

Annual Report 2009
Tea Research Institute of Sri Lanka



Annual Report 2009

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Cover

Sri Lankan tea industry has been strengthened with timely research on environmentally friendly cultural practices in order to maintain the status of ‘the cleanest tea of the world’. In 2009, TRI has focused more on impacts of global climate change, energy conservation, minimal use of agro-chemicals and use of advanced technologies with the view of addressing emerging global and local challenges.

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Functions of the Tea Research Board

- To conduct, assist and encourage scientific and technological research and investigations, of all problems and matters affecting the production and manufacture of tea including the prevention and control of pests affecting tea, the prevention and control of diseases affecting tea, and the improvement of the quality of tea, as well as the diversification of products manufactured from tea; and to disseminate and publish at its direction, 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 in such industry
- To establish and maintain relations with research institutions in Sri Lanka and abroad
- To conduct, in the discharge of its functions, joint study programmes, seminars or symposia, with foreign research institutions and research institutions in Sri Lanka

Members of TRB

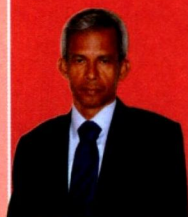
Dr. S S B D G Jayawardena
Chairman,
Tea Research Board



Dr. I S B Abeyasinghe
Director,
Tea Research Institute



Mr. P L U Dissanayake
Additional Secretary
Ministry of Plantation
Industries



Mr. N P Kariyawasam
Chairman
Tea Small Holding
Development Authority



Convenor/ Secretary to TRB



Dr. Mrs. M T K Gunasekare
Head
Plant Breeding Division
(from 01.04.2009)



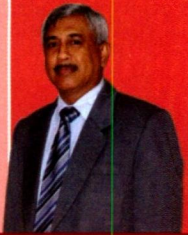
Dr. A M T Amarakoon
Deputy Director Research
(Technology)
(upto 01.04.2009)

Tea Research Board of Sri Lanka

The Tea Research Board of Sri Lanka was established on 12th November 1993 under the provisions of the Tea Research Board Act No. 52 of 1993. In, 2007 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 into the planting and manufacturing of tea.

Dr. D S A Samaraweera
Head of Operations
Tea Smallholders
Factories Ltd



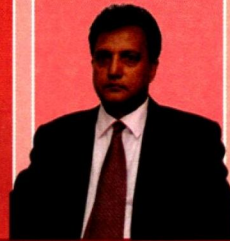
Prof Kapila Gunasekare
Vice Chancellor
University of Vocational
Training



Dr. D V Seevaratnam
Chief Executive Officer
Watawala Plantations Ltd



Mr. Nimal Mithrarathna
Additional Director General
Ministry of Finance and
Planning



Mr. J M B J Bandara
President,
Sri Lanka Federation of
Tea Smallholders (Ratnapura)



Members of the consultative Committee on Research

Dr. D S A Samaraweera	Head of Operations, Tea Smallholders Factories Ltd
Dr. S S B D G Jayawardena	Chairman, Tea Research Board
Dr. I S B Abeysinghe	Director, Tea Research Institute
Mr. D V Seevaratnam	Chief Executive Officer, Watawala Plantations Ltd
Dr. D T Wettasinghe	Ex Deputy Director (Research), Tea Research Institute
Prof. W A J M De Costa	Department of Crop Science, University of Peradeniya
Prof. Kapila Gunasekare	Vice Chancellor, University of Vocational Training
Mr. N Pilapitiya	Proprietor, New Vithanakanda Tea Factory
Mr. Russel Tennakoon	Director/ General Manager, Ceylon Tea Brokers Co. Ltd
Mr. M B Cyril	Deputy General Manager (Development), Tea Small Holdings Development Authority
Mr. S K L Obeysekare	Director/ CEO, Balangoda Plantations Ltd
Mr. Parakrama Jayasinghe	Director (Engineering), Haycarb (Pvt) Ltd
Mr. Melvin Samarasinghe	Vice President, Agro Technica Ltd
Mr. G D V Perera	Director, Lankem Tea & Rubber Plantations (Pvt) Ltd
Mr. L J Pieris	Managing Director, Helix Engineering (Pvt) Ltd
Dr. A M T Amarakoon	Deputy Director Research (Technology) (upto 27.06.2009), Tea Research Institute
Convenor/ Secretary of CCR	
Dr. L S K Hettiarachchi	Deputy Director Research (Production) Tea Research Institute

Members of the Consultative Committee on Estates and Advisory Services

Mr. D V Seevaratnam	Chief Executive Officer, Watawala Plantations Ltd
Dr. S S B D G Jayawardena	Chairman, Tea Research Board
Dr. I S B Abeysinghe	Director, Tea Research Institute
Dr. D S A Samaraweera	Head of Operations, Tea Smallholders Factories Ltd
Mr. Dhayan Madawala	Chief Executive Officer, Hapugastenna Plantations Ltd
Mr. Mohan Ganapathy	General Manager, Kelani Valley Plantations Ltd
Mr. T A G De Mel	General Manager, Balangoda Plantations PLC (from October 2009)
Mr. Asoka Somaratne	Ex Deputy General Manager, Tea Small Holdings Development Authority
Mr. S Wirasinghe	Ex Director, Department of Agriculture
Mr. S D Nandasena	General Manager, Tea Small Holdings Development Authority (upto June 2009)
Mr. K G B Obeysekare	Deputy General Manager, Tea Small Holdings Development Authority (from September 2009)
Convenor/ Secretary of CCEA	
Mr B A D Samansiri	Head, Advisory and Extension, Tea Research Institute
Dr. V S Sidhakaran	Actg. Head, Advisory and Extension, Tea Research Institute

Members of the Audit and Management Committee

Mr. Nimal Mithrarathne	Additional Director General, Ministry of Finance and Planning
Mr. J M B J Bandara	President, Sri Lanka Federation of Tea Smallholdings (Ratnapura)
Mr. R Kariyawasam	Internal Auditor, TRI, Convenor/ Secretary of A&M

“In keeping with the global needs and initiatives, TRI research programs and strategies are directed to mitigate the effects of climate change and generate information on use of alternate energy and conservation of energy and technology recommendations to be environmentally friendly”



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

Report of the Chairman, TRB

Tea Industry crisis, started in 2008, continued through the first quarter of 2009. Tea auction sales and prices started improving during the 2nd quarter of 2009 due to government policy interventions and financial assistance extended to smallholder sector through fertilizer subsidy and low interest bank loans to Regional Plantation Companies and Private Tea Factory Owners. However, the year under review was a very difficult one for the tea sector as a whole, as drought prevailed during the first quarter contributed to significant reduction in tea production. The situation was further compounded due to daily wage increase which became effective from April 2009. Tea Research Institute's two tea factories, St. Coombs and St. Joachim, also incurred financial losses and institute had to face difficult times as wage increase arrears payment constituted a significant share in the Institute budget.

During 2009, governing Board of the Tea Research Institute guided and directed the institute to respond to industry needs in managing the crisis. Institute scientists quickly responded to industry needs and conducted many seminars, workshops and special advisory visits to enhance the knowledge in cost saving strategies through conservation of energy, judicious nutrient management and increasing crop and worker productivity.

Analysis of climate data during January – December 2009 clearly revealed a climate change pattern as the monthly rainfall was erratic in all tea growing regions. Monthly rainfall during North-East monsoon has dropped considerably in all regions. Number of dry days during January – April 2009 has increased significantly contributing to low crop yields. Increase in average monthly temperatures has been recorded in all regions. Variation in maximum and minimum temperatures, rainfall and photo period during the year 2009 significantly contributed to the yield fluctuations in Ratnapura region. However, in Galle region it appeared that maximum temperature and rainfall fluctuations were the significant contributing factors for yield fluctuations, while Hantane and Passara, important climatic parameters were photo period and minimum temperature respectively. In Talawakelle region no significant yield fluctuations were observed due to climatic variations during 2009. All in all it could be summarized that a noticeable change in weather parameters occurred during January – July 2009 contributing to significant crop losses.

Having paid serious attention to changes in climate and its impact on tea cultivation, governing Board directed the TRI scientists to pay attention to the importance of re-visiting the timing of TRI recommendations on field operations such as planting, pruning and fertilizer applications etc.

In order to ensure that Institute's research program is stakeholder-driven and focused towards smallholder needs, Board encouraged and facilitated the diagnostic survey which generated very valuable information useful in making necessary policy decisions. Findings of this survey will be disseminated during 2010 while recommending corrective measures to the industry. Annual review of divisional research programmes were carried out with the participations of highly recognized scientists from other R & D organizations and industry. Review process enabled the Board to ensure that targets set in the Corporate Plans are achieved while enabling the Institute to enhance the quality of research and also serving as a tool to encourage, appreciate and acknowledge the work done by respective scientists. Annual review ensured maximum inter-disciplinary integration and team approach.

Through the annual review process and Consultative Committee on Research, Board has ensured that research undertaken is cost effective, industry development oriented and contributes to livelihood improvement of tea smallholders while fostering science and technology innovative culture enabling the Institute and the industry to face future global challenges and national development needs. Board also carefully guided the Institute research programmes to maintain a fair balance in basic, applied, adaptive and development research. Board also paid special attention to the advisory and extension role of the Institute and encouraged new initiatives in technology transfer to enhance knowledge of the industry stakeholders including tea smallholders.

Board encouraged and promoted TRI scientists to establish strong linkages and working relations with other national and international R & D organizations, universities and private sector organizations.

In keeping with the global needs and initiatives, TRI research programmes and strategies are directed to mitigate the effects of climate change and generate information on use of alternate energy and conservation of energy and technology recommendations to be environmentally friendly.

Consultative Committee on Research represented by senior stakeholders of the industry and eminent scientists regularly reviewed the Institute's research programmes, discussed and analyzed divisional research projects and paid attention to staff development needs of the Institute. Consultative Committee on Estates and Advisory Services continued to guide the management of two estates of the Institute while contributing to significant improvement in our advisory and extension services including the advisory role played by the technology division in assisting Regional Plantation Companies and Private Tea Factory Owners' in manufacturing technology.

Advisory and Extension Division of the institute continued to give leadership in co-ordinating the activities of the regional advisory and extension centres at Passara, Deniyaya and Kottawa. Crop clinics held regularly at these locations and various training programs conducted were

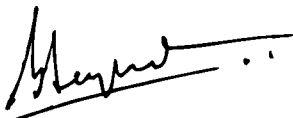
very effective in transferring new knowledge to smallholder farmers and Regional Plantation Companies. Regular Regional Scientific Committee meetings were very productive in establishing stakeholder linkages and knowledge transfer procedures. Low Country Station at Ratnapura continues to give leadership on research and development activities related to mechanization needs of the tea industry. Low country Regional Centre at Ratnapura played a major role in training smallholders in Ratnapura, Galle, Kalutara and Matara districts while continuing its mandated research activities in plant breeding, agronomy, plant protection and nutrient management.

Mid country Regional Centre at Hantane continued to give leadership in co-ordinating the mother bush program during 2009 and issued 12.2 million cuttings of improved tea cultivars from TRI and TSHDA mother bush sites in different locations. Due to serious drought conditions prevailed during the 1st quarter of 2009 a significant drop of about 600,000 cuttings were recorded. Mid Country Regional Centre at Hantane played a vital role in assisting SLSPC and JEDB in their technology and advisory needs.

During 2009, institute lost a very senior scientist, Head, Biochemistry Division who also functioned as the Deputy Director Research (Technology). His resignation to join the University system to further his carrier was a great loss to the Institute and to the sector as there are no senior officers to take over his position. Four other junior scientists also resigned creating a vacuum in the fields of Entomology, Biochemistry, Technology and Soils and fertilizers.

The governing Board closely monitored the institute's administrative and financial management by scrutinizing the regular audit committee reports and general audit reports to ensure good governance and financial management.

I take this opportunity to appreciate and acknowledge the contribution and commitment of the board members in governing the Tea Research Institute to achieve its goals. Direction, advice and the facilitating role played by the Hon. Minister of Plantation Industries, Secretary and Ministry officials in governing the Tea Research Institute is highly commendable



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



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

Tea Research Institute of Sri Lanka

The Tea Research Institute of Sri Lanka was established to enrich the tea industry through professional tea research. TRI, which was started as an arm of the Planters' Association of Ceylon, is presently governed by the Tea Research Board of Sri Lanka subsequent to gradual transformation.

Senior Management

Director/ Chief Executive Officer

Dr. I Sarath B Abeysinghe

B Sc (Peradeniya, Sri Lanka) Ph D (Sheffield, UK)

Deputy Director Research (Production)

Dr. L S K Hettiarachchi

B Sc (Peradeniya, Sri Lanka) Ph D (Aberdeen, UK)

Deputy Director Research (Technology) – up to 27th June 2009

Dr. A M T Amarakoon

B Sc (Peradeniya, Sri Lanka) Ph D (Southampton, UK)

Deputy Director (Administration)

Mrs. S S Guruge

B Sc (Kelaniya, Sri Lanka) (SLAS, Grade II)

“A demand driven research and development program on all aspects of tea cultivation and processing is a must to address emerging local and global challenges”



I Sarath B Abeysinghe
B Sc (Peradeniya, Sri Lanka)
Ph D (Sheffield, UK)

Review of the Director, TRI

1. General

TRI, Deniyaya Regional Extension Center was officially declared open by Hon. D M Jayaratne, Minister of Plantation Industries on 30th September 2009.

Iranian Parliamentary delegation led by Mr. Mahamoud Gorji, The Ambassador of Iran visited the TRI on 3rd November 2009. A proposal to sign a MOU on mutually beneficial aspects on tea production and exchange of scientists was agreed.

Honourable Federal Minister for Science and Technology of Pakistan, Mr M A K Swati made a visit to TRI in November 2009 to establish bi-lateral cooperation on tea research and related matters.

Prof. Liang Chen, Associated Director, National Center for Tea Improvement, Tea Research Institute of Chinese Academy of Agriculture Sciences, China visited TRI in December 2009 on a familiarization study tour.

2. Research, Advisory and Extension Matters

Scientific Advisory Committees (SAC) were appointed to review the progress of research projects carried out as per the TRI Corporate Plan 2008 - 2012.

The members of the SACs were;

- Agronomy Division
Prof. H P M Gunasena, Prof. W A J M de Costa and Prof. S Subasinghe
- Biochemistry Division
Prof. Ratnayake Bandara, Dr. Nandani Ediriweera and Dr. A C Liyanage
- Entomology and Nematology Division
Dr. N C Gnanapragasam, Prof. Rohan Rajapaksa, Dr. C Kudagamage and Dr. Anura Wijesekera
- Plant Breeding Division
Dr. Lalith Perera and Dr. Sumith Abeywardena
- Plant Pathology Division
Prof. R L C Wijesundare and Prof. N K B Adhikaram
- Soils and Plant Nutrition Division
Prof. A N Jayakody and Dr. Sarath Amarasiri
- Technology Division
Dr. D S A Samaraweera and Mr. Parakrama Jayasinghe

Research Highlights

- Tea plants raised through a refined micropropagation (*in vitro*) protocol was successfully integrated into the conventional breeding program for the first time, authenticating the practical application of tissue culture techniques in reducing the time taken to develop new tea cultivars by six years
- Germplasm collection was uplifted appreciably by adding accessions of diverse exotic origin
- Slow fermenting exotic germplasm were identified using fermentation test conforming their suitability for green tea
- A wide array of diversity was created by incorporating traits from distantly related germplasm of exotic origin to augment the base material with novel genes to meet the future needs of the end-users in a broader perspective
- Investigations carried out to find compatible scion and stock combinations for grafting to achieve high quality and productivity showed that TRI 777/ TRI 2025; TRI 777/ TRI 3020; TRI 777/TRI 3019; TRI 4067/TRI 3020 and TRI 4079/TRI 3020 give rise to higher yields compared to controls (TRI 777, TRI 4067 and TRI 4079) at St Coombs

- **Field trails to establish pesticide residue levels under Good Agricultural Practices as per FAO guidelines**

This activity continued during 2009.

- **Fungicides**

- Declining trials and regional trials for Tebuconazole, Bitertanol and Propiconazole were completed
- *In vitro* and field bio-efficacy trials were completed on a new generation fungicide, Pyraclostrobin (F 500) as an alternative for Bitertanol and Propiconazole. Results showed good control of blister blight with the new fungicide

- **Insecticides**

- Declining trials and regional trials for Fenthion was completed
- Declining and regional trials on Sulphur under GAPs were completed
- A new acaricide, "Acaritouch" (Lauric acid 70% EC) was found to be effective in controlling mites in tea plantations in an environmentally friendly manner

- **Weedicides**

- Field trials on MCPA continued during 2009

• **Other issues related to MRLs**

- A seminar was held in March 2009, where Mr. N Miura, Mitsui Norin Co. Japan presented the expectations of Japanese buyers on the use of pesticides. Difficulties encountered in plantations due to stringent MRLs in Japan were presented by a Planters Association representative
 - Meeting of the working group on MRLs appointed by the FAO/IGG was held in FAO Head quarters in Rome. Action plan to establish pesticide residue levels in the tea brew was developed
-
- Factors affecting potassium (K) availability in soils of different tea growing regions were identified to facilitate the Integrated Nutrient management (INM) approach. Elevation and gravelliness had a significant influence on available K. Soil organic carbon had a significant correlation while pH had a low negative relationship. Dolomite application had a significant influence. Application of fertilizer mixtures with different N to K ratios did not affect the K availability.
 - Investigations to find out alternatives for the use of sedimentation tanks in tea nurseries showed that raw water treated with bleaching powder at the rate of 100g/1000 L of water was effective in eradicating nematodes in raw water.
 - Laboratory bioassays carried out with a local strain of entomo-pathogenic fungi with incorporated UV protectants has significantly improved SHB control with compared to applying entomo-pathogenic fungi without UV protectants.
 - The effects of temperature and exposure to UV radiation on the vegetative growth and the pathogenicity of EPF *Beauveria bassiana* were quantified *in vitro*.
 - The first record of stem canker caused by *Fusarium spp* in Sri Lanka was recorded in a tea garden in Dehiowita area. The causal agent was identified as *Fusarium solan*
 - Membrane filtration technique was introduced to separate and prepare proteins from refuse and spent tea and the technique economically feasible.

Advisory and Extension Activities

- "Advisory-Research Linkage" was reactivated to improve the interaction between research and advisory staff at the TRI.

- **Diagnostic census in the corporate sector tea estates**
 - The agricultural census was carried out from 2007 - 2008 covering all 307 tea estates managed by 20 Regional Plantation companies was updated
 - Field-wise information on the average yields in last completed cycle, average length of pruning cycle, the average amounts of nitrogen applied and all the agricultural practices adopted by the estate were collected in this study

- **Private-Public Partnership Extension Approach**
 - A Factory based Private–Public Partnership Extension Approach for effective dissemination of technologies for tea smallholders through the participation of private tea factories was initiated
 - Para Extension Aide approach, a novel technology dissemination approach was introduced In view of reducing the technology adoption gap in the corporate sector plantations

- **ADB Motherbush project**
Supply of 3000 and 4000 series planting material – ADB mother bush project
 - Total of 12,892,511 cuttings from TRI 3000 and 4000-series were issued from the TRI, TSHDA and private motherbush sites
 - Site Manager’s meeting of the ADB mother bush programme was held in March 2009. A guideline on timing of pruning to issue cuttings at the required planting season was issued
 - Seed/ planting material certification
 Considering the importance of the availability of quality planting material to the growers, decision was taken to appoint representatives from the plantation crop sector to the National Seed Council. It was also agreed to designate “authorizing officers” from the plantation sector to facilitate implementing the Seed Act No. 22 of 2003.

3. Awards and Recognitions

- Dr. Mrs. M T K Gunasekare received a Presidential Award for Research (2005) and (2006) for the publication “Encapsulation of embryonic axes of *Camellia sinensis* L. (tea) and subsequent *in vitro* germination” in Journal of Horticultural Science and Biotechnology (2005) 80(1), 154 – 158 and “Direct somatic embryogenesis from explants derived from embryonic axes of tea” published in Journal of Horticulture Science & Biotechnology (U K), 81(3): 883 - 890 respectively.

- Dr. K M Mohotti received a Presidential Award for Research (2005) for the publication “Perfluorinated organic compounds in human blood serum and seminal plasma: a study of urban and rural tea worker population in Sri Lanka” in Journal of Environ. Monit. (2005) 7, 371 - 377.
- The National Research Council has awarded Rs. 5 million for the project title “Application of membrane filtration techniques in the preparation of protein from refuse tea” submitted by Dr. A M T Amarakoon and Mr. G A A R Perera.
- The National Research Council has awarded Rs. 4.4 million for the project title “Use of SSR markers for genetic characterization and finger printing of recommended tea cultivars and for tagging of blister blight diseases resistance in tea”, submitted by Mr. K M Mewan,
- Dr. I S B Abeysinghe, Director, TRI was invited to serve as the Editor for the book titled “ Smallholder tea growers” in the book series of Global Advances of Tea sciences by the International Society of Tea Science.
- Dr. L S K Hettiarachchi and Dr. Mrs. M T K Gunasekare were invited by the CRI to serve as reviewers to review the research programs on Soils and Plant Nutrition / Physiology / Agronomy and Genetics and Plant Breeding respectively.
- Dr. M A Wijeratne, Senior Research Officer, Agronomy Division is appointed as an Assistant Commissioner to the Sri Lanka Inventors Commission.
- Dr. Mrs. M T K Gunasekare was appointed as a member of two National committees, National Committee on Agricultural Biotechnology and National Committee on Plant Breeding, by the CARP.
- Dr. M A Wijeratna, Senior Research Officer, Agronomy division was invited to make a presentation on “*Climate change and its impact on Plantation Crops*” at the National Conference on Global climate change, organized by the University of Peradeniya.
- Dr. K M Mohotti was invited as country representative for Special Asian collaboration meeting at the East Asian Organic Conference in Korea.
- Project proposal submitted on “Low-cost *in vitro* propagation method for developing disease resistant tea varieties through embryo rescue” was selected to include in the National Biotechnology R&D program and an investment plan” which was jointly developed by FAO & CARP.

Publications

- Annual Report 2008
- Annual Report 2007 – Sinhala and Tamil
- TRI Update (Volume 13 No. 1)
- “Thei Thathu” (Sinhala) (Volume 6 No. 2)

- Advisory circulars
 - PU 1 – PU 4 on pesticide use
 - SP 7 - Soil Analysis, SP 8 - Analysis of Fertilizer samples, SP 9 - Sampling of foliar analysis of tea
 - PM 10 - Management of Tea Tortrix, PM11 - Fumigation of Nursery soils for Nematode
 - PN2 - Tea Nursery management
- Guideline
 - Use of Selective Tea Harvester
 - Measures to be Adopted on Tea Lands following Drought
- Cautionary note on “Use of Glyphosate”

Patents

“Discovery of an analytical method based on biosensor technology for monitoring polyphenol oxidase activity of tea flush" Patent No.14791

Ayanthi N. Navaratne and I S B Abeysinghe

4. Collaborative work/Links with other organizations

- **Uva Wellassa University**

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

- **Tocklai Tea Research Association**

The collaborative work programme between Tocklai Tea Research Association and the TRI generated residue data on copper and sulphur in order to make submissions to revise MRLs set by European Union

- **Shizuoka Sangyo University**

Prof. Katsuo Yamasaki, School of Management, Shizuoka Sangyo University, Japan and Mr. Akira Tsunogae, Kanemo Co. Ltd., Japan visited TRI on 5th March 2009. Discussions were held on production of green tea suitable for value added products.

- **TRI, SLTB, CTTA Meetings**

A special tripartite consultative meeting of Sri Lanka Tea Board/TRI/CTTA was held on 7th December 2009 to finalize the ISO definition on white tea.

Tripartite committee meeting SLTB, TRI and CTTA was held in August 2009. CTTA was briefed regarding the current position of MRLs and other developments at TRI.

- **Directors' Forum**

Director's forum, where Directors of Tea Research Institute, Rubber Research Institute, Coconut Research Institute and Sugarcane Research Institute meet to discuss common issues, was held in February, May, June, July, October, November 2009. Major topics discussed were; (1) Finalization of new scheme of recruitments; (2) Research collaborations: three sub-committees were appointed to discuss research activities related to crop improvement and biotechnology, soil fertility improvement and pests and diseases; (3) Organizing the third Crop Research Symposium.

- **TRI-TSHDA Linkage**

A joint program by the TRI, TSHDA and NFS was implemented to monitor the quality of fertilizers at various stages (eg. at the point of importation and blending *etc*) to ensure the quality of fertilizer used in tea cultivation.

5. Important meetings/ conferences attended

Meeting of the working groups appointed by the FAO/ IGG was held in FAO Head quarters meeting in Rome. Director, TRI was a member of the Sri Lankan delegation. Main topics discussed were (1) Geographical indicators of tea (2) Tea trade and quality and (3) MRLs in tea brew.

Director, TRI and Dr. A M T Amarakoon, Deputy Director Research (Technology) attended the 22nd Meeting of the ISO Technical Committee on tea.

6. Outside projects undertaken

- **Smallholder Plantations Entrepreneurship Development Programme (SPEnDP)**

Results of the factory study conducted under Smallholder Plantations Entrepreneurship Development Program (SPEnDP) were presented to the project staff in May and the final report was submitted.

- **National Awareness, Outreach and Evaluation Program on the Phasing-out of Methyl Bromide in the Tea Industry in Sri Lanka**

"Ozone Friendly Pure Ceylon Tea" logo was developed in order to add value to Ceylon tea.

Development Activities

The construction of the OIC bungalow and Guest House at Deniyaya Regional Extension was completed.

7. Special issues/ events

A study was conducted to study the drop in tea production in smallholdings sector in the year 2009. The study revealed that weather conditions prevailed during January to July 2009 played a key role in causing yield decline observed in low country. Low rainfall, high temperature, less number of wet days during January to March and less number of sun shine hours with overcast conditions during June/ July created unfavorable environment for growth of tea. In addition to the adverse weather condition, low soil pH values, low level of soil Carbon, K and Mg under poor soil conditions too also contributed considerably towards yield decline.

The committee appointed to examine the soil rehabilitation techniques, submitted their report to the CCR and based on their recommendations it was decided to develop a Soil Quality Index and to use it in proposed field trials on post replantation and rehabilitation techniques with *Grilicidia* and *Flemingia*.

8. Cadre and staff position

- Deputy Director Research (Technology) resigned from the service of the TRI with effect from 26th July 2009.
- Three Research Assistants, two Advisory Officers and a Clerk of Works were appointed to the TRI. One Research Assistant was a new recruitment while others were internal promotions.
- Dr. N Punyasiri assumed duties as a Senior Research Officer (Contract basis) on 5th October 2009.
- Mr. Chaminda Oliver was appointed as the Superintendent, St. Coombs Estate w.e.f 15th November 2009.
- Mr. P S Habaragoda was appointed as the Superintendent, St. Joachim estate w.e.f 15th November 2009.

9. Administrative and Financial Matters

Salaries and Cadre Commission members visited TRI on 2nd April 2009 to address the salary anomalies created by the implementation of Management Services Department Circular No. 30. Opportunities were given to trade union members, groups and individuals to discuss their grievances with the Salaries and Cadre Commission members.

Financial performance

Initial treasury allocation of Rs. 350 million (Recurrent Rs. 247 million and capital Rs. 103 million) for TRI was reduced to Rs.315.9. Severe cash flow problems were experienced in the first half of the year which hampered the activities of the Institute.

Human resource development

Postgraduate achievements

The following officers have completed their postgraduate degrees during 2009.

- Dr. V S Sithakaran – Ph D in Agriculture Extension
- Dr. W S Botheju – Ph D in Process Technology

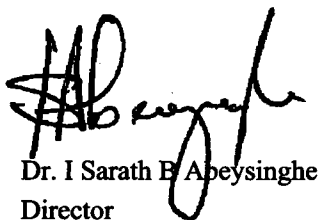
10. Performance of TRI estates

St. Coombs Estate

- Mr. J Hulangamuwa, Superintendent of St. Coombs completed his contract period on 30 April 2009 and Services of Mr. Gimhan Jayatilaka, Manager, Palmestern Estate was obtained to overlook St. Coombs Estate with effect from May 1, 2009
- Mr. Chaminda Oliver was appointed as Superintendent, St. Coombs Estate *w.e.f* 15 November 2009
- The rank of the St. Coombs estate was 8th and 7th in August and September. It was encouraging to note that St. Coombs Estate obtained the highest price for Dust 1 in the western high grown category in September 2009.
- Average yield of St. Coombs was 2105 Kg /ha. St. Coombs Estate made a profit of Rs.8.22 million during 2009 which is above the estimated figure Rs. Mn. 5.9
- St. Coombs Estate was selected by the Ethical Tea Partnership (ETP) for a pilot project in Sri Lanka.

St. Joachim Estate

- Mr. A U Weerasinghe Superintendent of St. Joachim completed his contract period on 1 November 2009
- Mr. P S Habaragoda was appointed as Superintendent, St. Joachim Estate *w.e.f* 15th November 2009.
- St. Joachim Estate made a loss of approximately Rs. 6.24 million during 2009. Estate is operating under capacity due to difficulties in obtaining green leaf.
- TRI and “Ruwanpura Gemidiriya Ekabadda Samagama” agreed to sign an MOU where Gemidiriya will supply green leaf to St. Joachim tea factory through the members of their organization.



Dr. I Sarath B Abeyasinghe
Director



Due to the rapid changes in socio-economic conditions of the modern society, additional income sources should be generated for plantations sector workers. Younger generations of rural women in the sector are highly potential if they are provided with needful trainings.

Agricultural Economics Division

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

Highlights of the Year

Socio-economic status of women in the tea gardens of Nuwara Eliya in Sri Lanka and Himachal Pradesh in India were compared. It was found that lack of opportunities and training provided to Sri Lankan women engaging in small scale industrial activity to supplement their income.

Peer-Reviewed Publications

- Shyamalie H W 2008 Socio-Economic Status and Livelihood Security of Women: Comparative Study of Hills of India and Sri Lanka, PhD thesis, Department of Agricultural Economics, CSK Himachal Pradesh Krishi Vishvavidyalaya Palampur
- Shyamalie H W and Saini A S 2009 Livelihood Security of Women in Mountains of India and Sri Lanka. Indian Journal of Agricultural Economics. (Accepted for publication)
- Shyamalie H W Saini A S and Tharkur D R 2009 Entrepreneurial Behaviour of Rural Farm Women in Tea Growing Locations. Sri Lanka Journal of Tea Science. (submitted for publication)
- Shyamalie H W and Saini A S 2009 Socio-economic status and livelihood security of women in hills of India and Sri Lanka. Readworth Publishers, New Delhi (Accepted for publication)
- Nakuline P, Abeynayake N R and Shyamalie H W 2009 Use of Multilayer group method of data handling for predicting tea crop production. AGRES Research, Faculty of Agriculture & Plantation Management, Wayaba University, Markandura.

Thrust A31. Identification of socio-economic measures to overcome shortage of workers in the tea sector

A 31.5 Identifying appropriate measures to overcome worker shortage in large plantations

The objective of this project is to recommend appropriate measures to improve worker productivity in the tea sector. Primary and secondary data were collected from Galamuduna and Hellbodde Estates. Some of factors identified to improve worker productivity were block plucking, recognize and reward good pluckers, contract work for registered workers, identify problems encountered by workers at the muster and help them to overcome their problems and organize programs to address issues related to health, alcoholism and hygiene *etc.*

Basic Research Projects

B1. Establishment and maintenance of a database on tea sector

The objective of this study is to analyze statistical data of Sri Lanka tea industry. Information on production, distribution, exports, imports, consumption, tea market prices and value added products were compiled. Data were analyzed and presented at the 23rd E & E Forum (Smallholder Sector).

B5. Cost calculating model for tea cultivation and processing

Digital cost calculation model for tea cultivation was completed.

D/Econ 2. Economic evaluation and micro analysis of of research recommendations

The following economic analyses, cost-benefit analyses were conducted during the year.

- Economics on the use of different air heaters
- Economics of soil rehabilitation, a revisit
- Economics on bought leaf supply to St. Joachim factory
- Strategies to cope up with high cost of production in the corporate sector with recent wage increase. Information was presented at 220th E & E forum (Corporate sector)
- Impact of wage hike in plantation sector on different components of cost of production
- Benefit cost analysis was done for shade management, site specific fertilizer recommendation, burying of pruning, replanting with new cultivars and drought mitigation
- Data on production (Agro-climatic district wise), climatic data (Rainfall, no. of wet days, sunshine hours and temperature) from meteorological stations situated in tea growing regions were analyzed for the study on drop in national tea production in Galle and Matara districts

Socio-Economic impact of drought in plantation sector

Primary and secondary data were collected from Morogolla, Lelwala, Walpita, Hays, Delmar, Liddesdale, Brownswick, Nayabedde and Gowerakelle Estates. Analysis of data is in progress.

Seminars and Meetings

- H W Shyamalie participated at a one day work shop on “managing for development results” organized by ministry of Plantation Industries on 06th March 2009 at the auditorium of Ministry of Plantation Industries.
- H W Shyamalie participated at a training program on Economics and Trade Related issues in Bio-Technology in Sri Lanka conducted by Sri Lanka Council for Agricultural Research policy (CARP) in collaboration with United Nations Food and Agriculture organization in Sri Lanka (UNFAO-SL) held on 21st April 2009 at National Institute of Library and Information Sciences (NILIS), University of Colombo.
- H W Shyamalie participated at E & E Forum (smallholder sector) held on 15th May 2009 at Ratnapura, Tea Research Institute.
- H W Shyamalie conducted a lecture on cost of tea cultivation and labour economics to trainee planters on 16th May 2009 at TRI Auditorium.
- H W Shyamalie delivered a presentation on ‘A Revisit on Economics of Soil Rehabilitation’ at the second meeting of the Committee appointed to study experimental evidence on soil rehabilitation techniques held on 23rd June 2009 at the auditorium of Sri Lanka Tea Board.
- H W Shyamalie and J C Bandara attended crop clinics held on 20th August 2009 and 3rd December at Uva and Kottawa.
- H W Shyamalie delivered a seminar on improvement of productivity to cope up high cost of production in corporate sector at RSC Talawakelle held on 20th November 2009.
- H W Shyamalie presented a paper at the 23rd E & E Forum (smallholder sector) on උසස් ජීවිතයක් සඳහා වෙළඳපොළ ප්‍රවණතා සහ අභියෝග පිළිබඳ විශ්ලේෂණයක් held on 14th December 2009 at the auditorium of Tea Research Institute, Talawakelle.
- H W Shyamalie delivered a seminar on improvement of productivity to cope up high cost of production in corporate sector at RSC Kandy held on 21st December 2009.

General

- Dr. H W Shyamalie completed her postgraduate education in December 2008 and assumed duties at the division
- Ms. K W N Nadeeshani, Technical Assistant, transferred to the Agricultural Economics Division *w.e.f* 2nd March 2009
- An undergraduate student from Wayamba University carried out a research on Use of Multilayer Group Method of Data Handling for Predicting Tea Crop Production.
- An inductive training was conducted for newly appointed Extension Officers and an awareness program was carried out for Trainee Asst. Superintendent in Stafford Estate.

Grafting has a high potential in obtaining composite plants with vigorous root-stocks and scions to support continuous production of healthy vegetative shoots.

Cultivar selection for stock



stock



Cultivar selection for scion



scion



Insert scion into stock



Graft union wrap by polythene



Agronomy Division

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

Highlights of the Year

- Investigations on the compatibility of stock and scion combinations for grafting towards better pest and disease tolerance, quality and productivity levels revealed that the rate of success of grafting is around 85%.
- Pesticide residue declining trials on MCPA at St. Coombs in dry season was completed
- A reduction of both sink strength and source capacity in the 4th year of pruning cycle were the main reasons for yield declining

Peer-reviewed Publications

- Wijeratne M A, Amarathunga M K S L D and Anandacumaraswamy A 2009 Effects of climate change on tea production in Sri Lanka and adaptation measures *In: Proceedings of the first national conference on global climate change and its impacts on agriculture, forestry and water in the tropics.* Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka. pp. 29-29
- Wijeratne M A 2009 Adaptation to the threats of climate change: Plantation crops with special reference to tea. Proceedings of the workshop on mainstreaming climate change for sustainable development in Sri Lanka. Dambulla, 19-21 August 2009. Institute of Policy Studies, Colombo, Sri Lanka
- Costa W A J M, Nawaratne D M S and Anandacumaraswamy A 2009. Physiological basis of yield variation of tea during different years of the pruning cycle in the central highlands of Sri Lanka. *Expl. Agric.* Vol 45, pp 429-450 Cambridge Univ. Press.
- Prematilake K G, Froud-Williams R J and Ekanayake P B (2008). Appraisal of the Weed Seed bank in Low-Grown Tea (*Camellia sinensis* [L. Kuntze]) Soil under different weed management techniques, *S L J Tea Sci.*, Vol 73, Part 1 March, Tea Res. Inst. of Sri Lanka, pp 11-28.

Thrust A 19. Development of water management techniques for young and mature tea in drought prone areas to minimize casualties and enhance yield

A 19.1 Evaluating different irrigation systems for low-grown tea (WL 2)

a. Evaluating drip irrigation in mature tea at St Joachim Estate (1999)

The plants were pruned in May 2009. Prior to pruning, plants were rested from March 2009. Tea yield for the period of January - March 2009, during which a severe dry spell was prevailed, was recorded.

Irrigated plots showed a yield increase during the dry spell significantly (509 and 547 MT kg per ha) compared to that of non-irrigated plots (177 and 205 MT kg per ha). TRI 3025 yielded more than TRI 2023 during dry months and the difference was significant (343kg for TRI 2023 vs 376 for TRI 3025).

b. Evaluating drip and sprinkler irrigation systems for mature tea (TRI 2023) at St Joachim Estate (2001)

Tea plants were pruned in May 2009. Prior to pruning, yield was recorded for the period of January-March, where dry weather was experienced. Treatment with sprinkler irrigation showed significantly higher yield (841 ± 58.2 Kg/ha/yr) than control plots (537 ± 50.2). Drip irrigation recorded 665 ± 38.4 Kg/ha/yr.

c. Studying plant water use under irrigated and non- irrigated tea

An experiment was conducted to evaluate the transpiration rate under rain-fed and irrigated systems with TRI2023 cultivar. The irrigated plants consumed higher water content (2.19 ± 0.27 mm per day) during the study spell. Water use by rain-fed plants was $1.03 (\pm 0.13)$ mm per day. During the study period crop co-efficient of rain-fed and irrigated plants varied from 0.39 to 0.83. Plant water use of irrigated plants exceeded the potential evapotranspiration.

d. Physiological response of different tea cultivars to drought

Tea plant physiology of cultivars TRI 3014, 3025, 4053, 4047 and 4049 was studied during the dry period (January- March 2009). Photosynthetic rate (PR), Transpiration rate (TR), Leaf temperature and Water use efficiency (WUE) of the cultivars were measured.

WUE of all the cultivars was similar, and it increased rapidly with decreasing ambient temperature. In all cultivars, TR and PR increased rapidly, when the ambient temperature fell sharply. However, cultivar TRI 4049 and TRI 3014 showed a higher TR and PRs. Leaf temperature of cultivars was $> 43^\circ\text{C}$, when the soil moisture level was very low (11-12%). Solar radiation and ambient temperature influenced the demand for water.

A 19.2 Evaluating growth and yield responses to different levels and methods of fertigation Investigation at sommerset estate with TRI 2023

Treatments on broadcasting fertigating of 180 and 240 Kg N /ha/yr were continued. Fertigating with 180 kg N, 240 kg and broadcasting with 360 kg N/ ha gave comparable results. These yields were significantly higher than that of the treatment 180 kg N/ha which recorded only 3680 kg MT/ ha.

A 19.4 Evaluating rain water harvesting techniques in tea lands

a. Effect of various rain water harvesting techniques on growth and yield of tea at the TRI Extension Centre, Passara)

Two cultivars, TRI 2024 and TRI 2025 were selected. Treatments were coir dust at 3 kg per pit (0.3 x 0.3 x 0.3 m) every other row (T1) staggerred silt pits (0.9 x 0.3 x 0.3 m) leaving 1.2 m bund (T2); burying of *Gliricidia* with Cassia and paddy straw at 5 kg each x 3/ 3.6 m (T3) were tested against untreated control (T4).

There was no significant difference in yield between treatments for cultivar TRI 2024. However, a significantly higher yield was observed with coir dust treatment compared to control with TRI 2023. Burying of *Gliricidia* with Cassia and paddy straw also recorded higher yields.

b. Rain water harvesting study at the TRI Extension Centre, Passara (2008)

This experiment was commenced in August 2008. Initial measurements for partitioning of rain water received by tea field i.e. tea plants and shade trees were completed in 2009. Rain water from the roof of the building was harvested and recorded regularly to study the rainfall intensity and distribution throughout the year. Based on this information, a water tank was permanently installed at the Centre to harvest rain water and irrigate a mature tea block in latter part of 2009. Experiment is in progress.

c. Study on burying of prunings and pruning height of different cultivars under soil rehabilitated and non-rehabilitated fields at Concordia Estate, Kandapola (2006)
This experiment was conducted under the Thrust A9 for testing soil rehabilitation techniques. Later prunings were buried in order to harvest rainwater water in mature tea. Two pruning heights were also tested.

Tea yield under rehabilitation was significantly greater than that of no rehabilitation. The highest yield was recorded with PK2 and the lowest with TRI 2025. Of the two pruning heights, the highest yield was recorded with 22" height. Experiment is in progress.

Thrust A 20. Development of appropriate mechanical devices and agronomic practices to overcome labour shortage

The objectives of these studies are to design and test new harvesting devices for improving labour productivity and to evaluate tea harvesting machines already available in the market under different systems of planting and bush management.

A 20.4 Developing, modifying and evaluating harvesting devices

a. Evaluating tea harvesting machines under two different systems of harvesting at Millakanda Estate, Horana (2008)

Two harvesting machines (Chinese and Indonesian made) are being tested at the Millakande Estate in comparison with manual harvesting. Both machines are used to harvest tea bushes either completely (full-bush plucking) at fortnightly intervals or half of the plucking table (half-bush) at weekly interval. The effects of mechanical harvesting, was compared with that of weekly manual plucking. Weekly assessments on the performance of 02 machines (fuel use, out put and area covered by the machine *etc*), crop yield and quality of the harvested crop were recorded. Treatments were imposed in August 2009 after 02 months of pre-harvesting of experimental plots.

Results showed that loss of yield under mechanical harvesting was around 50% in comparison to manual harvesting. Though the difference was not significant, preliminary results showed that the adverse effects of mechanical harvesting and yield decline was comparatively less under half-bush plucking than that under full-bush plucking. The mechanically harvested crop contained around 16-18% more coarse leaf than manually harvested crop. Weekly harvesting of tea bushes using machines (half-bush plucking) reduced formation of dormant shoots as compared with mechanical harvesting at fortnightly intervals (full-bush). Assessment on the damaged shoots in the harvest showed that mechanically harvested crop contained 25-30% damaged shoots compared to that of about 6% under manual harvesting. Mean output of the Chinese and Indonesian made machines was 148 and 177 kg per day respectively. Mean fuel consumption was 3 and 5 L per day for the same machines. The experiment is in progress.

b. Evaluation of the best time of pruning at different elevations, Nayabedda Estate, Bandarawela (2001)

Experiment was established at 02 elevations *i.e.* Nayabedda division- 1308 m AMSL and St. Catherine Division -1837 m AMSL

Timing of pruning operating was December and April and 02 pruning heights *i.e.* 18" and 22" and a cut across at 28" were being tested. Tea bushes were pruned in December 2009. The experiment is in progress.

- c. Effect of mechanical pruning with and without resting on growth and yield of tea, St. Coombs Estate, 2008.

A trial was commenced to test the effect of mechanical pruning with and without resting in comparison with manual pruning on yield of mature tea (TRI 2025) at Field No. 9.

Yield of the first year of harvesting after pruning showed that non-resting treatments recorded 20% higher yields due to early commencement of harvesting after tipping. Further, yields of plots pruned by machines were marginally higher than that of manually pruned tea in the first year after pruning. The experiment is in progress to study the long-term effect of mechanical pruning.

A 20.5 Modifying bush management to improve efficiency of harvesting devices

- a. Developing, modifying systems of planting and bush management suitable for mechanical harvesting at Balangoda Estate, Balangoda (1998)

In this experiment, four systems (spacing) of planting are tested using 02 cultivars, TRI 2026 and DG 39. The different spacing were 0.6x1.2 m (100%), 0.6 x 0.9 x1.5m (100%) 0.6 x 0.6 x 1.5m (114%) and 0.45 x 0.9 x 1.5m (98%). The tea bushes pruned in September 2008 were tipped in January 2009. Tipping weight of cultivar TRI 2026 were higher than that of DG 39 showing the vigorous growth of TRI 2026. There was no significant difference in growth and recovery after pruning between manually and mechanically harvested tea bushes and between different planting systems. This experiment was terminated.

- b. Developing and modifying bush management suitable for mechanical harvesting at Galaboda Estate, Ratnapura (2007)

Three different bush management (pruning) systems combined with plucking methods (*i.e.* Mechanical harvesting after lung pruning at 20" and tipping; Manual harvesting after lung pruning at 20" and tipping; Mechanical harvesting after cut-across at 26" and tipping). Results showed that yield loss under mechanical harvesting (motorized machine) was minimum with machine harvesting after cut-across pruning. The yield reduction with mechanical harvesting was 16% under lung pruning at 20" and about 3% under cut-across pruning at 26". Experiment is in progress.

Thrust A 24. Development of weed management strategies in tea

The objectives of the studies were to evaluate the efficacy of different methods of weed management strategies, to screen new herbicides and assess residue levels of recommended herbicides as per TRI recommendations.

A 24.1 Screening of herbicides

Testing of herbicide residues in made tea at St. Coombs estate, Talawakelle:

One declining test on MCPA residues in made tea was conducted from 15th January - 5th February and made tea samples were analysed for residues.

Final report on screening of Rapid and Trigger was submitted to the ACSMC in August.

A 24.2 Management of problem weeds in tea

A new hard-to-kill weed (Wal rampa) was reported from a tea estate in Halielle and it was identified as *Dianella ensifolia*.

A 24.3 Integrated weed management strategies with emphasis on cultural and biological methods for suppressing weeds

a. Evaluating different annual weed management programmes for the Low country and Uva region.

At Passara station, Integrated weed management method (T1) (hand weeding + chemical (Glyphosate at 1.65 L/ ha) + cultural (establishment of cover crops, green manure crops, Mana grass and mulching *etc*)) was compared with chemical control, Rapid at 4.4 L/ ha + hand pulling (T2) and Basta at 1.3 L/ ha (T3) + Hand weeding and Estate practice (T4). The total monthly cost of weeding was Rs 2475.00, Rs. 2060.00, Rs. 2540.00 and Rs 2879.00 for T1, T2, T3 and T4, respectively. The high cost was attributed to more labour use for manual weeding especially for estate practice. Dryweights of the weed after one month of treatment weeding were 241, 83, 21 and 299 g/ sq m for T1, T2, T3 and T4 respectively.

At Ratnapura, the total monthly cost of weeding for Integrated weed management method viz. hand weeding + chemical (Glyphosate at 1.65 L/ ha) + cultural [establishment of cover crops, green manure crops, Mana grass and mulching *etc*] (T1), Chemical [(Glyphosate at 1.65 L/ ha + paroto 3.3 L/ ha) + hand pulling (T2)], Chemical [Gramoxone - Paroto at 3.3 L/ ha + rapid 4.4 L/ ha + hand pulling (T3)] and Estate practice [Paroto at 3.3 L/ ha + Glyphosate 2.75 L/ ha (T4) were Rs 2204.00, Rs. 672.00, Rs. 1552.00 and Rs 962.00 for, respectively. The high cost in T1 was due to the use of more labour for manual weeding and cultural practices. Dry weights of weed after one month of treatment were 208, 200, 178 g/ sq m for

T1, T2 and T3 respectively. Earthworm population was lower in chemically treated plots (T2 - 45 and T3 - 37 No/ sq m) compared to integrated method and estate practice (T1 57 and T4 -78 No/ sq m). Experiments in both locations were terminated.

Thrust A 34. Evaluation of the performances of various tree species amenable for low and high shades in tea fields

A 34.1 Identifying alternative species of shade- developing a data base on alternative shade tree species

81 species selected were further reduced to 08 following screening on plant growth indicators.

A 34.2 Evaluating the identified shade tree species and establishing cultural practices

Evaluation of growth rate of *Derris microphylla*, a leguminous tree species to use as a shade tree species at Heminhgford estate, Parakaduwa (2007) Plant height was increased at the rate of 8.9 cm/ month ($R^2=0.94$) and the collar width was increased at the rate of 0.17 cm / month ($R^2=0.93$)

Thrust A 42. Development of economically viable energy plantations as supplementary sources of energy and green manure

A 42.1. Evaluating agronomic practices of potential fuel wood species such as *Gliricidia*, *Caliandra* and other trees species as energy plantations and to quantify the biomass yield under different field management systems in different regions

a. Cultivation of *Gliricidia* in the Low country

Two experiments were started at St. Joachim Estate, Ratnapura and Raigama Estate, Ingiriya to evaluate different planting spacings (1 x 1m, 1 x 2m and 2 x 2m) of *Gliricidia sepium* cultivated as energy plantations.

i. St. Joachim Estate (2007)

Loppings of branches were done at 8 month intervals. Results showed that 1 x 1m, 1 x 2m and 2 x 2m spacings (10000, 5000 and 2500 plants/ ha) yielded 30.8, 16.0, and 9.0 t/ha at each lopping. The weights of leafy portion were 11.2, 6.6 and 3.5 t/ha/lopping respectively for the same spacings. The experiment is in progress.

ii. Raigama estate (2007)

The experiment commenced in 2007 and casulaties were infilled in 2009.

It was recorded that 13.8, 4.3, and 2.4 t of stem can be harvested from one hectare under the spacings of 1 x 1m, 1 x 2m & 2 x 2m respectively (10000, 5000 & 2500 plants/ha/lopping). The leaf yield were 9.6, 4.3 & 2.6 t/ha/lopping respectively for the same spacings. The experiment is in progress.

- b. Cultivation of *Gliricidia* in Mid country
 - i. Carolina estate, Ginigathhena (2007)

There were many casualties and growth of stumps was poor owing to heavy gravel and clay content with water logging in soil. Taking assessments was therefore discontinued and experiment was terminated.
 - ii. TRI, Hantana station (2007).

The experiment is in progress. Weeding and infilling of casualties were done. Growth was not sufficient for lopping.
- c. Cultivation of *Gliricidia* and *Casia spectabilis* in Uva (2008)
 - i. TRI, Uva station, Passara (2008)

C. spectabilis was planted in September 2008 at 1x1m, 1x2m and 2x2m spacings. Weeding and infilling of casualties were done. Plants were not ready for lopping. Experiment is in progress.
 - iii. Glen Alpin estate, Hingurugamuwa

Gliricidia was planted at 1x1m, 1x2m and 2x2m spacings November 2008. Weeding and infilling of casualties were done. Plants were not ready for lopping. Experiment is in progress.
- d. Cultivation of *Caliandra* (*Caliandra calothyrsus*) at St. Coombs estate, Talawakelle (September 2008)

A new experiment with *Caliandra* was initiated at 1x1m, 1x2m and 2x2m spacings. The plot size was 48 m². Excess branches were removed to train plants to produce vigorous branches for harvesting as fuel wood. The weight of loppings (excess branches) was in the range of 3 - 4 tons (fresh weight) per ha.

Thrust A 50. Assessment of the impact of global climate change on productivity and profitability of the tea industry

A 50.1 Studies on physiological responses of tea to global climatic change and carbon sequestration

A study was initiated to estimate the current carbon sequestration capacity of tea plants, the potential of tea plantations to engage in carbon trading and also to predict the variation of carbon sequestration capacity with the expected future climate change. A thorough literature survey was done and the methodology was developed. The preliminary information such as carbon absorptions by tea plants, the carbon profile of tea plants was generated. The study is in progress.

Basic Research Projects

B 11. Partitioning of assimilates in relation to aging of clonal tea in a pruning cycle, St. Coombs Estate

In this study, variation of chemical parameter and, quality parameters with age of the pruning cycle was investigated for two cultivars, TRI 2025 and DT1, which have different canopy architecture and leaf morphology. In addition, yield was monitored.

Flush from the cultivars was harvested on a monthly basis and chemical parameters, namely, total amino acid content (AA), total chlorophyll content (Ch), total polyphenol (TP) content and polyphenol oxidase activity (PPO) were measured.

Made tea samples from individual cultivars and different years from the pruning were sent for taster's evaluation. In addition, the samples were analyzed for quality parameter namely, theaflavin (TF), thearubigin (TR), total colour (TC), brightness (BR) and theaflavin thearubigin ratio (TF/TR) to establish the relationship between year of the pruning cycle and quality of made tea.

TRI 2025 showed a significantly higher mean cycle yield than DT1. Four years were analyzed separately and TRI 2025 showed significantly higher yields in first, second and third years. There were no significant differences in yields during the fifth year in both cultivars.

Among the parameters measured, only total amino acid showed a significant decrease with the year after the pruning. A highly significant cultivar difference was shown only with total amino acid, total chlorophyll and TP content. There was no significant difference in PPO activity between the cultivars.

Quality parameters of made tea samples, TR content and TF, TR ratio showed highly significant ($p < 0.0001$) variation between the two cultivars and different years of the pruning cycle. TF and TC showed significant different when averaged over four years. Cultivar x year interaction effects were also highly significant when averaged over four years. The differences in all TF, TR, TC, brightness and TF/TR ratio were shown between cultivars.

B 64. Physiological behavior of tea root system

Study in tea root system under different shade levels in tea.

Root windows were installed in the field No. 8, St. Coombs estate with the objective of obtaining a better understanding of the tea root system and rhizosphere interactions. Periodic monitoring of root growth was carried out.

B 65. Identifying criteria for screening tea cultivars for drought tolerance

A study was designed to identify suitable biochemical and physiological parameters to be used in the screening of drought resistance for tea. A glass house and a field experiment were carried out at the TRI, Talawakelle. Cultivars were selected based on their ability to tolerate drought and they were evaluated using physiological parameters such as photosynthesis rate (PR), transpiration rate (TR), stomatal conductance (SC), relative water content (RWC), leaf water potential (LWP) and stomatal density (SD) and biochemical parameters such as total soluble sugar content (TSSC) and chlorophyll content (CC).

Cultivar x moisture level interaction was significant only with total soluble sugar content (P=0.0418), transpiration rate (P=0.0473), PR (P=0.0307), RWC (P=0.0353), and SC (P= 0.0374).

Selected cultivars were able to group as tolerant and susceptible cultivars. Cultivars TRI 2025 and DN were grouped into tolerant category in experiments conducted in Passara and Talawakelle and similarly TRI 2023 and TRI 2026 as susceptible cultivars in all locations. The cultivars with consistent grouping can be used as the reference cultivars.

The best parameters for testing a cultivar for drought tolerance were also selected using cultivar moisture level interaction and cluster analysis. They were PR, SC, TR and RWC and TSSC. These parameters could be successfully used to screen different tea cultivars for drought tolerance. This method can be used in future breeding programmes with the use of reference cultivars, and selected parameters in different environments.

B 66. Evaluating bio-filmed technology on soil N-fertility improvement in tea lands

a. Bio-filmed biofertiliser technology for tea nursery plants

Investigations on the confirmation of the results obtained for Biofilm studies are in progress using nursery plants at St.Coombs estate, Talawakelle, TRI Station, Passara, St Joichim estate, Ratnapura, and TRI Station, Hantane.

Treatments such as F3A + ½ T65 (monthly)(T1), F3B + ½ T65 (monthly) (T2), F3A + ½ T65 (bimonthly)(T3), ½ T65 alone (bimonthly) (T4) and T65 (standard mixture at two weeks intervals (T5), ½ T65 alone at two weeks intervals (T6) were tested commencing from mid 2009 and the soil analysis and growth analysis were recorded at 2 months interval up to 8 months.

F3A: (A=Bgl + Brt + BM (*Bacillus Megatherium*) + F3: fungi isolated from tea soil, F3B: (B= B' Bacteria isolated from *Arachis pintoii* + Semia + BM + TB1 bacteria isolated from tea roots + F3

Results indicated that the monthly application of Biofilmed biofertiliser F3A and F3B with half fertilizer is sufficient to obtain similar growth performance and soil improvement to that of Standard T65 fertilizer treatment. Leaf potassium, Magnesium and Phosphorus level are high with F3A in all nurseries other than in Passara and Soil pH, soil organic carbon were also improved with F3A at all locations. F3B performed better at Passara nursery. Soil N was improved by F3A only at Talawakelle nursery. F3A and F3B with half fertilizer increased leaf phosphorus and potassium at Ratnapura nursery. Considering leaf P and K levels, the fertilizer mixture for nurseries studies to be continued with amended rates of P and K in the nursery fertilizer mixture.

- b. Evaluating biofilmed bio-fertiliser technology for organic tea at Stassen Estate, Haldummulla (November, 2009)

A new experiment was commenced for immature tea (cultivar TRI 3019) to find out possible sources of biofilmed biofertilisers to supply N, P under organically-grown tea

Treatments were BF (F3A) + compost (T1), BF (F3B) + compost (T2), BF (F3A) (T3), BF (F3B) (T4), compost alone (T5) and compost (standard) (T6). Soil parameters, physiological parameters, pest and disease parameters are to be recorded at the initial stage and at six months interval.

B 67. Investigating compatibility of stock and scion for grafting of tea for high quality and productivity

The objectives of these studies were to identify compatible stocks and scions for grafting with special reference to high yield, high quality, drought tolerance and pest and disease tolerance of tea

- a. Compatibility of stock and scion for grafting on high quality and productivity of tea at St Coombs estate (2005)

Scions with high quality and stocks with drought tolerance were selected and single node cutting from selected scion cultivar has been planted as control treatment. Plants were in 4th year of the 1st cycle.

Graft combinations, TRI 777/ TRI 3019, TRI 777/TRI 3020, TRI 777/2025, TRI 4067/TRI 3020, TRI 777/4052, TRI 4079/3020 and TRI 4079/4052 showed better performance with compared to TRI 777, TRI 4067 and TRI 4079. Average yield increments of treatments were 35% in comparison with the control. Experiment is in progress.

- b. Investigation of compatibility of stock and scion for grafting on high yielding and pest and disease resistance (2006)

In grafting, Scions were selected from Blister Blight and Shot hole borer resistant and high yielding cultivars. Stock characters are high rooting, drought tolerance, resistance to Nematode (*Pratylenchus loosi*), and stem cancer.

Combinations were T1-TRI 4046/4006, T2-TRI 3072/4006, T3-TRI 4046/3072, T4-TRI 4006/3072, T5-TRI 4046/4053. T6-TRI 3072/4053, were used as treatments. The scions of TRI 4006 (T7), TRI 3072(T8), TRI 4053(T9) and TRI 4046(T10) were used as the 'Control'. After nursery period grafted plants were planted in August 2007 and plucking was started in April 2009 and experiment is in progress. TRI 4046/406, TRI 4046/3072, TRI 3072/4006 and TRI 3072/4053 were found to be the best combinations at nursery stage.

- c. Identification of suitable grafting combination for drought resistance and high yielding for Uva region

Grafted combinations TRI 3018/DN (T1), TRI 3019/DN (T2), TRI 4042/DN (T3), TRI 4046/DN (T4), TRI 4052/DN (T5), TRI 3018(T6), TRI 3019(T7), TRI 4042(T8), TRI 4046(T9) TRI 4052 (T10) were used as treatments.

Nursery period was started in May 2009. Growth measurements of shoot length, girth, root length, number of shoot and leaf area to be measured at the end of nursery period.

- d. Investigation of suitable grafting combinations for low- grown tea

Following scion and stock combinations were selected to identify the suitable grafting combinations for low country. Scion was TRI 2023 and seedling stocks selected were TRI 2025 (Sapumal Kanda - Polyclonal), TRI 4006 (Raigama - Biclinal), TRI 2023 (Rambukkanda - Polyclonal), KEN 3/16 (Salawa - Polyclonal), TRI 2016 (Halpe - Polyclonal) and TRI 2023 (Malimboda - Biclinal). Experiment was commenced in December 2009 at the TRI Low country Regional Centre, Ratnapura. The experiment is in progress.

B 86. Identifying factors associated with yield decline and bush debilitation in VP tea in the up and Low country

The objectives of these studies were to identify the underline causes for unusual yield decline of tea in some plantations.

a. Study on identification of causes for yield decline and bush debilitation at Meddakande Estate, Balangoda (2007)

A new experiment was commenced to study the possible causes of yield decline. Three blocks of tea (TRI 2023), severely affected (T1), moderately affected (T2) and healthy (T3), were selected from a field and observations were made. Analysis of soil (from the depth of 0 - 15 cm, 15 - 30 cm, and 30 - 45 cm) and leaf for nutrients carried out. Plucking of tea, Shot hole borer (SHB) and nematode assessments were also carried out.

- i. There was no significant difference in the levels of N, P, K, Mg, Al, pH and C% between treatments at each depth. Gravel percentage was significantly greater in T1 and T2 than that of T3 at 0 - 15 cm depth. Though not significant, relatively a greater gravel % was recorded in T1 and T2, also at other depths
- ii. Leaf K and Mg were significantly lower in totally and moderately affected tea bushes compared to healthy bushes
- iii. There was no significant difference in leaf weights between healthy and moderately affected tea bushes
- iv. All three blocks were severely affected by SHB (100%) and this might sometimes have occurred as a secondary problem. Nematodes were not detected in all three blocks.

b. Investigations on Bush Debilitation and yield decline at Deniyaya region

Experiment 1: Evaluation of different soil preparation and ammendment techniques to alleviate the bush debilitation problem at Richiland Estate, Deniyaya

- i. A profuse growth of tea plants in normal soil (not subjected to land leveling and filling) was shown than those of filled soil
- ii. Soil treatment with formalin or bleaching powder did not show any remarkable change in the state of soil sickening with soil borne pathogens. This indicates that the involvement of any soil born type pathogen for bush debilitation problem is ruled out.

B 88. Evaluating herbicidal effects of different plant extracts

Evaluating aqueous solution of Ginisapu seeds as a natural herbicide

Aqueous Ginissapu solution, sent to the ITI for identification of chemical compounds, was fractionated and samples were received for bioassays. All three Fractions,

Methanol 5%, Hexane 5%, and Hexane 10% were subjected to bioassays. It was found that all three fractions were phytotoxic on lettuce seedlings at 2 - 5 days. However, half the rates of above were only partially phytotoxic on lettuce seedlings. Bioassays are in progress at Ratnapura.

B 90. Developing and refining intercropping tea with coconut and rubber in the low country tea lands

The objectives of these studies are to identify suitable cropping patterns for intercropping tea with coconut and for improving land productivity.

- a. Effect of intercropping tea and coconut on productivity at St Joachim estate (2009)
A demonstration trial

Coconut was planted in May/June 2009 at two spacing 30'x8' and 40' x 8' and at recommended spacing 24' x 24' for comparison. Mana was also planted in all plots to be planted with tea for soil reconditioning, between coconut seedlings.

- b. Effect of intercropping tea and rubber on productivity, St. Joachim estate, TRI-Ratnapura (1993)

In the experimental block commenced in 1993 comprising three treatments viz. tea (stand of tea - 100%), tea under rubber (40' x 8') (stand of tea - 75%) and rubber (20' x 12') and observation block commenced in 1995 comprising rubber (20' x 12'), tea, tea in rubber (40' x 8') and tea in rubber (60' x 8' x 8') found that there was a continuous yield decline due to heavy shades of rubber. Hence, both studies were terminated and the two blocks were handed over to St. Joachim estate in mid 2009.

- c. Effect of intercropping Tea with Rubber, Rambutan, Durian and Cinnamon on productivity, RRI, Kuruwita (2003)

This experiment was commenced in collaboration with RRI, Department of Agriculture and Export Crop Department. Rubber was intercropped with Tea, Rambutan, Durian and Cinnamon at four systems of plating rubber (double hedge rows). Planting of tea under rubber was done with and without rehabilitation.

Since, there were no significant difference in tea yield under different spacings of rubber and the tea growth performances was further dropped and in turn yield was declined drastically due to heavy shade of rubber. Therefore, the trial was terminated and the experimental block was handed over to the RRI.

Supprotive divisional Projects

1. **C/MET:** Metereological data were collected from the met stations of St Coombs, Talawakelle, TRI, Low country Regional Centre, Mid country Regional Centre, Uva Extension Centre, Southern Extension Centre. A new automated weather station was installed by JAICA at the Deniyaya Extension in May.

2. **D/Agry. The preliminary study of high density planting to develop tea hedges for machine harvesting**

Objective of this investigation was to study the possibility of hedgerow planting with high density of tea for the purpose of mechanical harvesting of tea through regularly trimming with a machine similar to ornamental hedges.

Over a period of 2 years (from 15th Oct.2007 to 1st Sep 09), the mean plant density per raw was reduced from 246 to 171 plants i.e about 31% reduction. The average tea flush yield was estimated to be 357g/row/week based on yield data up to December 2009.

Growth assessments were done two years after planting of tea and it was recorded that root dry weights and root vertical distribution were significantly higher in side rows compared with the middle row. Root length was significantly higher in middle row plants compared with the side rows. Though not significant the total leaf area and collar thickness were fairly greater in the plants of side row than those of the middle row.

3. **D/Phys. Effect of Potassium spray on drought mitigation of young tea, Wewessa Estate, Passara (2009)**

A Study was commenced in August following pre-plucking for a period of two months. Three different K sources, Calcinite and water were used as treatments. Tea was sprayed with the above treatments in four rounds until end of September at fortnight intervals. However, experiment was interrupted due to unexpected rains. This study is to be repeated during the next dry spell and under glass house conditions.

4. **Collaborative Projects**

A short term research study was conducted in collaboration with the faculty of Agriculture, University of Ruhuna on the impact of resting, harvesting methods and spraying of Muriate of potash (MOP) on root reserves of tea nearing pruning. Results showed that, resting for two months before pruning significantly improved starch reserves. Hard plucking (Black plucking) also improved starch reserves up to one month; but there was no significant difference in root starch content between continuous plucking (estate plucking) and hard plucking two months after imposition of treatments (at the time of pruning). MOP spraying (2%) had no significant impact on root reserves. The degree of recovery after pruning (refoliation) showed a positive relationship with root reserves at pruning. Hard plucking has given only half that of the yield reported under non-resting (continuous estate plucking).

Service Projects

a. Testing of root starch

16 root starch analyses were undertaken at Talawakelle.

b. Soil compaction studies

The service of soil compaction measurements (model-field scout sc 900 spectrum technology, USA) were provided to RPC estates, Indola, Haputale and Concordia estate, Kandapola and; TRI station at Kottawa and trials at TRI Passara station.

General

Recognitions

Dr. M A Wijeratne was appointed as an Assistant Commissioner to the Sri Lanka Inventors Commission by the Cabinet of Ministers with effect from June, 2009.

Special meetings

The first divisional review meeting was held in 16th June. Prof. H P M Gunasena, Prof. W A J M De Costa and Prof. S Subasinghe were served as external reviewers.

Training programmes and Seminars, workshops, demonstrations

- Dr. M A Wijeratne made 10 presentations on agronomic practices, improving land productivity and quality, harvesting techniques, post harvest losses, pruning, drought mitigation and cultivation of Gliricidia as energy plantations for corporate and tea smallholding sectors. He also served as a resource person at NIPM training programmes. He made two presentations on climate change impacts on tea
- Dr. K G Prematilake delivered 10 lectures on Integrated Weed management, chemical weed management, Shade management, Crop diversification and potential of use of cover crops and green manure crops, soil fertility management and burying of prunings for both sectors. He also conducted number of field demonstrations on Burying of pruning.
- Mr. N P S N Bandara made a presentation on irrigation of tea, yield decline and bush debilitation and prevention of drought damages in tea at different locations.
- Dr. M A Wijeratne continued to serve as a member of the faculty board of Agriculture, University of Ruhuna, and a visiting lecturer of the Uva Wellassa University and University of Ruhuna.
- Dr K G Prematilake served as a visiting lecture at the Uva Wellassa University on weed management in tea.
- 15 training programmes for tea small holdings and school childrens were undertaken by the division at Ratnapura.
- Agronomy staff actively participated in two Crop Clinics organized for stakeholders in Badulla, Galle and Matara. Agronomy staff of Ratnapura actively participated in the Exhibition held at the Sivali Central College, Ratnapura during 21st - 25th September.

Training of students

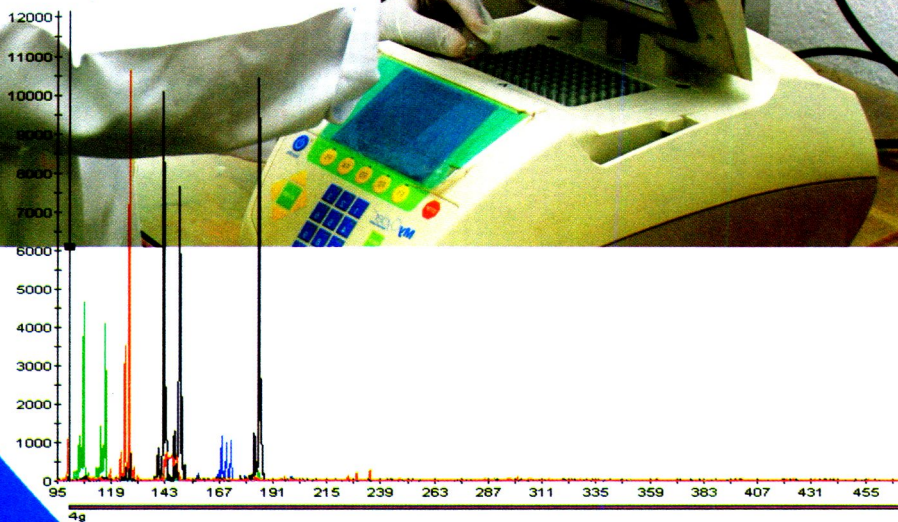
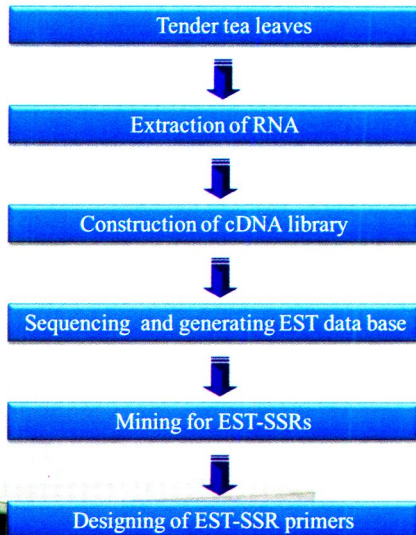
Four undergraduates of University of Ruhuna and Sabaragamuwa attached to LCS, Ratnapura and one student of the Sabaragamuwa University attached to Head Office undertook their final year research projects. Two students of NAITA and School of Agriculture were trained at Ratnapura and in the Head office.

Visitors

- Prof. Liang Chen of the Research Centre for Tea germ plasm and improvement of Chinese Academy of Agricultural Sciences visited the division in December to get an exposure to agronomic practices in tea.

Collaborators

- Project B 66
Dr. G. Seneviratne, Senior Research Officer, Institute of Fundamental Studies, Kandy -
- Project B 88
Dr. S Premakumara, Senior Research Officer, Industrial Technology Institute, Colombo



Latest developments of molecular marker techniques could be used to supplement the conventional methods of tea genetic improvements.

Biochemistry Division

M J Jayasundara

Acting Officer-in-Charge (*from 1st July 2009*)

A M T Amarakoon

B Sc (Peradeniya, Sri Lanka) Ph D (Southampton, UK)

Head (*up to 27th June 2009*) / Senior Research Officer

Highlights of the Year

The first report on Isolation and characterization of genomic SSR's of tea (*Camellia sinensis* L) was presented by K M Mewan in the International conference on 'Frontiers in molecular Life sciences' held on 16th - 18th September 2009, at Colombo

Simple Sequence Repeats (SSR's) technique was used for molecular characterization of Sri Lankan tea cultivars. This is the first report on the use of SSR for molecular characterization

The pesticide residue analysis work was enhanced by participating in ADMP TCQM –DEC proficiency test and FAO/IGG working Group on tea brew- ring test.

Peer-Reviewed Publications

Goonetilleke W A S N S T, Priyantha P G C, Mewan K M and Gunasekare M T K 2009 Assessment of genetic diversity of tea (*Camellia sinensis* (L.) O. Kuntze) as revealed by RAPD-PCR markers. J. Natl Sci Foundation of Sri Lanka. 37(2), 147-150

Kumar N S, Wijekoon M, Punyasiri P A N, Kumar V, Abeysinghe I S B (2009) Separation of proanthocyanidins in tea leaf by high speed counter current chromatography J.Chromatography 1216-4295-4302

Thrust A 30. Improvement of organoleptic properties of instant tea and extraction of proteins from spent tea and refuse tea

Application of membrane filtration techniques in the preparation of leaf protein concentrate from refuse/spent tea

This experiment was conducted with the objective of studying the possibility of application of membrane filtration technique in the preparation of leaf protein concentrate from refuse tea/spent tea. It was found that 100,000MWCO membrane is more suitable than other membrane tested for protein separation. According to the preliminary assessment the cost of protein concentrate/isolate prepared from refuse tea/spent tea would be around Rs. 632/Kg. Preparation of protein concentrate/isolate from refuse tea/spent tea by using the membrane filtration technique would be economically feasible provided that the quality of such product is comparable to that of other commercially available products.

Improvement of organoleptic properties of instant tea

The effects of extraction temperature, pH and duration of extraction on the extractability and chemical properties of extracts were studied.

Black tea was extracted at different combinations of temperature (10, 30, 50, 70 & 90 °C), pH (2, 4, 6, 8 & 10) and duration of extraction at (10, 20, 40, 80 & 160 min). Extracts were collected and analyzed for Total solids, TF, TR, Colour, Brightness, Total Polyphenols, Antioxidant activity and Catechins. The project is in progress.

Basic Research Projects

B16. Identification of parameters in green leaf to predict black tea made tea quality

The ability to predict black tea quality, using chemical parameters in green leaf would help breeding programs and selection of cultivars suitable for different agro-climatic regions. At present chemical/primary markers for quality are not available.

The chemical profiles of polyphenol oxidase activity (PPO), total polyphenole; amino acids, individual catechins, flavor profiles, fermenting rates and pH were completed for green leaf. The made tea obtained from the same green leaf samples manufactured using miniature manufacturing process were also analyzed for oxidized polyphenole (TF, TR), flavor profiles, total polyphenole, amino acids, and individual catechins. Analysis of data is in progress.

B18. Use of DNA markers for molecular characterization of tea

a. Screening of seedling populations using SSR markers to identify diverse individuals

A study was initiated to identify genetically diverse seedling individuals from old seedling population to use them as progenitors towards better selection and widening

of tea gene pool. The assessment is planned to be carried out with more informative simple sequence repeat markers (SSRs). Based on the geographical distribution, a total of 23 estates, covering all six planting districts in the region, were selected for SSR study. Project is in progress.

b. Analysis of parentage of tea cultivars

The aim of this project is to confirm parentages of tea cultivars using simple sequence repeat polymorphic markers (SSRPs). At the same time, project will generate additional information on molecular marker based assessment on genetic structure of tea germplasm, genetic diversity among and between individuals derived from various crosses reflecting the degree of inbreeding depression and individuals with comparatively higher genetic value to use as progenitor.

Initially 56 tea accessions were selected for the study and the study was planned to be carry-out in two phases. First phase of the study included 28 tea accessions which comprised of both recommended (22) and non-recommended cultivars (*i.e.* TRI 2020, TRI 4001, TRI 4028, ASM 4/10, TRI 4027 and TRI 4030). In the first phase of the study, 20 SSR primers (10 genomic and 10 EST –SSR primers) were used for genotyping in which resulted a total of 122 SSR loci (57 from EST and 65 from genomic SSR primers) were 100% polymorphic among accessions. Average number of alleles developed per primer was 6.4 where genomic SSR primers resulted a higher number of alleles than to EST- SSR primers. The results generated so far confirmed origins and parentage of most of the cultivars. The second phase of the study is in progress.

c. QTL mapping and marker assisted tea breeding

Towards marker assisted tea breeding (MAB), a new study to map quantitative trait loci (QTLs) controlling economically important traits was initiated.

d. Morphological characterization of F1 population TRI 2043 x TRI 2023

As a part of the QTL mapping project, morphological characterization of the F1 population has started. Characterization using 14 morphological characters namely length of mature leaf, width of mature leaf, size of mature leaf, leaf length to width ratio, length of mature leaf petiole, leaf pubescence, leaf shape, upper leaf surface, leaf apex shape, leaf apex habit, leaf base shape, leaf venation, leaf vestiture and leaf color is completed.

e. Biochemical characterization of the F1 population TRI 2043 x TRI 2023

The chemical characterization of the F1 population was also initiated. Determination of total catechins and individual catechins, using HPLC 300 F1 individuals is in progress.

- f. Establishment of chemical profiles for BB susceptible and tolerant cultivars**
To establish chemical profiles for BB susceptible and tolerant cultivars, total catechins and individual catechins levels of 20 Blister Blight (BB) susceptible and tolerant cultivars were determined using HPLC. Leaf samples were collected during both dry and wet periods and analysis was completed for the samples collected during the dry season. Study is in progress.
- g. Field assessments for blister blight disease resistance and mapping of QTLs responsible for BB resistance in tea**
To determine segregating pattern of the BB resistance, nearly 200 field assessments were completed to identify BB susceptible and tolerant individuals using F1 population (300 plants of TRI 2043xTRI 2023) segregating for BB disease resistance. Assessments are in progress.

D 30. Development of standards for tea – Green Tea Standard ISO 14502

ISO technical committee on tea is in the process of developing new standard for green tea. Sri Lanka generated information on catechins in Sri Lankan green tea and submitted for ISO technical committee.

Development of multi residue methods for the analysis of pesticide residue in tea Under this project various methods were tested for the analysis of pesticide residues. Extended and Revised Version of the DFG S19- E9 multi residue method developed in Germany was chosen as most suitable method to analyze residues in tea.

Extraction and purification of sample using Accelerated Solvent Extractor and Gel Permeation Chromatography were optimized. The black tea samples were analyzed for the pesticides, namely, Carbofuran and Propargite using Gas Chromatography- Mass Spectrophotometry (GC-MS).

Proficiency testing on pesticide residue analysis

In order to improve the performance of the pesticide residue lab, the TRI participated in the Proficiency Test (PT) which was organized by Asia –Pacific Metrology (ADMP) as a joint initiative of the Technical Committee for Amount of Substance (TCQM) and the Developing Economics Committee (DEC). Under the PT scheme, Cypermethrine (all isomers) in green tea and Endosulfan and Bifenthrin in oolong tea were tested.

FAO/ IGG working Group on Tea Brew-Ring test

The TRI participated in the ring test organized by FAO/IGG working group on the tea brew to analysis pesticides namely, Bifenthrin, Immidachloprid and Dimethoate in the tea brew. Results were submitted to FAO/IGG WG of TB.

Quantification of L-Theanine and other free amino acids in Sri Lankan Black Tea

L-Theanine is a unique non-protein amino acid found in the tea plant. This amino acid has been extensively studied in relation to food science and human nutrition. Theanine is known to be a neurotransmitter in the brain; a relaxation-inducing effect in human has been proposed. Therefore investigations on Theanine will be beneficial for the human nutrition and health.

However, data for L-Theanine content in Sri Lankan black tea is scanty. Therefore generation of data for L-Theanine in black tea in Sri Lankan tea is very important.

A HPLC method to analyze Pre-column online derivatization using O-phthalaldehyde (OPA) and 9- fluorenylmethyl chloroformate (FMOC) coupled to photodiode array and florescence detectors was developed. Tea samples representing all tea growing areas of Sri Lanka were analyzed for L-Theanine. This is a collaborative project with ITI, Colombo.

Evaluation of ISO method for determination of L-Theanine in Tea

Another HPLC method developed by ISO is also being evaluated for the determination of L-Theanine in tea.

General

- Dr. A M T Amarakoon Deputy Director Research (Technology) covered the duties of the Head, Biochemistry Division till 31st of June 2009.
- Mrs. Jayanthi Jayasundara was appointed as the Actg. Officer in Charge with effect from 1st July 2009.at the Biochemistry Division.
- Dr. P A N Punyasiri was appointed as a Senior Research Officer (Contractual basis) at the Biochemistry Division with effect from 1st October 2009.
- Ms. W A S N S T Goonetilake, Research Assistant resigned from the post of Research Assistant, with effect from 12th November 2009.

Trainings, Seminars and Meetings

- Mr. K M Mewan attended “Interactive Seminar on Best Practices for Safe Use & Management of Agricultural Biotechnology: experiences from USA and South Asia” organized by CARP and Michigan State University on 17th March 2009 at NILIS, University of Colombo.
- Mr. K M Mewan attended the 9th Agricultural Symposium, Wayamba University of Sri Lanka, Makandura, on 11-12 August 2009
- Mr. K M Mewan attended a symposium on Research for National Development organized by National Research Council of Sri Lanka on 10th November 2009 at Hilton, Colombo.
- Mr. K M Mewan, Research Officer, Biochemistry Division was appointed as a member of the Crop improvement/ Biotechnology Committee of the plantation crop research institutes.
- The Grant application ‘Use of SSR markers for genetic characterization and fingerprinting of recommended tea cultivars and for tagging of blister blight disease resistance in tea’ submitted to National Research Council of Sri Lanka by Mr. K M Mewan was selected for funding.
- Mr. K M Mewan made an oral presentation on “Isolation and characterization of genomic SSRs of tea (*Camellia sinensis* L)” at the International conference on Frontiers in Molecular Life Sciences, 16th to 18th Sep 2009, Colombo, Sri Lanka.
- Mr. P K P Muthukumarana attended a program on Machine operators role in improving quality, productivity, safety, and energy conservation organized by Institute of industrial techno management (Pvt) ltd. Colombo from 25^h and 26th July.
- Mr. P K P Muthukumarana attended a training program on “Boiler operation maintenance, steam distribution, condensate recovery and cost saving measures in steam generation organized by Institute of industrial Techno management (Put) ltd. Colombo from 26th and 27th September
- Mr. P K P Muthukumarana attended a training workshop for Technical Assistants organized by institute of Funder mental Studies, Hantana, Kandy from 29-30 October 2009.
- Mr. P G C Priyantha attended a training programme on Attitude change to motivate operations and maintenance technicians to achieve cleanliness, order, safety, energy saving and waste minimisation organized by Institute of Industrial techno management (Pvt) LTD ,Colombo, on 7th November 2009.
- Mr. G A A R Perera attended a workshop on Radiation Safety in using radio-isotopes for research and industrial applications, organized by Atomic Energy Authority from 24-27 November 2009.
- Mr. G A A R Perera, participated in the operator training on membrane filtration pilot plant and membrane technology in United States of America. from 5th June to 15th June 2009.
- Mr. H M S B Heenkenda attended a training programme for sampling testing calculations and statistics and environment management organized by Institute of Chemistry Ceylon on 7th October 2009.

Research Communications

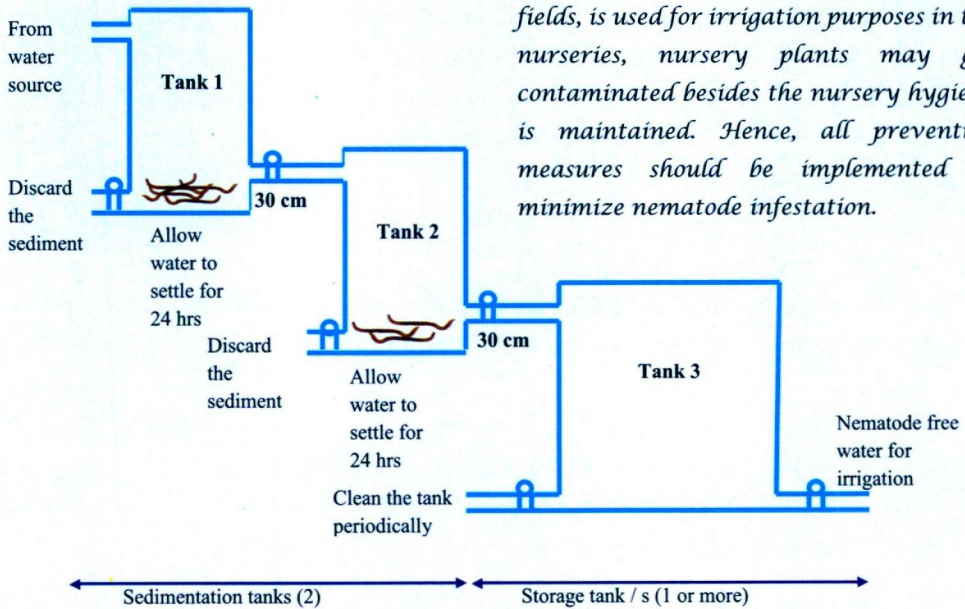
- Ariyaratne P N K, Mewan K M, Goonetilleke W A S N S T, Attanayake D P S T G and Priyantha P G C 2009 Study of Genetic Relationships of Tea (*Camellia sinensis* (L.) O. Kuntze) Using SSR Markers and Pedigree Analysis. Proceedings of 9th Agricultural Symposium, Wayamba University of Sri Lanka, Makandura, 11-12 August 2009, 293-298.
- Mewan K M, Abeysinghe I S B, Saha M C, Yongzhen P, Karunanayake E H and Dixon R A (2009) Isolation and characterization of genomic SSRs of tea (*Camellia sinensis* L). International conference on frontiers in Molecular Life Sciences, 16th to 18th Sep 2009, Colombo, Sri Lanka. 25p.

Collaborators

- Prof. E Karunanayake, Department of Molecular Biology and Biochemistry, Faculty of Medicine, University of Colombo, on Use of DNA markers for Molecular Characterization of Tea.
- Mr. J M D T Everard, Geneticist/Plant Breeder, Coconut Research Institute, Lunuwile, on Use of DNA markers for Molecular Characterization of Tea.
- Dr. (Mrs.) C Perera, Senior Research Officer, Plant Breeding Division, Coconut Research Institute, Lunuwile on QTL mapping
- Mr. S Somasiri, Chemical and Microbiological Laboratory, Industrial Technology Institute, Colombo.

Trainees

- Mr. P N K Ariyaratne, an undergraduate from Wayamba University of Sri Lanka, Makandura completed his research project under the supervision of Mr. K M Mewan
- Mr. Amila Premathilaka, an undergraduate student of University of Colombo commenced training under the supervision of Mr. K M Mewan
- Ms. H P D S Jinasena a student from University of Kelaniya completed her training at Biochemistry Division under the supervision of Ms. J Jayasundara.
- Ms. Mathivathani Gopal, an undergraduate of Uva Wellasa University, completed her research project at Biochemistry Division under the supervision of Mr. G A A R Perera.
- Ms. H P Nisansala an undergraduate from University of Peradeniya, completed her training at Biochemistry Division
- Two officers from Sri Lanka tea Board underwent training on pesticide residue analysis in tea at Biochemistry Division under the supervision of Ms. J Jayasundara



When water, running through infested fields, is used for irrigation purposes in tea nurseries, nursery plants may get contaminated besides the nursery hygiene is maintained. Hence, all preventive measures should be implemented to minimize nematode infestation.



Entomology and Nematology Division

K M Mohotti

B Sc (Peradeniya, Sri Lanka),

Ph D (Reading, UK), C. Biol. (Sri Lanka)

Head, Senior Research Officer

Highlights of the Year

- Nine (9) and four (4) cultivars tolerant to *Pratylenchus loosi* for Up country and Uva regions were identified
- Two accessions resistant to SHB for Uva were identified
- Irrigation water treatment using bleaching powder was found to be effective in place of sedimentation tanks and / or an user-friendly and cost effective alternative method
- In addition to the conventionally used four parameters for cultivar screening, three more statistically viable parameters determined
- Declining and regional trials to establish residue levels of Sulphur in made tea under GAPs were completed
- System sustainability of VP and seedling tea during “in conversion period” under Uva conditions was demonstrated
- Thirteen Arecanut varieties released by the Department of Export Agriculture did not serve as reservoirs of *P. loosi*. Hence, these varieties can be planted in the vicinity of tea growing areas prone to *P. loosi* in mid and up elevations
- The effects of temperature and exposure to UV radiation on the vegetative growth and the pathogenicity of EPF *Beauveria bassiana* were quantified *in vitro*

Academic Awards and Training

- Mrs. P G D S Amarasena, Experimental Officer completed the postgraduate study and was awarded the M Sc. in Plant Protection Technology from the University of Peradeniya at its convocation ceremony held in February 2009.
- Mrs. P D Senanayake, Experimental Officer commenced the post graduate studies on the project proposal entitled “Identification and evaluation of semiochemicals of low country live wood termite *Glyptotermes dilatatus* Bugnion and Popff (Isoptera: Kalotermitidae) for its potential use in the IPM Programme”. The research will be supervised by Prof. Mrs. Priyani Paranagama of the University of Kelaniya and Dr. K M Mohotti of the TRI.

Thrust A22. Development of cost effective control methods for integrated management of SHB

A 22.1 Screening of synthetic pesticides for reducing SHB damage in immature and mature tea

Screening of synthetic pesticides for reducing SHB damage

Refinements were made to experimental layout at Ury Group, Passara. The sampling procedure for SHB was also refined. Treatments included two doses of Ethiprole viz. 500 and 750ml/ha. Lebaycid was used as standard and untreated block as control in 3 replicates. Pre and post treatment assessments were carried out. The experiment is in progress.

Screening of synthetic pesticides for reducing SHB damage

At Hapugastenne Estate, Hapugastenna, two doses each of Thiocyclam and Ethiprole, Lebaycid as standard and an untreated control in 3 replicates were field tested.

Data suggested that the two new chemicals were effective only for one month in reducing the formation of newly occupied galleries of which the efficacy was inadequate in controlling SHB. Hence, the trial was terminated.

Testing the efficacy of two locally available oil formulation against SHB attack in new clearings

The treatments tested at Hanford Estate, Deniyaya were two oil based formulations obtained from Nakiyadeniya Oil Palm Factory. Lebaycid was used as standard and an untreated plot as control. A second treatment of the oil application was done after three months. The experiment is in progress.

Efficacy of locally available materials against SHB attack

Two by-products from Nakiyadeniya Palm oil factory, two natural adhesives (Resulted in Project A 32.3) and Lebaycid as standard were screened against SHB at Wirawa Estate, Dolosbage and compared with the untreated control. Pre-treatment assessment and chemical application were carried out. The experiment is in progress.

A 22.2 Screening of biological control agents for reducing SHB damage in tea **The effect of temperature and the exposure to UV on the vegetative growth of *Beauveria bassiana* and its pathogenicity to SHB**

A series of *in vitro* controlled experiments revealed that the growth and the pathogenicity of the fungus were affected by temperature and UV radiation. The UV protectants tested showed potentials of reducing the adverse effects of UV on the fungus and thereby increasing the growth and the pathogenicity.

A 22.5 Modifying K fertilization for reducing SHB in mature tea

Testing of mid cycle application of K to reduce SHB damage

The studies conducted at New Peacock Estate, Pussellawa were terminated considering the cost effectiveness of treatments.

Thrust A32. Development of sustainable organic farming systems for tea

Thrust covers generating scientific information on the sustainability of growing tea under organic, biodynamic, integrated and low-input systems and to compare with TRI-recommended conventional systems in the different agro-ecological regions. The information will be used to fill the gaps in grower practices.

During the period under review, periodic monitoring of the growth and yield of tea of the 'TRI-ORCON' trial at St Coombs, and BID-ORCON' trial at the Nature Farming Demonstration and Research Area was continued. Results showed comparable yields in organically and conventionally grown tea.

A 32.2 Evaluating crop responses to organic amendments

Assessment of pest, disease and weed incidences and studies on biological attributes of tea during "In conversion Period" to organic were conducted under conditions in Uva.

VP and seedling tea fields which were converted to "organic" at Nahavilla estate, Namunukula in Uva were chosen for the study. In order to compare with a conventional tea system in the same vicinity, similar field at Newburgh estate were studied.

Shoot growth, yield, pest and diseases incidence and tipping data were periodically recorded. Assessments on responsive sustainability parameters such as growth parameters and post prune growth parameters were completed during the period under review.

The highest shoot extension rate in VP tea (1.38 mm day^{-1}) was recorded in organic system. In seedling tea, it was with the conventional system (1.52 mm day^{-1}) probably due to environmental stress conditions under Uva condition. The yields of VP tea under organic and conventional systems were 3347 and 3022 kg dry weight ha^{-1} year⁻¹ respectively.

The feasibility of converting 'conventional' systems to 'organic' under appropriate adoption of cultural practices to sustain yields, develop bush health and tolerate external stresses of VP and seedling tea was established. The crop response following

pruning of VP tea too was positive. The preliminary data suggests that appropriate adherence to organic management practices would help to establish and maintain general bush health, vigor and performance in tea during conversion to organic. The economic and practical applications of the organic practices under Uva conditions need to be established.

Monitoring of biological, chemical and physical properties of soils under different cultivation systems is to be continued as attributes to growth and yield. The experiment is in progress.

Experiment No. N 445: Sustainability of tea during 'The Conversion Period of Organic Tea' under Mid country conditions

Location: Geragama Division, Geragama Estate, Pilimathalawa.

Timely adoption of appropriate cultural practices as per IFOAM guide lines were adopted during 'In conversion' period in comparison to conventional and integrated systems of tea cultivation. Comparative monitoring of growth and environmental indicators were performed during the period under review. The yield differences observed in the third year after pruning were not significant.

Monitoring of biological, chemical and physical properties of soils and pest, disease and weed incidences under different cultivation systems are to be continued until next prune. The experiment is in progress.

Effect of application of different sources of compost on organically grown tea lands

Cultivar: TRI2023/2025, Gamiseva Seva Sevana, Nilambe, AER: WM 3 (2002)

Though, no significant differences were observed between the treatments, yield obtained from the plots that receive Gliricidia spray was considerably lower compared to the compost treated plots. The trial is in progress.

A32.3 Evaluating and managing pest-, disease- and weed incidence

Central Biological Control Laboratory

The activities at Central Biological Control Laboratory in isolating and mass-culturing of insect, mite and nematode biocontrol agents were continued.

Monitoring of naturally-occurring nematode antagonists of tea nematodes

Nematode biocontrol agents and populations of *Pratylenchus loosi* and *Radopholus similis* in the Needwood and Stassens Estates, Haldummulla, and at the TRI station, Kottawa, were periodically monitored.

Experiment No. N 423 (e): Adaptive trials with Acaritouch and NEEMTEE in controlling tea mites

Locations: Downside Estate, Welimada and Hantana Estate, Hantane.

Two adaptive trials on use of the natural acaricides Acaritouch and NEEMTEE in controlling tea mites were completed at Downside Estate in Uva region and Hantana Estate in Mid Country.

For completion of the studies, further adaptive trials are planned in the Low Country.

Experiment No. N 443: Assessment of pest, disease and weed incidences and biological attributes of tea during “In conversion” period to organic under conditions in Uva.

Location: Nahavilla Estate, Namunukula.

VP and seedling tea fields converted to “organic” in Nahavilla Estate in Uva were compared with a conventional tea system in Newburgh estate which is located in the same vicinity. Assessments of foliar pest densities, soil microbial activity, arthworm populations and nematode population etc. were monitored.

Tea tortrix and blister blight incidences were found to be comparatively high in the conventional system despite control methods. Nematode incidence did not seem to vary with the management system. Overall results of the parameters studied in this experiment corroborated previous local and foreign research evidences.

Periodic monitoring of pest, disease and weed incidences under different systems is to be continued. The experiment is in progress.

Experiment No. N 446: Preparation of Natural adhesives with pesticidal properties for application against SHB and LCLWT

Preparation of natural pesticides for tea pest management was continued at the Laboratories of the Rubber Research Institute, Ratmalana.

During the period under review, three formulations of wood adhesives with natural origin were prepared. The efficacy was tested against SHB. Two treatments were included in a field study in the Mid Country.

Thrust A45. Development of cost-effective control methods for integrated management of nematode pests in tea

A 45.1 Introducing user-friendly alternate tea propagation and soil-sterilizing techniques, and protected tea nursery concepts, to minimize contamination and prevent dissemination of tea nematodes through planting materials

Experiment No. N 438 (b): Evaluation of nursery bed treatment using bleaching powder

Location: Alton Estate, Upcot.

The nursery beds infested with *P. loosi* in Alton estate was chosen for the study. Bleaching powder at 10 g per square meter basis was compared with recommended rate of Basamid to treat the nursery beds. Periodic assessments of soil populations of *P. loosi* following bed treatment were compared.

Results revealed that Bleaching powder was equally effective in lowering nematode populations in soil experiments will be replicated in different locations for further comparisons.

Experiment No. N 438 (d): Evaluation of bleaching powder for water treatment in tea nurseries

Laboratory bioassays were performed to recheck the mortality of nematodes in water due to bleaching powder treatments. Treatment of irrigation water with Bleaching powder at the rate of 0.1g per 100 ml water basis was found to be effective. Economics of the treatment was also perfected.

In order to confirm the practical adoption of the treatment as a method in place of sedimentation tanks and / or an alternative method, adaptive trials in different locations are planned.

Experiment No. N 439: Evaluation of nematicidal properties of bark extracts of Maha Patta

Maha Patta, a traditionally known pesticidal plant was used for studying the nematicidal properties against *P. loosi*. Water extracts of the bark of the plant and solid material were used to treat the soils infested with *Pratylenchus loosi* in an incubation trial under laboratory conditions. Carbofuran was used as the control. Results of mortality of nematodes revealed that Maha patta bark extracts and solid form were significantly effective in controlling *Pratylenchus loosi* in soil compared to Carbofuran.

The experiment is in progress to confirm the findings.

A 45.2 Evaluating methods for managing nematodes in young tea

Experiment No. N 248 a (2009): Screening of Arecanut varieties against *Pratylenchus loosi*

Location: TRI, Passara

Thirteen (13) varieties of Arecanut to be released from the Department of Export Agriculture, Matale for up and mid elevations in Sri Lanka were screened against *Pratylenchus loosi* according to the standard protocol.

The results revealed that none of the varieties acted as hosts for *P. loosi*. Hence, all the varieties of Arecanut tested shall be recommended to be grown in the vicinity of tea growing areas prone to *P. loosi* as they would not serve as reservoirs of *P. loosi*.

Experiment No. N 248 b (2009) Screening of Arecanut varieties against *Radopholus similis*

Location: Nematology Experimental Area TRI, Hantana

Thirteen (13) varieties of Arecanut to be released from the Department of Export Agriculture, Matale for growing in mid elevations in Sri Lanka were screened for *Radopholus similis* using standard protocol in Hantana. The experiment is in progress.

Experiment No. N 248 a (2008): Screening of Coconut varieties against *Radopholus similis*

Location: Nematology Experimental Area, TRI, Hantana

Two varieties of coconut were screened for *Radopholus similis* nematode populations using standard protocol. The experiment is in progress.

Experiment No. N 248 b (2008): Screening of Pepper varieties against *Radopholus similis*

Location: Nematology Experimental Area, TRI, Hantana

Eight pepper varieties were screened for *Radopholus similis* using standard protocol. The experiment is in progress.

A 45.3 Evaluating methods for managing nematodes in mature tea

Experiment No. N 440: Evaluation of different species of Lemon grass in lowering *P. loosi* populations of tea soils

Location: Nematology Experimental Area, Talawakele

Populations of *P. loosi* in soils planted with five different species of Lemmon Grass were monitored periodically under glass house conditions. The experiment is in progress.

Experiment No. N 442: Demonstration / model area on integrated management of *Radopholus similis* in mid Country

Location: Kurugama Estate, Pilimatalawa.

An old tea field in Kurugama Estate with previous history of *Radopholus similis* infestation was chosen for the study. All TRI recommended GAPs with respect to integrated management of *P. loosi* were scheduled. The field was uprooted and Mana grass was planted in August 2009.

The field is due for planting with a recommended cultivar following stipulated rehabilitation period under TRI recommended practices.

The experiment is in progress. It is envisaged to monitor and maintain this area as a demonstration cum model area in close association with the TSHDA staff and tea small holders in the area.

Experiment No. N 443: Studies on root behavior of tea grown in soils identified to cause debilitation, yield decline and death of tea in different regions in the low country

Location: Nematology Experimental Area, Talawakele

Standard root rhizotrones filled with soils of (a) affected tea (viz. Handford, Richiland, Hapugastenna and Sooriyakanda) and (b) healthy tea of neighboring areas (viz. Palitha Group and St. Joackims) were maintained under Hot House conditions. Periodic measurements of root establishment, extension and growth were performed by mapping of young tea plants (Cultivar TRI 2026).

Mortality, healthiness and disease conditions of roots were also studied in soils collected from respective locations. Preliminary results revealed the negative impacts of soil sickness on root establishment and behavior.

Experiment No. LE 100 (a) and (b) Model trial for demonstration of the role of GAPs in lowering biotic stresses and maintaining yields of tea in Deniyaya region
Locations: Palitha Group and Victor's Land, Deniyaya.

Post prune observations of mature tea under TRI monitored and grower practice were monitored. Periodic observations of pests, diseases and weed incidences were also monitored. Results showed the role of timely adoption of TRI recommended GAPs in sustaining crop under the conditions prevailed in Deniyaya.

The experiment is in progress. It is envisaged to monitor and maintain this area as a demonstration cum model area in close association with the TSHDA staff and tea small holders in the area.

Basic Research Projects

B 29. Refining techniques of screening tea cultivars for natural resistance to the major insect pests of tea

Experiment No. LE 115 a: Developing a laboratory bioassay using “glass plate method” for screening cultivars against LCLWT as an early screening method

A series of experiments on the glass tray method were conducted with different cultivars (i.e. TRI 2016, 2022, 2026, 2027, 3025, 3055, 4004, 4006, 4014, 4042, 4049, 4059 and 4061). The preliminary results did not correlate with the field observations. The experiment is in progress.

Experiment No. LE 115 b: Developing a laboratory bioassay using “test tube method” for screening cultivars against LCLWT as an early screening method

Five worker termites each were introduced into each test tube comprising of five inch long fresh stems. This was tested with 36 different cultivars replicated three times. Observations on gallery making of termites were made after one month. The experiment is in progress.

Experiment No. LE 115 c: Developing a laboratory bioassay using “Petri dish method” for screening cultivars against LCLWT as an early screening method

Fresh tea stems of 2 inches in length were introduced into Petri dishes consisting three replicates. Five worker termites were introduced into each Petri dish. The cultivars TRI 2026, 4004, 4048, 4054, 4055, 4059 and 4061 were assessed by measuring the gallery length in centimeters after one month. The experiment is in progress.

B 30. Biochemical analysis of roots of tea cultivars

Experiment No. N 446: Evaluation of biochemical parameters in roots of different tea cultivars

Location: Nematology Experimental Area, TRI, Talawakele

Biochemical components i. e. polyphenols and amino acids of the root samples drawn from the VP 80 trials of Hantane (N1 B) and Passara (N1 A) were determined. The growth parameters of the test cultivars measured were height, girth, no. of leaves, no. of branches, leaf area, internodal length, total root length, weight of root fragments, shoot fresh weight, leaf fresh weight, root fresh weight, shoot dry weight, leaf dry weight and root dry weight.

Data were compared with growth measurements of the nematode infested plants of respective experiments and correlations were done.

The results did not indicate any significant ($P < 0.05$) correlation between the growth parameters and root nematode density in both locations. The fifteen variables were subjected to a principal component analysis for statistical evaluation.

Based on the factor loading of 0.50 or greater for a component, weight of root fragments, nematode index and internodal length were selected as valid parameters for cultivar screening against *P. loosi*.

The studies need to be repeated for validation with the next set of screening trials in 2010. The experiment is in progress.

B 68. Assessment of crop losses due to major pests

Experiment No. E 372: Assessment of crop losses due to Tea tortrix

Location: Field No. 2A, Newton Division, Poyston estate, Norwood.

Varied levels of yield losses were resulted in association with every six generations of tea tortrix observed in a period of one year. A management programme for tea tortrix is to be developed using the information gathered.

B 69. Identification and use of semio chemicals for reducing insect, nematode and mite pest damage

Experiment No. LE 117: Identification and Evaluation of Semio Chemicals of LCLWT

Location: St. Joachim Estate

The preliminary work on the Post Graduate study program of Mrs. P Senanayake, Experimental Officer was commenced.

Field selections with severe LCLWT damage in St. Joachim Estate and laboratory studies to isolate fungal associations with termite affected wood materials were completed.

D/ Ent1. Identification of safe insecticides, acaricides and designing of IPM methods for control of seasonal pests

Experiment No. E 382: Screening of Abamectin and Nimbecidine against mites

Location: Field No. 15B, Glen Alpin Estate, Passara.

Testing of the chemical Abamectin which is reported to be effective against tea mites (Annual Report, 1993) was done under field conditions.

Two dosages each of Abamectin (*viz.* 300 and 500 ml/ha) and Nimbicide (*viz.* 750 and 1000 ml/ha) and Sulphur as the standard and an untreated control were screened against mites. The experiment is in progress.

Experiment No. ME 42: Screening of Milbemectin against mites

Location: Field No. 5AB, Top Division, Hantana Estate, Hantana.

Screening of two dosages of Milbemectin (*viz.* 750 and 1000 ml/ha) was carried out against mites under field conditions along with Sulphur as the standard with an untreated control. Results showed that Milbemectin at 750ml/ha affected both the egg and adult stages of the mites similar to that of Sulphur. The trial is in progress.

Experiment No. ME 37: Screening of chemicals against scavenging termites on young tea

Location: Field No. 29, Upper Division, Imboolpitiya Estate, Nawalapitiya.

A new formulation Thiacloprid was tested against scavenging termites along with Imidacloprid as standard with an untreated control in a replicated trial. The results showed that the new formulation was effective as Imidacloprid. This trial is in progress.

Experiment No. ME 45: Screening of chemicals on scavenging termites on young tea

Location: Field No. 6, Lower Division, Hatale Estate, Hatale.

The efficacy of Thiadoprid at 500 ml/ha, Imidacloprid 500ml/ha and Fipronil at 500ml/ha was tested for control of scavenging termites with an untreated in a block trial (each block consisted of 100 plants).

Assessments carried out in three months interval showed that termite attack was not found in any of the chemically treated blocks. The experiment is in progress.

Experiment No. E 383: Manual collection of Tea Tortrix egg masses

Location: Drayton Estate, Kotagala

Manual collection of egg mass of Tea Tortrix was studied in depth as an IPM strategy.

Since November 2008, any chemical spraying was not made and hence, the results envisaged that the manual collection of Tortrix egg masses was effective in controlling Tea Tortrix.

Incentives were given to workers for manual collection of egg masses.

Experiment Nos. ME 48 and E 384: Screening of insecticides for control of white grubs

Locations: (ME 48) Entomology Experimental area, TRI Mid Country Station and (E 384) Talawakele.

Different rates of Thiocyclam were tested in a pot trial. The results of two post treatment assessments carried out (4 and 10 days after treatment) did not show effective control of the white grubs. Hence, this experiment was terminated.

Experiment No. E 355: Declining and Regional trials on Sulphur residues

Locations: St. Coombs, St. Joachim, TRI Passara, Hantane Estate.

Declining and regional trials on S residues were completed as per FAO guidelines.

D/ Ent2. Management of LCLWT

Experiment No. LE 106: Evaluation of prune cut dressings for LCLWT

Location: Field No. 19, UWK Division, Hapugastenna Estate, Hapugastenna.

The treatments included (i) Tangle foot adhesive (imported from USA), (ii) Tangle foot adhesive + Imidacloprid and (iii) untreated control in 3 replicates.

This trial is in progress.

Experiment No. LE 114: Screening of two locally available waste materials as prune cut dressings for control of LCLWT

Location: Field No .27, Upper Division, Hapugastenne Estate, Hapugastenna.

Oil palm mill affluent containing <1% oil and Oil free waste material were tested in three replicates as prune cut dressings in LCLWT affected tea land with an untreated control. The results of the two assessments carried out did not show any termite attack in any of the plots. This experiment is in progress.

Experiment No. LE 116: Use of Light traps to study the colonization patterns of LCLWT

Location: St. Joachim Estate

Two light traps (18 W florescent bulbs) were fixed at 4 feet and 6 feet from the ground level with a distance of 20 feet apart. Traps were kept lit from evening to following day morning (6 pm- 5.30 am). Traps were checked daily for trapped alates (winged forms of termites). This experiment is in progress.

Service Projects

C/ NEM. Developing and maintaining a nematode diagnostic service

The Nematology Laboratories at Talawakele, Hantane, Ratnapura and Kottawa continued to assist corporate sector plantations and small holdings, in analyzing soil and root samples from nurseries and fields.

The nematology analytical laboratory was formally opened at the New Building Complex at Deniyaya.

Number of samples analysed for nematode estimation during the year 2009 is shown in the Table.

Sector	Region	Field	Nursery	Total
Plantations	Up country	100	215	315
	Mid Country	10	11	21
	Low Country	-	-	0
	Southern	9	6	15
Smallholder	Nuwara Eliya	4	6	10
	Kandy	1	-	1
	Ratnapura	21	120	141
	Deniyaya	9		9
Total		154	358	512

C/ ENT. Developing and maintaining facilities to assess pest-related damage in the field, and in made teas, for quarantine purposes

Routine pest diagnosis service was rendered by the Entomology Laboratories at Talawakele, Hantane and Ratnapura. A summary of samples analysed and reports dispatched is given below.

Pest	Number of samples assessed	Number of reports dispatched
Shot Hole Borer	132	4
Made Tea Pests	11	2

In addition to the analytical services, entomology and nematology staff delivered expert technical assistance in diagnosing attributes of the following field problems associated with pests and unknown factors.

Yield decline in Kew, Theresia and Kirkosowold estates,
Sudden death of tea in small holder tea lands in Deniyaya

Pest management related attributes contributing to high yielding tea fields in Homodola estate, Udugama were also studied.

General

Positions

- Dr. K M Mohotti continued to serve as the Convener/Secretary of the Institute's Experiments and Extension Forum.
- Dr. K M Mohotti served as a member of the TRI Pesticide Residue Monitoring Committee, and Agro-Chemical and Machinery Screening Committee.
- Dr. K M Mohotti served as an Executive Committee Member of the Institute of Biology, Sri Lanka, of the Organic Agriculture Movement (LOAM), and of the SLAAS Environment Committee (Section E).
- Dr. K M Mohotti served as a member of the Thematic Committee on Alternate Agriculture of the National Science Foundation (NSF), Colombo, Sri Lanka.
- Dr. K M Mohotti served as a member of the National Committee in the 'Control of the Papaya Mealy Bug' appointed by the Sri Lanka Council for Agricultural research Policy (CARP).
- Dr. K M Mohotti was a member of the Steering Committee of the Senior Scientist's Forum (SSF) of NASTEC of the Ministry of Science and Technology.
- Dr. K M Mohotti was a member of the National Steering Committee of the Global Environment Facility (GEF) of the UNDP, on voluntary basis.
- Dr. K M Mohotti continued to serve as a visiting lecturer on the Boards of Study, Plant Protection, Agricultural Engineering and Crop Science, in the Post Graduate Institute of Agriculture, Peradeniya and Uva Wellassa University, Badulla.
- Drs. K M Mohotti and R S Walgama supervised 4 and 2 research projects of final year University students respectively.

Participation at conferences and seminars

- Dr. K M Mohotti visited the Republic of Korea during 16 - 21 November 2009 to attend the "2009 East Asia Organic Conference" held at COEX, Namyangju City, Yangpyeong Country as a country representative. The program was sponsored by the Governor of *Gyeonggi Province* Namyangju City, Yangpyeong Country, South Korea.
- Drs. K M Mohotti and R S Walgama made presentations on pest management at the 219th E&E
- Dr. K M Mohotti participated in the "Crisis management and decision making workshop with respect to formulating a national strategy for the management of the Papaya Mealy Bug coordinated by the PGIA, Peradeniya.
- Dr. K M Mohotti presented natural control of mites at the RSC held at TRI Low country Regional Centre

Vacation of Post

Dr. R S Walgama Research Assistant vacated his post of the Institute with effect from 31 July 2009.

Transfers

Mrs. C De Seram, Experimental officer was transferred to Ratnapura from Talawakele with effect from with effect from 15 June 2009.

Research Communications

- R S Walgama, S Nandakumra, C De Seram, S Randeniya and R Sannasooriya 2009 A simple and cost effective way out for managing tea Tortrix in plantations which would be supplementary for an IPM programme: A case study. Proceedings of the 219th E & E Forum
- Y L B Pavithrani, R S Walgama and L Nugaliyadda 2009 The influence of temperature on the vegetative growth of *Beauveria bassiana* (Balsomo) Vuellemin and its' pathogenicity on *Xyleborus fornicatus* Eichh. (Coleoptera: Scolytidae). The shot-hole Borer Proceedings of the 2nd National Symposium "Food for Nation through Innovative Agriculture" Faculty of Agriculture, University of Ruhuna, Sri Lanka. 86p.
- D M C K Wijesinghe, R S Walgama and D C Abeysinghe 2009 The effect of UV irradiation on the vegetative growth of *Beauveria bassiana* (Balsomo) Vuellemin and its' pathogenicity on *Xyleborus fornicatus* Eichh. (Coleoptera:Scolytidae). The shot-hole borer of tea. "Proceedings of the 8th Research Symposium of the University of Wayamba. Sri Lanka.
- K M Mohotti, D S Amarasena, P D Senanayake, W M A Shantha, L Nugaliyadda, R Perera, B S Vithana and A K Prematunga (2009) Natural Pesticides for Mite Control. Proceedings of the 219th Experiment and Extension Forum, Tea Research Institute of Sri Lanka.

Advisory circulars

During the period under review, the following Advisory Circulars were released.

1. Tea Nursery Management (No. PN 2)
2. Fumigation of Nursery Soils for Nematode Eradication (No. PM 11)
3. Management of Tea Totrix (No. PM 10)



Hybrid seeds



Embryo germination



Shoot multiplication



Ex vitro rooting



Rooted plant



Nursery plants



Field planted
tissue culture plants

Production of large number of uniform plants from hybrid seeds within a short period of time using the perfected tissue culture protocol leads to the reduction of time taken for development of new tea cultivars

Plant Breeding Division

M T K Gunasekare

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

Head, Senior Research Officer

Highlights of the Year

- Protocol perfected for micropropagation of tea was successfully integrated into the conventional breeding program confirming its practical application to reduce the time taken to develop new cultivars by 6 years.
- Project proposal submitted on “Low-cost *in vitro* propagation method for developing disease resistant tea varieties through embryo rescue” was selected to include in the National Biotechnology R&D program and an investment plan” which was jointly developed by FAO & CARP.
- Germplasm collection was uplifted appreciably by adding accessions of diverse exotic origin.
- Slow fermenting exotic germplasm were identified using fermentation test conforming their suitability for green tea.
- A wide array of diversity was created by incorporating traits from distantly related germplasm of exotic origin to augment the base material with novel genes to meet the future needs of the end-users in a broader perspective.
- M T K Gunasekare received the Presidential Awards for Research - 2006

Peer Reviewed Publications

- M A B Ranatunga and M T K Gunasekare (2009). Assembling of preliminary core collection of tea (*Camellia sinensis L.*) genetic resources in Sri Lanka, Plant Genetic Resources Newsletter (IPGRI/FAO) Vol. 155: 41-45
- U V A Buddhika, M T K Gunasekare, S Hettiarchchi, M A B Ranatunga and G Hemamali (2009) Preliminary study on segregating pattern of anthocyanin pigmentation as a marker to facilitate tea breeding, Proc. of 6th Academic sessions of University of Ruhuna, 2009, 37 p.
- P K Madugalle, M T K Gunasekare, N Senanayake (2009) In vitro culture of immature embryos of tea (*Camellia sinensis L.*), Proc. of Research Symposium, University of Rajarata, May 7, 2009: 40p
- R S Walgama, M T K Gunasekare, M Jayatilaka, J D K Arachchi, D Liyanage, Evaluation of tea germplasm for host plant resistance to shot hole borer, S L J Tea Sci, 73(1); *In press*

Research activities

Towards meeting the objectives of the TRI Corporate Plan, the following activities were carried out under the applied research theme of “Breeding for Crop Improvement” and the progress of each project are reported under relevant thrust and project.

The main focus of thrust A1, A2, A3, and A4 was on incorporating desirable attributes, which is not present in the existing high yielding cultivars to increase the grower acceptability while meeting the diverse needs of the end-users. It is also intended to implement an agro-ecology based cultivar recommendation to facilitate growers to choose best possible cultivars for their specific localities more confidently.

Under the above thrusts main emphasis was placed on four priority areas to streamline the germplasm enhancement, cultivar development and release:

(1) evaluation of TRI 5000 series cultivars on multi-location trials aiming at agro-ecology based cultivar recommendation, (2) Identification of promising seed progenies as an alternative source of planting material and validating their potential under commercial settings, (3) Strengthening of controlled hybridization program with especially emphasis on wide and inter-specific hybridization and (4) Systematic characterization and evaluation of germplasm to promote its use in the breeding program.

Thrust A1. Development of high yielding tea cultivars suitable for agro-ecological regions in the up country and incorporated with high quality, resistance to blister blight, shot-hole borer, Nematodes, Poria and collar canker (*Phomopsis*) and traits suitable for mechanical harvesting

A1.1 Developing suitable cultivars through hybridization, non-conventional breeding methods and selection

a. Controlled hybridization program – Up country 2009 program:

Controlled hybridization of 2009 was focused on creating inter specific hybrids to facilitate introgression breeding program. Using different *C. sasanqua* germplasm as pollen parents inter-specific crosses were performed with 3 female parents, TRI 2142, 3013 and 3019. To enhance the pollination ability, pollen were treated with an aliquot of 10% Sucrose and 200 ppm Boric acid solution after dusting the pollen onto the stigma. Of the 120 crosses performed, only three fruits could be harvested from TRI 3019. Those seeds were cultured *in vitro* (see under project D 1).

2008 Program:

Harvesting of seeds was completed and 350 seeds collected from the cross, N2 x China, were sown and 129 germinated hybrid seedlings were transplanted in nursery bags and are being maintained in the nursery.

Hybrid plants of 2007 program:

Normal cultural practices were undertaken in the progeny trial established with 210 hybrid plants generated from genetically diverse parents such as China and Yabukita as male parents. Prior to centering of bushes, individual hybrid plants were photographed for documentation of their plant architecture and characterized those using some morphological descriptors and growth parameters. Statistical analysis of growth parameters revealed that there is a significant variation between half sib families derived from two male parents.

Hybrid plants of 2006 program:

Growth performances of hybrids were monitored. 3rd centering /tipping was carried out in July in the hybrids generated from 2006 program. Shoots taken from 139 hybrid plants were used for propagation to raise VP plants.

Hybrid plants of 2004 and 2005 program:

Plucking and yield recording of individual hybrid seedlings of 2004 and 2005 programs have been continued. According to the green leaf analysis, 8 hybrid individuals of 2004 program showed promising yields. First centering of VP plants raised from 31 hybrid progenies of 2004 program, which were planted in Field No. 13 - St. Coombs estate, was undertaken in November. First set of V.P. plants of 28 hybrids of 2005 program were planted in Field No 13, St. Coombs Estate, in June. Those VP plants were raised from individual hybrids in order to create their clonal materials aiming to establish replicated field trials in 4 regions in future.

- b. Evaluation of accessions/breeding lines in Phase I and II trials
Six Phase II trials (VP 80, 81, 83, 85, 87 and 89) are in progress at different stages of evaluation to select promising cultivars for different agro-ecological regions in the up country region. Weekly plucking and yield recording have been continued in VP 83, VP 85 & VP 89 while tipping assessment was undertaken in VP 81.
- c. Adaptive trials -Commercial Evaluation of cultivars in the pipeline in multi-locations – Phase III trials
Eight new potential cultivars are under commercial evaluation in the final stage, in the up-country region for developing agro-ecology-specific cultivars. Testing of cultivars established in Mattakelle Estate, Talawakelle has been continued in the first cycle with weekly yield recording and quality analysis.

Assessment at the time of second centering in the observational trial at Somerset estate, Nanu oya and trial established in field No. 30, Larchfield division at Gartmore estate, Maskeliya has been continued to monitor and infilling, centering and other cultural operations were carried out.

Eight potential TRI 5000 series accessions together with standard cultivars were issued and propagated in the nurseries at Dayagama West Estate, Agrapatana in June and in Carolina estate, Watawala in September aiming at establishing two new adaptive trials with the partnership of RPC estates. Nursery propagation of TRI 5000 series cultivars for adaptive trials in Glasgow estate, Agrapatana has been continued. Cuttings of TRI 5000 series propagated at the Plant Breeding nursery to establish a new adaptive trial on Pedro estate, Nuwara eliya has been monitored.

Mother bushes of TRI 5000 series: Eight selected accessions of TRI 5000 series were planted in clonal rows in Field No. 13, St Coombs to increase the number of mother bushes of potential TRI 5000 series cultivars in order to cater the demand for planting material in future.

d. Estate Cultivars selection program:

Old seedling tea selections on Fairlawn estate- First cycle yield recording on weekly basis has been continued

Screenings of plant breeding accessions were undertaken by the multi-disciplinary team and are reported under relevant project as follows:

A 1.3 Screening lines for resistance to Shot hole borer

As pest pressure was found not suffices to conduct screening in Phase I and II trials located in St Coombs estate, most of the screening work for SHB was carried out by the Entomology division in several other locations using know cultivars.

A 1.4 Screening lines for resistance to root-lesion nematode (*P. loosi*)

Of the 14 accessions from VP 80, nine accessions (Code Nos 5, 22, 88, 89, 99, 101, 210, 272 and 557) were grouped into tolerant – moderately tolerant to *Pratylenchus loosi*.

Twenty accessions of VP 83 are being screened for nematodes.

A 1.5 Screening lines for response to applied nutrient

Trial established at Field No. 13, St Coombs estate with cultivars of TRI 5000 series is being continued by the Soils and Plant Nutrition division for estimating the response of applied nutrients on different cultivars. Preliminary yield assessments are being continued prior to treatment application.

A 1.6 Evaluating lines amenable for mechanical harvesting

Major activities of this project is undertaken together with activities of Project A4.6 and reported accordingly.

A 1.7 Screening lines for made tea quality

The recently developed new tea cultivars for Nuwara Eliya Regions has been continued to test for made tea quality parameters against the control by the Technology Division. Experimental samples were manufactured using Environmentally Controlled “Withering and Fermenting Chamber”. Samples from eight test accessions and control DT 1 was subjected for quality testing in triplicate. Statically analysis of tasters’ scores and chemical quality parameters (TF & TR ratio) revealed that out of eight accessions, five accessions confer quality comparable to DT1. Three accessions together with PK 2 in Phase II trial at Pedro estate were also subjected for quality testing in triplicates and await tasters’ scores.

Other divisional activities undertaken to generate information for Plant Breeding Research Program in keeping with the immediate needs for generating basic information are described below:

a. Germplasm conservation, characterization and evaluation

In 2009, activities related to germplasm have been re-shifted from morphological characterization to chemical characterization and also strengthening the collection by adding exotic germplasm and their evaluation, especially to select cultivars suitable for green tea.

Some unique accessions taken from gene bank at Uva regional station were propagated in the Plant breeding nursery at Talawakelle to ensure safe duplication. Centering was carried out in the exotic germplasm accessions that were added to the up country gene bank collection recently. Yield assessment and evaluation of some exotic accessions of Korean origin was commenced in August and seedlings of Russian origin have been propagated in order to evaluate them as clonal progenies.

b. Biochemical characterization of selected germplasm accessions

A research project on biochemical characterization of selected tea germplasm accessions (40) was initiated in collaboration with Technology Division. Of the 12 biochemical parameters selected, crude fiber content and rate of fermentation were determined and processed black tea samples were sent to professional tea tasters for sensory evaluation. Slow fermenting germplasm accessions of exotic origin were identified using fermentation test conforming their suitability for green tea. Measurement of yield components and agronomic traits of same accessions were also initiated.

Thrust A2. Development of VP cultivars for the Mid country wet zone

Development of high yielding tea cultivars suitable for agro-ecological regions in the mid country- wet zone, and incorporated with high quality, resistance to drought, shot-hole borer, blister blight, stem canker, nematodes and traits suitable for mechanical harvesting.

A 2.1 Developing suitable cultivars through hybridization, non-conventional breeding methods and selection

A progeny trial established with a population of bi clonal seeds (TRI 4004 x TRI 4006), one phase II (MVP 12) trial, and mutation-breeding trial are in progress. Eight promising bushes selected based on yield, shoot growth rate and SHB resistance were propagated in May to study the second generation performance of mutated materials. Yield recording in the second cycle was commenced in mutation breeding trial in September.

Adaptive trials - Commercial Evaluation of cultivars in the pipeline in multi-locations in Mid country – Phase III trials

Propagation of cuttings of TRI 5000 series for establishing new phase III trials: Selected accessions of TRI 5000 series which were issued and propagated in Greenwood estate, Nawalapitiya were monitored regularly.

Screening of plant breeding accessions was undertaken by the multi-disciplinary team and is reported under relevant project as follows:

A 2.3 Screening lines for resistance to Shot hole borer

Individual plants of mutation breeding trial sampled for SHB screening revealed that 3 bushes (Code Nos 76, 77 and 80) raised from gamma irradiated cuttings were resistant as compared to none-treated control, TRI 2025 which showed high susceptibility in the same trial/ location.

A 2.4 Screening lines for resistance/tolerance to root-lesion and burrowing nematodes

Accessions subjected for nematode screening (*R. similis*) at Hantane was reported as inconclusive and will be repeated.

Projects A2.5 and Project A2.6 are pursued under Projects A1.5 and A4.6 respectively

A 2.8 Screening lines for resistance to drought

Basic studies to develop a method for screening of plant breeding accessions/tea cultivars are being pursued under the Project B 64.

Thrust A3. Development of high yielding tea cultivars suitable for agro-ecological regions in Mid country (semi-dry zone), and with incorporated high quality, resistance to drought, shot-hole borer, blister blight, stem canker, nematodes and traits suitable for mechanical harvesting.

A 3.1 Developing suitable cultivars through hybridization, non-conventional breeding methods and selection

- Phase I, II and adaptive trials

Fifty-seven accessions in Phase I /UVP 10 and II trial/UVP 9 and nine potential cultivars of TRI 5000 series are under evaluation in three locations in Uva region at various stages. Second cycle yield recording was completed in UVP 9 and bushes were pruned in September. First cycle yield recording has been continued in TRI 5000 series adaptive trials at TRI, Passara and Glen Alpine Estate, Passara. Second centering and tipping was undertaken and normal cultural practices have been continued in trial at Craig Estate, Bandarawella.

- Germplasm - Passara

Cuttings of some unique germplasm accessions available at gene bank in Uva Regional station were propagated at plant breeding nursery, Ratnapura and Talawakelle aiming at safe duplication.

A 3.2 Screening lines for resistance to shot hole borer

Results of screening carried out by the Entomology division in UVP 9 with 24 accessions revealed that only one accession (No.43) was resistant to SHB while accessions 243 and 125 were moderately resistant.

Accessions in UVP 10, none were found resistant whereas only accession 125 was moderately resistant to SHB.

A 3.4 Screening lines for resistance/tolerance to root-lesion and burrowing nematodes

Five accessions (Code Nos 5, 88, 89, 208 and 210) screened for *P. loosi* were subjected for final analysis and data revealed that four accessions (5, 88, 89 and 210) grouped into tolerant – moderately tolerant category.

Shoots from accessions (No. 21, 22, 497, 43, 53, 225 and Control -TRI 2025) were issued in May/ June to the Entomology division for propagation in order to conduct nematode screening in future.

A 3.5 and A 3.6 Pursued under Projects A 1.5 and A 4.6 respectively and reported accordingly.

A 3.8 Screening lines for resistance to drought

Basic studies to develop a method for screening of plant breeding accessions/tea cultivars are being pursued under the Project B 64.

Thrust A4. Development of high yielding tea cultivars suitable for agro-ecological regions in the Low country, and incorporated with resistance / tolerance to drought, low country live wood termite, stem canker, shot hole borer, nematodes and traits suitable for mechanical harvesting

A 4.1 Developing suitable cultivars through hybridization, non-conventional breeding methods and selection

a. Evaluation of Accessions: Phase I and II

One trial in Phase I and twelve phase II trials are presently under evaluation in the low country. Based on 1st cycle yield and visual assessments carried out from time to time, 31 promising accessions selected from LVP 84/Phase I were propagated in the nursery to advance those accessions in to Phase II. Based on overall performances of the accessions over two pruning cycles in LVP 80, 81 and 82 thirteen and from LVP 85 ten and from LVP 86 twenty two promising accessions were selected and propagated in the Nursery. The above trials were handed over to the St. Joachim Estate after completing preliminary evaluations.

Weekly plucking and recording of yield in the 3rd cycle in trials, LVP 76, LVP 77, LVP 78 and LVP 79 and 2nd cycle in LVP 83 have been continued. Yield recording in the 3rd cycle was commenced in LVP 85 in June.

b. Hadaraganga selections for LCLWT

Bushes were brought into bearing and first cycle yield recording was commenced in September.

c. PHASE III: Adaptive trials -Commercial Evaluation of cultivars in the pipeline in multi-locations

Four commercial evaluation trials in different agro-ecological regions in the Low country viz, Kottwa (Agro-ecological zone – WL 2). Cecilton Estate, Balangoda (agro-ecological zone, WM 3); Deniyaya Estate, Deniyaya and Indola Estate, Deniyaya (agro-ecological zone: WM 1) have been continued.

First cycle yield recording has been continued in trials at **Deniyaya and Indola**. First cycle yield recording was completed in August and pruning was done in trial at **Cecilton estate, Balangoda** while yield recording in the 2nd cycle has been

continued in trial at **Kottawa**. Visual observations on the performances under dry weather were carried out in February at Kottawa trial.

Two new TRI 5000 series adaptive trial were established: (1) with a partnership of a smallholder in Batapola, Southern region in May using 6 accessions (01, 59, 174, 195, 278) selected from LVP 74 together with two standard cultivars (TRI 4042 & 4049) and (2) In Balangoda estate, Balangoda (Field No. 4B NC, 2009, Maratanne Division) in October using potential TRI 5000 series accessions (Code Nos 15, 210, 243, 272, 582) cultivars together with 3 standard cultivars (TRI 2026, 4049, 4053).

d. **Controlled Hybridization program – Low country**

Recording of yields of individual bushes of hybrid progenies and assessments on active and banji shoots has been continued. Visual observations on growth performances of hybrid seedlings under dry weather were carried out in February. Second Centering of Hybrid seedlings (Batch 2) was carried out in December.

e. **Germplasm**

Overhaul of gene bank at Ratanapura: Propagation of accessions for a new gene bank was completed. A total of 150 accessions taken from gene banks at St. Joachim, Passara and Kottawa, were propagated in the Plant Breeding nursery at Ratnapura.

Multi-disciplinary research group from other divisions collaborate to undertake screening of plant breeding lines for various other traits as reported below:

A 4.2 Screening lines for resistance to canker

Pathology Division screened the accessions in LVP 85 in August and 6 accessions were found to be resistant to canker. All the accessions sampled from adaptive trial at Cecilton estate, Balangoda in October were free from canker infection and hence, reported to be unable to screen using the available protocol.

A 4.3 Screening lines for resistance to Shot hole borer and Low country live wood termite

a. **SHB screening**

LVP 85 and LVP 86 – SHB pressure was not adequate to do a proper screening in St Joachim and hence the results were inconclusive.

Entomology division screened the accessions for SHB in trial at Cecilton estate, Balangoda in September at the first prune and results revealed that of the 10 accessions, two accessions (Code Nos 107 and 142) showed low infestation levels.

b. LCLWT screening

Screening of 20 test accessions together with three controls in two replicates were carried out in LVP 85. LCLWT infestation was found only in two test accessions, No. 22 and 64.

A 4.4 Screening lines for resistance/tolerance to root-lesion and burrowing

Activities related to this project is combined with projects A2.4

LVP 75: Shoots of 4 selected accessions (29, 62,107, 131,139, 12/11, 23/5) from LVP 75 were issued in two batches to Nematology Division in May and in November respectively and 30 accessions from LVP 74 were collected by Nematology Division (Hantana) in November for Nematode screening.

A 4.5 Screening lines for response to applied nutrients

Activities related to this project were combined with Project A1.6 and reported accordingly.

A 4.6 Evaluating lines amenable for mechanical harvesting

A new experiment has been commenced by the Agronomy division in October using Plucking Shear (non selective) on TRI 2023, 2027, 3025, 3055, 4014, 4042, 4049 & 4061 to select cultivars amenable for mechanical harvesting. Parameters such as inter-nodal Length, Leaf angle, Leaf size, shoot composition of the Harvest, Shoot Density (using Quadrant) were measured.

Thrusts A5. Development of bi- and ploy- clonal seed stocks for drought prone areas in different agro-ecological regions

A 5.1 Development of improved seed cultivars suitable for different tea growing regions through selection

a. Regional trial for testing seed stocks - (On-station trials)

Second cycle yield recording was continued in up country and Uva regional trials. Harvesting and yield recording in the 3rd cycle was commenced in the mid country trial and in the low country trial in July and September respectively and continued weekly thereafter.

b. Commercial scale evaluation of seed stocks – Adaptive trials

First cycle yield recording has been continued in trials at TRI, Passara, Hesal Lanka (Pvt) Ltd, Galaha and Endana Estate, Kahawatta. Seedlings planted in the trial at Hesal Lanka were demarcated according to the accessions in each seed garden and yield recordings have been commenced separately in each accession in August. Visual drought assessment conducted in February in Hesal Lanka trial

showed that cultivar DG 7 was not affected by drought. Cultivars TRI 4046 and TRI 4042 were badly affected and all seed stocks were affected. Seed stocks Sapumalkanda 3055, 2043, 2025, S 106, Anhettigama 2043, Rambukkanda 3055, 2025 were comparatively better than the other seed stocks.

Third centering was carried out in trial at Small Holder in Warapitiya and second centering was undertaken in trial at Craig Estate, Bandarawella.

Research findings on testing the suitability of seed stocks for low output environments was presented at the Advisory Research Linkage meeting. As decided at the meeting, it was decided to establish seed stock evaluation adaptive trials on grower's fields in collaboration with the Advisory division before recommending seeds as an alternative planting material. Ten different seed stocks collected from 4 seed gardens were germinated in 3 locations (Talawakelle, Hantana and Passara) to produce sufficient planting materials for the trial. Seeds were collected from 4 seed gardens (Salawa, Halpe, Rambukkanda and Kiriporuwa) in July. Germination percentages were above 70% in Talawakelle and Hantana whereas none of the seeds were germinated in Passara. Currently, sufficient number of seedlings is available with majority of the seed stocks.

c. **Biclonal and polyclonal seed gardens:**

Visits to seed gardens aiming at upkeep and maintenance were restricted during the middle half of the year owing to financial constraints. Based on the available information related to flowering and fruit set surveys and seed stock evaluations, it was decided to continue maintenance of the seed gardens, Salawa, Halpe, Kiriporuwa, Anhettigama, Sapumalkanda Rambukkanda Rygama and Reucastle and terminate the maintenance of seed gardens, Urumeewala, Karadupona Maliboda and Sorana After a discussion with the Management of Rygama and Sorana estates, maintenance and up keep of both seed gardens were handed over to the estate with effect from August 2009.

Supportive projects

D1. Use of *In vitro* techniques to supplement the conventional breeding program

- a. **Micropropagation of hybrid seedling – 2006 controlled hybridization program:**
Another batch of 73 micro shoots was sub-cultured (5th sub-culture) and 290 micro shoots were obtained. It was observed that some hybrids (eg. Code K 33 & K 44, O 38 and C 169) has a higher multiplication rate as much as 35 -60 micro propogules from a culture passage of 9 months than some others hybrids. In general, all the other hybrids accounted for only an average 6- 15 shoots at the 3rd sub culture. Of the 148 *ex vitro* rooted microshoots, 83 micro shoots were transferred to normal environment.

- b. Micropropagation of hybrid seedling – 2007 controlled hybridization program: 65 microshoots were obtained after the 2nd sub-culture, with a total passage of 5 month from 20 hybrid seeds.
- c. Micropropagation of hybrid seedling – 2009 controlled hybridization program: Of the inter-specific crosses carried out (TRI 3019 x *C. sasanqua*) in 2009 controlled hybridization program, three fruits were harvested from, after attaining the full maturity. Those were cultured *in vitro*.
- d. Field planting of tissue culture plants:
Evaluation of growth performance of 27 micropropagated plants of first **batch** (Source: Open pollinated seeds) established in the field has been continued. **Second batch** of micropropagated plants (83 Nos) raised from 6 hybrid plants of 2006 controlled hybridization program and 34 numbers of micro propagated plants of Russian seed stock that were planted in the field in August have been monitored. Third batch of micropropagated plants (126 plants) used for comparison of micropropagated vs. conventional VP plants, as described below, were also planted in the field.
- e. Performances of tissue culture plants vs. conventional VP plants
A study which was initiated to make comparison between conventionally propagated plants and micropropagated tea plants have been continued and qualitative assessments were carried out. Destructive sampling was carried out to compare growth performances of micropropagated plants vs. conventional VP plants at 10 months of age. Parameters quantified were: plant height, number of leaves and branches, fresh and dry weights of shoot, roots and shoot to root ratio. More callus formation was seen in conventionally propagated cuttings whereas no such callus formation was apparent in micro shoots when rooted *ex vitro*, confirming exceptional rooting performances in micropropagated shoots. 126 Micropropagated plants and normal conventional VP plants have been planted in the field (No. 9) in October in order to evaluate and compare their field performances.

A study was initiated to monitor the progression of embryo of tea in order to facilitate development of an *in vitro* protocol for embryo rescue. Crosses of DT 95 x TRI 777 was carried out to use material for destructive sampling in close intervals. Light microscopic observations have been completed for monitoring of embryo growth at three different time intervals.

Awards and Recognitions

- M T K Gunasekare received the Presidential Awards for Research
- Proposal submitted by M T K Gunasekare (Principle Investigator) was selected to include in the National Biotechnology R&D program jointly developed by CARP – FAO. Projects deals with low-cost *in vitro* propagation method for developing disease resistant tea varieties through embryo rescue.
- M T K Gunasekare was invited to review the research program on Plant Breeding and Biotechnology at the CRI – 24th July.
- M T K Gunasekare was appointed as a member of two National committees, National Committee on Agricultural Biotechnology and National Committee on Plant Breeding, by the CARP.
- M T K Gunasekare was invited to deliver a presentation on: “Needs Assessment of Modern Biotechnology for Perennial crops” at the Workshop on Biosafety: Status verification and risk assessment at National level, jointly organized by CARP, Ministry of Environment & Natural Resources and NSF, 24-26 November.

Workshops/Training programs/ meetings attended:

M T K Gunasekare attended the following:

- Seminar on Biotechnology and GMF organized by the US Embassy - 20th February
- ADB mother bush project meeting with Director and site Managers held in TRI Hantane – 23rd March.
- Workshop to discuss modalities in implementing seed act, organized by Dept. of Agriculture at In-Service Center, Gannoruwa – 26th March.
- FAO /CARP – Principal investigators’ meeting to discuss details of the project proposal selected for the National Biotechnology R&D program jointly developed by CARP – FAO – 23rd April at NILS, Univ. of Colombo
- Presentation on Seed cultivars for marginal tea lands at the Advisory-Research Linkage meeting - 1st June
- Regional Technical and Extension Forum at Hantane - 27th July.
- RSC IV – Deniyaya & Matara -Made a presentation on “Tea cultivars for Low country region” - 14th September
- Regional Scientific Committee at TRI, Ratnapura –Participated in the panel discussion - 13th October
- National Committee on Agricultural Biotechnology at CARP - 29th October
- National Committee on Plant Breeding at CARP - 29th October
- Workshop on Access to Biological resources and benefit sharing conducted by the Ministry of Environment & Natural Resources and Dept. of Agriculture at Amaya Lake, Dambulla: 26-27 November
- Meeting to discuss Amendment of seed act No.22/ 2003 organized by MPI at Ministry of Agriculture Development and Agrarian Services -16th December

M A B Ranatunga attended the E&E (Small holder) forum at Ratnapura – 15th May and RSC seminar – Nuwara Eliya region on 19th November

H A C K Ariyaratne attended to the E&E (Small holder) forum at Ratnapura – 15th May

Grade I & II staff participated in the E&E forum (Smallholder sector) at TRI, Talawakelle on 14th December 2009

Services/Materials offered to growers and other research disciplines

- Cultivar identification at Somerset Estate nursery – 19th June
- Germinated seeds were provided to Entomology division for their studies – June
- Cultivar identification at Holyrood estate, Talawakelle – 28th July.
- Familiarization program on Plant Breeding activities at TRI for undergraduates from Faculty of Agriculture, University of Peradeniya – 27th July.
- Familiarization program on Plant Breeding activities for undergraduates from Wayamba University – 16th September.
- Clonal identification at Waltrim estate – 2nd October
- Inductive training program for newly appointed TRI Extension Officers - 9th October
- Familiarization program on Plant Breeding activities for undergraduates from Jaffna University – 11th November.
- Awareness program for Trainee Asst. Superintendents, Stafford estate – 10th December.
- Assisted Entomology staff for SHB sampling of TRI 3000 and TRI 4000 series cultivars at Luckyland Estate, Udapussellawa in January; Nematology staff to take soil samples from VP 81 – May; Provided Green leaf from germplasm accessions to Biochemistry Division for their molecular analysis work in January; Germinated seeds (open pollinated) from cultivars TRI 2024, 2043, 777 and 1114 to Entomology division and Seeds (open pollinated) from 6 seed gardens to the Agronomy division in July for their experiments.

Plant breeding staff at low country conducted the following training for growers:

- Demonstration on Seed propagation and Cultivar Identification for a group of student from Karapinche Farm School – 28th January
- Demonstration on new cultivars for a group of small holders from Yatiyantota – 26th March
- Public – Private partnership program conducted by the Advisory division – 23rd April
- Cultivar identification at Balangoda estate – 9th June
- Familiarization on cultivar identification for a group of small holders from Yatiyantota – June
- Nursery demonstrations and cultivar identifications for small holders from Yatiyantota - 16th September

- Nursery demonstrations and cultivar identifications for students from Sabaragamuwa University- 29th July and from Karapincha farm school -23rd July.
- Demonstration by the low country staff on Cultivar Identification for a group of small holders from Mathugama - 17th December
- Plant Breeding staff participated at the Crop clinics at Uva – 20th August and Southern region, at Kottawa – 3rd December

Visiting Scientist

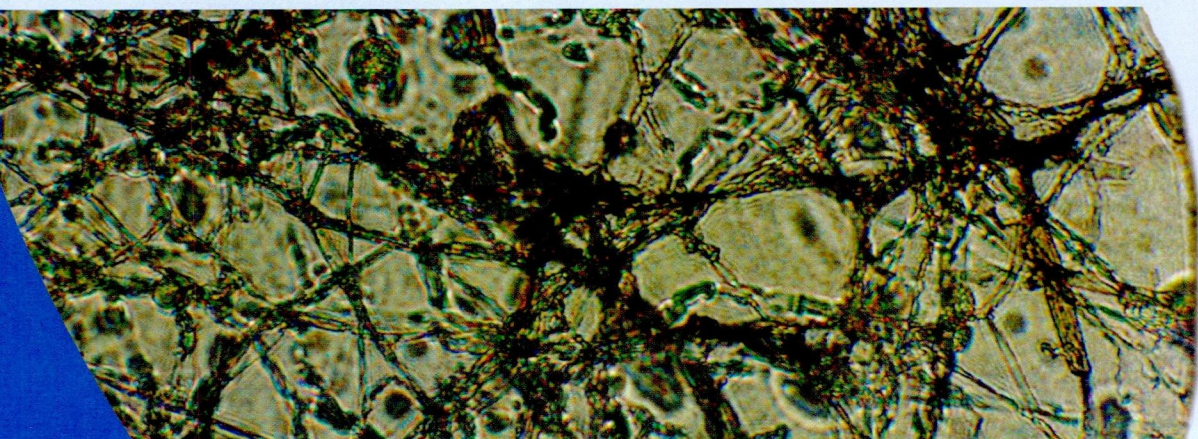
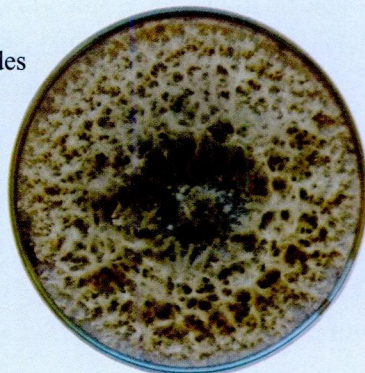
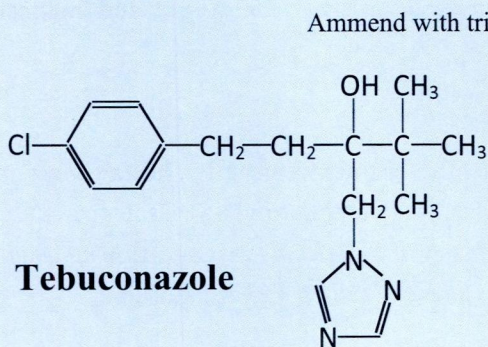
Prof. Liang Chen, Associate Director, National Center for Tea Improvement, Tea Research Institute of Chinese Academy of Agriculture Sciences made a study tour during 7-8th December and he made a presentation on” “*A general view of tea industry in China and the progress in molecular biology of tea based on Expressed Sequence Tags strategy*” at the TRI Auditorium.

Trainees

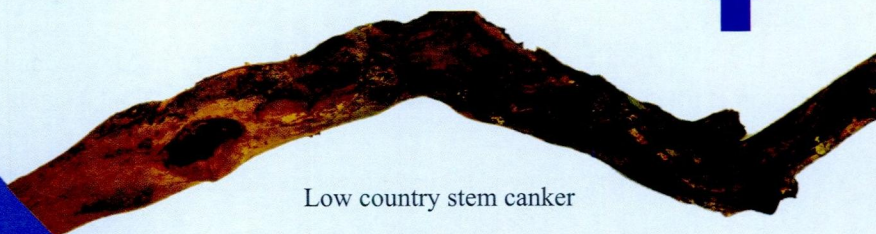
Ms A Buddhika, undergraduate from Faculty of Science, University of Ruhuna and Ms I Madugalla, Undergraduate from University of Rajarata completed their research project at the division. Ms K M R D Abayapala, undergraduate student from Rajarata University commenced her final year project at the Division on 7th December. Three trainees from Agricultural school, Niwala completed their in-plant training at Plant Breeding Division, Ratnapura.

General

- Progress of research carried out in Plant Breeding research program (A1 – A5 and D 1) was reviewed by two external scientists appointed for Scientific Advisory Committee – 19th March.
- M A B Ranatunga was promoted to Grade I, Senior Research Officer with effect from January 2008
- J H N Piyasundara was promoted to Grade II, Research Assistant with effect from March 2009.
- R Paskarathevan was promoted to Grade II, Research Assistant with effect from October 2009.
- J D K Arachchi commenced his research component in May leading to M Phil on the project titled: “Characterization of tea germplasm in Sri Lanka using morphological and biochemical markers”.
- A K M Mudalige continued his undergraduate studies on full time basis at Sabaragamuwa University.



Microscopic view of *Macrophoma theicola* fungal mycelium



Low country stem canker

Inhibition of Macrophoma theicola in the presence of tebuconazole (in vitro)

Plant Pathology Division

P N H Liyanage

B Sc (Ruhuna, Sri Lanka) M Sc (GBPUAT, India)

Acting Officer-in-Charge, Senior Research Officer

Highlights of the Year

- Residue trials on systemic fungicides were completed for FAO guidelines
- *Macrophoma theicola* isolates exhibited differential sensitivity to triazole fungicides

Thrust A 23. Development of integrated management strategies to control major diseases

A 23.1 Screening, evaluating and commercial formulation of soil-borne antagonists for major root diseases (*Poria*, Brown Root and White Root diseases) and their promotion

The objective of this project is to optimise the use of biological control agents to combat root pathogens, under field conditions.

The efficacy of *Trichoderma harzianum* (prepared as a talc-based powder formulation) against *Poria* root disease, compared with that of hexaconazole and bitertanol, under field conditions, was tested at Moray Estate, Maskeliya.

The treatments were applied as a soil drench to the affected bushes as follows: *T. harzianum* @ 1×10^5 CFU, hexaconazole @ 0.2% and bitertanol @ 0.2%. The experimental design was an incomplete block design with four replicates. The disease index was measured at three-month intervals. Data were analysed using the GLM procedure of SAS software. Results showed that both Hexaconazole and *T. harzianum* were able to reduce the disease significantly.

A 23.4 Screening synthetic fungicides, and establishing residue levels and pre-harvesting intervals (PHIs), for managing Blister Blight

The objective of this project is to achieve effective Blister Blight control, using synthetic fungicides with a minimum effective dosage, in order to satisfy Maximum Residue Levels (MRLs) set by importing countries for made tea.

Field trials were conducted using Bitertanol, Propiconazole, Tebuconazole and Copper Hydroxide, according to FAO guidelines. The residue analysis for systemic fungicides was carried out in an internationally-accredited laboratory in Germany. Residue analysis for copper hydroxide was conducted at the TRI.

Three decline trials on systemic fungicides Tebuconazole and Bitertanol were completed. Residue trials on the new generation systemic fungicide, Pyrachlostrobin is in progress.

Basic Research Projects

B 93. Use of refuse tea as a substrate for growing edible mushroom, *Lentinula edodes*

The observation on the ability of the white rot fungus *Lentinula edodes*, (Berk) Pegler to increase the refuse tea substrate nitrogen content was recorded. The crude protein content of Mycelia Grown Substrate (MGS) of refuse tea was significantly higher (26.02 ± 0.83) at $\alpha = 0.05$ than the initial refuse tea substrate (21.67 ± 1.11), depicting the “nitrogenous value” of the shiitake MGS of refuse tea. The simultaneous moisture absorbing pattern with mycelia growth on refuse tea substrate was established in the same study. The project was terminated.

B 98. Molecular diagnosis of canker-causing fungi in tea

The objective of this Project is to design primers to identify canker-causing fungi in tea.

M. theicola isolates collected from the survey conducted in 2008 - 2009 were used in this study. The morphological characteristics viz. pigmentation, texture, colony type, growth pattern, diffusible pigments and mycelial compatibility were measured in 15 randomly selected *M. theicola* isolates. Data were analyzed using the cluster analysis procedure of the SAS software. According to the results there were 04 main clusters between the isolates. Sensitivity of ten *M. theicola* isolates to triazole fungicides viz. Hexaconazole, Bitertanol, Propiconazole and Tebuconazole was tested under *in vitro* conditions. The EC_{50} value for each isolate under each fungicide was estimated using the Probit procedure of the SAS software. The results showed differential sensitivity of *M. theicola* isolates to each of the tested fungicides. DNA extraction of the *M. theicola* isolates is in progress.

D/PIPa 1 Activities of the Plant Pathology Division

Following estates were visited in connection with the divisional activities.

El Tab Estate, Ingestre Estate, Richieland Estate, Kiruwanaganga Estate, Balmoral Estae, Glasgow Estate, Nayapane Estate, Henford Estate, Talangaha Estate, Lelwala Estate, Devagiri Estate, Homodola Estate, Helboda estate, Waltrim Estate, Ceceilton Estate and Balangoda Estate

D/PIPa 3 Assessment of the microbial status of made tea and the tea-factory environment

The aim of the project was to establish the microbiological levels of made tea produced in different agro climatic regions of Sri Lanka. The sampling was carried out over a period of one and a half year at monthly intervals. The parameters measured were moisture content, Aerobic Plate Count (APC), total coliforms/g, total yeasts/g and total moulds/g. Data analysis is in progress.

C/Path.Analytical Services (C/As 3)

The following microbiological tests were performed, based on requests made by stakeholders.

10 made tea samples, 12 water samples and 30 swab samples were analysed for APC, total moulds, total coliforms and *E coli* (Test Method SLS 516 Parts 1, 2, and 3). Testing of black teas for possible microbial contaminants was carried out for 6 factories.

Training of quality assurance staff of concerned tea estates on the microbiological perspectives of tea manufacturing has been started. The sampling procedure and maintaining better hygienic practices for correct method of drawing tea samples were demonstrated. The Venture Organic Tea Garden was visited in executing this exercise.

General

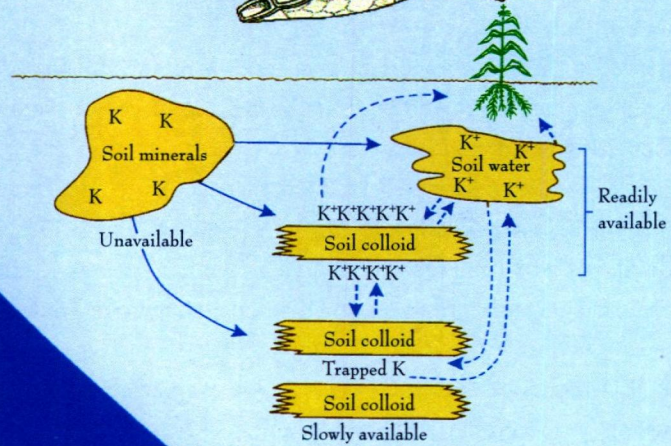
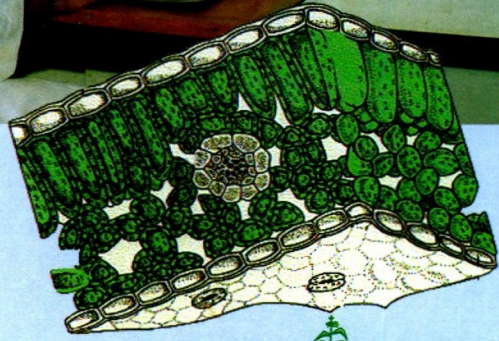
Mrs. P N H Liyanage attended the following

- Served as a resource person at the workshop conducted for Mathurata Plantations PLC on 18th March 2009 at Liddasdale group, Halgranoya on 'How to manage Blister Blight in tea fields'
- Conducted a workshop on 'How to manage Blister Blight Disease under the current MRL issues' for Executives of Watawala Plantations at Thangakelle Estate on 24th June 2009
- Served as a resource person at the workshop on 'Soil fertility management and Blister Blight management' conducted by TRI for the executives of Kelani vally plantations PLC on 16th Oct. 2009
- Served as a resource person in a field program on 'Tea totrix, nettle grubs and blister management' organized by TRI for the executives of Watawala plantations PLC on 15th Oct. 2009 at Lonach Estate
- Made a presentation on 'Blister blight management strategies and their economic importance' for RTEF Uva at TSHDA auditorium Bandarawela on 17th November 2009
- Served as a visiting lecturer at Uva wellassa university in faculty of Animal Science and Export Agriculture (on Pest and disease management) during 2009

Mrs. P N H Liyanage and Ms. D G N P Karunajeewa participated for 'Crop Clinics' held in Kottawa on 3rd December 2009 and Uva on 20th August 2009.



Potassium is the second most important macro-nutrient required for tea next to nitrogen. It is required for water regulation, vigorous growth, photosynthesis, cellulose formation, translocation, enzyme activities and cation-anion balance. Potassium present in soil solution is immediately available for plants to uptake and the ability of a soil to replenish soil solution K depends on the transformation between the various K forms.



Soils and Plant Nutrition Division

G P Guanaratne

B Sc Agric. (Peradeniya, Sri Lanka)

M Phil (Peradeniya, Sri Lanka) Ph D (Peradeniya, Sri Lanka)

Acting Head (*from 10th August*), Senior Research Officer

A K N Zoysa

B Sc Agric. (Ruhuna, Sri Lanka)

M Phil (Peradeniya, Sri Lanka) Ph D (Massey, New Zealand)

Acting Head (*up to 09th July*), Senior Research Officer

Highlights of the Year

- An island wide field survey was done to identify the factors affecting nutrient availability in soils of tea growing areas of Sri Lanka, including K. From this study, it was revealed that there was no significant difference in available K among rainfall zones, elevational categories and soil texture categories. There was a significant positive correlation between organic carbon content and available K. The relationship between soil pH and available K showed a low negative correlation. Significant differences in available K were observed with and without green manure application situation. Therefore, it is worthy to note that the promotion of Integrated Nutrient Management (INM) concept contributes significantly to the improvement of soil K through development of physico-chemical properties of soil rather than application of potash fertilizers
- A new method to assess manganese- nutrient availability in soil was developed and validated for all the soil series in tea growing regions of the country

Thrust A 15. Development of integrated soil fertility management strategies for improvement of productivity and profitability tea

A 15.1 Development of regional (AERs) and/or site-specific fertilizer recommendations

Soil samples were collected from Mid Country (Kandy, Matale, Kurunegala and Kegalle districts), Low country (Galle, Matara, Hambantota, Ratnapura districts), Up country (Nuwara eliya district) and Uva region (Badulla and Bandarawella districts) regions for evaluating nutrient buffering capacities and nutrient specific sites by plotting adsorption and desorption curves for each soil series. This activity is in progress.

A 15.2 Estimation of crop responses to macro nutrients (N, K, Mg, S and P) at AER level

a. Effects of application of different rates of N, K and Mg on growth, soil/plant nutrient status and yield

1. Effects of different rates of N (240, 420 and 600 kg ha⁻¹ yr⁻¹ N), K (120, 210 and 300 kg ha⁻¹ yr⁻¹ K₂O) and Mg (60, 105 and 150 kg ha⁻¹ yr⁻¹ MgO) on growth, soil- and plant nutrient status, and yield of tea Cultivar: TRI 2025, Field: NC New Division, Rangala Estate, Karaliyadda, AER: IU1 (2002)

The yield did not increase significantly with respect to increasing rates of N fertilizer. Also no yield increase was observed due to increasing rates of potash and kieserite fertilizer and no interaction could be observed between any of the treatment combinations on yield.

The soil pH values at 0-15 cm depth decreased significantly with the increasing rates of N from 240 kg to 600 kg. As expected, no variation could be seen either with increasing rates of potash or kieserite. As in the previous years, soil exchangeable K level in the current year continued to show significant increase with the increasing rates of K and decrease with increasing rates of N, and N and K interaction was also observed. No variation could be observed in soil Ex. Mg values due to increasing rates of kieserite.

The concentration of leaf nutrients (N, K and Mg) did not show any significant increase due to increasing rates of N, K and Mg fertilizer application during the year. The trial concluded in June 2009.

2. Effects of different rates of N (120, 360 and 600 kg ha⁻¹ yr⁻¹ N), K (0, 80 and 120 kg ha⁻¹ yr⁻¹ K₂O) on growth, soil/plant nutrient status and yield of tea

Cultivar: TC 9, Brunswick Estate, Maskeliya, AER: WU1 (1998)

Significant increase in yield with the increasing rates of N was observed. No interaction could be seen with the increasing rates of N and K fertilizers.

Soil pH at both depths decreased significantly with increasing rates of N from 120 kg to 600 kg N ha⁻¹ yr⁻¹ as observed in the previous year. Significant increase of the soil ex: K was observed with the increasing rate of K. The soil Ex. Mg values did not show significant variation due to increasing rates of potash in the 0-15 depth but decreased significantly in 15-30 cm depth.

The increasing rate of N fertilizer has increased the leaf N concentration significantly. However, the leaf K concentration remained unchanged due to increasing rates of N. However, increasing rates of K fertilizer significantly increased leaf K concentration. There was no significant change in leaf Mg concentration with increasing rates of -both N and K fertilizers. The trial is in progress.

3. Effects of different rates of N (180, 240, 360 and 600 kg ha⁻¹ yr⁻¹ N) and K (60, 120 and 240 kg ha⁻¹ yr⁻¹ K₂O) on soil/plant nutrient status and yield of tea

Cultivar: TRI 2025, Walpita Estate, Galle, AER: WL1 (2006)

The main effects of the treatments on yield in the 2nd year did not show any significant variation with the increasing rates of N and K fertilizer.

Soil pH at both depths decreased significantly with increasing rates of N from 180 kg to 600 kg N ha⁻¹ yr⁻¹. However with the increase in potash rate, the soil ex: K values increased significantly. The soil Ex. Mg values did not show significant variation due to increasing rates of potash.

The increasing rate of N fertilizer has increased the leaf N concentration significantly. The leaf K concentration increased significantly due to increasing rates of potash fertilizer. Also, there was no significant change in leaf Mg concentration with increasing rates of N and K fertilizers. The trial is in progress.

b. Effects of application of different levels of N with different levels of compost manure on growth, soil/plant nutrient status and yield

1. Effects of three different levels of N (200, 400 and 600 kg ha⁻¹ yr⁻¹) with different levels of compost manure (at 0, 10, 20 and 30 t ha⁻¹ yr⁻¹) on growth, soil/plant nutrient status and yield of tea

Cultivar: TRI 2026, Kallebokke Estate, Kallebokke, AER: WM3 (2002)

The increase in the N rate has increased the yield significantly compared to the lowest rate of 200 kg N ha⁻¹ yr⁻¹. But So far, compost application did not show any significant influence on yield. The trial is in progress.

c. Effects of application of different rates and proportions of urea and sulphate of ammonia on growth, soil/plant nutrient status and yield

1. Effects of application of different rates of N as urea and sulphate of ammonia (240 and 360 kg ha⁻¹ yr⁻¹) and their proportions (urea:SA = 100-0, 75-25, 50-50, 25-75 and 0-100) on growth, soil/plant nutrient status and yield of tea

Cultivar: TRI 2025, St. Coombs Estate, Talawakelle, AER: WU2 (1979)

The increase in N rate has not increased the yield significantly, and also no variation could be seen due to different proportions of SA and urea. The yield is comparatively lower when compared with previous years, as it was severely affected by frost and infestation of blister blight during recovery, after pruning

As in the previous years, both the rate of N fertilizer and proportions of sulphate of ammonia in the N combination, continued to significantly alter the soil pH and sulphate sulphur at both depths. Lower pH levels were found at the higher rate of N. It could be seen that when the proportion of sulphate of ammonia increases in the combination, sulphate sulphur concentration in soil also increased. So far, leaf S concentration was not affected either by the urea and S/A combinations or N rates. This experiment is in progress.

2. Effects of application of different rates of N as urea and sulphate of ammonia (200, 300 and 400 kg ha⁻¹ yr⁻¹) and their proportions (urea: SA = 100-0, 75-25, 50-50, 25-75 and 0-100) on growth, soil/plant nutrient status and yield of tea

Cultivar: TRI 3018, Field No. 2, Ury Estate, Passara, AER: IU2 (1999)

There is no significant increase of yield with respect to increasing rate of N fertilizer from 200 to 400 kg N ha⁻¹ yr⁻¹ and to different proportions of urea and SA.

The increase in the proportion of sulphate of ammonia in the N fertilizer combination, and increasing rates of N fertilizer significantly reduced soil pH at both depths. The soil sulphur values significantly increased with the increase of proportion of sulphate of ammonia in the N fertilizer combination and with increasing rates of N fertilizer.

The leaf S concentration did not vary with the different proportions of urea and SA in the combinations and also with increasing rates of N. This trial is in progress.

3. Effects of application of different rates of N as urea and sulphate of ammonia (200, 300, 400 and 500 kg ha⁻¹ yr⁻¹) and their proportions (urea: SA - 100-0, 75-25, 50-50, 25-75 and 0-100) on growth, soil/plant nutrient status and yield of tea

Cultivar: TRI 2023, Field No. 3, Upper Division, Mahaousa Estate, Madulkelle, AER: WM3 (2001)

The yield did not significantly vary with the increasing rate of N, and also no variation in yield could be seen due to application of different proportions of urea and sulphate of ammonia in the combination.

Both N fertilizer rate and the proportions of sulphate of ammonia and urea in the N fertilizer combination significantly altered soil pH at 0-15 cm and 15-30 cm depth. The pH levels decreased with increasing rates of N and when the percentages of sulphate of ammonia in urea: S/A combination increased.

The SO₄-S values at both depths significantly increased with the proportions of sulphate of ammonia in the N combination.

Leaf S was significantly affected due to increased proportions of sulphate of ammonia in the N fertilizer combination. It increased with increased proportions of sulphate of ammonia.

4. Effects of application of different rates of N as urea and sulphate of ammonia (200, 300, 400 and 500 kg ha⁻¹ yr⁻¹) and their proportions (urea: SA = 100-0, 75-25, 50-50, 25-75 and 0-100) on growth, soil/plant nutrient status and yield of tea

Cultivar: TRI 2026, Field No. 13, B Division, Kiriwanagange Estate, Deniyaya, AER: WM1 (2001)

The yield did not significantly vary with the application of different proportion of urea and sulphate of ammonia and with the increasing rates of N.

Soil pH values in the current year significantly decreased with the increasing proportions of sulphate of ammonia in the urea and sulphate of ammonia combination and with the increasing rates of N fertilizer. The SO₄-S values in the soil in both depths did not show any significant differences with the increase in proportion of sulphate of ammonia in the combination and with the increasing rates of N fertilizer.

The leaf S concentration did not show any significant variation due to the different proportions of urea and sulphate of ammonia combination. This experiment is in progress.

d. Effects of application of “Humic” substances on soil properties, plant nutrient status and growth and yield of tea

1. Effect of foliar application of “Humate” on growth and yield of tea

Cultivar: TRI 2027; Field No. 1999/3Ha, Raigam Estate, Ingiriya, AER: WL1

The application of normal humate to the ground and spraying of super humate with increasing rates, did not significantly affect the yield. Also, in the presence or absence of urea, increasing rates of super humate solution did not significantly affect the yield. This trial is in progress.

2. Effect of application of “Humate” treated waste tea compost (A rapid method of composting) on soil chemical and physical properties, and growth and yield of tea

Cultivar: TRI 2027, Field No. 1999/3Ha, Raigam Estate, Ingiriya, AER: WL1

The application of humate treated compost did not significantly increase mean yield of plots compared to that of plots applied with refuse tea without humate treatment. The trial is in progress.

3. Effect of application of “Humate” treated waste tea compost (A rapid method of composting) on soil chemical and physical properties, and growth and yield of tea

Field No. 01, 90 acre division, Talangaha Estate, Nakiyadeniya, AER: WL2 (2005)

The application of Humate treated compost did not significantly increase yield compared to that of plots applied with refuse tea without humate treatment for the composting activity. The trial is in progress.

There is no significant difference between Humate treated compost applied plots and plots supplied with refuse tea without Humate.

A 15.3 Estimation of crop responses to micro nutrients (Zn, B, Mn, etc) at AER level

Soil samples were collected from Mid country (Kandy, Matale, Kurunegala and Kegalle districts), Low country (Galle, Matara, Hambantota, Ratnapura districts), Up country (

Nuwara eliya district) and Uva (Badulla and Bandarawella districts) regions for evaluating micro nutrient status and dynamics. This activity is in progress.

A 15.4 Development of methods for formulation of bio-organic and mineral or compound fertilizers suitable for tea

Identification and evaluation of plant growth promoting Rhizo bacteria in tea soils (2009)

Laboratory equipment and chemical requirements for microbial analysis have been purchased. The soils sample collection for this study was commenced in November 2009. The activity is in progress.

Thrust A 16. Development of regional and site specific dolomitic limestone recommendations, for ameliorating soil acidity and enhancing soil productivity based on pH, pH buffering capacity and rainfall

Soil samples were collected from Mid Country (Kandy, Matale, Kurunegala and Kegalle districts), Low country (Galle, Matara, Hambantota, Ratnapura districts), Up country (-Nuwara eliya district) and Uva region (-Badulla and Bandarawella districts) regions for evaluating pH buffering capacities. This activity is in progress.

A 16.4 Establishing dolomitic limestone requirements for better growth of mature plants in different tea growing regions at soil-series levels

Effect of application of different rate of dolomite on yield and soil plant nutrient status

F/N 17, Lower Division, Midland Estate, Rattota, AER: WM 3 (2009)

The yield did not significantly vary with the application of different rate of dolomite.

Application of increasing levels of dolomite did not show any significant influence on soil pH and soil Ex.Mg and soil Ex. Ca at (0-15 and 15-30 cm) depths. This activity is in progress.

Supportive Projects

Collaborations with Advisory and Extension Division

Six trials were started at regional centres (Ratnapura, Kottawa, Hantane, St Coombs, Passara and Deniyaya) to compare the present (VPLC 880) and the former fertilizer (U709) recommendations in order to improve grower confidence. There is no significant difference in the yield between the two fertilizer treatments at Kottawa trial.

C/SPNI Development of regional analytical laboratories for soil, plant and fertilizer analysis

1. Analytical laboratory service

The analytical laboratory at Talawakelle participated at the international laboratory evaluating programmes on chemical analysis of soil (International Soil-Analytical exchange-ISE) and plants (International Plant-Analytical Exchange-IPE). Soil and plant samples were received quarterly over the year. They were subjected to the test methods such as pH (water, CaCl₂ solution), % C (Walkley and Black), E.C, Na, K, Mg and Ca in soil and Cu, Fe, Mn, Zn, Ca, K, Mg, Na, P, and Cd in plant samples. The results were submitted to the Wageningen University for evaluation.

- a. The total number of soil, leaf, fertilizer and organic samples analysed at Talawakelle SPND and Walahanduwa laboratory are 6407, 437, 1220, 74; 548, 65, 72 and 4 respectively.
 - b. The total number of analysis performed on soil, leaf, fertilizer and organic manure at Talawakelle and Walahanduwa SPND are 24,327 and 2795 respectively.
 - c. Out of these analysis, the highest number of analysis were performed for soil pH (6454) and soil organic carbon (4379).
2. In addition to the soil analysis, schedules for Site Specific Fertiliser Recommendations (SSFR) were also prepared for the estates under the purview of Elpitiya, Pussellawa and Kahawatte plantations). The analytical charges for soil, leaf, fertilizer, organic manure and water samples were revised and approved by Tea Research Board and new rates were implemented from 1st August 2009. For cess contributors a 25% concession was adopted.

General

Dr. A K N Zoysa vacated his post on 09th July 2010. Dr. G P-Gunaratne was appointed as Actg. Head of the Division with effect from 10th August 2009. Mr. L R M C Liyanage was appointed as Research Assistant with effect from 2nd March 2009. Mr. W M J C Bandara was transferred to Agricultural Economics Division with effect from 1st January 2009. Mr. C S K A Ratnayake resigned from TRI service with effect from 29th May 2009. Mr. R B M Sankhappriya resigned from TRI service with effect from 10th June 2009. Mr. W M S Wijathunge was transferred to Head Office laboratory at Talawakelle from 15th September and Mr. D M B N Dissanayake was transferred to Mid country Regional Centre with effect from 15th September 2009.

- Mr. D M B N Dissanayake was awarded the M Sc degree in Analytical Chemistry in August 2009, by the Post Graduate Institute of Science, Peradeniya

Dr. A K N Zoysa served as

- A member of the working group on Fertiliser Advisory Committee at the National Fertiliser Secretariat.
- A member of the Technical Committee on Organic fertilizer to the Sri Lanka Standards Institution.
- A visiting lecturer/resource person to the National Institute of Plantation Management, Sri Lanka.
- A member of National Advisory Committee on organic fertiliser at the Ministry of Agricultural Development, Government of Sri Lanka.
- A member of the board of study in Environmental Science, Post Graduate Institute of Science, University of Peradeniya.

Research Communications

- Gunaratne G P, Samansiri B A D and Hettiarachchi L S K. Factors affecting potassium (K) availability in mature tea fields. Proceedings of 219th E & E meeting, pp 24 - 40
- Tennakoon P L K, Jayasekara A P D A, De Silva M S D L, Hettiarachchi L S K and Seneviratne G. Bio Fertilizers (BFs): Preliminary Investigations on Tea. Proceedings of 219th E & E meeting

Thesis

Mr. D M B N Dissanayake successfully completed his M Sc (Analytical Chemistry) research projects and submitted a thesis entitled “Some aspects of Manganese Bio availability in soils of tea growing areas of Sri Lanka” on 17th August 2009.

Meetings, Seminars and Workshops

- Dr. A K N Zoysa, Dr. G P Gunaratne, and Mrs. S Ananthacumaraswamy attended the 218th and 219th E & E meeting held at the TRI Auditorium, Talawakelle on 30th January
- Dr. A K N Zoysa attended 11th Annual General Meeting of Sri Lanka Association of Testing Laboratories held at main auditorium of Industrial technology Institute, Colombo on 8th April 2009.
- Dr. A K N Zoysa, Dr. G P Gunaratne, Mrs. S Ananthacumaraswamy and Mr. L R M C Liyanage attended the 219th E & E meeting where Dr. G P Gunaratne made a presentation titled “Factors affecting potassium (K) availability in mature tea fields” held at the TRI Auditorium, Talawakelle on 31st June.
- Dr. G P Gunaratne made presentations titled as “Factors affecting nutrient availability in Low country soils” for the RSC held in Galle, Deniyaya, Ratnapura.

- Staff actively conducted Crop Clinic held at Passara and Kottawa, Galle on 20th and 03rd August and December respectively.
- Dr. G P Gunaratne attended Deniyaya station opening ceremony on 30th September.
- Dr. G P Gunaratne and Mr. W M S Wijayathunge conducted a workshop for tea small holders in Uva region on “Sulphur deficiency and remedial measures for its correction” at Uva smallholders site on 8th October 2009
- Dr. G P Gunaratne made a presentation titled “Enhancing fertilizer use efficiency by managing agricultural practices affecting tea growing soils of Low country” for the Low country RSC meeting held at Ratnapura on 13th October 2009. On the same day, a workshop on Site Specific fertilizer Recommendation was also conducted to the Estate Managers of Kahawatte Plantation Company Ltd in Ratnapura region.
- Dr. G P Gunaratne and Mrs S. Ananthacumaraswamy made presentations on “Enhancing fertilizer use efficiency by managing agricultural practices, affecting tea growing soils of Up and Low country” and “Correct use of TRI recommended fertilizer in Up country and Low country tea estates” respectively for the Managers, Assistant Managers & Field Officers of the Watawala Plantation Company and it was held at TRI, Talawakelle Auditorium on 06th -November 2009.
- Dr. G P Gunaratne attended a discussion to ascertain yield decline issues and its causative factors of some Up country plantations of the Madulsima Plantation Company held at Head Office board room on 16th December 2009.
- Mrs. S Ananthacumaraswamy made a presentation titled “Efficiency of fertilizer usage in Mid country tea estates” for the RSC meeting held at Mid country Research and Extension Centre Auditorium on 21st December 2009.
- Dr. G P Gunaratne prepared Site Specific Fertiliser Recommendation programme for three estates of the Elpitiya Plantation Company, namely Sheen, Meddecombare and Ferlands.

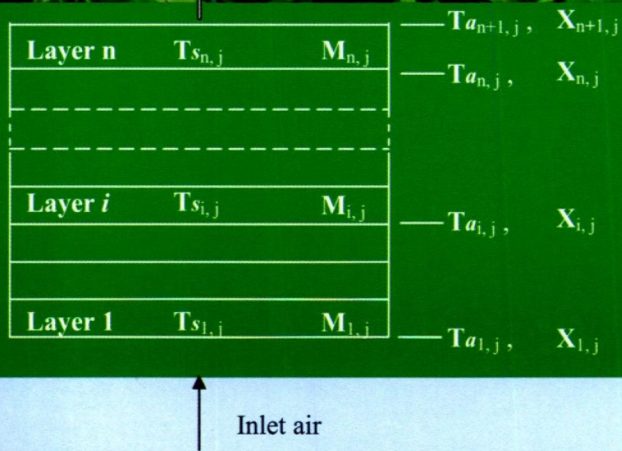
Training programmes

Mr. D M B N Dissanayake attended a workshop held at Institute of Personal Management of Sri Lanka, Colombo from 3rd October to 20th November 2008.

Visitors and Trainees

- The following groups of undergraduate students visited the division in order to familiarize themselves on soil fertility and tea plant nutritional aspects.
- A group of Plantation Agriculture students from Ruhunu University, Eastern University, Sabaragamuwa University and, Uva Wellasa University visited the division in order to familiarize themselves on soil fertility and tea plant nutritional aspects.
- A group undergraduate students of Faculty of Agriculture from University of Jaffna visited the division in order to familiarize themselves on soil fertility and tea plant nutritional aspects on 11 November.

- A training programmes on determination of some chemical and physical properties of soils was conducted for under graduate students from Uva Wellassa University by the staff on 10 and 12 of September.
- Mr. M M M Tennakoon undergraduate student from Faculty of Applied Science, Sabaragamuwa University completed her final year project in January 2009.
- Mr. H G W K Bandara student from Naiwala Advanced Technological Institute, Veyangoda commenced three months In-plant training on 24th July 2009 submitted a project report titled” Micro nutrients content in Black tea grown in some Agro Ecological regions of Sri Lanka.”
- Miss G I Kumari, an undergraduate student from University of Kelaniya underwent 3 months vacation training at the division from 1st October 2009
- Mr. Manoj S Kanagaratna from Department of Zoology, University of Colombo commenced six months undergraduate training at the division from 18th December 2009.



Uniformly withered tea leaves are essential for a high quality end product. Therefore, determining correct withering stage is also very important and this is merely depends on personal experience. A method for determining real time moisture content of tea leaf samples is very important.

Process Technology Division

W S Botheju

B Sc (Colombo, Sri Lanka) M Phil (Peradeniya, Sri Lanka) Ph D (Peradeniy, Sri Lanka)

Acting Head, Senior Research Officer

Highlights of the Year

- One dimensional heat and mass transfer mathematical model was developed to predict the real time moisture content of tea leaves during withering
- A paper titled 'Simulation of Trough Withering of Tea using One Dimensional Heat and Mass Transfer Finite Difference Model' was presented in 21st annual congress at PGIA.

Peer-Reviewed Publications

- W S Botheju, K S P Amarathunga and I S B Abeysinghe, Simulation of Trough Withering of Tea using One Dimensional Heat and Mass Transfer Finite Difference Model - Journal of Tropical Agriculture (2009)

Thrust A46. Development of technologies to enhance made tea quality and made tea keeping quality

A 46.1 Optimization of Low-country grade mix using combination of No.3 & 4 meshes in roll breaker

The objective of this study is to check the merits and demerits of using No.3 and No.4 mesh combination instead of No.4 mesh in the roll breakers in Low country tea manufacture. In this experiment a 4-roll program was designed and 1st, 2nd, 3rd and 4th dhools were collected from the roll breakers and changes in different dhool percentages and in grade mix were studied.

Six trials were conducted and the data analysis will be done after receiving the professional tea tasters' evaluation. This project is in progress.

Thrust A47. Development/improvement of machinery to reduce the cost of tea processing and to improve made tea quality

A 47.1 Design and development of a Rotary Sifting Machine for leafy grade teas

The objective of this experiment is to develop a suitable sifting machine to replace the Michie sifter in the Low country tea manufacture with the view to increase the output, reduce the particle degradation and to automate the sifting process. A rotary type of continuous machine with No 8 mesh was fabricated in the TRI low country station workshop and the performance of the pilot scale machine was tested. However, the efficiency of the machine was not comparable to existing Michie sifter. Therefore, it was decided to redesign the machine with the association from SAC members.

Thrust A48. Development of strategies to automate the tea manufacturing process

A 48.3 Automation of withering process

One-dimensional heat and mass transfer model was developed to predict the moisture content of tea leaves during withering at real time basis. The model validation was done under very wet and dry conditions. Model calculated moisture data of withering leaves were in close agreement with experimental data throughout the period of withering. A project proposal was prepared to study the automatic controlling of airflow using the model developed.

Basic Projects

B 91. Testing the characteristic curve of newly introduced withering trough fans

A test rig was fabricated to facilitate testing of withering trough fans with 48" diameter. Four conventional and five new impellers were tested for different pitch angles and speeds. A VSD was fixed to vary the speed of the fan. Static and velocity pressure were

measured using the pitot tube. At the same time power measurements were also carried out using the power analyser. Results showed that all four conventional fans had better efficiency than the new fans.

Work is in progress to generate the user friendly set of operating parameters of trough withering system to optimize the withering period and energy.

B 93. Optimizing the grading room operations in Low country manufacture

The objective of this study is to optimize/ minimize the use of machinery; increase the worker productivity and to develop a program for the low country tea grading. Processing time and the machinery output data were collected for the premium grades and a flow chart was prepared. Two trials were conducted for off grades. The work is in progress.

Divisional Activities (D/TECH)

1. Evaluating new type of paper sacks

The objective of this activity is to test and recommend low cost packing materials for packing teas. During the period under review, moisture barrier test was completed on three different types of paper sack samples supplied by two different companies.

2. Service to TRI tea factories

The technology staff conducted internal audit to obtain ISO 22000-2005 food safety management system for St Coombs and St Joachim tea factories belong to TRI. The staff continued to support the management in improving the tea manufacture and related activities.

Several awareness and training programs were conducted on ISO 22000-2005 food safety management system to factory staff in Ratnapura.

3. Formulating Reasonable price formula for green leaf

The bought leaf factories manufacture leaf supplied by the tea small holders. The price paid for the leaf is based on the NSA achieved by the tea factories. A committee has been appointed to revise the price formula. The staff of Technology Division served as members of the committee and participated in the discussions held on 13th and 23rd of January, 02nd, 06th and 25th of February and 02nd of March 2009.

4. Miniature tea manufacture

The staff supports other research divisions of the institute in manufacturing experimental leaf samples using the miniature tea manufacturing facility at the division. During the year 367 experimental leaf samples were manufactured at the Division.

Advisory Services

- The staff made 118 visits to tea factories on various aspects of tea manufacture.
- Dr. W S Botheju, Messer's K Raveendran, S Koneswaramoorthy, G L C Galahitiyawa. W M U A B Marapana and M A Chamindra participated at the crop clinic held on 3rd December 2009 at Southern Extension Centre, Kottawa, Galle.
- Mr. M A Chamindra and Mr. W M U A B Marapana conducted a training program for the students of Distance Education Modernization Project in July.

Analytical Services

- The number of tea samples received from estate for moisture determination was 482.
- Number of moisture meters calibrated was 52.
- Number of thermometers calibrated was 145. This includes standard thermometers, drier dial thermometers and electronic digital drier thermometers. Most of the drier thermometers were calibrated at the factory locations.
- Number of Hygrometers calibrated was 140.

General

Mr. G L C Galahitiyawa attended the following activities

- Participated program on Tea Factory study with Mr. Raveendran to select 17 model tea factories for refurbishment in January 17, 18, 31; February 01, 14 and 15, 21- 23; March 07 - 08; May 9 - 10.
- Participated as a resource person of the seminar for Factory Officers in Galle organized by TRI in January 27.
- Attended COP meeting Feb 02, 06 and 25; March 02
- Served as a member of examination panel at NIPM in March 20
- Served in the interview panel to recruit Tea Factory Managers into Tea Shakthi Factories
- Participated in a seminar on Post Harvest Damage for Galpaditenne and Sapumalkande tea factory small holders April 24, September, October 24 and 31, November 05

Mr. K Raveendran attended the following activities

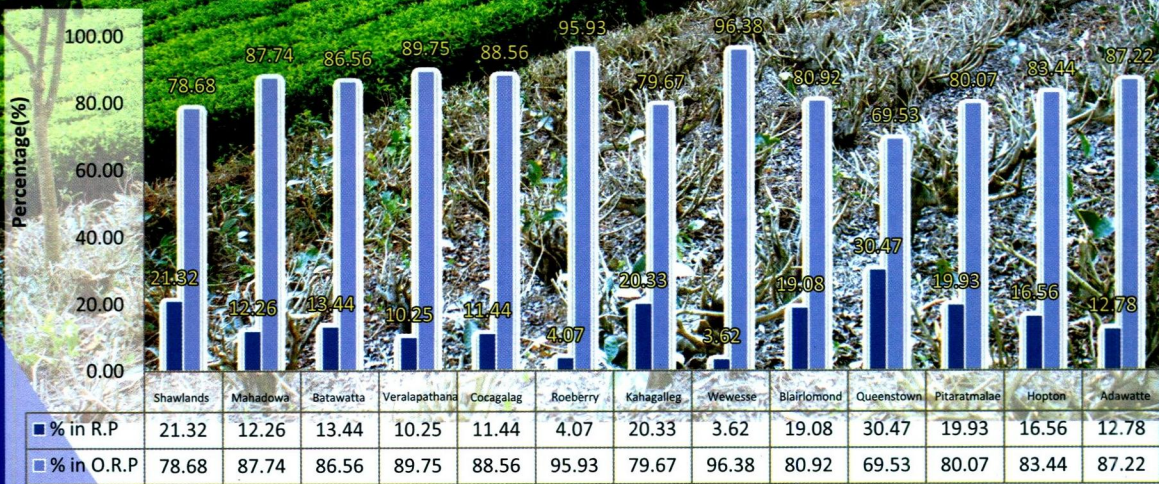
- Conducted three days program and one day refresher program on Building in-house Capacity of the Technical Staff of Tea Sector on Energy Conservation and Management
- Six training programs were conducted in various aspect of tea manufacture
- Conducted two energy audit programs in two tea factories collaborative with SEASL
- A survey was carried out to search the usage of VSD and new type of fans. Questioner prepared was sent to 252 private tea factories, CEOs of all plantation companies, JEBD and SLSPC factories.

Research Communications

- Dr W S Botheju presented a paper titled “Simulation of Trough Withering of Tea using One Dimensional Heat and Mass Transfer Finite Difference Model” at the PGIA annual congress in November 20 - 21.

Human Resource Development

- Mr. P K S P Dayananda participated in a 3-day training program on “Steam Engineering and Energy Conservation” conducted by Engineering Design Centre, University of Peradeniya from 13th to 15th November 2009.
- Mr. W S Botheju successfully completed his PhD program in September 2009 from PGIA, University of Peradeniya.



“Timely pruning adopting recommended cultural practices is a key for obtaining high productivity of a tea bush. It is worthy to study possible impacts of global climate changes on pruning periods for better performance”

T U S Peiris

B Sc Agric. (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka)
Senior Research Officer

Highlights of the Year

The analysis of weather parameters in Uva region revealed that the recommendation on pruning for the region needs reconsideration to accommodate various agro-ecological regions in Uva

B 95. Artificial neural networks for predicting and classifying tea flavor/ quality in regional teas in Sri Lanka

Development of a chemical composition and organoleptic character profile for regional teas is very useful as a complimentary tool for describing differences in regional teas and to reveal non-conformance to specifications.

Therefore, the main objective of the project is to develop two separate profiles in terms of chemical compositions and organoleptic characters of Sri Lankan black teas in different geographical origins.

Sample collection was completed on monthly basis from 52 factories covering 13 different geographical regions which having the inherent characters unique to the region. All samples were sent for organoleptic evaluations by a professional panel consisting eight members. Chemical analysis of samples for 18 parameters is in progress.

Evaluation of consistency and agreement for the scores given by tasting panel was completed. Analysis to find out the best agreed group of tasters with the application of a suitable statistical method and chemical analysis is in progress.

B 85. Investigation of the factors responsible for the vast gap between the experimental and normal yields

Experimental yields in field experiments are normally given in per ha basis, though the experiments are conducted in small plots ranging from 24-50 bushes per plot. Researchers have observed a vast gap between experimental and normal field yields. This gap may be due to true potential under optimal level of inputs in experimental fields, true potential of the treatments applied or due to unreliable limits of extrapolation. The objective of this study is to estimate the magnitude of error occurred due to extrapolation of small plot yields to per ha basis & to estimate a correction factor capable of giving reliable treatment potentials in experimental yields.

Three experiments were carried out at Wilpita, Diddenipotha and Moragolla estates. Results reveals that extrapolation not always overestimate the true yield. Over estimate or under estimate of yield depends on the condition (pest or disease infested, over or under fertilized etc.) and the position (sloppy, Flat, along contour etc.) of the particular plot in the field.

Ratio of extrapolated and actual yields in different plots varies 0.76 – 1.36 in Diddenipotha Estate, 0.71 – 1.94 in Wilpita Estate and 0.63 to 1.7 in Moragolla Estate. This clearly shows the underestimates and overestimates of true yield (below 1: underestimate and over 1: overestimate).

The difference of actual and extrapolated yields in different plots varies -25.56 to 33.12 MT kg/ ha, - 40.14 to 51.63 and - 29.16 to 41.36 MT kg/ ha at Diddenipotha, Wilpita and Moragolla correspondingly. Experiment at the Moragolla estate is continuing for a pruning cycle.

Risk assessment model for blister blight leaf disease

This study aims to develop a Risk Assessment Model (RAM) for assessing the level of risk due to blister blight damage.

Helboda Estate, Katukithula and Waltrim Estate, Lindula were identified as experimental locations based on the history of severe blister blight damage. Field no. 11 which consist of highly susceptible cultivar to blister damage (TRI 2025) and field No. 6 which also consists of highly susceptible cultivar (TRI 2026) were selected as experimental sites in Helboda and Waltrim Estates correspondingly. Experiments were laid out in four different micro environmental conditions in each field with three replicates.

This project is funded by National Research Council of Sri Lanka and conducted in collaboration with with Plant Pathology Division and Faculty of Agriculture, University of Peradeniya.

B 81. Assessing the impact of climate change on the growth and productivity of tea

Results of the diagnostic survey for pruning practice in tea and analysis of monthly climate pattern in Uva region were reported in previous Annual Reports.

Based on that analysis, following conclusions were made.

- September/ October is not the best time for pruning in Uva Region. January – April is the best time to adapt pruning practice in tea.
- The collective effects of all weather parameters (maximum & minimum temperature, sunshine hours, relative humidity and wind velocity) should be considered for timing of pruning in tea in addition to pattern (amount and distribution) of rainfall.
- Analysis of long term climatic parameters can also be used in planning and implementing of management practices.

D-Biometry. Designing of field experiments, data analysis and interpretation

Following visits were made on the requests by other research divisions for site selection and designing of field experiments.

- El-Teb Estate, Passara for site selection of drought mitigation experiment.

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- Elkaduwa Estate, Matale, Kottawa Regional Centre and New Peacock Estate, Udapussellawa for laying out experiments to study the effect of bio-film biofertilizer on growth and yield of tea and soil improvement.
- Glen- Elpin, Ury and Wewesse Estates for site selection for the experiment on potassium spray on drought mitigation.
- New Peacock Estate, Udapussellawa for site selection and designing experiment of evaluating the effects of increased potassium on the buildup of SHB in early stages of pruning cycle.
- Hapugasthenne Estate, Maskeliya Estate and Drayton Estate for site selection of the experiment on screening biological control agents and synthetic pesticides for reducing SHB damage in mature tea.
- Weerawa Estate, Gampola for site selection and designing experiment for screening synthetic pesticides for reducing SHB damage in mature tea.

Advice on efficient protocols for experimentation and surveys, sound statistical methods for data analysis and drawing of statistical inferences were provided to other research divisions. Major activities are given below.

- Experimental design for the project on carbon sequestration and potential for carbon trading in tea plantations of Sri Lanka.
- Experimental design for the project on effect of bio-dynamic farming and biofertilizer on physical properties and biological properties of the soil in organic tea.
- Efficient experimental protocol for biofertilizer experiment at Holyrood Estate.
- Possible statistical analysis techniques for entomological experiments to overcome non-significant response on standard treatment.
- New approach in laying-out and conducting experiments for SHB screening experiments.
- Improvement of methodology on assessing the correlation between field assessment and bioassay on SHB infestation ratings.
- Possible sampling protocol to identify the effect of drought on labour in tea industry.
- Evaluation of existing sampling strategy, data analysis and Interpretation to set microbiological standards for Sri Lankan black tea.
- Took part in development in sampling protocol, questionnaire development, focus group discussions, data analysis and interpretation of case study on investigation on the drop in tea production in the smallholder sector from January to July 2009 with special reference to Matara, Galle and Ratnapura districts.
- Analysis of weather data collected from TRI agro-met stations.

General

- Ms. T U S Peiris, Research Assistant Grade II was promoted to Senior Research Officer Grade I with effect from 01st October 2008.
- Ms. T U S Peiris participated at the National Statistical Conference organized by the Applied Statistical Association of Sri Lanka which was held at the University of Colombo during 06th – 07th January 2009.
- Ms. T U S Peiris participated at the Symposium on Research for National Development organized by National Research Council of Sri Lanka on 10th November 2010.



Advisory and Extension Division

V S Sidhakaran

B Sc Agric. (Peradeniya, Sri Lanka) M Sc (Peradeniya, Sri Lanka), Ph D (TNAU, India)
Dip in Development Research in Agriculture
Dip in Plantation Management
Acting Head (from 15th September), Senior Advisory Officer

B A D Samansiri

B Sc Agric. (Peradeniya, Sri Lanka), M Phil (Los Banos, Philippines)
Head (Up to 14th September), Senior Advisory Officer

Highlights of the Year

- Private-Public Partnership Extension - a novel approach for technology dissemination was introduced
- Para Extension Aide - a novel approach for technology dissemination was introduced
- New office premises of the Deniyaya Extension Centre was declared opened
- Four hundred and ninety five advisory field visits were made
- Three hundred and fifty six training programs were conducted
- Two Crop Clinics were held
- Three field survey studies were conducted
- Four Regional Scientific Committee seminars were conducted
- Two Sinhala Experiment and Extension seminars were held
- Six Regional Technical Extension Forums were held
- Three Advisory Circulars and two Guidelines were issued
- Six news articles were published in printed media
- One Extension-Research Linkage Forum was held
- Seven extension related publications were completed and eleven special presentations were made
- Mr. V S Sidhakaran completed his Ph D degree in Agriculture Extension
- Two new Extension Officers were recruited

Advisory and Extension activities organized and conducted by the Advisory and Extension staff at Talawakelle, Kandy, Ratnapura, Passara, Kottawa and Deniyaya regions for achieving the objectives given in the corporate plan for year 2009 are reviewed in this report.

Moreover, the special activities requested by the institute, the government and the stakeholders were also undertaken, over and above the activities scheduled in the corporate plan 2008 - 2012.

D/ADV 1. Routine Advisory and Extension Activities

D/ADV 1 a. Routine Advisory and Extension Activities; Talawakelle

Table 1. Summary of the Routine Advisory and Extension Activities Talawakelle

Activity	Nos.	Activity	Nos.
On call Advisory Visits-Estate	193	Exhibition	05
On call Advisory Visits-Small Holdings	05	Crop Clinics attended	2
Extension Visits	03		
Total Advisory & Extension Visits	201		
Collaborative Research Visits	03	Visitors	
Familiarization visits	02	Tea Growers	123
Total Visits	206	Foreign personnel	86
		General Visitors	305
Advisory Correspondences		Total	5151
Advisory Documents			
Extension /services report	839	Mass Media Extension	
Administrative Matters	141	Newspaper articles	02
Total	1113	Newsletters	02
	2083	Posters/Wall charts	12
Training Programs		Folders/Leaflets/Pamphlets	02
Lecture/Seminar/Field days/Work shops	10	Total	
Familiarization programs: Estates & SH	02		
Skill Training Program	07	Publications distributed	0
Educational Programs	06	Free issues	582
Customized training programs	05		
Total	43		

Special problems in the Up country region

Severe Red slug outbreak in Mahauva estate, scale insect attack in the new clearings of Brookside estate, severe Nettle Grub outbreak in Lonach estate were experienced during the year and they were successfully controlled by Integrated Management Approaches as advised by the Entomology division.

Severe frost damages were occurred in Nuwara Eliya, Park, Courtlodge and Concordia estates in the Nuwaraeliya, Kandapola regions.

D/ADV 1 b. Routine Advisory and Extension Activities; Ratnapura, Kalutara and Kegalle Districts.

Table 2. Summary of the Routine Advisory and Extension Activities - Ratnapura

Activity	Nos	Activity	Nos
Estate Visits		Commercial Nursery Inspection	50
Advisory visits to estate	16	Exhibition	2
Advisory visits to smallholdings	27	Visitors	
Extension visit	45	Tea growers	422
Total visits	88	University /Diploma students	46
Individual Contacts		School students	33
Office calls	145	General visitors	41
Telephone inquiries	170	Total	542
Total	315	Mass media activities	
Advisory Correspondence		Newspaper articles	3
Advisory documents	212	Research articles	4
Extension services reports	265	Video programmes	6
Publications	44	Posters, Wall charts	9
Administrative matters	38	Total	22
Total	559	Soil Testing	342
Training Programmes		10. Distribution of Publications	
Skill training programmes	1	Free issues	339
Educational programmes	8	Publications sold	160
Customized training programme	5	Total	499
Demonstrations	13	Meeting attended	
Group Discussions	83	Internal meetings	16
Lectures, seminars, Field-days etc.,	33	Outside meetings	17
Crop Clinics attended	2		33
Total	145		

Special problems in the Ratnapura, Kalutara and Kegalle regions

A new canker condition was identified in a smallholding in Yatiyantota area and the samples were handed over to Plant Pathology division for identification of the causal agent.

First incidence of papaya mealy bug damage in mature tea field was reported in a tea smallholding in Hedillanakanda, Ratnapura District. Sickly shape abnormal growth could be seen in the growing bud as a result of sucking by both nymphs and adult bug. This pest outbreak was detected at an early stage and controlled them successfully by taking precautionary actions to prevent spreading of mealy bug damage by team of officers from TRI, TSHDA and the Department of Agriculture.

D/ADV 1c. Routine Advisory and Extension Activities of Kandy and Matale Districts

Table 3. Summary of the Routine Advisory and Extension Activities, Kandy

Activity	Nos	Activity	Nos.
Estates Visits		Commercial Nursery Inspections	52
Advisory Visits to Estates	75	Exhibitions	02
Advisory Visits to Smallholdings	88		
Total Visits Made	173	Visitors	
		Tea Growers	502
Individual Contacts		Higher Educational Students	124
		Students	182
Inquiries through telephone	720	Foreign Personnel	17
Total	720	General Visitors	41
		Total	866
Advisory Correspondences			
Advisory Documents	206	Mass Media Extension	
Publications	2	Posters/Wall Charts	0
Administrative Matters	35		
Total	243	Soil Testing	199
Training Programs		Publication Distributed	560
Skill Training Programs	2	Free Issuing	26
Educational Programs	7		
Customized training Programs	3		
Demonstrations	3		
Group Discussion	2		
Lecture/Seminar/Field-days etc.,	13		
Crop clinic attended	2		
Total	30		

Special problems in the Kandy and Matale regions

One of very rare pest outbreak known as "Dadap Shoot Borer" (*Terstia meticolosalis*) was reported in Hunuwala estate, Elkaduwa and resulted a heavy defoliation of Dadap trees planted as medium shade. The pest was brought under control after adopting cultural measures as recommended by the TRI.

D/ADV 1 d. Routine Advisory and Extension Activities; Badulla and Moneragala Districts

Table 4. Summary of the Routine Advisory and Extension Activities, Passara

Activity	Nos.
Estates Visits	
Advisory visits to Estates and Smallholdings	49
Extension Visits	6
Total Visits Made	55
Advisory Correspondences	678
Training Programs	
Lecture/Seminar/Fielddays/workshops	14
Commercial Nursery Inspections	59
Exhibitions participated	2
Crop Clinics held	1
Crop clinic Attended	1
Visitors	
Planters	91
Smallholders	346
Students	128
TRI Officers	265
General Visitors	282
Total	1112
Soil Testing	
pH	750
Organic carbon	392
Publication Distributed	
Free Issues	238
Priced Publications	138
Total	376

Special problems in the Uva region

Severe drought conditions were experienced in the months of January, February, May, June, September and October. Overall annual rainfall drop was 15% below the average. Severe Sulphur deficiency symptoms were observed in some smallholdings in Passara, Badulla and Lunugala areas. Series of awareness programmes were conducted to make the small holders aware on this issue.

D/ADV1 e. Routine Advisory and Extension Activities Galle District

Table 5. Summary of the Routine Advisory and Extension Activities, Galle

Activity	Nos	Activity	Nos
Estates Visits		Commercial Nursery Inspections	07
On-call Advisory Visits-Estate	5	Visitors	
On call Advisory Visits: Small Holdings	5	Tea Growers	1422
Routine Advisory Visits	17	University/Diploma students	36
Extension Visits	37	School students	190
Collaborative Research Visits	29	Foreign visitors	19
Familiarization visits	13	General Visitors	259
Social Visits	13	Total	1926
Total Visits Made	119		
Individual Contacts			
Office calls	400		
Inquiries through telephone	484	Soil Testing (pH)	234
Total	884	Publication Distributed	
Advisory Correspondences		Free Issues	399
Advisory Documents	97	Priced Publications	608
Extension Services Reports	30	Total	1007
Publications	1		
Administrative Matters	21		
Total	149		
Training Programme			
Familiarization programs-Estates	5		
Familiarization programs-Small holders	13		
Skill Training Program	22		
Customized training programs	30		
Demonstrations	21		
Informal Group Discussion	72		
Total	163		

Special issues/ problems in the Deniyaya region

Potassium (K) deficiency was recorded in a smallholding site located in Morawaka and Brown root disease was recorded in the Lumbini estate, Pallegama

D/ADV1 f. Routine Advisory and Extension Activities; Matara and Hambantota Districts

Table 6. Summary of the Routine Advisory and Extension Activities Deniyaya

Activity	Nos.	Activity	Nos.
Estates Visits		Visitors	
Advisory Visits-Estate	35	Tea Growers- Estate Sector	117
Advisory Visits-Small Holdings	21	Tea Growers- Small holders	333
Extension Visits	02	School Students	31
		General Visitors	110
Advisory Correspondences	83	Total	591
		Meetings attended by Extension staff	
Training Programs	28	Internal	22
		External	07
Informal Discussion	27	Soil Testing	136
		Publications Distributed	
Commercial Nursery Inspections		14	Free
Issues	419		
		Priced Publications	149
Crop Clinics attended	02		

Nursery Development Activities

- Technical inputs were given to start five model nurseries in Kotapola DS division under the nursery development project initiated by the “Save the Children”.
- Collaborative works was undertaken with TSHDA to assist the replanting permit holders to raise the good quality plants.
- Two smallholdings were selected from two Tea Inspectors sub office regions to establish model tea gardens
- A mini-scale Crop Clinic was organized for the Morawak Korale Tea Producers Cooperative Society.

1. Training and Technology Dissemination

Public-Private Partnership Extension approach

- a. The launching of the pilot project of Public-Private Partnership Extension approach was held at RTS Tea Factory on 28th March 2009 for Ratnapura Region and at the Berubeula Tea Factory at Urubokka on 28th April for Matatra Region.
- b. A TOT program was conducted on 23rd April 2009 through the Public-Private Partnership Extension program for empowering Extension Offices attached to private tea factories, Agro-chemical companies, Agro-chemical dealers, leaders of Tea Smallholdings societies,

and tea factories and the owners of proprietary estates. Extension and research staff of TRI, Assistant Tea commissioners and Senior Tea Inspectors of TSHDA were participated.

Client oriented special Training Programs

Ratnapura Region

- a. Methods and results demonstrations:** Seven training programmes were conducted on request of TSHDA and Project officers of *Gamidiriya Praja Development Project* for empowering the smallholders in low country region. The main objective of this program was to educate the smallholders to become grass root level communicators to disseminate tea technologies to their neighbors.
- b. Pre-seasonal discussion for Commercial Nursery Holders and Establishment of Model Nurseries:** Seven programs of pre-seasonal discussions were held and three model nurseries were established at “Tea Technology park” TRI Low Country Station, Ratnapura, Carney Asoka estate, and “Govijanakendra” TSHDA sub office.
- c. Workshop on Effective use of Fertilizer in Smallholding Sectors:** Workshop on effective use of fertilizer in smallholding sectors was held at the auditorium TRI-Low Country Station, Ratnapura on 10th October. 140 numbers of participants including the senior staff members of TSHDA, Tea development Society members and Representatives, Private Tea Factory owner’s Association were attended the workshop.

2. Regional Scientific Committee (RSC) Seminars

Five RSC seminars were conducted for the corporate sector during the year under reference in Dimbula/Nuwaraeliya, Kandy, Ratnapura, Kegalle and Galle/Matara. Approximately 125-140 Superintendents and Assistant Superintendents from the RPCs participated in each of the program.

RSC I: Dimbula / Nuwaraeliya Region

Seminar was conducted on 19th November 2009 at the Auditorium of TRI under the theme of “Improving crop and worker productivity to cope up with the current high cost of production”

RSC IV: Kandy Region

Seminar was held on 21st December at TRI Hantane under theme of “Meeting economic challenges of managing mid country tea lands”

RSC V: Ratnapura and Kalutara Regions and RSC VI: Kegalle Regions

Seminar was conducted on 13th October 2009 at the Low Country Regional Center, on “Improvement of productivity and quality of tea through innovative agricultural practices”

RSC VII: Galle / Matara regions

Seminar, jointly organized by the Kottawa and Deniyaya regional stations was held on 13th September in Galle.

3. Experiment and Extension Forum (Sinhala) seminars for Smallholdings sector

Two E & E seminars (Talawakelle and Ratnapura) were conducted for the smallholdings sector during this year. Approximately 110 – 125 participants including Chairmen of TSHDA and TRB, Director General of Tea Board, Tea Commissioner, GM, DGMs, RMs, ARMs and Senior Tea Inspectors of TSHDA and representatives of smallholdings Development Societies were participated.

a. E & E (Sinhala) seminar held on 15th May 2009

As the guest speaker, Mr. Nimal Gunaratne, RO, of the Dept of Agriculture made a presentation on correct methods of compost preparation and usage. Dr. G P Gunaratne, Dr. M A Wijeratne and Mr. S L D Amaratunge were also made presentations.

b. E & E (Sinhala) seminar on 14th December 2009

Mr. Shantha Jayasinghe, Manager, Advisory & Extension of the A Baur & Co., was invited as the guest speaker for the seminar. Dr. Mrs. H W Shyamalie, Research Officer, Agricultural Economics Division, TRI, Mr. K Obesekara, DGM of TSHDA and Mr. T G N Mahinda were also made presentations.

4. Regional Technical & Extension Forum for Smallholdings sector

Seven Regional Technical & Extension Forum (RTEF) seminars were held in Talawakelle, Kandy, Passara, Ratnapura, Galle and Deniyaya with the participation of TRI officers and RTEF members of smallholdings sector during this year. Approximately 40-50 members were attended in each program.

a. Ratnapura, Kalutara and Kegalle regions: Seminar was held on 24th April 2009 at the TRI-Low Country Station, Ratnapura on Mitigation of Drought damage, Minimizing Post Harvesting Losses, Soil Fertility Management, Weed and Shade management.

b. Deniyaya region: Seminar was held on 21st July 2009 under the theme of soil fertility management and the “Deniyaya Problem” at TRI regional station, Deniyaya

c. Kandy Region: Seminar was held on 27th July 2009 at TRI Hanthana under the theme of Enhancing productivity through the improvement of soil fertility with special reference to the non chemical approaches, Importance of record keeping in smallholding tea lands and Efficient and judicious use of inorganic fertilizer.

d. Galle Region: Seminar was held on 31st August 2009 at the Kottawa station, Galle on Importance of raising quality nursery plants and the identification of 3000/4000 series cultivars.

- e. **Nuwara Eliya regions:** Seminar was held on 19th November at TRI mid country station in Kandy on “Improving of productivity through the improvement of soil fertility with special reference to the non chemical approaches”, “Importance of record keeping in smallholding tea lands” and “Efficient and judicious use of inorganic fertilizer” were made.
- f. **Badulla region:** Two RTEF programs were held in the Passara region on 30th March and 17th December at the TSHDA regional office at Bandarawella under the themes of timely important issues, improving organic status of Uva tea soil and prevention of drought effects, burial of pruning and management of blister blight at extreme climate situations.

5. Workshops and Field-Day Programs for the Corporate Sector

Thirty three Training/workshops/field-day programs were conducted, covering all the plantations companies in order to educate management and field staff on new developments in the areas of Nursery management and new clearings, soil fertility and other related subjects, spraying of agrochemicals, plucking and related topics. Approximately 40-50 Superintendents, Assistant Superintendents, and Field Staff participated in each program.

1. A workshop was held on Site Specific fertilizer application for Managers, Assistant Managers, Chief Clerks & Field Officers of Kahawatta Plantation Ltd., on 13th October 2009 at TRI Ratnapura.
2. Two Seminars with field demonstrations were held on Fertility management, soil sampling techniques and harvesting techniques for improving productivity and quality of made tea for Managers, Assistant Managers Field Officers of Kahawatta Plantation Ltd., on 13th August at Palmadulla Estate and 07th December 2009 at TRI Ratnapura.
3. Two seminars and field days on plucking and, Fertility management etc. was held for Managers, Assistant Managers and Field Officers of Hapugastenne Plantation Tea Estates in Rakwana Region, at Madampe Estate on 14th July 2009 and for tea estates in Bamambarabutuwa region, at Alupola Estate on 15th July 2009.
4. Field day on Shear Plucking was conducted for field staff of Lellopitiya Estate on 27th November 2009.
5. Two awareness programs were conducted for factory and field staff of Liddesdale estate in Halgranoya, in order to educate the staff on HACCP certification and Fair Trade certificate procedure.
6. Seven skill development programs for the field staff of five estates were conducted on nursery practices, plucking, safe use of Agrochemicals and fertility management to refresh the basic knowledge and to develop the skills for successful implementation on TRI recommendations.
7. One-day training program was conducted for the field staff of Loolcondera estate on pruning
8. Five workshop at, Kellebokka, Gomara, Midlands, Opalgala and Nicholaoya was conducted to facilitate to prepare of development plans based on their corporate plan.

9. Four Training programs were conducted for *Para Extension Aides* (PEA) under PEA pilot project for Agrakanda, Henfold, Lippakelle, Ouvakelle, Tangakelle and Waltrim estates.
10. Five training workshops on shear harvesting were conducted for the staff and selected pluckers of Newburg, Demodera, Oodoowere, Dammaeria B, Showlands estates by the TRI Extension Centre Passara.

6. Training programs for Small Holders

Fifty seven Training/workshops/field-day programs were conducted for smallholders, covering all aspects of tea cultivation. The following subject areas were seen high importance in these programs.

1. Improve the soil fertility using of green manure, and importance of adopting TRI-recommended nutrient management strategies.
 2. Potential Use of *Gliricidia* as a Green Manure and an Alternate Energy Source for the Tea Industry.
 3. Importance of record keeping, safe use of agrochemicals, and following of pre-harvesting intervals in order to minimize pesticide residues in made tea.
 4. Use of the TRI tea harvester and plucking basket during cropping months to minimize post-harvest losses;
 5. Sulphur deficiency in soil, prevention and remedial measures for smallholdings in Uva region.
- Ten Awareness Programs for the factory based Extension officers, Factory Officers, Leaf Supervisors and small holders were held during crisis period. All stakeholders representing Public sector (Officials from TRI, TSDA, Tea Commissioner's Division, Society leaders) and Private sector (factory owners and staff, Agro-chemical extension and promotional staff etc) worked together to leaf collectors and factory owners on crop management strategies and careful handling of leaf to minimize post harvesting losses, quality improvement to achieve higher NSA during crisis period.
 - Thirteen focus group discussions were conducted for dissemination of tea related technologies such as Bush management & harvesting techniques, Fertility management and productivity improvement of tea fields at RTS, KDU, Folcon, Karawita and St.Joachim, factories located in Ratnapura District and, Corp Lanka-Kotapola, Lumbini, Berubewula, Dhampala tea factories located at Matara Region where private-public partnership extension service is in place. Assessment on degree of adoption of good agricultural practices by small holders was done under each program and analysis of above information is in progress.
 - Thirteen training program for small holder groups, on nursery management, soil fumigation, pruning, plucking and basic cultural practices were conducted at Kottawa regional station.

7. Training programs for Undergraduates, School children and other special visitors

- Ten educational programs were conducted for the undergraduate students from the Universities of Sabaragamuwa, Peradeniya, Wayamba, Ruhuna, Uva-Wellassa and Jaffna,
- Five educational programs were conducted for students from Agricultural School at Karapincha, Aquinas, Naiwala, Palwehera, Kuliypitiya and Kundasale
- One awareness program for Administrative Officers and *Samurdi* Managers on Tea nursery management and other aspects of tea cultivation were conducted at the Hantana regional centre, Kandy.

8. Crop Clinics programs

Two crop clinics were conducted for both corporate sector and smallholding sector in the Uva region on 29th November at Badulla and on 3rd December at the regional station, Kottawa. The main theme of the crop clinics was the soil fertility management and composting.

9. Educational Exhibitions for the School children and General Public

Advisory staff participated in five public and educational exhibitions designed to educate tea growers, school children and the general public on new developments in the tea industry.

1. "Dayata Kirula" National Exhibition, 4 – 10 February at BMICH, Colombo
2. Golden Jubilee Exhibition at Seevali Central Collage, Ratnapura at 19 to 26 September
3. Silver Jubilee Exhibition at Weewelwattha - Babarabotuwa Vidyalaya: 14 & 15 October
4. Educational Exhibition – Josephvaaz college, Wennappuwa: 7 – 11 Oct.
5. "Gaalum Samaya" National exhibition at Galle, December, 27 – 31 December

10. Commercial Nursery Inspection visits

182 commercial nurseries in Kandy, Badulla, Kandy/Matale, Matara, Galle, Kegalle Kalutara and Ratnapura RM regions were inspected during the period under reference.

The details of nursery inspection are as given below.

District	No of Plants CN-5	Nursery Plants at CN-6	Suitable Plants	% Suitable plant
Ratnapura	1,364,850	1,121,500	879,675	78.4%
Kegalle	108,200	92,760	78,060	84.0%
Kalutara	970,500	572,595	393,650	68.7%
Badulla	1707000	1574000	688700	43.75%
Kandy		1,379,850	750,893	54.4%

There was a significant increase in the production of suitable nursery plants in registered commercial nurseries due to; the periodical supervision of commercial nurseries and pre-seasonal skill development training programs.

A 37.1 Identifying levels of adoption of TRI recommendations

i. Identifying levels of adoption of TRI recommendations in tea smallholdings in Ratnapura area

Assessment on degree of adoption of TRI recommended Agricultural practices by small holders attached to Pilot Research Project of public- private extension service was under taken. The analysis of information is in progress.

ii. A survey was conducted to assess the current status and adoption level of smallholding commercial nursery owners in Yatinuwara area

The objective of this study was to evaluate the standard of operations undertaken in the mid-country tea nurseries and to propose ways and means to improve them. Results revealed that the Adoption Level of the TRI recommendations in Yatinuwara DS area is poor and mean adoption index of the study area was 59.7% which indicates the significant GAP/technology adoption (41.3%). However there is significant difference in adoption of technology between registered and non registered nurseries (64.5 Vs 49.8)

iii. Survey on the drop in tea production in smallholder sector from January to July 2009, with special reference to Matara, Galle and Ratnapura districts

A study was conducted to study the drop in tea production in smallholdings sector in the year 2009, by the staff of Advisory division with the collaboration of research staff.

Weather conditions prevailed during January to July 2009 played a key role in causing yield decline observed in low country. Low rainfall, high temperature, less number of wet days during January to March and less number of sun shine hours with overcast conditions during June/July created unfavorable environment for growth of tea. In addition to the adverse weather condition, low soil pH values, low level of soil Carbon, K and Mg under poor soil conditions too also contributed considerably towards yield decline.

iv. Diagnostic Census in the Corporate Sector Tea Estates

The agricultural census was undertaken by the staff of the Advisory and Extension of TRI, covering all 307 tea estates managed by 20 Regional Plantation companies to achieve the following objectives.

- To study the levels of adoption of TRI recommendations in the corporate sector.
- To develop a data-base on the agricultural performance of tea estates in corporate sector.

Study was conducted from August 2007 to September 2008 and subsequently, updated with the basic information of 2009. Field-wise information on the average yields in last completed cycle, average length of pruning cycle, the average amounts of nitrogen applied and all the agricultural practices adopted by the estate were collected in this study.

The information on the age profile of tea, perception of management staff on the major issues of the plantation sector, the adoption levels of TRI recommendations *etc.*, were also collected through this study.

D/ADV3. Monitoring the Agricultural performance of tea plantations and smallholdings

a. Case studies in Mid country Region

Three case studies were conducted to identify the possible causes for the following specific problems identified in three plantations in the mid country region.

1. The continuous yield declining trend in the Stellenburg estate,
2. The influence of the cultural practice adopted over last 10 years period on current yield trend of Giragama estate and proposed a suitable development program.
3. To evaluate the present status in Gammaduwa estates and propose a development program.

b. ‘Para Extension Aide’ (PEA) approach

In view of reducing the technology adoption gap in the corporate sector plantations, “*Para Extension aide*” approach has been introduced in a pilot scale. In this approach, middle level employees (supervisory staff) are trained as “*Extension Assistants*” on needy subject areas, and to use them effectively to narrow down the high gap that exist between managerial and grass root level employees with respect to awareness, knowledge and adoption of agricultural technologies. Studies have been undertaken to identify needy subject areas and training of selected extension assistants or ‘*Para Extension Aides*’ have commenced from October, 2009.

The pilot project is implemented in collaboration with TRI and Watawala Plantations.

C/ADV1. Production of Extension and Teaching materials

Newspaper Articles: The members of the Advisory Division arranged to publish six articles in “Ladalumahima” newsletter to educate the general public on tea cultivation.

Revision of Advisory Circulars: The advisory circulars on Management of Tea Tortrix, Tea Nursery Management and Fumigation of Nursery Soil for Nematode Eradication were revised during the year under reference.

C/ADV2. Supply of new cultivars

Total of 12.3 million new cuttings (TRI 3000- and TRI 4000-series) were issued from the TRI, TSHDA and Private Mother Bush sites.

D/ADV2. Upgrading Extension Centers

Establishment of New Regional Advisory and Extension Centre at Deniyaya

Newly constructed office building which consisting of three office rooms, seminar hall, small laboratory and a business centre was ceremonially opened by the Hon. Minister of Plantation Industries Mr D.M Jayaratna on 30th September. The construction of a circuit bungalow and OIC bungalow is almost completed. The construction works of Automatic weather station was also completed.

D/AR. Adaptive Research

a. Extension-Research Linkage Forum

The Extension-Research linkage forum activities were revitalized two-day workshop was held at the TRI, Talawakelle on identified areas/subjects. The Advisory & Extension staff and the Research staff were participated at the workshop.

b. Comparative Study on VP/LC-880 vs. Site-Specific Fertilizer

A comparative study on VP/LC-880 vs. site-specific fertilizer is continuing, at the Field No. 1, St Joachim Estate, TRI, Ratnapura in collaboration with the SPND and St Joachim Estate. Maintaining yield records and field observations are in progress.

An adaptive trial to introduce new improved seedling plants for marginalized tea fields in mid country was initiated.

The planting of seedlings (1200 plants) in the nursery at TRI Hantane was completed and plants were four months old by the end of 2009. The land preparation works are being carried out at Hangurugama Estate, Medamahanuwara where these plants are to be planted.

Collaborative research activities with the Plant Breeding Division: Phase III trials on TRI 5000 series cultivars: Nursery planting and selection of a land for field planting has been completed in Green Wood Estate, Nawalapitiya.

c. On-going collaborative research trials at Kottawa station

The following research trials in collaboration with the research divisions were in progress;

LVP phase III trial at F/No.03: 5000 series, LVP phase II trial at F/No: 03: Testing for Low country Live Wood Termite resistnace, U 709 Vs VP/LC/880 and VP/LC1075 Vs T1130 trials at F.No.04, Organic tea fertilizer trial at F.No 07, Fertigation trial at Thalgaswella estate, Nematode population monitoring trial at .No. 04, Biofilm/ Bio fertilizer trial at F/No.02 and, Difference between the estimated yield/potential yield and the actual yield at Moragolla estate

d. On-going collaborative research trials at Deniyaya region

The following research trials in collaboration with the research divisions were in progress.

- TRI 5000 series commercial evaluation trials in Deniyaya Estate and Indola Estate
- Seedling commercial evaluation trial in Warapitiya TI region of Hambanthota district (IL1a) to evaluate the regional suitability
- Evaluation of crop response for different proportion of SA and Urea (Kiruwanaganga Estate)
- Bush debilitation in Deniyaya Region at Richiland Estate, Deniyaya
- Screening of waste material to protect the main stem of young tea plants from SHB at Field 01A Hanford Division, Hanford Estate
- Role of good agricultural practices on SHB management in Deniyaya region
- Demonstration and model trial LE 100 a, 100b at Palitha Group (Immature tea) Victor's land (mature tea)

e. On-going collaborative research trials at Passara station

The following research trials in collaboration with the research divisions were in progress.

- UVP 9 and UVP 10 PPPB trials in F/No.04
- Up keeping of 5000 series Phase III Trial in field No.02
- Up keeping of Germplasam in F/No.03
- 02 Seedlings trials in Field No.03 and 04
- Trial on pesticide residues in F/No.02
- Evaluation trial of 3000 and 4000 series on resistance to nematodes
- Cultivars on their tolerance to nematodes
- Rain water harvesting in F/No.01
- Dendro power experiment in F/No.03

- Nursery trial on Bio Fertilizer
- Up keeping of Grafted plant block in field No.01
- Integrated weed management trial at F/No.03
- Trial on fungicide residue level in F/No.03

Special Advisory and Extension Activities

1. In-service Training for Factory Based Extension officers

One week on the job training for newly appointed factory based extension officer of St. Joachim Tea factory and one day training program for Extension officers and Leaf Supervisors of Galpaditenne tea factory (8th July 2009) were under taken at Advisory division, TRI Low Country regional centre.

2. Extension Research Study

One undergraduate student from the University of Sabaragamuwa has undertaken a Research Project of “Impact of Public-Private Partnership Extension Service on livelihood development of smallholding sector” under supervision of Mr. S L D Amarathunga from 28th May to 07th October, 2009.

3. Selection of lands for demonstration Sites in Smallholdings (with TSHDA)

The assistance were rendered to the TSHDA to select 12 smallholdings to establish demonstration trials in Kandy, Nuwaraeliya, Bandarawella, Galle, Matara, Ratnapura, Kegalle and Kalutara RM regions.

4. In-Plant Training for Diploma and University students

Twelve diploma students were undergone four months in-plant training programme on tea cultivation in the Advisory divisions/stations at Ratnapura, Talawakelle, Kandy, Kottawa and Passara.

5. Regional Tea Development Councils

TRI was represented at the Regional Tea Development Councils which was established by the Ministry of Plantation Industries to bring the all stakeholders in tea industry under one umbrella. The following activities were initiated at the meetings in 2009.

New recruitments and Promotions

- Messrs. Dhakshina Hettiarachchi (B Sc Agric.) and P K R C F Munasinghe (B Sc Agric.) were appointed as Extension Officers with effect from 1st October 2009.
- Mr. K A Sunil Piyathilaka was appointed as clerk effect from 1st October 2009.

Study Programs

- Dr. V S Sidhakaran, successfully completed his doctoral studies and obtained the PhD degree in Agriculture Extension (Thesis Research: Private Extension for Corporate Sector tea Plantations: Scope and Strategies) from the Tamil Nadu Agricultural University, Coimbatore, India on 28th January 2009
- Mr. S L D Amaratunge, commenced the research component of his PhD program at the Post Graduate Institute of Agriculture, University of Peradeniya on the Private-Public Extension approaches in smallholding sector in Low country
- Mr. C J Liyanarachchi, proceeded to India to attend a 6 months training program on tea cultivation at the Kothari Plantation Management Institute on the 1st September 2009.
- Mr. B A D Samansiri was granted full-time study leave from October for a period of one year to pursue his PhD program at the Post Graduate Institute of Agriculture, University of Peradeniya
- Mr. K G J P Mahindapala is continuing his M Sc program in Agriculture Extension (Organizational Management) at the Post Graduate Institute of Agriculture, University of Peradeniya
- Ms. Hiromi Nishanthi is continuing her M Sc program in Agriculture Extension (Development Communication) at the Post Graduate Institute of Agriculture, University of Peradeniya
- Mr. B A D Samansiri attended “e-Asia 2009”- Asia’s Premier ICT Event: 3 day International Conference at the BMICH from 2 - 4 December.

Research Publications

- Amarathunga M K S L D, Balasuriya A, Wanigasundara W A D P and Dassanayake N C 2009. A field assessment of the factors affecting Horse Hair Blight (*Marasmius equicrinis*) in tea in the Ratnapura District, The Journal of Agricultural Sciences, University of Sabragamuwa, pp 59-66, Vol. 4. No. 2.
- Amarathunga M K S L D and Wanigasundara W A D P 2009. Building Public-Private Partnerships for the Dissemination of Agricultural Technology in Tea Smallholding Sector in Sri Lanka: An Apriority Pilot Project Stakeholder Analysis, Proceedings of Extension Symposium. Department of Extension, Faculty of Agriculture, University of Peradeniya. 27-28.
- Amarathunga M K S L D, Gunarathna W A D K L and Wijeratne M 2009. Factors affecting quality of the vegetatively propagated (VP) tea (*Camellia sinensis*) nursery plants in the commercial tea nurseries: A case study in Kegalle and Kalutara Districts, Proceedings of 2nd National Symposium, Faculty of Agriculture, University of Ruhuna. 66.
- Amarathunga M K S L D and Wijeratna M A 2009. Effects of variation of some ecological factors on the sustainable productivity of tea lands. This paper was accepted to publish in Journal of National Institute of Plantation Management

- Samansiri B A D and Rajasinghe J C K 2009. “Technology Dissemination in the corporate tea sector in Sri Lanka”. Proceedings of Extension Symposium, Department of Extension, Faculty of Agriculture, University of Peradeniya.
- Sidhakaran V S 2009. Clientele satisfaction in extension services of tea research institute at the Extension, Proceedings of Extension Symposium, Department of Extension, Faculty of Agriculture, University of Peradeniya

Mr. K G J P Mahindapala submitted an article to Tea Bulletin titled on “An assessment of some growth attributes of vegetatively propagated nursery plants of tea cultivars recommended for the Low country”

Special Presentations by the Advisory Staff

- Mr. M K S L D Amarathunga: Presentation on “Role of TRI in Tea industry” at a seminar organized by the Tea Board for tea stakeholders in Kaluthara, Kegalle, Ratnapura Districts on 16th June 2009.
- Mr. M K S L D Amarathunga: Presentation of a research paper “Public & Privet partnership for the dissemination of Agricultural Tea Smallholders” at Extension symposium held at the PGRC on 27th & 28th August 2009.
- Mr. B A D Samansiri: Sector Paper presentation on the “Technology Dissemination in the corporate tea sector in Sri Lanka” at the Extension symposium held at the PGRC on 27th - 28th August.
- Dr. V S Sidhakaran: Research paper presentation on “Clientele satisfaction in extension services of tea research institute at the Extension” symposium held at the PGRC on 27th - 28th August.
- Mr. M K S L D Amarathunga: Research Paper presentation at the symposium held at Faculty of Agriculture 9th September 2009, University of Ruhuna, on food for nation through innovative agriculture.
- Mr. B A D Samansiri: Presentation on “current status of corporate sector tea lands and the adoption of TRI recommendations on fertilizer use at the 219th E & E Forum on 31st July 2009.
- Dr. V S Sidhakaran: Presentation on “New Technology Transfer Strategy for Effective Adoption of TRI Recommendations in the Corporate Tea Sector, at the 219th E & E Forum (English) on 31st July 2009
- Mr. M K S L D Amarathunga and Dr. M A Wijeratne: Research paper presentation on “Effects of climate change on tea production in Sri Lanka and adaptation measures”, at workshop held at Hotel Tomarin, Kandy organized by Department of Agriculture and the University of Peradeniya, on 10th to 11th September, 2009.
- Mr. T G N Mahinda, served as a resource person for two science education program organized by the ‘Vidatha’ Centre
- Mr. S P Rathnayake: A lectures on “Protection of the environment” for the school children, teachers and volunteers at a program organized to celebrate the world environmental day.
- Mr. M K S L D Amarathunga: Presentation on “Tea Replanting and aftercare” at a meeting of Planters Association of Kaluthara Region held at Thebuwana Club, Neboda on 23rd June 2009

Special Assignments

- Mr. B A D Samansiri and Dr. V S Sidhakaran served as the visiting lecturers for the Tea Technology and Value addition degree program of the University of Uva-Wellassa.
- Mr. B A D Samansiri served as the coordinator and resource person for the program of National Diploma in Plantation Management conducted by the NIPM.
- Mr. J C K Rajasinghe, Dr. V S Sidhakaran, Ms. M A H Nishani, Mr. Haran Jayaweera and Mr. Rohitha Kumara served as resource persons for the program of National Diploma in Plantation Management conducted by the NIPM.
- Mr. M K S L D Amarathunga attended the workshop on 'Awareness program on implementation of seed act, held on 26th March 2009 at In-service Centre, Department of Agriculture - Gannoruwa.
- Mr. M K S L D Amarathunga attended the Meetings held at Ministry of Plantation Industry on 15th October and Ministry of Environment and Natural Resources, Colombo on 29th October 2009 for organizing "Haritha Divimaga" exhibition.
- Mr. M K S L D Amarathunga attended the Progress evaluation meetings on Factory based extension and development program held at the Head office TSHDA, Colombo on 04th November, 2009.
- Mr. B A D Samansiri, and Mr. M K S L D Amarathunga attended for the series of meetings organized for developing formula for COP of tea cultivation at the special review committee appointed by Hon. Minister of Plantations Industries to revise the green leaf formula.
- Mr. M K S L D Amarathunga and Mr. C J Liyanarachchi attended the monthly meeting of District Agricultural Deployment Committee held at the District Secretarial Office, Ratnapura.
- Mr. M K S L D Amarathunga attended four committee meeting held at the TRILC at Ratnapura on St. Joachim Factory based extension and development program as a convener for technology dissemination process of with Gamidiriya foundation.
- Mr. S P Rathnayake participated the International forum on Experiences and Challenges in Agricultural Extension: meeting Farmer Needs at PGRC, Gannoruwa, Sri Lanka representing the TRI.
- Mr. J C K Rajasinghe was appointed as the Actg. Officer-in-charge of Mid country station with effect from October 2009
- Mr. J C K Rajasinghe continued to be the coordinator of ADB Mother Bush Project.
- Mr. J C K Rajasinghe was appointed as a member of Advisory sub-committee of IFAD project.
- Mr. K G J P Mahindapala was continued to work as the Convener/Secretary of the Advisory and Extension Officers' Forum.
- Messes J C K Rajasinghe and K G J P Mahindapala provided the consultancy services for the IFAD project to improve the productivity of smallholdings comes under NADSA project area.
- Mr. S P Rathnayake continued to serve as the Convener/Secretary of the E & E Sinhala forum.
- Mr. S P Rathnayake was appointed to coordinate the study on National yield decline issue and the member of Technical Evaluation committee for fertilizer of the Institute.

- Mr. K D Dahanayake undertook the responsibilities of inspecting the tea fields of Walahanduwa TRI, in addition to his normal duties.
- Mr. B A D Samansiri continued to serve as the Convener/Secretary for the Consultative Committee of Advisory Services, a member of Publications and Presentation Panel, Agrochemicals and Machinery Screening Committee and the Pesticide Residues Monitoring Committee until October 2009.
- Mr. B A D Samansiri continued to work as a member of the Consultative Committee for Extension activities of the Board of TSHDA and the member of the steering committee of the Factory-based Extension System.
- Dr. V S Sidhakaran was appointed as the Actg. Head of the Advisory and Extension Division with effect from 15 September 2009.
- Dr. V S Sidhakaran was appointed to coordinate the revision of TRI Advisory Circulars and to coordinate the Research and Extension Linkage meetings.
- Dr. V S Sidhakaran was appointed as Convener/Secretary for the consultative committee of Advisory Services from October 2009.
- Mr. Haran Jayaweera continued to serve as the Chairman of the Regional Tea Development Council in the Nuwaraeliya region.

C/AV: Audio Visual Services

Mr. Neville S Ekanayake handled the audio and video activities of the TRI. He attended for preparing several video clips on field and laboratory experiments, crop clinics, seminars, training programs and other the special events of the TRI. Three hundred and thirty five DVDs and ten VCDs were sold during the period under reference.

Services provided and activities attended	Nos
Public and Educational Exhibitions	03
Crop Clinics	02
Opening of Deniyaya Station	01
Meetings, Training programs, Seminars etc.,	20
DVD and VCD	345

Further, he handled the activities held in TRI Auditorium in providing public address system facilities, assisting the technical evaluations job for purchasing computers, audio visual items etc. and the general photocopying activities of the institute.



T.R.I. ADVISORY CIRCULAR No. SP **7**



T.R.I. ADVISORY CIRCULAR No. PM **10**

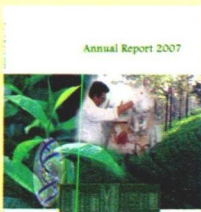


T.R.I. ADVISORY CIRCULAR No. PN **2**

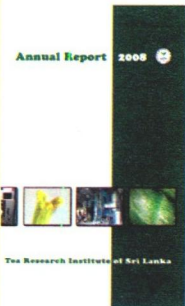
Publications and Publicity Unit

K P H Liyanage
B Sc (OUSL, Sri Lanka)
Publications/ Publicity Officer

Publications Issued during the Year



Tea Research Institute of Sri Lanka



Tea Research Institute of Sri Lanka



Annual Report 2007 (English)

Annual Report 2007 (Sinhala)

Annual Report 2007 (Tamil)

Annual Report 2008 (English)

TRI Update (Volume 13 No. 01)

Thei Thathu (Sinhala) Volume 6 No. 02

Advisory Circulars

- SP 7 – Soil Analysis
- SP 8 – Analysis of Fertilizer Samples
- SP 9 – Sampling for Foliar Analysis
- PM 10 – Management of Tea Tortrix (*Homona coffearia* Neitner)
- PN 2 – Tea Nursery Management
- PM 11 – Fumigation of Nursery Soils for Nematode Eradication

- **Guidelines**

- Measures to be adopted on Tea Lands following Drought
- Measures to be adopted on Tea Lands following Drought (Sinhala)
- Use of Selective Tea Harvester
- Cautionary note on Use of Glyphosate

Sale of Publications

Income generated through the sales of publications was Rs. 490,728.06.

In-house Printing/ Duplicating works

The unit has provided printing facilities for other divisions/ units on request. This includes the printing of advisory circulars, proceedings of E & E forums, leaflets for free distribution at crop clinics, *etc.*

Website

A prototype of a suitable website was developed. A training program conducted by National Science Foundation was very helpful in developing the prototype of the website

Necessary steps were taken to strengthen the infrastructure needs of the website and intranet.

Photography

Photography Unit covered all the functions of the institute and captured 4320 digital photographs. An income of Rs. 20,575.00 was earned by selling photographs.

General

- Publications/ Publicity Officer served as a member of the Publications and Presentation Panel of the institute
- Publications / Publicity Officer has attended a workshop on “Joomla web development’ from 23rd – 25th September 2009 conducted by the National Science Foundation
- Publications/ Publicity Officer has attended a workshop on “Report Writing” on 07th August 2009 conducted by the British Council
- Mr. U D Alagiyawadu attached to the IT Unit continued his support in graphic designing works undertaken by the Publications Unit. He specially rendered his support in graphic designing of Annual Report 2008 and crop clinic poster designing

- Mr. N S Ekanayake attached to the Advisory and Extension Division borne the responsibility of smooth functioning of main photocopy services. He extended his support in publications sales at crop clinics.
- Mr. R Krishan Kumar has been undergoing a training at the unit from 02nd March 2009 to date. He has been playing a vital role in computer graphics and typesetting and pagesetting of publications.

Library

R W M S K Amunugama
Diploma in Library Science
Library Assistant



Library provided its service to TRI staff, postgraduate, undergraduates and diploma students and to other libraries and people on official requests.

During the year collection of book at the library was expanded by 18 new books, as 5 purchase and 13 free of charge. Library procured 30 journals/serials through subscription, gift and exchange. It subscribed 13 foreign journals. One M Phil thesis and one Ph D thesis of TRI officials were submitted to the library collection during the year.

Information Technology Unit

U D Alagiyawadu
Experimental Officer

Information Technology Unit was able provided IT related services to the other divisions on request. These included operations and maintenance of file servers of the institute, trouble shooting of computers and accessories, installation of Anti-Virus program and other software packages, preparation of technical specifications for IT equipments.

Mr. Udeni D Alagiyawadu, Experimental Officer, Technology Division was transferred to the IT Unit w.e.f. 01st March 2009 with the view of expediting the functions of the Unit.

Highlights of the Year

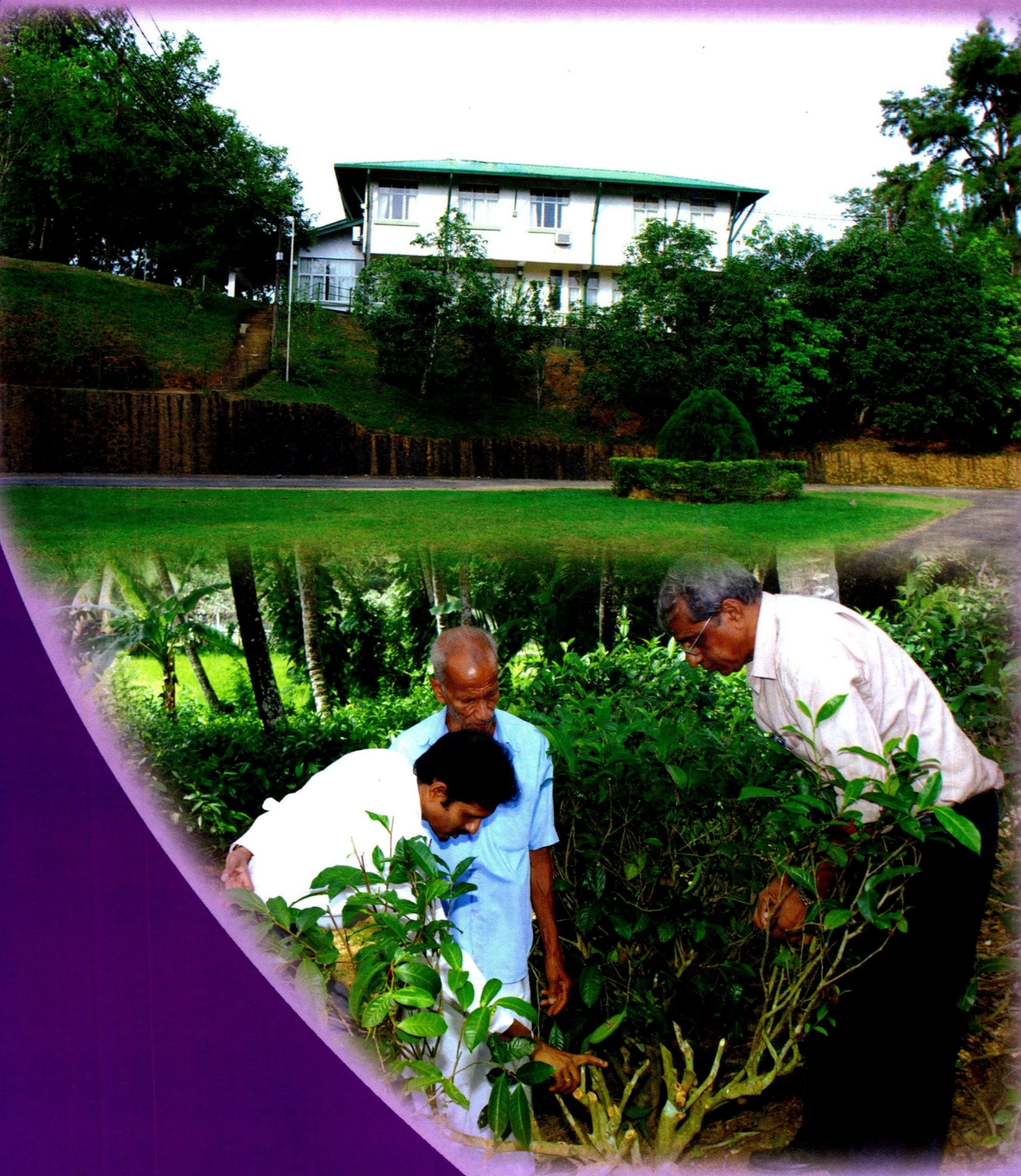
- Carried out a survey on institutional computers and accessories in order to set up a decision support system on computer status
- A new Anti-Virus Program was installed in server computers and personal computers
- A new server computer was purchased and it is installed with a new operating system
- A Load Balance Router was installed to ensure a steady internet connection
- Re-installation and configuration of two servers was carried out. This enhances the speed of the internet browsing.

Seminars/ Trainings

- Mr. U D Alagiyawadu followed a four month certificate course on computer networking and administration conducted by the National Institute of Business Management
- Mr. U D Alagiyawadu made a presentation on 'How to be an Efficient Computer User' for the TRI staff at the auditorium on 15th July 2009.

General

- Mr. U D Alagiyawadu assisted Publications/ Publicity Officer in computer graphics and designing printing material throughout the year
- Mr. U D Alagiyawadu assisted for multimedia arrangements in special occasions
- Mr. U D Alagiyawadu assisted the installation of Finger Print Scanners



Low country Regional Centre

M A Wijeratne

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

Officer-in-Charge, Senior Research Officer

Highlights of the Year

There were 41 permanent staff members in the sections of Administration, Advisory and extension, Agronomy, Entomology, Plant Breeding and Technology divisions of the TRI Low country station, Ratnapura. Scientists of the TRI Low country station conducted field and laboratory experiments in their respective divisions and estates in the low country region covering Ratnapura, Kalutara and Kegalle districts. In addition, short-term experiments and research projects on tea were carried out in collaboration with universities. Technical staff also provided assistance to the St. Joachim estate and factory. Advisory and extension officers organized many training programs to disseminate appropriate technology to the tea growers on tea cultivation and processing in addition to their routine and problem solving visits to the corporate sector estates and smallholdings. Technical staff of the TRI low country station participated as resource persons in extension and training programs organized by the tea related organizations such as Tea Board, Tea Smallholdings Development Authority (TSHDA) and National Institute of Plantation Management and other government organizations. Training of graduates, undergraduates and students from agriculture schools and other apprentice training institutes were also carried out. With close coordination of the TRI Low country station and TSHDA, St Joachim estate issued more than 525,000 shoots (around 2.5 million cuttings) of new cultivars to smallholders, commercial nurseries and estates. Some planting materials of rehabilitation grasses, shade trees, cover crops and hedgerow species etc were also issued in limited quantities on requests of the tea growers. The TRI Low country station received more than 670 visitors during the year 2009.

Research, Advisory and Extension Program

Research, advisory and extension activities of the TRI low country station in 2009 included more than 60 field experiments, 90 advisory and extension visits and 50 extension and training programs. The details of the experiments conducted and their findings have been discussed elsewhere in the reports of the respective Heads of Divisions. Training programs and seminars were mainly concentrated on productivity and quality improvements, improving fertilizer use efficiency, drought mitigation, minimizing post-harvest losses, energy saving options and low country tea manufacture. A number of one-day training sessions on tea cultivation were conducted for the members of tea smallholder development societies who visited TRI Low country station. Meetings and discussions were also held with smallholders and TSHDA officials on fertilizer related issues and problems related to yield decline. Around 50 commercial nursery inspections were carried out and the number of soil samples tested for soil pH exceeded 340. Visitors have taken more than 500 TRI publications including books, pamphlets, circulars and brochures *etc.* The TRI Low country station participated in two exhibitions in Ratnapura that received greater attention of smallholders in the region. Dr. MA Wijeratne made oral presentations at two climate change workshops organized by the Institute of Policy Studies and University of Peradeniya. TRI Low country station maintained a demonstration area showing proper management practices in tea cultivation.

Appointments, Training Transfers and Retirements

Mr. T A D Gamini, Driver attached to the TRI Low country station retired from the TRI services with effect from 7th June, 2009. Mrs. Chandima De Seram, experimental Officer, Entomology Division and Mr. J T S Weerakkody, Driver were transferred from TRI, Talawakelle to the TRI Low Country Station with effect from 15th June 2009. Mr. K A D Sudath Pradeep and Mr. K A S Piyatilaka, Skilled workers attached to TRI-Low Country Station were absorbed into the permanent cadre with effect from 1st October and Mr. Piyatilaka was stationed at the TRI Low Country Regional Centre as General Clerk and M. Sudath was given the appointment as Accounts clerk at the head office at Talawakelle.

Dr. MA Wijeratne appointed as an Assistant Commissioner to the Sri Lanka Inventors Commission with effect from June 1, 2009 by the Cabinet of Ministers. He also continued as a member of the Faculty Board of Agriculture, University of Ruhuna.

Overseas Training

Mr. C J Liyanaracchi, Extension Officer proceeded to Kothari Agricultural Management Centre, India for a 6 months training.

Local Training

Mr. N P S N Bandara continued his research project leading to PhD at the Adelaride University of Australia. Mr. M K S L D Amarathunga, Senior Advisory Officer continued his postgraduate studies leading to PhD at the PGIA, Peradeniya. Mr. Asoka Mudalige, Experimental Officer attached to Plant Breeding Division continued his studies at Sabaragamuwa University for the B Sc Degree in Agriculture.

Undergraduate and Apprentice Training

Three undergraduates from Ruhuna and Sabaragamuwa Universities carried out their research work on tea agronomy and extension at the TRI Low country Regional Centre under the supervision of senior scientists as partial fulfillment of the degree programs. In addition, eleven apprentices from NAITA, Hardy Technical School and School of Agriculture continued on the job-training in the technical and advisory divisions of the TRI Low country station.

Building and Layout maintenance

The timber flanks damaged by the termite were replaced by the State Engineering Corporation. Roof repair of the store room of the technology division was completed. Repairs of the bungalow Nos B/06 and C/16 were done. Roof of the C-16 bungalow was painted. General cleaning and other, day-to-day maintenance of layout and buildings were carried out. However, scheduled painting (colour washing) programme could not be carried out due to financial constraints. Only one C Type quarters (C-14) was colour washed with available resources. Limited road maintenance (sealing of cracks & surfacing) was also attended using available funds and facilities.

Electrical Maintenance

Electrical maintenance and repairs of office buildings, bungalows and street lights were satisfactorily done. New digital PABX system (telephone exchange) was installed at the centre.

Transport

Regular servicing and only urgent running repairs of the vehicles of the TRILCS were carried out.



Mid country Regional Centre

J C K Rajasinghe

B Sc Agric. (Peradeniya, Sri Lanka), M Sc (Peradeniya, Sri Lanka)
Acting Officer-in-Charge, Senior Advisory Officer

Highlights of the Year

Research Programs

The research programs of the Agronomy, Entomology, Soil Plant Nutrition and Plant Breeding Divisions are in progress. There are 21 experiments conducted by the Mid Country Regional Centre.

Advisory and Extension Programs

A Regional Scientific seminar (RSC) was held on 21st December at TRI Hantane under the theme of “Meeting economics challenges of managing mid country tea Lands “for the benefit of Managers, Assistant Managers and Proprietary Estate Managers in mid country region. Four presentations was held under the following topics: Present status and future challenges, Economizing fertilizer usage, Improvement of productivity to cope up with high cost of production (COP) in corporate sector and New technology transfer model to reduce the gap of technology adoption for improving crop and worker productivity.

Regional Extension and Technical Forum was held on 27th July 2009 at TRI Hantana and presentations on Enhance productivity through improvement of soil fertility with special reference to the non chemical approaches, Importance of record keeping in small holder tea lands and Efficient and judicious use of inorganic fertilizer were held for the benefit of Tea Small Holdings Authority field staff and society representatives (Tea Shakthi).

Three educational training programs were conducted for Diploma students of Kundasale Agriculture School and two Nursery training programs were conducted for the students attached to the Faculty of Agriculture, University of Peradeniya.

Experiments conducted with the collaboration of research disciplines

Phase III trials on TRI 5000 series cultivar and nursery planting and selection of a land for planting has been completed in Green Wood Estate, Nawalapitiya in collaboration with Plant Breeding Division.

Adaptive trials

An adaptive trial to introduce new improved seedling plants for mid-country marginalized tea fields was initiated jointly by Plant Breeding and Advisory staff of Hantana Station. Seedling plants (1200 plants) in the nursery at TRI Hantane were four months old by the end of 2009. The land preparation works are being carried out at Hangurugama Estate, Medamahanuwara, where these plants are scheduled to be planted.

Demonstration Trials

The work on demonstration plots at the station on Good Agricultural Practices (GAP), is in progress.

Extent

The extent as at 31st December 2006 is given below

Type of land use	ha
Seedling tea	2.00
VP tea (mature)	5.50
VP tea (young)	3.50
Mother bushes	2.75
Tea Nursery	0.20
Under Mana grass	0.50
Fruit trees	0.40
Coconut	0.81
Forestry	1.20
Marshy land	0.62
Building, gardens, paths and roads	5.77
Total	23.25

Crop

The green leaf (kg) harvested during the year 2009 is given below.

Month	Crop harvested/Sold	Rate paid (Rs.)	Income (Rs.)
January	396	36/04	14271/84
February	211	36/77	7758/47
March	672	39/70	26678/40
April	1393	41/34	57586/62
May	956	45/55	43545/80
June	2064	43/46	89701/44
July	2131	54/23	115564/13
August	1690	55/23	93338/70
September	1985	58/70	116519/50
October	2182	53/81	117388/42
November	2591	49/34	127814/94
December	2103	49/15	103337/45
Other additions			10977/60
Total	18374		924483/31

Income

No.of VP cuttings sold		552500
Income from sale of cuttings	Rs	276,250.00
No.of VP plants sold		23053
Income from sale of VP plants	Rs	276,636.00
Total crop harvested (kg)		18374
Income from sale of green leaf	Rs	924,483.31
Guesthouse occupation charges	Rs	44,900.00
Charges for soil testing(pH)	Rs	16,035.00
Sale of TRI publications	Rs	59, 635.00
Miscellaneous	Rs	17, 303.00
Total	Rs	1,615,242.31

Visitors to the station

• Tea Growers	502
• Students/ School Children	304
• General Visitors	38
• Foreign Visitors	22
• Total	866

Experiments conducted by Research Divisions at the centre

Results and details of the experiments are reported under the relevant Divisions, and only the experimental objectives of the field trials are given below.

Soil and Plant Nutrition Division

- Identification and evaluation of plant growth promoting Rhizobacteria in tea
- Estimating crop response to micro –nutrients (Zn, B, Mn, *etc*)
- Estimating crop response to macro–nutrients (N, K, Mg, *etc*)
- Farm centered research on organic tea: Soil fertility studies
- Providing laboratory analytical services to the stake holders
- SA/Urea trial

Plant Breeding Division

- Evaluation of cultivars to mid country
- Development of seed stocks/varieties for the mid country
- Controlled hybridization programmes.
- Use of nuclear –related techniques to improve tea cultivars
- Progeny trials on TRI 4004 and 4006

Entomology Division

- Screening of insecticides to manage scavenging termites
- Screening of insecticides for control of Shot-hole-borer.
- Screening of biological control agents for reducing Shot-hole-borer damage to tea.
- Screening of new cultivars for nematode resistance and tolerance.
- Management of Nematodes pests in tea.
- Nematological analytical service to estates.

Agronomy Division

- Effect of surface application and incorporation of *Gliricidia* on soil properties and growth of tea
- Use of low dosages of herbicides on management of weeds in young tea.
- Effect of in-situ application of *Gliricidia* on soil properties, yield and growth of tea.
- Effect of bio fertilizer inoculation on growth of nursery plants, Immature and Mature tea.
- Assessing *Gliricidia* species for Dendro power.

General

- K G J P Mahindapala, Advisory Officer was transferred from Deniyaya Extension Centre to the Mid country Regional Centre with effect from 1st January, 2009.
- Mr. D M B N Dissanayaka, Experimental Officer was temporary transferred to Mid country Regional Centre from Talawekelle, with effect from 15th August, 2009.
- Mr. J C K Rajasinghe was appointed as the Acting Officer-in-Charge with effect from 10th August 2009.

Buildings and constructions

Colour washing of A-2(OICs) Bungalow and two 'C' type bungalows was completed.

Work on renovation of fertilizer shed was commenced.

தேர்ச்சி மையத்தின் மூலம் உயர்
நிலை உருவாக்கி உலக அளவில்
உருவாக்கப்படும் அனைத்து
உருவாக்கங்களும் அனைத்து
உருவாக்கங்களும் அனைத்து

TEA RESEARCH INSTITUTE UVA CENTRE
CORDIALLY WELCOMES YOU

UVP 9C2/MP 37/UVA)
YEAR OF PLANTING-1998
EP-2 (ACCESSIONS-2D
CONTROLS-TRI 2025DN
BREEDING DIVISION

Uva Extension Centre

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

Highlights of the Year

General

Commercial nursery at the station was resumed and increased the nursery capacity up to 17000 plants. New Clearing work of 0.4 ha is in progress.

Advisory and Extension Activities

Advisory visits made to Estates and Smallholdings	50
Advisory letters issued	189
Seminars/Field days/Training programs held for Estates / Smallholders / Students	14
Crop Clinics	01
Regional seminars	03
Meetings/Seminars attended	22
Soil samples tested for pH	750
Soil samples tested for Organic Carbon content	392
VP cuttings issued	486200
VP Plants sold	7275
No. of Publications sold	138
Commercial Nursery Inspections	59

Visitors

Foreign	01
Planters	91
Small Holders	346
Students	128
Undergraduates	151
Others	282
TRI Officers	265
Total	1264

Land Use (ha)

Mature tea in plucking	4.00
Young tea (Experimental block)	0.30
ADB Mother Bush	2.06
Buildings/Roads	0.79
Under Rehabilitation	0.40
Forest / Scrub / Grass land	6.75
Total extent	14.30

Crop

Month	Green leaf (kg)	Price (Rs)	Amount (Rs)
January	1952	29.14	56881.28
February	1621	37.37	60576.77
March	1991	45.75	91088.25
April	4862	45.10	219276.20
May	3789	42.70	161790.30
June	3037	41.10	124820.70
July	1586	48.23	76492.78
August	1307	46.45	60710.15
September	3389	56.93	192935.77
October	1100	55.81	61391.00
November	2657	53.21	141378.97
December	2586	49.54	128110.44
Total	29884		1375452.61

Income

Highest ever total annual income at the station was recorded.

Sale of Green leaf	Rs 1375452.61
Sale of VP Cuttings	Rs 243100.00
Sale of VP Plants	Rs 109125.00
Soil Analytical charges	Rs 134810.00
Sale of Publications	Rs 28510.00
Guest House accommodation charges	Rs 21650.00
Sale of Firewood	Rs 18472.50
Other	Rs 1134.00
Total income	Rs 1932554.11

Check-roll Workers (as at 31st December 2009)

• No. of check-roll workers	23
• Out turn (Women)	48%
• Out turn (Men)	52%

Field Trials

- UVP 9 and UVP 10 PPPB trials are in progress in F/No.04
- Up keeping of 5000 series phase III Trial in field No.02
- Up keeping of Germplasm in F/No.03
- 02 Seedlings trials in Field No.03 & 04 are in progress.
- Up keeping of Grafted plant block in field No.01
- Integrated weed management trial at F/No.03
- Trial on pesticide residues (Entomology Div.) in F/No.02
- Evaluation trial of 30 and 40 series on resistance to nematodes division cultivars on their tolerance to nematodes. The trial is on going.
- Rain water harvesting trial (Agronomy Div.) in F/No.01
- Trial on fungicide residue level (Pathology Div.) in F/No.03
- Dendro power experiment (Agronomy Div.) in F/No.03
- Nursery trial on Bio Fertilizer (Agronomy Div.)

Special Events/Issues

- Drought conditions were experienced in the months of January, February, May, June, September and October due to the poor distribution of rainfall. Overall drop of the annual rainfall was 15% below the average.
- Highest ever issue of VP Cuttings and Commercial Nursery plants of new cultivars and highest ever total annual income were recorded at the centre.
- Severe Sulphur deficiency symptoms were observed in some smallholdings in Passara, Badulla and Lunugala areas. Series of programs were initiated to make aware small holders on this issue in these areas.
- A Crop Clinic was held for the benefit of tea growers in Uva.



Galle Extension Centre

K D Dahanayake
Diploma in Agriculture Engineering
Officer-in-Charge, Senior Advisory Officer

Research/Divisional Activities

- **Advisory correspondences**

The Advisory and Extension staff made 779 Advisory correspondences for the year 2009.

- **Advisory and Extension Visits**

The total number of advisory visits made by the Advisory and Extension staff was 64, which includes all on-call visits to the estates and smallholdings.

- **Commercial nursery inspections**

The Advisory & Extension staff conducted 07 commercial nursery inspections.

- **Training programs: Seminars/ field days/ workshops**

163 Seminars and Training Programs/ Field Days were conducted in the region. The target groups were tea Smallholders, Green leaf suppliers and Factory owners, RPC Managers and field staff.

- One Factory based extension program was held in Kottawa, TRI for the Factory and Extension officers
- One RTEF meeting was organized at Kottawa, TRI for Galle district TSHDA officers
- One RSC Seminar was organized at Yakkalamulla for Galle and Deniyaya corporate sector stakeholders
- One Crop Clinic was held successfully with the participation of more than 800 stakeholders
- Participated at the Galle Season Exhibition, Galle. More than 15000 stakeholders and general public visited

Video programs

22 video shows were presented on plucking, land preparation, soil conservation, Pest and Diseases of tea.

Visitors to the station

Estate management and smallholders - 1422

University/ Diploma students and others - 504

- Two students from University of Ruhuna (Faculty of Management and Faculty of Arts) were trained under the supervision of Mr. S P Rathnayake.
- Four students from Advance Technical Institute of Labuduwa were trained under the supervision of Mr. S P Rathnayake.
- One Advance Level Student from Labuduwa, Siridamma M. V. was trained under the supervision of Mr. S P Rathnayake.
- Three HNDE students were given the in-plant training under the supervision of Mr. S P Rathnayake and Mr. K D Dahanayake.

Meetings attended

Attended 44 meetings including HOD, Advisory Officers' forum, E & E, DDC meeting *etc*

Research Projects (Ongoing Trials, Experiments & Observations)

- **Collaboration with Plant Breeding Division**
 - i) 5000 series : LVP phase iii trial at F/No.03
 - ii) Low Country Live Wood Termite resistance testing: LVP phase ii trial on @ F/No: 03.
- **Collaboration with Soils and Plant Nutrition Division**
 - i) U 709 Vs VP/LC/880 trial at F/No.04
 - ii) VP/LC1075 Vs T1130 trial at F: No 04
 - iii) Organic tea fertilizer trial at F: No 07
 - iv) Fertigation trial at Thalgaswella estate
- **Collaboration with Nematology and Entomology Division**
 - i) Nematode population monitoring trial at F/No.04
- **Collaboration with Agronomy Division**
 - i) Bio film/ Bio fertilizer trial at F/No.02
- **Collaboration with Biometry Unit**
 - i) Difference between the estimated yield/potential yield and the actual yield at Moragolla Estate

Service Projects

i) Mother Bushes Project

Approximately 3.5 ha Mother Bush area used to issue new cultivars among the stakeholders and more than 426720 cuttings have been sold. (Cultivars issued: TRI 3025, 3055, 3069, 4006, 4042, 4049, 4052, 4053, 4054, 4059, 4061)

ii) Commercial Nursery

9137 VP Plants were sold @ 13 Rs/Plant. (Cultivars raised: TRI 2043, 3025, 4006, 4042, 4049)

iii) Soil samples tested for pH

234 Soil Samples were tested for pH Values

iv) Advisory publications distributed

608 Nos. of Priced and 399 nos. free Advisory and extension publications have been distributed.

General

Special Assignments

- Mr. S P Rathnayake continued as the Convener/ Secretary of the E&E Sinhala forum and successfully conducted the 02 forums scheduled for the year.
- Mr. S P Rathnayake appointed to coordinate the National yield decline issue and successfully conducted the 03 focus group discussions and coordinated 44 case studies in Galle, Matara and Ratnapura districts and completed the project report.
- Mr. S P Rathnayake served as a member of Technical Evaluation committee for fertilizer of the Institute.
- Mr. S P Rathnayake participated at the International forum on Experiences and Challenges in Agricultural Extension: meeting Farmer Needs at PGRC, Gannoruwa, Sri Lanka representing the TRI.
- Mr. S P Rathnayake made a presentation on Low country Live Wood Termite Infestation at the Extension–Research Linkage meeting.
- Mr. S P Rathnayake attended Uva Crop clinic.
- Mr. K D Dahanayake shared the responsibilities of supervising tea fields at Walahanduwa TRI.
- Successfully organized and celebrated the world environmental day by planting seedlings, cleaning Kottawa forest (Richest Bio-diversity spot in Sri Lanka) and conducting lectures on environment protection with the participation of School children, teachers and volunteers.

- Approximately 1.5 acres block planted with Mana to be used as a source in field No: 06.
- Removal of Mana and land preparation of 02ha in field No: 06 for planting tea is almost completed.
- Successfully replanted approximately 1/3Ac with TRI 4006, 4042, 4049 and 2043 cultivars in field No: 06.
- Colour washing of office and the seminar hall was completed.
- Urgent repairs to the meteorological station were attended.
- A desktop computer, UPS and a Photocopy machine were purchased

Land Use Information

VP tea mature (ha)	5.0
New clearings	0.4
VP tea Mother Bushes- ADB (ha)	5.0
Nursery (tea)	1.0
Seed garden (tea)	1.0
Under Rehabilitation (Mana & Guatemala)	3.6
Experimental Trials	1.0
Coconut, Fruit trees and etc. (ha)	1.5
Forestry (ha)	7.3
Buildings, gardens, roads	9.8
Total extent (ha)	35.6

Labour force

Number on check-roll	40
Out turn	33

Income

Sale of Green Leaf	1,635,316.53
Sale of VP cuttings (399250)	199,625.00
Sale of VP Plants (9137)	118,781.00
Sale of publications	48,680.00
Testing of soil samples for pH	13,365.00
Miscellaneous income	21,026.00
Total	2,036,793.00

Green leaf harvested

Month	Harvested Kg	Sold kg	Rate paid/ kg Rs.cts.	Total income Rs. Cts.
January	2249	2249	43.344	97,480.66
February	959	959	45.163	43,311.32
March	1119	1119	56.275	62,971.73
April	2696	2696	57.583	155,243.77
May	1622	1622	62.338	101,112.24
June	3133	3133	62.239	194,994.79
July	2810	2810	65.641	184,451.21
August	2101	2101	66.021	138,710.12
September	2950	2950	67.107	197,965.65
October	1989	1989	63.052	125,410.43
November	2554	2554	57.621	147,164.03
December	3229	3229	57.758	186,500.58
	27411	27411		1,635,316.53

Deniyaya Extension Centre

T G N Mahinda

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

Officer-in-Charge, Advisory Officer

Highlights of the Year

Development of the Centre

- Newly constructed office complex was declared opened by the Hon. Minister of Plantation Industries D M Jayaratna (MP) on 30th September 2009.
- Construction of Officer-in-Charge's quarters and Circuit Bungalow were completed. Automatic weather station was installed and data recording has been initiated.
- Construction of terraces and tea planting in front of the office complex were completed.
- 0.5 ha of rehabilitation was completed and site for a tea nursery was established. The service on nematode population estimation was commenced and 31 samples were tested.

Income

Crop harvested (kg)	Nil
Sales of crop	Nil
Miscellaneous income (Rs.)	34,485.47
Total income (Rs.)	34,485.47

Experiments / Survey

- TRI 5000 series commercial evaluation trials in Deniyaya Estate and Indola Estate
- A seedling commercial evaluation trial in Warapitiya TI region of Hambanthota district (IL1a) to evaluate the regional suitability
- Soils and Plant Nutrition Division: Evaluation of crop response for different proportion of SA and Urea (at Kiruwanaganga Estate).
- Ongoing two collaborative experiments on bush debilitation in Deniyaya Region at Richiland Estate, Deniyaya

- Trial (LE 113) on screening of waste material to protect the main stem of young tea plants from SHB at Field 01A Hanford Division, Hanford Estate.
- Experiments on Role of good agricultural practices on SHB management in Deniyaya region (Demonstration and model trial LE 100a, 100b) at Palitha Group (immature tea) Victor's land (mature tea)

Advisory and Extension Activities

• Advisory and Extension correspondence	83
• Advisory and Extension visits	
Estate Sector	35
Small holding sector	21
• Extension research visits, inspection visits and collaborative research visits	02

Visitors to the station

Corporate sector	117
Smallholders	333
Students / School children	31
General visitors (including foreign visitors)	110
Total	591

Advisory and Extension programs

Regional Scientific Activities

• Field days, seminars, demonstrations and awareness programs	28
• Informal discussions	
Planters	05
Smallholders	22
• Commercial nursery inspections	14
• Meeting attended by the advisory staff	
Internal	22
External	07
• Soil samples tested for pH	136
• Advisory publication distributed	
Free issuing	419
Priced publications	149
• Distribution of planting materials (cuttings)	
From Mother Bush area	Nil
From other mother bush areas	Nil

- Survey/ Case study carried out

A case study was carried out for investigation on the drop in tea production in smallholder sector in January to July 2009 with special reference to Matara, Galle and Ratnapura Districts with the collaboration of Advisory staff.

- Field observations

Potassium (K) deficiency was recorded in a small holding site located in Morawaka and brown root disease was recorded in Lumbini estate, Palegama

Special assignments

- The officer-in-Charge served as a member of the Regional Tea Development Council of Matara District.
- The officer-in-Charge delivered a lecture on investigation of current status of new cultivar planted in small holdings in low country at the 210th E&E Sinhala forum.
- Officer-in-Charge provided the technical support to a project initiated by Lumbini Tea Factory, Palegama on establishing 50 Model tea sites.
- Officer-in-Charge served as a resource person for the program organized by the 'Vidatha' Centre



St. Coombs Estate

Annual Report 2009

St. Coombs Estate

Mr. U C Oliver (November – December 2009)

Mr. P G G Jayatilake (May – October 2009)

Mr. J U Hulangamuwa (January – April 2009)

Superintendent

Field Works and Cultivation

Land use (ha)

	St.Coombs	Lamiliere	Total
Old Seedling tea in bearing	3.60	2.00	5.60
VP tea in bearing	80.72	45.50	126.22
VP tea (immature)			
ADB Project	11.39	2.62	14.01
New/Replanting	5.00	-	5.00
Nurseries	1.20	0.10	1.30
TRI Experimental Area	2.50	-	2.50
Total in Tea	104.41	50.22	154.63
Labour Housing	2.09	-	2.09
Ravines & Grass Land	31.00	1.00	32.00
Buildings, Roads, workers Gardens etc	34.28	14.70	48.98
TOTAL	171.78	65.92	237.70

Crop and Yield (kg)

	2009		2008	
St. Coombs	180,510	2,141	228,740	2,650
Lamiliere	96,922	2,039	113,337	2,386
Total	277,432	2,105	342,077	2,556
Bought Leaf	20,143	-	29,205	-
Grand Total	297,575	2,105	371,282	2,556

A yield of 2,105 kg/ha was recorded in the year 2009.

Weather and Rainfall

The severe drought experienced in the first 04 months of 2009, contributed to the low yield recorded with compared to 2008.

	2008	2009	Difference
Rainfall recorded (January – April)	723 mm	290.70 mm	432.3 mm

A total Rainfall of 2177.8 mm was recorded on 198 wet days, as against 1903.5 mm on 200 wet days in 2008.

Cultural operations

The following fields were pruned during the season;

Upper Division	1,1B,4
Lower Division	7
Lamiliere Division	8A, 10

The Nitrogen/Yield Replacement Ratio was at 11.55

Replanting

Up-rooted 2.00 ha in Field No.13, Lower Division, St. Coombs for replanting in 2011

ADB Mother Bush Project

641,250 VP Shoots from TRI 3000 – 4000 Series cultivars were issued to smallholders and corporate sector.

Top Prices

Silver Tips were sold at Rs. 9,000.00

General

- Mr. Mahen Madugalle, Visiting Agent visited the Estate on 25th April 2009.
- The St. Coombs mark shared by M/s. Forbes & Walker Tea Brokers (PVT) Ltd & Asia Siyaka Commodities till November, 2009. From December, 2009, it was given to M/S. Forbes & Walker Tea Brokers (PVT) Ltd.
- Mr. J U Hulangamuwa, Superintendent of St. Coombs Estate completed his contractual period on 30th April 2009
- Mr. P G G Jayatillake, Superintendent of Mattakelle Estate of Talawakelle Plantations Ltd overlooked the Estate from 1st May - 31st October 2009
- Mr. U C Oliver was appointed as the Superintendent, St. Coombs Estate *w.e.f* 1st November 2009
- Mr. N G L Dayatillake, Clerk, retired from the service on 9th February 2009.
- Mr. A D C Premalal, Junior Assistant Factory Officer resigned from the post *w.e.f* May 2009
- Mr. P H G K Jayaratne was transferred from St. Joachim Estate, Ratnapura *w.e.f* May 2009

Working Results

The Estate made a profit of Rs. 8,219,316.43 for the season.



St. Joachim Estate

Mr. P S Habaragoda (From 15th November 2009)

Mr. A U Weerasinghe (Up to 30th October 2009)

Superintendent

Field work and Cultivation

Hectarage as at 31st December 2009.

Tea in Bearing VP	46.34
Total Tea in Bearing	46.34
Major in-filled area (Field 2F – 1.18 ha and 8A .50 ha)	1.68
TRI Coconut area	3.89
VP Nursery	1.58
Mature Rubber	7.12
Mature Rubber (Intercrop area)	3.68
Paddy Fields	8.74
ADB Fields NC Tea	30.00
TRI Building & Exp' Area Field No' 09	13.02
Building Roads Jungle & Patana	25.93
Total	141.98

Crop (made tea kg)

The production on St. Joachim Estate in 2008, compared to the previous year is as follows

Year	Estate Crop (kg)	Bought Crop (kg)
2008	51,011	261,064
2009	41138	204063

The production on the Estate registered a decrease of 9873 kg or 19%, in comparison to the previous year.

Weather and Rainfall

Rainfall of 3921.4 mm was recorded on 210 wet days, as against 4206 mm on 192 days in 2008.

Cultural Operations

Pruning, Mossing, Ferning, fertilizing and weeding operations as per the estimates were carried out. No major pests and disease problems were encountered.

Infilling of Vacancies

A total of 3,000 plants were infilled. (F No. 2F & 8A)

ADB Mother Bush Project

513350 Shoots and 26374 plants of TRI recommended cultivars were issued to tea smallholders and to the cooperate sector.

Bought leaf

The Bought leaf manufactured at St. Joachim factory showed a decrease of 57001 kg or 21.83% in comparison to the previous year.

General

Messrs. Forbes & Walker Tea Brokers (Pvt) Ltd and Bartleet & Co. Ltd. continued to be the brokers of St. Joachim teas.

Trading results

The Net Sale Average (NSA) at the end of December 2009 was Rs. 387.26. In 2008 the NSA was Rs. 275.48. There was an increase of Rs.111.78 with compared to 2008 NSA.

The working results of St. Joachim Estate resulted in a loss of Rs. (7,252,173.44) as at 31st December 2009 compared to a trading loss of Rs. 6459419.98 in the previous year. Loss of crop and poor prices obtained during the year resulted in the above.

Staff position

Senior Assistant Factory Officer Mr. P H G K Jayaratne was transferred to the St. Coombs Estate, Talawakelle and Assistant Factory Officer Mr. S K Edirisinghe is covering up the duties

Two cadre positions of Junior Assistant Clerk remain vacant since 15th November 2005.

Another Junior Assistant Clerk position was vacant since 14th November 2009 due to the passed away of Mrs. K P K Udayanthi.

Administration Division

S S Guruge
B Sc (Kelaniya, Sri Lanka), SLAS Grade III
Deputy Director (Administration)

Recruitments

Name	Date	Designation
------	------	-------------

- | | | |
|----------------------------|------------|--------------------|
| • Mr. J H N Piyasundara | 2009.03.01 | Research Assistant |
| • Mr. G A A R Perera | 2009.03.01 | Research Assistant |
| • Mr. L R M C Liyanage | 2009.03.01 | Research Assistant |
| • Mr. T G N Mahinda | 2009.03.01 | Advisory Officer |
| • Mr. S P Rathnayake | 2009.03.01 | Advisory Officer |
| • Mr. C J B Abeykoon | 2009.03.01 | Clerk of Works |
| • Ms. D M S Nawarathne | 2009.10.01 | Research Assistant |
| • Mr. R Paskarathevan | 2009.10.01 | Research Assistant |
| • Mr. J W K K Jayasundara | 2009.10.01 | Research Assistant |
| • Mr. D Hettiarachchi | 2009.10.01 | Extension Officer |
| • Mr. P K R C E Munasinghe | 2009.10.01 | Extension Officer |
| • Mr. K A S Piyathilake | 2009.10.01 | Clerk/Typist |
| • Mr. K A D Sudath Pradeep | 2009.10.01 | Account Clerk |

Retirements

- | Name | Date | Designation |
|--------------------------|------------|------------------|
| • Mr. T A D Gamini | 2009.06.07 | Driver |
| • Mr. P B D L B de Silva | 2009.02.08 | General Mechanic |

Resignations

Name	Date	Designation
• Dr. A M T Amarakoon	2009.06.27	Dy Director, Research (T)
• Mr. V Shanmuganathan	2009.04.22	Clerk / Typist, Accounts Division (pending)
• Mr. C S K Rathnayake	2009.05.29	Experimental Officer, S P N Division
• Ms. Ranjani Godage	2009.07.10	Clerk/Typist, Accounts Division
• Mr. R B M Sankapriya	2009.06.10	Technical Assistant, S P N Division
• Mr. A M M V Abeykoon	2009.11.06	Experimental Officer, Technology
• Ms. W A S N S T Goonathileke	2009.11.12	Research Assistant, Biochemistry Division

Vacation of Post

Name	Date	Designation
• Dr. R S Walgama	2009.08.01	Research Assistant, Entomology Division
• Dr. A K N Zoysa	2009.07.09	Senior Research Officer, Soils and Plant Nutrition Division

Overseas Training / Seminars / Conferences - 2009

- Dr. L S K Hettiarachchi, Deputy Director Research (Production) proceeded to New Delhi, India, as a member of the CARP delegation for study visit on R & D Strategies Adopted by Research Institutes and Agriculture Universities of the Indian council of Agricultural of Research ICAR from 04th to 09th January 2009.
- Mr. V S Sidhakaran, Advisory Officer, Advisory and Extension Division who returned to Sri Lanka due to his mother's death, proceeded back to India to face the Viva Examination and to complete his PhD program from 21.01.2009 to 11.02.2009.
- Dr. I S B Abeysinghe, Director, TRI attended the meeting of the Working Groups of the FAO/IGG on Tea, in Rome, Italy, which was held from 18.05.2009 to 23.05.2009.
- Mr. G A A R Perera, Research Assistant, Biochemistry Division proceeded to USA for a Training on membrane pilot plant and membrane Technology from 05.06.2009 to 15.06.2009.
- Mr. C J Liyanarachchi, Extension Officer proceeded to India to attend the Post Graduate Diploma Course on Tea Plantation Management, from 01.09.2009 to 02.03.2010.
- Dr. I S B Abeysinghe, Director, TRI proceeded to United Kingdom to attend the 23rd Meeting of ISO/TC34/SC8 - Tea from 20th to 22nd October 2009.
- Dr. K M Mohotti, Senior Research Officer / Head, Entomology Division proceeded to Republic of Korea to attend the East Asian Organic Conference, which was held from 16.11.2009 to 21.11.2009.

Maintenance Work

Annual colour-washing program including the Agriculture Economics, Biometry, Director's Office, Museum and Board room, Administration & laboratory buildings. A03 Circuit Bungalow, Dukes Bungalow, B03, B06, C41, C54, C08, C57, C13, C03, D31, D11, D20, D36, Security mess, E03, Ladies Hostel, Camilla Hostel, C05, C53, C07 was completed.

Major roof and gutter repairs at TRI A and C type bungalows, Agriculture Economics Division were completed. Repainting of TRI name boards is in progress. Construction of new security hut for Lamb lane and road maintenance from Mattakelle Junction to TRI premises were completed. Up-keeping of lawns and fences of the campus were undertaken.

Cleaning of filter plant, sedimentation tanks and storage tanks was completed. Repairing of water supply lines to bungalows and installation of a new pump and pipe lines connected to the new pumping house were completed. Installation of new water tanks at different locations was completed.

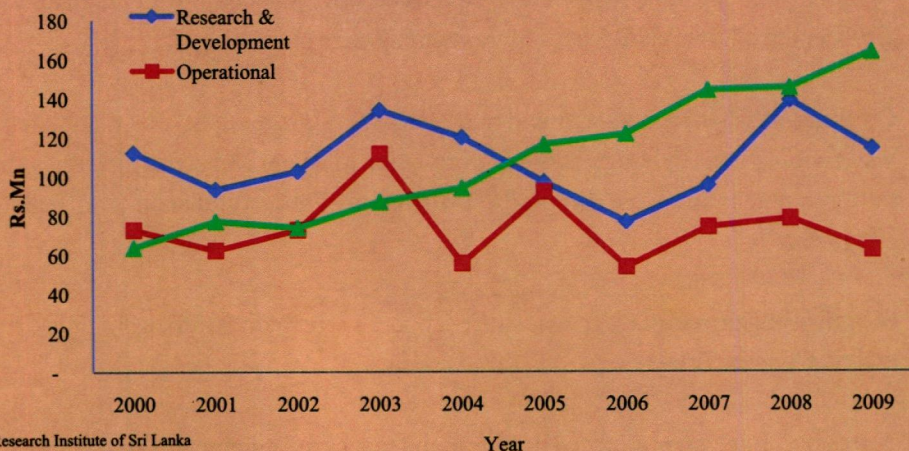
Electrical unit provided the maintenance support at laboratories, office buildings, regional centres, and St. Coombs Estate.

Telephone Exchange attended to the maintenance of telephone line connections at offices, bungalows, guest houses and regional centres.

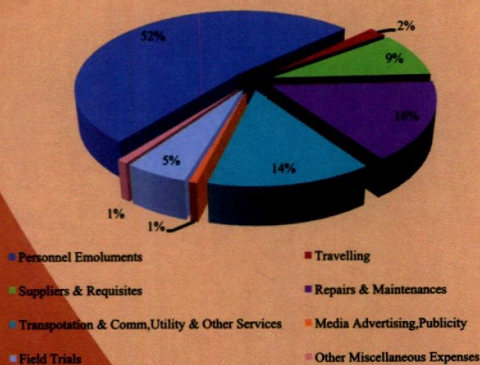
Finance Division

D M R Dissanayake
AAT (Sri Lanka) Associate
Accountant

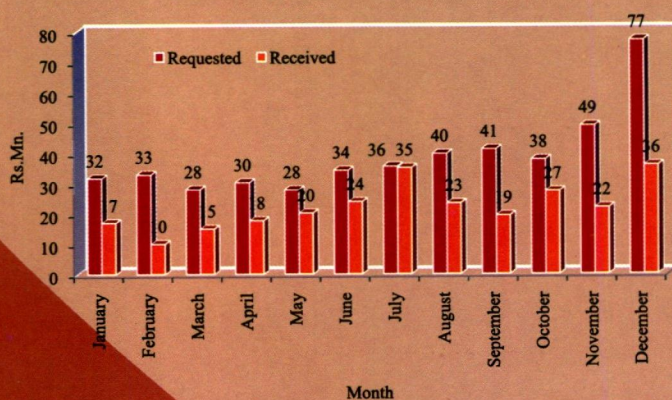
Tea Research Institute of Sri Lanka
Expenditure year 2000 - 2009



Tea Research Institute of Sri Lanka
Recurrent Expenditure Year 2009

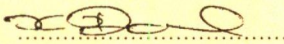


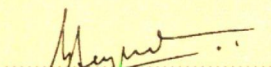
Tea Research Institute
CESS Money Requested and Received Year 2009

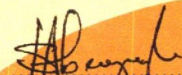


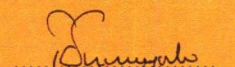
Tea Research Board
Statement of Financial Position as at 31st December 2009

	2009 Rs.(000)		2009 Rs.(000)	2008 Rs.(000)
ASSETS				
Non-current assets				
Property, plant and equipment	933,406	(Annex I)		900,436
Less: Accumulated Depreciation	<u>(554,895)</u>	(Annex I)		<u>(522,494)</u>
	378,511			377,942
Capital work-in-progress	12,959	(Annex II)		8,343
Other Assets	<u>23</u>			<u>23</u>
			391,492	386,308
Current Assets				
Inventories/Stocks	18,770	(Annex III)		22,424
Trade and other receivables	107,065	(Annex IV, V, VI)		110,697
Prepayments	740	(Annex V)		671
Cash and cash equivalents	63,313	(Annex VII, VIII)		55,197
			<u>189,888</u>	<u>188,989</u>
Others: Identify Losses Excess & Shortages	<u>(214)</u>	(Annex IX)	<u>(214)</u>	<u>(105)</u>
Total Assets			581,166	575,192
LIABILITIES				
Current Liabilities				
Payables	26,319	(Annex X)		13,838
Accrued Expenses	<u>22,912</u>	(Annex X)		<u>22,028</u>
			49,231	35,866
Non-Current liabilities				
Provision for Gratuity	103,204	(Annex XII)		87,538
Petrol Deposit Refundable	<u>21</u>	(Annex XIII)		<u>20</u>
			<u>103,225</u>	<u>87,558</u>
Total Liabilities			<u>152,456</u>	<u>123,424</u>
Total Net Assets			428,711	451,768
NET ASSETS/EQUITY				
Tea Research Fund	293,102			313,544
Grants & Reserves	135,608	(Annex XI)		138,224
Total Net Assets/Equity			428,710	451,768


.....
Internal Auditor


.....
Chairman-TRB


.....
Director-TRI


.....
Accountant
for Senior Accountant

Tea Research Board

Statement of financial performance for the year ended 31st December 2009

		2009 Rs. '000	2008 Rs. '000
Operating Revenue			
Recurrent Grant- Cess	Annex. XIV	267,245	282,950
Other Income	Annex. XIV,XVI,XVII	22,028	21,708
Other Income- Deferred Income	Annex. XIV	5,308	4,040
		294,581	308,698
Operating Expenses			
Personal Emoluments	Annex. I	158,617	140,751
Travelling	-do-	6,250	8,104
Supplies and consumable used	-do-	18,403	25,695
Maintenance	-do-	20,486	23,535
Contractual Services-Security / Insurance	-do-	15,208	13,556
Electricity & Heating	-do-	13,612	14,840
Communications	-do-	3,523	4,180
Research and Development	-do-	28,033	25,493
Depreciation	-do-	29,585	25,555
Other operating expenses	-do-	19,737	20,294
		313,454	302,002
Total operating expenses		313,454	302,002
Surplus/(Deficit) from operating activities	-do-	(18,873)	6,695
Finance Cost			
Gain on sales of property plant and equipment	Annex XIV	3,132	15
Total non operating revenue (expenses)		3,132	15
Net surplus/(Deficit) before extra ordinary items		(15,741)	6,710
Extra ordinary items			
Prior year Adjustments	Annex XIX	(4,700)	(711)
		(4,700)	(711)
Net surplus/(Deficit) for the period		(20,441)	5,999

Tea Research Board

**Consolidated cash flow statement for the year ended
31st December 2009**

<u>Cash Flow from Operating Activities</u>	2009	2008
	Rs'000	Rs'000
Surplus/(deficit) from ordinary activities	(23,451)	598
 <u>Non- Cash movments</u>		
Depreciation	35,074	31,022
Increase in provision for Bad Debts	(413)	319
Increase/(Decrease) in Payables	13,778	2,294
Increase in provisions relating to employee costs	15,666	2,354
Gains sale of fixed assets	(3,132)	(15)
(Increase) in other current assets(stocks) depo/prepay	3,873	14,982
Assets writ-offs	(3)	(9)
Decrease/(Increase) in receivables	3,172	(3,838)
Prior Years Adjustments	(4,700)	(711)
Accounting adjustment in capital reserve	<u>(3,293)</u>	<u>(4,902)</u>
 Net Cash Flow from operating activities	 36,571	 42,094
 <u>Cash Flow from Investing activities</u>		
Purchase of fixed assets	(35,643)	(70,809)
Interest on investments	4,442	5,685
(Increase)/Decrease Capital working-in-progress	(4,615)	(1,407)
Proceeds from sale of fixed assets	<u>3,132</u>	<u>15</u>
 Cash Flow from Investing activities	 (32,684)	 (66,516)
 <u>Net Cash Flow from Financing activities</u>		
Capital Grants- PHDT	866	807
- NSF		2,133
- UNDP		465
- Energy conservation Fund	152	
PLDP	<u>3,211</u>	
 Net Cash Flow from Financing activities	 4,229	 3,405
 Net Increase/(decrease) in Cash and cash equivalents	 8,116	 (21,017)
 Cash and cash equivalents at beginning of period	 55,197	 76,214
 Cash and cash equivalents at end of period	 <u>63,313</u>	 <u>55,197</u>

TEA RESEARCH BOARD

Annex. XVI

ST.COOMBS & LAMILIERE ESTATES WORKING ACCOUNT FOR THE PERIOD 1ST JANUARY TO 31ST DECEMBER 2009

<u>2008</u>	<u>INCOME</u>		<u>2007</u>	
<u>Rs.</u>	<u>Kg.</u>		<u>Kg.</u>	<u>Rs.</u>
98,998,159.24	336,145	Tea Sales Gross Proceeds		
<u>9,602,913.75</u>	<u>35,138</u>	Tea Sales Ex Brokers(Gross)	264,663	95,456,615.82 (Note 1)
<u>108,601,072.99</u>	<u>371,282</u>	Tea Sales Local & Graties	<u>32,912</u>	<u>10,327,918.00</u>
			<u>297,575</u>	<u>105,784,533.82</u> 105,784,533.82
		Add-		
147,238.11		Miscellaneous Income		190,547.19
<u>245,945.82</u>		Deferred Income		<u>445,725.31</u>
<u>108,994,256.92</u>		Total Income		<u>106,420,806.32</u>
		<u>EXPENDITURE</u>		
		<u>Less: Estate Expenditure</u>		
23,767,626.47		General Charges		24,204,700.17
14,793,064.19		Field work & Cultivation		15,361,701.85
50,338,101.76		Production		46,304,652.61
<u>7,019,136.55</u>		Bought Leaf(including transport charges)		<u>5,040,234.75</u> 90,911,289.38
<u>95,917,928.97</u>				
		<u>Administration & Finance</u>		
3,414,742.74		Bonus and Holiday pay		4,020,957.28
<u>2,053,889.35</u>		Depreciation		<u>1,957,827.97</u> 5,978,785.25
<u>5,468,632.09</u>				
		<u>Sales Tax & Distribution Expenses</u>		
1,682,619.57		Brokerage, Handling chgs., & Sales Expenses		1,311,414.88
<u>103,069,180.63</u>		Total Expenditure		<u>98,201,489.51</u>
5,925,076.29		Profit /(loss) for the year		<u>8,219,316.81</u>
<u>76,670.46</u>		Add: Under Value Unsold Tea 2008		<u>39,680.46</u>
<u>6,001,746.75</u>		Profit /(loss) transferred to TRI Operating A/c		<u>8,258,997.27</u>

Note:- 1. 7064 kgs unsold Teas valued NSA @ Rs.355.70

Staff Members

Senior Management

- I S B Abeysinghe
B Sc (Peradeniya, Sri Lanka) Ph D (Sheffield, UK)
Director/ CEO
- L S K Hettiarachchi
B Sc (Peradeniya, Sri Lanka) Ph D (Aberdeen, UK)
Deputy Director Research (Production)
- S S Guruge
B Sc (Kelaniya, Sri Lanka) SLAS Grade III
Deputy Director (Administration)

Office of the Director

- S Jeyasingham
Secretary to the Director
- R J Rayappan
Clerk

Office of the Deputy Director Research (Production)

- Devika Ratnayake
Stenographer (English)

Agricultural Economics Division

- H W Shyamalie
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka),
Ph D (CSKHPKV, India)
Research Officer
- W M J C Bandara
Experimental Officer
- KWN Nadeeshani
B Sc (Peradeniya, Sri Lanka)
Technical Assistant

Agronomy Division

- K G Prematilake
B Sc Agric (Ruhuna, Sri Lanka),
M Phil (Peradeniya, Sri Lanka)
Ph D (Reading, UK)
Head, Senior Research Officer
- M A Wijeratne
B Sc Agric. (Ruhuna, Sri Lanka)
PhD (London, UK)
Senior Research Officer/ Officer-in-charge, Low country Regional Centre
- M S D L De Silva
B Sc (Peradeniya, Sri Lanka),
M Phil (Peradeniya, Sri Lanka)
Ph D (James Cook University, Australia)
Senior Research Officer
- N P S N Bandara
B Sc Agric. (Peradeniya, Sri Lanka)
Research Assistant (*on study leave*)
- S R W Pathirana
B Sc Agric. (Ruhuna, Sri Lanka)
Research Assistant (*Low country Regional Centre*)
- T L Wijeratne
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka)
Research Assistant
- D M S Nawaratne
B Sc (Peradeniya, Sri Lanka)
M Phil (Peradeniya, Sri Lanka)
Research Assistant

- H S N Peiris
B Sc Agric. (Peradeniya, Sri Lanka),
M Phil (Peradeniya, Sri Lanka)
Experimental Officer (*Low country
Regional Centre*)
- A J Gamage
B Sc Agric. (Peradeniya, Sri Lanka)
Experimental Officer (*Low country
Regional Centre*)
- M G S Liyanage
B Sc Agric. (Peradeniya, Sri Lanka)
Experimental Officer (*Low country
Regional Centre*)
- L A S P Jayasinghe
B Sc Agric. (Wayamba, Sri Lanka)
M Sc (Peradeniya, Sri Lanka)
Experimental Officer
- M M N Damayanthi
B Sc Agric. (Peradeniya, Sri Lanka)
M Phil (Peradeniya, Sri Lanka)
Experimental Officer
- A R Amarasekara
Experimental Officer
- D W Viithana
Diploma in Agriculture
Experimental Officer (*Low country
Regional Centre*)
- U P Abeyssekara
Diploma in Agriculture
Experimental Officer
- A P D A Jayasekara
Experimental Officer (*Mid country
Regional Centre*)
- S N Wijesekara
Experimental Officer (*Mid country
Regional Centre*)
- E W T P Premathunga
Experimental Officer (*Low country
Regional Centre*)
- V Sidhakaran
Experimental Officer

Biochemistry Division

- M J Jayasundara
Acting Officer-in-Charge/ Senior
Research Officer
- P A N Punyasiri
Grad. Chem (Inst. of Chemistry, Sri
Lanka) PhD (Peradeniya, Sri Lanka)
Senior Research Officer (*Contractual
Basis*)
- W A S N S T Goonathilleke
B Sc. Agric. (Peradeniya, Sri Lanka),
M Sc. (Peradeniya, Sri Lanka)
Research Assistant
- K M Mewan
B Sc Agric. (Ruhuna, Sri Lanka)
Research Officer
- G A A R Perera
B Sc. Agric (Peradeniya Sri Lanka),
M Sc (J'Pura, Sri Lanka)
Research Officer
- G H Thotawattage
B Sc. Agric. (Peradeniya, Sri Lanka),
M Sc. (Peradeniya, Sri Lanka)
Experimental Officer
- P K P Muthukumarana
B Sc. Agric. (Ruhuna, Sri Lanka)
Experimental Officer
- P G C Priyantha
Experimental Officer
- H M S B Heenkenda
Technical Assistant
- M W Silva
Skilled Mechanic

Entomology and Nematology Division

- K M Mohotti
B Sc (Peradeniya, Sri Lanka),
Ph D (Reading, UK), C. Biol. (Sri Lanka)
Head/ Senior Research Officer
- R S Walgama
B Sc (Colombo, Sri Lanka),
Ph D (Queensland, Australia),
Dip. in HRM & OB (ACHE, Sri Lanka)
Research Assistant
- R M D T Pallemulla
B Sc (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka)
Research Officer
- D D Liyanage
B Sc (Kelaniya, Sri Lanka)
Experimental Officer
- N Navaratne
Experimental Officer
- R D P D Senanayake
B Sc (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka)
Experimental Officer
- P G D S Amarasena
B Sc (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka)
Experimental Officer
- A R Abeysekera
Experimental Officer (*Mid country Regional Centre*)
- R Perera
Experimental Officer (*Low country Regional Centre*)
- B S Vitana
Experimental Officer (*Low country Regional Centre*)
- A K Prematunga
Experimental Officer (*Low country Regional Centre*)
- P K Jayawickrema
Experimental Officer (*Galle Extension Centre*)
- U B Herath
Experimental Officer (*Mid country Regional Centre*)
- M M Jayathilake
Experimental Officer
- C De Seram
Experimental Officer (*Low country Regional Centre*)

Plant Pathology Division

- P N H Liyanage
B Sc (Ruhuna, Sri Lanka),
M Sc (GBPUAT, India)
Acting Officer-in-Charge/ Senior Research Officer
- J W K K Jayasundera
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (Punjab, India),
PGD in International Relations (BCIS, Colombo)
Research Assistant
- D G N P Karunajeewa
Diploma in Agriculture
Technical Assistant

Plant Breeding Division

- M T K Gunasekare
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Ph D (Southampton, UK)
Head/ Senior Research Officer
- M A B Ranathunga
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (TNAU, India)
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- H A C K Ariyaratna
B Sc (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka),
M Phil (Colombo, Sri Lanka)
Research Assistant
- J H N Piyasundara
B Sc (OUSL, Sri Lanka),
M Phil (Peradeniya, Sri Lanka)
Research Assistant (*Low country
Regional Centre*)
- R Paskarathevan
B Sc (Madras, India),
M Sc (Colombo, Sri Lanka)
Research Assistant
- P D Upali
Experimental Officer (*Low country
Regional Centre*)
- T M Sarathchandra
B Sc (Bioscience)
Experimental Officer (*Mid country
Regional Centre*)
- J D Kottawa Arachchi
B Sc (OUSL, Sri Lanka)
Experimental Officer
- K K Ranaweera
B Sc Agric. (Ruhuna, Sri Lanka)
Experimental Officer
- A K Mudalige
Diploma in Agriculture
Experimental Officer (*Low country
Regional Centre*) (*On study leave*)
- Y G S C Bandara
Technical Assistant

Soils and Plant Nutrition Division

- G P Gunaratne
B Sc Agric. (Peradeniya, Sri Lanka),
M Phil (Peradeniya, Sri Lanka),
Ph D (Peradeniya, Sri Lanka)
Acting Head/ Senior Research Officer
- S Ananthacumaraswamy
Senior Research Officer
- L R M C Liyanage
B Sc Agric. (Peradeniya, Sri Lanka)
Research Assistant
- W M S Wijayathunga
B Sc Agric. (Peradeniya, Sri Lanka)
M Sc (Peradeniya, Sri Lanka)
Experimental Officer
- P L K Tennakoon
B Sc Agric. (Peradeniya, Sri Lanka)
M Sc (Dharwat, India)
Experimental Officer
- W T B D Priyantha
B Sc (J'Pura, Sri Lanka)
Experimental Officer
- S M Dissanayake
Experimental Officer
- J R Y Abeywardane
Experimental Officer
- D M B N Dissanayake
Grad.Chem (Inst. of Chemistry, Sri
Lanka), M Sc (Peradeniya, Sri Lanka)
Experimental Officer
- O G K A Gunaratne
Dip in Agriculture,
ACLT (OUSL, Sri Lanka)
Experimental Officer

Process Technology Division

- W S Botheju
B Sc (Colombo, Sri Lanka)
M Phil (Peradeniya, Sri Lanka)
PhD (Peradeniya, Sri Lanka)
Acting Head/ Senior Research Officer
- K Raveendran
B Sc Engineering (Moratuwa, Sri Lanka),
M Eng (AIT, Thailand)
Chemical Engineer
- S Koneswaramoorthy
B Sc Engineering (Peradeniya, Sri Lanka)
Mechanical Engineer
- G L C Galahitiyawa
B Sc (Kelaniya, Sri Lanka)
Senior Research Officer
- S H Priyanthie
N D T (Moratuwa, Sri Lanka)
Experimental Officer
- L Jayasinghe
Experimental Officer
- W M U A B Marapana
B Sc (J'pura, Sri Lanka)
Experimental Officer
- M A Chamindra
Experimental Officer
- S P Dayananda
B Sc Engineering (Peradeniya, Sri Lanka)
Experimental Officer
- W M S Weerawardena
B Sc Engineering (Peradeniya, Sri Lanka)
Experimental Officer
- K B M Sripalika
B Sc Engineering (Peradeniya, Sri Lanka)
Experimental Officer

Mechanical Workshop

- A Nandasiri
Chief Mechanic
- L Weerasooriya
Mechanic
- M Gabriel
Mechanic

Biometry Unit

- T U S Peiris
B Sc Agric. (Peradeniya, Sri Lanka),
M Phil (Peradeniya, Sri Lanka)
Senior Research Officer
- H K K Deshapriya
Technical Assistant

Advisory and Extension Division

- V S Sidhakaran
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka),
Ph D (TNAU, India), Diploma in
Development Research in Agriculture
Diploma in Plantation Management
Acting Head/ Senior Advisory Officer
- B A D Samansiri
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- J C K Rajasinghe
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (PGIA, Sri Lanka)
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Charge - Mid country Regional Centre
- K D Dahanayake
Diploma in Agriculture Engineering
Senior Advisory Officer / Officer-in-
Charge - Galle Extension Centre

- M K S L D Amaratunga
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Extension Officer (*Mid country Regional Centre*)
- H Jayaweera
Extension Officer
- K R W B Kahandawa
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M Sc (Peradeniya, Sri Lanka)
Extension Officer / Actg. Officer-in-Charge, Uva Extension Centre
- M A H Nishanthi
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M Sc (Peradeniya, Sri Lanka)
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- D Hettiarachchi
B Sc Agric. (Peradeniya, Sri Lanka)
Extension Officer
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Extension Officer
- V G A Vishvajith
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- C S K Kiribathgoda
Stenographer (English)
- N S Ekanayake
Technical Assistant

Publications and Publicity Unit

- K P H Liyanage
B Sc (OUSL, Sri Lanka)
Publications/ Publicity Officer
- A P V Kalyani
Stenographer (English)
- K G R Niroshan
Photographer
- J T Thevasadan
Photographer

Library

- R W M S K Amunugama
Diploma in Library Science
Library Assistant

Information Technology Unit

- U D Alagiyawadu
Experimental Officer

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- M A Wijeratne
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Ph D (London, UK)
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Officer (Agronomy Division)
- G L C Galahitiyawa
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Senior Research Officer
- M K S L D Amarathunga
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M Sc (Peradeniya, Sri Lanka)
Senior Advisory Officer
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Experimental Officer
- J H N Piyasundara
B Sc (OUSL, Sri Lanka)
M Phil (Peradeniya, Sri Lanka)
Research Assistant
- A J Gamage
B Sc Agric. (Peradeniya, Sri Lanka)
Experimental Officer
- K B M Sripalika
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- W M U A B Marapana
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Experimental Officer
- C J Liyanaarachchi
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M Sc (Peradeniya, Sri Lanka)
Extension Officer
- E R Perera
Diploma in Agriculture
Experimental Officer
- B S N Vitana
Diploma in Agriculture
Experimental Officer
- D W Vithana
Diploma in Agriculture
Experimental Officer
- A K Mudalige
Diploma in Agriculture
Experimental Officer
- P D Upali
Experimental Officer
- A K Premathunga
Experimental Officer
- M A Chamindra
Experimental Officer
- E W T P Premathunga
Experimental Officer
- S S C J de Seram
Experimental Officer
- K A D Mervin
Accounting Assistant
- K A S Kumarapperuma
Clerk / Typist
- P V G Karunanayaka
Stenographer
- J S K de Silva NCT Diploma
Electrician
- K Gunawardena
Works Supervisor
- H K Seetha
Accounts Clerk
- K A S Piyathilka
General Clerk / Typist
- W K Munasinghe
Plumber Mechanic
- N A Bowie
General Mechanic
- M A B de Silva
General Mechanic
- D A Lionel
Driver

Staff Members

Annual Report 2009

- P D R de Silva
Driver
- S S Sunil
Driver
- K Chaminda
Driver
- P G Amarathunga
Driver
- G V S Jayalath
Driver

- J T S Weerakkody
Driver
- S M C M Senanayaka
Driver
- M D Sarath
Guest House Keeper
- A G Saman Ruckmalgoda
Hostel Care Taker

Mid country Regional Centre

- J C K Rajasinghe
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka)
Acting Officer-in-Charge, Senior
Advisory Officer
- K G J P Mahindapala
B Sc (Peradeniya, Sri Lanka)
Advisory Officer
- H J M De Silva
B Sc Agric. (Ruhuna, Sri Lanka)
Extension Officer
- W M S Wijethunga
B Sc Agric. (Peradeniya, Sri Lanka)
M Sc (PGIS, Sri Lanka)
Experimental Officer
- P L K Thennakoon
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (Dharwat, India)
Experimental Officer
- T M Sarathchandra
B Sc (Bio science)
Experimental Officer
- A P D A Jayasekara
Experimental Officer

- S N Wijesekara
Experimental Officer
- A R Abeysekara
Experimental Officer
- U B Herath
Experimental Officer
- D M B N Dissanayaka
Grad. Chemist (Inst. of Chemistry, Sri
Lanka) M Sc (PGIS, Sri Lanka)
Experimental Officer
- Kithsiri Pallethantrige
Works Supervisor
- Shanthilatha Gunasekara
Accounts Clerk
- C N K Edirisinghe
Station Assistant
Driver
- W D J P Thilak Bandara
Driver
- G Padmasiri
Driver
- W A D P M U Attanayaka
Driver
- W M A B Weerawanni
Guest House Keeper

Uva Extension Centre

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

- V G A Vishwajith
Diploma in Agriculture
Technical Assistant
- A M Karunadasa
Driver
- G Weerapperuma
Guest House Keeper

Galle Extension Centre

- Mr. K D Dahanayake
Diploma in Agriculture Engineering
Officer-in-Charge, Senior Advisory
Officer
- S P Ratnayake
B Sc Agric. (Ruhana, Sri Lanka)
MBA (Wuhan, China)
Advisory Officer
- P K Jayawickrama
Experimental Officer (Entomology)
- M Sarath
Field Supervisor
- P S Kulasiri
Field Supervisor
- P V D Chandrakanthi
Accounts Clerk
- K M Jagath Prasanna
Guest House Keeper

Deniyaya Extension Centre

- T G N Mahinda
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (Peradeniya, Sri Lanka)
Acting Officer-in-Charge, Advisory
Officer
- O W Jayawardana
Station Assistant
- S P D Tharanga
Driver

St. Coombs Estate

- Mr. U C Oliver
Superintendent
- D H Jayatillake
Chief Clerk
- H M Badra P K Jayathilake
Senior Assistant Clerk
Associate Member-Australian Computer
Society, Certificate Course in Human
Resource Management
- T G S Chandrakanthi
Clerk
- E M Dayaratne
Head Factory Officer
- H M R Kuladasa
Assistant Factory Officer
- S M Sunil Shantha
Assistant Factory Officer
- P Mohotti
Junior Assistant Factory Officer
- P H G K Jayaratne
Senior Assistant Factory Officer
(Transferred from St. Joachim Estate *wef*
May 2009)
- Nimal De Silva
Field Officer
- N Illangeswaran
Field Officer
- I W M D Alahakoon
Assistant Field Officer
- S Suresh
Junior Assistant Field Officer
- S D Perera
Junior Assistant Field Officer
- S Fernando
Estate Medical Practitioner
Certificate of Efficiency as Estate Medical
Assistant, Certificate of Homoeopathic
Medical System
- D Puniyamoorthy
Welfare Officer
- G N Sylvester
Creche Attendant
- K Selvaraj
Driver
- S Christopher
Driver
- T Ramanathan
Driver
- R Udayakumar
Driver
- D Sundaeson
Driver

Staff Members

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St. Joachim Estate

- Mr. P S Habaragoda
Superintendent
- N D A Gunawardena
Chief Clerk
- K P K Udayakanthi
Clerk (upto 14th November 2009)
- M W Jayasekare
Storekeeper Clerk
- Nilani Koralage
Junior Assistant Clerk
- M Kangaratnam Pulle
Estate Medical Practitioner
- P G J Senadheera
Junior Assistant Field Officer
- V Ariyaraj
Junior Assistant Field Officer
- P H G K Jayaratne
Senior Assistant Clerk (Transferred to St.
Coombs *w.e.f* May 2009)
- S K Edirisinghe
Assistant Factory Officer
- J R Yapa
Junior Assistant Factory Officer
- H T K Nihal
Junior Assistant Factory Officer
- D A Janaka Pushpakumara
Junior Assistant Factory Officer
- W N W Perera
Junior Assistant Factory Officer
- M D R Premalal
Junior Assistant Factory Officer
- P P Wickramaratne
Junior Assistant Factory Officer
- K B Siripala
Lorry Driver
- A V Sumanaratne
Lorry/ Tractor Driver
- M A J Kumara
Lorry/ Tractor Driver

Administration Division

- K G Piyasena
Public Relation /welfare Officer
 - W P A N Jayasinghe
Chief Clerk
 - S Shanmuganathan
Stenographer (English)
 - K R M Priyantha
Clerk/Typist
 - A W M G R Jayasinghe
Clerk/Typist
 - W M S R Wanasinghe
Clerk/Typist
 - R M D K Rathnayake
Clerk/Typist
 - C Jayaram
Clerk/Typist
 - I W M N Nihal Kumara
Clerk/ Typist
 - S Dharmalingam
Clerk/Typist
 - R M K Dias
Hostel Caretaker
 - R M B D Rathnayake
Circuit Bungalow Keeper (Colombo)
 - R Mahendran
Guest House Keeper (Talawakelle)
- Stores**
- K D H Pathirana
Stores Executive
 - K T U Kulathunga
Assistant Store Keeper
 - H P W Gunasekara
Stores Assistant
- Purchasing Unit**
- B Thilakarathna
Purchasing Officer
 - P D S L de Silva
Clerk/Typist

Internal Audit Unit

- R Kariyawasam
Internal Auditor
- P S Wickramasinghe
Internal Audit Officer
- N C Jayaweera
Internal Audit Clerk (temporarily
transferred to the Finance Division)
- W N K I Ariyaratne
Internal Audit Clerk

Engineering Unit

- C J B Abeykoon
Clerk of Works
- J G Gamage
Filter plant Assistant
- W C K Fernando
Chief Plumber Mechanic
- W R P de Silva
Clerk/Typist
- P T Perera
Clerk/Typist
- U D W Rathnasiri
Filter Plant Assistant
- K A F Dharmadasa
Assistant Plumber Mechanic
- J M Jothipala
Mason
- R Jayaraj
Carpenter

Telephone Exchange

- K M Senevirathna Banda
Telephone Operator
- P K N Damayanthi
Telephone Operator-cum-Receptionist
- S Karupiah
Telephone Linesman

Motor Garage

- G G E H Gamage
Chief Motor Mechanic
- W G Wijarathna
General Machanic

Electrical Unit

- U A Wickramasinghe
Electrical Foreman
- R W Rengasamy
Electrician
- J M R K Bandara
Electrician

Transport Unit

- M L H Perera
Transport Officer
- S H Chandrasena
Clerk/Typist
- S Bastian
Driver Class I
- K B V Piyasena
Driver Class I
- P A S L Luxman
Driver Class I
- P Sengamali
Driver Class I
- L Murugesu
Driver Class I
- M Kaliyaperumal
Driver Class I
- W G Senevirathna
Driver Class I
- R M N Premathilake
Driver Class I
- R Gunasekara
Driver Class I
- K M G de Silva
Driver Class I
- W S G W Perera
Driver Class I
- M Maradamuttu
Driver Class I
- K B V U N Gunasena
Driver Class I
- G G M Ranasinghe
Driver Class II
- M B S Priyashantha
Driver Class II

Staff Members

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Finance Division

- D M R Dissanayake
AAT (Sri Lanka) – Associate
Accountant
- M V Mohan
CMA (London) - Interim,
AAT (Sri Lanka)
Accountant
- S G Punchibanda
Senior Accounting Officer
- C B Koswatte
Diploma in Business Studies
Senior Accounting Assistant
- V Pahalage
Accounts Clerk
- B K S Herath
Accounts Clerk
- S Hewasiliyan
Accounts Clerk
- A A A P Amartunge
Accounts Clerk
- W A Nishantha
AAT (Part 1 & 2)
Data Entry Operator cum Accounts Clerk
- H B Thalgahagoda
Accounts Clerk cum Cashier
- M G Weerathilake
Cashier
- I Jayawickrama
Clerk/ Typist
- H N Dharmapala
Clerk/ Typist
- K A D Sudath Pradeep
Accounts Clerk



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கணக்காய்வாளர் தலைமை அறிப்பித் திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT



මගේ අංකය }
 எனது இல } PY//TRB/FA/2009
 My No. }

ඔබේ අංකය }
 உமது இல }
 Your No. }

දිනය }
 Date } 2/ September 2010

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 2009 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 2009 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 furnished to the Chairman of the Board on 10 May 2010.

1:2 Responsibility of the Management for the Financial Statements.

Management is responsible for the preparation and fair presentation of these financial statements in accordance with Sri Lanka Accounting Standards. This responsibility includes: designing, implementing and maintaining internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatements, whether due to fraud or error, selecting and applying appropriate accounting policies, and making accounting estimates that are reasonable in the circumstances.

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 කොළඹ 07, ශ්‍රී ලංකාව

சென்னை அலுவலகம்,
 கோழம்பேடி 07, இலங்கை

INDEPENDENCE SQUARE,
 COLOMBO 07, SRI LANKA

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 தொலைபேசி } 2691151
 Telephone }

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 டக்ஸ் இல } 2697451
 Fax No. }

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 E-மேயில் } saggov@silnet.lk
 E-mail }

1.3 Scope of Audit and Basis of Opinion

My responsibility is to express an opinion on these financial statements based on my audit. Comments and findings in this report are based on review of the financial statements presented to audit and substantive tests of samples of transactions. The scope and extent of such review and tests were such as to enable as wide an audit coverage as possible within the limitations of staff, other resources and time available to me. The audit was carried out in accordance with Sri Lanka Auditing Standards to obtain reasonable assurance as to whether the financial statements are free from material misstatements. The audit includes the examination on a test basis of evidence supporting the amounts and disclosures in financial statements and assessment of accounting policies used and significant estimates made by the management in the preparation of financial statements as well as evaluating their overall presentation. I have obtained sufficient information and explanations which to the best of my knowledge and belief were necessary for the purpose of my audit. I therefore believe that my audit provides a reasonable basis for my opinion. Sub-sections (3) and (4) of the 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.

2. Financial Statements

2:1 Opinion

So far as appears from my examination and to the best of information and according to the explanations given to me, I am of opinion that the Tea Research Board had maintained proper accounting records for the year ended 31 December 2009 and except for the effects on the financial statements of the matters referred to in paragraph 2:2 of this report, the financial statements have been prepared in accordance with Sri Lanka Accounting Standards, give a true and fair view of the state of affairs of the Tea Research Board as at 31 December 2009 and the financial results of its operation and cash flows for the year then ended.

2.2 Comments on Financial Statements

2:2:1 Sri Lanka Accounting Standards

- (a) Fully depreciated assets which are being used at present had not been revalued in terms of Sri Lanka Accounting Standard No.18.
- (b) The provision for payment of gratuity amounting to Rs.103,204,000 had not been invested separately in terms of Sri Lanka Accounting Standard No.16.

2:2:2 Accounting Deficiencies

Following observations are made.

- (a) Excesses and shortages of stocks such as fuel, electrical items, drugs etc. amounting to Rs.549,146 and Rs.335,121 respectively as at 31 December 2009 had been shown in the accounts after setting off each other. However it was observed in audit that those balances were brought forwarded continuously from prior years without making necessary adjustments in the accounts and take necessary action to fix the responsibilities.
- (b) Provision for bad and doubtful debts amounting to Rs.235,725 had been shown under creditors as payables without showing as a deduction of debtors in the balance sheet.
- (d) Payments made to obtain ISO certificate amounting to Rs.2,381,613 in 2003 had been shown under debtors without showing separately as a non current asset in the balance sheet.
- (e) Action had not been taken to transfer the goods in transit valued at Rs.98,262 relating to the years 1997 and 2006 to the relevant accounts which were received subsequently.

- (f) 38 Nos. of publications valued at Rs.4,371,520 had not been included in the stock of publications.

2: 2:3 Accounts Receivable and Payable

The following observations are made.

- (a) The analytical charges receivable as at the end of the year under review were Rs.522,868 and out of that, balances amounting to Rs.356,158 represented 68 per cent were outstanding for more than five years and a sum of Rs.77,595 represented 15 per cent were outstanding for 2 to 5 years.
- (b) According to the age analysis of sundry debtors forwarded for audit, a sum of Rs. 2,033,776 out of Rs. 4,191,629 had been remained unrecovered for more than 3 years.
- (c) Advances amounting to Rs.941,376 granted to 46 external Institutions for the procurement of goods and services had not been settled for the period ranging from 01 to 18 years. Out of that, a sum of Rs.102,410 represented an advance granted to a private Institution during 1998 and prior years. The recoverability of these amounts are doubtful due to time bar.
- (d) Foreign travelling advances amounting to Rs.152,791 had been remained outstanding for more than 08 years without settling them although it should have been settled within one month after returning of the officers concerned to the country.
- (e) Out of unsettled debtors totalling Rs.5,081,065 in St.Coombs Estate accounts as at the end, of the year under review, a sum of Rs.1,895,596 were outstanding for more than five years.

According to the Chairman, St.Coombs estate had paid Rs. 1,895,596 to Ceylon Electricity Board to supply overhead line and supply electricity to worker houses on condition to recover the cost by installments from the labourers concerned. However the estate has failed to recover due to objections raised by Unions subsequently.

- (f) A sum of Rs.1,213,380 had been shown as receivable from Sri Lanka Tea Board. But according to the financial statements of Sri Lanka Tea Board as at 31 December 2009 a sum of Rs.1,302,044 had been shown as payable to the Tea Research Board. The difference of Rs. 88,664 had not been reconciled and adjusted in the accounts.

2: 2:4 Non-compliance with Laws, Rules, Regulations and Management Decisions

Instances of non-compliance with the following Laws, Rules, Regulations etc., observed in audit are given below.

Reference to Laws, Rules, Regulations
and Management Decisions

Non-compliance

(a) Government Financial Regulations

(i) F.R. 177(1)

Cash receipts of the Board and its Regional offices had not been deposited daily or at the earliest possible opportunity to the bank and those receipts had been used for day to day expenses contrary to the Regulation.

(iii) FR 385 (i)

Payments over Rs.500 had been made by cash without drawing a cheque in terms of the Regulations. In some instances payments were made by cash for more than Rs. 50,000.

(v) FR 570

Action had not been taken in respect of security deposits lying in the deposit accounts amounting to Rs. 76,523 outstanding for more than two years.

(vi) FR 700 (3)

Action had not been taken in respect of the refundable tender deposits lying in the deposit account amounting to Rs.144,250 to unsuccessful tendereres for more than one year period.

(b) Public Enterprises Circular No
PED/12 of 02 June 2003

(i) Paragraph 6:5:1

The draft Annual Report had not been furnished to the Auditor General within 60 days after closure of the Financial year.

(ii) Paragraph 5:2:1

The budget should include the budgeted Income and Expenditure Statement , Balance Sheet, Cash flow and Capital Expenditure together with the Action Plan for the year. However the Board and the Estates of the Board had not prepared the budget in terms of the Circular.

(c) Treasury Circular No IAI /2002/02
of 28 November 2002

A Fixed Assets register relating to computers accessories and softwares had not been maintained in accordance with the Circular instructions .

3. Financial and Operating Review

3:1 Financial Results

According to the financial statements presented, the operating activities of the Board for the year ended 31 December 2009 had resulted in a deficit of Rs.15.74 million as against the surplus of Rs..6.71 million for the preceding year, thus indicating a deterioration of Rs.22.45 million in the financial results.

Further, the decrease of cess income by Rs.15.7 million and an increase of personal emoluments had mainly attributed for the decrease in financial results.

3:2 Operating Results of the Estates

The Board is managing two estates namely St Coombes Estate and St. Joachim Estate and the operating results of these Estates for the year under review as compared with the preceding year is given below.

	St. Coombes Estate (Including Lamilier Section)		St. Joachim Estate	
	2009	2008	2009	2008
Tea Sales				
Quantity (Kilograms)	297,575	371,282	245,201	312,075
Sales Value (Rs.'000)	105,785	108,601	93,883	91,616
Other Income (Rs.'000)	636	393	2,153	3,823
Total Income (Rs.'000)	106,420	108,994	96,036	95,439
Less:				
Total Expenditure (Rs.'000)	98,201	103,069	102,279	101,985
Profit/(Loss) (Rs.'000)	<u>8,219</u>	<u>5,925</u>	<u>(6,243)</u>	<u>(6,546)</u>
Cost of Production per Kilogram of Tea (Rs)	331.07	277.39	387.25	314.06
Yield per Hectare (Kilograms)	2,105	2,556	888	1,101
Net Sales Average (Rs. per Kilogram)	351.03	289.83	380.79	290.58

Though the sales quantity of the St.Combes Estate was decreased by 73,707 kilograms in the year under review when compared with the preceding year the profit had increased by Rs.2,294,241. The sales quantity of St.Jochims Estate had decreased by 66,874 kilograms when compared with the previous year and the loss had decreased by Rs.302,852 when compared with the preceding year.

3.3 Research Activities

The major function of the Tea Research Board is to conduct, assist and encourage scientific and technical research and investigations relating to the problems and matters connected with the cultivation and production of tea, diversification of production from tea as well as the propagation and publication of results of research works at the directions of the Board including the prevention and control of pests that damage tea cultivation and the improvement of the quality of tea. However the performance of the research activities could not be ascertained as the Action Plan had been prepared only with the financial targets without mentioning the physical targets.

3:4 Management Inefficiencies

Following observations are made.

- (a) According to the information made available for audit, it was observed that a sum of Rs.23,121,329 to be recovered from 14 officers who had granted leave with full pay for education purposes and failed to complete in the specified periods of service.

Following observations are made in this regards.

- (i) A sum of Rs.1,587,144 recovered from two officers only out of 14 during the year under review.
- (ii) Court cases could not be proceeded or filed in connection with 5 officers due to lapse of time. The value of outstanding bonds relating to those officers were Rs.2,121,491.
- (iii) Legal action is being taken in connection with other seven officers to recover the outstanding bonds to the value of Rs.20,999,838.
- (iv) This matter had not been disclosed in the final accounts in accordance with SLAS - 03.

- (b) According to the land survey plan prepared by Sri Lanka Survey Department in 2005 for St. Joachim Estate, 17.675 hectares out of the total land extent of 143.810 hectares had been encroached by external parties over a long period and constructed permanent houses and cultivated on the encroached land. Legal action had not been taken against those people to vacate those lands and it was observed in audit that due to these encroachments the Estate is losing income from cultivation of paddy, tea, rubber, coconut and other crops.
- (c) Audit inspection revealed that the external parties not relevant to Tea Research Board and St. Coombs Estate were engaged in cultivating vegetables in large extent of Estate lands and earned considerable income without obtaining proper approvals from the Board and the Ministry of Plantation industries. The details of unauthorized land utilizations had not been made available to audit.
- (d) The cadre position of the Board including St. Joachim and St. Coombs Estates was 368 and out of that 107 posts were vacant as at 31 December 2009. It was observed in audit that 23 vacancies out of 107 were Research, Research development and Technical officers. Information regarding casual labourers employed for factory works were not made available for audit.
- (e) Action had not been taken to complete the following activities which were appearing in the accounts under work in progress since 2007.
- (i) Advances totalling Rs.24,000 had been paid to a private company for repairs to solar project booster fan and an impeller switch in the solar system.
 - (ii) An advance amounting to Rs. 307,309 (20% of total work) had been paid to the Sri Lanka Institute of Development Administration for a computer net work system for the Finance Division of the Board.
 - (iii) Payments amounting to Rs. 377,611 had been made for construction of Rubble Retaining wall - Head office. It was

observed in audit that the wall constructed had collapsed subsequently.

- (g) A sum of Rs. 132,108 had been brought forward as work in progress in St. Coombs Estate accounts since 2008. However the construction had not been completed even up to the date of audit on 30 June 2010.

3:5 Asset Management

Following observations are made.

- (a) A sum of Rs. 4,142,173 had been shown in the accounts under work in progress as Lowery Tea Processing Project since 1982. Following observations are made in this connection.

(i) Supporting documents were not made available for the above amount.

- (ii) According to the board of survey reports, ^{dated 23 July 1997,} six machines had been imported by Tea Research Board for the value of Rs.4,487,663 and installed in six factories in up country for experimental purposes. However it was observed in audit that those machines had not been used for the intended purposes and idling at those factories.

According to the Chairman that these machines were brought to test its suitability of Sri Lanka Tea processing and resulted the experiments that LTP machineries were not suitable for Sri Lankan type of tea manufacture, therefore the project was terminated.

- (iii) The Management had not paid due attention for the above matter for the so long period.
- (b) It was observed in audit that 473 stock items such as fertilizer, firewood, stationery, low country stock costing Rs. 1,534,465 had remained either idle or under utilized from the beginning of the year under review.

Budgetary Control


- (i) The Board had not prepared an overall budget with the Estates belonging to the Board for the year under review .

- (iii) Major variations were observed in audit between the budget and the actual thus indicating that the budget had not been made use of an effective instrument of management control.

Systems and Controls

Deficiencies in systems and controls observed during the course of audit were brought to the notice of the Chairman from time to time. Special attention is needed in respect of the following areas of control.

- (a) Accounting
- (b) Granting of scholarships to Research Officers
- (c) Settlement of Advances
- (d) Assets management
- (e) Receivables and payables
- (f) Cash control


H.A.S.Samaraweera
Acting Auditor General