Biddyabil T.E. (Rajghat T.E.)	2019	105cm x 60cm
A3	Biddyabil T.E. (Rajghat T.E.)		
A4	Kurmah T.E.		
A5	Champarai T.E.		

B2-56: Long term Yield and Quality Trial of Four Test Clones (Multi-location trail) at Amo Tea Estate (2019-).

Kept under observation.

B2-57: Long term Yield and Quality Trial of Four Test Clones (Multi-location trail) at Ayeshabag Tea Estate (2019-).

Kept under observation.

B3: BREEDING OF TEA (NO. OF EXPERIMENTS-10)

B3-1.1: Controlled Pollination between Selected Clones/Agrotypes and Selection of Generative Clones for the Establishment of Clonal Seed Reserve (1964-)

Hybridization between the following parents was done in 2019:

Hybridization between the following clone pairs were done in order to identify new biclonal combinations (for hybrid seed production) as well as to select vegetative clones from the progenies.

Crossing compatibilities and germination:

Table 33: Crossing compatibilities and germination

Crossing combination		No. of pollinations	No. of fruit set	Fruit setting (%)	No. seeds germinated	Germination (%)
Receiver	Donar					
TV18X	BT3	29	23	79.31%	9	39.13%
BT4X	TV1	68	32	47.06%	8	25%
TV1 X	BT4	65	24	36.92%	15	62.50%
BT2 x	TV23	24	14	58.33%	11	78.57%
TV23X	BT2	23	15	65.21%	8	53.33%
BT12 x	TV26	54	32	59.26%	21	65.63%
TV26 x	BT12	63	34	53.97%	22	64.71%
BT10 x	TV26	38	21	55.26%	7	33.33%
TV26 x	BT10	67	44	65.67%	21	47.73%
BT2 X	BT17	55	40	72.72%	31	77.50%
BT4 X	TV26	50	36	72%	34	94.38%
TV26 X	BT4	28	18	64.29%	14	77.78%
BT6 X	TV26	34	22	64.71%	16	72.73%
TV26 X	BT6	39	30	76.92%	19	63.33%
TV19 X	BT2	45	12	26.67%	6	50%
BT2 X	TV19	41	22	53.66%	8	36.36%
TV1 X	TV19	24	-	-	-	-

TV19X TV1	44	33	75%	23	69.70%
TV9 X BT2	55	35	63.64%	27	77.14%
BT2 X TV9	8	5	62.50%	2	40%
TR1 X BT2	53	22	41.51%	19	86.36%
BT2 X TR1	67	37	55.22%	17	45.95%
TV1 X BT2	25	16	64%	11	68.75%
TV19 X BT3	5	2	40%	40%	50.00

Percentages of fruit setting was highest in TV18X BT3 (79.31%) followed by TV26 X BT6 (76.92%) and TV19X TV1 (75%) while the percentage of germination was highest in BT4 X TV26 (94.38%) followed by TR1 X BT2 (86.36%) & BT2 x TV23 (78.57%).

B3-1.3: Establishment of polyclonal seedbaries according to the proposed model by the Institute and observation on the open pollinated progenies.

Saplings of BT1, BT2, BT3, B207/39, BS1/3, BS1/4 and TV1 were raised in Botany nursery. Due to insufficient demand of polyclonal seedbaries by the tea estates, no polyclonal seedbarie was established in 2019.

B3-1.5: Establishment of a Biclonal Seedbarie with Clones TV18 and BT3.

Seedlings from the stock are being observed in the trial plots. Seeds are being collected and distributed to the Tea Estates. Seedbarie (B3-1.5) comprising TV18 and BT3 have been kept under observation. Comparative yield and quality potential of the hybrid progeny (TV18 and BT3) are being assessed against other standard biclonal seeds (B3-1.8 & B3-1.9).

B3-1.8: Comparative Yield and Quality Trial of BTRI Released Biclonal Stock BTS1, Biclonal Stock T18B3, Allynugger Polyclonal Stock (ANPS), Phulbari General Seed Stock (PBS) and Clone BT1 (BTRI, 1999-2020)

The plants of this trial were light skiffed at 73 cm and there were 26 plucking rounds in 2019. The yield data were analyzed and presented in Table 34. The estimated made tea production in kg/ha is presented in Fig. 17.

Table 34. Yield of green leaves

Clone	BT1	BTS1	PBS	ANPS	T18B3
Treatment mean	1030.7	963.2	1043.3	1063.2	979.8

Treatment difference- Significant (LSD value at 5% level of significance= 149.31)

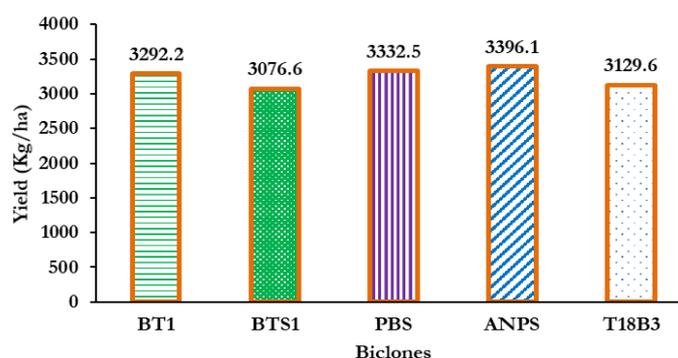


Fig. 17. Comparative yield of clones made tea (kg/ha)

The statistical results reveal that yield difference was significant (at 5% level of significance) in 2019. The cup quality of made tea for all the treatments was assessed through organoleptic test. The average scores are shown in Table 35.

Table 35. Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
BT1	7.48	7.71	7.35	7.67	2.74	32.95	AA
BTS1	7.54	7.41	7.62	7.41	2.84	32.84	AA
PBS	7.25	7.17	7.27	7.22	2.85	31.76	A
ANPS	7.43	7.69	7.22	7.47	2.83	32.64	AA
T18B3	7.55	7.76	7.57	7.62	2.83	33.33	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

The biclinal BTS1 and T18B3 are comparable in cup with the control clone BT1 while PBS was inferior to the control.

B3-1.9: Comparative Trial of 4 Biclinal Seed Stocks (BTS1, BTS3, TV18 × BT3 & TS463) and 3 Parental Clones (BT1, TV1 & TV19) (2002-2020)

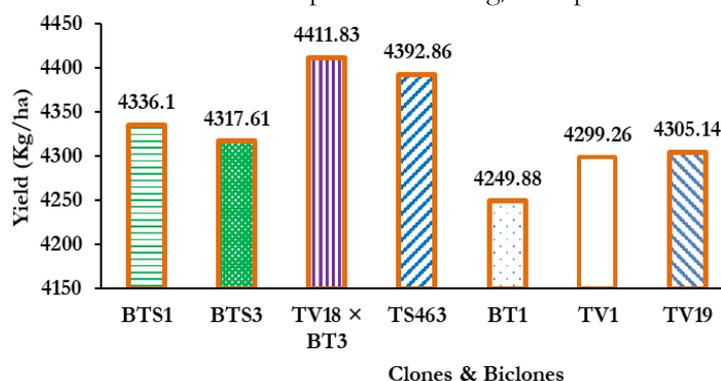
The plants of this trial were light skiffed at 73 cm and there were 29 plucking rounds in 2019. The yield data were analyzed and presented in Table-36.

Table 36. Yield of green leaves (g/plant)

Clone	BTS1	BTS3	TV18 × BT3	TS463	BT1	TV1	TV19
Treatment mean	1357.48	1351.7	1381.2	1375.26	1330.49	1345.96	1347.8

Treatment difference- Significant. (LSD value at 5% level of significance= 275.49)

The statistical results reveal that yield difference was significant (at 5% level of significance) in 2019. The cup quality of made tea for all the treatments was assessed through organoleptic test. The average scores are shown in Table 37. The estimated made tea production in kg/ha is presented in Fig. 18.

**Fig. 18.** Comparative yield of clones made tea (kg/ha)**Table 37.** Quality scores

Clone	Infusion	Liquor colour	Briskness	Strength	Creaming down	Total	Remarks
	10	10	10	10	10	50	
BTS1	7.41	7.49	7.43	7.66	2.89	32.88	AA
BTS3	7.45	7.15	7.15	7.44	2.67	31.86	A
TV18 × BT3	7.33	7.46	7.21	7.53	2.72	32.25	AA
TS463	7.51	7.47	7.37	7.39	2.73	32.47	AA
BT1	7.42	7.24	7.39	7.43	2.75	32.23	AA
TV1	7.42	7.43	7.51	7.57	2.87	32.82	AA
TV19	7.49	7.25	7.48	7.53	2.89	32.64	AA

(A: Average, AA: Above Average, E: Excellent cup quality)

In all the treatments excepting BTS3 the cup qualities were “Above Average” while BTS3 was just “Average”.

B3-8: Survey and Conservation of Gene Resources of Tea in Bangladesh (BTRI, 1981-)

Plants having fourteen special attributes like leaf color and size, seed bearing habit, disease pest tolerant, plant types etc. were collected from the following tea estates. Planting materials were raised in the nursery and afterwards planted in the field to observe the response of these diverse agrotypes and finally conserved in BTRI Tea germplasm centre. Proper care and attention were given to this experiment.

A total of 516 tea germplasm has been maintained (*ex-situ* conservation) in the Germplasm Bank in order to use in future for varietal improvement.

Table 38: No. of promising germplasm screened from different T.E. and planted in BTRI germplasm center

Source (Tea estates)	No. of promising germplasm screened	No. of plants/line/germplasm	No. of line/germplasm	Total planted population
Amo	8	10	1	80
Shumshernugger	8	10	1	80
Baraooora	4	10	1	40
BTRI Dulia	4	10	1	40
Total	24	-	-	240

B3-11: Detailed survey and assessment of tea seed baries in Bangladesh (1985-).**a. Survey and isolation of mother bush of breeding value in Parkul Tea Estate Seed Barie (2019-2020).**

In 2019, 16 mother bushes having breeding value were selected. Cuttings and seeds were collected. These were kept under observation.

b. Survey and isolation of mother bush of breeding value in Monipore Tea Estate Seed Barie (2019-2020).

In 2019, 20 mother bushes having breeding value were selected. Cuttings and seeds were collected. These were kept under observation.

c. Survey and isolation of mother bush of breeding value in Merina Tea Estate Seed Barie (2019-2020).

In 2019, 22 mother bushes having breeding value were selected. Cuttings and seeds were collected. These were kept under observation.

B3-12: Morphological characterization of BTRI released clones, some test clones and wild genotypes.

A total of 25 accessions (20 BTRI released clones, 4 test clones and 1 wild genotype) were planted in the nursery in October, 2017 to observe their rooting performance and to evaluate their rooting character. Details data will be published after completion of the experiment.

B4: SHORT TERM/MID TERM EXPERIMENTS (NO. OF EXPERIMENTS-4)**B4-4. Effect of different thickness of mulching materials on morpho-physiological characteristics of tea.**

T₁: Tea litter of 2 inch thickness

T₂: Tea litter of 4 inch thickness

T₃: Tea litter of 6 inch thickness

T₄: No mulching material

Parameters: Data were collected on following parameters:

- | | |
|---------------------|---|
| i. Base Diameter | ii. Shoot dry matter |
| iii. Leaf Area | iv. Dry matter production |
| v. Number of Branch | vi. Weight of pruning litter/ bush at de centering (Breaking) |

- vii. 100 Shoot weight viii. Weight of pruning litter/ bush at FFP-1
 ix. Shoot Length x. Soil moisture content

Based on above parameter, 4 and 6 inch thickness of mulching materials (T₂ and T₃) gave statistically similar and higher production than other treatments (T₁ and T₄).

B4-10: Effect of drought on morpho-physiological and water relations traits in tea clones at nursery level (2019-).

Striking Percentage of rooted cuttings, Chlorophyll Stability Index (CSI), Relative Leaf Water Content (RWC) and water relation parameters, Proline content, Poly-phenol content, Vertical Depth of Root, Root Shoot Ratio, Total primary and secondary root length were assessed to screen drought hardy/ drought tolerant plant in nursery condition. According to these parameters, two out of four tea accessions were found to be more promising over check and standard variety.

B4-11: Effect of drought on morpho-physiological and water relations traits in tea clones at field level.

Chlorophyll Stability Index (CSI), Relative Leaf Water Content (RWC), Proline content, Poly-phenol content, Rate of Photosynthesis, Transpiration loss, Water Use Efficiency, Leaf Water Potential, Vertical Depth of Root, Root Shoot Ratio, Total primary and secondary root length, Total dry matter production, 100 Shoot weight, Number of branching, Pruning Recovery, number of bullation, number of serration, Number of Pubescence and Wight of pruning litter/ bush at FFP-1 & FFP-2, Average Leaf area were assessed to screen drought hardy/ drought tolerant plant in field condition. According to these parameters, two out of four tea accessions were found to be more promising over check and standard variety.

B4-12: Sustainable protocol development of artisan tea and different kinds of value added tea.

The protocol of manufacturing and processing of Jasmine Flavored Tea and Rose Flavored Tea were optimized and standardized. Details data will be published after completion of the experiment.

Summary of activities of Botany Division

1. No. of Experimental, Advisory and Official Visit: 28
2. Correspondence: 25
3. Delivered lecture hours for postgraduate diploma/ certificate course at MTC: 16 hours
4. Tea Tasting Session: 06

Tea Tasting Sessions	Date	Venue	No. of Estates	No. of participants
Monu-Doloi Valley Tea Tasting Session	06.07.19	Monu-Doloi Valley Club	14	21
Juri Valley Tea Tasting Session	20.07.19	Juri Valley Club	24	39
Luskerpore Valley Tea Tasting Session	27.07.19	Loskerpore Valley Club	15	25
North Sylhet Valley Tea Tasting Session	24.08.19	Lackhatoorah Golf Club	10	18
Lungla Valley Tea Tasting Session	27.09.19	Chandbag Tea Factory	18	26
Group Tea Tasting Session	02.09.19	BTRI Tea Tasting Room	09	12

5. Received Tea Sample Taste: 48

6. Quantity of planting material supplied:

Rooted cutting (nos.)	Seasonal Bi-clonal seeds (kg)
702	1445

AGRONOMY DIVISION

Dr. Toufiq Ahmed
Principal Scientific Officer

RESEARCH

During the reporting year, Agronomy Division carried out nine experiments under two research program areas such as, (i) standardization of cultural practices; and (ii) development of soil fertility. Results of these experiments on the basis of collected data are briefly discussed below:

Experiment 1: Development of a new pruning cycle for higher sustainable tea yield in the context of present climate change (BTRI Farm; Long term: 2010-2023)

Treatments:

- T₁ : LP - DS - MS
- T₂ : LP - DS - MS - LS
- T₃ : LP - LS - DS - MS
- T₄ : LP - LS - DS - MS - DS - LS
- T₅ : LP - DS - MS - LS - DS - MS - LS

Planting materials: The clones BT1, BT2, BT5, BT11, BT12 and BT13 were used in the experiment. The experiment was laid out in a Split Plot Design with three replications and total number of plots under the experiment is 90.

Progress: The plants were pruned according to the schedule of treatments. Yield data were collected at weekly interval. From the analysis result of yield data obtained in 2019, it was observed that significantly highest yield was obtained in the treatment T₄ and that was followed by T₂, T₅, and T₃ and the lowest was obtained in T₁ (Table 1). Statistically, the yields from T₄, T₂ and T₅ are comparable to each other. Similarly, the lowest yield in T₁ is also comparable with T₃. These differences in yields were mainly due to the differences in given pruning operations.

Table 1. Made tea yield (kg/ha) of different treatments in 2019

Treatments	Yield (kg/ha)
T ₁ (LP-DS-MS)	2597 c (DS)
T ₂ (LP-DS-MS-LS)	3475 a (LS)
T ₃ (LP-LS-DS-MS)	2890 bc (MS)
T ₄ (LP-LS-DS-MS-DS-LS)	3503 a (LS)
T ₅ (LP-DS-MS-LS-DS-MS-LS)	3084 ab (LS)
LSD (0.05)	423.8
CV (%)	20.43

From the interaction effect, it was observed that highest yield (3919 kg/ha) was obtained in the treatment combination of T₄ × BT1 and the lowest in the combination of T₁ × BT12 (2213 kg/ha), but statistically the interaction was not significant (Figure 1).

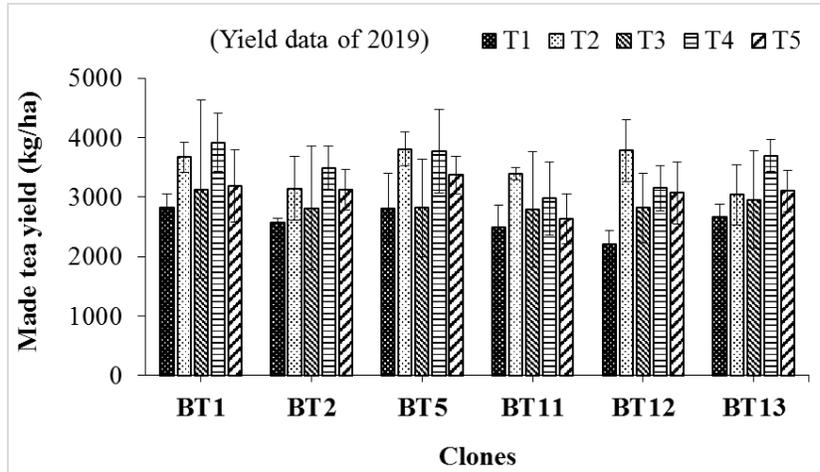


Figure 1. Interaction effect of different clones with different treatments in 2019

From overall analysis (2010-2019) it is observed that longer pruning cycles providing higher yield of tea (Figure 2). The experiment will be continued till 2023. Final comments will be made thereafter.

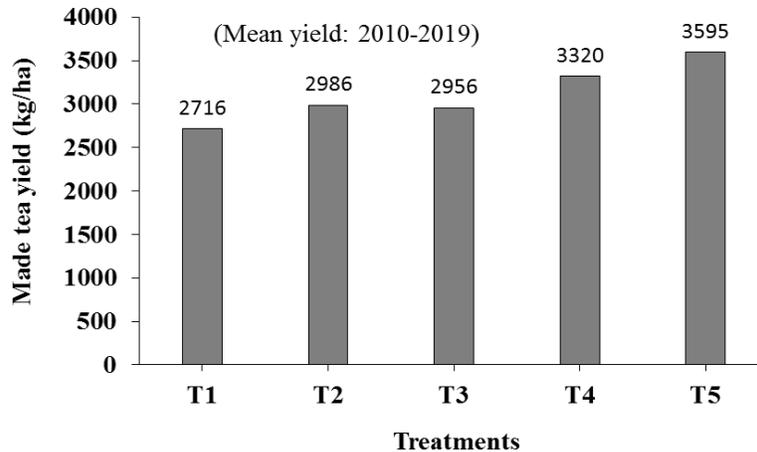


Figure 2. Average yield of made tea (kg/ha) in different treatments from 2010-2019

Experiment 2. Comparative study on yield and yield related parameters of different clones released from BTRI (BTRI Main Farm; Duration: 2017-2019)

Treatments: 04

BTRI released 4 mature tea clones were considered as different treatments e.g. (a) BT2, (b) BT5, (c) BT6 and (d) BT8. Bushes of the experimental site were planted in 1995.

Progress: In 2019, harvested yield data were collected regularly. At the end of the year, collected data were analyzed and it was observed that yield was not significantly different due to treatments. However, among the treatments maximum yield was observed in BT6 (2905 kg/ha) followed by BT2 (2843 kg/ha), BT8 (2575 kg/ha) and the lowest was in BT5 (2547 kg/ha), presented in Figure 3. When harvesting season was over, the experimental area was accomplished with DSK pruning operation for 2020 and number of branches counted after pruning.

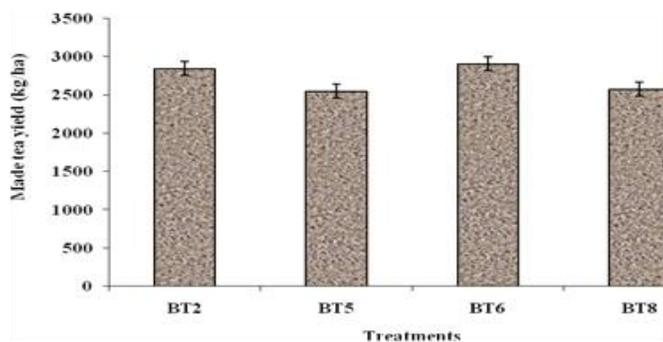


Figure 3. Variation of made tea yield due to treatments.

After analysis of data it was observed that maximum number of branches were in BT6 clone which was statistically similar with BT2 and BT8 but different with BT5 (Table 2).

Table 2. Presenting average number of branches after DSK pruning in different clones

Treatments/Clones	Number of branches after DSK
BT2	96 ^a
BT5	71 ^b
BT6	99 ^a
BT8	81 ^{a b}
CV (%)	23
Mean value	87
LSD value at 0.05	21

The experimental site was within an established 20-years old mature tea plantation area. The vacancy percentage was counted in the plantation area. When the vacancy percentage was analyzed, it was observed that maximum vacancy was in BT5 (5%) which was similar with BT8 (4%) but significantly different with others, showed in the Figure 4. Generally, death of tea bushes at mature tea plantation occurs mainly due to water stress (both water logging and drought) condition. Waterlogging at the root zone influence to break out many diseases such as root rot, collar rot etc. Hence, it can be considered that BT2 is comparatively less susceptible to water stress condition and infestation of diseases.

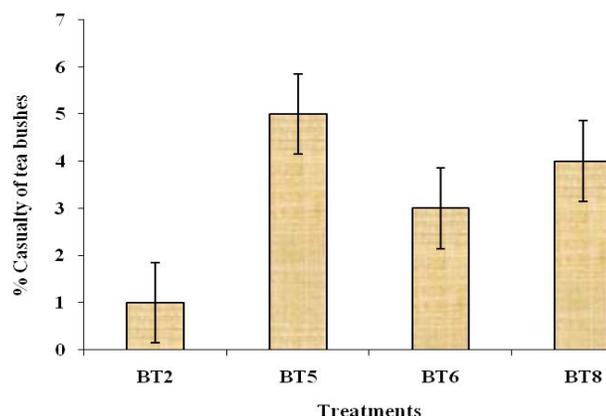


Figure 4. Casualty percentage of tea plants in different treatments

Comments: Among the 04 (four) established and mature tea clones, better performance in field was observed in BT2 considering different characteristics e.g. yield, branching behavior, casualty percentage particularly due to water logging condition and disease infestation followed by BT6, BT8 and BT5 clone, respectively.

Observation of this study continued from 2016 to 2019 and now it is over. Here, the data for the year of 2019 was presented. Considering all of the data of previous years, a scientific article will be written by the year 2020 and will be submitted to the Director of BTRI for publishing in Tea Journal of Bangladesh.

Experiment 3: Effect of different types of pruning on the yield and organoleptic quality of Tea (BTRI Main Farm, Srimongal. Short term: Dec/2017-Dec/2019)

Treatments: Six different types of pruning operations;

- | | |
|---|---------------------------------------|
| T ₁ : Unprune (UP) (Control) | T ₄ : Medium Skiff (MSK) |
| T ₂ : Light Pruning (LP) | T ₅ : Light Skiff (LSK) |
| T ₃ : Deep Skiff (DSK) | T ₆ : Level of skiff (LOS) |

Planting materials and Design: BT2 clone was used in the experiment. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and total number of plots under the experiment is 18.

Progress: The plants were pruned according to the treatments. Yield data were collected at weekly interval. From the analysis result of yield data obtained in 2019, it is observed that significantly highest average yield was obtained in the treatment T₆ (LOS- 3207 kg/ha) and lowest average in the treatment T₂ (LP- 2010 kg/ha) and these differences were due to the differences in given pruning operations (Figure 5). Highest fresh weight (g) of 100 shoot (3 leaf and a bud) was found in T₂ (LP- 192.0 g) and lowest in T₁ (Unprune- 143.7 g) (Figure 6). The maximum number of plucking point was found in T₆ (LOS-114) and minimum was in T₂ (LP-36) (Figure 7). From the investigation, it was observed that highest yield gap (%) was in T₆

(LOS) 36.98% and lowest in T₂ (LP) 14.14% as compared to the T₁ (Unprune) (Figure 8). From the results of this study it was observed that pruning types have highly significant effect on the yield and related parameters as well as on total production. For quality parameters i.e. organoleptic taste, recovery (%) and finally biochemical analysis, more intensive research is necessary. Data on quality parameters were collected only in the year 2018 which were presented in Table 3.

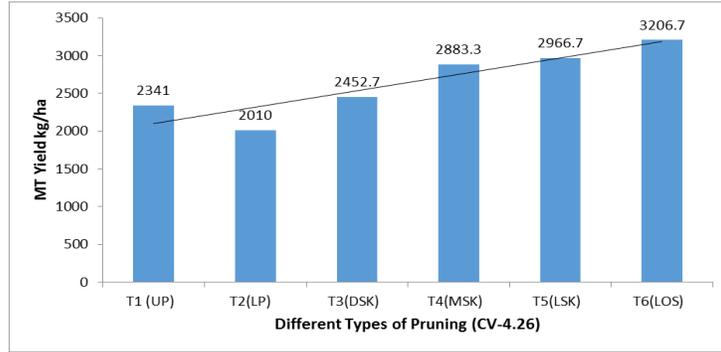


Figure 5. Yield (made tea) under different types of pruning

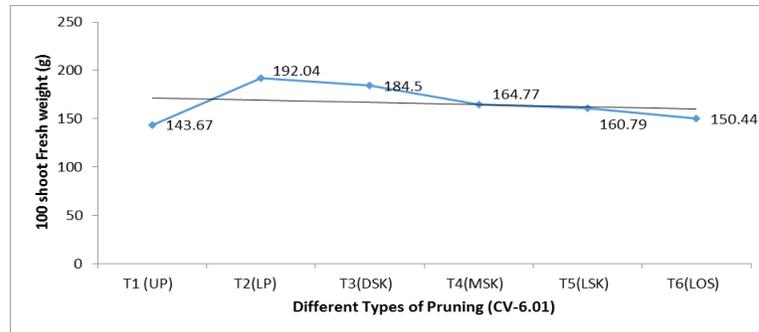


Figure 6. Fresh weight of 100 shoots (three leaves and a bud) under different types of pruning

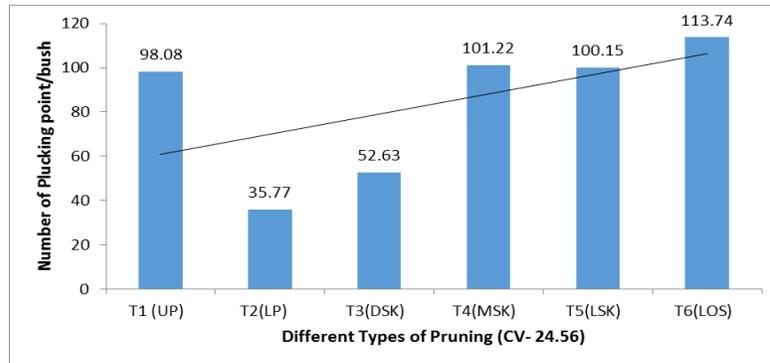


Figure 7. Number of plucking point under different types of pruning

Table 3. Result of organoleptic quality and recovery (%) of MT in different pruning types (Year 2018)

Pruning Type	April		May		June		July	
	Recovery %	Organoleptic test result						
LP	21.43%	32.76	21.21%	32.68	21.33%	32.72	19.21%	32.63
DSK	21.82%	32.50	21.74%	32.44	21.65%	32.64	20.41%	32.23
MSK	22.08%	32.46	22.12%	32.41	22.01%	32.50	20.23%	32.32
LSK	23.21%	32.33	23.22%	32.37	23.15%	32.47	21.63%	32.45
LOS	23.31%	32.19	22.75%	32.16	22.01%	32.33	21.11%	32.10
UP	22.59%	32.21	23.10%	32.11	23.19%	32.21	22.03%	31.76

Organoleptic test was done by scoring out of 50 points (Infusion, liquor color, briskness, strength and creaming down each criteria having 10 points)

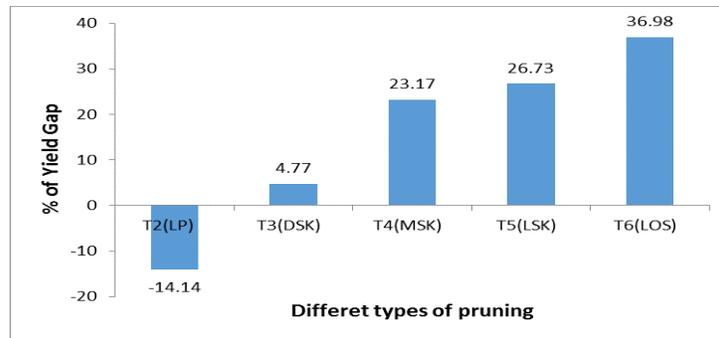


Figure 8. Yield gap (%) in different types of pruning compared to control T1 (Unprune)

Experiment 4. Effect of different types of plucking policies on yield and quality of tea (BTRI Main Farm; Duration: 2018-2020)

Treatments: 05

- T₁: Traditional hand plucking (Control)
- T₂: Shear plucking
- T₃: Plucking with a knife
- T₄: Single-worker operated machine plucking, and
- T₅: Double-worker operated machine plucking.

RCBD was followed as the experimental design with three replications. There were 15 plots under the experiment and each plot consisted with 70 matured tea bushes. The experiment initiated in the field from July 2018 and continued up to December 2019. During the last two

years different types of data were collected e.g. harvested green leaf yield, time required to harvest and wastage of leaf during the harvest.

Progress: Data on harvested green leaf yield was collected regularly from each plot. At the end of the year, collected data were analyzed by using SAS statistical software. Although the yield of different treatments were not significantly different but the highest yield was observed in T₃ (3761 kg/ha) which was followed by T₁ (3436 kg/ha), T₂ (3243 kg/ha), T₅ (3133 kg/ha) and T₄ (2602 kg/ha), presented in Figure 9.

Required time for plucking was significantly different for treatments. Maximum time required for hand plucking (T₁) which was similar with shear plucking method (T₂) and knife plucking method (T₃) but significantly different with other two treatments. To harvest 100 kg green leaf, it was observed that hand plucking method (T₁) required 8.16 hours, shear plucking method (T₂) required 8.03 hours, knife plucking method (T₃) required 6.32 hours, single-worker operated machine plucking method (T₄) required 4.29 hours and double-worker operated plucking method (T₅) required 3.36 hours, showed in Figure 10.

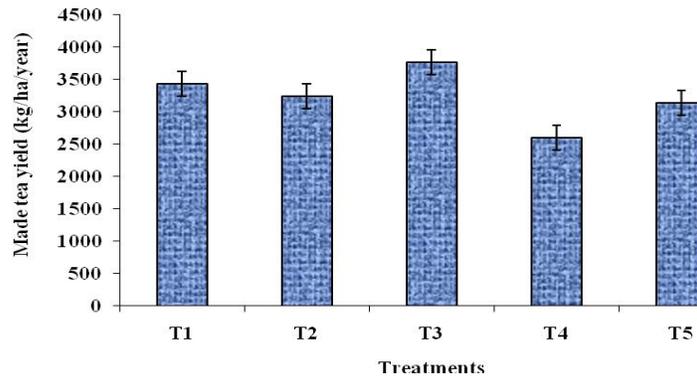


Figure 9. Variation of made tea yield due to treatments

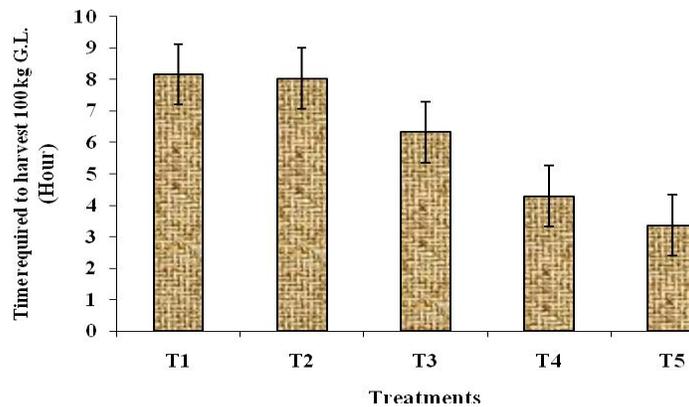


Figure 10. Time required for plucking in different harvesting methods

Comments: It was a short-term experiment and continued from 2018 to 2019. In the 75th RSC meeting which held on 25.02.2020, some expert members suggested to collect data on more parameters. Hence, it is decided to continue the experiment for further study.

Experiment 5. Effects of different types of compost on growth and development of clonal tea (BTRI Main Farm; Duration: 2017-2022)

Treatments: 04

- T₁=Applied 2 kg vermi-compost per pit during the plantation,
- T₂= Applied 2 kg farm-yard compost per pit during the plantation,
- T₃= Applied 2 kg decomposed water hyacinth per pit during the plantation, and
- T₄= Applied 2 kg decomposed cow-dung per pit during the plantation (Control)

For all of the above treatments, BTRI recommended chemical fertilizers (TSP and MOP) were applied in the pit.

Having four treatments, the experiment was set as Randomized Complete Block Design with four replications. In December 2018, tea plants were pruned at the height of 16 inches and then tipping was carried out maintaining standard height. During 2019, data were collected from the immature tea plants mainly the amount of green leaf harvested above the tipping height (20 inches), girth diameter and number of branches after the 2nd year pruning.

Progress: After analysis of collected data of 2019, it was observed that harvested green leaf yield was not significantly different but base diameter and number of branches were significantly different for treatments. Maximum base diameter was found in T₄ (19.2 mm) which was identical with T₁ (18.9 mm) and T₃ (18.3 mm) but different with T₂ (16.6 mm). Similarly, maximum number of branches was observed in T₄ (9) and the minimum was in T₂ (7), presented in Figure 11.

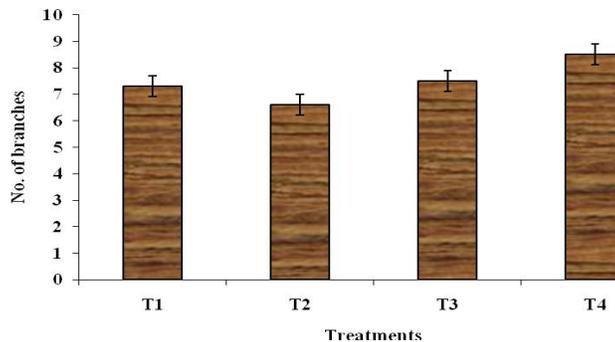


Figure 11. Number of branches found just after the 2nd year pruning

Comments: The experiment initiated in September 2017 and it will be continued up to December 2022. Here, progress of this experiment of 2019 presented briefly. During the five years of immature stage of the plantation, data will be collected on different parameters. After completion of the experiment in 2022, the report will be presented and published in detail.

Experiment 6. Effects of foliar application of different chemical fertilizers on growth, development and yield of tea (BEF Farm, Bilashcherra; Duration: 2019-2020)

Treatments: 06

The experiment initiated depending on the hypothesis is that “Drastic and sudden reduction of yield may be due to excess application of macronutrients containing chemical fertilizers in foliage of tea bushes”. Consequently to check the assumption, the experiment consisted with 06 (six) treatments e.g.

- T₁=Control
- T₂=1% Urea applied in foliar
- T₃=2% Urea applied in foliar
- T₄=1% Urea+1% MOP applied in foliar
- T₅=2% DAP applied in foliar, and
- T₆=1% MOP+1% ZnSO₄ applied in foliar.

The experiment was set as Randomized Complete Block Design in a mature tea field. There were 04 replications. In the experimental area, there were 24 plots and each plot with 20 tea plants. Chemical fertilizers applied in foliar once in a month. Data on harvested green leaf yield and yield related parameters collected regularly. The experiment initiated in 2019 and will be continued up to December 2020.

Progress: Data on harvested green leaf were collected regularly. At the end of the year, collected data were analyzed by using SAS statistical software. It was observed that yield was not significantly different for treatments (Figure 12).

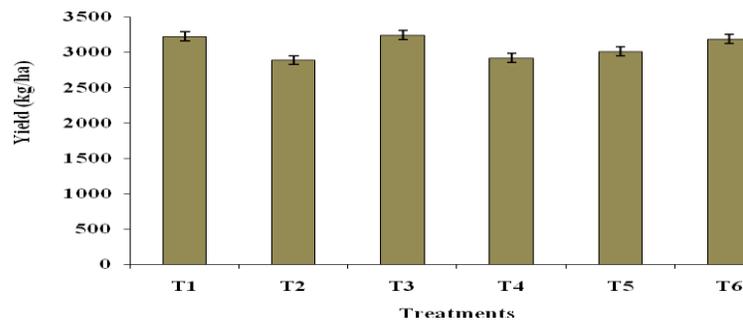


Figure 12. Variation of made tea yield due to treatments

Comments: The experiment initiated in 2019 and it will be continued up to December 2020. Report of this experiment presented here briefly. After completion of the experiment, the report will be presented and published in detail.

Experiment 7: Development of a tool for easy and effective transplanting of tea saplings in the nursery (BTRI Farm; Short term: 2018-2019)

Treatments: Tools with different shape (three shapes) will be used as different treatments of the experiment (Figure 13). The traditional tool of transplanting will be used as control.

T₁ : Transplanting using traditional tool (Control)

T₂ : Transplanting using Tool 1

T₃ : Transplanting using Tool 2

T₄ : Transplanting using Tool 3

Data collection method:

Transplanting work will be carried out with the tools with different shapes. The following data will be collected-

- Number of transplanted saplings per hour.
- Mortality percentage of the transplanted saplings.
- Growth data of the transplanted saplings.

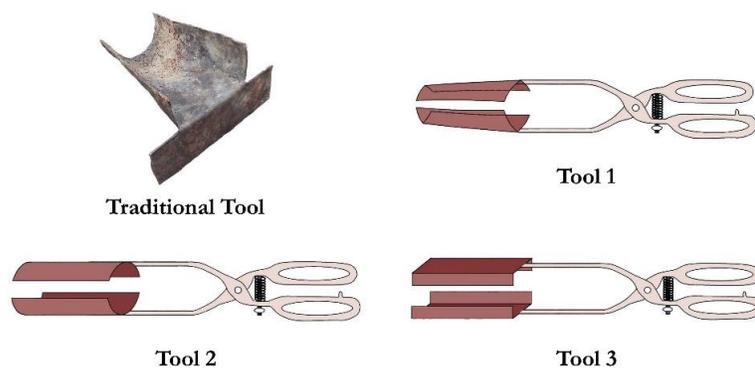


Figure 13. Different transplanting tools that will be used in the study.

Progress: First, one of the tool (Tool 2) has been developed in the local workshop according to the design (Figure 14). Then a preliminary test was made with the tool in the field. According to the experience of the field trial, the design of the tools were slightly modified. Due to some unavoidable circumstances the progress of preparing rest of the tools didn't continue. The experiment is proposed to be continued for another year for the development of other tools and to be evaluated experimentally.

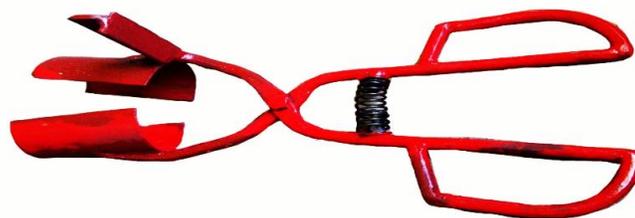


Figure 14. Developed Tool 2 according to the design.

Experiment 8: Effect of integrated nutrient management for raising clonal tea saplings in polytubes in secondary bed (2018-2019).

Treatments: (10)

- T₁ : Control (Recommended dose of cowdung and chemical fertilizers)
- T₂ : 50 g Cowdung (CD) per kg of soil,
- T₃ :100 g Cowdung (CD) per kg of soil,
- T₄ : 150g Cowdung CD) per kg of soil,
- T₅ : 50 g Poultry Manure (PM) per kg of soil,
- T₆ : 100 g Poultry Manure (PM) per kg of soil,
- T₇ : 150 g Poultry Manure (PM) per kg of soil,
- T₈ : 50 g Vermicompost (VC) per kg of soil,
- T₉ : 100 g Vermicompost (VC) per kg of soil and
- T₁₀ : 150 g Vermicompost (VC) per kg of soil.

Plant Materials: BT2 Clone.

Progress: Growth data including root length, shoot length, base diameter and leaf numbers were collected at 9 different dates after transplanting to observe the trend. The final growth data were analyzed for comparison and statistical significance. All the growth characteristics were found statistically significant due to the treatments (Table 4). The highest shoot length (50.083 cm) and leaf number (14.26) were found in T10, whereas lowest shoot length (45.217 cm) and leaf number (13.377) were found in T2 (Figure 15 & 16). On the other hand, the highest root length (18.233 cm) was found in T8 which is statistically similar with all the treatments except T6 and T7 (Figure 17). Similarly, maximum base diameter (7.380 mm) was found in T8, which is statistically similar with all the treatments except T5, T6 and T7 (Figure 18).

Table 4. Growth characteristics of tea saplings under different treatments

Shoot length (cm)		Root length (cm)		Root : Shoot Ratio		Base Diameter (mm)		Leaf Number (Nos)	
Treat.	Mean	Treat.	Mean	Treat.	Mean	Treat.	Mean	Treat.	Mean
10	50.083 a	8	17.047 a	7	3.1743 a	8	7.3800 a	10	14.260 a
1	50.050 a	4	17.060 a	6	3.1153 a	2	7.3533 a	1	14.106 a
9	50.033 a	2	17.007 a	10	2.9903 b	3	7.3033 ab	9	14.090 a
7	49.913 a	5	17.000 a	1	2.9827 bc	4	7.2833 ab	7	13.648 b
6	49.037 b	3	16.867 a	9	2.9817 bc	1	7.2067 abc	6	13.603 b
4	49.033 b	9	16.783 a	4	2.8767 cd	10	7.1333 abc	4	13.595 b
3	48.343 b	1	16.780 a	3	2.8680 d	9	7.0567 abc	3	13.448 b
8	47.207 c	10	16.747 a	8	2.7687 de	5	6.9967 bc	8	13.413 b
5	46.380 d	6	15.740 b	5	2.7283 e	6	6.9833 bc	5	13.384 b
2	45.217 e	7	15.727 b	2	2.6630 e	7	6.8667 c	2	13.377 b
CV	0.84	CV	2.25	CV	2.16	CV	1.35	CV	2.88
LSD (0.05)	0.6998	LSD (0.05)	0.6426	LSD (0.05)	0.1080	LSD (0.05)	0.3166	LSD (0.05)	0.3535

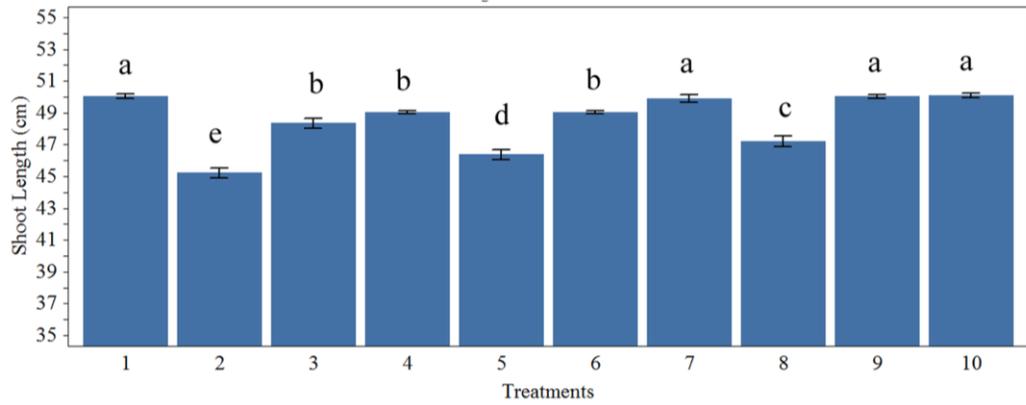


Figure 15. Shoot length of tea saplings under different treatments

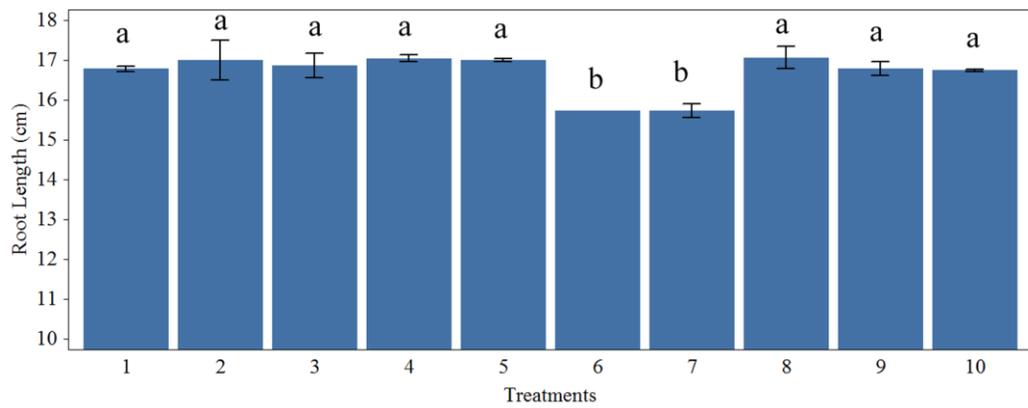


Figure 16. Root length of tea saplings under different treatments

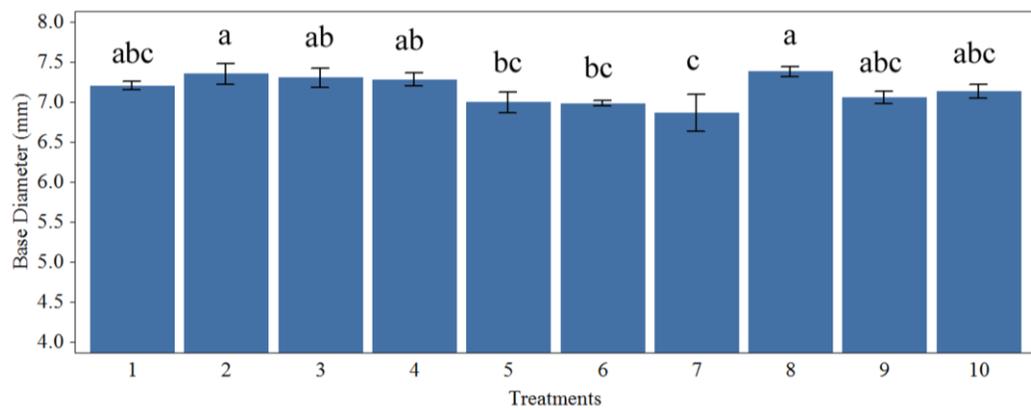


Figure 17. Base diameter of tea saplings under different treatments

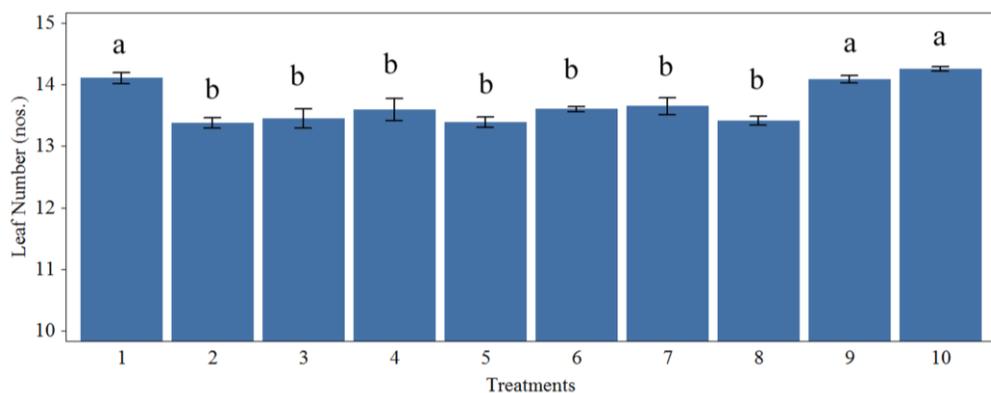


Figure 18. Leaf number of tea saplings under different treatments

Comments: From the study it is found that all the growth parameters were maximum when VC was mixed with the soil @ 150 g/kg of soil to prepare the secondary bed (polytube); whereas the recommended dose of CD and 150 g PM per kg of soil also showed similar performance statistically. However, more mortality percentage of the rooted cuttings were noted in the treatments consisting PM. Beside this, the root lengths were also found smaller with the increase of PM dose. Therefore, to prepare the soil of the secondary bed, VC @ 150 g/kg of soil or CD at recommended dose can be mixed for better growth of the tea sapling in the nursery; and use of PM should be avoided as it exerted detrimental effect on root growth and increased the mortality percentage of the rooted cuttings.

Experiment 9: Mechanization in pruning and its impact on tea production in Bangladesh (BTRI Farm, Short term: 2019-2022)

Objectives of the study:

- To check the impact of pruning mechanization on the yield of tea.
- To find out the best pruning policy using pruning/trimming machines.

Treatments: Different pruning policies using the machine and traditional pruning knife (Figure 19) were the different treatments of the experiment. The traditional method of pruning using pruning knife was the control treatment. Three pruning policies were tested on four different types of pruning operations (LP, DSK, MSK and LSK).

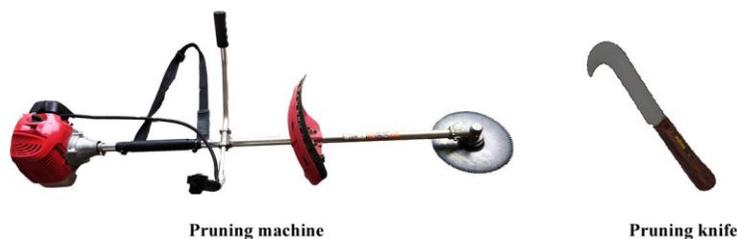


Figure 19. Pruning machine and traditional pruning knife

a) Different pruning policies-

T₁ : Manual pruning using traditional pruning knife (Control)

T₂ : Machine pruning only

T₃ : Machine pruning followed by manual repairing

b) On different types of pruning-

- Light Pruning (LP)
- Medium Skiff (MSK)
- Deep Skiff (DSK)
- Light Skiff (LSK)

Data collection method:

Different pruning policies will be implemented in the field on different types of pruning. The following data will be collected during the experimentation-

- Number of pruned bushes/hour
- Input (labour, fuel etc.) requirement for different mechanisms
- Yield data
- Economic analysis

Progress: The experiment was started at BTRI main farm on December 2019. A mature tea field of BT2 was used for the experiment. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications and total number of plots under the experiment is 36. All the pruning operations for the current year have been completed according to the treatments. Some data were collected for a preliminary comparison between machine and manual pruning which are shown in the Table 5 and Table 6.

Table 5. A preliminary comparison between machine pruning and manual pruning

Pruning Type	Machine Pruning		Manual Pruning (On the basis of tasks*)		Ratio (Machine : Manual)
	No. of bushes pruned per hour	Time required to prune one hectare area	No. of bushes pruned per hour	Time required to prune one hectare area	
LP	96	162 hrs	15	1038 hrs	1 : 6.41
DSK	214	73 hrs	31	498 hrs	1 : 6.82
MSK	254	61 hrs	44	356 hrs	1 : 5.84
LSK	365	43 hrs	50	312 hrs	1 : 7.26

* Considering, manual pruning task LP-120 plants, DSK-250 plants, MSK-350 plants, and LSK-400 plants per man-days; 8 working hours per man-days; 15576 plants per hectare

Table 6. Fuel consumption in machine pruning

Pruning Type	Fuel consumption per hectare (Octane in liter)	Fuel consumption per hour (Octane in liter)
LP	66.75	0.41
DSK	36.05	0.50
MSK	30.04	0.49
LSK	18.91	0.44

OTHER ACTIVITIES

Visits:

Researchers of the division paid 174 visits to different Tea Estates for experimental, advisory services and other official purposes during the reporting year. Number of visits for the reporting year 2019 presented in the table below.

Table 7. Number of visit paid by the scientific personnel of the division during the reporting year

Reporting year	No. of experimental visits	No. of advisory visits	No. of other official tours
2019	132	23	19

Workshop / Seminar

Scientific personnel of Agronomy division arranged 8 workshops in different tea estates and BTRI to disseminate updated technologies among planters on plantation, pruning, tipping, plucking, drought management in tea etc.

BTRI Main Farm

The institute is spread over an area of 34.90 hectare and breakup of the land is as follows:

Under tea

1) Young clonal tea	: 0.33 ha
2) Mature clonal tea	: 4.64 "
3) Mature seedling tea	: 4.15 "
4) Mother bush, seed bari etc.	: 1.48 "
5) Tea nursery	: 0.62 "
Total:	11.22 ha

Other crops

1) Rehabilitation crops	: 0.16 ha
2) Nursery	: 1.09 "
3) Mixed forest, Orchard, Lemon, Guava etc.	: 5.21 "
Total	: 6.46 ha

Other uses

Office, Laboratory, Guest house, Mosque, School, Factory, Club house, labour line, roads etc.	: 17.22 ha
Grand total	: 34.90 ha

Improved planting materials supplied

Year of supply	No. of fresh cuttings	No. of rooted cuttings
2019	1,02,500	53,133

Green leaf production and earning from other farm products

Reporting year	Green leaf production in kg	Earning from other farm products in Taka
2019	95,145	4,830

Green Leaf Supplied in kg

Reporting year	Central Factory BTRI	Mini Factory BTRI	Green Tea Factory (New)	Total Green Leaf Production
2019	92,365	35	2,745	95,145

Independence and Victory Day

National Independence Day and Victory Day were celebrated with due solemnity during the reporting year.

Meteorological Data for the year 2019

Month	No. rainy days	Rainfall (mm)	Evaporation (mm)	Temperature (°C)		Dew point (°C)	Sunshine hrs.	R.H. (%)
				Max.	Min.			
January	0	0	87.70	27.13	9.76	12.60	8.06	66.79
February	4	42	95.20	28.31	12.58	13.48	7.10	65.48
March	8	34	112.20	30.96	17.23	16.65	7.31	62.56
April	8	131	137.50	33.00	21.20	20.67	7.18	66.72
May	17	439	143.40	33.67	23.80	24.18	6.59	73.53
June	21	465	123.05	33.38	25.61	25.58	4.33	76.86
July	22	479	116.70	32.66	25.45	25.40	4.06	81.46
August	16	177	128.50	34.06	25.90	25.90	5.90	78.45
September	14	204	125.10	33.37	24.38	25.24	5.85	79.68
October	17	195	87.50	31.56	22.90	23.90	5.60	81.55
November	4	27	72.20	29.84	17.28	20.14	7.03	78.13
December	2	3	51.90	25.33	11.96	14.69	6.05	75.11
Total/ Average	133	2196	1280.95	31.11	19.84	20.70	6.26	73.86
	Total	Total	Total	Average	Average	Average	Average	Average

ENTOMOLOGY DIVISION

Md. Jahangir Alam

Scientific Officer

STAFF

Dr. Mohammad Shameem Al Mamun, Senior Scientific Officer was transferred to BTRI Substation, Panchagarh on 8th March 2017. Mr. Shovon Kumar Paul, Scientific Officer is now in deputation at Malaysia for PhD purpose. The posts of Principal Scientific Officer was lying vacant during the period under report. There was no other change in personnel position of the division.

RESEARCH

Two experiments under two programme areas were carried out during the year of 2019. The experiments were - Evaluation of some commercial biopesticides against Red spider mite Looper caterpillar and Thrips in Tea; Screening of pesticides against Helopeltis, Red spider mite, Termites, Nematodes and Thrips in tea; Details of the experiments together with their findings are furnished below:

ENT 1. BIO-CONTROL OF PESTS

ENT 1.1. Evaluation of some commercial biopesticides against Red spider mite, Looper caterpillar & Thrips (2018-2021)

Potential effects of Bracon hebetor as a bio-control agents for sustainable management of Looper caterpillar

Progress: An experiment was carried out to determine the effects of bio-control agents against Looper caterpillar and find out efficacy of *Bracon hebetor* as a larval parasitoid against Looper caterpillar infesting tea in laboratory conditions. The caterpillar was collected from different sections of BTRI main farm and Bilashcherra Experimental Farm and reared in the Entomology Laboratory, BTRI, at 27-30°C temperature and 70-80% relative humidity. The caterpillars were reared on tea leaves in rectangular jars (9.5 cm x 7.5 cm x 20 cm).

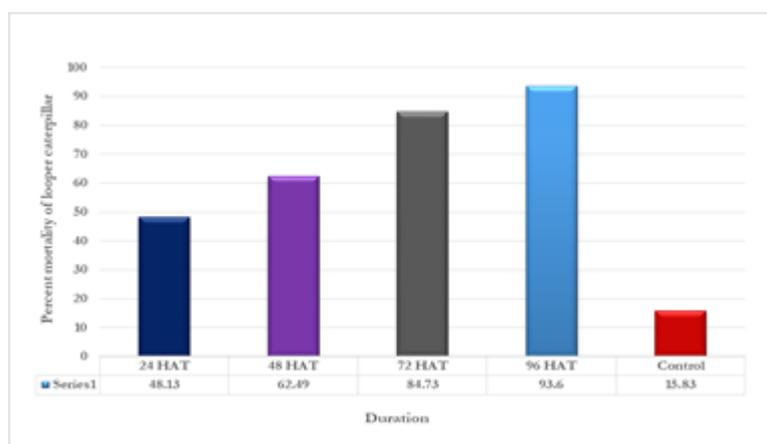


Fig. 1. Percent mortality of looper caterpillar by the larval parasitoid of *Bracon hebetor*

Result revealed that maximum mortality (93.60%) of looper caterpillar by the larval parasitoid of *Bracon hebetor* was found at 96 HAT in the laboratory condition. So, the *Bracon hebetor* may be used for the control of looper caterpillar infesting tea as one of the strong IPM component.

ENT 2. SCREENING OF PESTICIDES

ENT 2.1. Screening of pesticides against *Helopeltis*, Red spider mites, Termites, Nematodes Aphids and Thrips in tea (2017-2018)

Progress: During 2019, Twenty eight (28) pesticides under different groups were tested against *Helopeltis*, Red spider mite, Thrips, Termite and Nematode in the field and the reports were sent to plant protection wing for their standardization (Fig. 2). The result revealed that all the tested pesticides was found satisfactory (>80% effectiveness).

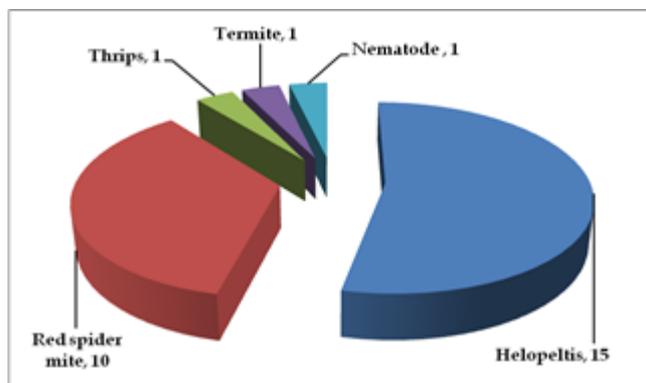


Fig. 2. Number of chemicals trial in the field against different insect pests of tea

OTHER ACTIVITIES

Advisory and Experimental visits

A total of Twenty nine (29) advisory visits were paid to different tea estates to identify and render advice on specific pest problems and Twenty three (23) advisory letters issued to different tea estates in respect of identification of various pests, their control measures and report on nematode analysis during the reporting year.

Analysis: A total of One hundred and thirty four (134) soil samples were analyzed in the Laboratory for nematode count and reported to different tea estates. A total of Twenty eight (28) pesticides including insecticides and miticides were received from plant protection wing, Department of Agricultural Extension, Dhaka for field trial and reports were sent to plant protection wing for standardizations during the year 2019.

Tours/Visits: A total of Two (02) official visits were paid by the Scientists of the division to different organizations for Official purposes.

Courses on tea culture

The Scientific personnel of the division delivered lectures on tea pest management at Annual Courses held at BTRI Main Station, Srimangal; BTRI Sub-Station, Fatikchari, Chittagong and BTRI Sub-Station, Panchagarh as well as in Post graduation diploma course, MTC, BTB. The resource persons gave comprehensive lectures and practical demonstration on tea pest spectrum, their control options, pesticides and its residue in made tea and spraying techniques.

Workshop/Seminar

A total of Nine (09) workshops were conducted at different tea estates under different valley circles on tea pest management during 2019.

PLANT PATHOLOGY DIVISION

Raihan Mujib Himel
Scientific Officer
Plant Pathology Division

STAFF

Mr. Md. Moshir Rahman Akonda, Scientific Officer, Plant Pathology Division was transferred to BTRI sub-station, Fatickcherri, Chattogram on 24 March 2019. Only one Scientific Officer was in charge of the division during the reporting period. The post of Chief Scientific Officer, Department of Pest Management; one Principal Scientific Officer and one Field Assistant of the division were remained vacant. There were no other changes in the staff position of this division during this period.

RESEARCH

Two experiments were discontinued in 2019. Only two experiments were carried during the reporting period of which one was new. The progresses of the experiments are as follows:

PP 4.7: Reduction of weed infestation through integrated weed management practices in mature tea plantations.

Objectives:

1. To reduce the intensity of tea weeds with different components
2. To find out the effect of different integrated approaches on tea production.

Progress:

The experiment was laid out in a Randomize Complete Block Design (RCBD) with comprising five treatments. T₁= Control T₂= Chilling (Mechanical control) + Pendimithalin (pre-emergent herbicide) + Paraquat (post-emergent herbicide) T₃= Chilling (Mechanical control) + Indaziflam (pre-emergent herbicide) + Paraquat (post-emergent herbicide) T₄= Simultaneous application of Pendimithalin + Paraquat + Sickling T₅= Simultaneous application of Indaziflam + Paraquat + sickling. Each treatment is replicated by three times and each plot size is 4m* 4m. Data was taken for 240 days at 15 days interval after application of all treatments. The results reveal that T₃ and Treatment T₅ shows 68.75% and 68.07% control of weed growth respectively over the control plot for the whole study period. T₂ and T₄ shows 53.95% and 54.35% control of weed growth respectively over the control plot for the study period.

Table 1: Growth of weeds in percentage over the different treatment combination

Treatments	Weed Growth%
T ₁	76.66 c
T ₂	35.30 b
T ₃	23.95 a
T ₄	35.30 b
T ₅	24.47 a

Green leaf production of different treated plot was also calculated to show the relationship between green leaf production and herbicide application. It was found that there is no significant change in terms of green leaf production comparing the all treatment combination with control plot. The experiment will be continued for the further assurance of this result.

Table 2: Production of green leaves/ha over the different treatment combination.

Treatments	Production of green leaf/ ha
T ₁	7,813.80 b
T ₂	8,557.80 ab
T ₃	9,036.00 a
T ₄	8,608.20 ab
T ₅	8,868.00 a

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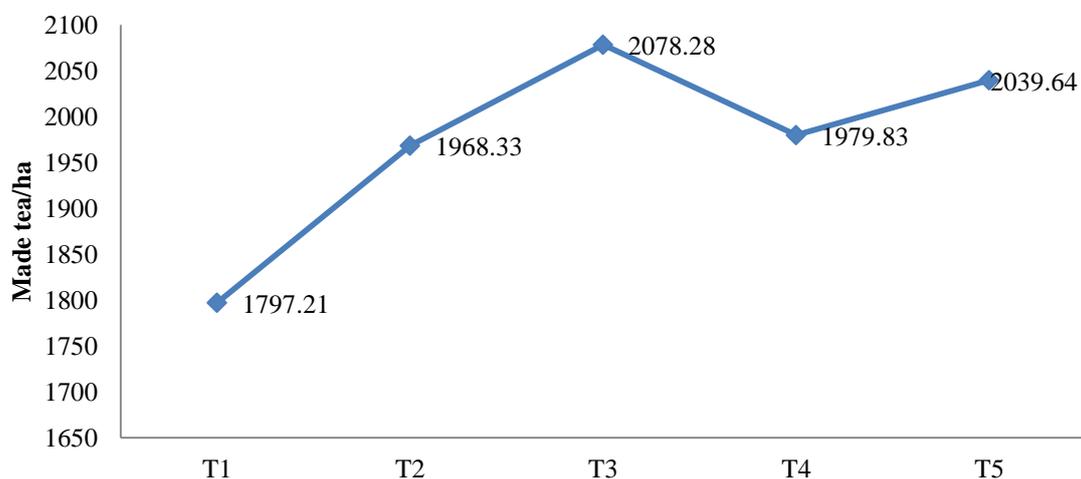


Fig: Made tea/ha over the different treatment combinations

PP 3.3: Screening of new fungicides and herbicides against different diseases and weed in tea (BTRI/BEF/TE(s)).**Progress:**

A total of seventeen fungicides and eleven herbicides of different groups were tested against respective diseases and weeds. Tested chemicals were found >80% effective against the respective pests. Reports were sent to PTASC for further necessary action.

OTHER ACTIVITIES**Advisory and Experimental visits**

A total of Nineteen (19) advisory visits were paid to different tea estates to identify and render advice on specific disease and weeds problem and twenty-three (23) correspondences issued to different tea estates in respect of identification of various diseases and their control measures during the reporting year. Twenty-four (24) experimental visits were made with particular preference to experimental data collection in tea estates.

Official visit/tours

A total of five (05) official visits were paid by the scientists of the division to different organizations for official purposes.

Courses on tea culture

The scientific personnel of the division delivered lectures on tea disease and weeds management at annual courses held at BTRI main station, Srimangal.

Workshop/Seminar

A total of five (05) workshops on tea disease and weed management were carried out in different tea valleys during the year.

STATISTICS & ECONOMICS DIVISION

Dr. Shefali Boonerjee
Senior Scientific Officer

STAFF

Dr. Shefali Boonerjee, Senior Scientific Officer joined on 23rd June 2015 in this Division. The posts of Principal Scientific Officer (PSO) and Statistical Assistant were lying vacant during the period under report. There was no other change in personnel position of the division.

RESEARCH

There were two experiments running in this division regarding economic efficiency of tea production and evaluation of technologies. The present situation of these experiments is summarized below.

SE 1: ECONOMIC EFFICIENCY OF TEA PRODUCTION

SE1.1. Economic efficiency of the test clones of BTRI. This experiment has undertaken to evaluate the economic efficiency of the test clones from which commercial clone (s) will be released. The economic performance is needed to be understood before commercial release of a clone. The test clones are examined in the experimental plots for 10 to 12 years to study the different performances of yield, quality, stress tolerance etc. Along with these attributes the economic performance is also needed to be understood before commercial release of the elite clones. The Study of economic performance in the controlled condition of the experimental plots for 10-12 years is enough to estimate the profitable efficiency of these clones in future.

With the view of importance, the experiment has been started at November 2018. Initially 2 experimental plots of BTRI farm has been selected for data collection which are named as Bt. 40 and Bt. 43. The data from both the plots regarding green leaf production, expenditure of workers wages and other cultural operations are being collecting. The secondary data collection of production and approximate expenditure of last 10 years is also going on.

Objectives

- Study the economic efficiency of the test clones in respect of yield.
- Find out the economic efficient test clone(s) comparing internal rate of return.
- Use of economic performance as a parameter for suitable selection of significant clone(s).

Progress: Data from both the plots regarding green leaf production, expenditure of worker's wages and other cultural operations are being collecting. The secondary data collection of production and approximate expenditure of last 10 years is also going on. For the first year the collected data were summarized and presented in the Table 1, 2, 3 & 4.

Table 1. Total expenditure and labor wages in different cultural practices (2019) in experiment Bt. 43.

Cultural Operation	No of application	Worker used (No.)	Total Cost (Taka)	Green leaf production (kg)
Plucking	27 (round)	28.2	2876.4	254200
Insecticide	19 (time)	3.05	551.58	
Fungicide & weedicide	13 (time)	1.81	186.63	
Manuring	3 (split)	0.49	446.00	
Pruning	2 (days)	7	714	
Other works	9 (days)	2.6	165.20	

Table 2. Total expenditure and labor wages in different cultural practices (2019) in experiment Bt. 40.

Cultural Operation	No of application	Worker use (No.)	Total Cost (Taka)	Green leaf production (kg)
Plucking	27 (round)	28.2	2876.4	641700
Insecticide	19 (time)	2.44	689.48	
Fungicide & weedicide	13 (time)	2.26	233.28	
Manuring	3 (split)	0.47	710.00	
Pruning	2 (days)	8	816.00	
Other works	9 (days)	2.6	265.20	

Table 3. Test clones/clone wise production and comparative cost of different cultural practices (2019) in experiment Bt. 40

Clones/Test clones	Production (kg)	Cost of cultural operation (Tk.)						
		Plucking	Fungicide & weedicide	Insecticide	Fertilizer	pruning	Other works	Total cost
T1 (MJ 39)	46100	410.914	66.25	134.05	108.27	116.57	37.885	873.939
T2 (E/4)	68950	410.914	66.25	134.05	108.27	116.57	37.885	873.939
T3 (D/13)	66100	410.914	66.25	134.05	108.27	116.57	37.885	873.939
T4 (B2T1)	69900	410.914	66.25	134.05	108.27	116.57	37.885	873.939
T5 (BR/97)	65800	410.914	66.25	134.05	108.27	116.57	37.885	873.939
T6 (SDL/1)	67800	410.914	66.25	134.05	108.27	116.57	37.885	873.939

T7 (BT2)	77050	410.914	66.25	134.05	108.27	116.57	37.885	873.939
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Table 4. Total expenditure and labor wages in different cultural practices (2019) in the experiment Bt. 43

Clones/Test clones	Production (kg)	Cost of cultural operation (Tk.)						
		Plucking	Fungicide & weedicide	Insecticide	Fertilizer	pruning	Other works	Total cost
T1 (PH 9/4)	56660	575.28	74.25	172.54	99.196	143.4	53.04	1117.70
T2 (PH9/25)	32250	575.28	74.25	172.54	99.196	143.4	53.04	1117.70
T3 (PH9/40)	61800	575.28	74.25	172.54	99.196	143.4	53.04	1117.70
T4 (BS-67)	56950	575.28	74.25	172.54	99.196	143.4	53.04	1117.70
T5 (BT 5)	46650	575.28	74.25	172.54	99.196	143.4	53.04	1117.70

The experiment plots are same in size and the conditions are controlled. The expenditure divided equally into the plots of corresponding test clones

SE 2: EVALUATION OF TECHNOLOGIES.

SE 2.1. Adoption of BTRI Innovated Technologies and its Extension to Bangladesh Tea Industry.

The study conducted to examine the overall feature of implementation and its efficiency of the BTRI technologies to the tea estates. BTRI has innovated a number of technologies and made a great impact on the tea industry providing these technologies. Bangladesh tea has increased its productivity remarkably from the last few decades. One of the reasons behind such improvement is the utilization of scientific technologies like superior planting materials, authentic control measures of pest and disease management, proper agronomic practices, increase of soil fertility and pH control etc. BTRI has so far released 20 outstanding clones and many other successful technologies which are effectively been used in the tea industry. But there is no information about the percentage of application of the technologies and its efficiency in implementation. So, the current data regarding the disseminated technologies to the estate required to up-to-date. This database will be helpful to find out the adoption efficiency in the field and to find out the limitations of dissemination of the BTRI technologies.

In the present experiment, the adoption percentages of both BT and TV clones in the tea estates of different valleys are explored. The collected data of total 144 gardens were summarized according to valley wise and management wise adoption of clone plantation. From the result it was observed that about 41.64% land of total tea area of the 7 valleys is occupied by clonal plantation with the average production of 1607.48 kg/ha. The use of BT and TV clones were 45.05% and 40.20% with the average production of 1591 and 1667 kg/ha respectively. Among the valleys, the highest BTRI released clones were adopted by Chittagong valley which is 74.62% of their clone area. After then the higher percentage of BT

clones were planted in Luskerpur valley (68.31%) followed by North Sylhet (51.79%), Lungla (51.28 %), Monu-Doloi (48.78 %) and Juri (47.69%) valley of their clone area respectively. The Balisera valley has the lowest (35.63%) clone area of which only 21.82% is occupied by BT clones. In case of different managements, it was observed that about 60% to 65% of clone area of NTC, New Sylhet TE Ltd. and Deundi Tea Co. Ltd. was planted with BT clones. The Duncun Brothers (BD) Ltd. and Finlay were also used BT clones which was 30.22% and 8.35% of their total clone areas (Table 5). Beside BT clones, the clone areas were planted by TV clones along with some other introduced or garden clones. The data on using of cultural practices like pruning cycle, plant to plant spacing, pests and disease control measures were also collected in the same time through the questionnaire from the estates and the results are under analyzing. From the study plantation of BT clones was also observed in BTB managed gardens (Table 6).

Table 5. The clone plantation in the gardens under different management.

Management	No. of TEs	Seedling % of total tea area		Clone area (%) of total tea area				
		Area (%)	Av. yield (kg/h)	Total clone area (%)	BT %	Av. yield of BT area (kg/h)	TV %	Av. yield of TV area (kg/h)
Finlays	7	63.76	1425	35.3	8.35	1500	72.2	1900
NTC	11	47.43	886	50.48	61.95	1416	32.9	1417
BTB	3	56.00	864	41.41	57	1386	42.81	1291
Duncun	16	61.22	1338.5	33.64	30.22	1695	41.93	1950
Deundi Tea Co. Ltd.	4	53.60	1215	46.40	60.55	1533	40	1500
The New Sylhet TE Ltd.	1	14.90	1200	85.09	65.55	1800	26.75	1700

Table 6. Clone plantation in BTB managed gardens.

Garden name	Total tea area (ha)	Total clone area (%)	BT clones (%)	TV clones (%)	Average production (kg/ha)
Deuracherra	430.97	40.18	58.26	41.74	1175
New Samanbagh	472.1	45.75	53.70	46.30	1350
Patharia	395.81	41.43	54.88	45.12	1500

STATISTICS

1. Estimation of Annual Crop for 2020:

A. Annual crop forecasting using theoretical production of last year

Suppose actual production up to September 2020 is 11.321 million kilogram. What would be the estimated production for 2020?

$$\begin{aligned} \text{Estimated production} &= \frac{\text{Actual production up to the month (September 2020)} \times 100}{\text{Theoretical \% production to the month (2019)}} \\ &= \frac{11.321 \times 100}{13.93} \\ &= 81.27 \text{ million kg} \end{aligned}$$

B. Annual crop forecasting (2020) using time series data (last 19 years) was done.

Methodology

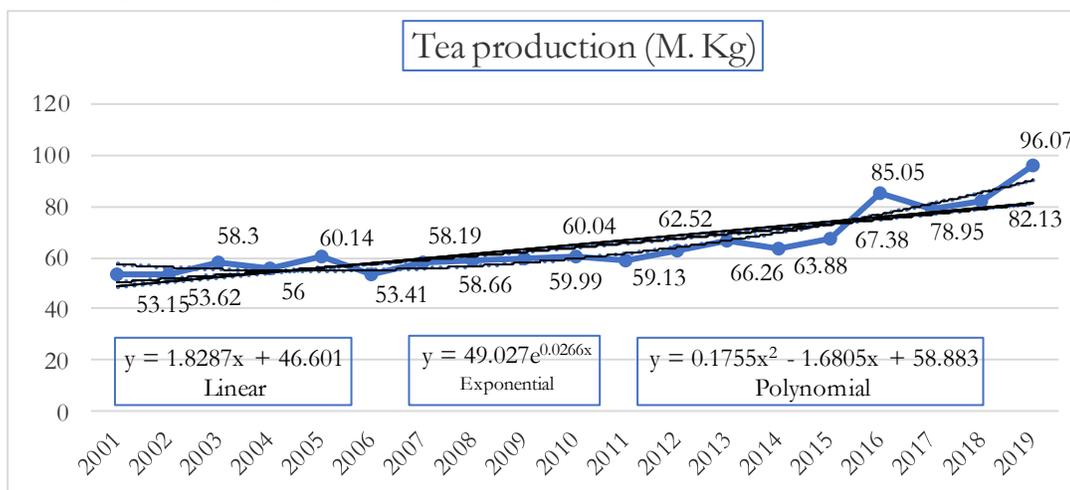
- Correlation analysis for assessing the relationship of forecasted year and other observed last year's production
- Regression analysis for dependency analysis and forecast crop production
- Trend analysis of time series data
- Linear, Polynomial and Exponential Growth Model

Table 7. Correlation regression analysis using last 19 years data for forecasting the tea crop of 2020

Sl	Year	Production (Mkg)	linear (0.62)	Polynomial (.7557)	exponential (.673)
1	2001	53.15	51.4615	56.5187	52.24120275
2	2002	53.62	52.731	55.7654	53.2858868
3	2003	58.3	54.0005	55.3011	54.35146174
4	2004	56	55.27	55.1258	55.43834532
5	2005	60.14	56.5395	55.2395	56.54696366
6	2006	53.41	57.809	55.6422	57.6777514
7	2007	58.19	59.0785	56.3339	58.83115186
8	2008	58.66	60.348	57.3146	60.00761724
9	2009	59.99	61.6175	58.5843	61.20760878
10	2010	60.04	62.887	60.143	62.43159692
11	2011	59.13	64.1565	61.9907	63.68006156
12	2012	62.52	65.426	64.1274	64.95349214
13	2013	66.26	66.6955	66.5531	66.25238791
14	2014	63.88	67.965	69.2678	67.57725813

15	2015	67.38	69.2345	72.2715	68.92862219
16	2016	85.05	70.504	75.5642	70.30700992
17	2017	78.95	71.7735	79.1459	71.71296171
18	2018	82.13	73.043	83.0166	73.14702876
19	2019	96.07	74.3125	87.1763	74.60977331
20	2020		83.175	95.473	83.4603081
SD		12.00532224	8.302352359	12.24621194	8.222908216
Mean		64.888	63.901	66.028	63.832
	Standard deviation close to original time series indicated good estimated model				

Graph 1: Yield trend in correlation regression analysis using last 19 years data for forecasting the tea crop of 2020



Three observations were found in linear (83.175), Exponential (83.46) and Polynomial (95.473) model for the estimation of annual crop of 2020. In Polynomial model the estimated data was found more relevant to last 19 years examined production data along with the closer SD value of time series data. So, the estimated crop for 2020 will may be **95.473** million kg. (NB. The analysis was done depending only on the yield parameter of the last 19 years. The climatic factors (e. g. rainfall parameters, temperature, RH, day length, wind velocity etc.) along with the pest and disease infestations are directly influence the yield of crop as well as the projection.

Conclusion: Correlation analysis using time series data showed estimated production of 95.453 M. Kg tea for the year 2020, whereas the analysis with actual production of the passing months of the year 2020 showed the result of 81.27 M. Kg tea. This difference is may be due to the influences of environmental and other related factors over the production of crop in 2020. So the forecasting crop for 2020, **81.27 M. Kg** will be more appropriate.

2. Estimation of Cost of Production (COP) for the crop of BTRI farms (BEF, BTRI and Kality) in 2019: The cultivation cost and the factory cost of 2019 of BTRI farms has determined. The summary of the estimation has given below.

Table 8. Production and per kg cost of green leaves and made tea produced in BTRI Farms in 2019

Item	BEF	BTRI	Kality	Total
Produced Green Leave (Kg.)	922437	92365	36570	1051372
Produced made Tea (Kg)	210251	21050	3937	235138 (Including Kashipur's 93582 Kg of made tea, a total of 335720 Kg. made tea has produced in the factory in 2019).
Field Cost/Kg (Tk)	25.5	32.58	36.9	31.66 (Avg.)
Factory Cost/Kg (Tk)				34.37
Cost of made tea/ Kg (Tk)	59.87	66.95	71.27	66.30 (Avg.)

Total field cost (Tk.) = 23520140.00 + 3009184.00 + 1349546.00 (BEF + BTRI + Kality)
= 27878870.00

Total factory cost (Tk.) = 11296914.00 {Including the processing cost of Kashipur's leave
(8080840.12 + 3216074.00 = 11296914.00 Tk.)}

Total return (Tk.) = 36253576.84 (Selling price of total made tea @154.18 Tk.)

Total Income (Tk.) = 41294475.14 {including selling income of Kality leaves from March –
September 2019 (736126.3 Tk) and factory processing income
of Kashipur's leaves (4304772.00 Tk) the total income is
41294475.14 Tk.}

BCR(%) = Total Return/Total Cost X100
= 41294475.14/39175784.00
= 1.05

(Benefit Cost Ratio is greater than 1, i.e. 105%, shows the profitable condition of the farms.)

Table 8. Tea Production, Internal Consumption, Export and Import of Bangladesh

Year	Production (mkg)	Internal Consumption (mkg)	Export (mkg)	Import (mkg)
2001	53.15	36.95	12.92	-
2002	53.62	41.50	13.65	-
2003	58.30	37.44	12.18	-
2004	56.00	43.33	13.11	-
2005	60.14	43.30	9.01	-
2006	53.41	40.51	4.79	-
2007	58.19	46.27	10.56	-
2008	58.66	52.12	8.39	-
2009	59.99	53.74	3.15	4.5
2010	60.04	57.63	0.91	6.0
2011	59.13	58.50	1.47	7.0
2012	62.52	61.19	1.50	8.5
2013	66.26	64.00	0.54	11.6
2014	63.88	67.17	2.66	6.9
2015	67.38	77.57	0.54	10.68
2016	85.05	81.64	0.62	8.83
2017	78.95	85.93	2.56	6.29
2018	82.134	90.45	0.643	7.45
2019	96.07	95.20	0.60	2.73

Source: BTB

Table 9. Month wise tea production (mkg) of last five years in Bangladesh

Month	Production (mkg)				
	2015	2016	2017	2018	2019
January	0.104	0.093	0.157	0.331	0.495
February	0.006	0.013	0.016	0.038	0.114
March	0.475	2.506	1.152	1.556	1.917
April	3.083	5.096	4.382	3.505	6.110
May	5.510	6.445	5.934	6.334	7.645
June	6.945	11.227	8.584	7.634	11.667
July	9.391	11.395	11.206	10.985	11.104
August	9.851	11.182	10.648	12.477	13.505
September	9.218	12.716	9.784	12.008	13.382
October	9.746	10.907	11.464	11.863	13.407

November	7.844	9.000	9.075	9.147	10.300
December	5.205	4.470	6.547	6.256	6.423
Total	67.378	85.05	78.95	82.134	96.069

Source: BTB Monthly Bulletin

OTHER ACTIVITIES

Annual Returns of BTB and BCS

The annual returns of BTRI farm including Bilashcherra experimental farm and sub stations on land use, tea seeds, plants and tea waste and also on employment and employment cost (BTB return Form No. 1 & 3) were prepared for the period of 2019 and sent to BTB. The annual statistical return of manpower and labor welfare and on tea garden land (BCS form No. 2 & 3) of BTRI farms including sub stations for 2019 had also sent to BCS office, Dhaka.

Courses on tea culture

The Scientific personnel of the division delivered lectures on tea Statistics and Economics at 54th Annual Course of BTRI held at BTRI Main Station, Srimangal.

Advisory visits

In 2019, a total of six (6) conjoined (with other divisions) advisory visits were paid by the scientific personnel of the department to different tea estates and rendered advice as per the estate's requirements. Six (6) advisory correspond letters were issued according to the visit.

BILASHCHERRA EXPERIMENTAL FARM

BTRI, SREEMANGAL

In Charge: A.K.M Ashraful Haque

STAFF

Md. Mehedi Hasan joined as Farm Supervisor in 10 February 2019. There was no other change in the staff position during the 2019.

FARM**Table 1.** Land Distribution

Sl. No.	Description	Area (ha)	
	Tea cultivated area	121.56	
	I. Plucking Area		
	1. Immature Tea (under 5 years)	11.15	
	2. Tea bushes 6 to 10 years	06.40	114.56
(a)	3. Tea bushes 11 to 40 years	36.91	
	4. Tea bushes 41 to 60 years	60.10	
	II. Seed Bari	6.00	
	II. Seed Nursery	0.50	
	III. Clone Nursery	0.50	
	Under Subsidiary Crops	19.76	
(b)	I. Fruit Tree	5.15	
	II. Soft and Hard Wood Timber Garden	10.56	
	III. Agar	4.05	
(c)	Office/Bungalow/Godown, Staff Quarter, Labour Line, School, Hospital, Graveyard, Masjid/Mandir/Church and Roads	29.60	
(d)	Cultivable, Fallow and Waste Land	57.44	
	Total Area of the Farm	228.36	

Table 2. Crop Production

Black Tea		Green Tea		Total Green Leaf (kg)	Total Made Tea (Black Tea+ Green Tea)	Tea cultivated area (In 2018)	Average Production (Made Tea/Tea cultivated area in 2018)
Green Leaf (kg)	Made Tea (kg)	Green Leaf (kg)	Made Tea (kg)				
922437	210618	12698	2695	935135	213313	110.64	1928

Table 3. Green leaf Production of the Farm in the Year 2019

Name of the Month	Month-wise crop production in 2019 (kg)		
	Green Leaf for Black Tea	Green Leaf for Green Tea	Grand Total
January	0	0	0
February	0	0	0
March	8574	0	8574
April	66280	104.0	66384
May	34772	193.0	34965
June	158414	685.0	159099
July	140935	3293.70	144228.7
August	150851	2395.70	153246.7
September	148050	5131.60	153181.6
October	148760	448	149208
November	55208	219	55427
December	10593	228	10821
Total	922437	12698	935135

Table 4. Production of Improved Bi-clonal Seed, Planting Materials and Sales of Farm Products

Bi-Clonal Seed production(kg)	Institutional use (kg)	Sales of Bi-Clonal Seed (kg)	Sale amount (Tk)	Sales of Different Fruit (Tk)
1520	All seeds were sent to BTRI		30000	23,000

Extension and Development

12.53 ha of land was newly planted in 2019. It has a nursery with the average capacity of 100000 plants. Water supply, labor houses, roads and bridges were regularly maintained. 3258 tea saplings were infilled in section no 12 in the year 2019. Experiments of different divisions had been facilitated at the period.

Miscellaneous

The Victory Day as well as the Independence Day were celebrated with due solemnity during the year. Prizes for sports and sweets were distributed among the labors of the farm and their children on both the occasions. Blankets were distributed among the labors as incentive of the year.

BTRI Fatickchari Sub-station Chattogram

Personnel

Mr. Md. Moshir Rahman Akonda (Scientific Officer, Plant Pathology Division) took over the charges of BTRI Sub-station from Mr. Ashim Kumar Saha, Senior Scientific Officer (Soil Science) on 28 May 2019. Mr. Md. Riyadh Arefin, Scientific officer (Botany) was transferred from the Sub-station to BTRI, Srimangal, and Mr. Md. Arifur Rahman Bhuiyan (Scientific Officer, Soil Science Division) was transferred from BTRI, Srimangal to the Sub-station during the reporting year. Mr. Md. Rayhan-Ur-Rahaman (Scientific Officer, Botany division), Mr. Ajit Chandra Chowdhury (Senior Farm Assistant) and Mr. Md. Kamal Hossen (Upper Divisional Assistant) were performed their duties as in before, consecutively.

Production of green leaves

During the reporting year, about 72,358 Kg of green leaves were plucked from the existing tea plantation and sold to Kaiyacherra Dolu Tea Estate @ Tk. 36 per Kg of green leaves.

Distribution of improved planting materials

About 2,493,933 Nos. of fresh cuttings were collected from the mother bush area and 413 Kg of bi-clonal tea seeds were harvested from the Seed-Bari of the sub-station. The materials were distributed to the different tea gardens, small tea growers in Chattogram and Chattogram Hill Tract project (CHT), Bandarban.

Infilling and Extension programme

About 19,550 tea saplings were planted to fill the vacancies in the existing young tea plantation during the reporting year.

Soil Analysis

During the reporting year, 10 soil samples were tested in the newly established 'Soil Analytical Laboratory' of the Sub-station. The laboratory was opened for analysis on 11 August 2019.

KALITI SUB-STATION**Kulaura, Moulvibazar****STAFF**

There was no change in the personnel position of the Sub-station during the reporting year.

PRODUCTION

Green leaves produced during 2019 and total number of fresh cuttings distributed to different tea estates is given below:

Year	Production of green leaf (Kg)*	Sale price of 19,730 kg @ 37.10 (Tk)	Fresh cutting supplied (nos.)	Sale price @ 0.30 (Tk)	Rooted cutting supplied at BEF (nos.)	Sale price @ 10 (Tk)
2019	36,570	7,31,983.00	1,56,000	46,800.00	5,100.0	-

*19,730 kg green leaves were sold and remaining 16,840 kg were sent to BTRI Black Factory.

BTRI SUB-STATION**Bandarban**

Suman Sikder

Senior Planning Officer & Project Director

Senior Tea Maker Mr.Md. Amir Ali, B.Sc. (RU), Bangladesh Tea Research Institute Joined BTRI SUB-Station Bandarban on 2019. There were no other changes in the personnel position of the Sub-station during the reporting year.

Extension Progress

There was a total no. of small grower under registration 324, No. of small grower under tea cultivation 111, total land under tea cultivation 504 Acre in the year 2020. Provided technical support all over the year to small holding tea growers. Co-ordinated sales of green leaves all over the year.

Works under the Project

1. Given newly registration small tea grower 189 N0s.
2. Tea sapling raised 10 lac.
3. Land lease for tea sapling production 2.38 Acre.
4. Training of different topics such as tea plantation, land preparation, pruning, plucking, disease and pest management, Total no. of farmer 650 under 26 batches.
5. Necessary repairing of the office building has been done in the reporting year.
6. Proper maintenance of mother bush plot around the year.
7. Made tea processed from factory 640 kg in 2019.

BTB REGIONAL STATION, PANCHAGARH**Dr. Mohammad Shameem Al Mamun**

Senior Scientific Officer
&
Project Director, Northern Bangladesh Project

STAFF

Mr. Md. Mominul Islam Khan, Driver was transferred from Bangladesh Tea Board, Head Office, Chittagong to BTB Regional Station, Panchagarh and joined on 05 November 2019. Mr. Jamshed Ali Munshi, Driver and Mr. Md. Nurul Alam, Office Helper (MISS), BTRI were transferred from BTB Regional Station, Panchagarh to Bangladesh Tea Board, Liaison Office, Dhaka and Bangladesh Tea Board, Head Office, Chittagong on 03 November 2019 and 8 August 2019, respectively. There was no other change in the personnel position of the substation during the period under report.

Development Project

A development project entitled "Extension of Small Holding Tea Cultivation in Northern Bangladesh" under Bangladesh Tea Board; Ministry of Commerce funded by Overseas Development Assistance (ODA) Revolving Fund has been implemented at BTB Regional Station, Panchagarh since September 2015. The objective of the project is to extend tea cultivation in 500 hectares of land (300 ha. in Panchagarh, 150 ha. in Thakurgaon, 25 ha. in Dinajpur & 25 ha. in Nilfamari) by organizing and motivating the farmers in the project areas and to supply the planting materials (Fresh cuttings) & 10 lacs tea saplings of appropriate clone/variety at the cheapest rate to the registered tea growers. About 450.40 hectare (1112.49 acres) of lands was extended and 966 small tea growers were registered under this project. One Consultant, one Field Assistant and one Night Guard were recruited under this project during the period under report. About 6.70 lac tea saplings were distributed to the registered small grower at the subsidized rate @ Tk. 2.00/Saplings upto December 2019. A total of 34 seminars/training/workshops/rallies and 39 motivational workshops were organized by the project. A total of 130 spray machines & pruning knife were distributed to the registered small growers free. The financial progress is 76.09% and the physical progress is 76.60% during the period under report. The project will be completed in June 2021.

VP Nursery

No tea saplings were raised and distributed at VP nursery under BTRI during 2019.

Advisory visit

A total of One hundred forty (140) advisory visits were paid to different tea gardens and small tea growers' gardens in northern Bangladesh (Panchagarh, Thakurgaon, Nilfamari & Dinajpur) and rendered advice on tea cultivation in scientific way during 2019. Nineteen (19) samples of tea plants/plant parts were received from different small tea growers in respect of identification of various pests, diseases, other nutrient deficiencies, and suggested their remedies during the reporting year.

Official visit

A total of Thirty three (33) official visits were paid to different organizations including Bangladesh Tea Board, Chattagram, BTRI Srimangal, IMED, a2i, Lalominirhat and Ministry of Commerce, Dhaka during 2019.

Monitoring visit

Thirteen (13) monitoring visits were paid to different tea estates at Panchagarh and Thakurgaon and collected information on development activities of the garden in a prescribed format and sent to PDU for necessary action during 2019. Besides, 18 bought leaf tea factories at Panchagarh and Thakurgaon were visited and report was sent to BTB, Chattagram, during 2019.

Training/Workshop

Two (02) practical training workshops (hand in hand) were organized by BTRI for small tea growers at Boda and Atwari Upazila, Panchagarh on different aspects of tea culture during 2019.

Miscellaneous

- Participated in the Innovation Showcasing Fair 2019 and presented the innovation of mobile app "Duti Pata Ekti Kuri" in the fair organized by Ministry of Commerce, Dhaka during 19-20 June 2019.
- Visited Indonesia Tea Board, Tea Research Institute, Small holding tea cultivation at Jakarta and Bandung along with respected Chairman, BTB during 21-27 July 2019.
- Visit of small holding tea cultivation, bought leaf tea factory, BTB sub station, Panchagarh by the respected Major General Md. Jahangir Al Mustahidur Rahman, psc, Chairman, Bangladesh Tea Board during 15 April 2019.
- Visit of small holding tea cultivation, bought leaf tea factory, BTB sub station, and exchange meeting with stakeholders of northern areas of Bangladesh by the respected Major General Md. Shohail Hossain Khan, psc, Chairman, Bangladesh Tea Board during 24-25 November 2019.
- Visited greater Mymensingh districts (Mymensingh, Sherpur, Jamalpur, Netrokona & Tangail) for the feasibility study for preparing the project of extension of smallholding tea cultivation in greater Mymensingh districts and the study report was sent to Bangladesh Tea Board, Chattagram during 2019.

Personnel at Bangladesh Tea Board. Regional Office. Panchagarh during the period under report.

- 1) Dr. Mohammad Shameem Al Mamun, Senior Scientific Officer & Project Director (BTRI)
- 2) Mr. Suman Sikder, Senior Planning Officer (BTB)
- 3) Mr. Mohammad Sayadul Haque, Assistant Farm Superintendent (BTRI)
- 4) Mr. Zayed Imam Siddique, Senior Farm Assistant (BTRI)
- 5) Mr. Md. Yasin Arafat, Steno typist (BTRI)
- 6) Mr. Suprojit Sarker, Field Assistant (Project)
- 7) Mr. Md. Mominul Islam Khan, Driver (BTB)
- 8) Mr. Narayan Chandra Dey, MLSS (BTB)
- 9) Mr. Entazul Haque Khokon, MLSS (BTRI)
- 10) Mr. Md. Abdul Hakim, Guard (BTRI)
- 11) Mr. Md. Mohsin Ali, Night Guard (Project)

Other activities of the divisions during 2019

Sl.	Item	Soil Science	Botany	Agronomy	Entomology	Plant Pathology	St. & Eco.
01	No. of experiments	7	38	9	2	2	3
02	No. of experimental visits	30	12	132	50	24	-
03	No. of advisory visits	26	8	23	29	19	4
04	No. of advisory correspondence	06	25	5	23	23	4
05	No. of official visits	02	8	17	2	08	-
06	No. of soil, fertilizer & dolomite samples analyzed	2561	-	-	-	-	-
07	No. of nursery soil, water & cowdung samples analyzed for nematodes	-	-	-	134	-	-
08	No. of pesticide residue analysis (commercial)	-	-	-	-	-	-
09	No. of pesticide residue analysis (Experimental)	-	-	-	-	-	-
10	Physical test of pesticides in Lab.	-	-	-	12	-	-
11	No. of pesticides/ Weedicides tested in tea fields	-	-	-	24	28	-
12	No. of circulars/pamphlets/leaflets issued to T. E.	-	1	1	-	-	-
13	No. of workshop/seminar conducted	-	7	7	9	05	-
14	MTC module conducted (Hours/year)	-	16	12	-	-	-
15	Attended national seminar, conference, symposium & workshop	1	-	1	-	-	-
16	Attended international seminar, conference & symposium	-	-	-	-	-	-
17	Attended Training/Course	06	7	7	4	6	4
18	No. of research paper published	-	2	-	-	-	-
19	No. of Fresh cutting supplied	-	-	102500	-	-	-
20	No. of Rotted cutting supplied	-	702	53133	-	-	-
21	Biclonal seed supply to T. E.	-	1445	-	-	-	-
22	Tea tasting	-	6	-	-	-	-