
# ANNUAL REPORT 2014

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**BANGLADESH TEA RESEARCH INSTITUTE**
SRIMANGAL-3210,MOULVIBAZAR
An organ of
**BANGLADESH TEA BOARD**
171-172, Baizid Bostami Road
Nasirabad, Chittagong

BTRI ANNUAL REPORT 2014

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# ANNUAL REPORT 2014

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# DIRECTOR'S REPORT

## STAFF

The report of the technical staff shows the position as on 31 December 2014.

**Director** : **Dr. Mainuddin Ahmed**
M.Sc. (DU), B.Ed. (DU), M.Sc. (London)
DIC (London), Ph.D.

## TECHNICAL DIVISIONS

### 1. DEPARTMENT OF CHEMISTRY

Chief Scientific Officer : **Vacant**

#### A. SOIL SCIENCE DIVISION

Principal Scientific Officer (In charge) : **Abdul Qayyum Khan**
B.Sc. (Hons). M.Sc. (DU)
M.Sc (Reading, UK)

Senior Scientific Officer : **Ashim Kumar Saha**
B.Sc. (Hons), M.Sc. (DU)

Scientific Officer : **Apu Biswas**
B.Sc. (Hons), M.S. (DU), PGD (India)

Scientific Officer : **Kanij Fatema Tuz Zohora**
B.Sc. (Hons), M.S. (CU)

#### B. BIOCHEMISTRY DIVISION

Scientific Officer : **Md. Imrul Hasan Chowdhury**
B.Sc. (Hons), M.S. (JU)

### 2. DEPARTMENT OF CROP PRODUCTION

Chief Scientific Officer : **S.M. Altaf Hossain**
B.Sc. (Hons), M.Sc. (RU)
M.Sc. (Reading, UK)

#### A. BOTANY DIVISION

Principal Scientific Officer : **Md. Ismail Hossain**
B.Sc.Ag.(Hons), M.S. (BAU)

Senior Scientific Officer : **Dr. Md. Abdul Aziz**
B.Sc. (Hons), M.Sc. (RU), Dipl. (China), Ph.D. (RU)

Scientific Officer : **Shefali Boonerjee**
B.Sc. (Hons), M.Sc. (RU)

Senior Farm Assistant : **Md. Majibur Rahman**
B.Sc. (CU)

#### B. AGRONOMY DIVISION

| | |
|---|---|
| Senior Scientific Officer | : **Dr. Toufiq Ahmed**<br>B.Sc.Ag., M.S. (BAU), Ph.D. (Sri Lanka) |
| Senior Scientific Officer (Deputation) | : **Mohammad Masud Rana**<br>B. Sc. Ag.(Hons), M.S. (BAU) |
| Farm Supervisor | : **Vacant** |

## 3. DEPARTMENT OF PEST MANAGEMENT

| | |
|---|---|
| Chief Scientific Officer | : **Dr. Mohammad Ali**<br>B.Sc. (Hons), M.Sc. (CU), M.Sc. (Newcastle, UK)<br>PGD (India), Ph.D |

### A. ENTOMOLOGY DIVISION

| | |
|---|---|
| Senior Scientific Officer | : **Mohammad Shameem Al Mamun**<br>B.Sc.Ag. (Hons.), M.S. (BAU), PGD (India) |
| Scientific Officer | : **Shovon Kumar Paul**<br>B.Sc.Ag. (Hons.) (KU), M.S. (BSMRAU) |

### B. PLANT PATHOLOGY DIVISION

| | |
|---|---|
| Senior Scientific Officer | : **Mohammed Syeful Islam**<br>B.Sc.Ag., M.S. (BAU) |
| Scientific Officer | : **Md. Moshiur Rahman Akonda**<br>B.Sc.Ag. (Hons), M.S. (BAU) |
| Scientific Officer | : **Raihan Mujib Himel**<br>B.Sc.Ag. (Hons.), M.S. (BSMRAU) |

### TECHNOLOGY DIVISION

| | |
|---|---|
| Scientific Officer | : **Dulal Chandra Dey**<br>B.Sc. Engg. Mech. (BUET) |
| Senior Tea Maker | : **Md. Amir Ali**<br>B.Sc. (RU) |
| Assistant Engineer (Civil) | : **Sadeque Ahmed**<br>Dip-in-Engg. Civil, (Dhaka) |
| Foreman | : **Nazrul Islam Chaudhury**<br>Dip-in-Engg. Elect. (Sylhet) |

### STATISTICS & ECONOMICS DIVISION

| | |
|---|---|
| Principal Scientific Officer | : **Vacant** |

## BTRI SUB-STATION, FATIKCHARI, CHITTAGONG

Scientific Officer & Officer in-charge : **Md. Abul Kasem**
B.Sc. (Hons), M.Sc. (CU)

Senior Farm Assistant : **Ajit Chandra Choudhury**
B.A. (NU)

## BTRI SUB-STATION, KALITI, KULAURA

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Dip.-in-Agric. (Sherpur)

## BTRI REGIONAL STATION, PANCHAGARH

Senior Farm Assistant : **Md. Zayed Imam Siddique**
Dip.- in- Agric. (Rangpur)

## BILASHCHERRA EXPERIMENTAL FARM

Assistant Farm Superintendent : **Mohammad Sayadul Huq**
M.Sc (NU)

Farm Supervisor : **Md. Hossain Mahamud**
Dip.- in- Agric. (Dhaka)

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)

## LIBRARY & PUBLICATION

Librarian & Publication Officer : **Mohammad Kamal Uddin**
M. Sc. (RUD), M.S.S. (NU), LL.B (NU)
PGD in Lib. Sc. (Dhaka)

## RESEARCH

The increasing need of the tea industry prompted the institute to expand its field of research, advisory activities and infrastructure developments. To fulfill its objective, all the research divisions were organized by imparting specialised training to some scientists in different fields and procurement to modern equipment for the laboratory under BARC grant and BTB fund. During the year under report, a total of 49 experiments on different aspects of tea culture were in progress in different disciplines, research divisions during 2014. The salient 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. Effect of dolomitic lime on the yield of tea and soil properties has been undertaken. Experiments on fertilizer requirement of mature tea in the tea growing areas of Panchagar and Lalmonirhat Districts in the Northern Zone are being continued. The importance of organic fertilizers and its sources were also encompassed. 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 analysis. A total of 2499 soil, 118 fertilizer including lime samples were analyzed during 2014.

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 agrotypes, collection and preservation of germplasms of tea from home and exotic sources were continued.

Agronomy Division carried out researches on various cultural practices i.e. planting, pruning, tipping, plucking and related agro-techniques as well as determining ideal plant population, shade spacing, etc. Besides, this year, new experiments on the effect of some common shade plants on tea soil, water and yield of tea and its management of shade canopy for sustainable tea production in Bangladesh have been initiated.

Research of Entomology Division include screening of host preference of pests, susceptibility of tea clones for nematodes, studies on indigenous plant extracts, searching and identification of bio-control agents, standardization of pesticides against *Helopeltis*, red spider mites, termites, nematodes, aphids & flush worms and determination of residue level of pesticides in made tea of different tea agro-types. The Division also rendered all sorts of advisory services to tea estates on problems arising out of pests of tea and analyzed soil, water and cowdung for nematode count. The 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 and culture of major disease causing organisms of tea and ancillary crops, screening of different fungicides and herbicides, bio-ecology of disease causing organisms and integrated management of diseases and weeds, assessment of arbuscular mycorrhizal (AM) fungi in tea and tea associated plants. Determination of critical period of weed competition in young tea and evaluation of biofungicidal activities of some plant extracts against different foliar diseases of tea were the new areas of research of the division.

Normal manufacture of tea in the factory from the green leaves harvested from its Main station farm and Bilashcherra experimental farm and different experiments on the improvement of tea manufacturing technique were being conducted by Technology Division.

The supply of improved planting materials in the form of fresh as well as rooted cuttings and biclonal seeds was continued from BTRI and sub-stations during 2014. A total of 4,90,150 fresh cuttings, 20,953 rooted cuttings and 242 kg bi-clonal seeds were distributed to different tea estates in the year

2014. 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, two general tea tasting sessions were conducted for the tea planters to improve further the manufacturing of quality tea from the tea factories as a whole at BTRI Tea Tasting Room for Sylhet and one more in Chittagong Sub-station. In addition, Open Day Tea Tasting Sessions were also arranged in each of the four valley circle clubs.

## VISITS

Scientific personnel of the institute and sub-stations paid a total of 161 **e**xperimental and 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. Director, BTRI attended International Tea Symposium 2014 (ITS 2014)-Innovation and Development, held on 10-13 November 2014 Hangzhou, China.

## PUBLICATIONS

Circular no. 137 on Approved Insecticides, Miticides and Nematicides for Tea (Revised & Updated) was published in October 2014, Circular no. 138 on Approved Fungicides and Weedicides for Bangladesh tea (Revised & Updated) was published in October 2014. Annual Report 2013 was published in June 2014 and Tea Journal of Bangladesh, Volume 42, 2013 was published in March 2015.

## ANNUAL COURSE / SEMINAR / WORKSHOP

The 49th Annual course (6 day-duration) was held on 'Tea Culture' at the Institute for the covenanted staff of Tea Estates of greater Sylhet. Same courses were held at Chittagong and Panchagarh Sub-stations having two- day duration each. In these courses, Managers, Assistant Managers, Proprietors of different Tea Estates, small tea growers 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 staff of different Tea Estates during the period under report.

## OFFICIAL CORRESPONDENCE 2014

Total receipts - 2027
Total issues - 1068

## LIBRARY

BTRI Library contained 4,586 books and 9,020 Periodicals, Journals, Pamphlets and Circulars, Newsletter, Research highlights, etc.

**(Dr. Mainuddin Ahmed)**
Director

# SOIL SCIENCE DIVISION

**Abdul Qayyum Khan**
Principal Scientific Officer (In- charge)

## STAFF

There was no change in the personnel position of the division during the period under report.

## RESEARCH

A total of four experiments were conducted during the year. Progress of the experiments is given below:

### SS 1. Response of Organic manure and chemical fertilizer for maximize yield of tea

The long term (2012-2015) experiment has been undertaken to observe the performance of organic matter on different level in reducing the chemical fertilizer use at Bilashcherra Experimental Farm. Dolomitic lime and NPK were applied on the soil after a good shower, simultaneously organic matter (cow-dung) was also applied and mixed with the soil by light forking in two split doses. Usual cultural practices and pest control measures were taken as and when needed. Regular weekly plucking data were recorded during the plucking season. There are eight treatments in a Randomized Block Design with three replications. The unit plot size is 14.4 $m^2$ .The treatment combinations are given below:

$T_1$= Control
$T_2$= Recommended dose of chemical fertilizer (BTRI)
$T_3$= Organic manure (2t/ha)
$T_4$= Organic manure (6t/ha)
$T_5$= 85% of $T_2$+Organic manure (2t/ha)
$T_6$= 85% of $T_2$+Organic manure (6t/ha)
$T_7$= 70% of $T_2$+Organic manure (2t/ha)
$T_8$= 70% of $T_2$+Organic manure (6t/ha)

(Recommended Fertilizer dose: ($N^{100}$, $P^{35}$, $K^{60}$ kg/ha & $Zn^{10}$ 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 | 4.3 | 1.03 | 0.106 | 5.12 | 52.4 | 43.2 | 6.3 |
| Critical value | Sandy loam to Loam | 4.5-5.5 | 1.0 | 0.1 | 10 | 80 | 90 | 25 |

The result showed that, in every treatment increased yield was recorded over the control. The highest made tea yield (2864 kg/ha) was recorded in treatment $T_6$ where 85% of the recommended dose of chemical fertilizer and 6 t/ha organic manure were applied. The rate of increase over the control was 13.70% in case of treatment $T_6$. Only Organic manure showed lower yield except treatment T5. But use of Organic manure with 6t/ha with chemical fertilizer showed higher yield. So use of IPNS fertilizer dose has been positive effect in increase yield.

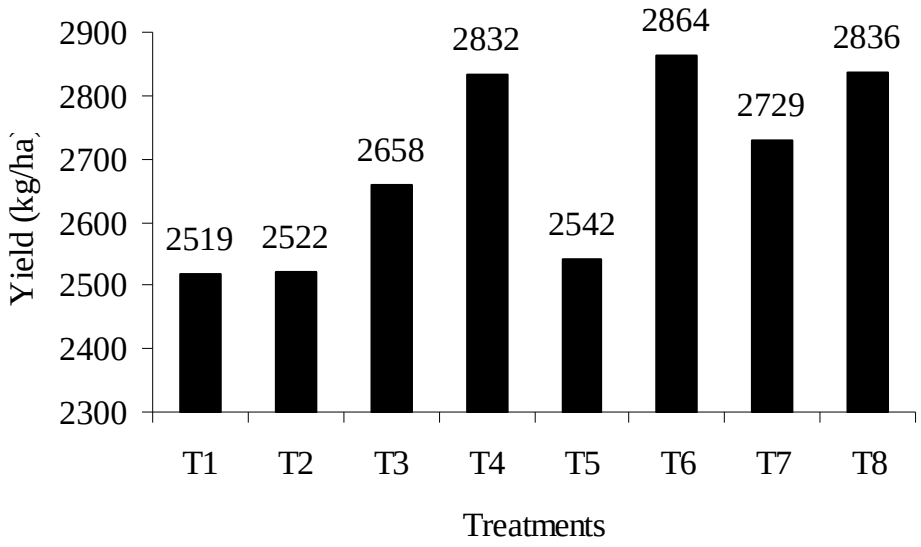


**Fig. 1: Effect of different treatments on the yield of tea (BEF)**

**SS 2. Studies on upgrading the present fertilizer recommendation**

A long term (2012-2015) experiment was initiated in 2012 to find out appropriate dose of chemical fertilizers for tea plantation with the change of soil environment on the basis of soil test based and crop production. The experiment was conducted at two locations- one at BTRI Farm and another at Srigobindpur T.E. Usual cultural operations and pest control measure were taken as and when needed. Fertilizer was applied in two split doses. The 1st dose was applied after a good shower of monsoon and the 2nd dose was applied in 1st week of August, 2014. Regular weekly harvesting data were recorded during the harvesting season. Each plot size is 35.60 $m^2$

Treatment combinations are as follows:

$T_1$= Control (without fertilizer)
$T_2$= $N^{40} + P^{5} + K^{30}$ (kg/ha)
$T_3$= $N^{50} + P^{10} + K^{35}$(kg/ha)
$T_4$= $N^{60} + P^{15} + K^{40}$(kg/ha)
$T_5$= $N^{70} + P^{20} + K^{45}$(kg/ha)
$T_6$= $N^{80} + P^{25} + K^{50}$(kg/ha)
$T_7$= $N^{90} + P^{30} + K^{55}$(kg/ha)

Zinc (10kg/ha) was applied as blanket dose at the time of split fertilizer application.
The result showed that, in every treatment increased yield was recorded over the control. The highest made tea yield (3429 kg/ha) was recorded in the treatment $T_7$ where $N_{90}$, $P_{30}$, $K_{55}$, and $Zn_{10\ kg/ha}$ were applied. The rate of increase over the control was 6.29% in case of treatment $T_7$. There was trend to increase yield with the increase of fertilizer dose.

**Table 2**. 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 |
|---|---|---|---|---|---|---|---|---|
| BTRI Farm PhD Plot | Sl | 4.1 | 1.09 | 0.11 | 3.33 | 25.0 | 46.6 | 7.5 |
| Srigobindpur T.E | SCl | 4.3 | 1.69 | 0.178 | 6.71 | 44.4 | 56.8 | 11.2 |
| Critical value | Sandy loam to Loam | 4.5-5.5 | 1.0 | 0.1 | 10 | 80 | 90 | 25 |

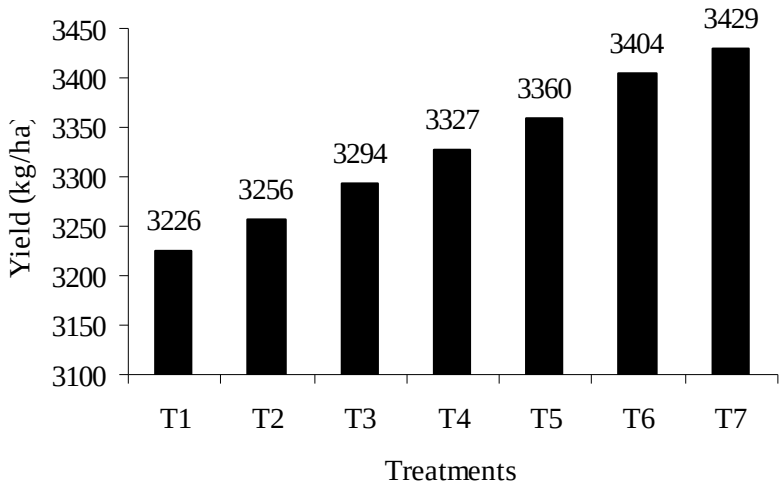


**Fig. 2: Effect of different fertilizer doses on the yield of tea (BTRI Farm, 2014)**

The result showed that, increase of yield was recorded in every treatment over the control. The highest made tea yield (793 kg/ha) was recorded in treatment $T_7$ where $N_{90}$, $P_{30}$, $K_{55}$, and $Zn_{10}$ were applied. The rate of increase over the control was 19.55% in case of treatment $T_7$. Similar trend was observed in yield as in BTRI farm but rate of increase not remarkable but yield was much lower than BTRI farm due to lower nutrient status in the soil.

Table 3. 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 |
|---|---|---|---|---|---|---|---|---|
| BTRI Farm A2 area | SCl | 4.3 | 1.34 | 0.10 | 5.95 | 33.0 | 87.46 | 23.40 |
| Critical value | Sandy loam to Loam | 4.5-5.5 | 1.0 | 0.1 | 10 | 80 | 90 | 25 |

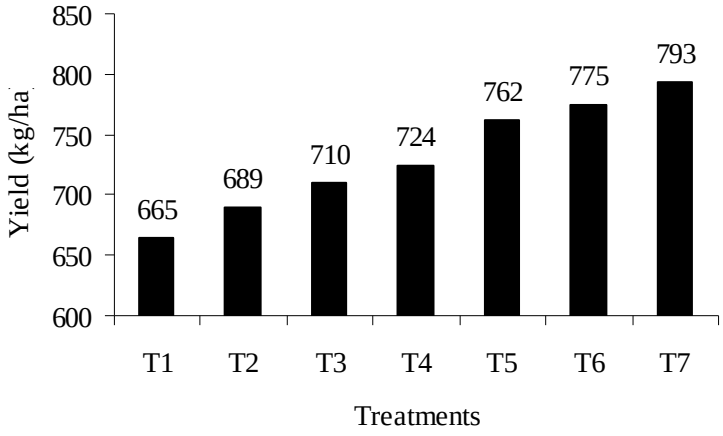


**Fig. 3: Effect of different fertilizer doses on the yield of tea (Srigobindpur T.E, 2014)**

**SS 3. Effect of single fertilizer dose on the yield of mature tea**

To estimate the effect of single fertilizer dose on the yield of mature tea, a long term (2014-2017) field experiment was conducted at BTRI Farm. The experiment was laid out in a RBD having four treatments and three replications. Fertilizer was applied in two split doses. The 1st dose was applied after a good shower of monsoon and the 2nd dose was applied in 1st week of August, 2014. Each plot size was 4.46 $m^2$. Usual cultural operations and pest control measure were taken as and when needed. Regular weekly harvesting data were recorded during the harvesting season. Treatment combinations are as follows:

$T_1$ = Control $T_2 = N^{130\ kg/ha}$
$T_3 = P^{35\ kg/ha}$ $T_4 = K^{90\ kg/ha}$

The result reveals that yield was increased over control in the treatment $T_2$ & $T_4$. But yield was decreased over control in the treatment $T_3$ which was (-) 4.34%. The highest yield (1277 kg/ha) was recorded in $T_2$ where 130 kg/ha nitrogen (N) was applied. The rate of increase was 3.99% over the control. It is noted that the yield was reduced in treatment T3 due to imbalanced fertilizer used. i.e. only P and K responses and almost similar yield to N only used. So, it may be concluded that only N, K effect was found positive but negative in case of phosphorus.

**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 | Av. Ca ppm | Av. Mg ppm |
|---|---|---|---|---|---|---|---|---|
| BTRI Farm $A_2$ area | SCl | 4.2 | 1.13 | 0.106 | 3.95 | 29.0 | 67.80 | 18.16 |
| Critical value | Sandy loam to Loam | 4.5-5.5 | 1.0 | 0.1 | 10 | 80 | 90 | 25 |

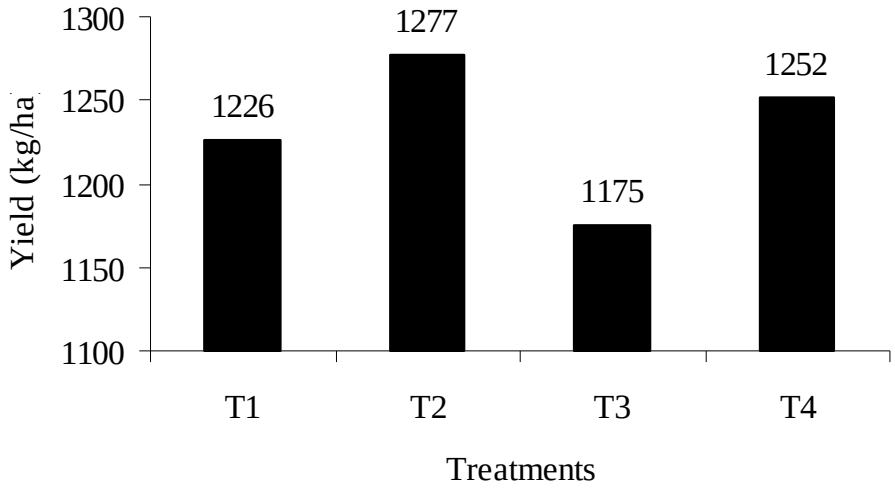


**Fig. 4: Effect of single fertilizer on the yield of tea during 2014**

**SS 4. Effect on growth and yield for rehabilitation of old tea soil before replanting**

The details of this experiment were presented by the Agronomy Division as it is a collaborative research program of Agronomy and Soil Science Division.

**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 and/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 2499 soil samples, 118 fertilizers and other samples from 85 tea estates were analyzed.

**Table 5.** Number of samples analyzed

| Year | Soil | Fertilizer | Lime/Dolomite | Water | Compost | Total (others) | (Soil & others) |
|---|---|---|---|---|---|---|---|
| 2014 | 2499 | 84 | 34 | - | - | 118 | 2617 |

**Table 6.** List of Tea Estates from where soil and other samples were received or collected and analyzed during the year 2014

| | | | | |
|---|---|---|---|---|
| Amo | Daragao | Jhemai | Marina | Rajnagar |
| Afjalia | Doloi | Junglebari | Mertinga | Rajghat |
| Ameenabad | Etah | Karimpur | M. R. Khan | Sagurnal |
| Amrail | Eco plantation | Kalikabari | New Samanbagh | Saif |
| Allynugger | Fyzabad | Kapnapahar | Neptune | Srigobindpur |
| Balisera | Fatehbagh | Khan | Nurjahan | Sathgao |
| Burjan | Foyaje | Kaiyacherra | Noyapara | Shumshernugger |
| Bidyabheel | Fotehpur | Luskerpore | Nalua | Surma |
| Brindaban | Gazipore | Lackatoorah | Oodalia | Silloah |
| Chaklapunji | Green Field | Luayuni-holicherra | Ootterbagh & Indanugger | Sonarupa |
| Chandpore | Horincherra | Lungla | Patrakhola | Tetulia |
| Clevedon | Hossainabad | Lubacherra | Phulbari | Udnacherra |
| Chandbagh | Hatimara | Malnicherra | Phulcherra | Zareen |
| Chandicherra | Hooglicherra | Madhupur | Pooteacherra | |
| Dhamai | Hafiz | Mazdehee | Phooltullah | |
| Dinarpur | Habibnagar | Mirzapore | Patharia | |
| Deanston | Jagcherra | Monipur | Rema | |
| Deundi | Julekhanagar | Madabpur | Rashidpur | |

**Advisory correspondence**

A total of 202 advisory letters to different tea estates on soil, fertilizers, dolomite, compost and other soil related aspects were sent during the year 2014.

**Tours**

During the year under report scientist of the division paid a total 40 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 organized by BTRI for the covenanted staff of tea estate during 2014. 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.

# BIOCHEMISTRY DIVISION

**Md. Imrul Hasan Chowdhury**
Scientific Officer

## STAFF

The posts of Principal Scientific Officer (PSO), Senior Scientific Officer (SSO), and Laboratory Helper (LO) were lying vacant during the period under report. There was no change in the personnel position of the division during the reporting year.

## RESEARCH

One experiment was carried out during the year of 2014 namely- Impacts of *Helopeltis* infestation on the biochemical parameters of tea leaves and black tea quality. The progress of the experiment is summarized below.

### Bio 1: Impacts of *Helopeltis* infestation on the biochemical parameters of tea leaves and black tea quality

Tea Mosquito Bug (TMB), *Helopeltis theivora* Waterhouse (Hemiptera: Miridae) is considered as the most notorious one among the available tea pests. It's activities have been increased in recent years and became a big threat to tea industry. Adults and nymphs punctures the plant tissues with needle like rostrum and suck the sap from buds, young leaves and tender stems. Punctures appear as reddish brown spots and due to intensive feeding, leaves curl up, badly deformed and remain small. Shoots dry up and crop loss is near total in response to severe incidence. Tea Mosquito Bug (TMB), laying eggs in the buds and tender stems leading to severe losses in crop yields to the tune of 7-15% and its management has also become the central problem for the planters. Apart from causing a considerable amount of crop loss in tea it also causes deterioration of quality in the prepared tea, leading to a lowering of its market value. In Bangladesh, due to increased drinking habit, domestic consumption has been rising to a noticeable extent. To keep pace with the increasing demand, there is no alternative of improving tea production and quality. Considering all the facts above, a study is undertaken to observe the effects of *Helopeltis* infestation on the physiological and biochemical parameters of tea leaves and quality.

#### Treatments

T1 = BT 2

#### Design of the experiment

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications.

#### Progress

Different biochemical parameters of fresh tea leaves and black tea contributing to the quality of tea were studied**.**

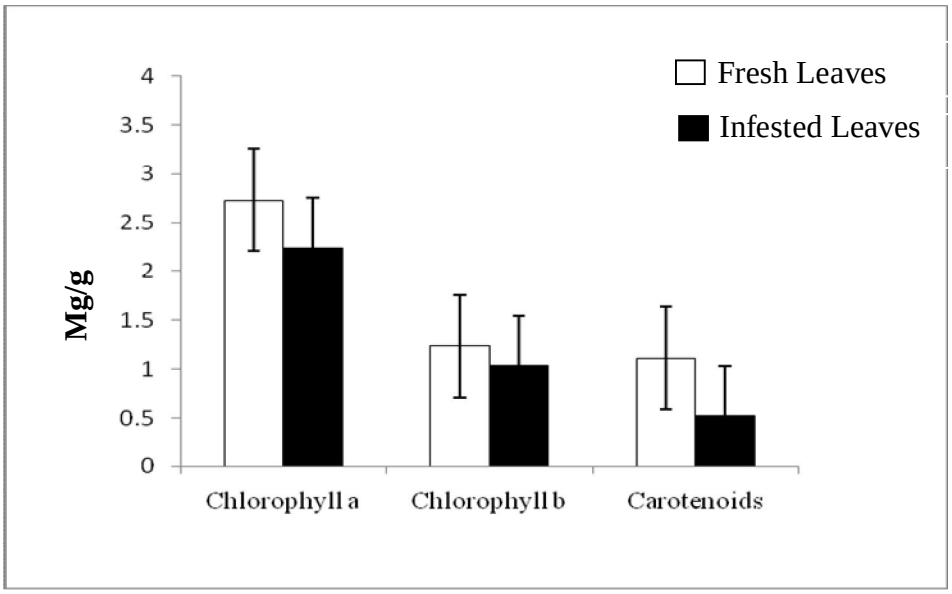


**Fig. 1**: Pigment variations between fresh and infested tea leaves

Biochemical parameters which are the determinants of black tea quality were also studied to have a clear indication of quality variations between fresh and *Helopeltis* infested black tea.

**Quality Parameters**

| Parameters | Normal Leaves | Infested Leaves |
|---|---|---|
| Theaflavin (%) | 0.651 | 0.612 |
| Thearubigin (%) | 6.562 | 6.098 |
| Total Liquor Color (TLC) | 2.47 | 2.30 |
| High Polymerised Substance (HPS) | 6.017 | 5.826 |
| Color Index (CI) | 5.177 | 5.136 |

**ISO Parameters**

| Parameters | Normal Leaves | Infested Leaves |
|---|---|---|
| Lipid (%) | 4.83 | 3.93 |
| Water extract (%) | 33.65 | 26.42 |
| Total Ash (%) | 5.54 | 6.07 |
| Water Soluble Ash (%) | 50.55 | 40.25 |
| Alkalinity of water soluble ash (g) | 1.30 | 2.04 |
| Acid insoluble ash (%) | 0.75 | 1.09 |
| Crude fiber content (%) | 6.42 | 10.38 |

From the accomplished experiment, it was observed that there was no significant impact of *Helopeltis* infestation on tea quality in comparison to the normal leaves and hence, the infested leaves can be used for manufacturing of black tea followed by consumption.

# BOTANY DIVISION

**Md. Ismail Hossain**
Principal Scientific Officer

## STAFF

Md. Abdul Aziz, Senior Scientific Officer was awarded Doctor of Philosophy (Ph.D.) degree on Plant Molecular Biology from the Institute of Biological Sciences (IBSc) of Rajshahi University. Ms. Shefali Boonerji, Scientific Officer joined the division on 1 January 2014 after completion of her deputation for Ph.D. course. Mr. Md. Abul Kashem, Scientific Officer transferred to Fatickchari Sub-station on 29 May 2014. Mr. Md. Mugahedul Islam joined the division as Laboratory Helper on 22 January 2014. The posts of one Scientific Officer and one Field Assistant were vacant. There was no other change in personnel position of the division during the period under report.

## RESEARCH

Twenty two experiments in four programme areas namely – preliminary selection of vegetative clones, long term yield and quality trial of provisionally selected clones, tea breeding and field performances of BTRI released clones were carried out by the division. Results are briefly described below:

### B1: PRELIMINARY SELECTION OF VEGETATIVE CLONES

**B1-27**: **Selection of Vegetative Clones at Shumshernugger T. E., Section Doublecherra-13 & Main Div. Sec. No. 9 (1993-2014)**

From the estate 21 new bushes were selected during the period under report besides previous selections. Newly selected bushes were pruned in order to collect cuttings. A total of 4945 cuttings from 26 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 (1993-2014)**

Twenty four 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 4889 cuttings from 27 bushes of section no. 8 of Amo Tea Estate were collected and planted in the nursery.

**B1-31: Selection of Vegetative Clones at Baraoorah T. E., Section No. 8 (2007-2014)**

Twenty two bushes have been selected during the period under report. The selected bushes have been pruned for collecting cuttings for rooting trial. A total of 1722 cuttings from 13 bushes of section no. 8 of Baraoorah Tea Estate were collected and planted in the nursery.

### B2: LONG TERM YIELD & QUALITY TRIAL OF PROVISIONALLY SELECTED CLONES

**B2-35: Yield and Quality Trial of Test clones Selected from Shumshernugger and Amo T. Es., Test clones Sh/D/11/313, A/8/8, A/17/7 and A/22/39 against Control BT1 (BTRI, 1996-2014)**

The plants of this trial were light pruned at 68 cm in 2014. There were 30 plucking rounds in 2014. The yield data were analyzed and found insignificant treatment difference which presented in table 1 and made tea production in kg/ha in Fig.1.

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

| Clone | Year | SH/D/11/313 | A/8/8 | A/17/7 | A/22/39 | TV1 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 764.0 | 766.0 | 811.0 | 752.0 | 708.0 |

Treatment difference- Insignificant

The statistical analyses reveal that all the test clones are comparable in the case of yield with the Control TV1. The estimated made tea production in kg/ha is presented in Fig.1. The cup qualities of all the test clones were assessed organoleptically and the average values of the scores are presented in table 2.

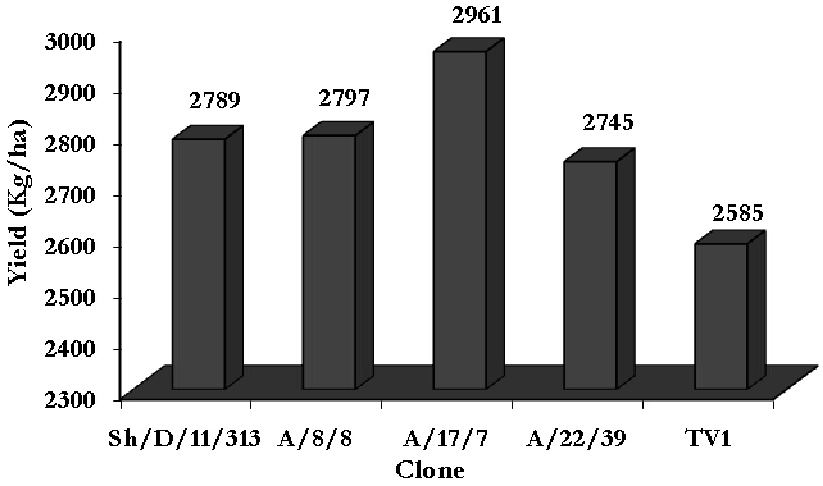


Fig. 1 Comparative yield of clones (made tea kg/ha).

**Table 2.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| SH/D/11/313 | 7.40 | 7.71 | 7.31 | 7.36 | 2.78 | 32.56 | AA |
| A/8/8 | 7.52 | 7.56 | 7.27 | 7.35 | 2.82 | 32.52 | AA |
| A/17/7 | 7.54 | 7.72 | 7.44 | 7.34 | 2.84 | 32.88 | AA |
| A/22/39 | 7.46 | 7.55 | 7.37 | 7.44 | 2.78 | 32.60 | AA |
| TV1 | 7.77 | 7.82 | 7.72 | 7.78 | 3.15 | 34.24 | E |

The test clones are above average while the Control is excellent in terms of quality.

**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, 1996-2014)**

The plants of this trial were light pruned at 68 cm in 2014. There were 26 plucking rounds in 2014. The yield data were analyzed and presented in table 3 and the estimated made tea production in kg/ha in Fig. 2.

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

| Clone | Year | A/8/01 | A/17/22 | A/22/27 | A/22/40 | BT1 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 563.5 | 530.08 | 433.3 | 681.0 | 616.6 |

Treatment difference: 2014- LSD at 5% =77.35

The analytical results reveal that yield difference was significant in 2014; test clone A/22/40 gave significantly higher yield over the control BT1 while test clone A/8/01 yielded similar with the control and test clones A/17/22 & A/22/27 yielded lower with the control. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 4.

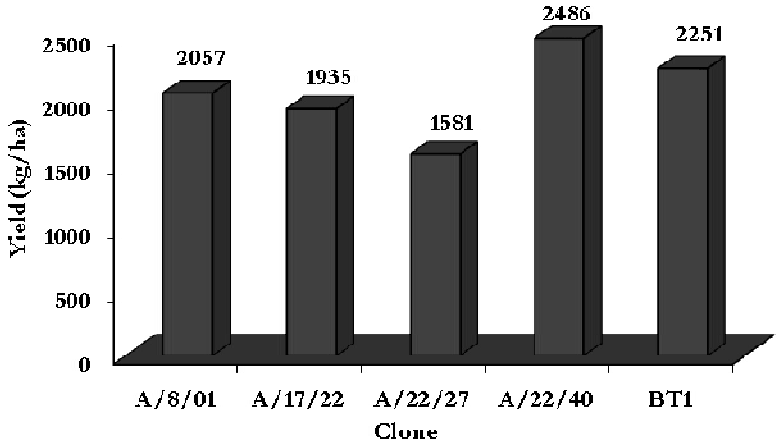

Fig. 2 Comparative yield of clones (made tea kg/ha).

**Table 4.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| A/8/01 | 7.02 | 7.09 | 7.20 | 7.37 | 2.30 | 31.08 | A |
| A/17/22 | 7.54 | 7.53 | 7.44 | 7.54 | 2.79 | 32.84 | AA |
| A/22/27 | 7.69 | 7.53 | 7.42 | 7.40 | 2.70 | 32.74 | AA |
| A/22/40 | 7.55 | 7.55 | 7.45 | 7.40 | 2.89 | 32.84 | AA |
| BT1 | 7.54 | 7.71 | 7.47 | 7.42 | 2.92 | 33.16 | AA |

All the test clones were comparable with the control BT1 in case of quality while test clone A/8/01 was inferior in cup than the 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, 1997-2014)**

The plants of this trial were light skiffed at 81 cm in 2014. There were 23 plucking rounds in 2014. The yield data were analyzed and presented in table 5 and made tea production in kg/ha is presented in Fig. 3.

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

| Clone | Year | CHA/J1/10 | Sh/B/6/59 | Sh/B/6/62 | A/8/24 | BT2 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 616.14 | 660.36 | 592.02 | 603.5 | 844.03 |

Treatment difference-Insignificant

The analytical results reveal that yield difference was not significant in 2014; all test clones were comparable with the control BT2. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 6.

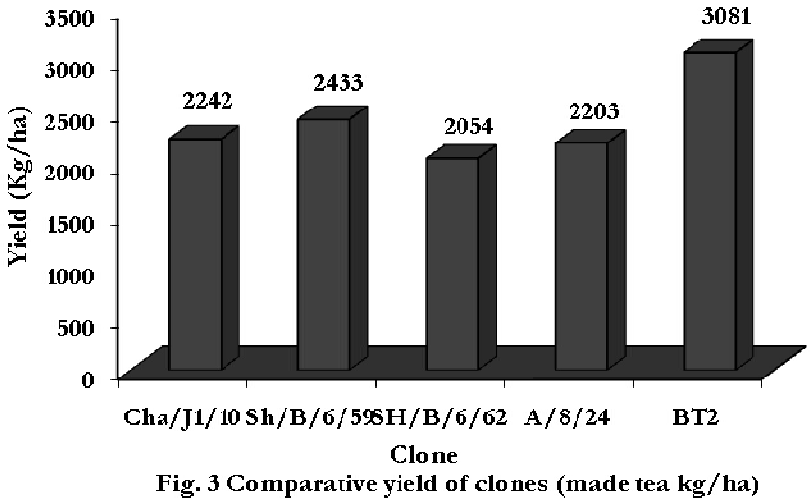


**Fig. 3 Comparative yield of clones (made tea kg/ha)**

**Table 6.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| CHA/J1/10 | 7.69 | 7.34 | 7.39 | 7.41 | 2.82 | 32.55 | AA |
| Sh/B/6/59 | 7.41 | 7.48 | 7.28 | 7.55 | 2.77 | 32.62 | AA |
| Sh/B/6/62 | 7.36 | 7.38 | 7.86 | 7.74 | 2.89 | 33.46 | AA |
| A/8/24 | 7.29 | 7.37 | 7.51 | 7.22 | 2.71 | 32.09 | AA |
| BT2 | 7.51 | 7.62 | 7.38 | 7.23 | 2.92 | 32.70 | AA |

All the test clones have got comparable cup quality with test clone BT2 excepting the test clones unique flavoury character.

**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, 1998-2014)**

The plants of this trial were medium skiffed at 79 cm in 2014. There were 22 plucking rounds in 2014. The yield data were analyzed and presented in table 7 and the estimated made tea production in kg/ha in Fig. 4.

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

| Clone | Year | Sh/B/6/36 | Sh/B/6/38 | Sh/B/6/55 | Sh/B/6/67 | BT1 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 537.83 | 643.09 | 598.04 | 546.86 | 868.3 |

Treatment difference- Insignificant.

The analytical results reveal that yield different was insignificant in 2014. The cup quality of made tea for all the test clones were assessed organoleptically and average scores are presented in table 8.

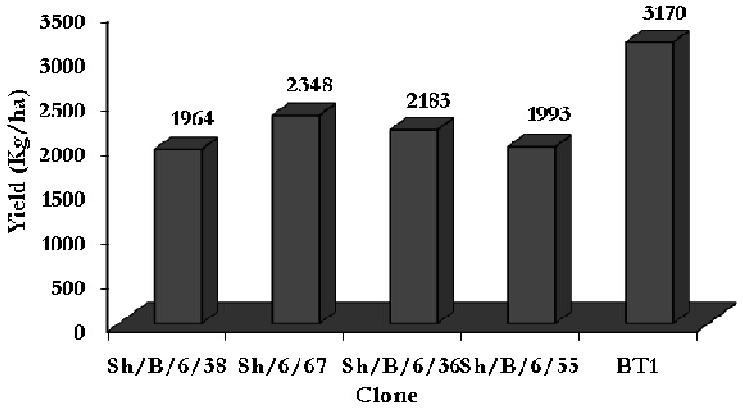


Fig. 4 Comparative yield of clones (made tea kg/ha)

**Table 8.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| Sh/B/6/36 | 7.13 | 7.33 | 7.97 | 7.26 | 2.92 | 32.61 | AA |
| Sh/B/6/38 | 7.37 | 7.42 | 7.58 | 7.36 | 2.77 | 32.50 | AA |
| h/B/6/55 | 7.13 | 7.13 | 7.02 | 7.16 | 2.80 | 31.24 | A |
| Sh/B/6/67 | 7.77 | 7.41 | 7.15 | 7.37 | 2.82 | 32.52 | AA |
| BT1 | 7.26 | 7.41 | 7.54 | 7.34 | 2.96 | 32.51 | AA |

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, 2000-2014)**

The plants of this trial were light pruned at 64 cm in 2014. There were 31 plucking rounds in 2014. The yield data were analyzed and presented in table 9 and the estimated made tea production in kg/ha in Fig. 5.

**Table 9.** Yield of green leaves (g/plant)

| Clone | Year | MZ/39 | E/4 | D/13 | B2T1 | BR2/97 | SDL/1 | BT2 |
|---|---|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 801.48 | 623.72 | 399.43 | 700.56 | 601.49 | 618.75 | 612.33 |

Treatment difference- LSD at 5% =124.39

The analytical results reveal that yield difference was highly significant in 2014. Test clones MZ/39 and B2T1 gave higher yield over control, while the test clones SDL/1 and BR2/97 are comparable with the Control BT2, the rest of the test clones performed lower yield than the control. The cup quality of made tea for all the test clones were assessed through organoleptic test and the average scores are presented in table 10.

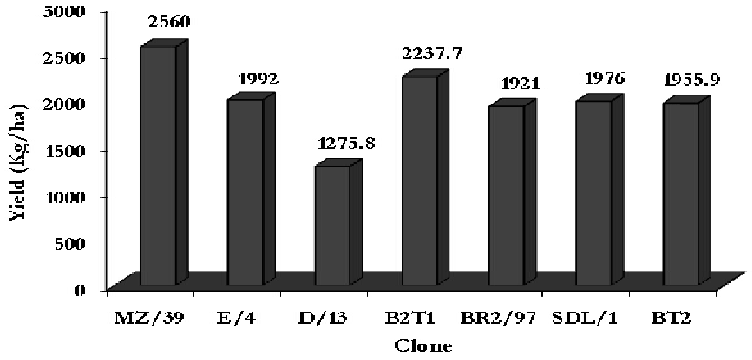


Fig. 5 Comparative yield of clones (made tea kg/ha)

**Table 10.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| MZ/39 | 7.43 | 7.49 | 7.53 | 7.44 | 2.69 | 32.58 | AA |
| E/4 | 7.52 | 7.70 | 7.44 | 7.38 | 2.62 | 32.66 | AA |
| D/13 | 7.60 | 7.52 | 7.40 | 7.42 | 2.83 | 33.77 | AA |
| B2T1 | 7.38 | 7.49 | 7.40 | 7.38 | 2.71 | 32.75 | AA |
| BR2/97 | 7.64 | 7.41 | 7.47 | 7.46 | 2.77 | 32.75 | AA |
| SDL/1 | 7.31 | 7.51 | 7.47 | 7.32 | 2.57 | 32.75 | AA |
| BT2 | 7.44 | 7.52 | 7.48 | 7.36 | 2.70 | 32.40 | AA |

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, 2000-2014)**

The plants of this trial were light pruned at 64 cm in 2014. There were 30 plucking rounds in 2014. The yield data were analyzed and presented in table 11 and made tea production in kg/ha is presented in Fig. 6.

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

| Clone | Year | A/8/37 | A/8/55 | A/8/62 | A/8/66 | BT2 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 720.95 | 486.96 | 422.46 | 678.43 | 632.87 |

Treatment difference- LSD at 5% = 123.61

The analytical results reveal that yield difference was significant in 2014; the yield potential of the Test clones A/8/37 and A/8/66 were comparable to the Control BT2 while remaining two is performed lower yield. The cup qualities of made tea for all the test clones were assessed through organoleptic test. The average scores are presented in Table 12.

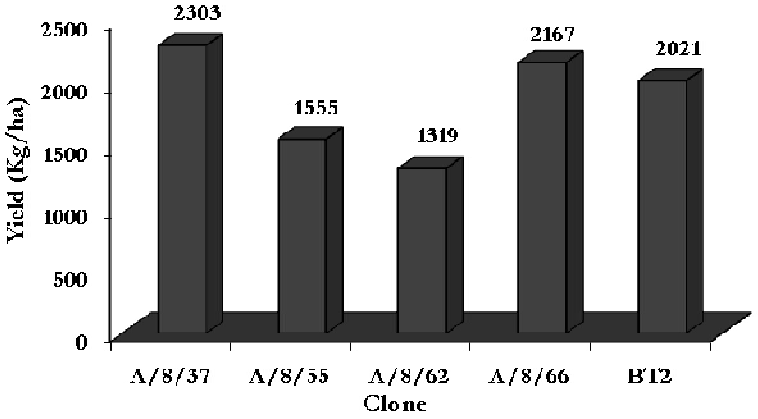


**Fig. 6 Comparative yield of clones (made tea kg/ha)**

**Table 12**. Quality scores

| Clone | Infusion | Liquor colour | Brisknes s | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| A/8/37 | 7.54 | 7.41 | 7.77 | 7.66 | 2.83 | 33.21 | AA |
| A/8/55 | 7.30 | 7.33 | 7.26 | 7.28 | 2.22 | 31.39 | A |
| A/8/62 | 7.19 | 7.35 | 7.48 | 7.21 | 2.62 | 31.85 | A |
| A/8/66 | 7.51 | 7.53 | 7.38 | 7.45 | 2.77 | 32.64 | AA |
| BT2 | 7.53 | 7.73 | 7.35 | 7.35 | 2.64 | 32.30 | AA |

Test clones A/8/37 and A/8/66 were comparable in terms of cup quality while A/8/55 & A/8/62 were 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, 2001-2014)**

The plants of this trial were light skiffed at 79 cm in 2014. There were 28 plucking rounds in 2014. The yield data were analyzed and presented in table 13 and made tea production in kg/ha in Fig. 7.

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

| Clone | Year | A/17/16 | Ph/9/1 | Ph/9/9 | Sh/B/6/46 | BT1 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 855.66 | 606.67 | 684.77 | 790.11 | 831.54 |

Treatment difference- Insignificant

The analytical results reveal that yield difference was significant in 2014; all the test clones were comparable in terms of yield with the Control BT1. The cup qualities of made tea for all the test clones were assessed organoleptically and the average scores are shown in table 14.

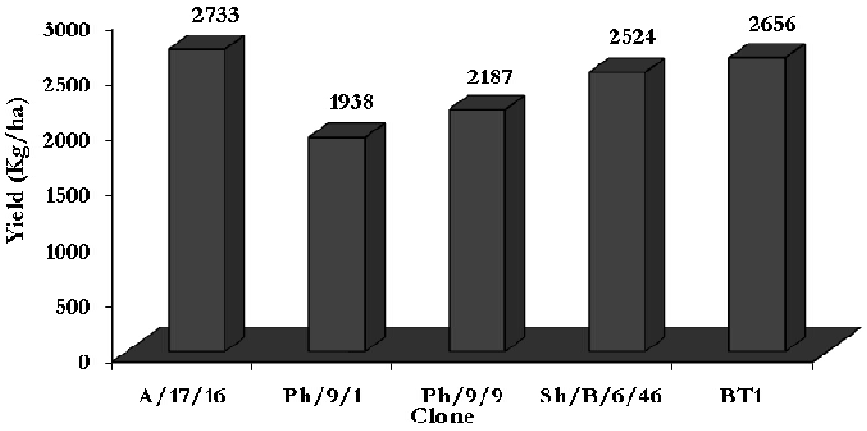


Fig. 7 Comparative yield of clones (made tea kg/ha)

**Table 14.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| A/17/16 | 7.30 | 7.36 | 7.31 | 7.32 | 2.87 | 32.16 | AA |
| Ph/9/1 | 7.31 | 7.28 | 7.27 | 7.21 | 2.52 | 31.59 | A |
| Ph/9/9 | 7.44 | 7.57 | 7.62 | 7.32 | 2.55 | 32.50 | AA |
| Sh/B/6/46 | 7.46 | 7.37 | 7.48 | 7.26 | 2.78 | 32.35 | AA |
| BT1 | 7.44 | 7.65 | 7.80 | 7.37 | 2.92 | 33.18 | AA |

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, 2001-2014)**

The plants of this trial were light skiffed at 79 cm in 2014. There were 31 plucking rounds in 2014. The yield data were analyzed and presented in table 15 and made tea production in kg/ha in Fig. 8.

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

| Clone | Year | Ph/9/4 | Ph/9/25 | Ph/9/40 | BS/67 | BT5 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 974.52 | 791.46 | 1002.28 | 934.87 | 1049.21 |

Treatment difference- LSD at 5% =168.93

The statistical results reveal that yield difference was significant in 2014 all the test clones excepting Ph/9/25 are comparable in terms of yield with the control. The yield performance of test clone Ph/9/25 was lower than the control BT5. The cup qualities of made tea for all the test clones were assessed through organoleptic test. The average scores are presented in table 16.

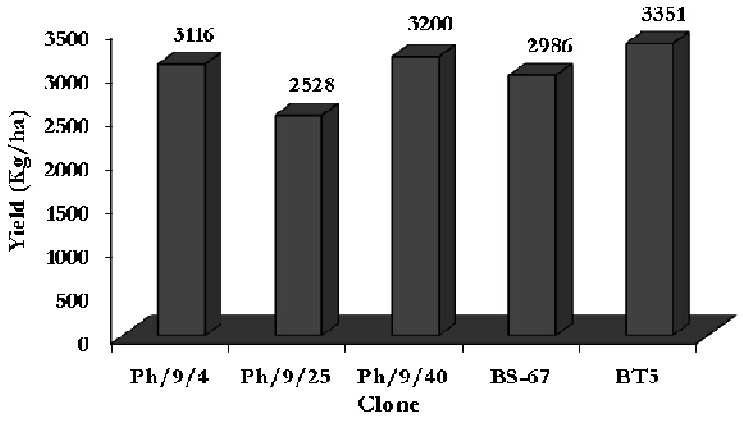


Fig. 8 Comparative yield of clones (made tea kg/ha)

**Table 16.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| Ph/9/4 | 7.25 | 7.58 | 7.60 | 7.45 | 2.86 | 32.74 | AA |
| Ph/9/25 | 7.27 | 7.55 | 7.34 | 7.50 | 2.45 | 32.11 | AA |
| Ph/9/40 | 7.41 | 7.23 | 7.19 | 7.15 | 2.67 | 31.65 | A |
| BS/67 | 7.56 | 7.60 | 7.58 | 7.51 | 2.80 | 33.05 | AA |
| BT5 | 7.62 | 7.37 | 7.54 | 7.47 | 2.66 | 32.88 | AA |

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, 2003-2014)**

The plants of this trial were deep skiffed at 69 cm in 2014. There were 21 plucking rounds in 2014. The yield data were analyzed and presented in table 17 and made tea production in kg/ha in Fig.9.

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

| Clone | Year | A/8B/1 | Ph/9B/1 | Ph/9/11 | BT1 |
|---|---|---|---|---|---|
| Treatment mean | 2014 | 878.35 | 982.99 | 980.85 | 978.87 |

Treatment difference- Insignificant

The analytical results reveal that yield difference was insignificant in 2014. All the test clones gave similar yield with the control BT1. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 18.

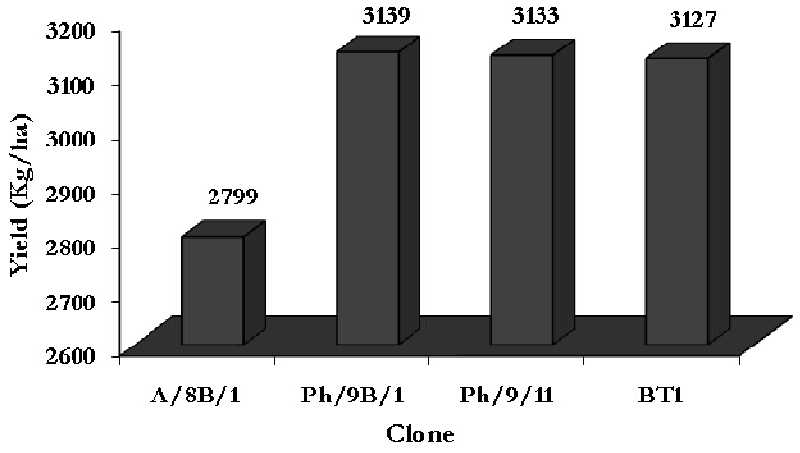


**Fig. 9 Comparative yield of clones (made tea kg/ha)**

**Table 18.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| A/8B/1 | 7.02 | 7.71 | 7.35 | 7.13 | 2.28 | 31.49 | A |
| Ph/9B/1 | 7.39 | 7.49 | 7.51 | 7.55 | 2.74 | 32.68 | AA |
| Ph/9/11 | 7.69 | 7.36 | 7.29 | 7.31 | 2.90 | 32.55 | AA |
| BT1 | 7.73 | 7.64 | 7.69 | 7.41 | 2.86 | 33.33 | AA |

All the test clones were comparable in terms of cup quality with the control BT1 excepting A/8/B/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, 2005-2015)**

The plants of this trial were light skiffed at 74 cm in 2014. There were 22 plucking rounds in 2014. The yield data were analyzed and presented in table-19 and made tea production in kg/ha in Fig. 10.

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

| Clone | Year | Ph/9/68A | Sh/D/11/18 | A/8/61 | SC/12/28 | BT2 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 671.7 | 349.02 | 621.42 | 681.69 | 783.49 |

Treatment difference- LSD at 1% = 221.86

The analytical results reveal that yield difference was highly significant in 2014; test clones SC/12/28, A/8/61 and Ph/9/68A comparable with the Control BT2, while Sh/D/11/18 gave lower yield than the Control BT2. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 20.

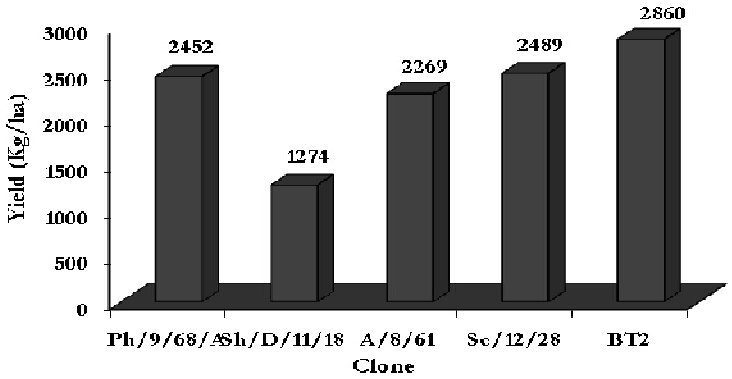


Fig. 10 Comparative yield of clones (made tea kg/ha)

**Table 20.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| A/8/61 | 7.34 | 7.30 | 7.55 | 7.42 | 2.89 | 32.50 | AA |
| Ph/9/68A | 7.50 | 7.44 | 7.65 | 7.32 | 2.63 | 32.80 | AA |
| Sh/D/11/18 | 7.25 | 7.44 | 7.71 | 7.33 | 2.77 | 32.50 | AA |
| SC/12/28 | 7.15 | 7.01 | 7.16 | 7.30 | 2.81 | 31.43 | A |
| BT2 | 7.53 | 7.45 | 7.66 | 7.72 | 2.70 | 33.08 | AA |

All the test clones excepting SC/12/28 were comparable in cup. The test clone SC/12/28 was inferior to the control 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, 2005-2015)**

The plants of this trial were light skiffed at 74 cm in 2014. There were 22 plucking rounds in 2014. The yield data were analyzed and presented in table-21 and made tea production in kg/ha in Fig. 11.

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

| Clone | Year | D1/18 | D/6 | D/10 | D/12 | BT5 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 956.68 | 552.97 | 734.69 | 833.46 | 1148.17 |

Treatment difference- LSD at 5% = 339.11

The analytical results reveal that yield difference was significant in 2014; the yield potential of the test clones D1/18 and D/12 were comparable to the control BT5. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 22.

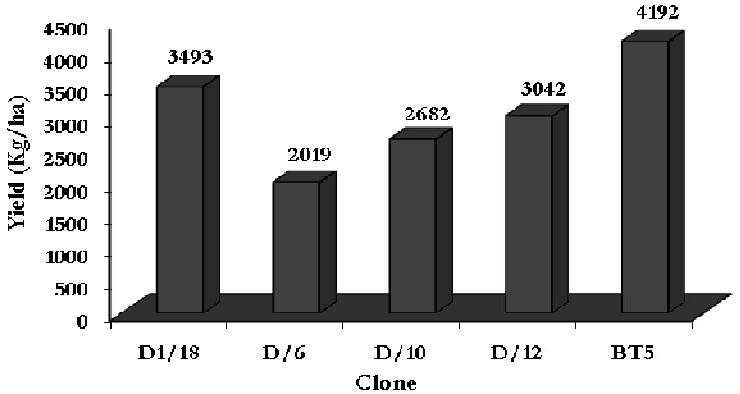

Fig. 11 Comparative yield of clones (made tea kg/ha)

**Table 22**. Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| D1/18 | 7.71 | 7.39 | 7.62 | 7.55 | 2.79 | 33.06 | AA |
| D/6 | 7.55 | 7.34 | 7.65 | 7.77 | 2.82 | 33.13 | AA |
| D/10 | 7.15 | 7.55 | 7.34 | 7.66 | 2.65 | 32.35 | AA |
| D/12 | 7.22 | 7.17 | 7.29 | 7.27 | 2.30 | 31.25 | A |
| BT5 | 7.19 | 7.28 | 7.63 | 7.43 | 2.78 | 32.31 | AA |

Test clones D1/18, D/6 and D/10 are comparable with the control while the remaining 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, 2006-2016)**

The plants of this trial were medium skiffed at 74 cm in 2014. There were 20 plucking rounds in 2014. The yield data were analyzed and presented in table 23 and made tea production in kg/ha in Fig. 12.

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

| Clone | Year | Ph/9/92 | BS/3 | Ph/9/108 | G/61/8 | BT15 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 606.3 | 630.95 | 496.86 | 593.8 | 570.10 |

Treatment difference- Insignificant

The analytical results reveal that yield difference was not significant in 2014; the performances of all the test clones were similar with the control BT15. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 24.

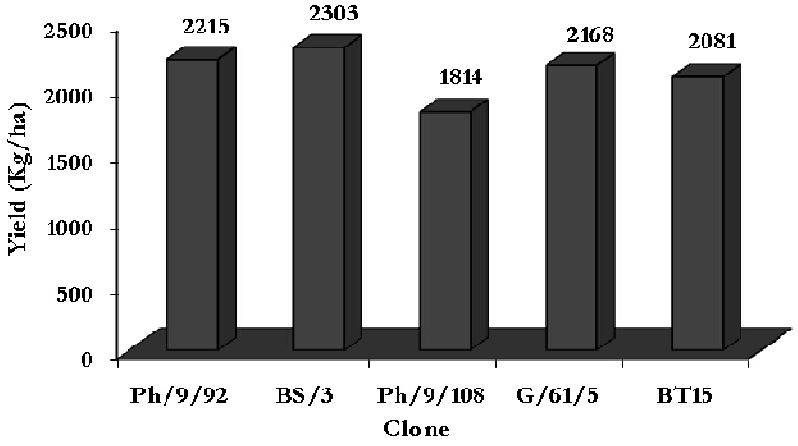


Fig. 12 Comparative yield of clones (made tea kg/ha)

**Table 24.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| Ph/9/92 | 7.65 | 7.33 | 7.55 | 7.41 | 2.79 | 32.73 | AA |
| BS/3 | 7.25 | 7.41 | 7.21 | 7.12 | 2.30 | 31.29 | A |
| Ph/9/108 | 7.50 | 7.66 | 7.36 | 7.52 | 2.81 | 32.85 | AA |
| G/61/5 | 7.44 | 7.61 | 7.69 | 7.71 | 2.88 | 33.33 | AA |
| BT15 | 7.85 | 7.79 | 7.85 | 7.72 | 3.50 | 34.71 | E |

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

**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 A/11/38 against Standard BT2 (BTRI, 2009-2019)**

The plants of this trial were pruned for bush formation (first formative pruning) at 45cm in 2014. There were 12 plucking rounds in 2014. The yield data were analyzed and presented in table 25 and made tea production in kg/ha in Fig. 13.

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

| Clone | Year | A/8/124 | Sh/10/2 | A/8/125 | A/11/38 | BT2 |
|---|---|---|---|---|---|---|
| Treatment mean | 2013 | 326.83 | 585.0 | 372.75 | 448.79 | 710.72 |

Treatment difference: 2014- Insignificant

The analytical results reveal that yield difference was not significant in 2014; all the test clones gave similar yield with the control BT2. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 26.

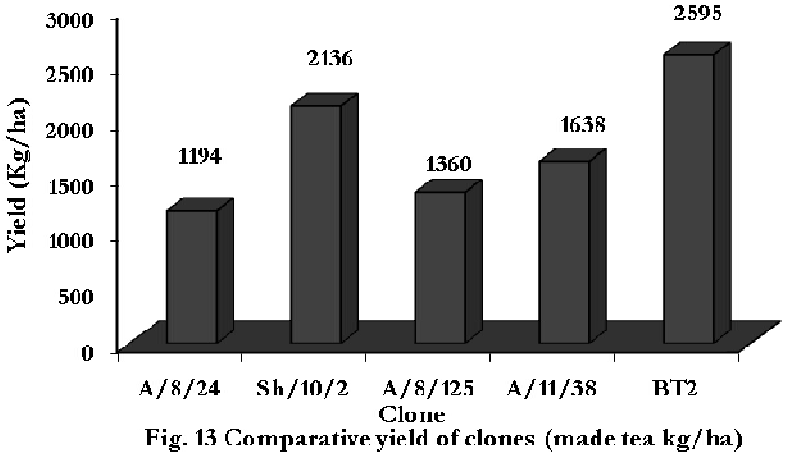

Fig. 13 Comparative yield of clones (made tea kg/ha)

**Table 26.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| A/8/124 | 7.44 | 7.55 | 7.39 | 7.46 | 2.88 | 32.72 | AA |
| Sh/10/2 | 7.39 | 7.65 | 7.77 | 7.38 | 2.83 | 33.02 | AA |
| A/8/125 | 7.57 | 7.59 | 7.80 | 7.33 | 2.79 | 33.08 | AA |
| A/11/38 | 7.53 | 7.18 | 7.26 | 7.55 | 2.86 | 32.39 | AA |
| BT2 | 7.55 | 7.69 | 7.45 | 7.69 | 2.78 | 33.16 | AA |

All the test clones were similar 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/13/4and Amo T. Es. Test clones – A/8/128, BS/91/6, against Standard BT2 (BTRI, 2011-2019)**

The experiment was initiated in May 2011 at BTRI Farm under Latin Square Design with 105cm x 60cm spacing. Normal cultural practices were followed. The plants were pruned at 45 cm in 2014 and tipping were done at 55 cm. The yield data were analyzed and presented in table 27 and made tea production in kg/ha. in Fig.14.

**Table 27.** Yield of green leaves (g/plant)

| Clone | Year | Sh/D/13/4 | BS/91/6 | Sh/10/5 | A/8/128 | BT2 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 307.38 | 276.85 | 267.4 | 432.46 | 412.58 |

Treatment difference- Insignificant

The analytical results reveal that yield difference was not significant in 2014; all the test clones gave similar yield with the control BT2. The cup quality of made tea for all the test clones was assessed through organoleptic test. The average scores are shown in table 28

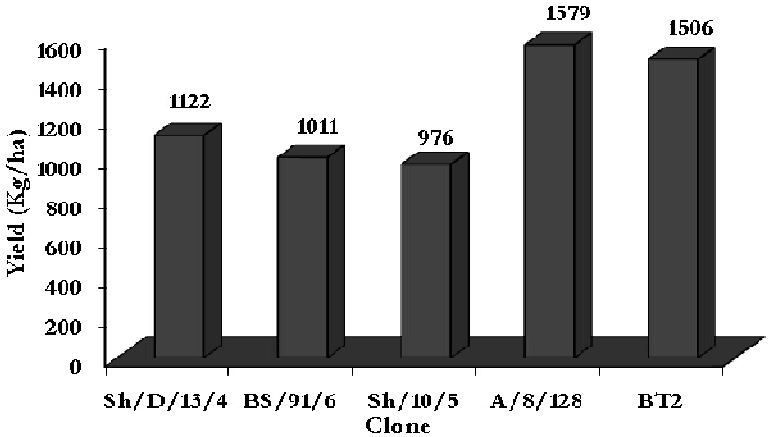

Fig. 14 Comparative yield of clones (made tea kg/ha)

Table 28. Quality scores

| Clone | Infusion | Liquor colour | Brisknes s | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| Sh/D/13/4 | 7.34 | 7.37 | 7.35 | 7.89 | 2.70 | 32.65 | AA |
| BS/91/6 | 7.38 | 7.41 | 7.36 | 7.31 | 2.77 | 32.23 | AA |
| Sh/10/5 | 7.49 | 7.73 | 7.56 | 7.36 | 2.78 | 32.92 | AA |
| A/8/128 | 7.46 | 7.45 | 7.37 | 7.24 | 2.76 | 32.28 | AA |
| BT2 | 7.56 | 7.34 | 7.34 | 7.46 | 2.81 | 32.51 | AA |

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

**B) Programme Area B3: *No. of Experiments- 5***

**Breeding of Tea**

**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 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.

**Hybridization between the following parents was done in 2014:**

BT4 X TV23, TV23 X BT4, BT6 X TV23, TV23 X BT6, BT1 X BT2, TV18 X BT2. The plants raised from earlier crosses are being preserved in Germplasm Bank. Yield, quality and other performance criteria of the progeny are being recorded.

**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 (TV 18 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, 1999-2014)**

The plants of this trial were medium skiffed at 79 cm in 2014. There were 31 plucking rounds in 2014. The yield data were analyzed and presented in table-29 and made tea production in kg/ha in Fig. 15.

**Table 29.** Yield of green leaves (g/plant)

| Clone | Year | BT1 | BTS1 | PBS | ANPS | T18B3 |
|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 838.85 | 901.31 | 806.6 | 779.34 | 943.32 |

Treatment difference: 2014- Insignificant

The analytical results reveal that there was no significant yield difference between the biclonal seed stocks. All the biclonal stocks were comparable with the Control BT1. The cup quality of made tea for all the treatments was assessed through organoleptic test. The average scores are shown in table 30.

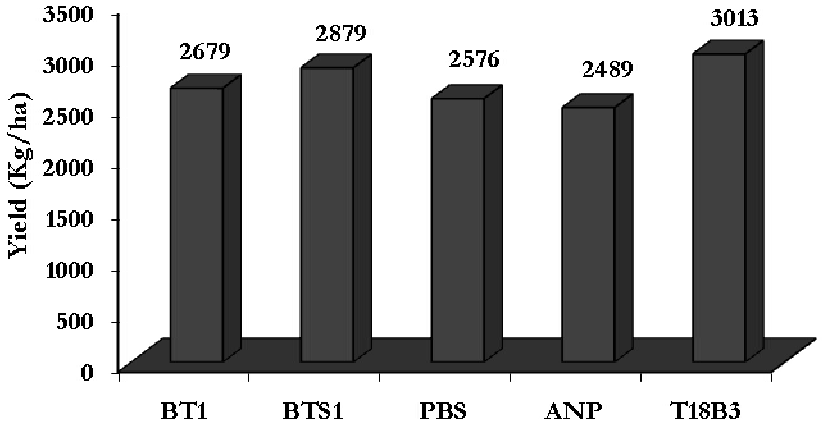


Fig. 15 Comparative yield of clones (made tea kg/ha)

**Table 30.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| BT1 | 7.45 | 7.66 | 7.39 | 7.69 | 2.84 | 33.03 | AA |
| BTS1 | 7.44 | 7.53 | 7.67 | 7.35 | 2.88 | 32.87 | AA |
| PBS | 7.11 | 7.16 | 7.23 | 7.31 | 2.87 | 31.68 | A |
| ANPS | 7.56 | 7.63 | 7.31 | 7.47 | 2.89 | 32.86 | A |
| T18B3 | 7.66 | 7.65 | 7.57 | 7.55 | 2.84 | 33.27 | AA |

The biclonal BTS1 and T18B3 are comparable in cup with the Control clone BT1 while the remaining two are inferior to the control.

### B3-1.9: Comparative Trial of 4 Biclonal Seed Stocks (BTS1, BTS3, TV18 × BT3 & TS463) and 3 Parental Clones (BT1, TV1 & TV19) (2002-2014)

The plants of this trial were medium skiffed at 74 cm in 2014. There were 26 plucking rounds in 2014. The yield data were analyzed and presented in table 31 and made tea production in kg/ha in Fig.15.

**Table 31.** Yield of green leaves (g/plant)

| Clone | Year | BTS1 | BTS3 | TV18 × BT3 | TS463 | BT1 | TV1 | TV19 |
|---|---|---|---|---|---|---|---|---|
| Treatment mean | 2014 | 989.1 | 1125.11 | 1005.45 | 1083.6 | 1080.9 | 1429.07 | 1223.15 |

Treatment difference: 2014- Insignificant

The statistical results reveal that there was no significant yield difference between the seedling jats. All the biclonal progenies were comparable with the parent-lines. The cup quality of made tea for all the treatments was assessed through organoleptic test.

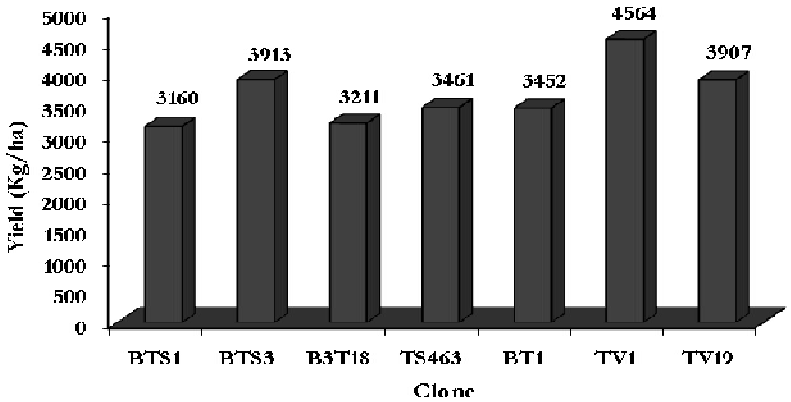


Fig. 16 Comparative yield of clones (made tea kg/ha)

**Table 32.** Quality scores

| Clone | Infusion | Liquor colour | Briskness | Strength | Creaming down | Total | Remarks |
|---|---|---|---|---|---|---|---|
| | 10 | 10 | 10 | 10 | 10 | 50 | |
| BTS1 | 7.32 | 7.61 | 7.49 | 7.61 | 2.93 | 32.96 | AA |
| BTS3 | 7.34 | 7.15 | 7.12 | 7.51 | 2.69 | 31.81 | A |
| TV18 × BT3 | 7.43 | 7.39 | 7.18 | 7.59 | 2.76 | 32.36 | AA |
| TS463 | 7.61 | 7.38 | 7.42 | 7.34 | 2.78 | 32.53 | AA |
| BT1 | 7.29 | 7.35 | 7.34 | 7.45 | 2.79 | 32.22 | AA |
| TV1 | 7.51 | 7.31 | 7.53 | 7.61 | 2.89 | 32.85 | AA |
| TV19 | 7.39 | 7.32 | 7.51 | 7.47 | 2.79 | 32.48 | AA |

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)

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.

### Tours

During 2014 Principal Scientific Officer, Senior Scientific Officer, Scientific Officer and Senior Farm Assistant of the Division paid visits to different Tea Estates and other related places for the experimental, advisory and official purposes, which are summarized below:

| Year | Experimental | Advisory | Others | Total |
|---|---|---|---|---|
| 2014 | 32 | 2 | - | 34 |

### Courses on Tea Culture

Principal Scientific Officer, Senior Scientific Officer, Scientific Officer and Senior Farm Assistant of the Division gave comprehensive lectures and practical demonstration on the method of tea improvement, clonal identification, establishment of biclonal seedbaries and NCP, tea tasting,

nursery management, etc. at the 48th Annual Courses arranged at BTRI for the covenanted staff of Tea Estates. Principal Scientific Officer also gave lectures on tea improvement and nursery management in the Annual Courses held at Fatickcharri and at Panchagarh Sub-stations. He delivered lectures as resource speaker at the Management Training Center (MTC) for the Post-Graduate Diploma course and Tea Production Courses organized by Project Development Unit (PDU) of Bangladesh Tea Board.

### Tea Tasting Sessions

There were four tea tasting sessions organized in 2014 under the supervision of the Division. Representatives from tea broking houses and tea planters from different Tea Estates participated in the sessions. Summary of the tea tasting sessions are tabulated below:

**Table 33.** Tea Tasting Sessions during 2014

| Open day/Valley Tea Tasting Sessions | Date | Venue | No. of Estate participated | No. of participants |
|---|---|---|---|---|
| 1. BTRI | 21.06.14 | BTRI | 68 | 84 |
| 2. Juri Valley | 09.08.14 | Juri Valley Club | 16 | 23 |
| 3. BTRI Sub-station Oodaleah | 23.08.14 | BTRI Sub-station Oodaleah | 14 | 24 |
| 4. Lungla Valley | 13.09.14 | Chanbag Tea Factory | 14 | 19 |

# AGRONOMY DIVISION

**S.M. Altaf Hossain**
Chief Scientific Officer
Department of Crop Production
&
**Dr. Toufiq Ahmed**
Senior Scientific Officer
Agronomy Division

## STAFF

The posts of Principal Scientific Officer, two Scientific Officers and Field Assistant were lying vacant during the period under report. After completion PhD from the University of Peradeniya Sri Lanka, Dr. Toufiq Ahmed joined as Senior Scientific Officer in the division. Mr. Masud Rana is on study leave to do his PhD in China.

## RESEARCH

The division carried out three long-term and two short-term experiments during the reporting year under two research program namely- Standardization of cultural practices and development of soil fertility. Results on the basis of collected data are briefly discussed below:

**Programme area: *Standardization of Cultural Practices***

**Long term: 3, Short term: 1**

**Ag 9.4-8c: Effect of different pruning cycles on the yield of different mature clonal tea (BTRI Farm, Long term: 2010-2023)**

**Objective of the study**

- To find out appropriate pruning cycle for the specific clone / bush architecture.

Treatments

**$T_1$ : LP -DS-MS**
**$T_2$ : LP -DS-MS-LS**
**$T_3$ : LP -LS -DS-MS**
**$T_4$ : LP-LS-DS-MS-DS-LS**
**$T_5$ : 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.

The plants were pruned according to scheduled of treatments. Yield data were recorded at weekly interval. Recorded yields from the treatments in the year 2010 to 2014 are presented in the table 1. It was observed that yield increased in all treatments in 2014 except the $T_1$ for all clones. For overall it was seen that the lowest yield in 2014 was in $T_1$ i.e. in the shorter pruning cycle (Table 2) However, before finishing a couple of pruning cycles of all treatments it is premature to make any comment. However longer pruning cycles have tendency to produce higher yield in all the clones. The experiment is continued.

**Table 1.** Yield (kg/ha) of different clones in different treatments from 2010 - 2014

| Treatment | Year | Made tea yield (kg/ha) | | | | | |
|---|---|---|---|---|---|---|---|
| | | BT1 | BT2 | BT5 | BT11 | BT12 | BT13 |
| T1 | 2010 | 2955 | 3052 | 2973 | 2732 | 2811 | 2991 |
| | 2011 | 2462 | 2337 | 2533 | 2401 | 2582 | 2523 |
| | 2012 | 3274 | 3272 | 3103 | 3480 | 3249 | 3259 |
| | 2013 | 3756 | 3825 | 4038 | 3004 | 2786 | 3475 |
| | **2014** | **2683** | **2864** | **2759** | **2665** | **2542** | **3022** |
| T2 | 2010 | 3158 | 2736 | 3063 | 2866 | 2968 | 2748 |
| | 2011 | 2278 | 2391 | 2377 | 2306 | 2111 | 2245 |
| | 2012 | 2935 | 2921 | 2787 | 2931 | 3061 | 3148 |
| | 2013 | 3592 | 3584 | 4001 | 3720 | 3649 | 3844 |
| | **2014** | **4401** | **4244** | **4333** | **3610** | **3809** | **3795** |
| T3 | 2010 | 3018 | 2988 | 3032 | 2941 | 3026 | 2973 |
| | 2011 | 2203 | 2227 | 2195 | 2193 | 2211 | 2168 |
| | 2012 | 2882 | 2910 | 2947 | 2921 | 2825 | 3115 |
| | 2013 | 3495 | 3583 | 3773 | 3535 | 3781 | 3696 |
| | **2014** | **5712** | **4479** | **4862** | **4199** | **4181** | **5232** |
| T4 | 2010 | 2700 | 2574 | 2629 | 2493 | 2456 | 2968 |
| | 2011 | 2028 | 2119 | 2093 | 2231 | 2241 | 1925 |
| | 2012 | 2750 | 2882 | 2775 | 2919 | 2797 | 2953 |
| | 2013 | 3943 | 3836 | 4092 | 3878 | 3888 | 3903 |
| | **2014** | **5740** | **5330** | **6140** | **4831** | **5093** | **5643** |
| T5 | 2010 | 2923 | 3178 | 3107 | 2973 | 3286 | 2931 |
| | 2011 | 2030 | 2059 | 1969 | 1941 | 2119 | 2001 |
| | 2012 | 3069 | 2957 | 3083 | 2900 | 2945 | 2955 |
| | 2013 | 3855 | 4026 | 4223 | 3872 | 3915 | 4156 |
| | **2014** | **7227** | **5714** | **6422** | **5533** | **4945** | **6730** |

**Table 2.** Made tea yield (kg/ha) of different treatments in 2014

| Treatment | Yield (kg/ha) |
|---|---|
| $T_1$ (LP-DS-MS) | 2756 |
| $T_2$ (LP-DS-MS-LS) | 4032 |
| $T_3$ (LP-LS-DS-MS) | 4777 |
| $T_4$ (LP-LS-DS-MS-DS-LS) | 5463 |
| $T_5$ (LP-DS-MS-LS- DS-MS-LS) | 6095 |
| LSD (0.05) | 446 |
| CV (%) | 8.0 |

**Ag. 12.2b: Management of shade plant canopy for maximizing tea production in Bangladesh (BTRI Farm, Long term: 2011-2017)**

**Objective of the study**

- To find out suitable shade canopy management practices for sustainable production.

**Treatments**

$T_1$: Control (normal practice – pruning is not done)
$T_2$: Pruning at 2 meter height
$T_3$: Pruning at 2 and 3 meter height (in the consecutive years)
$T_4$: Pruning at 2, 3 and 4 meter height (in the consecutive years)
**$T_5$: Pruning at 2, 3, 4 and 5 meter height (in the consecutive years)**

**Parameters to be studied**

a) Canopy size of shade trees
b) No. of effective branches of shade trees
c) Base diameter of shade trees (m)
d) Yield of harvested green leaf (kg/ha)

The experiment was laid out at the BTRI Farm with *Albizia odoratissima* shade tree. Increment of canopy coverage in the pruned shade plant is encouraging but in the treatment of $T_5$ pruning operation not yet completed as per schedule. For overall analysis based on the canopy coverage data of shade tree in the year 2014, shade tree canopy was found significant only in $T_1$ treatment and other treatments were statistically identical.

**Table 3.** Treatment wise canopy measurement/spreading ($m^2$) of shade tree in 2014

| Treatment | Spreading of shade tree canopy ($m^2$) |
|---|---|
| $T_1$ (Common practice) | 4.38 |
| $T_2$ (Pruned at 2m height after one year of planting) | 8.92 |
| $T_3$ (Successively pruned at 2m and 3m height after 1st and 2nd year of planting) | 9.39 |
| $T_4$ (Successively pruned at 2m, 3m and 4m height after 1st, 2nd and 3rd year of planting) | 9.37 |
| $T_5$ (Successively pruned at 2m, 3m, 4m and 5m height after 1st, 2nd, 3rd and 4th year of planting) | 9.08 |
| LSD (0.05) | 0.60 |
| CV (%) | 4.0 |

**Programme area:** ***Development of Soil Fertility***

**Title:** Effect on the growth and yield of tea after rehabilitation of old tea soil.

**Objectives of the study**

1. To observe the growth and yield of tea plants in the rehabilitated and non-rehabilitated soil.
2. To estimate the organic matter, lime and nutrient requirement in case of non-rehabilitation.

**Treatment:** 4

$T_1$ : Replanting without rehabilitation
$T_2$ : Without rehabilitation and replanting with recommended organic matter
$T_3$ : One year rehabilitation and replanting
$T_4$ : Two years rehabilitation and replanting

Initial soil samples were collected and analyzed in BTRI soil laboratory. On the basis soil analysis report dolomite was applied to all plots at the rate of 1000 kg / ha during the land preparation. Only additional cow dung at the rate of 18000 kg/ha were added in the treatment $T_2$. The treatments under $T_1$ and $T_2$ were planted (Planting date 2/7/2012) immediate after uprooting and preparation of land. Rest of plots under T3 and T4 were planted with guatemala grass as rehabilitation crop simultaneously as treatments. All others cultural practices remain same standard as normal practices.

At the end of 2014, soil samples were collected and analyzed. Base diameter / plant, number of brunches / plant initiated within 25cm height from ground level and mortality rate in treatments $T_1$ and $T_2$ were measured carefully and presented in the table 4. For overall, it was observed that though the base diameter, number of branches and mortality percentage of tea bushes were not significant but higher percentage of mortality was in $T_1$.

**Table 4.** Variation of different parameters due to treatments

| Treatment | Base diameter (cm) | No. of branches | % Mortality |
|---|---|---|---|
| $T_1$ (Replantation without rehabilitatior and additional organic matter) | 1.69 | 6.0 | 67 |
| $T_2$ (Replantation without rehabilitatior but additional organic matter) | 1.67 | 6.3 | 51 |
| LSD (0.05) | NS | NS | NS |
| CV (%) | 10 | 11 | 12 |

Analytical report of soil was shown in the table 5 and 6. There were no significant difference were found among the treatments for the status of soil organic matter and soil nitrogen. However, soil pH was higher in $T_1$ which was identical with $T_2$ and $T_3$ but different with $T_4$. Almost similar type of an experiment was started in 2014 at the BTRI Farm with same objectives. This experiment is continued.

**Table 5.** Soil sample analysis report for 2014

| Properties of soil | Critical Values | Treatment | | | |
|---|---|---|---|---|---|
| | | T1 | T2 | T3 | T4 |
| Texture | | SCL | SCL | SCL | SCL |
| PH | 4.5 – 5.5 | 4.85 | 4.90 | 4.63 | 4.73 |
| Organic carbon (%) | 1 | 1.34 | 1.92 | 1.27 | 1.23 |
| Total Nitrogen (%) | 0.1 | 0.14 | 0.12 | 0.12 | 0.13 |
| Available Phosphorus (ppm) | 10 | 18.84 | 12.38 | 9.54 | 7.19 |
| Available Potassium (ppm) | 80 | 27.91 | 29.85 | 23.76 | 21.20 |
| Available Calcium (ppm) | 90 | 134.59 | 140.76 | 105.72 | 112.78 |
| Available Magnasium (ppm) | 25 | 41.48 | 44.50 | 25.27 | 27.84 |

**Table 6.** Effects of treatments on soil characteristics

| **Treatment** | **Soil pH** | **Organic matter (%)** | **Soil $N_2$ (%)** |
|---|---|---|---|
| $T_1$ | 4.68 | 1.32 | 0.14 |
| $T_2$ | 4.67 | 1.51 | 0.12 |
| $T_3$ | 4.59 | 1.31 | 0.13 |
| $T_4$ | 4.48 | 1.29 | 0.12 |
| Mean | 4.61 | 1.36 | 0.13 |
| LSD (0.05) | 0.162 | NS | NS |
| CV (%) | 10 | 15 | 10 |

**Visit**

Members of the division paid 59 visits to different Tea Estates for experimental, advisory services and other official purposes during the reporting year. Number of visits for the reporting year 2014 is presented in the table below.

**Table 7.** No. of visit paid by the members of the division during the reporting year

| Reporting year | No. of experimental visits | No. of advisory visits | Nos. of other official tours |
|---|---|---|---|
| 2014 | 42 | 11 | 6 |

**Workshop / Seminar**

Scientific personnel of Agronomy division arranged 13 workshops in different tea estates and BTRI to disseminate updated technologies among planters on plantation, pruning, tipping, plucking, drought management in tea etc.

**Annual Course**

Scientific personnel of the division delivered lectures on tea culture in the 49th BTRI annual course.

## BTRI MAIN FARM

**Md. Majibur Rahman, Senior Farm Assistant, Botany Division continues working as the Farm Supervisor (in-charge) of BTRI Farm and Md. Hossain Mahmud (Farm Supervisor) was attested in Agronomy Division after transferring from BEF during the reporting year. 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 h |
| 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 |
|---|---|---|
| 2014 | 4,90,150 | 20,953 |

**Green leaf production and earning from other farm products**

| Reporting year | Green leaf production in kg | Earning from other farm products in tk |
|---|---|---|
| 2014 | 80,348 | 87,356 |

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

## Meteorological Data for the year 2014

| Month | No. rainy days | Rainfall (mm) | Evaporation (mm) | Temperature (°C) | | Dew point (°C) | Sunshine hrs. | R.H. (%) |
|---|---|---|---|---|---|---|---|---|
| | | | | Max. | Min. | | | |
| January | 0 | 0 | 62.30 | 25.71 | 11.26 | 13.18 | 4.50 | 73.61 |
| February | 4 | 0.13 | 78.10 | 27.34 | 11.22 | 11.90 | 6.21 | 64.00 |
| March | 4 | 0.49 | 134.10 | 32.29 | 16.30 | 14.40 | 8.37 | 54.69 |
| April | 8 | 96.0 | 144.80 | 35.10 | 20.49 | 20.25 | 8.02 | 62.34 |
| May | 21 | 440.0 | 108.50 | 33.47 | 23.78 | 24.14 | 6.23 | 75.56 |
| June | 25 | 457.0 | 71.40 | 32.91 | 25.28 | 25.46 | 3.73 | 82.33 |
| July | 25 | 310.0 | 83.10 | 34.00 | 25.80 | 25.50 | 5.40 | 77.40 |
| August | 22 | 399.4 | 98.00 | 32.60 | 25.50 | 25.50 | 4.20 | 82.00 |
| September | 21 | 487.0 | 116.00 | 32.80 | 24.60 | 24.90 | 5.10 | 81.20 |
| October | 7 | 74.0 | 125.30 | 32.18 | 21.84 | 23.05 | 6.93 | 77.95 |
| November | 0 | 0 | 92.80 | 30.70 | 16.30 | 18.10 | 7.60 | 71.80 |
| December | 0 | 0 | 65.90 | 26.40 | 12.20 | 15.00 | 5.09 | 75.50 |
| Average | 11.4 | 188.67 | 98.36 | 31.29 | 19.55 | 20.12 | 5.95 | 73.2 |

# ENTOMOLOGY DIVISION

**Mohammad Shameem Al Mamun**
Senior Scientific Officer

## STAFF

The posts of Principal Scientific Officer, Scientific Officer and Senior Farm Assistant were lying vacant during the period under report.

## RESEARCH

Nine experiments under six programme areas were conducted during the year 2014. The experiments were: *In vitro* and *in vivo* screening of tea clones at nursery level during clonal selection stage for nematode susceptibility; Susceptibility of red spider mite to different agro types and clones; Evaluation of some indigenous plant extracts against major pests of tea; Studies on physiological and biochemical changes in tea leaves due to mite infestation; Searching and identification of bio-control agents for the control of pests of tea; Bioefficacy of entomopathogenic fungi against major pests of tea; Screening of pesticides against *Helopeltis*, red spider mites, termites, nematodes and aphids in tea; Determination of judicious use of pesticides for a model tea estate and Determination of pesticide residue in Made tea of different tea agro-types. Details of the experiments together with their findings are furnished below:

### ENT 1. ENTOMOLOGICAL RESEARCH ON CLONAL VARIETIES OF TEA

### ENT 1.1. *In vitro* and *in vivo* screening of tea clones at nursery level during clonal selection stage for nematode susceptibility (2008-2014)

An experiment was conducted at BTRI nursery & Entomology Laboratory, BTRI to identify the resistance/susceptibility of a particular clone to nematode. Pathogenic nematode culture was prepared in a suitable medium and was kept as stock sample. Pathogen free medium or soil substrate by sterilization as control treatment was also prepared. Screening of five BTRI released clones i.e. BT2, BT5, BT6, BT11 and BT13 were planted in the primary bed and secondary bed. Seedlings were transplanted from the primary bed to the secondary bed in polybags accordingly during 2014. The pathogenicity of the nematodes was observed regularly at monthly interval. Mortality of the clones due to nematode attack was also observed. Results revealed that the average nematode population was higher and seedling mortality percentage was lower in BT13 plot followed by BT6, BT5, BT11 and BT2. So, it can be accomplished that BT13 clone is relatively resistance to nematode attack where as the clone BT2 is more susceptible. The experiment will be continued upto December 2015 with rest of the BTRI clones.

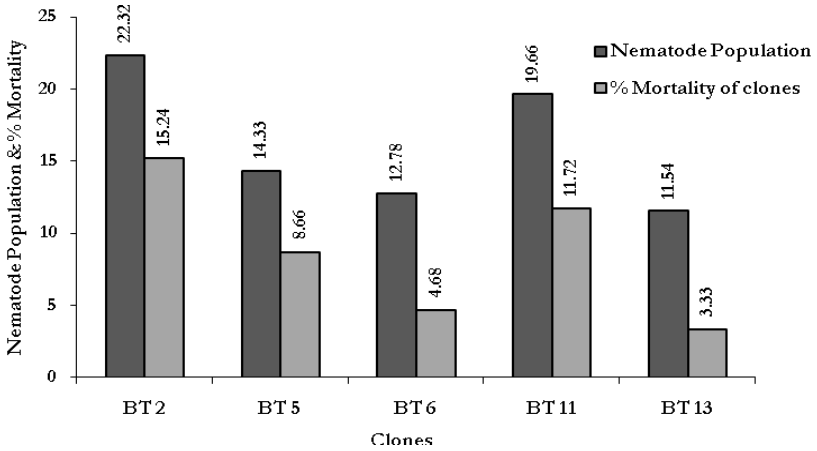


Fig. 1. Mortality percentage due to nematode infestation in tea saplings at primary bed

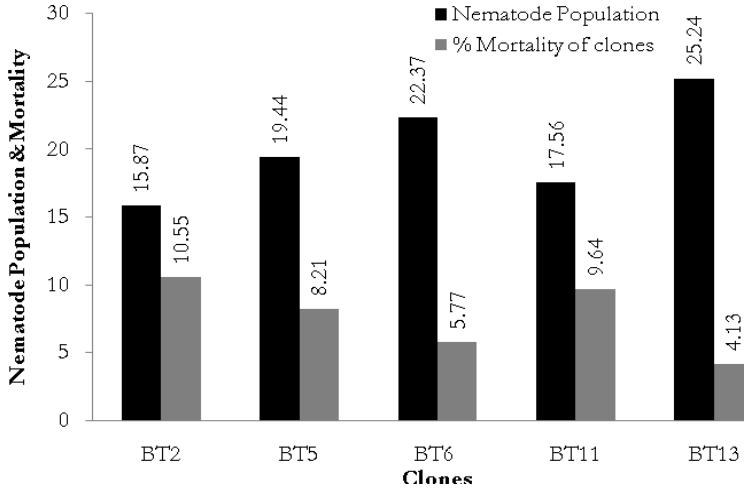


Fig. 2. Mortality percentage due to nematode infestation in tea saplings at secondary bed

**ENT 1.2. Susceptibility of red spider mite to different agro types and clones (2013-2014)**

Studies were carried out on the susceptibility of different tea agrotypes to red spider mite infestation at the clonal block of BTRI Main Farm. Susceptibility to red spider mites of different tea agrotypes such as China, Assam, Burma, Monipuri, Hybrids and tea clones namely, BT1, BT2, BT3, BT4, BT5, BT6, BT7, BT8, BT9, BT10, BT11, BT12, BT13, BT14, BT15, BT16, BT17, BT18, TV1 & Seedlings were evaluated. From the clonal block of BTRI, the mite population was estimated every month by sampling randomly 10 mature leaves per plot and transporting to the laboratory in poly bags where mites were then extracted from the leaves using a mite brushing machine (Model–Leedom Engineering, USA) and the number of mites was counted under the stereomicroscope.

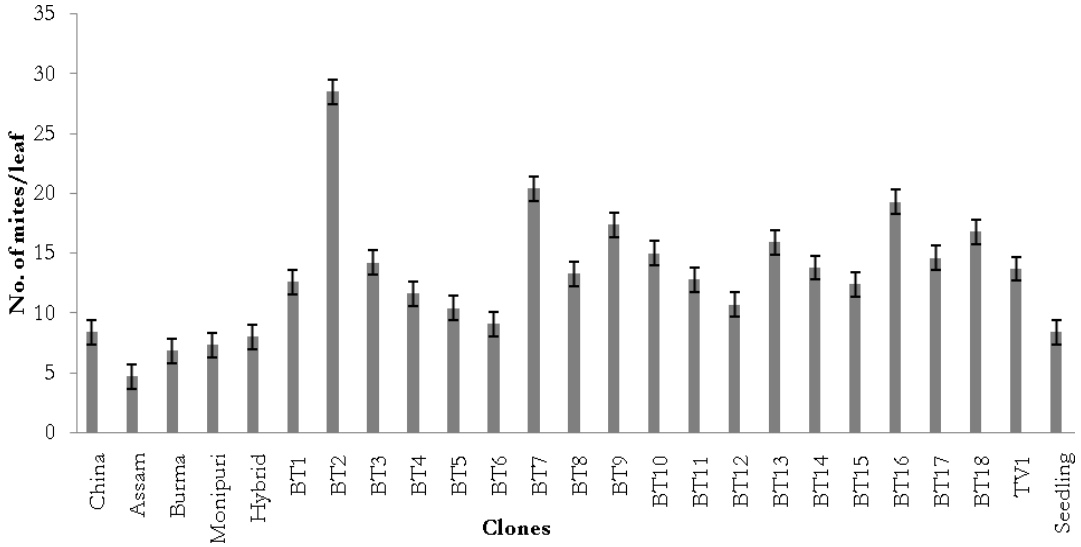


Fig. 3. Susceptibility of different tea agrotypes and clones to red spider mites

Result revealed that China agrotypes and BT2 clones were found to be more susceptible to the attack of red spider mite. The significant variability in damage may perhaps be attributed to physical or biological attributes of the agrotypes and clones. The experiment will be continued up to December 2015.

## ENT 2. STUDIES ON INDIGENOUS PLANT EXTRACTS

### ENT 2.1. Evaluation of some indigenous plant extracts against *Helopeltis*, Red spider mites & nematodes in tea (2008-2014)

***Laboratory screening of some plant extracts against Helopeltis (2008-2014)***

An experiment was conducted to evaluate the toxicity of six indigenous plant extracts, Bur weed (*Xanthium strumarium*), Datura (*Datura metel*), Kata-mehedi (*Duranta erecta*), Lantana (*Lantana camara*), Mahogani (*Swietenia mahagoni*) and Neem (*Azadirachta indica*) against tea mosquito bug, *Helopeltis theivora* under laboratory condition field condition. All the plant extracts showed toxic effect on tea mosquito bug. The experiment was concluded.

***Laboratory and field screening of some plant extracts against red spider mites (2008-2014)***

An experiment was conducted to evaluate the toxicity of six indigenous plants, Bishkatali (*Polygonum hydropiper*), Bur weed (*Xanthium strumarium*), Datura (*Datura metel*), Lantana (*Lantana camara*), Mahogani (*Swietenia mahagoni*) and Neem (*Azadirachta indica*) against red spider mite, *Oligonychus coffeae* in tea under both laboratory and field conditions. All the plant extracts showed toxic effect on red spider mite infesting tea. The experiment was concluded.

Experiment on another four indigenous plants, *Clerodendron, Leucas, Ipomea* and *Adathoda* against *Helopeltis* & red spider mite is in progress.

## ENT 3. PEST INFESTATION AND QUALITY OF TEA

### ENT 3.1. Studies on physiological and biochemical changes in tea leaves due to mite infestation (2013-2014)

A study was undertaken to determine physiological and biochemical changes in tea leaves as well as black tea due to the attack of red spider mites in tea at the Main Farm of Bangladesh Tea Research Institute (BTRI), Srimangal, Moulvibazar. The tea shoots comprising "two leaves and a bud" were collected where the plots are divided into four categories such as $T_1$) Fresh leaf plot, $T_2$) Low infested plot, $T_3$) Medium infested plot and $T_4$) Highly infested plot considered as treatments. The biochemical analysis was done at the Laboratory of the Department of Food Engineering and Tea Technology, Shahjalal University of Science and Technology (SUST), Sylhet. Calculations of chlorophyll a, chlorophyll b and carotenoids were done using the specific formula.

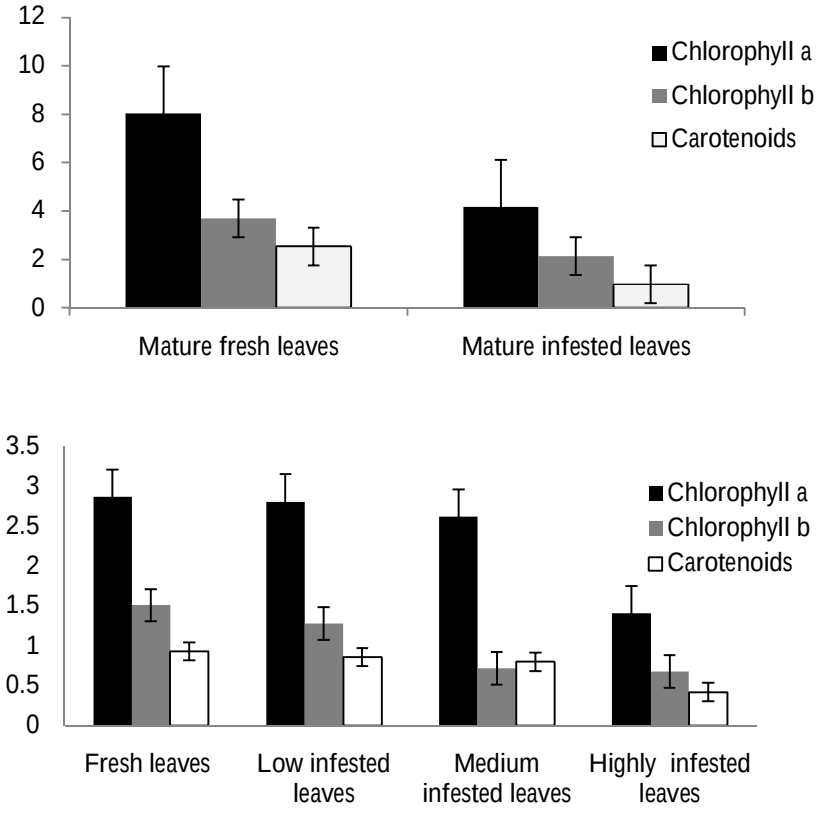


Fig. 4. Chlorophyll and Carotenoids contents (mg/g) in different treatments

**Table 1.** Changes in biochemical parameters in Tea Leaves and Made Tea due to mite infestation

| Treatment | Polyphenol (%) | Catechin (%) | Lipid (%) | Reducing sugar (%) | TF (%) | TR (%) | HPS (%) | TLC (%) | Colour index | Caffeine (ppm) | Total ash (%) | Moisture (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T1- Fresh | 76.22 | 21.20 | 4.70 | 55.57 | 0.53 | 5.31 | 9.81 | 4.25 | 3.50 | 62.04 | 5.21 | 3.45 |
| T2- Low | 57.44 | 20.60 | 4.49 | 53.64 | 0.52 | 5.78 | 8.73 | 4.17 | 3.58 | 56.82 | 5.36 | 3.08 |
| T3- Moderate | 46.00 | 19.60 | 3.94 | 40.07 | 0.49 | 7.40 | 6.86 | 2.38 | 3.44 | 56.68 | 5.53 | 2.88 |
| T4- High | 45.56 | 10.40 | 3.77 | 34.57 | 0.43 | 7.00 | 6.16 | 2.20 | 3.27 | 54.68 | 5.70 | 0.635 |

Results reveal that the fresh tea leaves contain more photo pigments like chlorophyll a, chlorophyll b and carotenoids. These parameters subsequently decreases in low infested to highly infested tea leaves. Other biochemical parameters were also found to be low in the Made Tea produced form mite infested leaves. The biochemical changes of Made Tea due to other pests will be assessed in the following years.

## ENT 4. BIO-CONTROL OF PESTS

### ENT 4.1. Searching and identification of bio-control agents for the control of pests of tea (2011-2014)

An investigation was carried out at Bangladesh Tea Research Institute (BTRI) Main Farm during 2011-2014 to document the arthropod natural enemies in the tea ecosystem. Frequent visits were made to search bio-control agents in the field. The survey was conducted twice in a month. A good number of natural enemies such as spiders, preying mantids, beetles, and some other insects were collected from the field and enlisted in this communication, of which most of the species were found to be intimately associated with tea pests or occurred as their hosts. Among the natural enemies, Coccinellid was dominant. No new species was identified other than the previous year. Monitoring, searching and collection are being continued. The experiment will be continued up to 2015.

### ENT 4.2. Bioefficacy of entomopathogenic fungi against major pests of tea (2013-2014)

An experiment was carried out to evaluate the bioefficacy of some microbial pesticides *Beauveria bassiana, Metarhizium anisopliae, Streptomyces avermitilis, Paecilomyces fumosoroseus, Verticillium lecanii,* and *Pseudomonas fluorescens* against red spider mite *Oligonychus coffeae* Nietner (Tetranychidae: Acarina) infesting tea under both in the Entomology Laboratory and Main Farm of Bangladesh Tea Research Institute (BTRI), Srimangal, Moulvibazar during 2013-2014.

***Laboratory test for acaricidal activity of entomopathogens***

Entomopathogens viz., *Beauveria bassiana, Metarhizium anisopliae, Streptomyces avermitilis, Paecilomyces fumosoroseus, Verticillium lecanii,* and *Pseudomonas fluorescens* @ 5.0 g/L, 5.0 g/L, 2.0 ml/L, 5.0 g/L, 5.0 g/L, 4.0 g/L concentration, respectively are considered as treatments. Effect of the entomopathogens on mortality of *Stethorus gilviforns* and *Oxyopes* sp. the potent predator of red spider mite was also studied. Data were collected at 24 HAT, 48HAT, 72HAT in the laboratory and at weekly interval in field condition. Results indicated that all the biopesticides showed the toxic effect on red spider mite in tea and significantly reduced mite population both in laboratory and field condition. In laboratory condition, among the biopesticides, the highest mortality of red spider mites was observed in *Verticillium lecanii* (64.38%) followed by *Streptomyces avermitilis* (58.46%) and *Paecilomyces fumosoroseus* (56.67%) at 24 HAT. Similar trend was also found at 48 HAT & 72 HAT after spraying of biopesticides.

***Field evaluation of entomopathogens against red spider mite***

From the field evaluation it was found that the application of *Verticillium lecanii* @ 4.0 kg/ha significantly reduced the mite incidence to the tune of 83.44-98.32% followed by *Streptomyces avermitilis* @ 2.0 L/ha to the tune of 81.83-97.24%. The order of toxicity of the tested biopesticides on adult red spider mite was *V. lecanii*>*S. avermitilis*>*P. fumosoroseus*>*P. fluorescens*>*M. anisopliae*>*B. bassiana* both *in vitro* and *in vivo*. Application of the tested biopesticides did not affect the non-target organisms such as *Stethorus gilviforns* and *Oxyopes* sp. So, these commercially formulated entomopathogens may be utilized potentially in the tea fields as eco-friendly & safer biopesticides as well as one of the major components of integrated pest management (IPM) strategy to minimize the pesticide load in the tea ecosystem.

***Metarhizium anisopliae against termites in tea***

An experiment was conducted to determine the bioefficacy of *Metarhizium anisopliae* (Bio-terminator) against termites infesting tea at the Main Farm of Bangladesh Tea Research Institute, Phulbari Tea Estate and Baraoora Tea Estate, Srimangal, Moulvibazar. From the results of the trials that Bio-Terminator was found to be highly effective (85.21, 84.91 & 85.97% respectively) in controlling termites and maintain their effectiveness to the desired level up to 9 months. The overall performance of the tested Bio-terminator against termites of tea was found 'satisfactory' @ 5.0 kg/ha (84.91 - 85.97% effectiveness) up to 9 months. Hence, the Bio-terminator may be efficiently used as the component of IPM for the management of termites in tea in Bangladesh condition.

***Bacillus thuringiensis against looper caterpillar in tea***

A laboratory experiment was conducted to determine the bioefficacy of *Bacillus thuringiensis* against looper caterpillar at Entomology Laboratory, BTRI and the field evaluation was made at Bilashcherra Experimental Farm of BTRI during January 2013 to December 2014. The experiment is in progress and will be continued up to 2015.

**Table 2.** Laboratory & Field evaluation of *Bacillus thuringiensis* against looper caterpillar in tea

| ***Dose*** | ***% Mortality*** | |
|---|---|---|
| | Laboratory | Field |
| 1.0 g/L | 79.26c | 76.58c |
| 1.5 g/L | 84.63b | 80.67b |
| 2.0 g/L | 86.38a | 82.44a |

## ENT 5. SCREENING OF PESTICIDES

### ENT 5.1. Screening of pesticides against *Helopeltis*, Red spider mites, Termites, Nematodes, Aphids, Flushworm, Jassids and Thrips in tea (2012-2014)

One hundred and thirty eight (138) pesticides under different groups against *Helopeltis*, Red spider mites, Termites, Nematodes and Aphid in tea which were received from Plant Protection Wing, Department of Agricultural Extension (DAE), Ministry of Agriculture for conducting field trial in 2014. The experiment was conducted at Baraoora T.E. and BTRI Main Farm at CRD & RCBD with three replications. Data on percent infestation were collected at weekly, fortnightly and monthly intervals for *Helopeltis*, Red spider mites, Termites, Nematodes respectively in tea. A

total of twelve data were recorded. Abbott's formula, Henderson and Tilton formula, Lubischeb analytical method, Baermann funnel method etc. were applied for determining the effectiveness of the pesticides. The tested chemicals were found 'good' i.e. >80% effectiveness against the mentioned pests of tea. Trial reports were sent to PTASC for standardization.

**Control of *Helopeltis* in tea**

Evaluation of the performance of the pesticides, viz. Khusi 2.5EC, Hashi 10EC, Cyper 10EC, Adthrin 10EC, Topthrin 10EC, Neda 2.5EC, Wincy 2.5EC, Leader 2.5EC, Dhadkhan 36EC, Python 10SL, Method 180SC, Lamguard 247SC, Acithrin Plus 10EC, Gevin 85WP, Xu-Long 40WG, Sheng-Li 30SC, Dao-Ming 24.7EC, Fury 5EC, Equity 2.5EC, Exit 2.5EC, Envoy 2.5EC, Lemon 2.5EC, Starthrin 10EC, Correct 2.5EC, Fasal special 30WP, Helocide 240SC, Zonaki 3WDG, Venza 3WDG, Rainbow 50EC, Thiamectin 30WDG, Mukti 200SL, Power Pack 10EC, Mukti 550EC, Ayesha 3WDG, Lahib 38WDG, Novastar 56EC, Arrivo 10EC, See Link Sun 10EC, Neon 10EC, Libra 24.7SC, Latin 15WP, Betatin 3WDG, Bomathrin 10EC, R-kill 10EC, Cradit 5EC, Pailambda 2.5EC, Night Queen 2.5EC, Hard Hitter 5EC, Random 5EC, Amethy 3WDG and Green plus 3WDG against *Helopeltis* in Tea.

**Progress:** Fifty one insecticides including Lambda Cyhalothrin, Cypermethrin, Nytenpyrum, Lambdacyhalothrin+Thiamethoxam, Fipronil+Thiamethoxam, Emamectin Benzoate+Thiamethoxam, Carbaryl, Zetacypermethrin, Abamectin+Imidacloprid, Carbendazim+Imidacloprid+Metalaxyl, Chlorpyrifos+Cypermethrin, Bifenthrin+Abamectin, Abamectin+Beta-cypermethrin, Thiacloprid, Fenitrothion and Imidacloprid were received from Plant Protection Wing, DAE in controlling *Helopeltis*. Data were collected regularly at 7 days interval. The trial reports had been sent to PTASC to consider their standardization. The efficacy of the tested chemicals was >80%.

**Control of Red Spider Mite in tea**

Evaluation of the effectiveness of pesticides viz. Heping 10WDG, Riyadh 6WDG, Cassino 3WD, Cosamil 80DF, Dhanovit 80WDG, Jabber 45EC, Netsul 80WDG, Shiropa 80WDG, Novastar 56EC, Bonidon 80%WDG, Sunvit 80WDG, Sulphin 80WDG, Bicoguard 10SL, Bicoaloo 80WDG, Mitex 57EC, Hexythiao 5.45EC, Adam 3WG, Wintin 3WG, Supertin 3WDG, Boma 6WG, Free claim 6WDG, Mectin plus 1.8EC, Bentin 60EC, Ethrin 3EC, Sunjoy 3WDG, Cymec 5EC, M-FOD 10WDG, Supervit plus 80WDG, Sunvit 80WDG, Amectin 1.8EC, Bioneem 0.3EC, Bioneem plus 1EC against Red Spider Mite in tea.

**Progress:** Thirty two miticides including sulphur based compounds, Emamectin Benzoate, Hexythiazox, Abamectin+Emamectin Benzoate, Abamectin+Beta cypermethrin, Bifenthrin+Abamectin, Nytenpyrum, Nytenpyrum+Pymetrozine, Propergite, Azadirachtin (biopesticide), Abamectin, Dimethoate+Cypermethrin were received from Plant Protection Wing for field trial against red spider mite in tea. Data were collected regularly at weekly interval. The trial reports had been sent to PTASC to consider their standardization. The efficacy of the tested chemicals was >80%.

**Control of Termites in tea**

Evaluation of effectiveness of the insecticides viz. Shanti 20EC, Xtra Care 50SP, Sure 55EC, Tataphos 48EC, Winmix 55EC, SN-fos 48EC, Bipolar Plus, Cyperphos 550EC, Oropyrifos 48EC, Aciprid 20SL, Orimida 200SL, Pro-Imida 200SL, Rexiprid 20SL, Brake 20%SL, Ascend 50SC, Regent 50SC, Rexiprid 70WDG, Nobel 3GR, Regent 3GR, Digital 10G, Thiaprid 70WDG, Double Dose 17.5WDG, Oroguard 55EC, Chlorthin 55EC, Al Chlorid 20SL, Ascend

3GR, Prince 50SC, Aidfos 48EC, Silico 280EC, Volbo 55EC, Cychon 55EC, Judo 10EC, Optima 25WDG against Termites in Tea

**Progress:** Thirty three insecticides including Chlorpyrifos, Chlorpyrifos+Cypermethrin, Cartap, Imidacloprid, Fipronil, Diazinon, Thiamethoxam+Imidacloprid, Lambdacyhalothrin Fipronil+Lamdacyhalothrin, Acetamiprid+Emamectin+Benzoate were received from Plant Protection Wing for field trial against termites in tea. The termiticides were applied in the field against termites and data were collected regularly at monthly interval. The trial reports had been sent to PTASC to consider their standardization. The efficacy of the tested chemicals was >80%.

**Control of Nematodes in tea**

Evaluation of effectiveness of nematicides viz. of Falan 5G, M-Furan 3G, Confuran 5G, Rajcarb 3G and Pro-Carb 5G against Nematodes in tea.

**Progress:** Five nematicides under Carbofuran were received from Plant Protection Wing, for field trial. The nematicides were applied in the pot against nematodes. Data were collected regularly at 15 days interval. Trial reports were sent to PTASC for standardization. The efficacy of the tested chemicals was >80%.

**Control of Aphid in tea**

Evaluation of effectiveness of insecticides viz. Scope 55EC, G-Five 55EC, Pitar 1.8EC, Dyana plus 10WDG, Dana double plus 10WDG, Sym EB 10WDG, Flow plus 70WDG, Fasthrin 3%WDG, Tacoma 40SC, Cymec 3WDG, Solve 10WDG, Achamka 3WDG, Blesun 3% WDG, Hamlet 6EC, Neymar 6%WDG, Pulcher 30WDG against Aphids in tea.

**Progress:** Sixteen insecticides including Chlorpyrifos+Cypermethrin, Abamectin, Emamectin Benzoate, Imidacloprid, Abamectin+Beta-cypermethrin, Buprofezin, Abamectin+Emamectin Benzoate were received from Plant Protection Wing, for field trial against aphid. Data were collected regularly at weekly interval. Trial reports were sent to PTASC for standardization. The efficacy of the tested chemicals was >80%.

**Control of Thrips in Tea**

Evaluation of effectiveness of Inteprid 10SC against Thrips in tea.

**Progress:** One insecticide under Chlorphenapyr was received from Plant Protection Wing, for field trial against thrips. Data were collected regularly at weekly interval. Trial reports were sent to PTASC for standardization. The efficacy of the tested chemicals was >80%.

**ENT 5.2. Determination of judicious use of pesticides for a model tea estate (2014-2018)**

***Objective of the experiment:*** To determine the judicious use of potential pesticides (Insecticides, miticides and nematicides) to avoid pest resistance, undesirable pesticide residue and develop economically viable pesticide schedule for a model tea estate. Pesticide spray was given in standard plots by monitoring the insect pest infestation as well as observing the Economic Threshold Level (ETL) of different insects. The weight of green leaves of each plot was taken in every plucking interval and insect pest infestation was also observed. *Helopeltis* and

red spider mite infestation was maximum year the round where as termite, aphid and thrips infestation was sporadic. It was found that the amount of spray volume was lower in standard plots compared to general practiced plots. This experiment will be continued at BTRI and will also be set up at Bilascherra Experimental Farm in this year to confirm the significant yield difference between the standard and general practiced plots.

**Table 3.** Economic Threshold Level (ETL) of pests of tea in Bangladesh

| Name of the Pest | Economic Threshold Level (ETL) |
|---|---|
| Tea Mosquito Bug | 5% infestation |
| Aphids | 20% infestation |
| Thrips | 3 Thrips per shoot |
| Jassids | 50 nymphs per 100 leaves |
| Looper caterpillar | 4-5 Lopper per plant |
| Flushworm, Leaf Rollers | 5 infested rolls per bush |
| Red Spider Mites, Pink and Purple Mites | 5 mites per leaf |
| Termites | 10% infestation |
| Nematodes | 7 nematodes per 10 g soil |

**Table 4.** Determination of judicious use of pesticides for a model tea estate

| Plots | Insect infestation | No. of spray | Average yield (Kg/ha) | Increase of yield over control (%) |
|---|---|---|---|---|
| Standard plot | *Helopeltis* | 7 | 2050.15 | 34.35 |
| | Red spider mite | 5 | | |
| | Thrips | 2 | | |
| | Termite | 1 | | |
| General plot | *Helopeltis* | 10 | 2074.37 | 35.93 |
| | Red spider mite | 8 | | |
| | Leaf roller | 2 | | |
| | Termite | 1 | | |
| Control plot | *Helopeltis* | - | 1526.05 | - |
| | Red spider mite | - | | |
| | Aphids | - | | |
| | Termite | - | | |

## ENT 6. PESTICIDE RESIDUE ANALYSIS

### ENT 6.1. Determination of pesticide residue in Made Tea of different tea agro-types (2012-2014)

An experiment was initiated to determine the pesticide residue in Made Tea of different tea agro-types such as Assam, China, Monipuri Hybrid, BT1, TV1 and Seeding. As tea is a consumable product, the presence of pesticide residue in Made Tea is harmful to human health. The purpose of this study is to find out the degradation rate of pesticide residue in different tea agro-types. Cypermethrin (Ripcord 10EC), a very common insecticide was applied on pluckable shoots at BTRI approved dose i.e. @ 500 ml/ha. Pluckable shoots were collected from selected plots of different tea agro-types of BTRI germplasm centre and pesticide residue plot at 0th, 7th & 14th

days interval after the application of pesticides and subsequently manufactured in the manufacturing unit of the Pesticide Residue Analytical Laboratory of the Institute. The residue analysis was done according to the methods developed by Ahmed & Sarker (2002) at Central Science Laboratory (CSL) in U.K. (Method reference: PGD-95/01-07). The determination of residue was done by Electron Captured Detector (ECD) and Flame Thermoionic Detector (FTD) using Gas Chromatograph (Shimadzu 14-B) with DB-5 Capillary Column. Nitrogen gas (99.997% pure) was used as carrier gas. Hexane and Acetone were used as extracting reagents and Florisil as Clean-up reagent. The experiment is in progress.

**Table 5.** Pesticide residue in made tea of different tea agro-types

| Agrotypes | Residues in made tea (ppm) | | |
|---|---|---|---|
| | 0 day | 7 day | 14 day |
| Assam | 26.32 | 1.86 | 0.09 |
| China | 19.56 | 1.05 | 0.06 |
| TV1 | 21.38 | 1.36 | 0.08 |
| BT1 | 20.44 | 1.28 | 0.05 |
| Seedling | 22.68 | 1.46 | 0.08 |

**Advisory**

Entomology Division issued 17 advisory letters to different tea estates in respect of identification of various pests and their control measures during the reporting year. Regular assistance was extended in helping identification of unknown pesticides through short-term trials.

**Visits/ Tours**

A total of 13 advisory visits were paid to different tea estates to identify and render advice on specific pest problems. In addition, 22 experimental visits were made with particular reference to experimental data collection in tea estates. SSO of the division attended the 97$^{th}$, 98$^{th}$ & 99$^{th}$ PTASC meeting of plant protection wing, DAE, Khamarbari, Dhaka.

**Analysis**

A total of 90 soil samples for nematode count was sent from different tea estates and analyzed in the laboratory. A total of 138 pesticides including insecticides, miticides, nematicides and termiticides were received from plant protection wing, Department of Agricultural Extension, Dhaka for field trial and trial reports were sent to plant protection wing for standardizations during the year 2014.

**Annual Courses**

The Senior Scientific Officer & the Scientific Officer delivered lectures on tea pest management at 49$^{th}$ Annual Courses held at BTRI and Fatikchari Sub-Station in Chittagong and Panchagarh. 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.

# PLANT PATHOLOGY DIVISION

**Dr. Mohammad Ali**
Chief Scientific Officer
Department of Pest Management
&
**Mohammed Syeful Islam**
Senior Scientific Officer
Plant Pathology Division

## STAFF

Mr. Mohammed Syeful Islam, Senior Scientific Officer was returned to the Plant Pathology division of BTRI from Fatickchari Sub-station, Chittagong on 8th June 2014. Mr. Md. Moshiur Rahman Akonda, Scientific Officer joined the division on 3rd March, 2014 after completion of the training course held in Tamil Nadu, India. Mr. Raihan Mujib Himel joined the division as Scientific Officer on 18th March, 2014 and Mr. Abul Kashem joined as MLSS on 7th January 2014. The posts of one Principal Scientific Officer and one Field Assistant were remained vacant. There were no other changes in the staff position of this division.

## RESEARCH

Six experiments were conducted during the year 2014 under three research areas.

### PP 3: DISEASE MANAGEMENT

### PP 3.5: Evaluation of antifungal activities of some plant extracts against different foliar diseases of tea (2011- 2015)

**Progress:** Leaf extracts of five indigenous plants viz. arjun (*Terminalia arjuna*), bashok (*Adatoda vasica*), neem (*Azadirachta indica*), bishkatali (*Polygonum barbatum*) and lemon grass (*Cymbopogon citratus)* were applied @ 2.0% to the dieback infected tea shoots on mother bushes at NCP. Minimum disease development in terms of lesion size was observed in bashok treated shoots followed by arjun both in 7 and 15 DAS (table 1). The experiment will be continued.

**Table 1.** Effect of leaf extracts @ 2.0% of different indigenous plants on the development of dieback disease caused by *Colletotrichum gloeosporioides*

| Treatments | Lesion size (mm) (Average of five replications) | | | PDI | |
|---|---|---|---|---|---|
| | Initial | 7 DAS | 15 DAS | Initial | 15 DAS |
| Control | 4.10 f | 5.56 b (35.60%) | 7.08 c (72.68%) | 60 | 78 |
| Arjun | 4.36 d | 5.20 c (19.26%) | 7.04 c (61.46%) | 60 | 68 |
| Bashok | 4.84 b | 4.96 d (2.48%) | 5.02 d (3.72%) | 60 | 64 |
| Neem | 4.30 e | 5.00 d (16.28%) | 7.10 c (65.12%) | 52 | 64 |
| Bishkatali | 4.50 c | 6.50 a (44.44%) | 7.54 a (67.55%) | 52 | 64 |
| Lemon grass | 4.92 a | 6.58 a (33.74%) | 7.40 b (50.40%) | 52 | 60 |

### PP 3.3: Screening of new fungicides and herbicides against different diseases and weeds in tea (BTRI/BEF/ T.Es.: Short term)

**Progress:** A total of forty nine fungicides of different groups and seventy nine herbicides were tested against respective pests. Tested chemicals were found >80% effective against weeds and diseases. Reports were sent to PTASC for further necessary action.

## PP 4: WEEDS MANAGEMENT

### PP 4.5: Determination of critical period of weed competition in young tea (BEF: 2011-2015)

**Progress:** The maximum number of weeds was found in the plots which are kept weed free from $T_{10}$ (15th July- 30th September) and then are declined due to environmental condition. Weed height and canopy size are also statistically noticeable in that time. Number of effective branches was more or less statistically similar with $T_1$ and $T_{10}$. Highest canopy size was found in $T_{10}$ which was identical with $T_{11}$ to $T_{15}$. Though yield was also found in lower as increasing the number of weeds, but in $T_{8,}$ $T_{9,}$ $T_{10}$ and $T_{11}$ it showed statistically identical. So, preliminary it can be said, in young tea, weed free from 15th July- 30th September is statistically identical (table 2).

**Table 2.** Effect of different intervals of weed control

| Treatments | Number of weeds | Height (cm) | Canopy size (cm) | No. of branch | Yield (Kg) |
|---|---|---|---|---|---|
| $T_1$= Weed free (1st March- 30th Sept.) | 1.36 l | 6.50 j | 15.13 e | 13.56 a | 10.29 a |
| $T_2$= Weed free (15th March- 30th Sept.) | 9.22 k | 8.78 i | 15.54 e | 13.22 ab | 10.11 b |
| $T_3$= Weed free (1st April- 30th Sept.) | 20.83 j | 13.33 h | 16.35 e | 12.72 abc | 9.98 c |
| $T_4$= Weed free (15th April- 30th Sept.) | 33.83 i | 17.55 g | 18.51 de | 12.72 abc | 9.38 d |
| $T_5$= Weed free (1st May- 30th Sept.) | 43.39 g | 18.20 g | 20.58 d | 12.55 abc | 9.24 e |
| $T_6$= Weed free (15th May- 30th Sept.) | 65.60 e | 21.13 f | 25.48 c | 12.55 abc | 9.07 f |
| $T_7$= Weed free (1st June- 30th Sept.) | 76.19 d | 25.67 e | 28.91 b | 12.21 bc | 8.85 g |
| $T_8$= Weed free (15th June- 30th Sept.) | 88.84 c | 28.28 d | 30.87 b | 12.21 bc | 8.56 h |
| $T_9$= Weed free (1st July- 30th Sept.) | 98.06 b | 32.18 c | 30.89 b | 12.04 bc | 8.55 h |
| $T_{10}$= Weed free (15th July- 30th Sept.) | 111.73 a | 35.42 b | 36.18 a | 11.70 c | 8.55 h |
| $T_{11}$= Weed free (1st Aug.- 30th Sept.) | 84.734 c | 39.32 a | 35.94 a | 11.53 cd | 8.51 h |
| $T_{12}$= Weed free (15th Aug.- 30th Sept.) | 75.85 d | 39.65 a | 36.63 a | 11.53 cd | 8.32 i |
| $T_{13}$= Weed free (1st Sept.- 30th Sept.) | 58.09 f | 40.30 a | 36.29 a | 10.51 de | 8.31 i |
| $T_{14}$= Weed free (15th Sept.- 30th Sept.) | 38.61 h | 40.62 a | 36.51 a | 10.34 e | 8.16 j |
| $T_{15}$= Weed free up to 0 day (control) | 18.11 j | 40.30 a | 36.80 a | 10.17 e | 7.88 k |

### PP 4.6: New: Weed management in tea with BecAno 500 SC (BTRI, BEF, T.Es: 2014-2018)

**Progress:** An experiment was carried out at BTRI Farm with seven treatments following RCBD. The treatments $T_0$ = Control, $T_1$ = BecAno 50 SC @ 50 ml, $T_2$= BecAno 50 SC @ 100 ml, $T_3$= BecAno 50 SC @ 150 ml, $T_4$= BecAno 50 SC @ 200 ml, $T_5$= BecAno 50 SC @ 250 ml and $T_6$= Chinochlor 5G @ 20 Kg ha-1 were applied on clean and weeds free plots containing sufficient soil moisture mixed in 400 L of water. Data were collected in terms of per cent weed germination at monthly interval. The germination of both monocot and dicot weed species were found to be started after 2 and 3 months of application in $T_1$ and $T_2$ plots respectively. In untreated control plot ($T_0$), it was found that the germination of weed species was more than 50% after one month and after 3 months both species reached up to 100%. In treatment $T_3$, no germination of weed species (both dicot and monocot) were observed (0%) after one month and after 6 months it was only 5-10% (table 3). The experiment will be continued.

**Table 3.** Percent germination of mixed stand weeds at different intervals

| Treatments | 1 month | 2 month | 3 month | 4 month | 5 month | 6 month |
|---|---|---|---|---|---|---|
| | D and M | D and M | D and M | D and M | D and M | D and M |
| $T_0$ | 50- 60 | 70-80 | 100-100 | 100-100 | 100-100 | 100-100 |
| $T_1$ | 0-0 | 15-20 | 30-40 | 50-60 | 70-80 | 80-90 |
| $T_2$ | 0-0 | 0-0 | 10-15 | 20-25 | 25-30 | 25-30 |
| $T_3$ | 0-0 | 0-0 | 0-0 | 0-0 | 5-10 | 5-10 |
| $T_4$ | 0 | 0 | 0 | 0 | 0 | 0 |
| $T_5$ | 0 | 0 | 0 | 0 | 0 | 0 |
| T6 | 0-0 | 0-0 | 0-0 | 10-15 | 15-20 | 20-20 |
| *LSD(0.05)* | | | | | | *3.99* |

**PP 4.7: Allelopathic effect of *Mimosa invisa* on weed control in tea (BTRI, BEF, TEs: 2014-2018)**

**Progress:** The experiment was laid out in paired plot design with *Mimosa invisa* seeded and unseeded (control) conditions. Seeds of *Mimosa invisa* were sown in cleaned, weed free tea section. Data were collected at monthly interval in terms of percent coverage of *Mimosa invisa* and percent mixed weeds population present in treated and untreated plots. In treated plots, per cent green coverage formed by *Mimosa invisa* were gradually increased with the increasing of time but, percent mixed weed populations were gradually decreased. After six months, 98% green coverage and 2% mixed weed populations were recorded in the treated plots. Whereas, gradual increase of mixed weed populations were found in control plots and reached at 95% after six months of observation.

**Table 4.** Coverage of weeds in *Mimosa invisa* seeded and unseeded plots at different intervals

| Treatment | | Month | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1st | 2nd | 3rd | 4th | 5th | 6th |
| *Mimosa invisa* | % Coverage | 20 | 40 | 70 | 80 | 95 | 98 |
| | % mixed weed population | 10 | 30 | 30 | 20 | 5 | 2 |
| Control | % mixed weeds | 25 | 50 | 65 | 80 | 90 | 95 |

Data were collected at monthly interval in terms of percent coverage of *Mimosa invisa*

**PP 5: ARBUSCULAR MYCORRHIZAL FUNGI IN TEA**

**PP 5.2: Effect of AM fungi on growth and development of tea (BTRI: 2010-2014)**

**Progress:** All plant growth parameters like Plant height, Length of roots, Weight of plants and Weight of roots were found to be significantly higher in $T_4$ which was treated with only Mycorrhiza followed by $T_3$ (Nursery mixture + Mycorrhiza) (table 5). The experiment will be continued.

**Table 5.** Effect of AM fungi on growth parameter of tea saplings in the nursery

| Treatments | Plant height (cm) | Length of roots (cm) | Weight of plants (gm) | Weight of roots (gm) |
|---|---|---|---|---|
| | Mean of five replications | | | |
| $T_1$= Untreated control | 15.30 | 12.80 | 1.42 | 0.80 |
| $T_2$= Nursery mixture | 23.79 | 15.20 | 4.18 | 1.95 |
| $T_3$= T2 + Mycorrhiza | 30.58 | 15.30 | 6.58 | 3.57 |
| $T_4$= Mycorrhiza | 33.78 | 19.10 | 8.37 | 3.61 |
| LSD (0.05) | 5.606 | 2.300 | 0.272 | 0.785 |

# TECHNOLOGY DIVISION

**Dulal Chandra Dey**
Scientific Officer

## STAFF

There was no change in the division during the period under report

## RESEARCH

Three experiments were carried out by this division during the period under report. The progress of these experiments is summarized below.

### TT1.1 Withering

T 1-11: Effect of heat in the withering trough on the quality of tea.

**Objective**

1. To compare the quality of made tea with and without use of heat in the withering trough.

**Progress**

a. During excess humidity, application of heat improves quality.
b. At low humidity application of heat decrease quality.
c. Broken percentage is high at without heat and dust percentage is high with heat.

Table 1**. Scoring of tea quality parameter with and without heat**

| RH (%) | | Infused leaf | Color | Strength | Briskness | Total | Average |
|---|---|---|---|---|---|---|---|
| 70 | Without heat | 6.50 | 7.50 | 6.50 | 7.50 | 28.00 | 7.00 |
| | With heat | 7.00 | 6.50 | 7.00 | 6.50 | 27.00 | 6.75 |
| 75 | Without heat | 6.00 | 6.50 | 6.50 | 6.00 | 25.00 | 6.25 |
| | With heat | 6.50 | 7.00 | 6.50 | 6.00 | 26.00 | 6.50 |
| 80 | Without heat | 6.00 | 6.50 | 5.50 | 6.00 | 24.00 | 6.00 |
| | With heat | 6.50 | 7.50 | 6.50 | 6.50 | 27.00 | 6.75 |
| 90 | Without heat | 6.00 | 6.50 | 5.50 | 6.00 | 24.00 | 6.00 |
| | With heat | 7.50 | 6.50 | 7.00 | 7.00 | 28.00 | 7.00 |
| 95 | With heat | 5.50 | 6.00 | 5.50 | 5.50 | 22.50 | 5.63 |
| | With heat | 6.00 | 6.50 | 7.50 | 7.00 | 27.00 | 6.75 |

**Table 2**. Grade percentage

| Without heat | With heat |
|---|---|
| 52% Broken | 50% Broken |
| 22% Fanning | 21% Fanning |
| 12% Dust | 17% Dust |
| 14% Over | 12% Over |

**T 1-12: Study the effect of different physical leaf composition on the tea quality and its grade percentage**

**Objectives**
Find out the quality of made tea according to plucking variation.
Find out the grade percentage according to plucking variation.

**Progress**
a. Highest quality of made tea from one bud and one leaf.
Lowest quality of made tea from one bud and three leaves.

**Table 3.** Scoring of tea quality parameter with leaf composition

| Sl. No. | Leaf | Infused leaf | Color | Strength | Briskness | Total | Average |
|---|---|---|---|---|---|---|---|
| 1 | One bud & one leaf | 6.50 | 7.50 | 6.50 | 7.50 | 28.00 | 27.83 |
| | | 7.00 | 7.00 | 6.50 | 7.50 | 28.00 | |
| | | 6.50 | 6.50 | 7.50. | 7.00 | 27.50 | |
| 2 | One bud & two leaves | 6.50 | 6.00 | 6.50 | 6.50 | 25.50 | 25.83 |
| | | 7.00 | 6.50 | 6.00 | 6.00 | 25.50 | |
| | | 6.00 | 7.50 | 6.00 | 7.50 | 26.50 | |
| 3 | One bud & three leaves | 5.50 | 6.00 | 6.50 | 5.50 | 23.50 | 23.67 |
| | | 6.00 | 5.50 | 5.50 | 6.00 | 23.00 | |
| | | 5.50 | 6.00 | 6.00 | 6.50 | 24.00 | |

**T1-13: Determination of made Tea quality at different temperature of CTC Rollers.**

**Objective**
1. Find out the quality of made tea according to temperature variation of CTC roller.

**Progress**
a. Highest quality of made tea from lowest temperature of CTC roller.
Lowest quality of made tea from highest- temperature of CTC roller.

**Table 4.** Scoring of tea quality parameter with different temperature of CTC roller

| Sl. No. | Average Temperature | Infused leaf | Color | Strength | Briskness | Total | Average |
|---|---|---|---|---|---|---|---|
| 1 | 41º c | 7.00 | 7.50 | 7.00 | 6.00 | 27.50 | 6.88 |
| | 43º c | 6.50 | 6.00 | 6.50 | 6.50 | 25.50 | 6.37 |
| | 46º c | 6.00 | 5.50 | 6.50 | 5.50 | 23.50 | 5.88 |
| 2 | 42º c | 6.50 | 7.50 | 6.50 | 7.00 | 27.50 | 6.88 |
| | 45º c | 6.50 | 7.00 | 6.00 | 6.50 | 26.50 | 6.50 |
| | 47º c | 6.00 | 6.50 | 5.50 | 5.50 | 25.50 | 5.88 |
| 3 | 43º c | 7.50 | 6.00 | 7.00 | 7.50 | 28.00 | 7.00 |
| | 46º c | 6.00 | 6.00 | 6.00 | 6.50 | 24.50 | 6.13 |
| | 47º c | 5.50 | 5.00 | 6.00 | 5.50 | 22.00 | 5.50 |

**Factory**
Maintenance and repair works of the factory machinery were done as usual. Re- sharpening of CTC rollers was done at workshop with high degree of standard. Maintenance of power house and different kind of vehicles were done as usual.

# BILASHCHERRA EXPERIMENTAL FARM

BTRI, SREEMANGAL

## STAFF

Mr. Zobayer Ahamed joined as Field Assistant, Mr. Md. Sabbir Mahedi Joy joined as Field Assistant and Mr. Atiqur Rahaman joined as Assistant Teacher (Primary) at Bilashcherra Experimental Farm on 6 January 2014, 6 February 2014 and 24 April 2014 respectively. Later Mr. Sabbir has been transferred to BTRI sub-station, Kality, Kulaura on 13 August 2014. Mr. Habibur Rahman, Laboratory Assistant joined on 10 August 2014 at this farm. Mr. Md. Shiam Ansari joined as Assistant Store Keeper on 5 May 2014. There was no other change in the staff. position.

## FARM

### Land Distribution

| Sl. No. | Description | Area (ha) | |
|---|---|---|---|
| (a) | Under Tea | 107.53 | |
| | I. Plucking Area | | |
| | 1. Immature Tea (under 5 years) | 5.17 | |
| | 2. Tea bushes 5 to 10 years | 4.38 | 100.53 |
| | 3. Tea bushes 11 to 40 years | 50.16 | |
| | 4. Tea bushes 41 to 60 years | 40.82 | |
| | II. Seed Bari | 6.00 | |
| | II. Seed Nursery | 0.50 | |
| | III. Clone Nursery | 0.50 | |
| (b) | Under Subsidiary Crops | 19.26 | |
| | I. Fruit Tree | 4.65 | |
| | 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, Fellow and Waste Land | 71.97 | |
| **Total Area of the Farm** | | **228.36** | |

### Crop Production

| Sl. No. | Description | Quantity |
|---|---|---|
| a. | Green Leaf | 5,63,662 (kg) |
| b. | Made Tea | 1,28,440 (kg) |
| c. | Average Production | 1,277 (kg /ha) |

**Monthly Crop Production of the Farm in the Year 2014**

| Name of the Month | Month-wise crop production in 2014 (kg) |
|---|---|
| January | - |
| February | - |
| March | 1,103 |
| April | 22,235 |
| May | 42,956 |
| June | 1,13,065 |
| July | 59,024 |
| August | 1,19,749 |
| September | 45,701 |
| October | 77,155 |
| November | 51,625 |
| December | 31,009 |

**Production of Improved Bi-clonal Seed, Planting Materials and Sales of Farm Products**

| Bi-Clonal Seed (kg) | Sales of Bi-Clonal Seed (Tk.) | Sales of Different Fruit (Tk.) |
|---|---|---|
| 242 | 27,000 | 30,000 |

**Extension and Development**

1.17 ha of new plantation was done in 2014. It has a nursery with the average capacity of 50,000 plants. Water supply, labor houses, roads and bridges were regularly maintained. One hectare of new land was brought under tea cultivation in section no. 11 during the year under report. Forty thousand tea saplings were infilled in different sections in the year 2014. 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 SUB-STATIONS

## FATICKCHERRI, CHITTAGONG

### STAFF

Mr. Md. Syeful Islam, Senior Scientific Officer (Plant Pathology Division) was transferred to BTRI, Srimangal and Mr. Md. Abul Kashem, Scientific Officer (Botany Division) took over the charge of Officer in-charge of the sub-station on 1 June, 2014. Mr. Md. Nurul Alam, MLSS was joined at the sub-station on 26 October, 2014 and transferred to Bangladesh Tea Board, Chittagong on 24 November, 2014. There was no other change in personnel position of the sub-station during the reporting year.

### PRODUCTION

43,314 kgs green leaves were produced during the year 2014. Harvested green leaves were sent to Oodaleah Tea Estate and Agunia Tea Estate for manufacturing.

**Distribution of improved planting materials**

| Year | Items | Tea Estate | | CHT Project | Banshkhali | Total (No./kg) |
|---|---|---|---|---|---|---|
| | | No. | Quantity (No./kg) | | | |
| 2014 | Fresh Cuttings | 6 | 1898000 | 85000 | - | 1983000 |
| | Rooted Cuttings | 2 | 5550 | 5200 | - | 10750 |
| | Biclonal Seed | 5 | 206 | - | - | 206 |

Besides the above mentioned items, a half-destroyed building along with a risky overhead water tank was broken and jackfruits were sold at worth of 2000/=Tk and 10,000/=Tk respectively during the year. About 502 nos. timber plants of different species were sold through auction by Bangladesh Tea Board in 2014.

**Infilling and Extension Programme**

About 1650 nos. tea plants were infilled and more than 1 acre area of new plantation was done during the reporting year.

**Seminars and Workshops**

A course of two days duration on tea culture and workshops on different topics such as pruning, plucking, diseases and pest management etc. were organized time to time at the sub-station for the tea planters of Chittagong Valley. Tea Tasting Programme was arranged during the year 2014 where the proprietors and management staff of Chittagong Circle were present.

# KALITI SUB-STATION
## KLAURA, MOULVIBAZAR

### STAFF

There was no change in the personnel position of the Sub-station during the year 2014.

### PRODUCTION

Green leaves produced during 2014 and total numbers of fresh cuttings distributed to different tea estates are given below:

| Year | Production of green leaf (Kg) | Fresh cutting supplied (nos.) | Callus cuttings supplied (nos.) |
|---|---|---|---|
| 2014 | 29,951 | 71,000 | 0 |

# REGIONAL STATION
## PANCHAGARH

### STAFF

There was no change in the personnel position of the Sub-station during the year 2014.

2990 nos. of shade tree seedlings i.e. *Albizia odoratissima* @ Tk. 6.0; 200 nos. of Neem seedlings @ Tk. 3.0; 400 nos. of Ghoraneem @ Tk. 2.0; 500 nos. of BT2 @ Tk. 3.0; 1000 nos. of TV23 @ Tk. 4.0 & 2150 nos. of TV26 @ TK 4.0 cuttings were supplied to tea estates.

## Other activities of the divisions during 2014

| Sl. | Item | Soil Science | Biochemistry | Botany | Agronomy | Entomology | Plant Pathology | Technology |
|---|---|---|---|---|---|---|---|---|
| 01 | No. of experiments | 04 | 02 | 23 | 03 | 09 | 06 | 03 |
| 02 | No. of experimental visits | 31 | - | 32 | 42 | 22 | 44 | - |
| 03 | No. of advisory visits | 06 | - | 02 | 11 | 13 | 04 | 03 |
| 04 | No. of advisory correspondence | 202 | - | 02 | - | 17 | 10 | - |
| 05 | No. of official visits | 03 | 01 | - | 06 | 05 | 08 | - |
| 06 | No. of soil, fertilizer & dolomite samples analyzed | 2,617 | - | - | - | - | - | - |
| 07 | No. of nursery soil, water & cowdung samples analyzed for nematodes | - | - | - | - | 90 | - | - |
| 08 | No. of pesticide residue analysis (commercial) | - | - | - | - | - | - | - |
| 09 | No. of pesticide residue analysis (Experimental) | - | - | - | - | 06 | - | - |
| 10 | No. of circulars/pamphlets/leaflets issued to T. E. | - | - | - | - | 01 | 01 | - |
| 11 | No. of pesticides tested in tea fields | - | - | - | - | 138 | 128 | - |
| 12 | No. of workshop/seminar conducted | 02 | - | - | 13 | 10 | 01 | 03 |
| 13 | MTC module conducted (Hours/year) | - | - | - | 30 hrs. | - | - | 21 hrs. |
| 14 | Attended national seminar, conference, symposium & workshop | - | - | 02 | - | 05 | - | - |
| 15 | Attended international seminar, conference & symposium | 01 | - | - | - | - | - | - |
| 16 | Attended Training/Course | 01 | 01 | - | - | 03 | - | - |
| 17 | No. of research paper published | 02 | - | - | 01 | 07 | 01 | - |
| 18 | No. of Fresh cutting supplied | - | - | - | 4,90,150 | - | - | - |
| 19 | No. of Rotted cutting supplied | - | - | - | 20,953 | - | - | - |
| 20 | Biclonal seed supply to T. E. | - | - | 242 Kg. | - | - | - | - |
| 21 | Tea tasting | - | - | 04 | - | - | - | - |

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