

# **ANNUAL REPORT**

# **2013**



**Tea Research Institute of Sri Lanka  
Talawakelle  
Sri Lanka**



## **Annual Report 2013**

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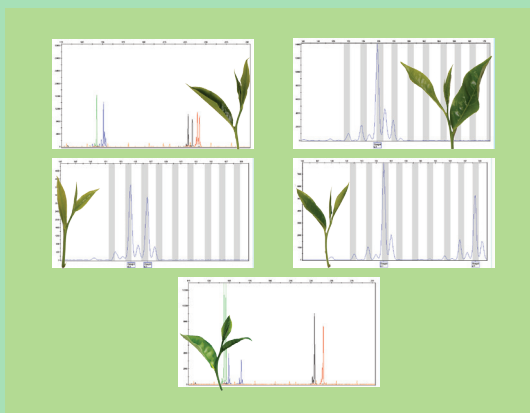
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### **Cover**



### **Genetic characterization of recommended Tea cultivars**

Genotyping primers of recommended tea cultivars generated by SSR primers

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# TEA RESEARCH INSTITUTE OF SRI LANKA

The Tea Research Institute of Sri Lanka (TRISL) was founded in 1925 in accordance with the provisions of an Ordinance passed in the Legislative Council of Ceylon to enrich the tea industry through professional tea research. The TRI established as an arm of the Planters' Association of Ceylon, is presently governed by the Tea Research Board of Sri Lanka subsequent to gradual transformation.

## Vision

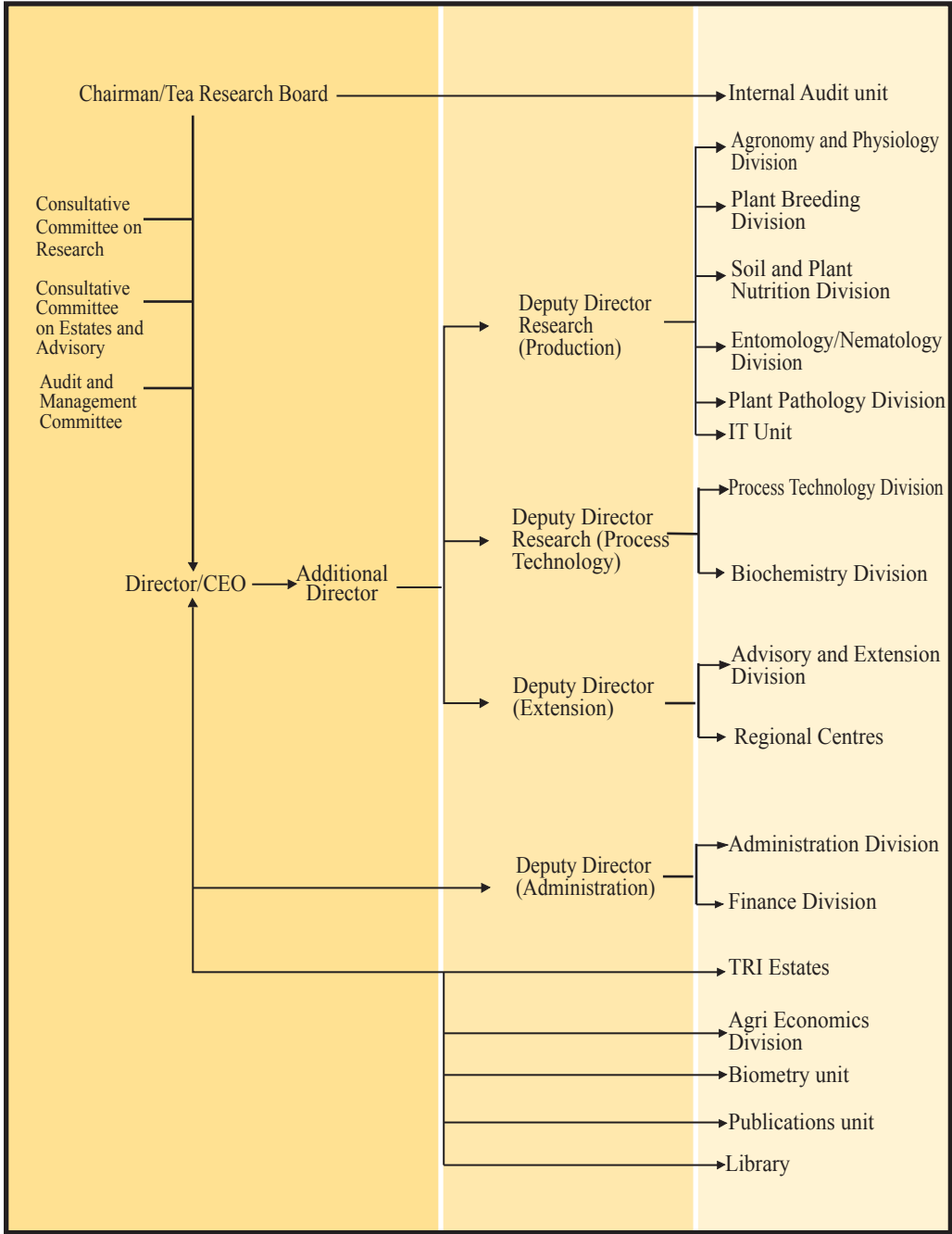
To achieve excellence in tea research and to provide technological guidance to the tea industry, in order to make Sri Lankan tea the most preferred tea in the world, at a competitive price

## Mission

To generate and transfer scientific knowledge and technologies appropriate for the stakeholders to improve productivity and quality of Sri Lankan tea in a most profitable manner



# Organizational Structure of the TRISL



# BOARD OF MANAGEMENT

## Tea Research Board of Sri Lanka

The TRISL is presently governed by the Tea Research Board of Sri Lanka that was established on 12<sup>th</sup> November 1993 under the provisions of the Tea Research Board Act No. 52 of 1993. In 2007, the Tea Research Board Act was amended and a Supplementary Act No. 43 of 2006 was approved by the Cabinet.

The functions of the Tea Research Board shall be to engage in and to encourage, foster and facilitate, research leading to cultivation and processing of tea.

### Specific functions of the Tea Research Board

- To conduct, assist and encourage scientific and technological research and investigations into all problems and matters affecting the production and processing of tea including the prevention and control of pests and diseases, improvement of quality of processed tea, as well as diversification of products of tea and to disseminate and publish results of such research
- To conduct, assist and encourage research into the economic viability of the tea industry in Sri Lanka, including future economic trends of the industry
- To establish and maintain relations with research institutions in Sri Lanka and abroad
- To conduct joint study programmes, seminars or symposia, with foreign and local research institutions



*Standing :* Mr. M D B C Jayasundera, Mr. J M B J Bandara, Mr. Gehan de Livera, Mr. W A D Gunasinghe, Mr. Prasanna Fernando, Dr. K M Mohotti (Convener / Secretary, TRB), Dr. D S A Samaraweera.

*Seated :* Mr. N Padmasiri Kariyawasam, Dr. Dan Seevaratnam, Dr. S S B D G Jayawardena (Chairman, TRB), Dr. I S B Abeysinghe (Director, TRI), Mrs. M D Y Dharmasekara.

## Members of the Tea Research Board



**Dr. S S B D G Jayawardena**  
Chairman, Tea Research Board



**Dr. I S B Abeysinghe**  
Director, Tea Research Institute  
of Sri Lanka



**Dr. D V Seevaratnam**  
Representative, Planters'  
Association



**Mrs. M D Y Dharmasekara**  
Representative, Ministry of  
Plantation Industries



**Mr. W A D Gunasinghe**  
Representative,  
Government Treasury



**Mr. N Padmasiri Kariyawasam**  
Representative, Tea Smallholdings  
Development Authority



**Mr. Gehan De Livera**  
Representative, Sri Lanka  
Tea Factory Owners' Association



**Mr. J M B J Bandara**  
Representative,  
Sri Lanka Federation of  
Tea Small Holdings  
Development Society



**Mr. Prasanna Fernando**  
Member, Nominated by the  
Hon. Minister



**Mr. M D B C Jayasundera**  
Member, Nominated by  
Hon. Minister



**Dr. D S A Samaraweera**  
Observer Member



**Dr. K. M. Mohotti**  
Tea Research Institute of Sri Lanka  
Convenor/ Secretary to the  
Tea Research Board

# CONSULTATIVE COMMITTEES

## Members of the Consultative Committee on Research

- Dr. D S A Samaraweera (Chairman of the Committee)  
Head of Operation, Tea Smallholders Factories PLC
- Dr. S S B D G Jayawardena  
Chairman, Tea Research Board
- Dr. I S B Abeysinghe  
Director, Tea Research Institute of Sri Lanka
- Dr. D V Seevaratnam  
Chief Executive Officer, Watawala Plantations Ltd.
- Dr. P Sivapalan  
Ex- Director, Tea Research Institute of Sri Lanka
- Prof. W A J M de Costa  
Department of Crop Science, Faculty of Agriculture, University of Peradeniya
- Prof. H P M Gunasena  
Chairman, Coconut Research Board
- Mr. N B H Pilapitiya  
Proprietor, New Vithanakanda Tea Factory, Kalawana
- Mr. M B Cyril  
Deputy General Manager (Development),  
Tea Small Holdings Development Authority
- Mr. S K L Obeyesekere  
Director/ CEO, Balangoda Plantation Ltd. and Madulsima Plantation Ltd.
- Mr. L P Jayasinghe  
Managing Director, Geo Tech Ltd.
- Mr. P M Samarasinghe  
D/Ag for Engineering Services
- Mr. S Sirisena (From May 2012)  
Director/CEO, Lanka Commodity Brokers Ltd.
- Mr. G D V Perera  
Director, Lankem Tea & Rubber Plantations (Pvt) Ltd.
- Mr. L J Pieris  
Managing Director, Helix Engineering (Pvt) Ltd.
- Dr. L S K Hettiarachchi  
Additional Director, Tea Research Institute of Sri Lanka, Convenor/ Secretary

## **Members of the Consultative Committee on Estates and Advisory Services**

- Dr. D V Seevaratnam  
Chief Executive Officer, Wattawala Plantations Ltd.  
(Chairman of the Committee)
- Dr. S S B D G Jayawardena  
Chairman, Tea Research Board
- Dr. I S B Abeysinghe  
Director, Tea Research Institute of Sri Lanka
- Dr. L S K Hettiarachchi  
Additional Director, Tea Research Institute of Sri Lanka
- Dr. D S A Samaraweera  
Head of Operations, Tea Smallholder Factories PLC
- Prof. W A D P Wanigasundara  
Head, Department of Agricultural Extension, Faculty of Agriculture,  
University of Peradeniya
- Mr. K G B Obeysekare  
General Manager, Tea Small Holdings Development Authority
- Mr. R K Nathaniel  
Ex-Head, Advisory & Extension Division, Tea Research Institute of Sri Lanka
- Mr. A L W Gunawardena  
Chief Executive Officer, Elpitiya Plantations PLC
- Mr. Viren Ruberu  
Chief Executive Officer, Kahawatte Plantations PLC
- Mr. T A G de Mel  
General Manager, Balangoda Plantations PLC
- Dr. V S Sidhakaran, Senior Advisory Officer,  
Tea Research Institute of Sri Lanka  
Convenor/ Secretary

## **Members of the Audit and Management Committee**

- Mr. W A D Gunasinghe  
Chairman of the Committee  
Additional Director General- National Budget Department of Treasury
- Ms. M D Y Dharmasekera  
Deputy Director (Development), Ministry of Plantation Industries
- Mr. J M B J Bandara  
President, Sri Lanka Federation of Tea Small Holdings Development Societies
- Mr. R Kariyawasam  
Tea Research Institute of Sri Lanka  
Convenor/ Secretary



## REPORT OF THE CHAIRMAN, TRB

On behalf of the Tea Research Board (TRB), I take great pleasure in presenting the 2013 Annual Report and audited financial statement of the Sri Lanka Tea Research Institute (TRISL). During 2013, tea industry recorded the highest ever tea production of 340 million kilos, in spite of very high degree of variability in rainfall in most of the tea growing regions. Compared to 2012, rainfall in 2013 was above average in most of the tea growing districts. In 2013, the variation in rainfall in all weather stations of the TRI was very significant compared to the average annual rainfall. The monthly rainfall figures were either above or below long term average in all stations.

St. Coombs Estate, Talawakelle experienced an above average rainfall in January, February, June and July. August and December months recorded the lowest. Passara station reported an above average rainfall only during first 5 months. Ratnapura and Deniyaya stations reported an above average rainfall during January, February, May, June and September only. Meanwhile, Kandy weather station reported above average rainfall through out, except in the months of April, November and December 2013. Rains occurred during the months of January, June, August and October was more significant contributing to higher crop yields.

In spite of high degree of variation in weather pattern during 2013, highest ever tea production is an indication of stability of the industry due to adoption of climate mitigating strategies recommended by TRI to the (Regional Plantation Companies) and Smallholders. Government fertilizer subsidy is another reason for higher yields as fertilizer use in tea during 2013 also recorded a higher use of fertilizer. It is also interesting to note that contribution of the Smallholder sector to national tea production was also the highest ever reaching approximately 245 million kilograms which was higher by about 10 million kg compared to that of 2012 smallholder sector tea production.

Having identified the emerging challenges of the tea industry during 2013, Tea Research Institute commenced the implementation of the new Corporate Plan. In order to monitor the progress of the Corporate Plan implementation, TRB regularly listen to scientists presentation at Board level and at Consultative Committee meetings and encouraged the scientists, while guiding them in achieving their set targets to serve the industry needs.

Tea Research Board decision making process on matters related to R & D, technology transfer, advisory services and management of two estates of the Institute are guided by the recommendations made to the Governing Board by the Consultative Committee on Research and Consultative Committee on Estates & Advisory Services. These committees are chaired by two professional Board Members and other members representing industry stakeholders, recognized scientists from Universities and Crop Research Institutes.



**Dr. S S B D G Jayawardena**  
*B Sc Agric. (Ceylon)*  
*M Sc (Kyoto, Japan)*  
*Ph D (Kyoto, Japan)*

Through this process, industry stakeholders, scientists of other organizations are given an opportunity to become partners in formulating the research agenda of the Institute. Governing Board always ensures that recommendations of the above Consultative Committees held quarterly are implemented and monitored regularly at monthly Board Meetings.

The above procedure allows Tea Research Board to identify R & D needs, technology transfer and training needs and current and emerging challenges to the industry. Tea Research Board then guides the Tea Research Institute's scientists on their R & D initiatives and Technology Transfer procedures. Tea Research Board facilitates the establishment of certain formal and informal mechanisms for regular interaction with the industry stakeholders and maintains a constant dialogue with the Institute. In order to ensure smooth and effective transfer of technological information to smallholder growers through the extension services of Tea Small Holdings Development Authority (TSHDA), emphasis is given to "TRI/TSHDA Linkage Meetings" held twice a year where common action plans and joint responsibilities are identified. It is through this mechanism industry planting material needs, adaptive research programmes field demonstration programmes and other activities are discussed and agreed upon.

One of the most effective and highly accepted interactive forums TRB has initiated is the 'Stakeholder Forum' held twice a year. During 2013, first forum was held in May under the theme "viable alternate employment models and interventions to consolidate the current issues of the tea industry".

This seminar was held to share experience and information gathered through a pilot research project carried out by researchers to explore possibilities of developing a non-salary based employment model to manage cost of production issues of the RPCs. In November 2013, second Industry Stakeholder Forum was held under the theme “Sustainable energy sources and efficient use of energy”.

Experiment & Extension (E & E) Forum held twice a year at Tea Research Institute, Talawakelle is another forum where predominantly scientific presentations are made with few presentations on matured technology ensuring quick dissemination of information on current industry status and matured technological messages on issues related to the industry. Tea Research Board guided TRI to make this forum more acceptable and valuable to participants by inviting a reputed industry stakeholder to make a presentation on a subject relevant to the stakeholders’ interest. During 2013, theme for the 226<sup>th</sup> E & E Forum was “Alternate crop, soil and pest management for sustainability” and “Sustainability of tea industry through alternative worker deployment models and field consolidating practices” at the 227<sup>th</sup> E & E held in July 2013.

While serving the information and training needs of the plantation sector through regular advisory services, Low Country Regional Centre at Ratnapura initiated activities on Data collection and analysis on climate change in tea growing agricultural regions (AR) and its impacts. Advisory & Extension Centres at Deniyaya, Passara, Kottawa, Mathugama and Hantana continued to play a vital role in carrying out extension services to smallholder sector. Mid country Regional Centre at Hantana played a major role in technology transfer activities to RPCs, Sri Lanka State Plantations Corporation (SLSPC), Janatha Estates Development Board (JEDB) and Elkaduwa Plantations and Mid country smallholder sector while attending to R & D activities, co-ordination of “Mother bush programme” and “Tea nursery certification programme”.

In implementing the Popularization of mechanization of the tea cultivation under the 2012 budget announcement and special allocation, TRB guided the TRI staff in its implementation by appointing a co-ordinator and regularly monitoring the progress. Initially, awareness creating and consensus building programmes were carried out in 8 districts covering 50 tea smallholder societies and 25 private tea factories. Seven residential training programmes were carried out at Ratnapura where equipment recipients were trained in using the equipment. At the end of 2013, procurement procedure to purchase all equipment was completed with a view to launch the project in early 2014.

Technology Division of TRI, Talawakelle and Ratnapura during 2013 carried out very vital functions of extending advisory services to RPC factories and a large number of private tea factories. Regular visits, calibration of machinery, advice on tea machinery and tea manufacture were the services rendered to the industry. Under the National Energy Management Plan, TRI jointly with Sri Lanka Sustainable Energy Authority (SLSEA) initiated an energy conservation programme in the tea manufacturing sector for the first time in 2012. This was a very positive step taken by TRI in relation to the energy needs of the industry and its cost effectiveness in manufacture. The above programme was continued through 2013 and training programmes carried out were very effective in creating awareness on energy saving and importance of energy auditing in reducing cost of production.

Advisory & Extension Division of the Institute during 2013, continued to focus on the importance of technology adoption and various interactive procedures were put in place to communicate important technical messages to RPCs and Smallholder sector. Fourteen Training of Trainers (TOT) programmes were conducted in collaboration with TSHDA, covering all 8 regions under the Regional Technical and Extension Forum activity implemented by the Regional Advisory and Extension Centres in Ratnapura, Kottawa, Deniyaya, Passara, Hantane and Kalutara. Regional Scientific Committees (RSC) also organized programmes and workshops. Under the technology transfer activities one mini crop clinic was held in the Henatanna Private Tea Factory for smallholders organized by Matugama Centre in collaboration with TSHDA staff.

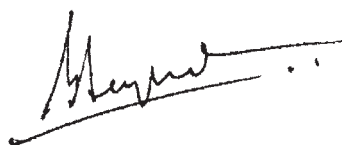
During 2013, St. Coombs continued to perform well by earning profits of Rs. 6,468,876.60. St. Coombs also received Gold Award for Highest Sale Average, Award for Highest Sale Average for Western High Elevation Category, Most number of Top Prices for Dust 1 category and All Time Record price for Western High Dust 1. St. Joachim estate continued to reduce financial losses from the estate while recording marginal profits from the bought leaf operations.

The Tea Research Board through Audit & Management Committee continued to monitor the administrative and financial management of the Institute to ensure highest degree of compliance of government instructions and circulars on good governance. Governing Board closely monitored the audit committee reports regularly and scrutinized the Auditor General's reports and directed the Institute to implement the recommendations of the committee. With limited staff Internal Audit Division ensured satisfactory control environment in financial management and estate management through regular audit checks.

Ministry of Plantation Industries through regular consultations, review meetings, ministerial directives guided the TRB and TRI in achieving the goals and objectives of the Corporate Plan while achieving the set targets of the government in economic development.

I take this opportunity to appreciate and acknowledge the dedicated services of the Institute scientific, supporting and administrative staff towards achieving the targets. directions, guidance and facilitating role played by the Honourable Minister, Secretary and Ministry Staff are highly commendable.

On behalf of the Tea Research Institute, I wish to acknowledge with great appreciation the commitment, contribution and guidance given to the Chairman by the members of the Tea Research Board.



**Dr. S S B D G Jayawardena**  
**CHAIRMAN**  
**TEA RESEARCH BOARD**

## REVIEW OF THE DIRECTOR, TRISL

‘Dayata Kirula’ exhibition was held during 23<sup>rd</sup>-30<sup>th</sup> March at Ampara Hardy Institute. TRI participated at the exhibition as an institution under Ministry of Plantation Industries (MPI) and the MPI stall won the 10<sup>th</sup> position where more than 200 institutes participated at the exhibition.

### **Popularization of tea harvesting and pruning machines in smallholdings sector**

A project was launched to popularize mechanical devices in tea smallholdings with Rs. 100 million approved by the government (Budget proposal 2013). This project was initiated by the TRI in collaboration with the TSHDA, Federation of Tea Smallholders, Private Tea Factory Owners Association and Sri Lanka Tea Board under the direction of the Ministry of Plantation Industries. The objectives of the project were to popularize mechanical devices for harvesting and pruning in the smallholding sector to increase labour productivity, train smallholders on the proper use of mechanical devices, attract and retain youth in the tea industry and design, test and fabricate a light weight and user friendly motorized machines suitable for harvesting.

### **Research, advisory and extension matters**

The Institute’s Draft Corporate Plan for 2013-2017 was prepared.

### **Research highlights**

#### **Crop Improvement**

##### **“TRI 5000 series” – Cultivars in pipeline/ next series of tea cultivars**

Evaluation of potential TRI 5000 series cultivars using 36 adaptive trials was continued with the partnership of growers. Thirteen new adaptive trials were established in the smallholder properties in different tea growing regions during 2013. These grower driven and community-based trials will serve as nucleolus mother bush blocks for dissemination of planting materials.

#### **Estate cultivar selection program**

In 2013, 50 promising seedlings selected from Glenanore estate, Haputale have been propagated for further evaluations and developing new tea cultivars.

### **Improved seeds as alternative planting materials for marginal tea growing areas**

Rejuvenation of two abandoned seed gardens was initiated in collaboration with respective estates. A new polyclonal seed garden was established at the TRI Regional Station, Hantana, Kandy in order to meet future demand especially in the mid country region.



**Dr. I S B Abeyasinghe**  
*B Sc (Peradeniya, Sri Lanka)*  
*Ph D (Sheffield, UK)*

### **Characterization and metabolite profiling of tea germplasm**

The project on metabolite profiling of the Sri Lankan tea germplasm using a high throughput technique was continued successfully. Selected 87 accessions were profiled for flavonol composition and preliminary results revealed that there was a wide variation within germplasm accessions.

### **Use of *in vitro* techniques to supplement the conventional tea breeding program**

Research activities aimed at developing necessary tissue culture protocols to supplement the conventional tea breeding program were continued. An attempt was made to develop plants through direct somatic embryogenesis from cotyledon tissues to facilitate mass multiplication of hybrid seeds. Plants generated from somatic embryos were field planted for further evaluations.

### **Identification of drought tolerance accessions of tea (*Camellia sinensis* L.) in Uva region of Sri Lanka**

Drought tolerance ability of tea cultivars and accessions was determined using Drought Susceptibility Index (DSI) with photosynthesis rate (PR) as a reference parameter of the known cultivars and accessions under stress and non-stress conditions. Results confirmed that DSI could be successfully use to determine drought tolerance ability of tea cultivars. Net photosynthesis rate (NPR) showed a positive correlation with actual yields confirming the feasibility of using NPR as a potential productivity parameter in drought screening studies.

### **Screening quality aspects of seedling tea cultivars planted in Dimbulla region**

Newly propagated seedling teas planted in Dimbulla region were assessed for quality in comparison with two known cultivars with better quality (DT1) and poor quality (TRI 2025). Out of six seedling teas tested, two were promising as its quality comparable to DT1. In addition, both seedling teas were quick fermenters similar to DT1.

### **Screening of tea accessions, cultivars and seed stocks against major tea pests**

During the period under review, potential accessions, cultivars and seed stocks for low, mid and high elevations selected by the Plant Breeding Division were screened against nematodes (*Pratylenchus loosi* and *Radopholus similis*) Shot hole borer and Low country live wood termite. Results of screening revealed that 9 accessions are tolerant or moderately tolerant to *Pratylenchus loosi*. Trial on screening against *Pratylenchus loosi* and *Radopholus similis* at Deniyaya TRI Extension centre revealed that 18 accessions are tolerant or moderately tolerant.

### **Land Productivity Improvement**

#### **Development of on-farm analytical kit to assess soil/ plant nutrient status in tea growing regions**

Site Specific Fertilizer Recommendations (SSFR) is a concept of applying fertilizer specific to the site, which allows tea growers to apply fertilizers more precisely than general fertilizer recommendation and optimize their yields with more profits. This concept takes in to account of field variability of soil characters and crop features in order to estimate nutrient requirement.

In order to facilitate SSFR a prototype of the soil analytical kit was developed to evaluate soil nutrient status. The testing and the validation of the prototype showed very high correlations between traditional methods of determination of pH, organic carbon content, available P, S and exchangeable Al and prototype measurements.

#### **Validation of Soil Quality Index (SQI)**

Soil quality index was further validated using the data of soil quality (physical, chemical and biological) parameters. Soil quality index was thus reported as 6.91 in an old tea field and 7.26 in a grass land at Mahadowa estate, Passara; 6.76 in an old tea field and 7.08 in a grass land at Cocagalla estate, passara. In Kew estate, Bogawantalawa SQI was reported as 6.32 and 6.24 in an old tea and grass land, respectively.

#### **Evaluation of different irrigation systems in tea**

A study conducted to evaluate the response of mature TRI 4042 (planted in 1998) to sprinkler irrigation in at St. Joachim estate, Ratnapura showed that leaf water potential and shoot extension rate of the irrigated plants were significantly higher than non-irrigated plants. In addition, rain-fed plants showed a higher active to dormant shoot ratio. Yield increment due to irrigation was around 50%.



### **Use of grafting techniques to increase productivity and quality and to mitigate biotic and abiotic stresses**

The graft combinations having scions with Blister blight and Shot hole borer resistant and high yielding characteristics and stocks with high rooting, drought tolerance and nematode (*Pratylenchus loosi*) resistance were tested at St. Coombs estate. TRI 4046 on TRI 4006, TRI 3072 on TRI 4006, TRI 3072 on TRI 4053 and TRI 4006 on TRI 3072 gave significantly higher yields. Yield increments observed were 47%, 24%, 24% and 29% respectively.

The graft combinations with ‘scions’ of high quality cultivars and ‘stocks’ of drought tolerant cultivars were tested at St. Coombs estate. The yield of graft combination, TRI 777 on TRI 2025 was significantly higher than the other combinations and TRI 4067 on TRI 3019, TRI 4079 on TRI 2025 and TRI 4079 on TRI 4052 gave higher yields compared to the controls.

### **Molecular diagnosis of canker causing fungi in tea**

Based on the ITS sequences, it was found that the stem canker disease is mainly caused by three anamorphic species belonging to family *Botryosphaeriaceae* (*B. dothidea*, *B. mamane* and *Lassiodiplodia theobroma*). However *B. dothidea* and *B. mamane* cannot be distinguished based on morphological features alone. *Macrophoma theicola* was found to be an anamorphic species complex of *Botryosphaeria dothidea* and *Botryosphaeria mamane*. Species specific primers were designed to differentiate the above *Botryosphaeria* species from other closely related fungal species and they were validated using the already characterized fungal isolates.

### **Molecular characterization of *E. vexans***

Variations among the *E. vexans* the causative organism of tea Blister blight were studied. The DNA sequences of both species showed higher similarity (>80%) with the DNA sequences of *Basidiomycetes* fungi in the Genbank. ITS sequences of *E. vexans* showed 77-89% homology with other *Exobasidium* spp. when subjected to Basic Local Alignment Search Tool (BLAST) analysis confirming the accuracy of the amplified region

### **Collar canker and bush dieback in tea**

Identification and characterization of the pathogens responsible for collar canker and dieback of tea bushes conformed *Fusarium solani* as the causative agent. There were variations among the selected isolates with respect to cultural and growth characters. *F. solani* showed high sensitive to Tebuconazole (EC<sub>50</sub> 0.23 µg/ ml) and field application at 500 and 1000 ppm resulted in 48% and 52% reduction of disease severity.

### **Screening of herbicides**

#### **Adaptive trials with Trigger (Glyphosate Iso Propyl Amine + Carfentrazone Ethyl) and Rapid (Glyphosate Iso Propyl Amine + MCPA Iso Propyl Amine)**

Both herbicides controlled common weeds and some of the hard-to-kill weed when applied at the rate of 3.3 L/ ha of Trigger and 3.85 L/ ha of Rapid under Low, Mid and up country conditions.



### **Screening of wound cut dressings for Low country Live Wood Termites**

Results of adaptive trials of Brunolium 15% carried out confirmed the field efficacy of Brunolium as a promising wound dressing.

### **Developing a Soil Quality Index**

Data on parasitic and free living nematode densities in soils were generated in locations identified to validate the Soil Quality Index (SQI) developed by the Agronomy Division.

### **Studies on physiological responses of tea to global climate change**

The carbon sequestration potential of seedling and VP tea plants in Up, Mid and Low country regions were determined. Seedling tea had a higher carbon sequestration potential than VP tea in all regions. At the age of 30 years the highest carbon sequestration rate was recorded with Low country seedling tea and the lowest was recorded with Up country VP tea.

Sheffield Dynamic Global Vegetation Model (SDGVM) was further fine tuned to predict the impact of climate change on tea yields. The preliminary predictions of the present study showed that the increase in atmospheric CO<sub>2</sub> levels will have a positive impact on tea yield in all elevation zones.

### **Analysis of climate change in different tea growing regions**

Trend analyses were carried out using rainfall surface data generated for (AERs) by the Department of Meteorology, Sri Lanka. Analysis of rainfall and temperature data showed that WL1a, WL1b, WL2a, WM2a, WM2b, WM3a, IM2b, IM3a and IM3c AERs are highly vulnerable to climate change and WM1a, WM1b, WM3b, IM1a, IM2a, IU3a, IU3d and IU3e are vulnerable.

### **Effects of climate change on pest incidences**

The mortality of five populations of the *Pratylenchus loosi* was tested under different conditions. All nematode populations were sensitive to 28°C. Passara region showed a highly sensitive mortality viz. 66.66% and 82.67% at 28°C in aqueous (p=0.0467) and soil media (p=0.0088), respectively. In contrast, Talawakelle region exhibited the lowest mortality percentage at 16°C (13.33%), 20°C (20%) and 24°C (20%) temperatures though not significantly different. The results indicated potential of using nematodes as an indicator of climate change impacts in agriculture.

### **Tea processing technology and product development**

#### **Development and improvement of tea machinery and factory conditions**

##### **Study on cast iron components of air heaters**

Quality of cast iron components used in air heaters in the tea industry at present was studied. It was revealed that certain metals like Cr and Ni chemical composition of cast iron components were not up to the required standard.

### **Development of a self-cleaning sifter for low grown tea grading process**

A ball-tray arrangement coupled with Michie sifter was tested as a self-cleaning continuous sifting machine for the low country tea grading process. Initial studies on optimizing the operational parameters of existing Michie sifter were completed and fabrication of the ball tray arrangement and coupling with the existing Michie shifter was also completed. The performance of the self-cleaning sifting machine was found to be satisfactory.

### **Improvement to drying process in Orthodox–Rotorvane tea manufacture**

A study was conducted on fluidizing behaviour of teas using different bedplates with varying opening area percentages and perforation sizes. Three different bedplates with modified dimensions have been identified for improving fluidizing behaviour of teas. Results revealed that the teas could be dried at lower temperatures than the present recommended temperatures.

### **Application of membrane filtration technique for concentration of tea extract**

Instant black tea prepared through the application of membrane pre-concentration technique was superior in physicochemical and organoleptic properties. Membrane concentration consumed less energy as compared to thermal evaporation. Therefore, membrane pre-concentration technique can be applied to improve the physicochemical and organoleptic properties of instant black tea in an economically feasible manner.

### **Extraction of proteins from refused tea/spent tea**

It was possible to prepare a protein concentrate with the composition of 24% protein, 12% total ash, 0.4% ether extract, 0.4% crude fiber and 7% polyphenols. Economic feasibility study of the process for a capacity of 1000 kg of protein concentrate per day was carried out. Results showed that the process would be economically feasible at the selling price of Rs. 250/ kg of the final product.

## **Socio Economics and Resource Planning**

### **Assessment of tea out- grower system on livelihood security of workers**

An assessment of tea out- grower system was carried out in Selagama estate, Matale district to assess the socio-economics of existing out grower system. There were significant differences between economic security, education security and habitat security among two groups and out growers were comparably better than non out-growers. Number of tea bushes in the allocated plot, family labour and hired labour significantly affected the yield. The study showed that inefficiency is positively and significantly correlated with distance to the field, number of other income sources and number of estates workers in a family. As selection criteria for the out grower system, distance to the out grower field, number of estate workers in the family and other income sources should be considered in order to obtain higher productive efficiency from the out growers. It can be concluded that out grower system in Selagama estate can continue as a socio-economically viable system in order to overcome labour shortage and uplift livelihoods of workers.

## **Micro & macro-economic analysis**

### **Identification of contributory factors for below norm pluckers in Up country tea estates**

The walking distance, slope, vacancies, weed density were the contributory factors for not achieving the norm and significant positive factor to achieve the norm was height of the workers. It can be suggested that improvement of land productivity by maintaining recommended number of bushes through infilling, maintaining tea fields free of weeds, placing weighing points near the tea field to reduce unproductive walking time of the pluckers, regular training on plucking and counseling and motivation of low performers are the important measures to be considered for improving plucker productivity and to overcome the adverse impacts of below-norm pluckers on cost of plucking.

### **Productivity variation among tea smallholders in the Uva region**

The productivity of the smallholders in the Uva province highly varied from 213.33 to 11728 kg/ ac/ yr and technical efficiencies of tea small holdings varies from 17.09% to 99.71%. The hired labor, amount of fertilizer, chemical cost, Zn cost, extent of land, cultivar, type of tea, health condition of farmer and intercropping were the major contributory factors for productivity variation. Optimum utilization of the land and labor resources, making the smallholders aware of the TRI recommendations and good agricultural practices such as fertilizer and Zn application would be the effective strategies for increasing the productivity.

## **Services to Stakeholders**

### **Advisory and extension visits**

Total of 700 advisory and extension visits have been done by the staff of Advisory and Extension Division. Almost 32% of visits have been covered during the 1<sup>st</sup> quarter as the majority of land selection requests in the South Western monsoon sector were received during this period.

### **Visits to the estates with TRI scientists for special field issues**

On the request of Ceylon Planter's Association through the Consultative Committee on Advisory and Estates, special program was initiated to visit RPC estates jointly with the scientists to tackle the special field problems of the RPCs. To begin with, the plantations of Elpitiya PLC in the Up country region, Fernlands, Sheen, Nayapana, New Peacock, Dunnsinan and Madakumbura estates were visited with the scientists of Soils and Plant Nutrition, Plant Breeding and Entomology Divisions to investigate the problems of low phosphate in soil, unusual tea tortrix out breaks during the rainy season, dying of some tea cultivars, such as TRI 2021 *etc.* This program continues to cover the requests of all the other RPCs.

### **Stakeholder Forum seminars**

With the objective of fostering the interaction between TRI scientists and the stakeholders, two Stakeholder Forum seminars were conducted, one at the auditorium of HARTI on 31<sup>st</sup> May 2013 and the other at the auditorium of SLIDA in Colombo, on 29<sup>th</sup> November 2013. The themes of the seminars were "Viable Alternative Employment

Models and Interventions to Consolidate the Current stand of Tea” and the “Sustainable Energy Sources and Efficient Use of Energy”. Seminars were successfully conducted with the participation of the senior scientists and extensionists of TRI, CEOs and the senior management of the RPCs and the senior management of the other tea related organizations.

### **Fertilizer adaptive trials**

The adaptive trials to compare the new fertiliser mixture proposed by the TRI for the smallholding sector were concluded. Evaluations of the adaptive trials were done jointly by the staff of TRI and TSHDA. Awarding ceremony for the fertilizer adaptive trial participants was held on the 20<sup>th</sup> December 2013 along with the 25<sup>th</sup> E&E (Smallholdings sector) forum held at the TRI Low country station.

Bio film bio fertilizer (nursery) adaptive trial results were presented to the Technology Release Committee of the TRI. Adaptive trials were also conducted to evaluate the new products proposed for the Shot Hole Borer (SHB) control at Fairly estate (Ozada Plantation) in Dolosbage and to evaluate the effectiveness of Chlorine (Cl) as an alternative for eradicating nematodes in irrigation water in tea nurseries at the TRI Mid country station nursery.

### **Para extension approach (PEA) for the corporate tea sector**

During 2013, PEA programs were conducted for two RPCs namely Kahawatte Plantations PLC (Nawalapitiya & Kahawatte regions) and Watawala Plantations PLC (Lindula & Hatton regions). These programs were conducted by the TRI extension staff with the assistance of research staff of Entomology, Pathology and Agronomy divisions. The implementation of the PEA in tea estates helped improving awareness and adoption of good agricultural practices, skills and positive attitudes among field staff and workers.

### **Commercial nursery inspection**

TRI officers have inspected 249 commercial tea nurseries in 2012. It was found that only about 60-65% of nursery plants inspected were suitable for Planting.

### **Crop clinics and exhibitions**

A mini ‘Crop clinic’ was conducted in the Henetenna Tea Factory for smallholders, organized by TRI Matugama centre in collaboration with the staff of TSHDA. All the aspects of nursery management including the identification of suitable cultivars, growing media and techniques of cleft grafting were demonstrated by the staff of Advisory, Agronomy, Plant Breeding and Entomology/Nematology Divisions of the TRI.

Staff of the Advisory division participated at three public and educational exhibitions including the "Dayata Kirula 2013: National Exhibition" held at Ampara. Officer in charge and staff of Uva Advisory & Extension Centre were involved in organizing the Dayata Kirula exhibition activities. The exhibition stall of the Ministry of Plantation Industries was selected amongst the best 10 stalls out of 200 stalls at the exhibition.

Prior to the “Dayata Kirula” exhibition, a series of mobile educational and service programs were organized by the Ministry of Economic Development in Kurunegala, Kegalle and Puttlam District during end of 2013. The officers from the Advisory & Extension division at Talawakelle, Ratnapura and Kandy conducted 22 extension programs in Kegalle district.

### **ADB mother bush project**

Around seven million cuttings of 3000 & 4000 series cultivars were issued to both small holdings and estate sector from mother bush sites during the year 2013 as against estimated 10.5 million cuttings. Unfavorable weather conditions and less demand for certain cultivars contributed for non-accomplishment of the target.

### **Demonstration block (Technology Park) at St. Coombs estate, Talawakelle**

The initiatives have been taken to convert one hectare block of tea in the field no. 8 of lower division at St. Coombs estate as a technology park. Soil rehabilitation with recommended grass species, different planting spacing, soil and water conservation techniques, standard pruning and harvesting methods are being demonstrated in this site. The establishments of other Good Agricultural Practices (GAPs) are in progress.

### **Collaborative work/ links with other organizations**

#### **TRI and Natures Beauty Creations Ltd.**

Research work on “Investigate the properties of fresh tea extracts and their stability when incorporated in a cosmetic formulation” was continued in 2013 under MOU between M/s Natures Beauty Creations Ltd. (NBC) and TRI.

#### **TRI and Agriculture Research Organization (ARO), Israel**

Research Officer attached to Entomology and Nematology Division underwent training on Integrated Pest Management sponsored by the MASHAV at the Agriculture Research Organization (ARO) under the MOA with ARO.

#### **Sri Lanka Institute of Nanotechnology (SLINTEC)**

A collaborative project on “Soil fertility improvements using slow releasing fertilizer” was continued with Sri Lanka Institute of Nanotechnology (SLINTEC). The glasshouse trials were completed and field trials are established. MOU was signed and field testing on slow releasing fertiliser was commenced.

#### **Uva Wellassa University**

Scientists at TRI continued to provide services for the degree programme on Tea Technology and Value Addition at Uva Wellasa University.

#### **TRI-IFS**

Collaborative work on the use of Bio-filmed bio fertilizer (BFBF) in tea with Institute of Fundamental Studies was continued. Adaptive trials on the use of BFBF were completed and use of BFBF in immature and mature tea fields are in progress.

### **TRI and Sustainable Energy Authority**

A joint programme by TRI and Sustainable Energy Authority (SEA) on “Energy management in Tea Sector” was conducted for energy managers and Energy Management Officers attached to RPCs and factories.

### **Awards and recognition**

Mrs. T L Wijeratne received a merit award for the presentation made on ‘Carbon sequestration in tea plantations’ at the National Science and Technology Commission (NASTEC), Colombo in January 2013.

Dr. K M Mewan was awarded the membership of the Institute of Biology of Sri Lanka.

Dr. K M Mohotti was awarded the Fellow category at the Institute of Biology Sri Lanka and served as the President of the Institute of Biology of Sri Lanka. Mrs. P G D S Amarasena received the membership of the Institute of Biology of Sri Lanka.

Mr. M A B Ranatunga was appointed as a member of the National Committee on Plant Breeding and National Committee on Agricultural Biotechnology of CARP.

TRI Low country Regional Centre received the Silver Award under the category of “Service sector-Small scale” in the Islandwide competition on social dialogue & workplace cooperation organized by the Department of Labour, Ministry of Labour and Labour Relations.

Mr. C J Liyanaarachchi, Extension Officer attached to the TRI Low country station won a merit award in the poem competition (Sinhala Medium).

### **Administrative and financial matters**

Mr. Anuradha Nanayakkara assumed duties as Superintendent, St. Joachim w.e.f 2<sup>nd</sup> December 2013.

Ms. S P A P K Jayarathna, A Abeysooriya, Ms. P A L K Dharmapala and W M S S Kumari were appointed as Extension Officers w.e f. 01.10.2013

Ms. P S Wickramasinghe, Internal Audit Officer , K A S Kumarapperuma, Clerk/Typist , Wimalasena Silva, Skilled Mechanic and K M Gamini De Silva, Driver retired from the services after rendering their valuable services to TRI.

### **Human Resource development**

One Ph D thesis and two M Phil thesis of TRI officials were added to the library thesis collection during the year 2012.

## **Publications**

- TRI Corporate Plan- 2013-2017
- Sri Lanka Journal of Tea Science Volume 75, Part 2, 2010
- Tea Bulletin Volume 21, Number 1, June 2012
- “Thei Thathu” Volume 9, No. 2, December 2012
- Guidelines for Use of Motorized Tea Harvesting Machines
- Tea Industry and Tea Research Institute of Sri Lanka (Sinhala/ Tamil/ English)
- තේ තතු Volume 9, Part 1

## **TRI Advisory Circulars**

- HP 1 Pruning of Tea
- HP4 Rejuvenation Pruning
- WM1 Integrated Weed Management in Tea
- PN2 (Sinhala) තේ තවාන් පාලනය
- SP 7 (Sinhala) පාංශු විශ්ලේෂණය
- SP 8 (Sinhala) පොහොර නියැදි විශ්ලේෂණය
- SP 9 (Sinhala) තේ පත්‍ර විශ්ලේෂණය සඳහා නියැදි ලබා ගැනීම
- PM 2 (Sinhala) කළු විදින ගුල්ලා කළමනාකරණය කිරීම
- PM 9 තේ වගාවන්හි උඩරට සෑහිල්ලු දැව වේයා පාලනය කිරීම

## **TRI estates**

St. Coombs estate faced adverse weather conditions during the months of June and July 2013. As a result the estate crop dropped by 55% and 72% respectively.

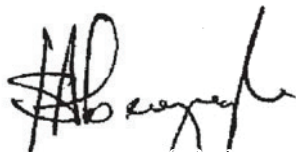
St. Coombs estate recorded a yield of 2,200 kg/ ha in the year 2013. The estate made a profit of Rs. 6,468,876.60 for the year.

St. Coombs won the Gold Award for achieving rank 1<sup>st</sup> in Western High Grown category and also Award for the highest sale average in Western High Grown.

The estate also received the all time record price for Dust No.1 (Rs. 850.00) and achieve top prices 24 times during the year and also the award formost number of the top prices for Dust No.1 grade. The Gross Sale Average for 2013 was Rs. 499.22, which was Rs. 85.04 above the Western High Grown elevation average. The estate replanted 2.00 ha with new TRI cultivars.

A tea nursery with 250,000 tea plants was raised at St. Joachim estate jointly with the TSHDA.

I thank the Chairman and board of management for their continuous support, advice and guidance extended to me during the year to carry out my duties. My great appreciation to the TRI staff for extending their fullest cooperation to achieve the goals set in the corporate plan.

A handwritten signature in black ink, appearing to read 'I S B Abeyasinghe', with a stylized, cursive script.

**Dr. I S B Abeyasinghe**

**Director**

**Tea Research Institute of Sri Lanka**



# **TRI STAFF MEMBERS**

## **DIRECTORATE**

### **Director**

Dr. I S B Abeysinghe B Sc (Peradeniya, Sri Lanka) Ph D (Sheffield, UK)

### **Additional Director**

Dr. L S K Hettiarachchi B Sc (Peradeniya, Sri Lanka) Ph D (Aberdeen, UK)

### **Office Staff**

S M Jayasingham, Secretary to Director

S Shanmuganathan, Secretary to Chairman

Devika Ratnayake, Stenographer

R J Rayappan, Clerk

P Selvaraj, General worker

## **ADVISORY & EXTENSION DIVISION**

### **Head**

B A D Samansiri Principal Advisory Officer B Sc Agric. (Peradeniya, Sri Lanka) M Phil (University of Philippines)

### **Principal Advisory Officers**

J C K Rajasinghe B Sc Agric. (Peradeniya, Sri Lanka) M Sc (PGIA, Peradeniya, Sri Lanka),

Dr. V S Sidhakaran B Sc Agric. (Peradeniya, Sri Lanka) M Sc (PGIA Peradeniya, Sri Lanka) Ph D (TNAU, India)

### **Advisory Officers**

K G J P Mahindapala B Sc Agric. (Peradeniya, Sri Lanka) M Sc (PGIA Peradeniya, Sri Lanka) PG. Dip. (Applied Statistics)

T G N Mahinda B Sc Agric. (Peradeniya, Sri Lanka) M Sc (PGIA Peradeniya, Sri Lanka)

S P Ratnayake B Sc Agric. (Ruhuna, Sri Lanka) MBA (Wuhan University, China)

### **Extension Officers**

H J M de Silva B Sc Agric. (Ruhuna, Sri Lanka)

Haran Jayaweera Undergraduate Level V (Open University)

K R W B Kahandawa B Sc Agric. (Peradeniya, Sri Lanka) M Sc (PGIA Peradeniya, Sri Lanka)

M A H Nishanthi B Sc Agric. (Peradeniya, Sri Lanka) M Sc (PGIA Peradeniya, Sri Lanka)

A L R U Kumara B Sc Agric. (Peradeniya, Sri Lanka) M Sc (PGIA Peradeniya, Sri Lanka)

C J Liyanarachchi B Sc Agric. (Wayamba, Sri Lanka) M Sc (PGIA Peradeniya, Sri Lanka)

P K R C E Munasinghe B Sc Agric. (Wayamba, Sri Lanka)

**Technical Assistant**

D K D Dissanayake Diploma in Agriculture

**Technical Officers**

N S Ekanayake

C S K Kiribathgoda, Stenographer/ Typist (English)

**AGRICULTURAL ECONOMICS DIVISION****Acting Head**

Dr. H W Shyamalie Senior Research Officer B Sc Agric. (Peradeniya, Sri Lanka)  
M Sc (PGIA, Sri Lanka) Ph D (CSKHPKV, India)

**Research Officer**

H R Aabeyratne B Sc Agric. (Peradeniya, Sri Lanka) (up to April 2013)

**Technical Assistant**

K W N Nadeeshani B Sc Science (Peradeniya, Sri Lanka)

**AGRONOMY DIVISION****Head**

Dr. K G Prematilake, Senior Research Officer B Sc Agric. (Ruhuna, Sri Lanka) M Phil (Peradeniya, Sri Lanka) Ph D (Reading, UK) Senior Research Officer

**Senior Research Officers**

Dr. M A Wijeratne B Sc Agric. (Ruhuna, Sri Lanka) Ph D (London, UK)  
Officer-in-Charge, Low country Regional Centre, Ratnapura

Dr. M S D L De Silva B Sc (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka)  
Ph D (Queensland) Officer-in-Charge, Mid country Regional Centre, Hantana (wef 1<sup>st</sup> Nov. 2013)

**Research Assistants**

Dr. N P S N Bandara B Sc Agric. (Peradeniya, Sri Lanka) Ph D (Adelaide University, Australia)

S R W Pathirana B Sc Agric (Ruhuna, Sri Lanka) Low country regional Centre

T L Wijeratne B Sc Agric. M Sc , (Peradeniya, Sri Lanka)

D M S Navaratne B Sc (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka)

**Experimental Officers**

H S N Peiris B Sc Agric. (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka) Low country Regional Centre

M G S Liyanage B Sc Agric. (Peradeniya, Sri Lanka) Low country Regional Centre

D W Viithana Diploma in Agriculture Low country Regional Centre

L A S P Jayasinghe B Sc Agric. (Wayamba, Sri Lanka) M Sc. (Peradeniya, Sri Lanka) **27**  
Low country Regional Centre

E W T P Premathunga Low country Regional Centre  
Chandima De Seram Low country Regional Centre  
M M N Damayanthi B Sc Agric. (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka)  
U P Abeysekara Diploma in Agriculture  
V Sidhakaran  
A P D A Jayasekara (upto 13<sup>th</sup> Dec. 2013) Mid country Regional Centre  
S N Wijesekara Mid country Regional Centre

**General Worker**

N. Sivasubramaniam  
R. Puwaneswaran

**BIOCHEMISTRY DIVISION**

**Acting Officer-in-Charge**

Dr. K M Mewan B Sc Agric. (Ruhuna, Sri Lanka) Ph D (Colombo, Sri Lanka) Research Officer

**Research Officer**

G A A R Perera B Sc Agric. (Peradeniya, Sri Lanka) M Sc (Sri Jayawardenapura, Sri Lanka)

**Experimental Officer**

G H Thotawattage B Sc Agric. (Peradeniya, Sri Lanka) M Sc (Peradeniya, Sri Lanka)  
(up to 07.02.2013)

**Technical Assistant**

H M S B Heenkenda (up to 25.03.2013)

**Technical Officer**

E N U Edirisinghe Diploma in Agriculture

**Skilled Mechanic**

M W Silva (Retired on 10.03.2013)

**General Workers**

G Periyasamy  
A Mahendran (from 07.01.2013)

**PLANT BREEDING DIVISION**

**Officer in Charge**

M A B Ranatunga B Sc Agric. (Peradeniya, Sri Lanka) M Sc (TNAU, India)  
Senior Research Officer

**Research Officers**

J H N Piyasundara B Sc (OUSL, Sri Lanka) M Phil (Peradeniya, Sri Lanka) (Low country Regional Centre)

R Paskarathevan B Sc (Madras, India) M Sc (Colombo, Sri Lanka)

**Experimental Officers**

T M Sarathchandra B Sc (Canterbury, UK)

J D Kottawa Arachchi B Sc (OUSL, Sri Lanka) M Phil (Peradeniya, Sri Lanka)

K K Ranaweera B Sc Agric. (Ruhuna, Sri Lanka) M Phil (Peradeniya, Sri Lanka)

A K Mudalige Diploma in Agriculture, BSc Agric. Science & Management (Sabaragamuwa, Sri Lanka) (Low country Regional Centre)

**Technical Officer**

M G M Kumara HNDDT (Agric.)

**General Workers**

B K Jayanthi

D Rita

A M U Liyanage (Low country Regional Centre)

A K J Athukorala (Low country Regional Centre)

**PLANT PATHOLOGY DIVISION****Senior Research Officers**

N H L Pradeepa B Sc (Ruhuna, Sri Lanka) M Sc (GBPUAT, India) (On study leave)

G D Sinniah B Sc (EUSL, Sri Lanka), Ph D (PGIS, Sri Lanka) (Contractual basis)

**Technical Officer**

D G N P Karunajeewa Diploma in Agriculture

**SOILS & PLANT NUTRITION DIVISION****Head**

Dr. G P Gunaratne B Sc Agric. (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka)

Ph D (Peradeniya, Sri Lanka)

**Research Assistant/ Research Officer**

L R M C Liyanage B Sc Agric. (Peradeniya, Sri Lanka)

W M S Wijayathunga B Sc (Peradeniya, Sri Lanka) M Sc (Peradeniya, Sri Lanka)

**Experimental Officers**

P L K Tennakoon B Sc (Peradeniya, Sri Lanka) M Sc (Dharwad, India)

W T B D Priyantha B. Sc (J'Pura, Sri Lanka)

S M Dissanayake B Sc Plantation (Wayamba, Sri Lanka)

J R Y Abeywardane

O G K A Gunaratne Diploma in Agriculture ACLT (OUSL, Sri Lanka)

W M J C Bandara B.S (OUSL, Sri Lanka)

### **General Workers**

D Silvester

V Rathakrishnan

A Selvanayagum

## **PROCESS TECHNOLOGY DIVISION**

### **Head**

Dr W S Botheju B Sc (Colombo, Sri Lanka) M Phil (Peradeniya, Sri Lanka) Ph D (Peradeniya, Sri Lanka)

### **Senior Research Officers**

K Raveendran B Sc Eng (Chemical) (Moratuwa, Sri Lanka) M Eng (AIT, Thailand)

G L C Galahitiyawa B Sc (Kelaniya, Sri Lanka) (Low country Regional Center)

S Koneswaramoorthy B Sc Engineering (Mechanical) (Peradeniya, Sri Lanka)

### **Experimental Officers**

S H Priyanthie N D T (Moratuwa, Sri Lanka)

L Jayasinghe

W M S Weerawardena B Sc Engineering (Peradeniya, Sri Lanka)

W M U A B Marapana B Sc (J'pura, Sri Lanka) (Low country Regional Center)

M A Chamindra (Low country Regional Center)

### **Chief Mechanic**

A Nandasiri

### **Mechanics**

L Weerasooriya

M Gabrial

N Bowei

### **General Workers**

R Illongovan

P Sellethurai

## **ENTOMOLOGY & NEMATOLOGY DIVISION**

### **Head**

Dr. K M Mohotti B Sc (Peradeniya, Sri Lanka) Ph D (Reading, UK) F Biol (Sri Lanka), C. Biol. (Sri Lanka)

R D P D Senanayake B Sc (Peradeniya, Sri Lanka) M Sc (PGIS, Sri Lanka)

**Experimental Officers**

D D Liyanage B Sc (Kelaniya, Sri Lanka)

P G D S Amarasena, B Sc (Peradeniya, Sri Lanka), M Sc (PGIA, Sri Lanka)

N Navaratne

A R Abeysekera

R Perera

B S Vitana

A K Prematunga

P K Jayawickrema

U B Herath

**General Workers**

S Hettiarachchi

V Sabaratnam

**LIBRARY**

R W M S K Amunugama Library Assistant

Diploma in Library Science (Sri Lanka Library Association)

**General Worker**

S Parameswary

**PUBLICATION & PUBLICITY UNIT****Publication & Publicity Officer**

Dr. K M Mewan, Research Officer (covering- from 15.08.2013)

A P V Kalyani (Stenographer/Typist (English))

**General Workers**

A Krishnamenan

P Sivapalan

**IT UNIT****Experimental Officer**

U D Alagiyawadu

**ADMINISTRATION DIVISION**

N D M Karunadasa Administrative Officer

K R M Priyantha Clerk/Typist

W M S R Wanasinghe Clerk/Typist

C Jayaram Clerk/Typist

R M D K Ratnayake Clerk/Typist

S Dharmalingam Clerk/Typist

A A H Chinthaka Clerk/Typist

R A C Lasantha Clerk/Typist

**General Workers**

N Pushparaj

V Chandrasekaran

## **ELECTRICAL UNIT**

U A Wickramasinghe Electrical Foreman

R W Rengasamy Electrician

J M R K Bandara Electrician

### **General Workers**

J Anthony

K Jayarathnam

L R Rajalingam

M Bernard

## **ENGINEERING DIVISION**

C J B Abeykoon Clerk of Works

K Pahalathanthige Works Supervisor

J G Gamage Filter Plant Assistant

W C K Fernando Chief Plumber Mechanic

P T Perera Clerk/Typist

I W Nihal Kumara Clerk/Typist

U D W Ratnasiri Filter Plant Assistant

K A Francis Dharmadasa Asst. Plumber Mechanic

R Jeyaraj Carpenter

### **General Workers**

S Balakrishnan

A Loganathan

H M Wijesekara

N C Paul

B K Jayasinghe

R Velmurugan

D A Wimalasiri

## **FINANCE DIVISION**

M V Mohan Accountant

W M T B Weerasekara Accountant

G B Jayawardena Accounting Officer

B K S Herath Accounts Clerk

K T U Kulatunga Assistant Store Keeper

Saman Hewasiliyan Accounts Clerk

H P W Gunasekera Stores Assistant

I Jayawickrama Clerk/Typist

W A Nishantha Data Entry Operator/Cum Acc. Clerk

A A A P Amaratunga Accounts Clerk

H B Talgahagoda Accounts Clerk/Cum Cashier

H N Dharmapala Clerk/Typist

K A D Sudath Predeep Accounts Clerk

V E Kumara Accounts Clerk

T S S Kumara Accounts Clerk

R M N M Ariyaratna Management Assistant (Accounting)

D S C Weerasuriya Management Assistant (Accounting)

**General Workers**

G S Raju  
P K Sarath  
K Jegatheshwaran  
P Muthukumar

**Guest House/ Circuit Bungalows/ Hostels**

R M B D Ratnayake Circuit Bungalow Keeper (Colombo)  
G Weeraperuma Guest House Keeper

**Internal Audit Unit**

R Kariyawasam Internal Auditor  
W N K I Ariyaratne Internal Audit Clerk  
N C Jayaweera Internal Audit Clerk

**Mechanical Workshop**

A Nandasiri Chief Workshop Mechanic  
M C Gabriel General Mechanic  
D L J Weerasooriya General Mechanic

**General Worker**

K Rajalingam

**Motor Garage**

W G Wijeratne Motor Mechanic  
K Rajarathnam General Worker

**Purchasing Unit**

B Tilakaratne Purchasing Officer  
P D S de Silva Clerk/Typist

**General Worker**

K Balakrishnan

**Telephone Exchange**

K M Seneviratne Banda Telephone Operator  
P K N Damayanthi Tele. Operator Cum Receptionist

**General Workers**

P Vythilingam

**Transport Unit**

S H Chandrasena Clerk/Typist  
M Kaliyaperumal Driver Class I  
P A S L Luxman Driver Class I  
H I Mettananda Driver Class I  
L Murugesu Driver Class I  
W G Senaviratne Driver Class II  
R M N Prematilake Driver Class II  
Ranjan Gunasekera Driver Class II  
U K A B Uduwella Driver Class II  
W S G W Perera Driver Class II  
M Maradamuttu Driver Class II  
K B V U N Gunasena Driver Class II



K M T Seneviratne Driver Class  
M B S Priyashantha Driver Class I  
S P Dhammika Tharanga Driver Class II  
T K A Kumarasinghe Driver Class II  
H A D Niranjana Driver Class II  
P Sengamalai Driver Class II

### **General Workers**

W M S J Weerasinghe  
S L Joseph

### **Low country Regional Centre, Ratnapura**

P V G Karunanayake Stenographer (English)  
K Gunawardana Works Supervisor  
J S K de Silva Electrician  
H K Seetha Accounts Clerk  
B M B Basnagode Administrative Officer  
K A Sunil Piyatilake Clerk/Typist  
K A S Kumarapperuma Clerk Typist  
N A Bowie General Mechanic  
U W K Munasinghe Asst. Plumber Mechanic  
P D R P de Silva Driver Class I  
S S Sunil Driver Class II  
G V S Jayalath Driver Class II  
P G Amaratunga Driver Class II  
S A C Suraweera Driver Class II  
S M C S Senanayake Driver Class II  
J S Weerakkody Driver Class II  
K Chaminda Driver  
M D Sarath Guest House Keeper  
A G Samantha Ruckmalgoda Guest House Keeper

### **General Workers**

A K J Athukorala  
D V S P Denagama  
W M D C Perera  
H A T K K Sumanaweera  
I D Subasinghe  
P D N B D Silva  
A M U Liyanage

### **Mid country Regional Centre, Kandy**

G A S Gunasekara Accounts Clerk  
R M P K Wijeratna Driver Class I  
W D J P Tilakbandara Driver Class I  
R C A Jayasinghe Driver Class I  
W A D P M U Attanayake Driver Class I  
G Padmasiri Driver Class I  
G G M Ranasinghe Driver Class II  
WM Abeybandara Guest House keeper

**Advisory & Extension Centre, Deniyaya**

O W Jayawardena Station Assistant

M D Chandana Driver Class II

**Advisory & Extension Centre, Talgampola**

P V D Chandrakanthi Accounts Clerk

P S Kulasiri Field Supervisor

M Sarath Field Supervisor

Jagath Prasanna Circuit Bungalow Keeper

Kapila Chaminda Driver Class II

**Advisory & Extension Centre, Passara**

A M Karunasundara Driver Class II

**General Workers**

R H C Nisansala

S M P Ramyalatha

**Soils & Plant Nutrition Laboratory Complex, Walahaduwa**

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# RESEARCH HIGHLIGHTS

## CROP IMPROVEMENT

**Breeding of new tea cultivars to improve productivity, quality and to face emerging challenges**

### **Development of new tea cultivars**

Controlled hybridization program has been continued with different *Camellia* sub species. Exotic germplasm has been used for the first time and 1750 crosses were made using three parental combinations. Parents for the crossing program have been selected based on the diversity of catechine and caffeine profiles and it is expected to produce cultivars with variable amounts of metabolites for commercial exploitation. Currently, 15% success rate was obtained and around 160 seeds have been harvested and germinated in the sand bed.



### **Estate cultivar selection program**

Estate cultivars are very vital components in tea germplasm as they originated from various agro-ecological regions of the country and have enormous potential in tea crop improvement programs. In 2013, 50 promising seedlings selected from Glenanore estate, Haputale have been propagated for further evaluations and developing new tea cultivars.

### **“TRI 5000 series” – Cultivars in pipeline/ next series of tea cultivars**

Evaluation of potential TRI 5000 series cultivars in 36 adaptive trials was continued with the partnership of growers. Thirteen new adaptive trials were established in the small holder properties in different tea growing regions during 2013. These growers driven and community-based trials will serve as nucleolus mother bush blocks for dissemination of planting materials.



First cycle yield and growth performance evaluations of two trials were completed in IU3a (Craig estate) and IM2a (Cecilton estate) agro-climatic regions and data are being analyzed. Preliminary screening of TRI 5000 series cultivars for blister blight leaf diseases revealed that three cultivars selected for Up country were highly resistant and one cultivar was resistant to the disease showing their superiority against other cultivars. Evaluations on quality and tolerance to shot hole borer and Low country live wood termite were also carried out.

### **Improved seeds as alternative planting materials for marginal tea growing areas**

Efforts to maintain seed gardens to ensure a constant seed supply were continued. Rejuvenation of two abandoned seed gardens was initiated in collaboration with respective estates. A new polyclonal seed garden was established at the TRI Regional Station, Hantana, Kandy in order to meet future demand especially in the Mid country region.

### **Characterization and metabolite profiling of tea germplasm**

The project on metabolite profiling of the Sri Lankan tea germplasm using a high throughput technique was continued successfully. Selected 87 accessions were profiled for flavonol composition and preliminary results revealed that there was a wide variation within germplasm accessions. Attempts were made to identify important metabolites to predict the made tea quality of cultivars. Profiling of major amino acids was continued.

### **Use of *in vitro* techniques to supplement the conventional tea breeding program**

Research activities aimed at developing necessary tissue culture protocols to supplement the conventional tea breeding program was continued. An attempt was made to develop plants through direct somatic embryogenesis from cotyledon tissues to facilitate mass multiplication of hybrid seeds. Plants generated from somatic embryos were field planted for further evaluations. Another study confirmed that a combination of morphological and molecular markers can be effectively used to assess genetic fidelity of embryo cultured plants in order to adopt tissue culture techniques in conventional tea breeding programs. Studies on developing an effective sterilization protocol by combining pre harvesting sterilization measures using nodal explants of new tea cultivars were continued. Most abundant contaminants of explants were identified and efforts were made to develop efficient control mechanisms to overcome contamination problem.

### **Identification of drought tolerance accessions of tea (*Camellia sinensis* L.) in Uva region of Sri Lanka**

An experiment was conducted in the field no. 2 of the Tea Research Institute, Uva Regional Centre, Passara using four control cultivars (TRI 2025, TRI 4042, TRI 3019 and DN) and nine accessions (243, 199, 210, 88, 89, 21, 5, 17 and 208) of 5000 series tea

as treatments. Measurements of plants and soil moisture content were taken from randomly selected 12 representative samples which comprised of mature, fully grown and healthy leaves on the plucking table from each treatment. Changes in physiological and biochemical parameters over time were studied.

At higher moisture levels physiological and biochemical parameters of most of the accessions were not significantly different from the known cultivars. However, under the moisture stress conditions parameters of most of the accessions were significantly different between cultivars. With cluster analysis accessions could be categorized into different groups. Accessions 89 and 199 were categorized into one group and drought tolerant ability of these two was similar to that of known cultivars *viz.* TRI 2025, DN and TRI 3019. Accessions 5 and 17 could be categorized into another group and their drought tolerant ability was more or less similar to the cultivar TRI 4042. Accessions 243, 210, 208 and 21 were categorized into one group. Accession 88 alone was put into another group. Drought susceptibility index (DSI) was calculated using photosynthesis rate (PR) as a reference parameter of the known cultivars and accessions under stress and non-stress conditions. The DSI showed that accessions 243, 21, 5 and 208 were more susceptible to the drought than the other accessions and Accessions 89 and 199 were found to be the most drought tolerant. These results confirmed the last year results on the same accessions.

Furthermore, net photosynthesis rate (NPR) of accessions measured between 9 am- 12 noon during dry spell showed a positive correlation ( $y = 0.006x + 5.636$ , where  $y$ = yield and  $x$ = net photosynthesis rate and  $R^2 = 0.8$ ) with actual yields recorded during the same period confirming the feasibility of using NPR as a potential productivity parameter in drought screening studies.

### **Screening of '5000 series' tea cultivars for drought under Low country wet zone conditions**

Objectives of this experiment are to investigate as to how the selected physiological and biochemical parameters of new accessions respond to drought and to identify the drought tolerant accessions using most important characters responsible for drought tolerance. The known cultivars such as TRI 2025, TRI 2026 and TRI 2023 and Accessions 107, 131, 01, 133, 163, 62, 23/5, 12/11, 10/1, 29, 294 of existing field experiment (Phase II) in field no 1 of St. Joachim estates, Ratnapura were used for the investigation.

Soil moisture content was measured along with physiological parameters such as relative water content (RWC), photosynthesis rate (PR), transpiration rate (TR) and stomatal conductance (SC). Total soluble sugar (TSS) was measured as a biochemical parameter. DSI was calculated taking PR and RWC as reference parameters. Experiment needs to be repeated due to unfavorable weather condition.

## **Screening of ‘5000 series’ tea cultivars for drought under conditions of Mid country wet zone conditions**

The known cultivars such as TRI 2025 and TRI 4042 and Accessions LVP 75-12, LVP 75-139, LVP 75-133, LVP 75-62 and LVP 75-131 of existing experiment in Field No 2 of TRI Regional Station, Kandy were used. Soil moisture content was measured along with physiological parameters such as RWC, PR, TR and SC and soluble sugar content as a biochemical parameter. The DSI was calculated taking PR and RWC as reference parameters. Differentiation of drought tolerant accessions was done using cluster analysis and DSI. Experiment is in progress.

## **Screening of tea accessions, cultivars and seed stocks against major tea pests**

As the prime step in the integrated pest management and a measure of minimizing pesticide usage in tea in Sri Lanka, selection of cultivars and seed stocks resistant and/or tolerant to economically important tea pests in the different agro ecological regions is continued. During the period under review, potential accessions, cultivars and seed stocks for low, mid and high elevations chosen by the Plant Breeding Division were screened against nematodes (*Pratylenchus loosi* and *Radopholus similis*) Shot hole borer (SHB) and low country live wood termite (LCLWT) following standard screening protocols at various localities. The results of screening against *Pratylenchus loosi* at Talawakele revealed that code numbers M1, M2, M5, M6, M9, M10, SM1, SM2 and ST1 are tolerant and moderately tolerant accessions. Also, the trial for screening against *Pratylenchus loosi* and *Radopholus similis* at Deniyaya TRI Extension centre resulted in the code numbers 168, 200, 126, 267, 184, 218, 174, 1, 72, 203, 110, 171, 278, 84, 251, 274, 127 and 195 of LVP 75 as tolerant and moderately tolerant accessions. Trials were underway in Mid country Station to screen cultivars coded as 5, 15, 89, 101, 208, 210, 272, 497 and 582 against *R. similis* and *P. loosi*.

Pruning assessments on resistance/susceptibility to LCLWT and SHB in Low country revealed that code Nos. 139, 379 of LVP 56 and 4/6 of LVP 59 were found to be free of LCLWT infestation. The results need to be validated with additional field information for confirmation of the results.

## **Application of molecular technology to support genetic conservation and improvement of tea**

### **Use of SSR markers for genetic characterization and finger-printing of recommended tea cultivars**

Characterization of tea at its’ molecular level is the first fundamental step towards maintaining germplasm, efficient selection of parents for hybridization programs, improvement of tea for important traits of agronomic importance, and also for identification/ finger-printing of tea cultivars and protecting intellectual property rights



etc. Even though a total of 64 tea cultivars (50 'TRI developed cultivars' and 14 'estate cultivars') has been recommended for growers, so far, a little information is available on their genetic differences at molecular/ DNA level. Hence, this experiment was initiated to characterize TRI recommended tea cultivars using highly informative microsatellite/ simple sequence repeat markers (SSR) with the objectives of assessing genetic diversity and relationships among recommended tea cultivars and to explore the possibility of developing a SSR markers based cultivar identification system for them. To achieve this goal, a set of florescent labeled EST and genomic SSR primers were pre-screened and based on their performance, 30 primers were selected for the study. Genotyping of cultivars using capillary gel electrophoresis is in progress.



## LAND PRODUCTIVITY IMPROVEMENT & CROP MANAGEMENT

### Integrated approach to soil fertility management

#### Tea factory wood ash as a plant nutrient source

The manufacture of black tea from green leaf delivered to the factory requires few stages of processing *ie.* withering, rolling, roll breaking, fermentation, drying, shifting, grading and packaging. Wood ash is formed during drying stage which is an expensive component in processing of tea. Common energy sources used in the tea industry are fuel and firewood. Although large quantity of wood ash is removed from tea factories in Sri Lanka, still there is no efficient and proper way to reap the maximum benefit of this wood ash. The application of wood ash to tea plantation has been limited due to lack of information on wood ash composition and the plant nutrient value of wood ash. Therefore, an in-depth study on wood ash would provide invaluable information in order to use wood ash more rationally in tea plantations. The main objective of this study was to estimate nutrient composition of Tea factory wood ash derived from different sources of firewood.

Wood ashes collected from tea factories of different tea growing regions having ashes of 29 different fire wood *spp.* including *Rubber*, *Gliracedia*, *Eucalyptus*, *Finus*, *Dadap*, *Mango*, *Jungle wood*, *Teak*, *Jak*, *Burutha* and *Tolurina*, *etc.* were analyzed for both macro and micro nutrient concentrations.

Analytical results showed that wood ash is rich in both macro and micro nutrients except N, which was volatilized during burning.



### **Development of on-farm analytical kit to assess soil/ plant nutrient status in tea growing regions**

Site Specific Fertilizer Recommendations (SSFR) is a concept of applying fertilizer specific to the site, which allows tea growers to apply fertilizers more precisely than general fertilizer recommendation and optimize their yields with more profits. This concept takes in to account of field variability of soil characters and crop features in order to estimate nutrient requirement. Although, SSFR is a very useful tool, proper sampling and detailed analysis of soil are a prerequisite to establish the fertilizer recommendation.

Therefore, it also involves an additional cost and the process is time consuming. Considering these constraints, this study was proposed to develop a low cost soil analytical kit for insitu assessment of the nutrient requirement of tea growing soil.

A prototype of the soil analytical kit has been developed to evaluate soil nutrient status. This instrument is based on the Beer and Lambert law. The concentration of the solution was determined by transmittance of light beam going through the solution. Silicon photodiode array sensor was used for determination of the transmittance and to developed light beam LED was used. The testing of the prototype and the validation of readings were continued using measuremenst from standard methods.

Very high correlations were found between traditional methods of determination of pH, organic carbon content, available P, S and exchangeable Al and prototype determinations. Also very high correlation was found between traditional methods and prototype determinationof leaf N concentration.

Therefore, it can be concluded that prototype developed in this study could be used for determination of soil chemical parameters mentioned above and also for determination of leaf N concentration.

### **Study on application of different rates of N and K on soil and plant micro nutrient status**

This research was formulated to address two objectives namely, to evaluate micro nutrient recommendations for mature tea and to study effect of application of increasing rate of N and K on soil and plant micro nutrient status.

Although soil pH levels did not vary significantly with increasing rates of N or with increasing rates of K there was a decreasing trend of soil pH with increasing rates of N application. Leaf and soil Fe concentration did not show any significant difference with increasing rate of N and K. Although there was a decreasing trend, leaf and soil Mn concentration did not vary significantly with increasing rates of N and K. Leaf Zn concentration did not vary significantly with N and K rates. Leaf and soil Cu concentration also did not vary significantly with N and K rates. Leaf B level significantly reduced with increasing rates of N and K fertilizers but soil available B level was not affected by N and K application rates.

### **Study on application of different rates of dolomite on soil and plant micro nutrient status**

This experiment was carried out to investigate the effect of dolomite application on micro-nutrient availability in soil and plants. The increasing in rate of dolomite application increased soil pH significantly. The exchangeable Mg and Ca in soil increased significantly with dolomite application. With the increase in application rate of dolomite, available Mn concentration significantly decreased because of increase of soil pH. Increasing rate of dolomite application did not show a significant effect on available Zn concentration in soil. Increasing level of dolomite significantly decreased, available Cu concentration. No significant difference was observed in Fe concentration under the different rate of dolomite application. Increasing levels of dolomite did not influence soil available B concentration and leaf Mn, Zn, Cu and Fe content significantly.

### **Response of micro nutrients on tea quality and flavor parameters**

Tea, being a perennial leaf crop, nitrogen content in the flush is the highest followed by potassium (K), calcium (Ca), phosphorus (P), sulfur (S), magnesium (Mg) and zinc (Zn). The N, P, and K are key constituents of plant tissues that play vital roles in the biochemistry and physiology, affecting the productivity as well as the quality of tea. In addition to macro nutrients, micro nutrients such as boron (B), manganese (Mn) and zinc (Zn) are known to be of prime importance for the growth and development of plant, and subsequently on the productivity and the quality aspects of the final product. However, the focus has been mostly on estimation of the effect of macro nutrients *i.e.* N, P, K on the yield and the quality of tea and hence, ample researches findings are available on this area. But with respect to micro nutrient, a limited number of research has been carried out to evaluate their effect on yield and quality aspects of tea. Therefore, new experiments were initiated with the objective of to evaluating effect/ s of micro nutrients on quality and flavour profiles of tea, with special focus on B, Mn and Zn.

To generate data on quality and flavour parameters prior to imposing of treatments samples were collected and miniature manufacturing and analyses were done. Analysis of quality and flavour parameters of tea after imposing of treatments is in progress.

### **Improvement of soil fertility and tea yield through application of Biofilmed biofertilisers (BFBF) in immature (young) tea**

- (a) BFBF with selected inocular with half dose of recommended tea fertilizer was tested under field conditions during 5<sup>th</sup> year after planting of tea at the TRI, Regional Station, Kottawa.

The yield and soil parameters in plots treated with BFBF and half the recommended fertilizer were comparable with those in plots treated with recommended fertilizer. At St. Joachim estate, Ratnapura the same trend in yield and soil parameters was observed for pruning weights and tipping weights. At Holyrood Estate in the Up country also the same trend was found during the 2<sup>nd</sup> year after commencement of harvesting (4<sup>th</sup> year after planting).

- (b) New experiments were commenced at St Joachim Estate, Ratnapura and Barcaple Estate, Nawalapitiya in July and October 2013, respectively. Treatments were BFBF with two rates of Nitrogen and two rates of phosphorus and recommended chemical fertilizer quantities. Initial soil parameters such as pH, organic carbon and available soil phosphorus were measured. Experiment is in progress.

- (c) Evaluating soil fertility improvement in organically grown tea through Biofilm technology at Stassen Blackwood estate, Haldummulla.

BFBF treatments were tested in organically grown tea in 2010 (TRI 3019). The treatments tested were F3A + compost, F3B+compost, F3A, F3B, compost, FR, BD (Biodynamic compost-standard treatment). Compost was applied initially at 100g and BFBF was applied at 3 months interval. The yield during 3<sup>rd</sup> year after commencement of harvesting (5<sup>th</sup> year after planting) was significantly higher in F3A + compost and FR treatments compared to the BD standard treatment. Experiment was terminated.

### **Improvement of land productivity through agronomic practices**

#### **Development of an economically viable system to eliminate/ reduce soil rehabilitation period prior to replanting**

Some alternative strategies to eliminate/reduce the time period of rehabilitation were investigated since 2011 under Mid and Low country conditions.

- (a) **Establishment of grasses and leguminous species simultaneously prior to uprooting of old tea at New Peacock estate, Pussellawa 2011.**

Tea was replanted in June 2013 in (T1) *Gliricidia sepium* and *Mana* and (T2) *Flemingia congesta* and *Mana* treatments after cutting of rehabilitation grasses and uprooting of old tea (T3). Direct replanting of tea was done in June 2013 following uprooting of old

tea (T4). Replanting of tea was done in June 2013 following two years of soil rehabilitation with *Mana* grass as the control. Direct planting (T5) of tea was done in 2011 as the Control (with *Gliricidia* as medium shade).

Tea flush was harvested from old tea until mid 2013 in plots assigned for treatments 1, 2 and 3 and the made tea yield from old tea was thus recorded as 2573, 2589 and 2742 kg/ha (based on the per bush yield), for the first year and 679, 696 and 741 kg/ha, respectively for the next two months period. The total biomass production under recommended practice of *Mana* cultivation was 30.4 mt/ha. It was recorded 17.9 mt/ha of biomass from *Flemingia/ Mana* and 13.9 mt/ha from *Gliricidia/ Mana* combinations. There was no significant difference in plant casualties in newly planted plots.

**(b) Testing of new grass species with high biomass yield to reduce the time period of rehabilitation Houpe estate, Kahawatta and Kottawa TRI Regional Center (2011)**

Two grass species, Hybrid *Napier* (variety CO-3) and East Indian lemon grass (*Cymbopogon flexuosus*), which are known to be higher biomass producers, were established to evaluate the growth performances in comparison with *Guatemala* (*Tripsacum laxmum*) and *Mana* (*Cymbopogon confertiflorus*)

**Haupe estate (July, 2011)**

At the end of rehabilitation period 17,678 kg, 10,345 kg, 7419 kg and 6,107 kg/ha of carbon yield was recorded from hybrid *Napier* (variety CO-3), *Gautemala*, *Mana* and East Indian *Lemongrass*, respectively. The monetary values of planting of each grass species in terms of their nutrient values (N P K and C) were also evaluated assuming that at least 50% of NPK are available in soil after mineralization. They were Rs. 925,359, 561,386, 386,652 and Rs. 321,497 respectively. Benefit Cost ratios were 5.12, 3.1, 2.13 and 1.78 for hybrid *Napier*, *Gautemala*, *Mana* and *Lemongrass*, respectively. Tea was planted in June 2013 after soil rehabilitation and tea plant growth was assessed in December. There were no significant differences in number of branches/plant, height and girth between grass treatments. Experiment is in progress.

**TRI Regional Center, Kottawa (October 2011)**

At the end of rehabilitation, the Soil quality index was 6.68, 6.46, 6.48, 6.37, and 5.65 for *Napier* grass, *Lemon* grass, *Gautemala*, *Mana* and control, respectively. Soil chemical properties such as N, P and K were improved. Earth worm population was increased with *Napier* grass than in other treatments. Tea was planted on each plots in November 2013. Experiment is in progress

In both locations, hybrid *Napier* grass produced 1.5 - 2.0 times more organic matter (30-60 mt/ha) than *Gautemala* (19 - 30 mt/ha) and 1.5-3 times than *Mana* (19.5-20) and *Lemon* grass (21.5) and (19.5 mt/ha) from above ground parts in two locations. Root biomass of *Napier* grass increased 5 times (7.9 mt/ha) more than *Mana* (1.57) and *Lemon* grass (1.6) and two times more than *Gautemala* (3.98 mt/ha).

## **Reducing the period of soil rehabilitation through enhancement of soil quality with application of Bio film bio fertilizer (BFBF)**

Investigation on reducing the period of soil rehabilitation with application of BFBF at New Peacock estate, Pussellawa and Houpe estate, Kahawatta (June 2011). The treatments were

- T1: Rehabilitation with *Mana* grasses for 12 months period (planting in 2012) + BFBF +  $\frac{1}{2}$  U625, followed by replanting tea in 2013
- T2: Rehabilitation with *Mana* grasses for 12 month period + BFBF alone (*Mana* planting in 2012) followed by tea replanting in 2013
- T3: Direct planting of tea (2011) treating with BFBF +  $\frac{1}{2}$  T200
- T4: Rehabilitation with *Mana* grasses for 24 month period (U625 for *Mana*) followed by tea replanting in 2013 (TRI recommendation)
- T5: Direct planting tea in 2013 with BFBF +  $\frac{1}{2}$  chemical fertilizer (T200)
- T6: Direct planting tea in 2013 with recommended fertilizer-T200

Lopping weight of *Mana* was recorded for the treatments T1 and T2 at Haupe and New Peacock estates. Soil pH, Pottasium, MBC levels were higher in T3 and T4 compared to those of T1 whereas, organic carbon and CEC were comparable in all three treatments. Sulphur was less in T3 and T4 compared to T1 at New Peacock estate trial. Experiments are in progress.

## **Validation of Soil Quality Index (SQI)**

Soil quality index was further computed using the data of soil quality (physical, chemical and biological) parameters for some estates. Soil quality index was thus reported as 6.91 in an old tea field and 7.26 in a grass land at Mahadowa estate, Passara; 6.76 in an old tea field and 7.08 in a grass land at Cocagalla estate, Passara. In Kew estate, Bogawantalawa SQI was reported as 6.32 and 6.24 in an old tea and grass land, respectively.

## **Developing a Soil Quality Index (SQI)**

Data on parasitic and free living nematode densities in soils were generated in locations identified to validate the Soil Quality Index (SQI) developed by the Agronomy Division.

## **Evaluation of different irrigation systems in tea**

An experiment on drip irrigation was commenced in field no. 1, St. Joachim estate. The TRI 2023 and TRI 4061 cultivars were planted in June 2013, after soil rehabilitation with *Napier* grasses. However, some plants had to be replaced in some plots, due to vandalism in September, 2013. Plants were not irrigated after field planting, as there was enough soil moisture. However, rain was below normal during December, 2013 and hence irrigation is to be commenced since January 2014. Experiment is in progress.

The experimental field under drip and sprinkler irrigation was under soil rehabilitation with *Napier* grass and tea planting is scheduled for May 2014. An experiment was conducted to evaluate the response of mature TRI 4042 (planted in 1998) to sprinkler irrigation in field no. 6, St. Joachim estate, Ratnapura. Plots were irrigated during the months of February and March, 2013 using a portable large (Premier Parrot ZM 22), rain



gun type sprinkler. This is a portable type irrigation system attached to a bowser and a kerosene water pump. Leaf water potential and shoot extension rate of the irrigated plants were significantly higher than non-irrigated plants. In addition, rain-fed plants showed a higher active to dormant shoot ratio. Yield increment due to irrigation was around 50%.

Irrigation radius for the sprinkler was 17 m under the given pressure conditions and 4 irrigation treatments were demarcated according to the distance from the base (4 m) and rain-fed plots outside the irrigated periphery. The average irrigation rates for the plots, from the base of sprinkler, were I1 -  $5.2 \pm 0.2$ , I2 -  $7.6 \pm 0.2$ , I3 -  $4.4 \pm 0.1$  and I4 -  $3.9 \pm 0.1$  mm/hr, respectively, while rain-fed treatment I0 received no irrigation, except rainfall. Yield for I1, I2, I3, I4 and I0 treatments, during January-February, 2013 were  $77.3 \pm 7.4$ ,  $74.8 \pm 6.2$ ,  $70.5 \pm 7.1$ ,  $62.5 \pm 4.1$  and  $46.6 \pm 6.9$  kg MT/ ha/ week, respectively.

An experiment was conducted to evaluate suitability of Wick and Pitcher irrigation as low cost and simple technology option for tea irrigation. Wick irrigation gave a better yield response than pitcher irrigation. The yield increase was attributable to higher shoot extension rate and presence of more active shoots.

The water penetration to the root zone was poor from the Pitcher irrigation than Wick irrigation. Alternate irrigation methods such as Wick and Pitcher irrigation are economical only when the materials like irrigation cans and pots are available at lower prices and labour is freely available. Therefore, these types of irrigation methods are more suitable for tea small holders. However, the alternate irrigation methods lack the precise water application rates as against the other standard irrigation methods.

### **Evaluation of rain water harvesting techniques**

An experiment was established at Kahagalle estate Haputale to evaluate the efficacy of mulching to retain rain water for a longer period during drought through minimizing evaporation losses from ground surface. The treatments tested were compost mulch, *Mana*, polythene sheet and plastic mulching sheet. The suppressed weed growth under polythene and plastic mulches reduced the weeding cost. Plants in plots covered with polythene and plastic mulch were found to be more greenish and healthier than those in un-mulched plots.

### **Evaluation of growth performances of new shade tree species**

*Derris mycophylla* and *Albizzia odorosima* were planted as high shade species during soil rehabilitation with *Mana* at 20' x 20' spacing in 8 replications at Millakanda estate, Horana in 2013 to assess the growth performances of shade trees and tea under shade. Experiment is in progress.

Planting of *Derris mycophylla* and *Cassia nodosa* was commenced in November 2013 to assess the growth in comparison with *Albizzia molluccana* at Haupe estate, Kahawatta. Planting spacings were 20' x 20', 20' x 32' and 30' x 32'. *Gliricidia sepium* was planted as the medium shade at 10' x 12' spacing. Experiment is in progress.

### **Investigating the compatibility of ‘stock’ and ‘scion’ for grafting tea to improve productivity and quality of tea**

The objectives of these studies were to identify compatible tea ‘scion’ and ‘stock’ for grafting tea with special reference to high yield, high quality, drought tolerance and pests and diseases resistance.

‘Scions’ of high quality cultivars and stocks of drought tolerant cultivars were selected for graft combinations and single node cuttings from selected scion cultivars were planted as the control. Plants were in the 3<sup>rd</sup> year of the 2<sup>nd</sup> cycle at the St. Coombs estate. The yield of graft combination, TRI 777 on TRI 2025 was significantly higher than the other combinations and TRI 4067 on TRI 3019, TRI 4079 on TRI 2025 and TRI 4079 on TRI 4052 showed higher yields compared to their controls (scion). Experiment is in progress.

‘Scions’ of cultivars with Blister blight and Shot hole borer resistance and high yield and stock of cultivars with high rooting and drought nematode (*Pratylenchus loosi*) tolerant ability were assessed in the 6<sup>th</sup> year of the 1<sup>st</sup> cycle at St. Coombs estate.

TRI 4046 on TRI 4006, TRI 3072 on TRI 4006, TRI 3072 on TRI 4053 and TRI 4006 on TRI 3072 showed significantly higher yields than each of their respective controls. Yield increments over the controls were 47%, 24%, 24% and 29% respectively. Plants were due for pruning and experiment is in progress.

Graft combinations were field planted after completion of nursery period. Selected graft combinations were TRI 4006 on TRI 3019, TRI 3072 on TRI 3019, TRI 2023 on TRI 4053, TRI 2023 on DN and TRI 4071 on DN. TRI 4006, TRI 3072, TRI 2023, TRI 4071, TRI 4053 and DN were used as controls. Experiment is in progress at the TRI, Mid country station, Kandy.

Cultivar TRI 4053, TRI 4054 and TRI 4042 were selected as ‘scion’ and DG 7 and DG 39 as stocks for identification of graft combinations for Balangoda region. The plants have completed first year in the field.

The experiment was commenced at the nursery of the Tea Research Institute, Low country station and treatments were TRI 4042 on TRI 4049, TRI 4042 on TRI 3025, TRI 4053 on TRI 4049, TRI 4053 on TRI 3025, TRI 2023 on TRI 4049, TRI 2023 on TRI 3025, TRI 4006 on TRI 4049, TRI 4006 on TRI 3025 and TRI 4049 on TRI 3025 as graft combinations and TRI 4042, TRI 4053, TRI 2023, TRI 4006, TRI 4049 and TRI 3025 as controls. Assessments in the nursery were completed. Graft combinations and the controls selected based on the success rate were planted in the field at St. Joachim estate.

### **Investigations on the rejuvenation of old seedling tea plants in the nursery**

The experiment was started in Balangoda estate in 2013. Selected seeds of Supumalkanda TRI 2043, Talawakelle TRI 2043 and Talawakelle 2015 were collected from seed gardens and planted in the nursery for about 1 ½ years. TRI 4053 was selected as the scion for grafting on above seedling. The seedlings (controls) and graft combinations were planted in the field after completing nursery period.



At St. Joachim estate, Ratnapura, seedling stock with a deep root system was selected considering their drought toleranceability. Talawakelle TRI 2015 was the 'stock' and TRI 3055 and TRI 4042 were the 'scions'. Experiment is in progress.

### **Investigations on the behavior of root system of tea at Concordia estate, Ragala.**

The experiment was commenced in 2005 to study the effect of burying of pruning on physiological behavior of tea root system of three estate cultivars (PK 2, DT 1, NAY 3) and two TRI cultivars (TRI 2024, TRI 2025). Tea yield and soil physical properties were measured.

Yield was significantly higher with burying of pruning than the control plots. A significantly greater yield ( $P<0.001$ ) was recorded by estate cultivars than TRI cultivars. Treatment x cultivar interaction was also significant. Water holding capacity (WHC), soil moisture content field capacity (FC) and permanent wilting point (PWP) and bulk density (BD) were measured at three soil depths (15, 30 and 45 cm). Water holding capacity was higher with burying of pruning than in the control plots. Higher FC, PWP and WHC were observed at 15 cm depth and a higher BD was recorded at 45 cm depth. Soil organic carbon and soil microbial carbon were significantly higher with burying of pruning than the Control. The experiment is in progress.

C/MET: Gathering of daily weather data from six weather stations is in progress and monthly data were sent to the Meteorological Department, Colombo by 5 Regional Centers and to the NRMC, Peradeniya by The TRI, Mid country station, Kandy.

### **Screening of herbicides**

#### **Screening of Indaziflam (pre-emergent herbicide)**

Field screening was commenced in January at St. Coombs estate in January 2014 and Hantana and Ratnapura Regional Stations in August 2013.

Indaziflam was applied to the bare soil after clean weeding in all experiments. All pre-emergent herbicides were applied in January, 2014 at St. Coombs estate. Weed dry weight was significantly reduced in all herbicide treated plots compared to the untreated control. Presence of weeds was estimated to be 16%, 26% and 39% of that in the control treatment in Indaziflam 100, 75 and 50 g a.i./ ha treated plots, respectively. Weed % with Diuron was 25% of the control at 3 months after application (MAA). With 2<sup>nd</sup> assessment done at 6.5 MAA weed percentatge was 4%, 3% and 13% in Indaziflam 100, 75 and 50 g a.i./ ha treated plots and 14% in Diuron treated plots when compared with the control.

At St Joachim estate, Ratnapura, all pre-emergent herbicides were applied in August, 2013. Weed dry weight was significantly reduced in all herbicide treated plots compared to the untreated control. Presence of weeds was estomated to be 1.94-4.46 % of that in the control in all Indaziflam (50-100 g a.i./ ha) treated plots. However a higher weed % was recorded with Oxyfluorfen and Diuron treated plots (4.46-7.6%) at 4 months after application. Glyphosate was first applied in early December to weedy plots and weed aseessment was done in late December.

At Hantana regional station, weed growth was monitored two months after spraying. Same was assessed 3 weeks after application of Glyphosate in October. Weed growth was significantly reduced in all herbicide treated plots compared to the control 4 months after spray. The lowest was recorded with Indaziflam 100 and 75 g a.i/ ha treatments. Approximately, 7.1, 11.6, 13.4 and 23.6% of weed control was achieved with Indaziflam 100,75,60 and 50 g a.i / ha respectively compared to that of control.

**Adaptive trials conducted on Trigger (Glyphosate Iso Propyl Amine-179 g/ L + Carfentrazone Ethyl - 6.5 g/ L) and Rapid (Glyphosate Iso Propyl Amine-293 g/ L + MCPA Iso Propyl Amine-58 g/ L)**

It was found that both herbicides have properly controlled common weeds and some of the hard-to-kill weed when applied at the rate of 3.3 L/ ha of Trigger and 3.85 L/ha of Rapid under Low, Mid and Up country conditions.

**Management of problem weeds**

Different herbicide formulations were tested to manage *Heen couch* (*Panicum spp*) weed at Venture estate, Norwood.

Weed could be properly controlled with Glyphosate @ 2.75-5.5 L/ ha, Rapid @ 3.85-5.5 L/ ha and Trigger @ 4.4 6.6 L/ ha. However, weeds climbing through the frame and reaching the canopy should be manually removed as spraying of herbicides on the tea canopy damage the bush.

**Evaluating potential fuel wood species as alternative sources of energy**

*Cassia spectabilis* planted at spacings of 1 m x 1 m, 2 m x 1 m and 2 m x 2 m recorded 0.74, 0.66 and 0.6 t/ ha of fuelwood (at 20% moisture level) at the 2<sup>nd</sup> lopping and dry weight of leaf and tender parts were 2.08, 1.70 and 1.60 t/ ha, respectively.

*Calliandra calothyrsus* planted at a spacing of 1 m x 1 m, 2 m x 1 m and 2 m x 2 m recorded a mean fuel wood weight (at 20% moisture level) of 10.56, 8.41 and 7.41 t/ ha at 4<sup>th</sup> lopping, respectively. The dry weights of green shoots and tips were 6.74, 2.98 and 2.34 t/ ha, respectively.

**Evaluating growth, yield, pest and disease management under organic tea cultivation**

In order to generate information on sustenance of soil and crop productivity and level of natural biological control mechanisms and pest, disease and weed incidences under organic and low input tea cultivation, data collection from field trials of TRIORCON and BIDORCON at St. Coombs estate and a few other estates under RA (Rainforest Alliance) certification and conventional tea fields in Talawakele was continued for validation purpose.

## **Pest incidences**

Preliminary investigations were done to compare the system sustainability and pest incidences as scientific validations to the rigid criteria adopted by Sustainable Agriculture Network (SAN) for Rainforest certification in tea estates. Data on incidence of tea tortrix, blister blight, weeds and spiders and lady bird beetles as natural enemies and earthworms in soils revealed that SAN guidelines were based on more of TRI recommended GAPs besides requisites to strict compliance on enhanced floral biodiversity, shade, live fences, recycling of organic matter, strengthening non chemical methods *etc.* In general, the pest management seemed to be comparatively superior in RA and organic tea fields despite non-adoption of chemical control measures. Adherence to TRI recommended non-chemical methods under organic and SAN systems strengthened biological control mechanisms through significantly enhanced natural enemy populations.

Organic and SAN systems possessed higher proportion of broad-leaved weed species while conventional systems possessed predominantly grasses and sedges. Further, greater earthworm populations at different depths in organic and SAN systems indicated increased soil health due to non-chemical and rational use of soil agrochemicals, respectively.

## **Impacts of ‘Biochar’ incorporation in tea soils**

Harnessing ‘Biochar’ as a source of soil amendment for improving soil characteristics, plant growth and bioremediation is infancy. Further, the confusion over Biochar and charcoal usage as well as standard specifications of the ‘Biochar’ sources are not scientifically validated. In order to evaluate the characteristics, three local ‘Biochar’ sources were manufactured through imposed pyrolysis at the TRI and were compared in the laboratory with an imported (standard) source from Thailand.

In order to study the short term impact of ‘Biochar’ incubated soil on early growth of tea and nodulation of *Sesbania spp*, a series of experiments was conducted to test the impact of three types of ‘biochar’ compared with compost on selected soil properties, earthworm survival, root and shoot growth of tea and nodulation of *Sesbania sesban* using a glass house bioassay techniques.

The earthworm populations in the Biochar and compost mixed soils were over 60%, indicating their preference on Biochar and acceptance as a non-toxic treatment. The selected Biochar showed a significantly positive impact on shoot growth rate, root depth and root elongation rate of tea. Also, Biochar had a significant impact on root nodulation of *sesbania spp* but did not increase the active nodules.

‘Biochar’ exhibited short term alteration of soil chemical properties but not soil biological properties and moisture in the amended soils as claimed but needs further investigations. For further studies, root rhizosphere studies in root windows filled with tea soils amended with three sources of ‘Biochar’ were commenced. Measurements on root and shoot growth parameters and soil parameters are being monitored. Preliminary results

indicated differences in root architecture in tea soils amended with biochar showing potential long term impacts.

### **Evaluation of leaf litter decomposition in tea under organic and conventional systems**

As opposed to conventional tea cultivation system with intensive use of synthetic agrochemicals, organic systems are reported to improve soil quality and environment. Further, greater accumulation and carbon sequestration are envisaged in organic systems but not researched in tea as supporting sustainable indicators. Hence, data were generated in the TRI-ORCON trial evaluating litter decomposition rate of tea under organic and conventional systems as a preliminary study. Leaf litter decay rates were measured using the standard litterbag technique. Soil properties and the major nutrient dynamics of decomposing tea leaf litter were also analyzed. The results provided empirical evidence that organic and conventional systems have a significant effect ( $p < 0.0001$ ) on mass loss of decomposing tea leaf litter. The highest decay rate was found with compost treatment followed by tea waste, neem oil cake and conventional plots. The results of soil analysis indicated that the incorporation of organic manures increases soil moisture, organic C, total N and soil microorganisms. The rate of litter decomposition was positively related to soil moisture ( $R^2 = 0.9843$ ,  $p = 0.0079$ ) and fungal populations associated with leaf litter ( $R^2 = 0.9404$ ,  $p = 0.0303$ ). Dynamics of N, K and C content of decomposing leaf litter were significant in different treatments whereas P dynamic was not significant.

Overall, organically maintained soils had a greater organic carbon content compared to the conventional system supporting sustainable indicators through accumulation and carbon sequestration. Carbon accumulation and conservation of dry matter and carbon sources were the least under conventional system.

### **Role of GAPs on tea yield and SHB and LCLWT management in Deniyaya region**

Negligence and poor adoption of the TRI recommended GAPs in crop, soil and pest management coupled with unusual changes in climate were identified as attributes to loss of vigor, yield and even death of tea in certain low grown areas. The demonstration and model trials in immature and mature tea in two smallholder tea lands in Deniyaya monitored since 2005 in comparison with the grower practices.

Data resulted in superior growth and yield responses with the recommended GAPs and tolerance to perennial pests such as nematodes, SHB and LCLWT. Demonstrating the importance of TRI recommended GAPs in crop, soil and pest management in mitigating biotic and abiotic stresses to tea, the experiment was concluded.

## CROP PROTECTION

### **Identification of safe pesticides and developing IPM methods**

#### **Screening of nematicides and soil pesticides against nematodes and white grubs**

In the IPM, prophylactic soil treatments are of paramount importance for minimizing pesticide load and environmental safety. Nevertheless, banning of the recommended soil pesticide; Carbofuran warranted identifying alternates. Hence, laboratory and glass house bioefficacy trials with different doses of selected soil pesticides viz. Virtako and granular form of Fipronil for control of nematodes and white grubs were commenced at Talawakele Ratnapura and Hantane. It is expected to continue field efficacy trials with the proven chemicals and doses.

#### **Existence of possible biotypes of shot hole borer (SHB) and association with *Fusarium* fungal isolates**

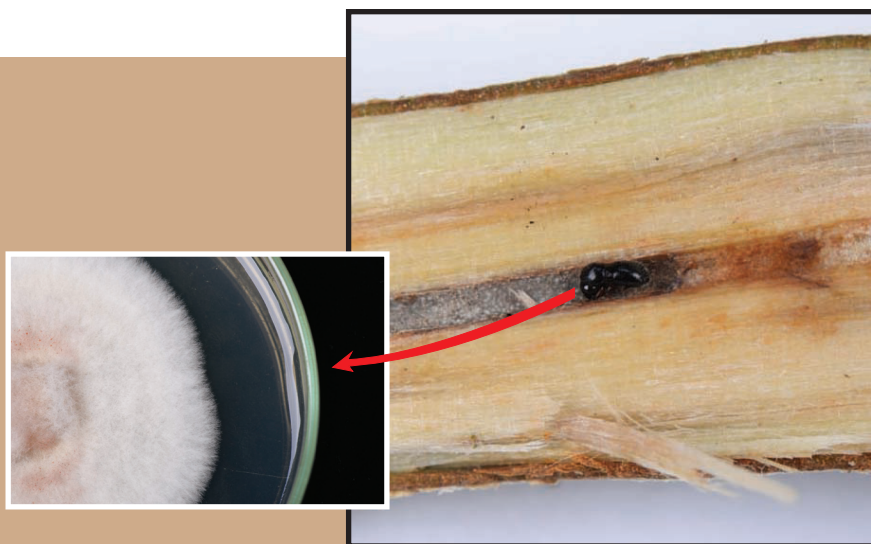
Insect-disease complex was evident with different symptomological expressions of the shot hole borer (*Xyleborus fornicatus*) in tea grown in different agro ecological regions and associated with different *Fusarium* fungal isolates. In order for furthering the collaborative studies with the Agriculture Research Organization, Israel and Invasive Pest Research Institute of University of Florida, extensive collection of shot hole borer and affected tea stems and other hosts were continued in different agro-ecological regions. Insect specimens including eggs, larvae and adult beetles were preserved, mass cultured, fungal cultures of borer infested tea galleries were maintained in the Entomology and Pathology laboratories for insect – fungus complex and molecular studies.

Preliminary results of the molecular and morphological studies of the *Fusarium* specimens from SHB in different localities conducted at the Agricultural Research Organization, Israel revealed Cecilton estate (Balangoda) source was seen extremely unusual and hence, further studies with additional sources were envisaged.

### **Prophylactic measures for pest control**

#### **Protection of vulnerable stages of tea from SHB**

Lime sulphur, a natural stem protectant in 1:1 ratio tested against SHB was proven effective under field conditions. During the period under review, studies aimed at finding solutions to the practical difficulties of manual mixing of lime and sulphur and formulation with adhesive properties were



continued at the laboratories of the Rubber Research Institute, Ratmalana. Confirmative trials at Levellen estate, Kenilworth estate and Kellebokke estate were also continued. Studies with formulated Fipronil were also commenced.

As a parallel study, application of 1:1 Lime sulphur was advocated along with all sanitary, agronomic and cultural practices inclusive of determination of G% and two months resting of tea prior to pruning, clean pruning, cleaning and liming of pruned bushes, burial of pruned branches in Field No. 65 of Panmur Division, Strathdon estate, Hatton. Encouraging results with comparatively superior recovery of tea after prune and yield recorded by the estate elucidated the necessity of adhering to the TRI recommended GAPs in SHB management.

#### **Evaluation of biochemical resistance of tea cultivars against (LCLWT)**

Studies on bioactivity of extracts of debarked stems of tea cultivars known to be tolerant and susceptible using no choice force feeding bioassay were continued. The extract of TRI 2027 obtained in chloroform showed high mortality next to the Imidarcloprid treated filter papers. While the extract of TRI 2027 obtained in chloroform showed the lowest weight loss amongst the extracts. Cultivar TRI 2027 showed the anti-feeding activity to termites from four cultivars tested.



Additional studies to isolate chemical constituents from debarked stems of tea cultivar TRI 2027 which exhibited resistance against *G. dilatatus* were also carried out. Among the 4 compounds isolated, the sub fraction TRI 2027-2-3-2 was identified as caffeine using <sup>1</sup>H NMR and <sup>13</sup>C NMR. Confirmation of the chemical compounds is underway.

### **Screening of wound cut dressings for (LCLWT)**

Results of adaptive trials of Brunolium 15% carried out in field no: 7, TRI Kottawa Station confirmed the field efficacy of Brunolium as a promising wound dressing.

### **IPM of tea tortrix mass rearing of *Macrocentrus***

Owing to closer incidences and unusual occurrences of tortrix damage and withdrawal of the pesticide, special attention was given to educate the tea growers in tortrix active regions regarding the TRI recommended GAPs on field and crop management practices and cultural and biological control methods. Release of mass reared *Macrocentrus* was continued.

### **Plant defence elicitors in Blister blight disease management**

The effect of 2, 1, 3-Benzothiadiazole (BTH) and salicylic acid against blister blight disease caused by *Exobasidium vexans* Massee, was studied (Trial 2). TRI 2024, a susceptible cultivar to blister blight was treated with five treatments (1000 ppm salicylic acid, 1000 ppm BTH, 0.1% copper hydroxide - Champ DP 37.5%, 0.05% Hexaconazole and untreated control) at seven day intervals for four weeks under field conditions. Blister blight severity was lower in fungicide treatments followed by the elicitor treatments. Germination of basidiospores was significantly inhibited by all the chemicals at the above concentrations tested. Total polyphenol content was higher in both fungicide and elicitor treatments which may have contributed to lessen diseases severity. TR to TF ratio was more than 10 in all the chemical treatments showing that there is no effect of these chemical on made tea quality.

### **Molecular diagnosis of canker causing fungi in tea**

Based on the ITS sequences it was found that the stem canker disease is mainly caused by three anamorphic species belonging to family *Botryosphaeriaceae* (*B. dothidea*, *B. mamane* and *Lassiodiplodia theobroma*). However *B. dothidea* and *B. mamane* cannot be distinguished based on morphological features alone. *Macrophoma theicola* (this was the earlier name given for the causal agent of stem canker in the Low country) was found to be an anamorphic species complex of *B. dothidea* and *B. mamane*. Species specific primers were designed to differentiate the above *Botryosphaeria* species from other closely related fungal species and they were validated using the already characterized fungal isolates.

### **Molecular characterization of *E. vexans***

To study the variation among the *E. vexans* the causative organism of tea blister blight 42 samples were collected from all tea growing regions in Sri Lanka. To collect the sufficient basidiospores for DNA extraction a sporefall technique was modified and spores were collected and DNA extractions were carried out. PCR conditions with ITS 1F and ITS 4B primer were optimized and the Basidiomycetes specific band of about 700 bp of *E. vexans*

and *Poria hypolateritia* (positive control) were sequence characterized. The DNA sequences of both species showed higher similarity (>80%) with the DNA sequences of *Basidiomycetes* fungi in the Genbank. ITS sequences of *E. vexans* showed 77-89% homology with other *Exobasidium spp.* when subjected to Basic Local Alignment Search Tool (BLAST) analysis confirming the accuracy of the amplified region. Sequencing of more samples is in progress.

### **Collar canker and bush dieback in tea**

A collar canker and dieback of tea bushes has recently emerged in smallholders' fields in certain Low, Mid and Up country regions. Identification and characterization of the pathogen was carried out. Isolation from cankers consistently yielded *Fusarium solani* and confirmed by morphological characters and internal transcribed spacer (ITS) regions of rDNA. On artificial inoculation of one year and 10 years old plants resulted in cankers showing ability to infect the tea bushes of wide age range. The optimum temperature and pH for growth and sporulation of the isolates were 26-30 °C and pH 5.5 and 7. There were variations among the selected isolates with respect to cultural and growth characters. *F. solani* showed high sensitive to Tebuconazole (EC50 0.23 µg/ ml) and field application at 500 and 1000 ppm resulted in 48% and 52% reduction of disease severity.





## CLIMATE CHANGE IMPACT ASSESSMENT

### **Studies on physiological responses of tea to global climate change**

The carbon sequestration potential of seedling and VP tea plants were determined using destructive sampling from Talawakelle (1382 m amsl), Hantana (762 m amsl), Ratnapura (29 m amsl) and Passara (1028 m amsl) representing Up, Mid and Low country and Uva regions, respectively. Accordingly, seedling tea had a higher carbon sequestration potential than VP tea in all regions. At the age of 30 years the highest carbon sequestration rate was recorded with Low country seedling tea and the lowest was recorded with Up country VP tea.

The carbon sequestration potential of high and medium shade tree species were also determined for the same sites using the allometric equations. This study emphasized the necessity of establishment and proper management of shade trees in tea plantations not only to improve the micro climate, but also to enhance the carbon sequestration per se and thereby enhance the environmental sustainability of the tea plantations. Sheffield Dynamic Global Vegetation Model (SDGVM) was further fine tuned to predict the impact of climate change on tea yields. The preliminary predictions of the present study showed that the increase in atmospheric CO<sub>2</sub> levels will have a positive impact on tea yield across all elevation zones. In the absence of increasing atmospheric CO<sub>2</sub>, the increasing temperature and variation of rainfall pattern will have an appreciable negative impact on future tea yields in the low country. The work is in progress to further refine the SDGVM model to increase the accuracy of predictions.

Differences were observed in soil microbial respiration measurements between seedling and VP tea fields as well as among different locations tested. Therefore, further investigations on these aspects are continuing. It has been noted that the photosynthetic light response curves also differ between the seedling and VP tea plants. The light response curve measurements were completed in the Up country and continued in the other locations.



### **Analysis of climate change in different tea growing regions**

As weather stations representing all tea growing agro-ecological regions (AERs) and a complete set of data covering the period of 50 years were not available, trend analysis were carried out using rainfall surface data generated for AERs by the Department of Meteorology, Sri Lanka according to the internationally accepted procedures. Analysis of rainfall and temperature data showed that WL1a, WL1b, WL2a, WM2a, WM2b, WM3a, IM2b, IM3a and IM3c AERs are highly vulnerable to climate change and WM1a, WM1b, WM3b, IM1a, IM2a, IU3a, IU3d and IU3e are vulnerable. These results were conveyed to the stakeholders.

### **Effects of climate change on pest incidences**

In order to identify the climatic attributes to immigrances or interruptions to pest, natural enemy and their interactions, studies on nematodes were prioritized. During the period under review, mortality of five populations of the *Pratylenchus loosi* Talawakelle (SL 1), Passara (SL 2), Deniyaya (SL 3), Hantana (SL 4) and Cecilton (SL 5) was tested in aqueous and soil media under 16°, 20°, 24° and 28 °C *in vitro*.

The results highlighted potential of using nematodes as an indicator of climate change impacts in agriculture. All nematode populations were sensitive to 28 °C. Passara showed a highly sensitive mortality *viz.* 66.66% and 82.67% at 28 °C in aqueous ( $p=0.0467$ ) and soil media ( $p=0.0088$ ), respectively. In contrast, Talawakelle exhibited the lowest mortality % at 16 °C (13.33%), 20 °C (20%) and 24 °C (20%) temperatures though not significantly different. The statistically significant correlations of mortality in SL 2 (79.19%), SL 4 (63.02%) and SL 5 (96.25%) populations between aqueous and soil medium strongly indicated the potentials of using aqueous medium for *in-vitro* mortality studies of nematodes instead of soil medium.

### **Capacity and resources displayed in organic tea cultivation system in adapting to climate change: A case study in rural small holder community in Galle region of Sri Lanka**

Growth and yield of organically maintained twenty small tea holdings of tea extents below 0.5 ha were compared with that of conventionally grown tea lands in Baddegama area in Galle district during the period 2008-2011. Special emphasis was given to weekly green leaf harvest and post prune recovery of the crop in order to study the response of the two systems to most vulnerable physiological stresses in tea under significantly changing climate parameters.

Organically managed tea appeared to adapt better and exhibited healthier plants, better recovery after pruning and higher yield responses (*i.e.* higher green leaf per ha) compared to that under conventional tea system. Early and satisfactory recovery from pruning and higher yield were recorded indicating improved ability to succumb biotic and abiotic stresses in sustaining growth compensation.

The results on organic tea in Sri Lanka added new information on the benefits of organic agricultural systems for adapting to climate change with reduced greenhouse gasses, sequestering carbon into soil, using less water, reducing soil erosion and nutrient run off and more resilient to adverse weather conditions.

## MECHANIZATION OF FIELD PRACTICES

### **Mechanization of field practices**

Plucking operations of experiment at Balangoda estate were carried out from January to June 2013. The field was pruned in August 2013 after resting for 6 weeks. The yield was found to be significantly higher with manual harvesting than mechanical harvesting. The yield under full-bush and half-bush mechanical harvesting methods was 22% and 18% less than manual harvesting. The coarse leaf content of mechanically harvested crop was recorded to be about 25% higher than that of manual harvesting. The experimental plots were pruned and there was no difference in pruning weights among the treatments. The tea cultivar TRI 2026 has given 20% more crop yield than DG 39 and however, there was no significant difference in the pruning weights among the two tea cultivars. There was no interaction effect between the plucking method and the tea cultivars tested. The data collection from experimental plots was discontinued.

Experimental plots at Galaboda estate were harvested until May 2013 after which, the field was rested for 6 weeks before pruning. There was no significant difference in tea yield among the different pruning styles (lung pruning at 20" and cut-a-cross at 26") combined with different harvesting treatments (manual and mechanical). Coarse leaf content was significantly higher in mechanically harvested plots than in manually harvested plots. Tipping assessments showed that manually harvested bushes had better recovery after pruning than those mechanically harvested. The experimental assessments were discontinued after tipping.

### **Popularization of tea harvesting and pruning machines in smallholding sector**

A project was launched to popularize mechanical devices in tea smallholdings with Rs. 100 million approved by the government (Budget proposal 2013). This project was initiated by the TRI in collaboration with the TSHDA, Federation of Tea Smallholders, Private Tea Factory Owners Association and Sri Lanka Tea Board under the direction of the Ministry of Plantation Industries. The objectives of the project were to popularize mechanical devices for harvesting and pruning in the smallholding sector to increase labour productivity, train smallholders on the proper use of mechanical devices, attract and retain youth in the tea industry and design,



test and fabricate a light weight and user friendly motorized machines suitable for harvesting.

Awareness programmes for the smallholders, TSHDA and Tea Board officials were conducted covering all tea growing districts. Further, selected tea smallholders and TSHDA officials were trained as “Trainers for machine operators” at the TRI Low country station, Ratnapura. With the initial allocation of Rs. 20 million, procurement procedures were initiated to purchase TRI selective tea harvesters, plucking baskets, motorized tea harvesting machines, motorized tea pruning machines and holing machines to be supplied to the selected 50 tea smallholder societies and 25 tea factories. The project is in progress.

## **Nursery Management Techniques**

### **Different media and their mixtures for tea nursery bags**

Objectives of experiments are to overcome the problem of scarcity of soil media for tea nursery and to find the most suitable media mixture for tea nursery. Treatment combinations are compost: soil, compost: soil: sand, tea waste: soil, tea waste: soil: sand, paddy husk: soil, paddy husk: soil: compost and nursery soil alone (control). Same proportion from different media was used to fill the nursery bags. Experiment were commenced in October at St. Joachim and St. Coombs estate and they are now in progress.

### **Investigating the effect of nursery bag size on tea plant growth under nursery and field conditions**

Two experiments were commenced to study the possibility of producing healthy and vigorously tea plants using a minimum volume of soil thereby to find the minimum possible bag size at St. Coombs estate, Talawakelle and TRISL Low country station, Ratnapura. Nursery trial was completed at Talawakelle and plants are now 1 year old at the field. Experiment in low country was started in November 2013 with the treatments such as 5" X 9" (control 1), 5" X 7" (control 2), 5" X 5", 4" X 9", 4" X 6", 3" X 9", 3" X 12" and plants were arranged in a CRD.

### **Evaluating nylon shade nettings and gunny material as a high shade materials for tea nurseries in comparison with coir matting**

Experiment was established at the Low country Station, Ratnapura in November to evaluate the performances of nylon shade netting and gunny material against conventional coir matting. Treatments were T1- Nylon net with 70% shade at 1.8 m height, T2- Nylon net with 80% shade at 1.8 m height, T3- Nylon Net with 70% shade at 2.4 m height, T4- Nylon net with 80% shade at 2.4 m height, T5- Gunny material at 1.8 m height, T6- Gunny material at 2.4 m height and T7- Coir matting at 1.8 m height as the control.



Initial growth assessments showed that Gunny material is found to be better for nursery plant growth. Inside the gunny material, temperature was low when compared to other shade nettings. Experiment is in progress.





## **TEA PROCESSING TECHNOLOGY AND PRODUCT DEVELOPMENT**

### **Development & improvement of tea machinery and factory conditions**

#### **Study on cast iron components of air heaters**

Quality of cast iron components used in air heaters in the tea industry at present was studied. It was revealed that certain metals like Cr and Ni chemical composition of cast iron components were not up to the required standard.

#### **Development of a self-cleaning sifter for low grown tea grading process**

A ball-tray arrangement coupled with Michie sifter was tested as a self-cleaning continuous sifting machine for the low country tea grading process. Initial studies on optimizing the operational parameters of existing Michie sifter were completed and fabrication of the ball tray arrangement and coupling with the existing Michie shifter was also completed. The self-cleaning sifting machine performance tests are in progress.

#### **Improvement to drying process in Orthodox-Rotorvane tea manufacture**

Orthodox-Rotorvane type of manufacture has been changed in the recent past with a view to produce higher percentages of tea grades that contain smaller size tea particles. The primary objective of this study was to develop fluidized bed tea drying model for the production of quality Orthodox-Rotorvane teas at a lower cost. A study was conducted on fluidizing behaviour of teas using different bedplates with varying opening area percentages and perforation sizes. Three different bedplates with modified dimensions have been identified for improving fluidizing behaviour of teas. Further, a study on drying curves for teas at different drying temperatures in the range of 110-127 °C was conducted.

Results revealed that the teas could be dried at lower temperatures than the present recommended temperatures. Hence, the study will be continued for obtaining optimum range of drying temperatures for Orthodox-rotorvane teas.



### **Developing an energy optimizing model for VSD**

Four quadratic equations were developed to predict airflow rate at different static pressure for four different frequencies (35 Hz, 40 Hz, 45 Hz & 50 Hz) using the test rig designed and fabricated at the Process Technology Division. These four equations were incorporated into previously developed mathematical model and the computer program (Q-Basic) developed to calculate real time moisture content of withering leaves was successfully executed. Four other equations were also developed to estimate the power consumption during withering. Development of an automated withering system is in progress.

### **Application of membrane filtration technique for concentration of tea extract**

This experiment was carried out to study the possibility of applying membrane concentration technique to improve the quality of instant black tea. Instant black tea prepared by applying membrane pre-concentration technique was superior in physicochemical and organoleptic properties. Membrane concentration consumed less energy as compared to thermal evaporation. Therefore, membrane pre-concentration technique can be applied to improve the physicochemical and organoleptic properties of instant black tea in an economically feasible manner.

### **Development of stable catechin mixture for cosmetic application**

A method was developed to prepare stable catechin mixture for cosmetic application. The Natures Beauty Creations Ltd. has agreed to purchase this technology.

### **Extraction of proteins from refuse tea/spent tea**

This experiment was carried out to study the possibility of applying membrane filtration technique to purify the protein extracted from the spent tea. It was possible to prepare a protein concentrate with the composition of 24% protein, 12% total ash, 0.4% ether extract, 0.4% crude fiber and 7% polyphenols. Economic feasibility study of the process for a capacity of 1000 kg of protein concentrate per day was carried out. Results showed that the process would be economically feasible at the selling price of Rs. 250/ kg of the final product.

## **SOCIO ECONOMICS AND RESOURCE PLANNING**

### **Assessment of tea Out-grower system on livelihood security of workers**

A survey was conducted in Selagama estate, Matale district to assess the socio-economics of existing out-grower system. The specific objectives of the study were to evaluate/compare livelihood security of out-growers and non out-growers, to identify socio-economic factors which cause inefficiency among out-growers, to identify constraints in implementing the system and suggest appropriate strategies for improving it as a socio-economically viable system. Thirty out-growers and thirty non out-growers were selected for the study. The primary data were collected through a structured questionnaire and the secondary data were obtained from the estate records. The livelihood security was measured based on five indices, food security, education security, economic security, health security and habitat security. The productive efficiency and the determinants of inefficiency were estimated with stochastic frontier analysis using Battese and Coelli (1995) specification. Results revealed that there were significant differences between economic security, education security and habitat security among two groups and out-growers were comparably better than non out-growers. According to the Cobb-Douglas production function estimates, number of tea bushes in the allocated plot, family labour and hired labour significantly affected the yield. The coefficient for bush count, family labour, and hired labour had positive values of 0.69, 0.15 and 0.08 respectively. The mean technical efficiency of the out growers in Selagama estate was found to be 60% with a range of 39%-90%. The study showed that inefficiency is positively and significantly correlated with distance to the field, number of other income sources and number of estates workers in a family. As selection criteria for the out-grower system, distance to the out-grower field, number of estate workers in the family and other income sources should be considered in order to obtain higher productive efficiency from the out-growers. Poor prices for green leaf, problem of stray cattle and low yielding fields were identified as the main constraints in this system. It can be concluded that out-grower system in Selagama estate can continue as a socio-economically viable system in order to overcome labour shortage and uplift livelihoods of workers.



### **Micro and macro-economic analysis**

#### **Identification of contributory factors for below norm pluckers in Up country tea estates**

The cost of plucking depends on many factors and land and worker productivity are the most important factors affecting the cost of plucking. There is an inverse relationship between plucking cost and average plucker intake or plucker productivity. However, under norm below-norm pluckers in a plucking gang is a serious problem for tea estates and it has a negative impact on cost of plucking. Therefore, the study was undertaken to identify the levels (degree) of below-norm pluckers, contributory factors for below-norm plucking and suggest measures to reduce below norm plucker percentage.

Thirty five pluckers (10% of the total pluckers in the estate) were randomly selected representing all three divisions of the estate. Primary data were collected on age of the pluckers, height, education level, experience on plucking, health condition, training, walking distance (from fields to weighing point), weed density and casualty rate. Secondary data on productivity of fields, field extent, slope of the field etc. were also collected from the estate records. Descriptive statistics such as percentages and means etc. were calculated to study the degree of below

norm pluckers and to assess their demographic information. Probit model was employed by using STATA to identify contributory factors for below-norm pluckers. Of the thirty five randomly selected pluckers, 44 percent were categorized in to below-norm pluckers. The walking distance, slope, vacancies and weed density were the contributory factors for not achieving the norm and significant positive factor to achieve the norm was height of the workers. It can be suggested that improvement of land productivity by maintaining recommended number of bushes through infilling, maintaining tea fields free of weeds, placing weighing points near the tea field to reduce unproductive walking time of the pluckers, regular training on plucking and counseling and motivation of low performers are the important measures to be considered for improving plucker productivity and to overcome the adverse impacts of below-norm pluckers on cost of plucking.



### **Productivity variation among tea small holders in the Uva region**

Tea smallholding sector in Sri Lanka plays a vital role in the economy and accounts for about 70% of the total tea production. However, land productivity varies among tea small holders due to many reasons. Objectives of this study were to compare the variation in productivity among the tea small holders, examine contributory factors for productivity variation and suggest appropriate strategies for improving productivity.

One hundred twenty smallholders were selected from Badulla district in the Uva province and pre-tested questionnaire was used to collect data on production (yield), cost of production, socio economic parameters as well as the constraints of the farmers. Maximum likelihood parameters of the stochastic frontier model (using Cobb-Douglas models) were estimated for green leaf production as a function of land extent, family labour used, hired labour used, quantity of fertilizer applied and cost of chemicals and Zn. The determinants of technical efficiency such as age of farmer, health condition, experience, education level, occupation, type of tea and practice of intercropping were estimated following the Battese and Coelli (1995) specification. Data showed that the



productivity of the small holders in the Uva province highly varied from 213.33 to 11728 kg/ ac/ yr and technical efficiencies of tea small holdings varies from 17.09 percent to 99.71 percent. According to the Cobb-Douglas production function and the inefficiency model, the hired labor, amount of fertilizer, chemical cost, Zn cost, extent of land, cultivar, type of tea, health condition of farmer and intercropping were the major contributory factors for productivity variation. Optimum utilization of the land and labor resources, making the small holders aware of the TRI recommendations and good agricultural practices such as fertilizer and Zn application would be the effective strategies for increasing the productivity.

### **Economics of energy plantations in the Corporate tea sector**

The tea industry is one of the energy intensive food-processing sectors consuming both thermal and electrical energy. The thermal energy for tea factories is mainly obtained from firewood. However, shortage of firewood for tea factories is one of the constraints that increases cost of processing. Therefore, there is a growing interest in converting land unsuitable for tea to energy plantations. This will provide additional benefits through improving land productivity by optimum utilization of resources, in addition to fulfilling firewood requirements. Economic viability of the investment on commonly cultivated energy plantations crops such as *Gliricidia*, *Eucalyptus* and *Albizia* was evaluated. Economic feasibility of *Gliricidia* plantations was assessed considering two scenarios, *i.e.* accounting for wood value and both wood value and leaves as benefits. The results of the analysis revealed that planting *Gliricidia*, *Albizia* and *Eucalyptus* in lands unsuitable for tea is an economically viable investment.

### **Application of geographic information system (GIS) to tea sector**

#### **Mapping of tea lands in Sri Lanka using GIS technology**

Under the direction of the Ministry of Plantation Industries, mapping of tea lands in all tea growing districts was initiated in collaboration with the Land Use & Policy Planning Department (LUPPD) and other relevant organizations. A pilot project covering the Galle district was in progress. Several progress meetings were held at the Ministry of Plantations Industries with relevant organizations in order to finalize methodologies and for securing adequate funds. The project activities are in progress.

## Services To Stakeholders

### Advisory and Extension Programs

Major Activities	TK	Rat	Kan	Gal	Den	Uva	Kal	TOTAL
Visitors to the Division/Centre	2,963	1,402	523	622	1,088	829	131	7,558
Advisory correspondence	632	406	82	432	221	163	284	2,220
Advisory visits	156	125	101	102	92	40	84	700
Group Training Approaches	63	63	90	46	76	18	69	425
Distribution of Publications	120	95	-	325	1,417	61	129	2,147
Soil Samples tested for pH		734	241	131	532	1,174	63	2,875
Soil Samples tested for C%						687		687
Soil analysis for Nematodes					404			404
Commercial Nursery Inspection	9	53	9	53	73	38	14	249
Visits/Involvements in Adoptive Trial	8		11	10	7	7		43
Exhibitions/Crop Clinic	Dayata Kirula at Ampara, Mini Crop Clinic at Matugama, Educational Exhibition at Matugama							

TK: Talawakelle, Rat: Ratnapura, Kan: Kandy, Gal: Galle, Den: Deniyaya, Uva: Badulla,

Kal: Kalutara

### 1. Problems identification and solving

Visiting tea estates for identification of cultivation related problems and solving them and advising them on estates development activities remained the main advisory activity during 2013 too. The advisory visits were organized based on the request made by clients and the priority was given to the corporate sector tea plantations. The requests received from smallholdings were dealt with the participation of the officers of the TSHDA.

### Advisory and extension visits

Total of 700 advisory and extension visits have been done by the staff of advisory and Extension division. Almost 32% of visits have been covered during the 1<sup>st</sup> quarter as the majority of land selection requests in the South Western monsoon sector were received during this period. The least number of visits have been done during the 4<sup>th</sup> quarter.

Extension staff of the Up country region has made 156 visits mainly to the corporate sector tea plantations which is 32% out of the total advisory and extension visits, whereas staff of Ratnapura region has made 125 visits during 2013. Extension staffs of Kottawa, Kandy, Deniyaya, Matugama, and Passara extension centers have done 102, 101, 92, 84 and 40 visits respectively. Majority of advisory visits were mainly on investigating the



land suitability for replanting. Requests for investigating the causes for yield declining, pest attacks, debilitation of bushes, nursery failures and disease incidences were among the other advisory visits.

### **Visits to the estates with TRI scientists for special field issues**

On the request of Ceylon Planter's Association through the Consultative Committee on Advisory and Estates, special program was initiated to visit RPC estates jointly with the scientists to tackle the special field problems of the RPCs. To begin with, the plantations of Elpitiya PLC in the Up country region, Fernlands, Sheen, Nayapana, New Peacock, Dunnsinan and Madakumbura estates were visited with the scientists of Soils and Plant Nutrition, Plant Breeding and Entomology Divisions to investigate the problems of low phosphate in soil, unusual tea tortrix out breaks during the rainy season, dying of some tea cultivars, such as TRI 2021 *etc.* This program continues to cover the requests of all the other RPCs.

## **2. Training Activities**

On the request of stakeholders, 425 training programs, seminars, workshops *etc.* were conducted during the year under reference.



### **Residential Training programs**

The tea modules of the residential training programs coordinated by the National Institute of Plantation Management for the extension personnel involved in the plantation sector, Plantation management and the school leavers were conducted at the TRI as shown in the following table. Ms Hiromi Nishanthi, Extension Officer coordinated these programs.

Program	Duration	No.of participants
Induction course for planter trainees - 2013	19-24 Aug. (6 day)	32
National Diploma in Plantation Management - 15 <sup>th</sup> Program: Tea Cultivation & Processing Module	Sep, Oct & Nov. (12 day)	28
National Diploma in Plantation Extension Management - 2013	Nov & Dec. (9 day)	18

### **Training of graduate officers attached to the Ministry of Economic Development**

Officers of the Advisory division and the scientists were involved in 36 programs for training of graduate trainees attached to the “Divinaguma” Project of the Ministry of Economic Development, on tea cultivation. These programs were conducted in twelve army camps throughout the island.

## **3. Participatory Technology Dissemination Activities**

### **Regional Technical and Extension Forum (RTEF)**

Fourteen RTEF workshops were conducted in collaboration with the TSHDA covering all eight regions. Various subject areas selected by the RTEF committee were discussed at the above *fora*. The special issues and problems that were raised at the above fora were discussed further at the E & E Forum and the TRI-TSHDA interaction monitoring committee meetings, for further investigation and for taking necessary policy decisions where necessary.

### **Experiment and Extension (E&E) Forum for the smallholdings sector**

Mr. S. P. Rathnayake, Advisory Officer/OIC of Advisory & Extension Centre, Deniyaya coordinated the E & E forum for the smallholding sector held bi-annually with the participation of TSHDA, SLTB, SLPTOA and the officials of Tea Development Societies. Two sessions of Experimental and Extension forum for smallholdings sector were held during the year as follows.

2013.06.21: ‘The protection of the environment, sustainable tea cultivation and challenges’

2013.12.20: The trends in global and local tea market by Guest speaker Mr. H G Hemaratne, Former Director General of Tea Board, ‘Selection of tea clones for a higher productivity’ by Mr. Mahasen Ranatunge and ‘Management of SHB and Low country Live wood Termites’ by Dr. Keerthi Mohotti.

### **Experiment & Extension (E & E) Forum for the corporate sector**

There were two sessions of Experimental and Extension forum for the corporate sector plantations coordinated by Dr. Keerthi Mohotti.

#### **E & E Forum: 25th January, 2013**

The subjects covered were;

1. 'BFBF applications in young tea' by Dr. Luxmi de Silva
2. 'Protection of mature tea from SHB and LCLWT' by Dr. K M Mohotti
3. 'Tissue culture technique for reducing cultivar screening period by'  
Mr. K Ranaweera
4. 'Quality prediction of tea cultivars based on biochemical constituents'  
by Dr. N Punyasiri
5. 'Alternative grass species for soil rehabilitation' by Dr. K G Premathilake

#### **E & E English Forum: 26th July, 2013**

1. 'Research evidences on cast iron usage in tea factories' by Dr. Sarath Samaraweera
2. 'Outcome of application of out-grower concept in tea estates'  
by Dr. H W Shyamali
3. 'Field experiences on application of the out-grower concept in tea estates'  
by Mr. Sugeewa Godage, Deputy General Manager, Kahawatta Plantations Ltd.
4. 'Increasing tea yields through consolidation of tea fields by infilling' by  
Dr. M A Wijeratne

### **Regional Scientific Committee (RSC) seminars**

Four seminars were organized by the Regional Scientific Committees covering Dickoya, Uva, Kegalle/ Ratnapura/ Kalutara and Galle/ Matara regions. The main subject areas addressed at the RSC seminars were the 'Productivity improvement through fertility management', and 'Good manufacturing practices and machinery maintenance' 'Current trends in tea market' 'Management of Blister Blight leaf disease'.

### **Stakeholder Forum Seminars**

With the objective of fostering the interaction between TRI scientists and the stakeholders, two stakeholder forum seminars were conducted, one at the auditorium of HARTI on 31<sup>st</sup> May 2013 and the other at the auditorium of SLIDA in Colombo, on 29<sup>th</sup> November 2013. The themes of the seminars were "Viable alternative employment models and interventions to consolidate the current stand of tea" and the "Sustainable energy sources and efficient use of energy". Seminars were successfully conducted with the participation of the senior scientists and extensionists of TRI, CEOs and the senior management of the RPCs and the senior management of the other tea related organizations.

## **4. Information Dissemination**

### **Advisory correspondence**

About 2,223 advisory correspondences have been sent out on various subjects and the visit reports following the advisory visit to plantations and smallholdings from advisory division during 2013. The majority of correspondence has been sent during the 1<sup>st</sup> and 2<sup>nd</sup> quarters of the year. The reason for this situation was due to the high number of requests for advisory visits and the information on weed management, pest and disease problems, other cultivation practices and land suitability inspection reports for replanting, during this period due to the overlapping of first inter-monsoon rains and South West monsoonal rains during these periods. Out of the total number of correspondence 29% has been sent out by the advisory and extension staff for the Up country region.

### **Production of audio-visual and information materials**

Several extension and educational information materials were developed by the staff of advisory division for conducting extension programs, information dissemination and publicity purposes.

Five digital posters and four light boxes on different subjects were prepared for display purposes in 'Dayata Kirula' exhibition at Ampara. A booklet under the theme of "Tea Cultivation and the Tea Research Institute of Sri Lanka" in three languages was published to distribute at the Dayata Kirula exhibition. Two issues (Vol. 9. No. 1 & 2 issues) of "Tea Thathu" were published.

## **5. Publications**

### **Details for Annual Report 2013-Publications Unit**

The Publication Unit of the TRI has undertaken work related to printing, publishing and issuing of institute's journals, periodicals, books & pamphlets, *etc.* The following publications were issued during the year.

February	PN 2 (Sinhala) තේ කඩාන් පාලනය තේ කතු Volume 9, Part 1
March	SP 7 (Sinhala) පාංශු විශ්ලේෂණය SP 8 (Sinhala) පොහොර නියැදි විශ්ලේෂණය SP 9 (Sinhala) තේ පත්‍ර විශ්ලේෂණය සඳහා නියැදි ලබා ගැනීම
April	Tea Industry and Tea Research Institute of Sri Lanka (Sinhala/ Tamil/ English)
June	Sri Lanka Journal of Tea Science Volume 75, Part 2, (2010) PM 2 (Sinhala) කඳ විදින ගුල්ලා කළමනාකරණය කිරීම HP 1 Pruning of Tea HP4 Rejuvenation Pruning WM1 Integrated Weed Management in Tea
July	Tea Bulletin Volume 21, Number 1, June 2012
August	PM 9 තේ වගාවන්හි උඩරට සජීවී දැව වේයා පාලනය කිරීම Corporate Plan 2013-2017
September	Guidelines for Use of Motorized Tea Harvesting Machines
Nov	තේ කතු Volume 9, No. 2, December 2012

The income generated by sales of publications during 2013 was Rs. 391,430.

Name of publication	No. of copies sold	Unit rate (Rs.)	Total (Rs.)
Handbook on Tea	143	1500/=	214,500/=
Twentieth Century Tea Research in SL	07	2000/=	14,000/=
තේ දැව් නෙලීම	136	20/=	2,720/=
තේ නවාන් පාලනය	130	20/=	2,600/=
තේ පඳුරු කප්පාදු කිරීම	140	20/=	2,800/=
Monograph No. 4	01	100/=	100/=
Monograph No. 6	08	100/=	800/=
Monograph No. 7	64	100/=	6,400/=
Shoot Growth & Harvesting of Tea	13	100/=	1,300/=
Field Guide Book (Sinhala)	01	125/=	125/=
Field Guide Book (Tamil)	80	125/=	10,000/=
Chemical Control of Tea Pests (English)	46	150/=	6,900/=
Chemical Control of Tea Pests (Tamil)	37	50/=	1,850/=
Tea for Health	126	100/=	12,600/=
සුව රැකුමට තේ	21	125/=	2,625/=
Tea & Health	37	750/=	27,750/=
Cost of Tea Cultivation from Nursery to the Field	12	400/=	4,800/=
Nuwara Eliya District Tea Development Plan	01	150/=	150/=
Advisory Circular Folder (English)	70	500/=	35,000/=
Advisory Circular Folder (Sinhala)	59	400/=	23,600/=
Advisory Circular Folder (Tamil)	06	400/=	2,400/=
Correction of Nutrient Deficiency Symptoms in Tea (English)	46	15/=	690/=
Correction of Nutrient Deficiency Symptoms in Tea (Tamil)	11	15/=	165/=
Proper Planting Techniques (Tamil)	01	5/=	5/=
Weeds of Tea Lands in Sri Lanka	49	200/=	9,800/=
Wall Chart: Major Pests of Tea in Sri Lanka	67	100/=	6,700/=
Poster on Soil Conservation with Vetiver Grass(English)	11	30/=	330/=
Poster on Soil Conservation with Vetiver Grass (Sinhala)	10	30/=	300/=
Poster on Soil Conservation with Vetiver Grass (Tamil)	14	30/=	<u>420/=</u>
<b>Total</b>			<b><u>391,430/=</u></b>

The Photography Unit supported on-going research programme by taking photographs of experimental activities and events such as E & E forums, seminars, workshops, skill development programs, planting programs and entertainment programs *etc* organized by the TRI.

## **6. Stakeholders Interaction and Public relation Activities**

### **Visitors**

Total of 7,437 stakeholders, students, foreign guests visited the TRI for educational and awareness purposes. Majority of them have visited during the second and third quarters of the year. Out of the total, 40% of the visitors were for the TRI main station at Talawakelle and 19% and 15% for the Low country Regional Station Ratnapura and the Extension centre at Deniyaya, respectively.

### **Crop Clinics and Exhibitions**

A mini Crop Clinic was conducted in the Henetenna Tea Factory for smallholders, organized by TRI Matugama centre in collaboration with the staff of TSHDA. All the aspects of nursery management including the identification of suitable cultivars, growing media and techniques of cleft grafting were demonstrated by the staff of Advisory, Agronomy, Plant Breeding and Entomology/ Nematology divisions of the TRI.

Staff of the Advisory and extension division participated at three public and educational exhibitions including the "Dayata Kirula 2013: National Exhibition" held at Ampara. Officer in charge and staff of Uva Advisory & Extension Centre were involved in organizing the Dayata Kirula exhibition activities. The exhibition stall of the Ministry of Plantation Industries was selected amongst the best 10 stalls out of 200 stalls in the exhibition.

### **“Dayata Kirula” mobile programs**

Prior to the “Dayata Kirula” exhibition to be held in Kuliyaipitiya in February 2014, a series of mobile educational and service programs were organized by the Ministry of Economic Development in Kurunagala, Kegalle and Puttlam District during end of 2013. The officers from the Advisory & Extension division at Talawakelle, Ratnapura and Kandy conducted 22 extension programs in Kegalle district.

## **7. Services to Stakeholders**

### **Soil analysis**

Several services such as analysis of soil pH and organic carbon were undertaken by the staff of extension centers at Galle, Uva, Ratnapura, Kandy and Deniyaya. In addition issuing of limited amount of new clonal materials and tea plants were also undertaken as a service to the stakeholders. Altogether 2,875 soil samples for pH analysis and 687 soil samples for organic carbon analysis were received by the advisory staff.

### **Pest diagnostic services**

Nematology and Entomology laboratories of the TRI at Talawakele, Hantane, Ratnapura and Deniyaya continued to serve small holder and corporate sectors in nematode and insect pest diagnosis. Also, tea exporters were also assisted in curtailing problems in connection with stores and warehouse pests. Assistance in pesticide residue monitoring and generating data on MRLs *etc.* helped both growers and exporters immensely. The nematode diagnostic service analysed more than 285 samples during the period under review.

### **Supply of new clonal cuttings**

#### **ADB mother bush program**

Mr Janaka Rajasinghe, Principal Advisory Officer continued to coordinate the supply of cuttings from mother bush sites established in different tea growing areas. Around seven million cuttings of 3000 and 4000 series cultivars were issued to both smallholdings and estate sector from mother bush sites during the year 2013 as against estimated 10.5 million cuttings. Unfavorable weather conditions and less demand for certain cultivars contributed for non-accomplishment of the target.

### **Commercial nursery inspection**

On the request of TSHDA, 249 commercial tea nurseries were inspected for approving of suitable plants. It was found during the inspection that only about 60- 65% of nursery plants were suitable for recommending in terms of the bag size, number of leaves and height of the plants.

## **8. Infrastructure Development Activities**

### **Upgrading extension centers:**

Development activities of the Galle Advisory and Extension center was continued by establishing 0.1 ha of energy plantation (*Bamboo*) with the objectives of investigating the possibilities of using bamboo as a fuel wood for tea processing. Four different *Bamboo* varieties were planted in two blocks of marshy land in an area of approximately about 0.18 ha. Establishment of 0.2 ha block of *Mana* and PGN grasses was undertaken during the year under reference, for the purpose of providing planting material for soil rehabilitation. A “Tea Technology Park” was established with the objectives of demonstrating the recommended, good agricultural practices (GAP) for the visitors of the station. Moreover, TRI 5000 series cultivars to be released after testing were planted. Advisory and extension facilities at the Matugama Advisory and Extension Centre were improved to provide more services to the smallholders and RPC estates in the Kalutara district.

### **Demonstration block (Technology Park) at St. Coombs estate, Talawakelle**

About one hectare block of tea, in the field no. 8 of lower division in St. Coombs estate was selected and prepared for establishing a technology park. The work is in progress under the supervision of Advisory and Agronomy divisions. Soil rehabilitation with recommended grass species, different planting spacing, and soil and water conservation techniques and standard pruning and harvesting methods are being demonstrated in this site. The establishments of other good agricultural practices are in progress.

## **9. Extension Research**

### **Identifying and assessing of widely adopted agricultural practices by tea growers nursery experiment**

A nursery trial was established at Talawakelle to make a preliminary assessment of the use of bed plants, nursery bags with different heights and widths. Healthy cuttings of cultivar TRI 4078 were planted in February 2012. Survival percentage, plant height, number of branches, number of leaves, root length and fresh and dry weight of plants were recorded after the nursery period of 12 months. Selected healthy plants were planted in the field no. 11 B of St. Coombs estate in February 2013. The experiment was laid out in a RCBD with 8 treatments and 3 replicates.



**Potential shade tree species**

The tree species *Trema politoria* of family *Ulmaceae* (or *Urticaceae*) known as "Gadumba" was planted in the F. No 13 of lower division of St. Coombs estate as a high shade, along with recommended high shade *spp. Gravelleia robusta* for comparison. However, due to the over-maturity of plants and the unfavorable weather conditions, only five *Gadumba plants* were survived. Arrangements were made for replacing the casualties.

**Para Extension Approach (PEA) for the corporate tea sector**

PEA has been initiated in the previous years with the view of strengthening grassroot level technology dissemination in the corporate sector tea plantations. Selected field staffs of estates were trained as "Para Trainers" by the TRI who subsequently train groups of workers regularly by conducting Tea Field Schools. PEA was implemented in collaboration with the selected RPCs.

"Para Trainer" groups each consisting 25-30 field staff members were regularly trained on agricultural and communication subjects. In addition, visits to the TRI and demonstration sites/fields were organized for the trainees. New information centers at estates were established for the use of grassroot level plantation employees. Demonstration plots established in estates were maintained. The tea field schools conducted in estates were monitored and evaluated by the respective estate management and the TRI.

During 2013, PEA programs were conducted for two RPCs namely Kahawatte Plantations PLC (Nawalapitiya & Kahawatte regions) and Watawala Plantations PLC (Lindula & Hatton regions). These programs were conducted by the TRI extension staff with the assistance of research staff of Entomology, Pathology and Agronomy divisions.

**Synopsis of PEA activities conducted during 2013**

Activities	Watawala Plantations PLC	Kahawatte Plantations PLC
Training of Para Trainers (PTs) by TRI	12 programs for a group of 30 PTs	6 programs for a group of 30 PTs
Tea Field Schools (TFS) conducted by PTs	24 TFS: Hatton region 12 TFS: Lindula region	
Agro information centers - New	4	
Visits to demonstration sites/fields	2	
Familiarization visits to TRI by PTs	3	2
Video program on TFS	2	-
Evaluation/review programs	2	-

The implementation of the PEA in tea estates helped improving awareness and adoption of good agricultural practices, skills and positive attitudes among field staff and workers.

**10. Adaptive Trials**

**Fertilizer adaptive trials**

The adaptive trials were concluded to compare the efficacy of TRI recommended fertilizers mixtures and those preferred by the smallholders. Evaluations of the adaptive

trials were done jointly by the staff of TRI and TSHDA. Mr J C K Rajasinghe, Principal Advisory Officer successfully coordinated the awarding ceremony for the fertilizer adaptive trial participants on the 20<sup>th</sup> December 2013 along with the 25<sup>th</sup> E & E (Smallholdings sector) forum held at the TRI Low country station.

Bio Film Bio Fertilizer (nursery) adaptive trial results were presented to the Technology Release Committee of the TRI. Adaptive trials were also conducted to evaluate the new products proposed for the Shot Hole Borer (SHB) control at Fairly Estate (Ozada Plantation) in Dolosbage and to evaluate the effectiveness of Chlorine (Cl) as an alternative for eradicating nematodes in irrigation water in tea nurseries at the TRI Mid country station nursery.

## **11. Other Activities**

Principal Advisory Officer at the Low country station, Ratnapura coordinated the tea nursery project to raise 250,000 tea plants at St. Joachim estate jointly with the TSHDA. TRI, Low country station participated in establishing a tea garden in the “Janakala Centre” at Battaramulla for the visiting foreign delegates of CHOGM.

## **12. Audio Visual Service**

Mr Neville Ekanayake, Technical Officer of Advisory and Extension Division attended the following Audio-visual services of the Division.

- Provided the services to 57 events of symposium, meeting, training programme and workshops, 7 groups of university students/trainees and three exhibitions and Crop Clinics
- 1,646 video films on tea were copied and distributed among the stakeholders of the tea industry
- New AV and multimedia system was installed in the Lecture hall and Auditorium
- Preparing of video clip on laboratory activities for seminar presentation, recording of video/photo of special events of the institute, designing of printing material for TRI publications and preparing technical specifications for purchasing of AV equipment and computer accessories

The Audio Visual Unit generated an income of Rs. 44,978.00 for providing its services to the TRI staff and Rs. 207,274.00 from the divisional projects as photocopy charges during the year.

## **13. Library**

The TRI library renders its services to the staff, undergraduates and students who undertake projects at the TRI and other libraries and individuals making official requests.

The library involved in the following activities during the year.

- Acquisition, collection and maintenance of library materials.
- Lending library materials
- Maintaining a collection of news clippings
- Photocopy service
- Inter library service

Three new books were added to the current collection of 4718 books. The Library procured 31 journals/ serials through subscription, gift and exchange. It subscribed to 11 foreign journals. One Ph D thesis and two M Phil thesis of TRI officials were added to the library thesis collection during the year.

During the year, 397 newspaper articles were collected and sent to the Director for information. Under Inter Library Loan Service (ILL), library has supplied 9 articles for outside libraries and 3 articles for the TRI users. More than 4061 papers were photocopied for the TRI staff from bound periodical collection and other library materials. Sixty eight students from the Universities and Technical Colleges used the library facilities.

#### **14. Information Technology Unit**

Information Technology Unit rendered its ICT related services to other divisions, units, regional and extension centers and the TRI estates. These included;

- Administration & maintenance of internet, e-mail and file servers
- Installation and troubleshooting of computers, computer accessories and Local Area Network (LAN)
- Installation and maintenance of anti-virus software with up-to date security
- Updating of TRI Website with new information
- Maintenance of Finger Print Scanners located at Head Office and Low country Regional Centre and its software
- Maintenance of Fixed Assets Register of Computers, Accessories and Software
- Desktop computers (10), two notebook computers, one tablet computer, five laser printers, dot matrix printer, 650VA UPS Systems (22) and one digital colour scanner were purchased and distributed among the head office and other regional and extension centers as per the procurement plan of the year.
- Kaspersky® Anti-Virus software was also purchased and installed in 115 desktop and notebook computers at head office and St. Coombs estate.
- New air conditioner was also purchased and fixed in the server room of the IT Unit.

#### **15. Analytical Services**

##### **Development of regional analytical facilities for soil, plant and fertilizer analyses**

The main objective of this service was to provide analytical facilities to stakeholders and assist site specific fertilizer application. The total number of analysis of soil, leaf, fertilizer and organic manure samples at Talawakelle, Walahanduwa and Hantane laboratories during 2013 were 12,298, 2,078, 4,704 and 111 respectively. Out of these analyses, the highest number of analysis was performed for soil pH (5,743) and soil organic carbon (3,497). In addition, schedules were also prepared for Site Specific Fertilizer Recommendation (SSFR).

The total number of sodium and iron analyses performed during 2013 was 105 and 65 respectively. The main objective of this analysis was to monitor the adulteration of made tea.

In order to test the quality of fertilizers at retail outlets, 98 fertilizer samples were analyzed during 2013.

## TRI REGIONAL CENTRES



## **Low country Regional Centre**

M A Wijeratne

B Sc Agric. (Ruhuna, Sri Lanka), Ph D (London, UK)

Officer-in-Charge

### **General**

There are four research units *viz.* Agronomy, Plant Breeding, Entomology and Nematology and Process Technology and an Advisory & Extension section at the Low country Regional Centre, Ratnapura. A number of field and laboratory experiments have been conducted by the scientific staff of research units in line with the Corporate Plan of the institute and details of such experiments have been described elsewhere in this Annual Report under reports of the respective Heads of Divisions. In addition to being involved in divisional research activities, the staff of the Process Technology Division continued to visit tea factories in the Low country region for testing tea machineries and advising on tea manufacture related problems. The number of such visits during 2013 was 61. The Advisory and Extension officers attached to the Low country Regional Centre have done 125 advisory visits, 32 training programs and 18 seminars for both corporate sector estates and smallholdings. Additionally, they have inspected 53 commercial nurseries in the Ratnapura and Kegalle districts. The Low country Regional Centre has entertained more than 1429 visitors during the period under review.

The Regional Scientific Committee (RSC) seminar for the Managers & Assistant Managers of the corporate sector estates in Ratnapura, Kegalle and Kalutara districts and two Experiment and Extension (E & E) forums for tea smallholders were conducted in 2013. Two Regional Technical and Extension Forums (RTEF) were held at the Low country Regional Centre for TSHDA officials and smallholders society representatives in the Ratnapura and Kegalle districts. The Low country Regional Centre lead Rs 100 million project approved by the government on Popularization of harvesting Devices and other selected machineries used for field operations in the



smallholdings sector. Of the four initial awareness programmes of this project, the inaugural programme was held at the Low country Regional Centre in October 2013 for the TSHDA officials and selected tea smallholders in Ratnapura, Kegalle and Kalutara districts. Additionally, five residential programmes were also conducted at the Low country Regional Centre to train tea smallholders and officials of TSHDA and Sri Lanka Tea Board on the proper use of TRI selective tea harvesters, motorized tea harvesting machines, pruning machines and holing machines. The number of participants of these Training of Trainer's (TOT) programmes was around 150.

### **Awards**

TRI Low country Regional Centre received the 'Silver Award' under the category of "Service sector-Small scale" in the islandwide competition on social dialogue & workplace cooperation organized by the Department of Labour, Ministry of Labour and Labour Relations. Mr. C J Liyanaarachchi, Extension Officer attached to the TRI Low country Regional Centre won a Merit award in the poem competition (Sinhala Medium).

### **Administration and staff movements**

Mr. Kapila Chaminda, Driver attached to the Low country Regional Centre was transferred to the TRI Advisory & Extension Centre, Kottawa with effect from 1st January and to fill his vacancy, Mr. S A C Suraweera, Driver was transferred from the Kottawa station. Mrs. L A S P Jayasinghe was transferred to the Agronomy Division, TRI Low country station from the Head Office w.e.f. 1<sup>st</sup> January 2013. Mr. J C K Rajasinghe, Principal Advisory Officer was transferred from the TRI Mid country station to the TRI, Low country station, with effect from 1<sup>st</sup> October 2013. Mr. K A S Kumarapperuma, General Clerk retired from the TRI service w.e.f. 8<sup>th</sup> June 2013. Mr. A.G. Samantha Jayasiri, Hostel Caretaker resigned from the TRI service w.e.f. 31<sup>st</sup> July 2013. Miss. M D I U Senaratne was appointed as a graduate trainee and resigned from the TRI w.e.f. 15<sup>th</sup> June. Mrs. I D Subasinghe, Mrs. H A T K Sumanaweera, Mrs. D V S P Denagama, Mr. D C Perera, Mr. P D N de Silva, Mr. A K J Athukorala and Mr. A M U Liyanage, skilled workers (Shop & Office Act) attached to the Low country Regional Centre were absorbed to the TRI permanent service as General Workers with effect from 7<sup>th</sup> January 2013.

An Eye Clinic was held with the assistance of a reputed eye specialist at Ratnapura to provide spectacles for the staff and workers of the Low country center on concessionary price and payment on installment basis. A seminar on "Workplace cooperation and positive thinking" was conducted by the resource personnel of the Social Dialogue and Workplace Cooperation Unit, Labour Department for the staff of the Low country Regional Centre, Ratnapura in July 2013. TRI Low country Regional Centre Sports Club hold customary Annual Children's Party and Sinhala and Hindu New year celebrations with the participation of staff and their families.

### **Human resource development and training**

Arrangements were made to hold tamil language class for the staff of the Low country Regional Centre with the assistance of National Institute of Language Education and Training. Mr. Toufic Ahmed, a Ph D student from Bangladesh Tea Research Institute carried out his research activities under the supervision of Dr. M A Wijeratne and Prof. J M De Costa (Faculty of Agriculture, University of Peradeniya). Mr. G L C Galahitiyawa and Mrs. P D Senanayake went to India and Israel respectively for short term overseas training. Mr. Sampath Pathiranage, Research Assistant and Mrs. P D Senanayake continued their post graduate studies leading to Ph D at the Post graduate Institute of Agriculture, University of Peradeniya and Faculty of Graduate Studies, University of Kelaniya, respectively. In addition, 5 university undergraduates and 23 apprentices from the government establishments were trained on tea related subjects and clerical and allied duties at the Low country Regional Centre. Dr. M A Wijeratne served as a member of the National Committee on Agriculture Machinery of the CARP, Sri Lanka.

### **Infra-structure developments**

The routine maintenance work of water and electricity supply, maintenance repairs of staff quarters, office, auditorium and laboratory and other buildings, cleaning and maintenance of layout and repairs and services of institute's vehicles were satisfactorily attended. Overhaul engine repairs of one double cab (253-3140) was carried out. Internal and external colour washing of C-02, B-02, and D-02 bungalows, security mess and Advisory Officer's room was completed. Painting of roof of Bungalow No C-06 and B-03 was completed. The Low country Regional Centre library was fumigated to control insect pest damage.



## **TRI Mid country Regional Centre**

J C K Rajasinghe

B Sc Agric (Peradeniya, Sri Lanka) M Sc (Peradeniya, Sri Lanka)

Officer-In-Charge (up to 26<sup>th</sup> October 2013)

M S D L De Silva

B Sc (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka), Ph D (JCU, Australia)

Acting Officer-In-Charge (from 1st November 2013)

The TRI Mid country Regional Centre, Hantana, Kandy is equipped with 4 laboratories attached to four research divisions *viz.* Agronomy, Entomology and Nematology, Plant Breeding and Soils and Plant Nutrition together with an Advisory and Extension section. Agronomy Division commenced a new Bio-filmed Bio-fertilizer (BFBF) trial along with two different rates of nitrogen and phosphorus for young tea and a screening trial of new herbicide, Indaziflam for managing common weeds. In Entomology Division, there were eight (8) screening trials with '5000 series' cultivars on SHB and Nematodes tolerance were in progress. Bio assay on experiments with Vertako for Nematodes and SHB control were completed. Evaluation of chemical protectants for SHB control was also completed. Studies on SHB attack to the collar region of tea bushes were commenced. In SPND, there were six (6) new trials on Bio-fertilizers. New trials on Nano fertilizer and micro nutrients were commenced. A seed garden was established at Hantana Regional Centre by the Plant Breeding Division. Adaptive trials on 5000 series cultivars were commenced. The trial on direct planting of tea seeds in the field was established. The land use pattern of the Kandy Regional Centre was as follows.

<b>Land use</b>	<b>Extent (ha)</b>
Seedling tea	2.00
VP tea (mature)	4.5
VP (uprooted for replanting)	1.00
VP tea (young)	3.5
Mother bushes	2.75
Tea nursery	0.2
Under mana grass	0.5
Fruit trees	0.4
Coconut	0.81
Forestry	1.2
Marshy land	0.62
Building, garden, paths and roads	5.77

Research units in consultation with the Heads of Divisions at Talawakelle conducted a number of experiments in the laboratories, glass house and in the fields of Mid country plantations in Kandy and Matale districts.

Advisory & Extension division extended its services through organizing training & awareness programs for both in corporate and smallholder sector in Mid country. Scheduled programmes such as Regional Technical and Extension forums (RTEF) was also held at the Mid country Regional Centre, taking in to account the needs and request of the smallholdings sector, with the participation of TRI, TSHDA officials and the members of Tea Development Societies in Kandy & Matale districts. RTEF programs were conducted and the subjects under discussion were the “Irrigation in tea, Collar canker in Mid country and pest management, Update on recommended pesticides, Challenges and suggestions for maintaining 2% replanting rate and Fertility management in tea through chemical and biological methods.” Presentations made by the TRI scientists were followed by an interactive session where issues related to mid country were discussed.

### **Staff movements**

Mr. J C K Rajasinghe Officer-in-Charge was transferred to Low country Regional Centre, Ratnapura with effect from October 2013 and Ms. M D L De Silva took over the duties *w.e.f.* the 1<sup>st</sup> November 2013. Mr. Kithsiri Palathanthirige, Work Supervisor was transferred to Head Office, Talawakelle with effect from September 2013.

### **Adaptive trials**

Adaptive trials on ‘5000 series’ cultivars in Sogama estate in Paradeka, Pussellawa and improved seedlings trial at Hangurugama estate, Medamahanuwara are in progress with collaboration of Plant Breeding Division.

### **Demonstration plots**

Demonstration plots on adoption of Good Agricultural Practices (GAPs) continued at the station to educate the stakeholders and the general public.

### **Infrastructure developments and maintenance**

The routine maintenance work of electricity supply mainly to street lights, maintenance and repairs of staff quarters C1 and C2, security guard room and muster-shed were completed. Construction of a toilet pit for OIC’s bungalow was completed. Cleaning and maintenance of layout and repairs and services of institute's vehicle fleet were attended. Major repairs of the bus and Panther jeep were completed.

## Visitors to the station

Tea growers		
-Planters	-	25
-Small holders	-	202
Students/School children	-	249
Other local visitors	-	37
Foreign visitors	-	10
<b>Total</b>	-	<b>523</b>

## Income

Number of VP cuttings sold	-	3,93,275
Income received from sale of cuttings (Rs)	-	3,14,620.00
Number of VP plants sold	-	53,747
Income received from sale of VP plants (Rs)	-	9,67,446.00
Total crop harvested (kg)	-	17,486
Income received from sale of Green Leaf (Rs)	-	11,07,840.10
Guest house accommodation charges (Rs)	-	50,100.00
Income received from soil pH testing (Rs)	-	6080.00
Sale of TRI publications (Rs)	-	41,035.00
Miscellaneous income (Rs)	-	24189.00

## Crop

The green leaf (kg) harvested during the year 2013, is given below.

Month	Crop harvested / sold (kg)	Rate (Rs per kg)	Income (Rs)
January	670	59.78	40,052.60
February	845	62.26	52,609.70
March	1750	64.13	1,12,227.50
April	1855	63.45	1,17,699.75
May	1734	62.04	1,07,577.36
June	1421	60.67	86,212.07
July	1321	61.87	81,730.27
August	1843	62.97	1,16,053.71
September	1683	64.32	1,08,250.56
October	1231	64.49	79,387.19
November	1584	64.37	1,01,962.08
December	1549	67.14	1,04,077.31
<b>Total</b>	<b>17,486</b>		<b>Rs. 11,07,840.10</b>

## Summary of advisory and extension activities

Activity	Nos	Activity	Nos
Advisory visits to estate	20	Commercial nursery inspection	74
Advisory visits to smallholders	45		
<b>Total</b>	<b>65</b>	Exhibitions	<b>02</b>
Advisory correspondents	82	<b>Visitors</b>	
Publications/Articles	03	Planters	25
<b>Total</b>	<b>85</b>	Smallholders	202
		Higher educational students	249
Training programs	-	Foreigners	10
Skill trainings	27	General visitors/school children	37
Educational	34	<b>Total</b>	<b>523</b>
Customized trainings	-		
Demonstrations	03	Soil testing	<b>241</b>
Group discussions	-		
Seminars/Lectures/Field days	26	Publications distributed	-
Crop clinics		Free issuing leaflets	-
<b>Total</b>	<b>90</b>	Posters	-

## **Uva Extension Centre**

Mr. K R W B Kahandawa B Sc Agric.(Peradeniya, Sri Lanka)  
M Sc (Peradeniya, Sri Lanka)  
Officer in Charge

TRI Uva Extension Centre, Pelagahatenne, Passara has been established in 1931 with the objective of providing services to tea plantations in Uva province. At present it provides the service to an extent which spread over 20539 ha in estate sector and 9219 ha in smallholding sector directly or indirectly. The centre is equipped with a small scale laboratory for soil and carbon analysis and a field extent of 14.30 ha for field trials and demonstrations. The land use pattern in hectares as follows.

### **Land use pattern (ha)**

Mature tea in plucking	-	4.00
Young tea and demonstration blocks	-	0.70
ADB Mother Bushes	-	2.06
Buildings/Roads	-	0.79
Forest/ Scrub/ Grass lands	-	6.75
Total extent	-	14.30

### **Advisory and extension activities**

In 2013 Uva extension Center organized a large number of field investigations in plantations situated in Badulla and Monaragala districts and made necessary recommendations. The centre extended its services to both corporate and smallholdings by conducting advisory and extension visits, training programmes in the form of seminars, workshops, and field days in this year too.

Two RTEF meetings were held for the officials of TSHDA and Tea Smallholding Developments Societies. The subjects presented by the research and extension staff for those meetings were, “Nonchemical weed management in tea,” “New fertilizer recommendations for Uva, Importance and management of shade in tea” and Identification of new tea cultivars.

Among the different programmes conducted for RPC sector, seminar on ‘Replanting for the company and estate executives and field officers of the Madulsima Plantations (Uva)’ in January and field day for all the estate executives and field staff of Balangoda Plantations (Uva) on ‘Shear harvesting were very effective as it was refreshing their knowledge just before to use it.’ Also a one day programme was organized for the estate executives and field officers of Malwatte Valley (Range 1) estates on harvesting. Two programmes on recommended practices of harvesting, pruning and management of soil fertility were conducted by the centre for junior executives and field officers of Hapugastenne Plantations (Haliela Region), on their request. A method demonstration was held for the executives and field staff of Agarapatne Plantations (Uva), on “Management of SHB using Lime and sulphur.” Another programme was conducted by the centre for the estate executives and field staff of Namunukula Plantations on “Mixing of straight fertilizers.”

Two one day training programs were held at the Centre on “Deferent agricultural practices in tea plantation management” for the students of Tea Technology and Value Addition Course and Export Agriculture course at Faculty of Export Agriculture in Uva Wellassa University. Also a special awareness program was held on Sri Lankan Tea Industry with special emphasis to Uva for a group of post graduate students of University of Tokyo, Japan at TRI Uva Centre. Two adaptive trials of ‘5000 series’ cultivars were started in two smallholdings in Welimada and Kandegedara of Badulla district. Summary of advisory and extension activities in the year is given as follows.

Advisory visits made to estates and smallholdings in Uva	-	40
Advisory letters issued	-	163
Seminars/ Field days/ Training programs	-	18
Regional seminars held in the area	-	02
Meetings/ Seminars attended	-	34
Soil samples tested for pH	-	1174
Soil samples tested for organic carbon content	-	687
VP cuttings issued	-	311200
VP plants sold	-	4150
No. of publications sold	-	73
Commercial nursery inspections	-	38
Exhibitions	-	1
Field Trials		

Following field trials were continued at the centre with the supervision of relevant divisions of the head office

- UVP 9 & UVP 10 PPPB trials are in progress in field no. 4
- Up keeping of 5000 series phase III trial in field no. 2
- Up keeping of Germplasam in field no. 3
- Two seedlings trials in field no. 3 & 4 are in progress.
- Up keeping of Grafted plant block in field no. 4 & 2
- Evaluation trial of ‘5000 series’ cultivars on their tolerance to nematodes (Nematology Division)
- Two trials on Bio Fertilizer (Agronomy Div.) at field no. 2
- PPPB phase I trial commenced in F /No.02

### **ADB mother bush project**

Out of the (target) 400,000 cuttings. it was able to issue 311,200 cuttings from the Mother Bush site at the centre.

### **Special Events/ meetings**

The officer-in-Charge and the Staff of the Centre successfully coordinated and actively participated for the TRI stall at the “Deyata Kirula” National Exhibition held at Ampara from 23.03.2013 to 30.03.2013

Mr. KRWB Kahandawa continued to serve as a technical committee member, representing the institute in the project, “Land Degradation Assessment and Monitoring for Sustainable Land Management and Climate change Adaptation in South Asia” and participated to two local and regional workshops held at Kandy and Kalutara .

Extension Officer/ OIC, Mr. KRWB Kahandawa participated to the short course on “Sampling Techniques, Survey Design and Analysis” held at PGIA Kandy on 4<sup>th</sup> to 6<sup>th</sup> September 2013.

Mr. KRWB Kahandawa, Extension Officer/OIC participated in a study tour in India on Sustainable Tea Production and Management System for Small Tea Growers, from 23<sup>rd</sup> October to 1<sup>st</sup> November 2013, which was funded by SPEnD project under the Ministry of Plantation Industries. The programme was organized by the Indian Institute of Plantation Management, Bangalore.

Research studies were started on unusual dying of middle aged *Gravillea* shade trees in tea plantations of some AER s in Uva province.

### **Visitors/ Trainees**

Details of vistors to the centre is as follows

Foreign	-	26
Planters	-	95
Smallholders	-	167
Students	-	10
Undergraduates	-	69
Others	-	282
TRI officers	-	180
Total	-	829

Mr. S Ramesh, a student of faculty of export agriculture of Uva Wellassa University completed his final year research project and Ms. N N Yakupitiya, a trainee from Hardy National Technical College Completed her six-month in plant training at the centre under the supervision of Mr. K.R.W.B. Kahandawa

### **Infrastructure development and maintenance**

- Construction work of the drinking water supply system for the station was started
- Construction work of the Soil Conservation Demonstration Block was started with the funds of Land degradation assessment and adaptation to the climatic change project of Food and Agriculture Organization.
- Color washing and necessary repairing work of the guest house were carried out.



## Crop

Month	Green Leaf (kg)	Price (Rs.)	Amount (Rs.)
January	2284	54.17	123724.28
February	2328	51.91	120846.48
March	4642	52.25	242544.50
April	5244	51.65	270852.60
May	5151	57.88	298139.88
June	4218	55.87	235659.66
July	3564	51.15	182298.60
August	3501	51.65	180826.65
September	3638	54.49	198234.62
October	3330	60.23	200565.90
November	3763	65.88	247906.44
December	3495	65.00*	227175.00*
Total	45158		2528774.61*

\* Approximate amount

Highest annual crop in last 15 years was achieved at the centre.

## Income

Highest ever income was achieved at the center

Sale of Green leaf (45158 kg)	Rs. 2528774.61 *
Sale of VP cuttings	Rs. 248960.00
Sale of VP plants	Rs. 74700.00
Soil analytical charges	Rs. 286695.00
Sale of publications	Rs. 38635.00
Guest house accommodation charges	Rs. 14950.00
Sale of firewood	Rs. 17850.00
Other	Rs. 3204.00
Total income	Rs. 3213768.61 *

\* Approximate amount

## Galle Extension Centre

K G J P Mahindapala

B Sc Agric. (Peradeniya, Sri Lanka), M Sc (Peradeniya, Sri Lanka)

PG. Dip. (Applied Statistics)

Office-in-Charge

### General

The TRI, Galle Extension Centre is equipped with a small scale laboratory for soil pH analysis and a total extent of 33.92 hectares for carrying out regional level field trials. The land use pattern of the centre in hectares is as follows:

Land use	Extent (ha)
Mature tea in plucking	7.50
Young tea	0.41
New Clearing (VP & Seedling)	0.26
ADB Mother Bushes	2.01
TRI 5000 series mother bushes	0.05
Nursery (tea)	0.50
Abandon (replanting/ new planting)	1.30
Land preparation for planting in 2014	0.60
Under rehabilitation (Mana & Guatemala)	1.60
<i>Giliricidia</i> (Energy crop)	0.40
<i>Bamboo</i> (Energy crop)	0.18
Seed garden	0.33
Grass Planted area (for planting materials)	0.50
Coconut, fruit trees and <i>etc.</i>	1.50
Utilized marshy land	0.40
Un utilized marshy land	0.62
Forestry	5.56
Thatch bank	1.30
Buildings, gardens, roads, weather station <i>etc.</i>	8.90

Similar to other regional stations, TRI Kottawa centre is dedicated for transfer of technologies, distribution of planting materials and monitoring of regional level field trials and adaptive trials.

This station carried out a number of field investigations in corporate and proprietary estates as well as in some smallholdings in Galle district and Akuressa region and gave recommendations with comprehensive reports. It is worthy to note that most of the field problems reported in 2013 was associated with labour problems and bush debilitation due to Low country Live Wood termite, Shot hole Borer, and adverse climatic conditions. Hence, the scheduled programs such as Regional Technical and Extension Forums (RTEF) and Regional Scientific Committee (RSC) seminar were targeted to discuss those issues.

In addition to scheduled programs, Advisory Officer involved in Plant certification process in order to improve the quality of plants in this year too by inspecting commercial nurseries. Training of stakeholder is a mandatory requirement of the technology transfer process. This station executed a number of training programs in the form of field days, workshops, demonstrations and seminars *etc* for tea growers, trainers and workers to develop their skills and improve the knowledge on new and existing technologies.

### **Advisory and extension activities**

Advisory correspondences: 432

#### **Advisory Visits**

Advisory visits	: 55
Extension visit	: 47
Commercial nursery inspections	: 53

#### **Training programs:**

General training program	: 43
RSC for the corporate sector	: 1
RTEF for TSHDA	: 2
Video programs shown	: 12 video sessions

The TRI staff involved in training of two creepers and two field officer trainees. In addition, 325 priced publications/ extension materials carrying the information on tea cultivation were distributed. Also 131 soil samples were tested for pH and necessary recommendations were given to ameliorate soil acidity.

### **Exhibition**

Advisory Officer actively participated in the “Crop Clinic” held at Henetenna Tea Factory for smallholders, organized by the TRI Matugama centre.

### **Meetings**

Advisory Officer attended 50 meetings of the TRI on policy matters and monitoring and management of extension activities.

### **Adaptive Trials**

This station continued to establish adaptive trials in collaboration with respective research divisions in farmer’s fields in different agro ecological regions to assess the performance of proven technologies under grower’s perspectives and periodically monitored them.

Under this scheme, 4 trials on ‘TRI 5000’ series cultivar were established in Smallholders fields at the TI regions of Mawanana, Kottawa, Ethkandura and Wanduramba.

### **Research trials**

Following trials have been carried out by the respective research divisions in collaboration with the Galle extension centre.

### **Plant Breeding Division**

- TRI 5000 series : LVP phase III trial at field no 3 was terminated and based on the performance, four plots comprising most promising cultivar have been identified for mother bushes and experimental planting.
- Low Country Live Wood Termite resistance testing: LVP phase II trial at field no 3 was terminated.

### **Entomology and Nematology Division**

- Nematode population monitoring trial at field no 4 is in progress.
- Assessment of effectiveness of wound dressing on pruning cuts in relation to wood rot is in progress.

### **Agronomy Division**

- *Bio film-Bio fertilizer* trial at field no 2 was terminated in July, 2013
- Evaluation of performance of different grass varieties for the purpose of soil rehabilitation in tea was completed and tea plants were planted for validating the results obtained.

### **ADB mother bush project**

Distribution of newly improved planting materials is one of the major services of the centre offered to the growers in this region. About 349,120 cuttings belong to the improved cultivars were issued from 2.01 ha mother bush area, which is 11% less than that issued in the last year.

Moreover, 66,330 nursery plants were propagated and 42,646 VP plants were sold. A total of 622 personnel visited the extension centre and the details are as follows.

<b>Category</b>	<b>Number</b>
Smallholders	516
Corporate and proprietary estate sectors	52
Extension workers	54
<b>Total</b>	<b>622</b>

### **Infrastructure development and maintenance**

The balance work of repairing of C 3 bungalow was completed. The office expansion and renovation work was commenced. In addition, following field development activities were carried out.

- Tea plants were planted in few small blocks in field no 1, 2 and 6 (0.26 ha) including 500 directly planted seeds collected from polyclonal seed garden at Kiriporuwa estate.
- 207 plants belong to TRI 2043 were infilled.
- A census of timber trees were taken and the inventory was prepared.

## **Special events**

### **Out-grower nursery**

A nursery was established under the out-grower model, initially as a pilot project to propagate 30,000 plants. In this project, all the materials required were given to selected three workers and encouraged them to produce the standard plants with the technical support of the TRI staff. The project was very successful and 45% of the plants were sold for tea growers and balance was carried forward to the next year. The out-growers too were happy about the project and requested to continue the project.

### **Assisting the ‘B-Leaf 60’ program of the Sri Lanka Tea Board (SLTB)**

TRI has given the fullest cooperation for ‘B-Leaf 60’ program of the SLTB, especially in the awareness programs and monitoring activities. In the monitoring programs, leaf collecting centers, transport channels and tea factories in Neluwa and Yakkalamulla areas were inspected at night with the SLTB officers and necessary instructions were given to minimize the leaf damage.

### **Activities under the Corporate Plan 2013-2017**

#### **Establishment of energy crop-Bamboo (0.1 ha)**

Objective of this project is to see the possibilities of using the bamboo as fuel wood for energy requirement in tea processing. Planting of 4 different Bamboo varieties was completed in two sections of marshy lands of approximately 0.18 ha. These marshy lands were prepared for cultivation activity by cutting deep drains at 15 feet intervals.

#### **Establishment of grasses as planting material (0.2 ha)**

The purpose of this activity is to provide planting material required for soil rehabilitation before replanting. Planting of *Mana* and *PGN* grasses were completed in 3 blocks of field nos. 2, 6 & 7 in an area of 0.5 ha.

### **Tea Techno Park**

Objective of this task is to demonstrate recommended and good agricultural practices to the visiting tea growers. The field preparation work related to plucking, pruning, high shade, irrigation, land preparation for planting, trench planting, value added production area and direct tea seed planting block were completed. Other works related to planting of different stage of tea, soil conservation methods, cover crops, rehabilitation area, composting methods, seed planted area and foot paths were partially completed.

### **Planting of ‘TRI 5000’ series mother bush**

The TRI is in the process of releasing new cultivars (TRI 5000 series) in years to come. Hence, the objective of this project is to provide adequate number of planting materials once the ‘TRI 5000’ series is released. The establishment of nursery plants for 1.5 ac completed and land preparation work was completed to plant them during the next rainy season.

In addition to the above, TRI staff at Kottawa attended to the following activities.

- Officer-in-Charge attended the AGM of Planters Association.
- Officer-in-Charge has been working as the Editor of “Tea Thathu” newsletter and Vol. 9, No. 1 & 2 were released.
- Officer-in-Charge attended to a two days short course on ‘Data analysis using R and R Studio Software’ conducted by the PGIS, University of Peradeniya and two days workshop on “Human Resource Development through Proper Disciplinary Management” conducted by the Centre for Studies in Disciplinary Management.
- Ms. P V D Chandrakanthi attended to a workshop on “Team building” conducted by the Skill Development Fund.

### Crop

Monthly harvested tea crop, price offered by the factory for the green leaf supplied and monthly income are as follows:

Month	Green leaf (kg)	Price (Rs.)	Amount (Rs.)
January	2842	64.000	181,888.00
February	2643	64.818	171,313.97
March	3573	69.137	247,026.50
April	3413	68.287	233,039.49
May	3452	70.000	241,640.00
June	3010	70.000	210,700.00
July	3445	70.000	241,150.00
August	3404	70.000	238,280.00
September	2616	75.000	196,200.00
October	4844	85.000	411,740.00
November	3672	81.500	299,268.00
December	4984	*81.500	*406,196.00
<b>Total</b>	<b>41898</b>	<b>-</b>	<b>3,078,431.87</b>
			<b>(* Provisional)</b>

Activity	Income (Rs.)
Sale of green leaf	3,078,431.87
Sale of VP cuttings	235,520.00
Sale of VP plants	789,378.00
Analytical charges for soil pH	11,305.00
Sale of publications	31,740.00
Guest house accommodation charges	12,800.00
Other	12,000.00
<b>Total income</b>	<b>4,171,174.87</b>

Note: Total of 19 inventorized timber trees which have been identified as dangerous to residents were removed and given to the State Timber Corporation on the recommendation of Divisional Secretary Galle.

## Deniyaya Extension Centre

S P Rathnayake

B Sc Agric. (Ruhuna, Sri Lanka), MBA (Whut, China)

Officer- in -Charge

### General

The TRI Deniyaya Extension Centre, Deniyaya is primarily an Advisory and Extension Centre equipped with a small scale laboratory for soil pH and Nematodes analysis on a total of 5.00 acres in the extent. The land use pattern of the Centre in is as follows:

Land Use	Extent (ha)
New clearings (bearing)	0.3
New clearings	0.2
Under Rehabilitation ( <i>Mana</i> )	2.2
Buildings, gardens, roads	2.3

The Extension Centre in consultation with the Heads of Divisions at Head office, carried out a number of field investigations in the Low grown plantations situated in Matara and Hambantota districts and rendered its services by conducting advisory visits, training programmes in the form of field days, workshops and seminars *etc* for both corporate and smallholder sector stakeholders. Many training programmes in the form of field days, workshops and seminars were successfully held in and outside of Deniyaya, TRI on tea nursery, soil & shade management, bush debilitation in Deniyaya region (Management of Pest & Diseases) & the way forward, tea productivity improvement through good agricultural practices (GAPs) and awareness on weather station & meteorological data collection. The other scheduled programmes such as Regional Technical and Extension Forums (RTEF) were held at the Deniyaya extension centre for the smallholder sector with the participation of TRI and TSHDA, and the members of Tea Development Societies while a Regional Scientific Committee (RSC) seminar was jointly organized by Deniyaya and Kottawa centers for the corporate sector stakeholders in the Matara and Galle districts. Outcome of the adaptive fertilizer trials, Irrigation for tea, Management of bush debilitation in Deniyaya region, Tea & Environment, Management of Shot Hole Borer & Low Country Live wood tea termite, Proper selection of planting materials and tea manufacture in Low country were the subject areas deliberated in these programs. In addition to the scheduled programmes, staff of the Deniyaya extension centre in consultation with the Head, Advisory and Extension Division, involved in delivering lectures on postharvesting damage & rush crop management of tea under the 'B Leaf-60' project of the Sri Lanka Tea Board.

### Staff movements

Mr. S P A P K Jayarathne, Extension Officer, assumed duties at Deniyaya center with effect from 11<sup>th</sup> November 2013.



## Advisory and Extension activities

No	Item	Number
1	Visitors (from estate/ Students/ Foreigners/ Smallholders/ Others)	1088
2	All correspondence (Advisory, Extension & Administrative)	457
3	Advisory visits to Corporate sector & Small holding sector	92
4	Training programs/ Seminars/ Group discussions / Field days/ Demonstrations/ Educational/ Familiarizations & Meetings	76
5	Issue of Publications / Leaflets/ Pamphlets	1417
6	Soil samples tested for pH	532
7	Soil samples tested for C%	-
8	Soil samples tested for Nematodes	404
9	VP cuttings sold	-
10	Green leaf sold	903 kgs
11	Commercial nursery inspection	73
12	Exhibitions	-
13	Visits/ Involvements in experiments (Research & Adaptive Trials)	07
14	VP plants issued	-

## Extension and Experimental forum

Mr S P Rathnayake, Advisory Officer attached to the Advisory and Extension Division, in his capacity as the Coordinator of the above forum, organized the forum bi-annually with the participation of TRI, TSHDA, SLTB, SLTFOA and the officials of tea development society members. “Tea and environment,” Use of organic manure in tea fields & composting, “Current scenario of the world tea trade & its impact on local tea industry & the way forward, Selection of proper planting materials for higher productivity, Management of Shot Hole Borer & Low country Live wood tea termite” were discussed in these forums. During the open forum followed presentations, the possibility of productivity improvement in tea lands, and importance of imposing the Seed Act (quality nursery tea plants) were highlighted.

## Project on mechanization of tea harvesting in tea smallholdings sector

The project objectives are as follows.

- 1) Popularization of mechanical devices for tea harvesting and pruning in the smallholding sector to increase labour productivity ensuring industry sustainability
- 2) Training of smallholders on the proper use of mechanical devices
- 3) To attract and retain youth in the tea industry
- 4) Design, test and fabricate a light weight and user friendly motorized harvesting machine suitable for tea smallholders

### **Implementation arrangements**

The project will be jointly implemented by the Tea Research Institute and the Tea Smallholdings Development Authority in collaboration with the Sri Lanka Tea Board, Smallholder's Federation and Factory Owners Association under the guidance of the Ministry of Plantation Industries.

### **Activities identified**

- 1) Initial awareness programmes
- 2) "Training of Trainers" programmes (TOT)
- 3) Regional skill development programmes for smallholders
- 4) Follow-up training/observations
- 5) Procurement of equipments (Selective tea harvesters & Plucking Baskets, Plucking machines, Pruning machines, Holing machines and Safety clothes)
- 6) Supply of equipments to the end users
- 7) Development and testing of new harvesting machines

Mr S P Rathnayake, Advisory Officer attached to Advisory and Extension Division, in his capacity as the Coordinator of the above project, successfully organized the initial awareness programmes in October 2013 covering Matara, Galle, Ratnapura, Kalutara, Kegalle, Kandy, Nuwara Eliya and Uva with the participation of TRI, TSHDA, SLTB, SLTFOA and the Tea Development Society members. Presentations were made on the project, objectives and implementation arrangements in the smallholder sector, selection of trainees, the package of items (machinery) to be distributed among the societies, plucking and pruning policies (manual & machine) by Mr. S P Rathnayake (TRI), Mr. C J I T Fernando (TSHDA) and Dr. M A Wijeratne (TRI) respectively. Five Training of Trainer (TOTs) programmes (field sessions on mechanical pruning, plucking & holing) were completed successfully at the Low country Regional Centre, Ratnapura (two-day residential programme with 30 participants in one group) for the selected trainees by Dr. M A Wijeratne and the staff of Advisory & Extension and Agronomy Divisions of the TRI Low country station.

### **Adaptive trials**

Two adaptive trials on '5000 series cultivars' were established in smallholder lands in Morawaka and Akuressa of Matara district in collaboration with the Plant Breeding Division and TSHDA. One observation trial on new cultivars (5000 series) was also established at Deniyaya, TRI in collaboration with the Plant Breeding Division. One adaptive trial on Site Specific Fertilizer Recommendations (SSFR) was established at Batuwangala estate in collaboration with the Soils & Plant Nutrition Division.

### **Research trials**

Following trials were carried out in the region in collaboration with the respective Research Divisions.

- i) '5000 series': LVP phase iii trials at Indola, Kiruwanagaga and Deniyaya estates (Plant Breeding Div).
- ii) Improved seedling trial at Warapitiya smallholder's field (Plant Breeding Div.)
- iii) Fertilizer trial at Kuruduwatta proprietary estate, Kotapola (SPND)
- iv) '5000 series' monitoring trial at Deniyaya, TRI (Entomology and Nematology Division.)

### **Training opportunities**

One university student from Ruhuna University completed a short term research project under the supervision of Mr. S P Rathnayake.

### **Infrastructure developments and maintenance**

Concreting of the internal roads has been completed and the construction of the new C type quarters was initiated. Also the routine maintenance and repairs of staff quarters, office and other buildings, cleaning and maintenance of layout and repairs and services of Institute's vehicle were satisfactorily attended.

### **Income**

Total income of the centre and its breakdown is as follows:

<b>Activity</b>	<b>Income (Rs.)</b>
Sale of green leaf	73928.00
Sale of publications	878500.00
Testing soil samples for pH	45505.00
Miscellaneous	61015.84
<b>Total</b>	<b>188949.71</b>

## **Kalutara Extension Centre**

H Jayaweera  
Officer-in-Charge

### **General**

The TRI Kalutara Extension Centre, Niwithigalakelle, Matugama is located in the premises of the Rubber Research Institute and is primarily an extension centre equipped with a smallscale laboratory for soil pH analysis.

The Extension centre in consultation with the Heads of Divisions at Head Office, Tea Research Institute Talawakelle, carried out large number of field, and factory investigations in plantations situated in Kalutara, Gampaha and Colombo districts. Extension centre rendered its services by conducting advisory visits, and training programs in the form of field days, workshops and seminars *etc.* for both corporate and small holder sector stakeholders.

The scheduled programs such as Regional Technical and Extension Forums (RTEF) were held at the Kalutara Extension centre for the smallholders with the participation of TRI, TSHDA, SLTB officials and the members of Tea Development Societies while a Regional Scientific Committee (RSC) seminar was organized for the corporate sector stakeholders in the Kalutara district in collaboration with the TRI Low country Regional Centre, Ratnapura. The Extension centre organized a ‘Crop Clinic’ in Delmella with collaboration of Sri Lanka Tea Board and Tea Small Holdings Development Authority. District Secretary Kalutara District, Chairman Tea Research Board, Private Secretary to the Minister of Plantation Industries, Staff of Tea Research Institute, Assistant Tea Commissioner of Sri Lanka Tea Board and Assistant Regional Manager of Tea Small Holdings Development Authority and more than 350 stakeholders participated in the program. The Officer-in-Charge attended district Agriculture Committee and District Development Committee meeting of Kalutara representing the TRI.

### **Staff movements**

Mrs. T L Samaraweera, Public Relation Officer resigned from the Extension centre with effect from 10<sup>th</sup> January. Mr. H. Jayaweera, was promoted as the Officer-in-Charge of the Extension centre with the effect from 15<sup>th</sup> October 2013. Mr. A Abeysooriya assumed duties as an Extension Officer with effect from 11<sup>th</sup> November 2013.

### **Advisory and Extension Activities**

<b>Activity</b>	<b>No. of programmes</b>	
Training programs	RPC	09
	Smallholders	29
Advisory visits	RPC	19
	Smallholders	65
Exhibition	RPC	01
	Smallholders	01
Visitors	RPC	30
	Smallholders	101
Seminars	RPC	02
	Smallholders	02
Crop Clinic	RPC	01
	Smallholders	01
Nursery inspections	RPC	02
	Smallholders	12
pH testing	RPC	20
	Smallholders	51

### **Adaptive trials and new initiatives**

Adaptive trials were commenced in three small holder properties in the Kalutara district on ‘TRI 5000 series’ in collaboration with the Plant Breeding Division. Establishment of demonstration plot with new tea cultivars was completed with the help of Plant Breeding Division, TRI Low country station, Ratnapura.

### **Infrastructure developments and maintenance**

The routine maintenance and repairs of laboratory, office and lecture hall, cleaning and maintenance of layout and repairs and services of the office vehicle were satisfactorily attended.

### Visitors and training opportunities

Number of visitors to the center was 131 and given below are the details.

RPC	-	16
Smallholders	-	107
University/ Diploma students and others	-	8

Two students from NAITA completed in-plant training under the supervision of Mr. H Jayaweera.

### Income

Total income of the centre and its breakdown is as follows:

Activity	Income (Rs.)
Sale of Publications	13,530.00
Testing Soil Samples for pH	6,745.00
<b>Total</b>	<b>20,275.00</b>

## **AWARDS, GRANTS, STUDY PROGRAMS, PUBLICATIONS AND SPECIAL PRESENTATIONS**

### **Agronomy Division**

#### **Awards/ grants**

Mrs. T L Wijeratne received a ‘merit award’ for the presentation made on “Carbon sequestration in tea plantations” at the National Science and Technology Commission (NASTEC), Colombo in January 2013.

#### **Study programmes**

Dr. N P S N Bandara attended a three days workshop on “Climate Predictions” at the Department of Meteorology, Colombo.

Ms. S Nawarathne, Ms. N Damayanthi and Mr. A Jayasekara participated in the workshop on “Presenting your research works at a scientific forum” on 27<sup>th</sup> June, 2013 at the Faculty of Agriculture, University of Peradeniya.

Dr. M S D L De Silva participated in a workshop on “Environmental impact of potentially toxic heavy metals in soils” on 5<sup>th</sup> September, 2013 at the PGIA, University of Peradeniya.

Ms. S Nawarathne participated in the workshop on ‘Safety in chemical and microbial laboratories’ on 26-27<sup>th</sup> September, 2013 at the ITI, Colombo.

Ms. V Sidakaran participated in the short course on ‘Survey design and analysis’ at the PGIA, University of Peradeniya held during 4-6<sup>th</sup> September 2013.

### **Biochemistry Division**

#### **Awards/ grants**

Dr. KM Mewan was awarded the membership of the Institute of Biology of Sri Lanka.



## **Study programmes**

Mr. GAAR Perera attended a workshop titled ‘Presenting your research work at a scientific forum’ at the Faculty of Agriculture, University of Peradeniya organized by the Young Scientist Forum, National Science and Technology Commission (NASTEC) on 27<sup>th</sup> June 2013.

Mr. GAAR Perera participated in a seminar on ‘Valid analytical measurements and consumer protection’ organized by the Sri Lanka Association of Testing Laboratories’ on 24<sup>th</sup> July 2013.

Dr. KM Mewan attended one day workshop organized by Skilled Development Fund Limited on ‘Exceptional Leadership and Authentic Image Management’ on 15<sup>th</sup> Aug 2013 at Water’s Edge, Battaramulla.

Mr. ENU Edirisinghe participated in two day training seminar on ‘Safety in chemical and microbial laboratories’ at ITI, Colombo on 26<sup>th</sup>-27<sup>th</sup> September 2013.

Dr. KM Mewan participated in the 33<sup>rd</sup> Annual Session of the Institute of Biology of Sri Lanka on 27<sup>th</sup> September 2013 at SLIDA, Colombo.

Dr. KM Mewan participated in a seminar on “Benefits of plant variety protection systems in line with the UPOV convention” on 25<sup>th</sup>-26<sup>th</sup> Nov 2013, at PGRC, Gannoruwa.

## **Entomology and Nematology Division**

### **Awards/ Grants**

Dr K Mohotti was awarded the Fellow category at the Institute of Biology Sri Lanka and served as the President of the Institute of Biology of Sri Lanka.

Mrs. P G D S Amarasena received the membership of the Institute of Biology of Sri Lanka.

## **Study Programmes**

Ms. P D Senanayake, Research Officer, Entomology and Nematology Division underwent training on “Integrated Pest Management” sponsored by the MASHAV at the Agriculture Research Organization (ARO), Israel during 21<sup>st</sup> April - 13<sup>th</sup> May 2013. In addition, she was exposed to laboratory training on ‘Molecular characterization of symbiotic fungi isolated from tea shot hole borer’ at the Pathology Division in ARO during 14<sup>th</sup> May 2013-15<sup>th</sup> July 2013.

## **Plant Breeding Division**

Mr. M A B Ranatunga was appointed as a member of the National Committee on Plant Breeding and National Committee on Agricultural Biotechnology of CARP.

## **Study programmes**

Mr. M A B Ranatunga and Mr. R Paskarathevan continued their postgraduate degrees.

Mr. J D Kottawa-Arachchi attended two months training program on “Tea Plantation Management” under Colombo Plan Aid Scholarship conducted by Kothari Agricultural Management Training Institute, Tamil Nadu, India.

Mr. J H N Piyasundara and Mr. A K Mudalige participated in the 4<sup>th</sup> International symposium of Sabaragamuwa University of Sri Lanka, Belihuloya in January.

Mr. M A B Ranatunga participated in a workshop on “The benefit of plant variety protection systems in line with the UPOV convention” at the PGRC, Kandy in November 2013.

Mr. M A B Ranatunga and Mr. J H N Piyasundara attended a workshop on “Data Analysis using R and R studio” at the PGIS, Peradeniya.

## **Agricultural Economics Division**

## **Study programmes**

Dr. H W Shyamalie attended Stakeholders’ workshop on ‘Economics survey-2013’ held on 13<sup>th</sup> March 2013 at the Department of Census & Statistics.

Dr. H W Shyamalie attended the workshop on the ‘National Survey on Science, Technology and Innovation initiatives and Research and Development in Sri Lanka-Phase I’ of a National R & D system Development organized by Coordinating Secretariat for Science and Technology on 01<sup>st</sup> August 2013 at the BMICH.

Mrs. N Nadeeshani completed the advanced certificate programme in ‘Tea Tasting and Quality Assurance’ in Kothari Agricultural Management Centre (KAMC), India.

Dr. H W Shyamalie attended the workshop on the ‘National Survey on Science,’ NASTEC on 20<sup>th</sup> December 2013.

## **Soils and Plant Nutrition Division**

### **Study programmes**

Dr. G P Gunaratne participated in the workshop on “Environmental impact of potentially toxic heavy metals in soils” at the PGIA, University of Peradeniya on 5<sup>th</sup> September 2013.

## **Information Technology Unit**

### **Study programme**

Mr. U D Alagiyawadu, Experimental Officer commenced a four month certificate course on Web application development at the National Institute of Business Management, Colombo.

## **Advisory & Extension Division**

### **Publications**

Sidhakaran V S (2010), Clientele satisfaction towards TRI extension services rendered to the corporate tea sector, S. L. J. TEA SCI. Vol 75 (2): 46 – 61.

Samansiri, B A D Rajasinghe, J C K and Hiromi Nishanthi (2010), Forecasting productivity of VP tea under varying rates of replanting in the corporate sector in Sri Lanka, S.L.J.TEA SCI, Vol 75 (2): 30 - 45.

Rajasinghe J C K and Samansiri, B A D (2010), Assessment of levels of adoption of some important cultural practices recommended to the corporate sector estate by the Tea Research Institute of Sri Lanka, S.L.J.TEA SCI. Vol 75 (2): 11 - 29.

Samansiri B A D and Wanigasundera, W A D P Use of Information and Communication Technology (ICT) by the Extension Officers of Tea Small Holdings Development Authority of Sri Lanka

Mahindapala K G J P (2012) Contributory Factors of Cost of Production in Tea Smallholding Sector of Matara District, Tea Bul. Vol. 21 No 2, Tea Research Institute of Sri Lanka

### **Special presentations**

Mr. B A D Samansiri made a presentation at the 25<sup>th</sup> PGIA Congress on the Use of Information and Communication Technology (ICT) by the Extension Officers of Tea Small Holdings Development Authority of Sri Lanka held on 21<sup>st</sup> November 2013.

Dr. V S Sidhakaran made a presentation on “Rational use of fertilizers in tea” at the Dickoya region RSC workshop at Darawala Planters Club on 27<sup>th</sup> June 2013

Dr. V S Sidhakaran made a presentation on “Management of the important tea diseases in the Low country region” at the Ratnapura region RSC seminar on 18<sup>th</sup> December 2013.

Dr. V S Sidhakaran made a presentation on “Rush crop management” at the Superintendents meeting of Watawala Plantations (Hatton Region) at Carolina estate on 30<sup>th</sup> October 2013

Dr. V S Sidhakaran participated at the workshop on “Indigenous agricultural knowledge” organized by the NSF Colombo on 27<sup>th</sup> August 2013

Mr. Saman Ratnayake delivered a lecture on Current scenario of world tea trade & way forward for Sri Lankan Tea Industry and Tea nursery management for final year crop science students of Agriculture Faculty, University of Ruhuna, Mapalana.

Mr. Saman Ratnayake conducted lectures and practical sessions on ‘Tea Nursery Management, Pest & Diseases Management and Weed Management for Quality Tea Production’ for the certificate course students attached to Agriculture Faculty, University of Ruhuna, Mapalana.

Mr. Saman Ratnayake made a presentation on the proposed development plan for the Mawarala Tea Shakthi fields at the Tea Shakthi Board meeting.

## **Agricultural Economics Division**

### **Publication**

Subasinghe S A M S, Shyamalie H W Abeynayake N R and Wellala N N K (2013). Productivity variation among Tea smallholders in uva region. Proceedings of the 12<sup>th</sup> Agricultural Research Symposium, 337-341, Wayaba University of Sri Lanka.

Shyamalie H W (2012). Economic analysis of Sri Lankan Tea Industry. Tea Bull. 21 (1). 1-12.

### **Special presentations**

Dr. H W Shyamalie delivered a lecture on “Economics of Tea Industry” for the officers of Department of Commerce on 23<sup>rd</sup> January 2013 and 8<sup>th</sup> August 2013 at the Board Room of the Tea Research Institute.

Dr. H.W. Shyamalie presented content of the proposal submitted to the Plantation Association on “Implementation of Out grower system in tea plantations” on 4<sup>th</sup> March 2013 at the auditorium of Ministry of Plantation Industries.

Dr. H W Shyamalie made a presentation on “Alternative viable worker deployment models” at the stakeholder forum held in Colombo on 29<sup>th</sup> May 2013 and at the 227<sup>th</sup> E & E forum (Corporate Sector) held on 29<sup>th</sup> July 2013 at the Tea Research Institute, Talawakelle.

Dr. H W Shyamalie delivered a lecturer on “Measures to improve worker productivity at the workshop” organized by Talawakelle Tea Estates PLC & Kelani Valley Plantations PLC held on 23<sup>rd</sup> July 2013 at the Tea Research Institute, Talawakelle.

Dr. H W Shyamalie presented a paper on ‘Economic feasibility of energy plantations in the corporate tea sector’ at 63<sup>rd</sup> Consultative Committee on Research meeting held on 16<sup>th</sup> August 2013 at the Sri Lanka Tea Board.

Dr. H.W.Shyamalie made a presentation on “Determination of ‘Economic value of tea plantation’ at the RETF held on 31<sup>st</sup> October 2013 at the auditorium of Regional center, Kottawa.

Dr. H W Shyamalie delivered a lecture on “Cost of tea cultivation & labour economics” for planter trainees, Induction Course, National Institute of Plantation Management on 16<sup>th</sup> & 26<sup>th</sup> November 2013 at the Tea Research Institute, Talawakelle.

Dr. H W Shyamalie made a presentation on “Economic importance of replanting” at the RETF held on 17<sup>th</sup> December 2013 at the TRI Mid country Regional Center, Kandy.

## **Agronomy Division**

### **Publications**

Damayanthi M M N A J Mohotti and Nissanka, S.P. (2012). Physiological and biochemical parameters that can be used in screening tea cultivars for drought, Proceedings of the Young Scientists Forum Symposium, 18<sup>th</sup> January 12.

Damayanthi, M M N Mohotti, A. J. and Nissanka, S P (2011). Physiological responses of nursery grown tea . A preliminary Study, S L. J of Tea Sci. Vol 76, Part 1 / 2, (Mar./Sep), pp 47-50, ISSN 1010-4208.

De Silva, M S D L, Jayasekara, A P D A Seneviratne G Prematunge, E W T P and Wijesekera, S.N (2013). soil fertility improvement through Bio filmed Bio fertilizers: Potential for field applications. Proc. of the 226<sup>th</sup> E & E forum, Tea Research Institute, Talawakelle.

Jayasekara A P D A and De Silva, M S D L (2012). Application of Bio filmed biofertilizer with T65 for tea nurseries: A new method, The Thatu, Tea Res. Inst., Talawakelle, Vol 9, **113** No. 2 December.

Jayasinghe S and Prematilake K G (2010). Evaluation of growth of grafted tea plants in sealed polythene propagator at nursery and performances of stock-scion combinations at the nursery and early stage in the field S L J. of Tea Sci., Vol 75 Part 2, 1-10

Prematilake K G (2013). Development of resistance in two weeds for Glyphosate herbicide, Crop Life , Sri Lanka Plant Protection Industry Journal, Vol 7, 102-104.

Prematilake K G, Bandara N P S N, Kahandawa K R W B, Mahindapala, K G J P, Rajasingha J C K, Munasinghe C E, Wijeseakara S N, Ratnayake S P and M A Wijeratne (*in press*). The impact of drought experienced in 2012 on tea plantations. TRI UPDATE, TRI, Talawakelle.

Wijeratne, T L., W A J M De Costa, F I. Woodward, M Lomas and M A Wijeratne (2013). Predicted impacts of climate change on the tea yields of different elevation zones of Sri Lanka during the 21<sup>st</sup> Century, Proceedings of the Young Scientists Forum symposium, 18<sup>th</sup> January, 55.

### **Special Presentations**

Dr. K G Prematilake made two presentations on “Agronomic practices to be undertaken in replanting of tea” for Managers, Assistant Managers and field officers of Madulsima Plantations at Batawatta estate, Passara on 4<sup>th</sup> Jan. and Kirkosward Estate, Bogawantalawa on 13<sup>th</sup> February 2013.

Dr. K G Prematilake delivered an introductory lecture on ‘Agronomic practices used in tea cultivation’ for the para extension training team of Kahawatte plantation on 20<sup>th</sup> February 2013.

Dr. K G Prematilake made a presentation on ‘problem weeds and their control’ and Dr N P S N Bandara made a presentation on ‘drought mitigation strategies’ for para extension officers of the Watawala Plantation at the TRI, Talawakelle on 27<sup>th</sup> February 2013.

Dr. K G Prematilake made a presentation on Ecological weed management practices at the RTEF of TSHDA at the training Center, Hali Ela on 13<sup>th</sup> June 2013.

Dr. K G Prematilake made a presentation on ‘integrated soil fertility management’ at the RSC meeting of Nuwara Eliya Region at Darawala Club on 28<sup>th</sup> June 2013.

Dr. K G Prematilake made a presentation on Pruning at the RTEF of Ratnapura and Kegalle regions at 4<sup>th</sup> April 2013.

Dr. M A Wijeratne made a presentation on ‘Harvesting of tea’ for Managers, Assistant Managers and field officers of Madulsima Plantations at Kirkosward estate, Bogawantalawa on 13<sup>th</sup> February 2013.

Dr. M A Wijeratne made a presentation on ‘Infilling of tea’ at the Stakeholder forum held at the HARTI , Colombo in 31<sup>st</sup> May 2013.

Dr. M A Wijeratne made a presentation on ‘Mechanization’ at the RTEF of Ratnapura and Kegalle regions at TRI Low country station, Ratnapura on 4<sup>th</sup> April 2013.

Dr. N P S N Bandara made three presentations on ‘Micro irrigation’ at three RTEFs held at Hantana, Deniyaya and Ratnapura and factory based Extension Officers at Ratnapura.

Dr. N P S N Bandara made a presentation on Micro irrigation for NIPM trainees at the TRI, Talawakelle on 27<sup>th</sup> September 2013.

Dr. K G Prematilake made a presentation on ‘Pruning of tea’ for the Regional Managers, Senior and Deputy Managers, Assit Managers of the Talawakelle and Keleni Velley Plantations on 23<sup>rd</sup> July 2013.

Dr. K G Prematilake delivered lectures on ‘Shade and Wind belts management and Weed management’ for NIPM trainees at TRI, Talawakelle on 27<sup>th</sup> September 2013.

Dr. K G Prematilake delivered lectures on ‘Weed Management in tea’ for newly recriuted batch of Tea Inspectors at the TSHDA Training Centre, Hantana on 20<sup>th</sup> July 2013.

Dr. K G Prematilake served as a visiting lecturer and delivered lecture series on ‘Weed Management in tea’ for the 2<sup>nd</sup> year students of the Uva Wellassa University on 21<sup>st</sup> July 2013.

Dr. M A Wijeratne made a presentation on ‘Increasing tea yields by consolidation of fields by infilling’ at the 227<sup>th</sup> E & E forum on 26<sup>th</sup> July 2013.

Dr. M A Wijeratne made a presentation on ‘Tea harvesting’ for the Managers and Assitant Managers of Talawakelle and Keleni Velley Plantations on 23<sup>rd</sup> July 2013 and for NIPM trainees at TRI, Talawakelle on 27<sup>th</sup> September 2013.

## **Biochemistry Division**

### **Publication**

Sandamali HPN, Karunarathne KHT, Mewan KM, Wickremasingha IP. (2013) Microsatellite based Estimation of Genomic Similarities of Cultivated Tea (*Camellia sinensis* L.) and Non-tea (*Camelliaspp.*) Types in the Genus *Camellia*. Accepted to publish in the Proceeding of the Undergraduate Research, Department of Agricultural Biology, University of Peradeniya.



Yongzhen Pang, I. Sarath B Abeysinghe, Ji He, Xianzhi He, David Huhman, K. Mudith Mewan, Lloyd W. Sumner, Jianfei Yun and Richard A Dixon. (2013) Functional characterization of proanthocyanidin pathway enzymes from tea (*Camellia sinensis*) and their application for metabolic engineering. (2013). Plant Physiology. 161:1103–1116.

NS Totawattage, Totawattage G H, Punyasiri P A N and Subodhini A M N (2012) Effect of degree of fermentation on phenolic profile of black tea. International Symposium on Agriculture and Environment: Student Session 2012. Faculty of Agriculture, University of Ruhuna, Sri Lanka. Pg 58-61.

Karunarathna, K H T, Mewan K M, Weerasena, O V D S J and Abeysinghe I S B. (2013). Microsatellite based approach towards identification of blister blight resistant and susceptible tea (*Camellia sinensis* L. O. Kuntze) cultivars. Sixth Annual Scientific Sessions, Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo, Sri Lanka. 15.

Karunarathna K H T, Mewan K M, Weerasena O V D S J, Punyasiri PAN Brasathe J and Abeysinghe ISB. (2013) Variation of biochemical composition between blister blight resistant and susceptible tea (*Camellia sinensis* L. O. Kuntze) cultivars. Proceedings of the 69<sup>th</sup> Annual Sessions, SLAAS, 2013, 5th Dec 2013. 165p.

Kulatunga D C M, Sinniah G D, Balasuriya A, Karunarathna K H T and Mewan K M. (2013) Use of ITS region for molecular differentiation of *exobasidium vexans* causing blister blight in tea. Proceedings of the International Symposium on Agriculture and Environment (ISAE2013), Faculty of Agriculture, University of Ruhuna, Sri Lanka. 28<sup>th</sup> Nov 2013. 271-274.

K. M. Mewan and I Sarath B. Abeysinghe (2013). Recent advances in molecular biological applications in Sri Lankan tea (*Camellia sinensis* L.) industry: An overview on the achievements during last ten years. Special Issue. Proceedings of 2013 International Symposium on Tea Science and Tea Culture. Journal of Tea, 39 (4), 267-278.

### **Special Presentations**

Mr. GAAR Perera conducted a lecture on ‘Principles of Tea Manufacture’ for the professional programme in Tea Manufacture and Factory Practices at the NIPM on 02 September, 2013.

Dr. KM Mewan made a presentation titled “Recent advances in molecular biological applications in Sri Lankan tea (*Camellia sinensis* L.) industry: An overview on the achievements during last ten years’ in the International Symposium on Tea Science and Tea Culture (2013ISTSTC), China, 28<sup>th</sup> – 30<sup>th</sup> Nov 2013.

## Plant Breeding Division

### Publication

Ranaweera K K, Gunasekare M T K and Eeswara J P (2013) *Ex vitro* rooting: A low cost micropropagation technique for Tea (*Camellia sinensis* (L.) O. Kuntze) hybrids. *Scientia Horticulture* 155; 8–14.

Kottawa-Arachchi J D, Gunasekare M T K, Ranatunga M A B, and Jayasinghe L 2013. Use of biochemical compounds in tea germplasm characterization and its implications in tea breeding in Sri Lanka. *Journal of National Science Foundation of Sri Lanka* 41(4): 309-318.

Piyasundara J H N, Mudalige A K, Gunasekare M T K, Ranathunga M A B and Kumara, J B D A P (2013) Assessment of yield components, nursery performances and morphological characterization of some newly improved Tea (*Camellia sinensis* (L.) O. Kuntze) Cultivars, *Proceedings of the 4th International symposium of Sabaragamuwa University of Sri Lanka*, 22.

Silva K W K I, Ranatunga M A B, Wickramasinghe I P and Gunasekare M T K 2013. Phenotypic diversity of exotic tea germplasm collection in Sri Lanka. , *Proceedings of the 4<sup>th</sup> International symposium of Sabaragamuwa University of Sri Lanka*, 26.

Malkanthi M G D, Ranaweera K K, Ranatunga M A B and Weerasinghe P A 2013 Standardizing a sterilization protocol for stem nodal culture and establishment of in vitro multiplication rates of new tea cultivars (*Camellia sinensis* (L.) O Kuntze) *Undergraduate Research Symposium, Faculty of Agriculture, Rajarata University of Sri Lanka*. 54.

Jeganathan B, Punyasiri P A N, Kottawa-Arachchi J D, Ranatunga M A B, Abeysinghe I S B, Gunasekare M T K and Bandara B M R (2013) Metabolomics of Sri Lankan Tea Germplasm: Quantitative Analysis of Catechins, Gallic acid and Caffeine. *Book of abstracts of the Peradeniya University Research Symposium -2012* (17). 178.

Punyasiri P A N, Jeganathan B, Kottawa-Arachchi J D, Ranatunga M A B, Abeysinghe I S B, Gunasekare M T K and Bandara B M R (2013) Optimization of Sampling Methodology for Metabolite Profiling of Sri Lankan Tea. *Book of abstracts of the Peradeniya University Research Symposium -2012* (17). 194

Jayaweera J K P T P, Wickremasinghe I P and Ranatunga M A B 2013 Evaluation of genetic diversity in estate selections of tea (*Camellia sinensis* (L.) using floral characteristics and SSR markers. *Book of abstracts of the Peradeniya University Research Symposium -2012* (17). 217

Abeysinghe I S B, Ranatunga M A B and Gunathilake H A J (2013) History of Plantation crops in Sri Lanka In; Siyawasaka Abimanaya (Eds. Pandula Edagama, E M Aberatne, Rohan Wijekoon) *Department of Agriculture, Sri Lanka*. 97-110.

## Special Presentations

Mr. K K Ranaweera made presentations at the RTEF and 226<sup>th</sup> E & E (English) forum held at Talawakelle.

M A B Ranatunga made three presentations at the RSC VII Galle and Deniyaya, SLTFOA forum and 31<sup>st</sup> E & E (Sinhala) forum.

M A B Ranatunga and A K Mudalige made a presentation at the RTEF, Kalutara region and J D Kottawa Arachchi made a presentation at the RTEF, Uva

## Plant Pathology Division

### Publication

Pradeepa NHL, Weerasena OVDSJ, Liyanaarachchi CJ, Wijesundera RLC and Abeysinghe ISB (2013). Recent outbreaks of stem canker of tea [*Camellia sinensis* (L.) O kuntze] caused by *Fusarium solani* in Sri Lanka. Proceedings of Sixth Annual Scientific Sessions of IBMBB. University of Colombo, 03<sup>rd</sup> May, 2013, Colombo, Sri Lanka.

Bharathy S, Pradeepa N H L, Weerasena O V D S J (2013) Identification of cellulase producing *Beauveria felina* from decaying tea roots. Proceedings of Sixth Annual Scientific Sessions of IBMBB. University of Colombo, 03<sup>rd</sup> May 2013, Colombo, Sri Lanka.

Kulathunga DCM, Sinniah GD, Balasuriya A, Mewan KM and Karunaratna T M (2013) Molecular characterization of *Exobasidium vexans* using ITS primers. Undergraduate Research Symposium, Faculty of Agriculture, Rajarata University of Sri Lanka, 31<sup>st</sup> July, 2013, Anuradhapura. 51.

Kulatunga D C M, Sinniah G D, Balasuriya A, Karunarathna K H T and K M Mewan 2013 Use of ITS region for molecular differentiation of *Exobasidium vexans* causing Blister Blight in Tea. pp 271-274 Proceedings of International Symposium on Agriculture and Environment, 28<sup>th</sup> November 2013, University of Ruhuna Sri Lanka, Kamburupitiya.

Pradeepa, N H L, Weerasena, O V D S J, Liyanaarachchi, C J, Karunajeew D G N P, Mahindapala K G J P, Wijesundera, R L C and Abeysinghe, I S B (2013). Sensitivity of isolates of *Macrophoma theicola* from untreated and DMI treated tea to hexaconazole. Journal of Plant Diseases and Protection (Accepted).

Pradeepa, N H L, Weerasena, O V D S J, Liyanaarachchi, C J, Wijesundera, R L C Abeysinghe, ISB and Reeder, R (2013). Recent emergence of *Fusarium dieback* of tea (*Camellia sinensis*) in Sri Lanka and its potential link with Tea Shot Hole Borer (*Euwallacea fornicates*). Proc. 19<sup>th</sup> Australasian Plant Pathology Society Conference (APPS), University of Auckland. 25<sup>th</sup> No-28<sup>th</sup> November 2013. Auckland, New Zealand

## Soils and Plant Nutrition Division

### Publication

Pitigala, P K D S D, Gunaratne, G P, Abeysinghe, D C and Fernandopulle, M N D (2013). Effect of different application rates of nitrogen and potassium on soil and plant micronutrient status of tea, *Camellia sinensis* (L). Proceedings of 12th Agricultural Research Symposium, Faculty of Agriculture and Plantation Management, Wayamba university of Sri Lanka, Makandura, Gonawila (NWP), 199-203.

Palliyaguru, S J, Gunaratne, G P, Abeysinghe, D C and Fernandopulle, M N D (2013). Effect of different application of dolomite on soil and plant micronutrient status of tea, *Camellia sinensis* (L). Proceedings of 12th Agricultural Research Symposium, Faculty of Agriculture and Plantation Management, Wayamba university of Sri Lanka, Makandura, Gonawila (NWP), 190-194.

Keerthirathna, D U A T, Gunaratne, G P and Amarasekara, M.G.T.S. (2013). Development of on farm analytical kit to assess soil/plant nutrient status in tea growing regions,. Proceedings of Undergraduate Research Symposium, Faculty of Agriculture, Rajarata University of Sri Lanka, Puliyakulama, Anuradhapuraya,(NCP), 61.

Ugendarajah, L, Gunaratne, G P, and M G T S Amerasekera (2013). Tea factory wood ash as a plant nutrient source and soil amendment. Proceedings of Undergraduate Research Symposium, Faculty of Agriculture, Rajarata University of Sri Lanka, Puliyakulama, Anuradhapuraya, (NCP), 72.

### Special Presentation

Mr. W M S Wijayatunga conducted a lecture on fertilizer use in tea at familiarization program of para extension trainers of Kahawatte plantation on TRI, Talawakelle on 20<sup>th</sup> February 2013.

Mr. W M S Wijayatunga made presentation at the Competency Development Programme of Ministry of Economic Development on 7<sup>th</sup> April 2013 at Cadet Training School, Rantambe and on 25<sup>th</sup> June 2013 at the Army Training School, Maduruoya.

Mr. W M S Wijayatunga conducted lectures for a group of students from the Rajarata University of Sri Lanka on 23<sup>rd</sup> April, 2013.

Mr. W M S Wijayatunga conducted a lecture on instrumentation and the divisional activities for a group of officers of Industrial Technology Institute on 7<sup>th</sup> June 2013.

Mr. W M S Wijayatunga conducted a lecture and practical session on Mixing Strait Fertilizers and sampling for a group of officers of Namunukula plantation at Gonakelle Estate on 18<sup>th</sup> June, 2013. **119**

Mr. W M S Wijayatunga made presentation on “Organic manure and composting” at the 30<sup>th</sup> Experiment and Extension Forum (Sinhala) held at the auditorium, TRI Ratnapura on 21<sup>st</sup> June 2013.

Dr. G P Gunaratne conducted a lecture on “Proposed new fertilizer recommendation for tea” at the Regional Extension Technical Forum at Deniyaya Advisory and Extension centre on 30<sup>th</sup> May 2013.

Dr. G P Gunaratne conducted a lecture on “Proposed new fertilizer recommendation for tea” at the Regional Extension Technical Forum at Matugama advisory and Extension centre on 04<sup>th</sup> June 2013.

Dr. G P Gunaratne conducted a lecture on “Proposed new fertilizer recommendation for tea” at the Regional Extension Technical Forum at Hali Ela, TSHDA Sub office on 13<sup>th</sup> June 2013.

Dr. G P Gunaratne conducted a lecture on “Soil fertility management and fertilizer use in tea” for Assistant Superintendents of Hapugastenne and Udapussallawa PLC on 5<sup>th</sup> July 2013.

Mr. WMS Wijayatunga conducted lecture and practical session on “Soil fertility and fertilizer recommendation for tea” for a newly recruited Tea Inspectors of TSHDA at Hantana on 20<sup>th</sup> July 2013.

Dr. G P Gunaratne and Mr. WMS Wijayatunga conducted lecture and practical session on “Soil fertility improvement and fertilizer use in tea” and “Organic manure and composting” for a group of farmers of Matugama on 8<sup>th</sup> August 2013.

Mr. W M S Wijayatunga conducted a lecture on “Soil fertility and fertilizer recommendation for tea” for a batch of planter trainees of NIPM on 22<sup>nd</sup> August 2013.

Mr. W M S Wijayatunga made presentation at the Skill Development Programme of NIPM for tea Field Officers at the auditorium, TRI Talawakelle on 29<sup>th</sup> August 2013

Mr. S M Dissanayaka made presentation to the awareness programme on good agricultural practices to bough leaf Suppliers of Eratne and Pathagama routes at the auditorium, TRI Ratnapura on 30<sup>th</sup> August 2013

Dr. G P Gunaratne conducted a lecture on “Soil fertility management and fertilizer use in tea” for the executive staff of Kahawatta Plantations PLC at the auditorium, TRI Ratnapura on 16<sup>th</sup> September 2013 and at the auditorium, TRI Talawakelle on 03<sup>rd</sup> October 2013.

Dr. G P Gunaratne conducted lecture on “Soil fertility and fertilizer recommendation for tea” for a batch of planter trainees of NIPM on 11<sup>th</sup> October 2013.

Mr. W M S Wijayatunga conducted a lecture and practical session on “TRI fertilizer recommendation and nutrient management of tea soil” for Assistant Managers and Field Officers of Hali-Ela Region - HPL on 11<sup>th</sup> October 2013.

Dr. G P Gunaratne gave a presentation on “Towards site specific fertilizer Recommendations (SSFR) for mature Tea” at TRI/SLTFOA forum on 24<sup>th</sup> October 2013.

Mr. W M S Wijayatunga conducted a lecture on Instrumentation and the divisional activities for Familiarization programme for new Extension Officers of TRI on 5<sup>th</sup> November 2013.

Mr. W M S Wijayatunga conducted a lecture on “Soil fertility and fertilizer recommendation for tea” for a batch of planter trainees of NIPM on 22<sup>nd</sup> November 2013.

Mr. W M S Wijayatunga conducted a lecture and practical session on “Importance of Dolomite use in tea and enhancing fertilizer use efficiency for Uva province” for a group of farmers of Kahataruppawa on 26<sup>th</sup> November 2013.

Mr. W M S Wijayatunga conducted lecture on “Enhancing fertilizer use efficiency by managing agricultural practices affecting nutrient availability in tea growing soils” at the Regional Technical and Extension Forum in Nuwara-eliya at the auditorium, Mid country station, Hantana on 6<sup>th</sup> December 2013.

Mr. W M S Wijayatunga conducted lecture and practical session on “Soil fertility and fertilizer recommendation for tea” for newly recruited Tea inspectors at the TSHDA, Hantana on 10<sup>th</sup> December 2013.

Mr. W M S Wijayatunga made a presentation at the workshop on “Improving quality of organic fertiliser” for officers of Urban councils in Sabaragamuwa province at the compost yard in Balangoda on 17<sup>th</sup> December 2013.

## **Process Technology Division**

### **Publications**

Raveendran K, Amarasinghe A D U S and Botheju W S (2012). A study on fluidization behavior of Orthodox- Rotorvane teas. Proceedings of the forth symposium on Plantation Crop Research September 20-21. Page 283-293.

## **Special presentations**

Staff members of the Process Technology Division made presentations at RSC seminars, Experimental & Extension forums and at factory demonstrations. They also made presentations at several seminars of B Leaf – 60 program organized by the Tea Commissioners Division of the Sri Lanka Tea Board.

## **Entomology and Nematology Division**

### **Publications**

Hemachandra, P A I U, Mohotti, K M, Ahangama, D (2013). Evaluation of four methods for cultivar screening against shot-Hole Borer (*Xyleborus Forficatus* Eichhoff.) in tea in comparison with the Conventional Method. Proceedings of the Undergraduate Research, Department of Agricultural Biology, University of Peradeniya, Sri Lanka, 29.

Mohotti, K M (2013). Bioprospecting in agricultural systems: Ensuring healthy agro ecosystems for value addition and benefit sharing. Presidential Address, Proceedings of the 33rd Annual sessions, Institute of Biology Sri Lanka, 8-11.

Mohotti K M (2013). Earthworms. Supplementary booklet, Biodiversity Indicators in Agricultural Systems, Institute of Biology Sri Lanka, 24-25.

Mohotti K M (2013). Leaf Litter. Supplementary booklet, Biodiversity Indicators in Agricultural Systems, Institute of Biology Sri Lanka, 20.

Mohotti K M (2013). Millipedes, centipedes, pillbugs and sowbugs. Supplementary booklet, Biodiversity Indicators in Agricultural Systems, Institute of Biology Sri Lanka, 26-27.

Mohotti K M (2013). Nematode Parasites and their naturally occurring bio control agents in tea soils of Sri Lanka. Proceedings of National Symposium on Soil Biodiversity, Biodiversity Secretariat, Ministry of Environmental & Renewable Energy, 83.

Mohotti K M and Amarasena P G D S (2013). Microbial activity in different tea soils in Sri Lanka as affected by soil pesticides. Proceedings of National Symposium on Soil Biodiversity, Biodiversity Secretariat, Ministry of Environmental & Renewable Energy, 167.

Mohotti K M and Mohotti A J (2013). Enhanced soil biodiversity in organic and biodynamic tea cultivation systems in comparison to conventional system. Proceedings of National Symposium on Soil Biodiversity, Biodiversity Secretariat, Ministry of Environmental & Renewable Energy, 167.



Ranaraja R M R U K, Mohotti K M, Balasuriya A, and Amarasena, P G D S (2013). Mortality and behavioral changes of root lesion nematode (*Pratylenchus loosi*) in different temperature regimes. Proceedings of Undergraduate Research Symposium, Rajarata University of Sri Lanka, 52.

Tennakoon T M C H, Mohotti K M, Ahangama, D, Amarasena P G D S (2013). Mortality of five populations of the burrowing nematode, *Radopholus similis* in Aqueous and soil media under different temperatures In Vitro . Proceedings of the Undergraduate Research, Department of Agricultural Biology, University of Peradeniya, Sri Lanka, 45.

Vinoj Kumar K, Mohotti K M, Warnasooriya W M R S K and Amarasena P G D S (2013). Capacity of Biochar as a soil amendment in enhancing use efficiency of synthetic fertilizers and soil pesticides. Proceedings of Undergraduate Research Symposium, Rajarata University of Sri Lanka, 34.

Matthew T. Kasson, Kerry O'Donnell, Alejandro P. Rooney, Stacy Sink, Randy C. Ploetz, Jill N. Ploetz, Joshua L. Konkol, Daniel Carrillo, Stanley Freeman, Zvi Mendel, Jason A. Smith, Adam W. Black, Jiri Hulcr, Craig Bateman, Kristyna Stefkova, Paul R. Campbell, Andrew D.W. Geering, Elizabeth K. Dann, Akif Eskalen, Keerthi Mohotti, Dylan P.G. Short, Takayuki Aoki, Kristi A. Fenstermacher, Donald D. Davis and David M. Geiser. (2013). An inordinate fondness for *Fusarium*: Phylogenetic diversity of fusaria cultivated by ambrosia beetles in the genus *Euwallacea* on *avocado* and other plant hosts. Elsevier Inc.

## TRI ESTATES

### ST. COOMBS ESTATE - TALAWAKELLE

#### Superintendent

Mr. T M S K Tennakoon

#### Staff Members

Mrs H M Badra Jayathilake	- Chief Clerk
Mrs T G S Chandrakanthi	- Clerk
Mr K Rajkumar	- Junior Assistant Clerk
Mr E M Dayaratne	- Head Factory Officer
Mr H M R Kuladasa	- Assistant Factory Officer
Mr S M Sunil Shantha	- Assistant Factory Officer
Mr P Mohotti	- Junior Assistant Factory Officer
Mr S Sivan	- Factory Mechanic
Mr M Sarath Kumar	- Junior Assistant Factory Officer
Mr Nimal De Silva	- Field Officer
Mr N Illangeswaran	- Field Officer
Mr I W M D Alahakoon	- Assistant Field Officer
Mr S Suresh	- Field Officer
Mr S D Perera	- Junior Assistant Field Officer
Mr S F Jayasinghe (on contractual basis)	- Estate Medical Assistant
Mr D Puniyamoorthy (on no-pay leave)	- Welfare Officer
Mrs G N Sylvester	- Creche Attendant
Mrs K Jothy	- Creche Attendant
Mrs T Ponmany	- Creche Attendant
Mr K Selvaraj	- Driver
Mr S Christopher	- Driver
Mr T Ramanathan	- Driver
Mr R Udayakumar	- Driver
Mr D Sundareson	- Driver



## Crop & Yield

	2013		2012	
	Crop (Unit)	Yield (Unit)	Crop (Unit)	Yield (Unit)
St. Coombs	184,303	2,222	185, 503	2,282
Lamiliere	103,538	2,226	107, 378	2,309
<b>Total</b>	<b>287,841</b>	<b>2,220</b>	<b>292,881</b>	<b>2,293</b>
Bought leaf	86,257	83,831		
<b>Grand total</b>	<b>374,098</b>	<b>2,220</b>	<b>376,712</b>	<b>2,293</b>

## Weather condition and tea yield

St. Coombs being in the Western High Grown region faced adverse weather conditions during the months of June and July 2013. As a result the estate crop dropped by 55% and 72% respectively.

## Replanting

Two hectares of rehabilitated land was planted with new TRI cultivars (10NC- 0.5 ha, STC, 11NC -0.5 ha, STC & Lamiliere 1 ha.). Field No. 13C -2 ha planted in 2010 was taken into the revenue extent in 2013.

### **ADB mother bush project**

Approximately 429,732 VP shoots from TRI 3000 & 4000 series cultivars were issued to tea small holders and the corporate sector estates. Profit made from this project during the year 2013 was Rs. 113, 811.31.

### **Factory and manufacture**

The estate crop and the profit made were as follows.

Crop : 86, 257 kg (Made Tea)

Profit : Rs. 957,452.70

St. Coombs received following awards during 2013.

- Gold Award for being in the 1<sup>st</sup> rank in Western High Grown category.
- Award for the highest sale average in Western High Grown.
- Award for achievements in the all-time-record price for Dust No.1 (Rs. 850.00)
- Award for most number of the top prices for Dust No.1 Grade
- The Gross Sale Average for 2013 was Rs. 499.22, which was Rs. 85.04 above the Western High Grown elevation average

### **Top prices**

Dust No1	24 times – Inclusive of 2 all time record prices
BOP	1 time
BOPF	1 time
FGI	3 times inclusive of 1 all time record price

### **Overseas training/ Seminars/ Conferences**

Mr. Sanjeewa Tennakoon, The Superintendent participated in the 2<sup>nd</sup> Africa Tea Convention and Exhibition held in Kigali, Rwanda from 26<sup>th</sup> to 29<sup>th</sup> August 2013.

### **General**

- Mr. M Madugalle, Visiting Agent visited the Estate on 18<sup>th</sup> July 2013.
- M/s. Forbes & Walker Tea Brokers (Pvt) Ltd. continued auctioning the St. Coombs teas.
- Mr D H Jayatilake Chife Clerk retired w.e.f 11<sup>th</sup> February 2013, and continued the service upto October 2013 and thereafter served the St. Joachim estate on contractual basis.
- Mrs H M Badra Jayatilake promoted as the Chief Clerk w.e.f 1<sup>st</sup> October 2013.
- Mr S F Jayasinghe was appointed as the EMA w.e.f 4<sup>th</sup> March 2013 on contractual basis.

- Mr M Sarath Kumar was appointed as Jnr. Asst. Factory Officer w.e.f 1<sup>st</sup> August 2013 .
- Mr D Puniyamoorthy was on “No-Pay Leave” from 28<sup>th</sup> June 2012 to 28<sup>th</sup> June 2014.
- Mr S Fernando, Estate Medical Practitioner has been suspended from the service w.e.f. 10<sup>th</sup> May 2012 and the disciplinary inquiry was in progress.

**Estate profits**

The Estate made a profit of Rs. 6,468,876.60 for the year.

## ST. JOACHIM ESTATE - RATNAPURA

### Superintendent

Mr P S Habaragoda (Up to 26<sup>th</sup> September, 2013)  
Mr Anuradha Nanayakkara, (From 18<sup>th</sup> November, 2013)

### Staff Members

Name	Designation
Mrs Nilani Koralage	- Snr. Asst. Clerk
Mrs K M G L Dias	- Jnr.Asst.Clerk
Mrs A Sivanandhini	- Jnr.Asst.Clerk
Mr P K Jayathilake	- Chief Clerk (from 15.10.2013)
Mr S K Edirisinhge	- Act Head Factory Officer (August 2013)
Mr J R Yapa	- Asst. Factory Officer
Mr H T K Nihal	- Jnr. Asst. Factory Officer
Mr D A J Pushpakumara	- Jnr. Asst. Factory Officer
Mr P P Wickremaratna	- Jnr.Asst.Fact.Officer
Mr Rohana Premalal	- Jnr.Asst.Fact.Officer
Mr W N Perera	- Jnr.Asst.Fact.Officer
Mr V Ariyaraj	- Jnr.Asst.Fld.Officer
Mr J Senadeera	- Jnr.Asst.Fld.Officer
Mr A W S W Peiris	- Jnr.Asst.Fld.Officer
Mr M K Pulle	- E.M.A
Mr M W Jayasekera	- Storekeeper/Clerk
Mr J Kumara	- Lorry Driver
Mr N Jayamaha	- Suptd's Driver
Mr W G D Amarasinghe	- Lorry Driver (from 16.05.2013)
Mr A M A H Dharshana	- Lorry Driver (from 16.05.2013)
Mr D V D Jagath	- Lorry Driver (from 16.05.2013)
Mr C Perera	- Lorry Driver (from 16.05.2013)

### General

Ms. Forbes & Walker Tea Brokers (Pvt) Ltd continued to be the Brokers of St. Joachim teas. The roller nos. 3, 9, 1, 5, 8 and 6 were re-tabled and new cones to roller nos. 1 & 6 were fixed. The Visiting Agent Mr. Nimal M. Amarasekera made one visit to this estate on 1<sup>st</sup> July 2013.



Mr P S Habaragoda resigned from the post of Superintendent of St. Joachim estate with effect from 26<sup>th</sup> September 2013 and the estate was managed under the supervision of Dr. M A Wijeratne, Officer-in-Charge and Mr G Galahitiyawa, Senior Research Officer of the TRI Low country station, Ratnapura until 17<sup>th</sup> November 2013. Mr. Anuradha Nanayakkara, assumed duties with effect from 18<sup>th</sup> November 2013 as the Superintendent of St. Joachim estate.

### **Achievements**

The factory was certified with the SLSI ISO 22000 Food Safety Management System (Issued on 28-01-2013 valid up to 27-01-2016).

### **Extent (ha)**

V.P. tea in bearing	60.23
TRI coconut area	3.89
Nurseries	1.58
Estate rubber	7.12
Mature rubber (Interropping area)	5.68
Paddy fields	8.74
ADB mother bushes	17.79
TRI buildings & experimental field no.9	11.02
Buildings, roads, jungle & patna	25.93
<b>Total</b>	<b>141.98</b>



\*As per the bush count undertaken in December 2012, the effective hectarage is given below.

V.P. Tea in bearing	-	13.54 ha
ADB mother bushes released for plucking	-	10.98 ha
Total effective tea extent	-	24.52 ha

### **Crop (made tea kg)**

The made tea production by St. Joachim estate in 2013 in comparison with the previous year was as follows.

<b>Tea</b>		
<b>Year</b>	<b>Estate crop (kg)</b>	<b>Bought crop (kg)</b>
2012	45,305	237,760
2013	44,478	253,421
<b>Variance</b>	<b>-827</b>	<b>+15661</b>

Estate crop continued to decrease as the effective bush count was reducing year on year.

<b>Rubber</b>		
<b>Year</b>	<b>Estate crop (kg)</b>	<b>Yield (kg/ ha/ yr)</b>
2012	11233	1040
2013	10735	1054
<b>Variance</b>	<b>-498</b>	<b>+14</b>

### **Cultural operations**

About 13,650 tea plants and 300 rubber plants were put out in the field no. 8C and field no. 3 respectively.

### **St. Joachim nursery**

Around 62312 nursery plants of tea were sold by the esate.

### **A D B mother bush project**

A total of 234,297 VP shoots were issued to the small holders and the Corporate Sector estates as against 250,650 shoots in 2013.

### **Factory Manufacture**

A NSA of 460.08 was achieved in the year 2013 as against 389.70 in 2012.

**Bought leaf**

The bought leaf manufactured at St. Joachim factory showed an increase of 15,661 kg when compared with the previous year.

**Weather & rainfall**

Rainfall of 3700.10 mm was recorded on 163 wet days, as against 3516.20 mm on 153 wet days in 2012.

**Estate profit/loss**

The St. Joachim estate resulted in a loss of approximately Rs. 1,499,222 as at 31<sup>st</sup> December 2013 compared to a trading loss of Rs. 6,728,147 in the previous year.

**New Appointments.**

Mr W G D Amarasinghe, Mr A M H Dharshana, Mr D V D Jagath and Mr C Perera were appointed as drivers with effect from 16<sup>th</sup> May, 2013. Mr D H Jayatilaka transferred from St. Coombs estate served as the Chief Clerk of St. Joachim estate on contractual basis with effect from 15<sup>th</sup> October 2013.

## ADMINISTRATION AND FINANCE

### Special highlights

#### 1. Human Resource Development and Capacity Building

##### a) Staff strengthening and motivation

#### Staff recruitments

Name	Designation	Date
R M K Jayathilaka	Senior Administrative Officer	23.01.2013
A Selvanayagam	General Worker	07.01.2013
S L Josep	General Worker	07.01.2013
B K Jayanthi	General Worker	07.01.2013
W M D C Perera	General Worker	07.01.2013
A M U Liyanage	General Worker	07.01.2013
P D N B D Silva	General Worker	07.01.2013
D V S P Denagama	General Worker	07.01.2013
I D Subasinghe	General Worker	07.01.2013
S M P Ramyalatha	General Worker	07.01.2013
A H C Nisansala	General Worker	07.01.2013
H A T K K Sumanaweera	General Worker	07.01.2013
A K J Athukorala	General Worker	07.01.2013
R Velmurugan	General Worker	07.01.2013
K Jegatheshwaran	General Worker	07.01.2013
B K Jayasinghe	General Worker	07.01.2013
K Balakrishnan	General Worker	07.01.2013
D A Wimalasiri	General Worker	07.01.2013
D Rita	General Worker	07.01.2013
M Bernard	General Worker	07.01.2013
P Muthukumar	General Worker	07.01.2013
P Sivapalan	General Worker	07.01.2013
K Rajalingam	General Worker	07.01.2013
R Puwaneswaran	General Worker	07.01.2013
A Mahendran	General Worker	07.01.2013
P D DE Alwis	Extension Officer	01.11.2013
S P A P K Jayarathna	Extension Officer	01.11.2013
A Abeysooriya	Extension Officer	01.11.2013
P A L K Dharmapala	Extension Officer	01.11.2013
W M S S Kumari	Extension Officer	01.11.2013

## **Resignations**

<b>Name</b>	<b>Designation</b>	<b>Date</b>
R M K Jayathilaka	Senior Administrative Officer	13.02.2013
G H Thotawattege	Experimental Officer	07.02.2013
H M S B Heenkenda	Technical Assistant	25.03.2013
H R M P Abeyrathna	Research Officer	26.04.2013
R M R R L Ranaraja	Resident Engineer	17.07.2013
A G S Rukmalgoda	Circuit Bungalow Keeper	31.07.2013
H K K Deshapriya	Technical Assistant	06.09.2013
T U S Peiris	Senior Research Officer	28.09.2013
S M Dissanayake	Experimental Officer	14.11.2013
A P D A Jayasekara	Experimental Officer	13.12.2013

## **Retirements**

<b>Name</b>	<b>Designation</b>	<b>Date</b>
M Wimalasena Silva	Skilled Mechanic	10.03.2013
K M Gamini De Silva	Driver	09.08.2013
K A S Kumarapperuma	Clerk/Typist	08.06.2013
P S Wickramasinghe	Internal Audit Officer	28.09.2013

## **b) Overseas Training/ Seminars/Conferences**

Mr. A L R U Kumara, Extension Officer, Advisory & Extension Division attended a training program from 7<sup>th</sup> January to 01<sup>st</sup> of February in Netherlands under Netherland Fellowship Program, 2012–2013.

Dr. I S B Abeysinghe, Director, TRI, participated in a discussion on “Quality standards in Sri Lankan Teas in Iraq from 21<sup>st</sup> to 25<sup>th</sup> February 2013.

Ms. Padmini Senanayake, Research Officer, Entomology Division attended a training program on “Integrated Pest Management & Molecular in Israel during the period of 21<sup>st</sup> April to 15<sup>th</sup> July 2013.

Dr. S S B D G Jayawardena, Chairman, TRB, represented as a ministerial delegate for a tea promotion tour to Dubai, Chile, Argentina & Brazil from 15<sup>th</sup>-30<sup>th</sup> June 2013.

Mr. T M S K Tennekoon, Superintendent, St. Coombs estate, participated in “2<sup>nd</sup> Afrika Tea Coinvention,” Kigali, Rwanda from 27<sup>th</sup> to 01<sup>st</sup> September 2013.

Mr. J D Kottawarachchi, Experimental Officer, Plant Breeding Division, participated in “Advanced Certificate Program in Tea Plantation Management in India from 01<sup>st</sup> September to 31<sup>st</sup> October 2013.

Ms. K W N Nadeeshani, Technical Assistant, Agricultural Economics Division participated in ‘Advance Certificate Program’ in India from 01<sup>st</sup> September to 30<sup>th</sup> November 2013.

Dr. I S B Abeysinghe, Director, TRI, participated in CIFIT Tea Fair 2013 in Fujian China during the period of 4<sup>th</sup> – 17<sup>th</sup> September 2013.

Dr. S S B D G Jayawardena, Chairman, TRB, represented ministerial delegation on a visit to Australia from 14<sup>th</sup> to 21<sup>st</sup> September 2013.

Mr. G L C Galahitiyawa, Senior Research Officer, Technology Division attended on a study tour on ‘Tea cultivation, processing & marketing’ in India from 22<sup>nd</sup> October to 01<sup>st</sup> November 2013.

Mr. K R W B Kahandawa, Extension Officer, Advisory & Extension Division attended a study tour on ‘Tea cultivation, processing & marketing’ in India from 22<sup>nd</sup> October to 01<sup>st</sup> November 2013.

### **c). Local Training/ Seminars/ Workshops**

Mr. U A Wickramasinghe, Electrical Forman & Mr. J M R K Bandara, Electrician, participated in a two day training program conducted by the Institute of ICTAD, Colombo on operation maintenance to diesel generators.

## **2). Infrastructure developments and maintenance**

### **a). Infrastructure developments**

About 250 jobs on road repairs, building maintenance & sanitation works were completed during the year 2013.

**b). Maintenance work**

Colour washing of Administration & Agronomy Divisions, old telephone exchange, motor garage, “A” type bungalows (9 & 11), C type bungalows (5 & 53), “D” type & “E” type bungalows (52 & 6 respectively) and room no 6 of Junior staff ladies hostel completed. All repair works of these buildings were also carried out along with the color washing programme. Renovation works on office complex at Kottawa regional station was started and was in progress. A road was constructed to provide access to “D” type quarters at Deniyaya. Construction of twin worker quarters at Galle Extension Center was started and in progress. Construction work of “C” type quarters at Deniyaya Extension Center continued. Colour washing of circuit bungalow at Uva Extension Center, Passara Center and construction of the soakage pit & drainage system at OIC bungalow at Hantana regional station was completed.

Designing and tender procedure were completed for improvement of water treatment plant at the TRI, Talawakelle. Renovation of sanitation system at Process Technology Division was completed.

Replacement of gutters, down pipes and renovation of pavements and drainage systems of “B” & “C” type bungalows were continued. Construction of new septic tank in “C” type quarters no. 6 was completed.

**c) Water supply**

About 218 jobs were undertaken by the staff during year 2013. Shower valves and pipe lines of “A” type 9 & 10, “B” type 17, 11, 14, “C” type 08, 09, 11, 13, 15, 31 & 36 and Camellia Junior staff hostel nos. 19, 29, 31 & 36 were replaced.

Laboratory sink & pipe line was replaced in the Plant Breeding Division. Major plumbing repairs were undertaken at circuit bungalow at Talawakelle. Filtration plant and sedimentation & storage tanks of different locations were cleaned two times during the year 2013. Installation of a new raw water pump & pipe lines for the new pump house were completed. Further repairs on water supply for all newly allocated quarters were undertaken.

**d). Electrical unit**

About 165 jobs were completed by the electrical unit during the year 2013. Maintenance works were undertaken at 47 staff quarters (A type – 8, B type – 5, C type – 22 & D type – 12) Senior staff quarters, Camellia & Junior ladies hostels, guest house, motor garage, mechanical workshop and St. Coombs estate. Maintenance works of laboratories of Process Technology, Plant Breeding, Plant Pathology, Advisory and Biochemistry Divisions were completed.

Reconstruction of 3 phase over head line of junior staff houses and replacement of three phase meters at Biochemistry and Soil & Plant Nutrition Divisions, senior & junior staff quarters water pump houses & laboratory water pump house were completed.

**e). Telephone exchange**

New PBX system (305 CDB 300 pair IDF with krone based) was installed and telephone exchange display board, LCD Monitor, UPS & printer were purchased for the unit. New communication earth was also installed. Sofa set, coffee table and chair were purchased. New telephone exchange and reception area were constructed. Two new telephone connections were given to the office and staff quarters. Ten repairs and 25 line services were undertaken. Total work undertaken by the staff was 80 & the works under 18 job cards were completed.

**f). Procurement activities****Department procurement committee (Major & Minor)**

Eleven Departmental Procurement Committee (Minor) meetings were held for the purchase of both foreign and local items such as chemical and glassware, machinery and laboratory equipment, agricultural inputs for tea cultivation, printing of books and periodicals, spare parts for machinery, laboratory equipment and vehicles, office equipment and stationeries, fuel and lubricants, building materials and accessories for water and electrical supplies.

Eight Departmental Procurement Committee (Major) Meetings were held for the purchase of fertilizer, firewood and multi wall paper sacks for St. Coombs & St. Joachim estates, 54 seater passenger bus, insurance coverage for buildings and vehicles, fixing new gutters and renovate drainage systems in office quarters, construction of an official quarters for junior officers at Deniyaya, sale of used vehicles (2 nos motor cars, 2 nos double cabs, one jeep, one lorry and one ambulance) provision of security service to head office and other regional centres and computer with accessories *etc.*

**g). Transport and motor garage**

Vehicles were serviced 75 times during the year 2013. Under routine maintenance and day today repairs, tires and tubes were replaced in 71 vehicles. Four full suspense repairs and four engine repairs were undertaken. Out of four engine repairs two were done internally and rest were done through outside sources. Total mileage done by the institue's vehicle fleet during the year 2013 was 925,592 km.

**h) Board of survey**

Board of Survey was carried out to identify unserviceable items for dispose in Centers, Divisions and Units of the TRI and unserviceable items found were sold through a public auction held on 22 May 2013.



# FINANCIAL PERFORMANCE

## TEA RESEARCH BOARD

### STATEMENT OF FINANCIAL POSITION AS AT 31st DECEMBER 2013

		SLPSAS 2013 Rs. '000	SLPSAS 2013 Rs. '000	Re- measurement Rs. '000	SLAS 2012 Rs. '000
	Note				
<b>ASSETS</b>					
<b>Current Assets</b>					
Cash and Cash Equivalents	06		91,776	-	53,978
Trade and Other Receivables	07	88,854		-	65,953
Less:- Provision for Bad Debts		171		-	103
			88,683	-	65,850
			180,459		119,828
Inventories/Stocks	08	25,524		-	24,730
Deposits and Prepayments	09	6,621		-	8,669
Excess & Shortages	10	31		-	29
			32,176	-	33,428
<b>Total Current Assets</b>			212,635	-	153,256
<b>Non-Current Assets</b>					
Capital work-in-progress	11		8,873	-	5,348
On Going Projects Work	12		2,519	-	-
Property, Plant & Equipment	13	1,087,161		-	1,052,526
Less:- Accumulated Depreciation		682,181		-	651,875
			404,980		400,651
Intangible Assets	14		2,404	-	2,404
			407,384		403,055
<b>Total Non-Current Assets</b>			418,776	-	408,403
<b>Total Assets</b>			631,411	-	561,659
<b>LIABILITIES</b>					
<b>Current Liabilities</b>					
Creditors and Payables	15	15,475		-	11,915
Accrued Expenses	16	19,268		-	23,712
Short-term Borrowings	17	33,291		-	2,500
Short-term Provisions	18	7,501		-	6,788
Employee Benefits	19	3,104		-	2,863
			78,639	-	47,779
<b>Non-Current Liabilities</b>					
On Going Projects	20	1,993		-	3,347
Provision for Gratuity	21	155,087		-	142,640
Petrol Deposit Refundable	22	20		-	26
			157,100	-	146,013
<b>Total Liabilities</b>			235,739	-	193,792
<b>Total Net Assets</b>			395,672	-	367,867
<b>NET ASSETS/EQUITY</b>					
Grants & Reserves	23		179,066	-	127,838
Tea Research Fund			216,606	-	240,029
<b>Total Net Assets/Equity</b>			395,672	-	367,867

The accounting policies on pages 24 to 26 and notes on pages 05 to 23,27,28,29 form an integral part of these Financial Statements .  
The Board of Directors is responsible for the preparation and presentation of these Financial Statements. These Financial Statements were approved by the Board of Directors and signed on their behalf.

Certified by:-

Internal Auditor

Chairman TRB

Director-TRI

Accountant  
for Senior Accountant

**TEA RESEARCH BOARD**
**STATEMENT OF FINANCIAL PERFORMANCE FOR THE YEAR ENDED 31ST DECEMBER 2013**

		SLPSAS	Re- measurement	SLAS
		2013		2012
	Note	Rs. '000	Rs. '000	Rs. '000
<b>Revenue</b>				
Government Funds (Recurrent)	24	252,113	-	283,186
Deferred Income (Capital)	24	36,639	-	8,517
Other Income	25	49,421	-	30,765
		<b>338,173</b>	<b>-</b>	<b>322,468</b>
Add: P/L from Two Estates	26	5,359	-	13,768
		<b>343,532</b>	<b>-</b>	<b>336,235</b>
<b>Expenses</b>	27			
Personal Emoluments		196,422	-	178,069
Travelling		8,577	-	9,178
Supplies and Consumables		20,435	-	20,819
Repairs & Maintenance		24,772	-	25,717
Contractual Services-Security / Insurance		14,990	-	14,865
Electricity & Heating		17,732	-	17,504
Communications		2,398	-	2,948
Research and Development		32,413	-	38,985
Depreciation		28,108	-	29,697
Other Expenses		20,928	-	26,927
Finance Cost		447	-	-
<b>Total Expenses</b>		<b>367,222</b>		<b>364,711</b>
Surplus/(Deficit) before Adjustments		(23,690)	-	(28,475)
Prior Year Adjustments		267	-	(206)
<b>Net surplus/(Deficit) for the period</b>		<b>(23,423)</b>	<b>-</b>	<b>(28,682)</b>

**TEA RESEARCH BOARD**
**CONSOLIDATED CASH FLOW STATEMENT FOR THE YEAR ENDED 31ST DECEMBER 2013**

	<b>2013</b>	<b>2012</b>
	<b>Rs. '000</b>	<b>Rs. '000</b>
<b>Cash Inflow / (Out Flow) from Operating Activities</b>		
Net Surplus / Deficit for the year before Adjustments	(23,423)	(28,681)
<b>Adjustment for</b>		
Prior year Adjustment	(267)	206.00
Provision for Gratuity	28,104	19,502
Depreciation	35,306	36,963
Interest Income on Investment	(5,893)	(4,782)
Accounting Profit from Sale of Fixed Assets	(6,391)	-
Deferred Income (Recurrent & Capital)	(289,991)	(9,819)
	(239,132)	42,070
<b>Operating Cash Inflow / (Out Flow) before Changes in Working Capital</b>	<b>(262,555)</b>	<b>13,389</b>
<b>Changes in Working Capital</b>		
Increase / Decrease in Inventories	(794)	1,242
Increase / Decrease in Trade, Deposits & Other Receivables	(20,518)	22,570
Increase / Decrease in Excess & Shortage	(2)	(1)
Increase / Decrease in Creditors & Other Payables	(1,284)	(927)
Increase / Decrease in Refundable Deposit	(6)	2
	(22,604)	22,886
	(285,159)	36,275
Less: Gratuity Paid	(15,658)	17,019
	(15,658)	17,019
<b>Net Cash Inflow / (Out Flow) from Operating Activities</b>	<b>(300,817)</b>	<b>19,256</b>
<b>Cash Inflow / (Out Flow) from Investing Activities</b>		
Proceeds from Sale of Fixed Assets	6,391	-
Interest on Investing Activities	5,893	4,782
Purchase of Fixed Assets	(39,635)	(32,547)

Increase in WIP	(3,525)		
Increase in On-going Projects	<u>(2,519)</u>	-	
Net Cash Inflow / (Out Flow) from Investing Activites		<u>(33,395)</u>	<u>(27,765)</u>
<b>Net Cash Inflow / (Out Flow) from Operating &amp; Investing Activites</b>		<b>(334,212)</b>	<b>(8,509)</b>
<b>Cash Inflow / (Out Flow) from Financing Activites</b>			
Grants received from Treasury	339,409	10	
Grants received from other sources	1,810	-	
Grants received for Tea Factories Studies	-	286	
Loan Obtained	21,000	-	
Loan Repaid	(6,000)		
Brokers Advance	260,455		
Brokers Advance Repaid	<u>(242,164)</u>		
Net Cash Inflow / (Out Flow) from Financing Activites		<u>374,510</u>	<u>296</u>
<b>Net Increase / (Decrease) in Cash and Cash Equivalents</b>	<b>40,298</b>		<b>(8,213)</b>
<b>Cash &amp; Cash Equivalents at beginning of the year</b>	<b>51,478</b>		<b>59,691</b>
<b>Cash &amp; Cash Equivalents at end of the year</b>	<b><u>91,776</u></b>		<b><u>51,478</u></b>

TEA RESEARCH BOARD  
ST.COOMBS & LAMILIERE ESTATES WORKING ACCOUNT FOR THE  
PERIOD 1ST JANUARY TO 31ST DECEMBER 2013

2012 Rs. Cts	2012 Kg's	2013 Kg's	2013 Rs. Cts	2013 Rs. Cts
158,592,502.10	338,832.75	335,277.55	167,949,157.96	(Note 1)
15,282,095.75	37,879.25	38,820.00	15,927,891.00	
173,874,597.85	376,712.00	374,097.55		183,877,048.96
REVENUE				
Tea sales Gross Proceeds				
Tea Sales Ex. Brokers(Gross)				
Tea sales Local & Grates				
Add				
Sale of Green Leaf				
ADB Profit (sale of VP Cuttings)				
Miscellaneous Income				
Deferred Income				
Total Income				
356,611.87			113,811.31	
1,616,334.01			1,606,865.52	
382,709.63			382,709.63	
2,355,655.51				2,103,386.46
176,230,253.36				185,980,435.42
EXPENDITURE				
Less: Estate Expenditure				
General Charges				
Field Work & Cultivation				
Production				
Bought Leaf(Including Transport Charges)				
38,333,712.57		38,564,258.29		
13,988,860.41		15,203,373.38		
54,112,726.97		62,216,962.18		
36,729,382.00		40,881,408.14		
143,164,681.95				156,866,001.99
Administration & Finances				
Bonus and Holiday Pay				
Depreciation				
5,441,140.24		17,935,951.18		
2,341,365.70		2,288,426.66		
7,782,505.94				20,224,377.84
Sales Tax & Distribution Expenses				
Brokerage, Handling charges & Sales Expenses				
2,315,681.16		2,419,692.20		
2,315,681.16				2,419,692.20
153,262,869.05				179,510,072.03
Total Expenditure				
Profit /(Loss) For the Year				
22,967,384.31				6,470,363.39
(334,903.00)				(32,805.27)
Less: Over Value Unsold Tea 2012				
Profit/(Loss) transferred to TRI Operating A/C				
(Note.1) 10561.35 kgs unsold Teas valued COP Rs. @ 473.21				
22,632,481.31				6,437,558.12

TEA RESEARCH BOARD  
ST.JOACHIM ESTATE WORKING ACCOUNT FOR THE  
PERIOD 1ST JANUARY TO 31ST DECEMBER 2013

2012 Rs. Cts	2012 Kg's	2013 Kg's	2013 Rs. Cts	2013 Rs. Cts
<b>REVENUE</b>				
<b>Tea sales Gross Proceeds</b>				
110,783,994.43	279,569.25	292,239	136,950,197.47	(Note. 01)
988,810.26	3,495.75	5,660	1,778,351.47	
<b>111,772,804.69</b>	<b>283,065.00</b>	<b>297,899.00</b>		<b>138,728,548.94</b>
<b>Add</b>				
475,170.38			188,792.08	
9,004,043.96			14,071,403.50	
928,003.40			835,685.28	
4,261,127.00			3,605,739.50	
855,719.52			855,719.52	
15,524,064.26				19,557,339.88
<b>127,296,868.95</b>				<b>158,285,888.82</b>
<b>EXPENDITURE</b>				
<b><u>Less: Estate Expenditure</u></b>				
2,371,521.84			2,855,428.05	
3,321,848.52			3,835,473.17	
6,012,817.64			8,139,184.10	
2,156,741.99			2,293,682.24	
111,689,602.38			132,738,959.88	
<b>125,552,532.37</b>				<b>149,862,727.44</b>
<b><u>Administration &amp; Finances</u></b>				
2,628,254.96			2,297,687.54	
4,935,540.25			4,910,730.14	
<b>7,563,795.21</b>				<b>7,208,417.68</b>
1,904,386.93			2,106,184.89	
<b>135,020,714.51</b>				<b>2,106,184.89</b>
(7,723,845.56)				<b>159,177,330.01</b>
(1,140,965.92)				<b>(891,441.19)</b>
<b>(8,864,811.48)</b>				<b>(186,664.28)</b>
				<b>(1,078,105.47)</b>

**Profit/(Loss) transferred TRI Operating A/C**  
(Note.01) 28,168.50kgs unsold Teas valued NSA Rs. @ 455.89

# AUDITOR GENERAL'S REPORT



## විගණකාධිපති දෙපාර්තමේන්තුව கணக்காய்வாளர் தலைமை அபிபுதி திணைக்களம் AUDITOR GENERAL'S DEPARTMENT



මගේ අංකය  
எனது இல. } LP/I/TRB/1/13/16  
My No. }

ඔබේ අංකය  
உமது இல. }  
Your No. }

දිනය  
திகதி }  
Date }

23 May 2015

The Chairman

Tea Research Board

### Report of the Auditor General on the Financial Statements of the Tea Research Board for the year ended 31 December 2013 in terms of Section 14(2)(c) of the Finance Act, No.38 of 1971.

The audit of financial statements of the Tea Research Board for the year ended 31 December 2013 comprising the statement of financial position as at 31 December 2013 and the statement of financial performance, statement of changes in equity and cash flow statement for the year then ended and a summary of significant accounting policies and other explanatory information, was carried out under my direction in pursuance of Provisions in Article 154(1) of the Constitution of the Democratic Socialist Republic of Sri Lanka read in conjunction with the Section 13(1) of the Finance Act, No. 38 of 1971 and Section 15 of the Tea Research Board Act, No.52 of 1993. My comments and observations which I consider should be published with the Annual Report of the Board in terms of Section 14 (2)(c) of the Finance Act appear in this report. A detailed report in terms of Section 13(7)(a) of the Finance Act was issued to the Chairman of the Board on 15 May 2015.

#### 1.2 Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Sri Lanka Public Sector Accounting Standards and for such internal control as the management determines is necessary to enable the preparation of financial statements that are free from material misstatements, whether due to fraud or error.

#### 1.3 Auditor's Responsibility

My responsibility is to express an opinion on these financial statements based on my audit. I conducted my audit in accordance with Sri Lanka Auditing Standards consistent with International Standards of Supreme Audit Institutions (ISSAI 1000- 1810 ). Those Standards require that I comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatements.





An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgments, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the Board's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Board's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the financial statements. Sub-sections (3) and (4) of Section 13 of the Finance Act, No.38 of 1971 give discretionary powers to the Auditor General to determine the scope and extent of the audit.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my audit opinion.

#### **1.4 Basis for Qualified Opinion**

My opinion is qualified based on the matters described in paragraph 2.2 of this report.

### **2. Financial Statements**

#### **2.1 Qualified Opinion**

In my opinion, except for the effects of the matters described in paragraph 2.2 of this report, the financial statements give a true and fair view of the financial position of the Tea Research Board as at 31 December 2013 and its financial performance and cash flows for the year then ended in accordance with Sri Lanka Public Sector Accounting Standards.

#### **2.2 Comments on Financial Statements**

##### **2.2.1 Sri Lanka Public Sector Accounting Standards (SLPSAS)**

###### **(a) SLPSAS - 07**

- (i) Although the land and buildings are separable assets and are accounted for separately, the Board had shown the value of land and buildings amounting to Rs.201.14 million together in the financial statements instead of being shown them separately.



(ii) Fixed assets amounting to Rs. 158.20 million had not been categorized in the ledger accounts in accordance with the Standard. It was observed in audit that the value of those fixed assets were brought forward over a long period of time and the fixed assets valued at Rs. 662,077 at the Chemistry Laboratory in Colombo could not be physically identified as no such Laboratory of the Board existed in Colombo.

Further, the Chairman of the Board informed me on 01 September 2014 that, since the Institute is an entity of more than 75 years old and its assets are very old and available in the Head Office, Talawakelle, 5 Substations, two Estates and in many other staff bungalows. Most of such assets are depreciated fully and appeared in the accounts at zero value. The assets depreciated to zero value have been identified. The Department of Valuation has undertaken the revaluation and the process is almost completed.

(b) **SLPSAS - 09**

Although inventories are usually written down to the net realizable value, an unusable tea research scientific stock costing Rs. 302,893 shown in the books since 2005 without determining the net realizable value of the stock.

**2.2.2 Accounting Policies**

The accounting policy on the development expenditure had not been disclosed in the financial statements for the year under review.

**2.2.2 Accounting Deficiencies**

The following observations are made.

- (a) Advances amounting to Rs.800,000 and Rs.1,000,000 had been given to the officer in charge of Low Country Regional Office of the Board and Tea Small Holdings Development Authority for training of trainers under Mechanization of Tea Harvesting in Tea Small Holdings Sector Project. However, these amounts had been debited to work-in-progress in full at the end of the year under review without debiting to advances to on going Projects as this activity was in progress.



- (b) Although a sum of Rs. 4,142,173 had been shown under works- in- progress since the year 1982 to test the suitability of tea processing in Sri Lanka during the period 1979 to 1982, it was observed that the project was abandoned due to the machinery purchased were unsuitable for the tea production process in Sri Lanka during those days. However, action had not been taken to adjust the accounts up to the end of the year under review.

### 2.2.3 Unexplained Differences

Although sums of Rs. 30,459 and Rs.1,972,668 had been shown as receivables from Tea Smallholdings Development Authority and Sri Lanka Tea Board respectively as at the end of the year under review, no such amounts had been shown as payables to the Board in the financial statements of the respective institutions.

### 2.2.4 Accounts Receivable and Payable

The following observations are made.

- (a) Sundry debtors amounting to Rs.232,386 relating to the Head Office had remained without being settled for over two years.
- (b) Action had not been taken to recover the debtor balances of St. Coombs Estate totaling Rs.697,663 remaining outstanding for over five years.

### 2.2.5 Non-compliance with Laws, Rules, Regulations and Management Decisions

The following instances of non-compliance were observed.

Reference to Laws, Rules, Regulations and Management Decisions	Non-compliance
(a) Financial Regulations of the Democratic Socialist Republic of Sri Lanka	
(i) Financial Regulation 177(1) and (3)	Daily collections amounting to Rs.3,616,770 and Rs.1,538,515 made during the year under review by St. Coombs Factory and St. Joachim Factory respectively had not been banked daily or at the earliest possible time period and some of these collections had been utilized to meet the day to day expenses.



- (ii) Financial Regulations 371(2)(c)
- (i) Settlement of advances amounting to Rs.280,198 had been delayed more than three months after the completion of the purposes for which the advances were given.
- (ii) The cash advances amounting to Rs.15,267 given by St. Coombs Factory had not been settled for more than 05 years.
- (b) Treasury Circular No 842 of 19 December 1978 Register of Fixed Assets had not been properly maintained as specified by the Circular.

### 3. Financial Review

#### 3.1 Financial Results

According to the financial statements presented, the operation of the Board for the year ended 31 December 2013 had resulted a deficit of Rs. 23.42 million as compared with the corresponding net deficit of Rs.28.68 million of the preceding year, thus indicating an improvement of Rs.5.26 million in the financial results. This increase was mainly due to the increase of other income by Rs18.66 million. Further, the profits from two Estates had decreased by Rs. 8.41 million as compared with the previous year.

#### 3.2 Operating Review

##### 3.2.1 Operating Results of the Estates

Two Estates, namely St. Coombs Estate and St. Joachim Estate including two factories are functioning under the Board and the operating results of the Estates for the year under review as compared with the preceding year are given below.



	<u>St. Coombs Estate</u>		<u>St. Joachim Estate</u>	
	<u>2013</u>	<u>2012</u>	<u>2013</u>	<u>2012</u>
	Rs.'000	Rs.'000	Rs.'000	Rs.'000
<b><u>Tea Sales</u></b>				
Sales Value	183,877	173,875	138,729	111,773
Other Income	2,103	2,356	19,557	15,524
Total Income	185,980	176,231	158,286	127,297
<b><u>Less :</u></b>				
Total Expenditure	(179,510)	(153,263)	(159,177)	(135,021)
Operating Profit /(Loss)	6,470	22,968	(891)	(7,724)
Prior year adjustments	(32)	(335)	(187)	(1,141)
Net Profit/(Loss) (Rs.'000)	6,438	22,633	(1,078)	(8,865)
Sales (Kilogrammes)	374,098	376,712	297,899	283,065
Cost of Production per Kilogramme of Tea (Rs)	473.21	411.49	455.89	405.25
Yield per Hectare (Kilogrammes)	2,400	2,293	1,746	774
Net Sales Average (Rs.1 per Kilogramme)	485.05	455.29	458.62	388.37

The following observations are made in this connection.

- The quantity of sales of the St.Coombs Estate had decreased by 2,614 kilograms in the year under review as compared with the preceding year and the operating profit had also decreased by Rs.16.5 million though the sales had increased by Rs.10 million.
- As a result of increase of sales of tea by 14,834 kilograms, the operating loss of St. Jochims Estate had decreased by Rs.6.8 million as compared with the preceding year.
- According to St. Jochims Estate accounts it was observed that the profit of Rs.1.49 million had been earned from the factory and a loss of Rs. 4.9 million had been sustained from tea estate during the year under review. According to the Tea Book 211,045 kilogrammes of green tea leaves had been obtained from the estate and 1,200,527 kilogrammes had been purchased from the suppliers of tea leaves during the year under review. It was further observed that a better harvest could have been obtained, if infilling activities in vacant areas of the Estate had been carried out continuously. According to the records submitted for audit there were 329,796 vacant plants as at the end of the year under review. Even though a profit of Rs. 1.3 million had been earned from rubber cultivation, no income whatever had been earned from 35 tenant cultivators who cultivated 8.74 hectares of paddy lands.



(d) According to the information made available, the tea production capacities of the machines in two factories had been 10,000 kilograms and 15,810 kilograms per day. However, it was observed that the actual average utilization of the machinery per day had been 4,630 kilograms (46.3 per cent) and 3,870 kilograms (24 per cent) respectively.

#### 4. Performance Review

##### 4.1 Research Activities

The following observations are made.

(a) According to the Progress Reports made available for audit, the financial progress of Research and Development Activities of the Board during the year under review are shown below.

Programme	Amount Allocated		Financial Progress	
	Percentage		Capital	Recurrent
	Capital Rs. Millions	Recurrent Rs. Millions	Capital	Recurrent
i. Crop Improvement	11.50	12.89	64.70	96.97
ii. Land Productivity Improvement	8.81	21.86	71.96	106.31
iii. Impacts of Climatic Change, Adaption and Mitigation Strategies	1.54	2.11	77.92	101.90
iv. Mechanization of Field Practices	0.03	1.84	33.33	135.33
v. Nursery Management Techniques	0.52	0.98	90.38	185.71
vi. Crop Management	5.67	11.77	53.26	91.33
vii. Tea Processing Technology.	2.17	7.56	72.81	96.30
viii. Made Tea Quality	0.74	1.83	6.76	45.36
ix. Value Added Tea Product	5.97	3.65	58.29	41.64
x. Resource Planning	0.44	3.00	29.55	71.67
xi. Experimental Protocol Improvements.	0.02	0.72	50.00	04.17
xii. Technology Dissemination	2.28	11.46	35.09	88.39
xiii. Service to Stakeholders	2.16	15.18	64.81	76.61
xiv. Research Management	7.34	14.80	70.44	125.88
xv. Internal Service and Maintenance	30.81	181.35	67.22	102.97
Total	80.00	291.00	64.76	100.30





- (b) A special Project was launched to popularize tea harvesting and pruning machines among the Tea Small Holders and a sum of Rs. 100 million had been approved by the Government for this purpose. This was initiated by the Board in collaboration with the Tea Small Holdings Development Authority, Federation of Tea Small Holders, Private Tea Factory Owners Association and Sri Lanka Tea Board under the direction of the Ministry. The initial allocation of Rs. 20 million had been received in latter part of the year 2013 and out of that a sum of Rs.2.5 million only had been utilized for this programme.

#### 4.2 Assets Management

The following observations are made.

- (a) Out of the total land 143.810 hectares in extent of the St. Joachim Estate 17.675 hectares had been encroached by external parties over a long period and they had constructed permanent houses and cultivated paddy, tea, coconut and other crops etc. Therefore, the Estate had been losing income from encroached lands and no action had been taken to recover the lands up to 31 March 2014.

The Chairman of the Board informed me on 01 September 2014 that, out of 17.675 hectares an extent of 8.74 hectares of paddy lands had been given to 35 tenant cultivators prior to acquisition of St.Joachim to Tea Research Institute in the year 1963. The balance land had been encroached. The Estate has taken action to obtain the landlord's share of tenant cultivation through Govi Janaseva Center of Ratnapura. The Estate has taken action against encroachments. Those encroachments had taken place more than 25 years ago.

- (b) It was observed in audit that 38 Staff Quarters out of 165 had been idling more than five years up to the end of the year under review.





#### 4.3 Utilization of Funds

The following observations are made.

- (a) Although a sum of Rs. 6,000,000 had been given by the General Treasury in October 2013 for improvement of living conditions of the workers of the Tea Research Institute, the activities related to the programme had not been commenced even up to the date of audit inspection carried out on 23 April 2014 and only Rs.261,680 had been included as consultation and advertising expenses under this programme in the works- in- progress as at the end of the year under review.
- (b) According to the Procurement Plan for the year under review, the activities of the construction of C type Quarters at Deniyaya, renovation of office building and construction of Twin Quarters at Kottawa, construction of labour rest rooms and toilets at Thalawakalle and water supply of Passara had not been implemented according to the plan even up to date of audit on 31 May 2014 though funds amounting to Rs. 9,321,000 had been provided by the Treasury.

#### 4.4 Project Management

The following observations are made.

- (a) Out of the funds amounting to Rs.9,608,752 received from Methyl Bromide Project (MEBR Project) for soil research activities during the period from 2007 to 2008, only a sum of Rs.8,179,693 had been spent up to the end of the year under review. Therefore, a sum of Rs.1,429,059 had not been utilized though the Project period had elapsed on 30 March 2010 in terms of the Project Agreement. The progress of the Project was not furnished for audit.
- (b) Even though a balance amounting to Rs. 187,452 remained under the Project on Tea Factory Studies, no activities had been carried out during the under review.



#### 4.5 Staff Administration

The following observations are made.

- (a) According to the information made available, approved cadre and the actual cadre of the Board as at 31 December 2013 had been 443 and 236 respectively. There were 207 vacancies including 04 Deputy Directors, 05 Heads of Divisions and 14 Principal Research Officers. Action had not been taken by the Board to fill those vacancies since the year 2011.
- (b) Out of the approved and actual cadre of St. Coombs and St. Jochim Estates, those who are working under the Collective Agreement, had been 42 and 31 respectively.
- (c) An allowance of Rs.3,000 per month had been paid to 06 Officers In Charge without obtaining the approval from the Treasury. It was further observed that the post of Officer In Charge was not included in the approved cadre of the Board.
- (d) The Board of Directors had approved on 24 May 2007 to reimburse a monthly labour allowance to the Director, Deputy Directors and Officers In Charge of Regional Offices to maintain their official staff quarters. However this allowance had been calculated based on the labour wages including production bonus, over time attendance bonus etc. and it was observed in audit that sums totalling to Rs.2,717,945 had been reimbursed by the Board during the year without an approval from the line Ministry and the Treasury. The Chairman of the Board informed me on 01 September 2014, that if the approval of the Ministry and Treasury is not given, this payment will be stopped from 01 January 2015.
- (e) It was observed that the following privileges other than those of other similar Research Institutions had been given to the staff of the Board in terms of the Manual of Administrative Procedure of 1995.

##### (i) Leave

	<u>Casual</u>	<u>Vacation</u>	<u>Medical</u>	<u>Total</u>
Senior Grade	11	22	30	63
Junior Grade	05 1/2	22	30	57 1/2
Minor Grade	05 1/2	16 1/2	30	52



(ii) Electricity Quota for Staff occupying in the quarters in Thalawakale and Sub - stations

Grade I	300 units
Grade II	225 units
Grade III- V	150 units
Grade VI	100 units

Action had not been taken to regulate the Manual of Administrative Procedure of the Board to suite the present rules and regulations applicable for the similar Organizations.

In this connection, the Chairman of the Board informed me on 01 September 2014 that the Board has already taken action to appoint a committee to revise Tea Reserch Institute Manual according to the existing circulars in order to make necessary amendments/corrections and Manual of Procedure is revised accordingly.

- (f) According to the information made available, a sum of Rs.27,090,600 had not been recovered from 10 officers who had obtained study leave with full pay and failed to serve the compulsory periods of service. It was observed in audit that a sum of Rs.1,031,668 was included in the gratuity provision relating those officers for the period which they were employed.
- (f) A court case had been filed by the Labour Commissioner against the Board in 2008 for neglect of implementing the decision of the labour tribunal publish in Special Gazette Notification of 26 June 2008 regarding a promotion and grant of permanent status to two employees those who were working at St. Joachim Estate . It was observed in audit that the Board had proceeded the case without come to a settlement at the early stages and a sum of Rs. 902,000 had been paid to private lawyers up to the end of the year under review. However, the case had been withdrawn by the Board in February 2013 and paid sums of Rs. 110,393 and Rs.73,676 in 2013 and 2014 respectively as arrears of increments to those employees.



#### 4.4 Utilization of Motor Vehicles

- (a) Six motor vehicles belonging to the Board had met with accidents in 07 occasions during the year under review. However, these had not been reported to Auditor General in terms of the Financial Regulation 104(2),(3),(4) and the repairing cost had exceeded the reimbursements made by the insurer by a sum of Rs.76,240.
- (b) Six motor vehicles registered in the name of the Director General of the Sri Lanka Tea Board are being used by the Board without being registered under the Board.

#### 5. Budgetary Control

Significant variances were observed between the budgeted and the actuals thus indicating that the budget had not been made use of as an effective instrument of management control.

#### 6. Systems and Controls

Deficiencies in systems and controls observed during the course of audit were brought to the notice of the Chairman of the Board in time to time. Special attention is needed in respect of the following areas of control.

- (a) Accounting
- (b) Payment and Settlement of Advances
- (c) Assets Management
- (d) Receivables and Payables
- (e) Factory Management

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Acting Auditor General