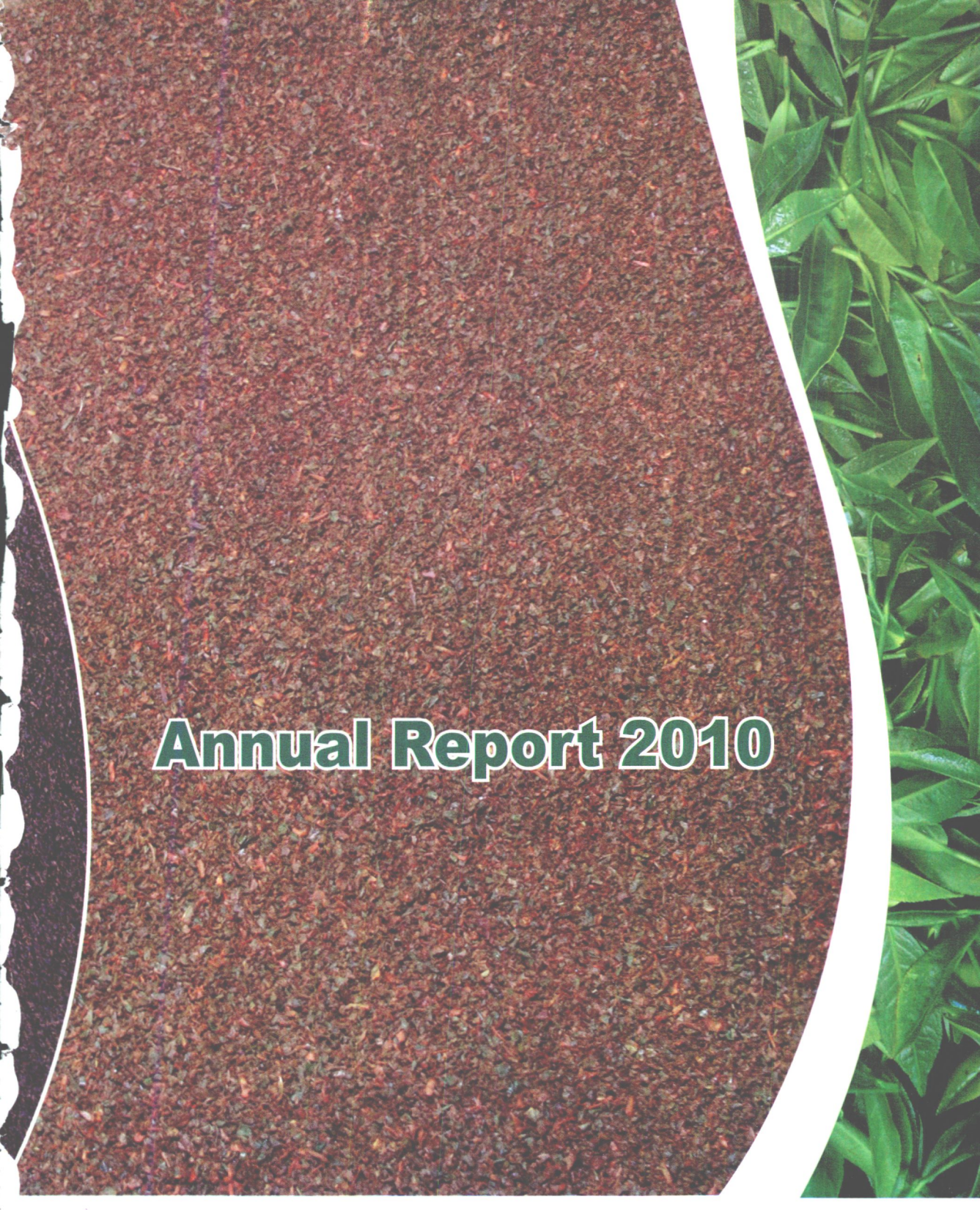

Annual Report 2010

Tea Research Institute of Sri Lanka

Annual Report 2010

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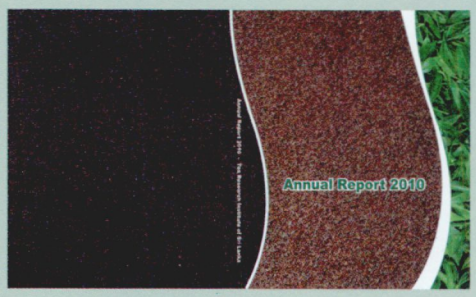
Cover



Sri Lanka is renowned for the production of best quality black tea of the world. The TRI conducts extensive research on processing technology in order to strengthen the quality of made tea. It is important that producers adhere to Good Manufacturing Practices (GMPs) for a quality final product. The cover photograph depicts fresh tea leaves, fermented dhools and black tea.

Contents

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.

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 the Tea Research Board

- Dr. S S B D G Jayawardena
  Chairman, Tea Research Board
- Dr. I S B Abeysinghe
  Director, Tea Research Institute
- Mr. Prasanna Fernando
  53, P B Alwis Perera Mawatha,
  Katubedda, Moratuwa
- Mr. P L U Dissanayake
  Additional Secretary,
  Ministry of Plantation Industries,
  55/75 Vauxhall Lane, Colombo 2
- Dr. D V Seevaratnam
  Chief Executive Officer,
  Watawala Plantations Ltd,
  60, Dharmapala Mawatha, Colombo 3
- Mr. L P Jayasinghe
  Representative - Sri Lanka Private Tea Factory Owners Association
- Mr. Ajith Abeysekara
  Deputy Director,
  Department National Budget, Colombo 1
- Mr. N Padmasiri Kariyawasam
  Chairman, Tea Holdings Development Authority,
  70, Parliament Road, Pelawatte, Battaramulla
- Mr. J M B J Banadara
  President,
  Sri Lanka Federation of Tea Small Holdings Development Authority,
  Block 01, Ketandola Estate, Ratnapura
  (Re-appointed on November 2010)
- Dr. D S A Samaraweera
  Head of Operations, Tea Smallholders Factories PLC,
  1st Floor, Mackinnon's Building, No. 04,
  Leyden Bastian Road, Colombo 1.
  (up to March 2010 and reappointed as an Observer from October 2010)
- Prof. Kapila Gunasekare,
  Vice Chancellor, University of Vocational Training
  (up to March 2010)
- Convenor/ Secretary to the TRB
  Dr. (Ms) M T K Gunasekara, Tea Research Institute of Sri Lanka

Consultative Committees

Consultative Committee On Research

- Dr. D S A Samaraweera
  Head of Operations, Tea Smallholders Factories PLC,
  1st Floor, Mackinnon's Building,
  No.04, Leyden Bastian Road, Colombo 1
- Dr. S S B D G Jayawardena
  Chairman, Tea Research Board
- Dr. I S B Abeysinghe
  Director, Tea Research Institute, Talawakelle
- Dr. D V Seevaratnam
  Chief Executive Officer,
  Watawala Plantations Ltd
- Dr. P Sivapalan
  Ex-Director, Tea Research Institute of Sri Lanka
- Prof. W A J M de Costa
  Department of Crop Science,
  Faculty of Agriculture, University of Peradeniya
- Prof. H P M Gunasena
  Chairman, Coconut Research Board
- Mr. N B H Pilapitiya
  Proprietor, New Vithanakanda Tea Factory,
  Kalawana
- Mr. M B Cyril
  Deputy General Manager (Development),
  Tea Small Holding Authority
- Mr. S K L Obeysekare
  Director/ Chief Executive Officer,
  Balangoda Plantation Ltd and Madulsima Plantation Ltd
- Mr. L P Jayasinghe
  Representative, Sri Lanka Private Tea Factory Owners Association
- Mr. P M Samarasinghe
  General Manager (Production),
  Agro Technica Ltd
- Mr. J G Jayawardena
  Director, Mercantile Produce Brokers (Pvt) Ltd
- Mr. G D V Perera
  Director, Lankem Tea & Rubber Plantations (PVT) Ltd
- Mr. L J Pieris
  Managing Director, Helix Engineering (PVT) Ltd
- Convenor/Secretary
  Dr. L S K Hettiarachchi, Deputy Director Research (Production)

Consultative Committee on Estates And Advisory Services

- Dr. D V Seevaratnam
  Chairman of the Committee
  Chief Executive Officer, Wattawala Plantations PLC
- Dr. S S B D G Jayawardena
  Chairman, Tea Research Board of Sri Lanka
- Dr. I S B Abeysinghe
  Director, Tea Research Institute of Sri Lanka
- Dr. L S K Hettiarachchi
  Deputy Director Research (Production), Tea Research Institute of Sri Lanka
- Dr. D S A Samaraweera
  Head of Operations, Tea Smallholders Factories PLC
- Prof. W A D P Wanigasundra
  Department of Agricultural Extension
  University of Peradeniya, Peradeniya (*From August 2010*)
- Mr. K G B Obeysekare
  Deputy General Manager (Extension).
  Tea Small Holdings Development Authority (*from September 2010*)
- Mr. R K Nathaniel
  Ex-Head, Advisory & Extension Division, Tea Research Institute of Sri Lanka
- Mr. Dhayan Madawala
  Chief Executive Officer, Hapugastenna Plantation Ltd
- Mr. S Wirasinghe
  Ex-Director, Department of Agriculture
- Mr.T A G de Mel
  General Manager, Balangoda Plantations PLC
- Convenor/Secretary
  Dr V S Sidhakaran, Actg. Head,Advisory and Extension Division, Tea Research Institute of Sri Lanka

Audit And Management Committee

- Mr. Ajith Abeysekare
  Chairman of the Committee
  Deputy Director, Department of National Budget
- Mr. J M B J Bandara
  President, Sri Lanka Federation of Tea Small Holdings Development Societies
- Mr. P L U Dissanayake
  Additional Secretary, Ministry of Plantation Industries
- Convenor/Secretary
  Mr. R Kariyawasam, Internal Auditor, Tea Research Institute of Sri Lanka

Report of the Chairman, TRB

Tea production in 2010 registered the highest ever recorded figure of 329 million kgs. This record production in 2010 was mainly through a 3.5 percent increase in national average yield over 2009. Very favourable weather conditions prevailed during the first three quarters of the year in most of the tea growing regions contributed significantly to the increased crop productivity. In response to the high green leaf prices, driven by high auction averages, smallholders who contribute about 75% percent of the national production paid more attention to good agricultural practices, judicial use of subsidized fertilizer and adoption of soil amendment practices as recommended by the TRI.

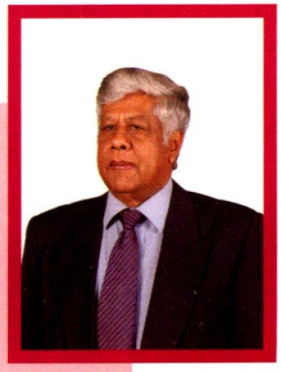
The Tea Research Institute continued to focus on the impact of climate change by paying more attention to recording and analyzing weather data in different climatic zones. The Tea Research Board, having observed the trends in climate change, stressed the need to monitor climatic parameters and directed the TRI scientists to re-visit the recommendations on timing of cultivation practices such as pruning, fertilizer application *etc* in relation to shift of rainfall pattern observed during the last few decades where high intensity rainfall in short spells has been recorded.

The Board directed the Tea Research Institute to present the valuable information generated by the diagnostic survey to the stakeholders and to the Ministry of Plantation Industries. Based on these findings, the Ministry of Plantation Industries has taken a policy decision to encourage re-planting to reach a target of 3 percent annually.

The Ministr of Plantation Industries, based o Tecommendations, continued to justify fertilizer subsidy for smallholders so as to sustain high productivity levels. Based on the feedback received from Low country tea smallholders, the Ministry of Plantation Industries directed the TRI to revise its fertilizer recommendations and carry out field trials to revalidate the Institute's recommendations.

The Tea Research Board continued to monitor the progress of the Institute's annual review of divisional research programs with the participation of highly recognized external scientists from universities and other research organizations. This review process enabled the Governing Board to ensure that research outputs are monitored through inter-disciplinary research and also ensure that stakeholder driven need based research activities are undertaken by the Institute. Progress of internal reviews were regularly monitored through reports submitted

to the Consultative Committee on Research where policy directions were given to focus on research activities directed to address industry challenges such as increase in productivity, reduction in cost of production, conservation of energy and research on mechanization.



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

Recognizing the fact that more than 75% of the national tea production is generated by the tea smallholding sector, the Tea Research Board directed the Advisory and Extension Division to pay more attention to technology transfer activities, Training of Trainers programs and TRI-TSHDA linkage mechanisms to ensure that the technology adoption rate is high among a majority of smallholder growers. The Committee on Estates & Advisory Services represented by TSHDA and tea smallholders continued to focus on technology transfer procedures and extension activities and the program of the Technology Division is rigorously monitored so as to ensure that good manufacturing practices are adopted. This Committee also paid serious attention to the management of St Coombs Estate and Factory at Talawakelle and St Joachim Estate and Factory at Ratnapura. It is a commendable achievement to place on record that St Coombs improved its leaf standards and the management of the property to obtain a high net sale average and record a net profit of Rs. 5.2 million in 2010. St Joachim Estate and Factory, which recorded a loss of Rs.6 million in 2009, reduced losses to zero during 2010 mainly by increasing the leaf supply through an agreement with "Gemi Diriya" program.

The Advisory and Extension Division continued to perform its functions by serving the technology needs of the Regional Plantation Companies through advisory visits while paying special attention to the need for strengthening linkages with the Tea Small Holdings Development Authority as directed by the Tea Research Board.

advisory and extension visits to RPC Estates and small holder properties during the year 2010. This division also organized 371 seminars, workshops and training programs as effective instruments in technology transfer and extension activities. The Board directed the Institute to re-visit the original objectives of conducting Regional Scientific Committee Seminars and to reorganize the agenda for RSCs to be more effective and participatory. Based on this directive five RSCs were conducted during 2010 introducing a more interactive agenda where planters were given an opportunity to present their issues and seeking clarifications from scientists.

In November 2010, a new Advisory and Extension Centre was declared open by the Honorable Minister of Plantation Industries to serve the advisory and extension needs of 38,184 smallholders and 69 proprietary estates, which are more than 20 acres in extent, as well as 10 RPCs. The most effective and popular technology transfer event with the highest stakeholder participation is the Experiment and Extension Forum (E&E). This forum is conducted both in English and Sinhala twice a year on a very timely and relevant theme to the industry covering both RPCs and smallholder sectors. Furthermore, the E&E forum was held at regional level as RTEF mainly to cater to the technological needs of the smallholders. Two major Crop Clinics, conducted both for corporate and smallholder sectors in Deniyaya, Ratnapura and Galle regions, proved to be very effective as a large number of smallholders participated at these events. The Low country Regional Centre at Ratnapura continued to play a major role in serving the RPC and smallholder advisory and extension needs while giving leadership to R&D work on mechanization and other research disciplines. The Mid country Regional Centre at Hantana while serving the needs of the Mid country RPCs, SLSPC and JEDB plantations continued to coordinate the Mother Bush Programs and nursery plant inspections.

A new concept on technology transfer for the corporate sector, namely "Para Extension", was tested as a pilot project with the active participation of the corporate sector. This proved to be very successful in bridging the knowledge gap between supervisory and worker level grades. During the year under review, five TRI Advisory Circulars have been revised based on new research information while action has been initiated to translate many circulars into Sinhala and Tamil languages.

In order to ensure good governance and sound financial management, the

governing board closely monitored the regular audit committee reports and scrutinized the Auditor General's reports and directed the Institute to implement the recommendations of the committee.

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

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

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

Dr. S S B D G Jayawardena
Chairman
Tea Research Board of Sri Lanka

Tea Research Institute of Sri Lanka

The Tea Research Institute (TRI) of Sri Lanka was established to enrich the tea industry through professional tea research. The 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 Mangement

Director/ Chief Executive Officer
Dr. I Sarath B Abeysinghe
B Sc (Peradeniya, Sri Lanka) Ph D (Sheffied, UK)

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

Deputy Director Research (Technology)
Vacant

Deputy Director (Administration)
Vacant

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

Review of the Director, TRI

General

The sixth TRI Advisory and Extension Regional Centre at Nivitigalakelle, Matugama was declared open by the Honorable Minister, MPI to celebrate the occasion of the second term of office of His Excellency the President in November 2010. The TRI Matugama Extension Centre serves the advisory and extension needs of nearly 40,000 smallholdings, proprietary estates and RPC estates.

Also a religious ceremony as well as a tree planting campaign and repairs to Lindula Base Hospital were conducted to celebrate the occasion of the second term of office of His Excellency the President.

The Honourable Minister Mr. Mahinda Samarasinghe and the ministerial delegation visited the TRI Headquarters at Talawakelle in May 2010 and had meetings with the TRI staff as well as the Chief Executive Officers and Senior Managers of the Regional Plantation Companies to discuss issues related to the industry, research as well as development. The Hon. Minister also visited the TRI Low country Station, at Ratnapura, in December 2010. Along with the TRI Low country Station staff, he also met the tea factory owners and estate managers of Ratnpura and Kegalle Districts to discuss current issues faced by the industry.

The TRI, Deniyaya circuit bungalow was officially opened by the Honourable Minister on 1st August 2010.

The Third Symposium on Plantation Crop Research was successfully held from 30th September – 1st October 2010 in Colombo. The presentation made by the TRI scientists on "Quantification of L–theanine in Sri Lankan black and green tea using high performance liquid chromatography" was awarded the gold medal at the symposium.

Research, Advisory and Extension Matters

The review of the research programs of the Institute by the Scientific and Advisory Committee, which comprises of eminent scientists from other organizations and universities, was continued during 2010. This process helped to ensure monitoring and successful implementation of the research programs as per the TRI -Corporate Plan. The outcome of this review was presented to the Consultative Committee on Research as well as to the Tea Research Board for policy directives.

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

Research Highlights

An Index was developed to evaluate the soil quality (Soil Quality Index) which will help in identifying tea soils for their suitability for planting/replanting of tea.

Grafting techniques were applied towards increasing yield as well as resistance to drought/ diseases. The stock and scion combinations of TRI 777/ TRI 3020, TRI 777/ TRI 3019, TRI 4067/ TRI 4053 and TRI 4067/ TRI 3020 gave 45% increase in yield in the first cycle. The best combinations for Blister-Blight tolerance were TRI 3072/ TRI 4053 and TRI 4046/ TRI 4053. The graft combinations of TRI 4046/ DN and TRI 4052/ DN were the best for drought tolerance.

Collaborative work with the Institute of Fundamental Studies led to the formulation of Bio-filmed bio fertilizer, the use of which could enhance soil fertility and thereby reduce the use of artificial tea nursery fertilizer mixture (T65) by about 50%. This will reduce the cost of fertilizer used in the nurseries and also would help to grow tea in an environmentally friendly manner.

A protein-rich feed, having all essential amino acids, was developed from refuse/ spent tea, using membrane filtration technique at a cost of Rs. 115 per kg. This feed contains a high level of protein (24), low level of undesirable compounds, polyphenol (7%), caffeine (0.9%) and crude fibre (0.44%).

A new type of white tea, which contains higher amounts of natural compounds having health giving properties, was developed using the bud and first leaf of a unique cultivar developed by the TRI. This product is now marketed as "St. Coombs Bud Plus"

A method was developed/ perfected to mass culture Shot hole Borer on artificial diets which will help to speed up experiments on Shot hole Borer control.

In order to shorten the long time (20 - 25 years) taken to develop new tea cultivars through conventional breeding techniques, tissue culture plants that were raised through the protocol perfected previously was effectively integrated into the current breeding program. This will accelerate release of new tea cultivars.

A well focused program was initiated to conserve the elite germpalsm with the aim of achieving diverse breeding objectives to directly cater the needs of the end-user by developing cultivars that match their needs.

Investigations towards the identification of tea cultivars that have the potential to make green teas suitable for diverse markets have been initiated, as the green tea market is expected to grow at a faster rate than that for black tea by the year 2017.

Genetic variability of Blister blight leaf disease pathogen, Exobasidium vexans in different tea growing areas were confirmed by molecular and morphological studies indicating the need for refinement of Blister blight control measures in different tea growing areas.

Micro nutrient (Manganese, Ferrous, Copper, Zinc, Boron and Molybdenum) status in major tea growing soil series were established in order to increase productivity of mature tea through the formulation of a micro nutrient package for the different tea growing regions of Sri Lanka.

The most suitable wither for Orthodox-Rotorvane tea processing was established as 40 – 43% to produce better quality tea with improved quality characters such as blackness, liquor colour, liquor strength and infused leaf colour.

Analysis of long term rainfall data from TRI agro-met stations indicated that rainfall received during monsoonal and inter monsoonal rainy seasons changed significantly during the last decade when compared to the previous decades, thus indicating the necessity to make appropriate changes to certain cultural practices.

Issues related to MRLs

Field trails to establish pesticide residue levels under Good Agricultural Practices as per FAO guidelines were continued during 2010. Based on the work carried out in 2010, applications were submitted to Japanese health authorities to enhance the MRLs set for Bitertanol, Propiconazole and MCPA.

Training and Technology Dissemination

Diagnostic Census in the Corporate Sector Tea Estates

The final report of the Diagnostic Census conducted on all 307 tea estates managed by 20 Regional Plantation Companies was released. Findings revealed the urgency of replanting at least at the 3% rate. It also revealed significant gaps in adopting some of the more important TRI recommendations. The report will help the Ministry to take appropriate policy decisions to improve the overall performance of the RPC sector.

Para Extension Aide (PEA) approach

With a view to narrowing the technology adoption gap in the Corporate Sector plantations, the "Para Extension aide" concept was introduced as a pilot project in 2009. The approach aimed at training middle level employees (supervisory staff) as "Extension Assistants" and using them effectively to narrow down the gap that exists between managerial staff and grass root level workers. The pilot project was implemented successfully in collaboration with Watawala Plantations.

Crop clinics

Two major crop clinics were conducted for both corporate and smallholding sector in Deniyaya and Ratnapura/Kegalle regions. One mini crop clinic was held for small holders in Waturawa, Deniyaya. Tea machinery exhibitions were also organized in parallel with the major crop clinics in collaboration with private agro-machinery companies.

Adaptive trials

Adaptive trials to introduce new improved seedling plants for the marginalized tea fields of the Mid-country were initiated jointly by Plant Breeding and Advisory staff of Hantana Station at Hingurugama estate.

Special issues in the Up country region

Severe incidents of White Grub attacks were reported in new clearings of Glentilt, Gampaha, Bogahawatte, Bearwell, Kotiyagala and Hollyrood estates. The problems were investigated in collaboration with Entomology Division and appropriate recommendations were made.

Special issues in Deniyaya Region

A survey was conducted to assess factors related to bush debilitation in the Deniyaya region. Development of brown spots on tea leaves was reported in smallholder lands. It was identified that this condition was due to an algae attack which was successfully controlled by spraying copper fungicides.

ADB Mother Bush Project

A total of 11,834,149 cuttings from TRI 3000 and 4000-series were issued from the TRI, TSHDA and Private Mother Bush sites. A Site Managers' meeting of the ADB mother bush program was held in April 2010. It was decided to increase the price of a tea shoot from Rs 2.50 to Rs 3.50, re-evaluate recommended cultivars and establish demonstration trials using new cultivars with the leadership of TSHDA.

Awards and Recognitions

Dr. L S K Hettiarachchi, Dr. (Mrs) M T K Gunasekare, Dr. K Mohotti, Dr. P A N Punyasiri, Mrs. Saroja Ananthacumaraswamy, Mr. Saman Dissanayake and Dr. I S B Abeysinghe received Presidential awards for Scientific Research for 2005 and 2006 at the Temples Trees.

Dr. K G Prematilake received the Commendation Award of the NSF for Popularization of Science for the period of 2005-10, at a ceremony held in Colombo in November.

Dr I S B Abeysinghe, Director TRI, was appointed by the Board of Directors, Department of Agriculture to serve in the Editorial Board of the Journal "Tropical Agriculturist".

The presentation on "Quantification of L–theanine in Sri Lankan black and green tea using high performance liquid chromatography" made by Dr P A N Punyasiri, SRO, Biochemistry Division, was adjudged as the best presentation among those made by the four Crop Research Institutes and was awarded the gold medal.

The presentation titled "Application of membrane filtration techniques in the preparation of protein rich feed from spent tea" made by Mr G A A R Perera, Research Officer, Biochemistry Division was adjudged as the best presentation among those made by the Tea Research Institute and awarded the silver medal.

Mrs P G D S Amarasena was presented the best student award at the Session on Plant Protection of the Post Graduate Institute Agriculture held in November 2010.

The Director TRI was invited to deliver the keynote address at "China Cross-straits symposium on Green Agriculture" in Fujian, China.

Chinese Academy of Sciences had invited Dr M T K Gunasekare, Head, Plant Breeding Division to contribute a chapter for the professional & scholarly book titled "Global Tea Breeding: Achievements, Challenges and Perspective".

Dr M T K Gunasekare, Head, Plant Breeding Division was invited to serve as a member of the organizing committee of the "5th Asian Biotechnology Conference – 201" hosted by CARP in collaboration with Research and Information System, New Delhi and Michigan State University, USA.

Dr. M A Wijeratne continued to render his services as an Assistant Commissioner to the Sri Lanka Inventors' Commission. He also served as a member of the Faculty of the Board of Agriculture, University of Ruhuna and visiting lecturer of the Uva Wellassa University and University of Ruhuna.

Dr. K M Mohotti continued to serve as Vice President of the Institute of Biology, and 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.

Publications/ Patents

Advisory Circulars: PN2- Tea Nursery Management; PM 11 – Fumigation of nursery soils for Nematode eradication.
Sri Lanka Journal of Tea Science, Vol. 73 (Part 1)
Sri Lanka Journal of Tea Science, Vol 73 (Part 2)
Sri Lanka Journal of Tea Science, Vol.74, (Part 1)
Annual Report 2008 – Tamil translation
Annual Report 2008 – Sinhala translation

Collaborative work/ Links with other organizations

Sri Lanka Institute of Nanotechnology (SLINTEC)
A collaborative project on "Soil fertility improvements using slow releasing fertilizer" was initiated with the Sri Lanka Institute of Nanotechnology (SLINTEC).

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

Tocklai Tea Research Association
As a result of the collaborative project on field trials on the use and application of copper, a joint application has been prepared to make a request to EU to enhance the current Copper MRL.

TRI-TSHDA Linkage
Adaptive trials on TRI recommended fertilizer mixtures were started as a joint program with the TSHDA in tea smallholder lands.

Important Meetings/ conferences attended

Dr. I Sarath B Abeysinghe, the Director TRI, and Dr. K M Mohotti, Head, Entomology Division, participated at the Tocklai Tea Centenary Conference from 10th to 11th May 2010 and attended FAO/ IGG meeting from 12th to 14th May 2010, in New Delhi, India, as members of the Sri Lankan delegation.

Dr. I Sarath B Abeysinghe, the Director TRI, attended and delivered the keynote address at the China Cross –Straits Symposium on Green Agriculture in Fujian, China which was held from 19.06.2010 to 20.06.2010.

Dr. L S K Hettiarachchi, Deputy Director Research (production), and Mr. J C K Rajasinghe, Senior Advisory Officer, took part in a Study tour- of the Mines and Processing Units of natural Kieserite in Germany from 22nd to 27th November 2010, to acquire knowledge for use in future fertilizer recommendations.

Special issues/ events

As a response to the issues raised by the small holder sector regarding TRI recommended fertilizer mixtures, the Honourable Minister instructed the TRI to formulate an alternative fertilizer mixture for the smallholder sector as an interim measure. The mixturers UT 752 and UT 397 were proposed as alternative mixtures.

Cadre and Staff Position

Dr. K L Wasantha Kumara and Prof. A N Jayakody assumed duties as Senior Research Officers (Contractual) in February 2010 in Plant Pathology Division and Soils and Plant Nutrition Division respectively.

Administrative and Financial Matters

Mrs. S S Guruge, Deputy Director (Administration) has completed her 2 year period of secondment at TRI on 31st December 2009. Interviews were held to select suitable candidates for the posts of DDA and Resident Engineer. Duties of the DDA were covered up by Director and DDR (P).

A Health Clinic was organized at the TRI for the officers and their family members in August 2010.

Financial performance

Severe cash flow problems were experienced in the first half of the year which hampered the activities of the Institute. Honourable Minister and the officials and representatives of Plantation sector met the Secretary to the Treasury in June 2010 to discuss the financial situation of Institutions under MPI.

Human Resource development

Mr. K G J P Mahindapala, completed his M Sc degree program in Agriculture Extension (Organizational Management) at the Postgraduate Institute of Agriculture, University of Peradeniya in April 2010.

Mr. N P S N Bandara, Research Assistant, TRI Low country Station Ratnapura, proceeded to Australia to follow the final part of his Ph D Program including submission of the thesis at the University of Adelaide.

Ms. T L Wijeratne, Research Assistant, Agronomy Division, Proceeded to the United Kingdom to follow the foreign component of her Ph D program at the University of Sheffield for a period of one year.

Mr. C J Liyanarachchi, completed a six-month post graduate diploma program on tea cultivation at the Kothari Plantation Management Institute, India in March 2010.

Ms. Ganesha Harshani Thotawattage, Experimental Officer, Biochemistry Division, Participated at the "2010 International Training Workshop Of Botanic Extracts Processing Technology", Human Agricultural University Human, China from 07.09.2010 - 26.09.2010.

Performance of TRI Estates

St. Coombs Estate

St Coombs Estate made a profit of Rs 11.81 million in 2010. The rolling room of the factory was expanded and machinery upgraded and resited at a cost of Rs. 4,083,712.59. Following the factory development and resultant improvements to the leaf standard, the "St. COOMBS" mark ranked 3rd in the "WESTERN HIGH GROWN" category. St. Coombs Dust 1 grade received "7 TOP PRICES" in the Auctions during the year.

Replanting

Two heactares of rehabilitated land was planted with new TRI cultivars and another two hectares of old seedling tea was uprooted and rehabilitated.

ADB Mother Bush Project

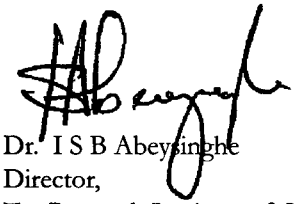
A total of 4,857,935 cuttings from TRI 3000 & 4000 Series cultivars were issued to Tea Small Holders and the Corporate Sector. This project was transformed into a viable venture, since its inception in the year 2000, recording a profit of Rs. 805,699.66.

St. Joachim Estate

The Hon. Minister of Plantations Industries Mr. Mahinda Samarasinghe (MP) visited the tea factory in December 2010. St. Joachim Estate made a Profit of Rs 557,315/76 during 2010. The joint program between TRI and Ruwanpura Gemidiriya was commenced in order to supply green leaf to St. Joachim Estate in February 2010.

Conclusion

I thank the Chairman and the Board of Management of the TRI for their support, advice and guidance extended to me during the year to carry out my duties. Thanks are also due to the Deputy Director Research (Production) who shared the administrative responsibilities in the absence of the Deputy Director (Administration). My profound appreciation also go out to the TRI staff for extending their fullest cooperation towards achieving the goals set in the Corporate Plan despite outstanding issues related to salary and scheme of recruitment.



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

Agricultural Economics Division

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

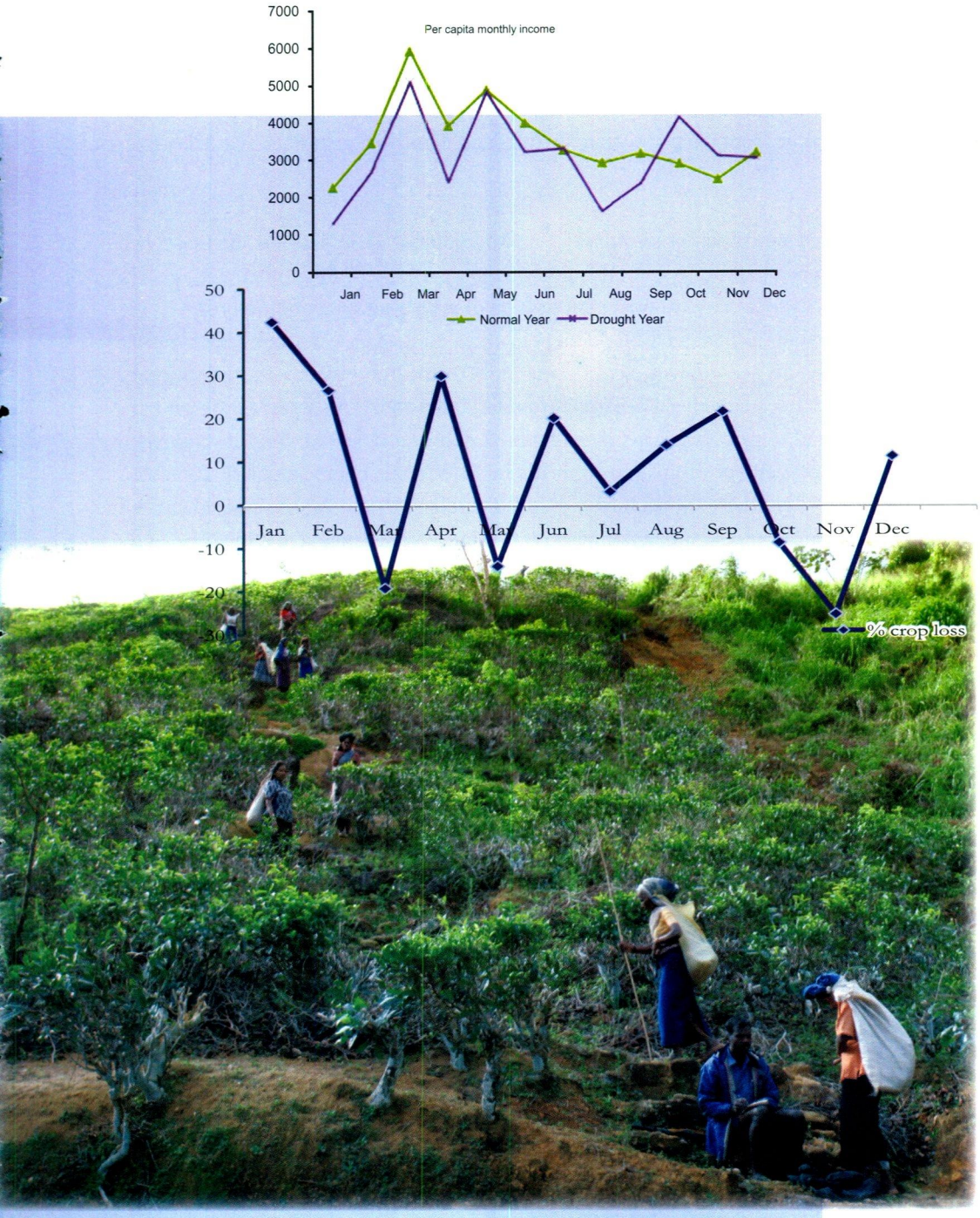
Research Highlights

Drought is a natural phenomenon that can occur in any region and cause economic, social and environmental losses. Survey in Uva region revealed that crop losses vary 27 - 44 % from a normal year to a drought year and worker income was low during drought period. Average per capita income for a normal period was Rs. 3500 head-1 month-1 and this was reduced to 3100 head-1month-1 in the drought period.

Wage increase invariably raises the cost of production (COP) and reduces the profit margin of the enterprise. There will be an immense impact of wage increase on tea sector as its labour intensive nature. Analyzing the impact of wage increase on components of cost of production may facilitate to understand impacts and take remedial measures minimizing the negative impacts on tea industry. The wage revision alone has increased the COP by about 16 - 17% Total COP has increased by Rs. 54.93, 59.20, 57.73 and 64.51 per kg of made tea, respectively in Up, Mid, Low and Uva regions.

Staff News

Mr. W M J C Bandara, Experimental officer of Agricultural Economics Division, was transferred to the Soils and Plant Nutrition Division w.e.f 2nd January 2010.


Per capita monthly income
7000
6000
5000
4000
3000
2000
1000
0
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Normal Year
Drought Year
50
40
30
20
10
0
-10
-20
-30
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
% crop loss

A.41.4 Impact assessment of fiscal, monetary and trade policies on the tea sector - Economic impact of fertilizer subsidy for small scale tea growers in Southern Province, Sri Lanka

The aim of this project was to analyze the economic impact of fertilizer subsidy on small scale tea growers and evaluate the significance of economic changes due to the subsidy. The specific objectives were to evaluate economic impact of the fertilizer subsidy, determine significant factors (*i.e.* occupation, education, experience, land extent and fertilizer cost per hectare) that contributed to the income from tea per hectare in 2009 and identify constraints in the fertilizer subsidy scheme.

This study was carried out in tea growing areas of Matara and Galle districts, as these two districts have the higher number of small holders when compared with other districts. In addition to this, both districts have almost similar type of agro climatic conditions and living style of people. A total of 335 tea small holders (157 from Galle and 178 from Matara) were selected for this study. To accomplish the aforementioned research objectives, both primary and secondary data sources have been utilized throughout this study. As a part of the primary data collection method, a questionnaire was prepared and administered. Results indicated that there was an improvement in income from tea in 2009 when compared with 2008 as a result of fertilizer subsidy. Regression analysis showed that land extent, labour and subsidized fertilizer cost per hectare had a significant impact on income from tea per ha in 2009. The study concluded that subsidized fertilizer cost was one of the important factors that contributed to the increase in income in 2009 when compared with 2008. The study also revealed that a majority of small scale tea growers were not satisfied with the quality of the NPK fertilizer mixture applied and they were also affected by higher transportation cost. Based on the results of this study, a recommendation could be made that subsidized fertilizer mixtures should be provided to small holders continuously to enhance their income.

Thrust A49. Application of Geographic Information System (GIS) in the tea sector

A project has been initiated with the objectives of developing a digital map of St. Coombs. Generation of the base map was started and data fusion was applied to the satellite image. Estate boundary map and field maps were generated and collection of estate data is in progress.

B1. Establishment & maintenance of tea database

A database on production, exports, imports and prices, as well as consumption and world exports of tea for the year 2010 was established.

D/Econ2. Evaluation of research recommendation and micro analysis

Socio-Economic impact of drought in the plantation sector

Five estates from Uva region were selected for this study. Primary data was collected using a structured questionnaire and secondary data was gathered from the estate records. Short term impacts due to drought were identified as delay in getting revenue (due to growth retardation), additional cost for maintenance (due to delay in harvesting) and income loss. The long term impacts were identified as loss of capital (due to casualties), additional cost for re-supplying

plants and decreased income due to crop loss. The capital losses in the year of planting at different levels of damage, ranging between 5% and 30%, were Rs.65,000 and 389,000/ha, respectively. The capital losses in the first year after planting were Rs. 76,000 and 457,000/ ha at 5% and 30% level of damage respectively. It was estimated that the income loss due to casualties at 5% and 30% were Rs. 5,200 and 30,000/ ha in the year of planting. According to the survey, crop losses vary between 27 and 44 % from a normal year (2008) to a drought year (2009). It was further observed that worker income was low during drought periods. Average per capita income for a normal year (2008) was Rs.3,500/head/month and this was reduced to Rs 3,100/head/month in the drought year (2009). These results were presented at the Regional Scientific Conference at Uva.

Economic viability of buying Gamidiriya green leaf by St. Joachim Estate
It was revealed that Gamidiriya crop has a direct impact on estate cost of production. The cost of production has been considerably decreased thereby indicating that buying green leaf by the St.Joachim factory is financially feasible with the present agreements between TRI and the Gamidiriya project.

Seminars and Meeting

- H W Shyamalie presented a paper on "Impact of Recent Wage Increase on COP and Strategies to Improve Worker and Land Productivity" at the 200th E&E Forum held on 12th February 2010 at the Auditorium of Tea Research Institute, Talawakelle.
- H W Shyamalie attended the Review of Research and Development programmes of Technology and Plant Breeding Divisions held by the Scientific Advisory Committee (SAC) at the TRI Library Board Room.
- H W Shyamalie presented a papers on "Economic Analysis on Impact of Drought in Uva" at the Regional Scientific Conference held on 1st April 2010, and on "Impact of Recent Wage Increase on COP and Strategies to Improve Worker and Land Productivity of Low Grown Tea" at the RSC held on 7th May 2010 in the Auditorium of the TRI Low-country Station, Ratnapura.
- K W N Nadeeshani attended a workshop on number in science-Right Way to Handle Quantitative data organized by National Science & Technology Commission on 8th April 2010.
- H W Shyamalie participated at a workshop on BICOST VI – Implementation of National Science and Technology Policy at Kandy

Other

- Mr. R V Prasanna, an undergraduate student of Uva Wellassa University, carried out a research project on impact of fertilizer subsidy on small scale tea growers.
- A concept paper was prepared on the possibility of implementing an out grower system at St. Coombs estate.
- The annual revenues and costs of existing projects/activities of the Tea Research institute were reviewed and new income generating activities were proposed.
- The development plan of Agricultural Economics Division for the period of 2012-2015 was prepared.

Agronomy Division

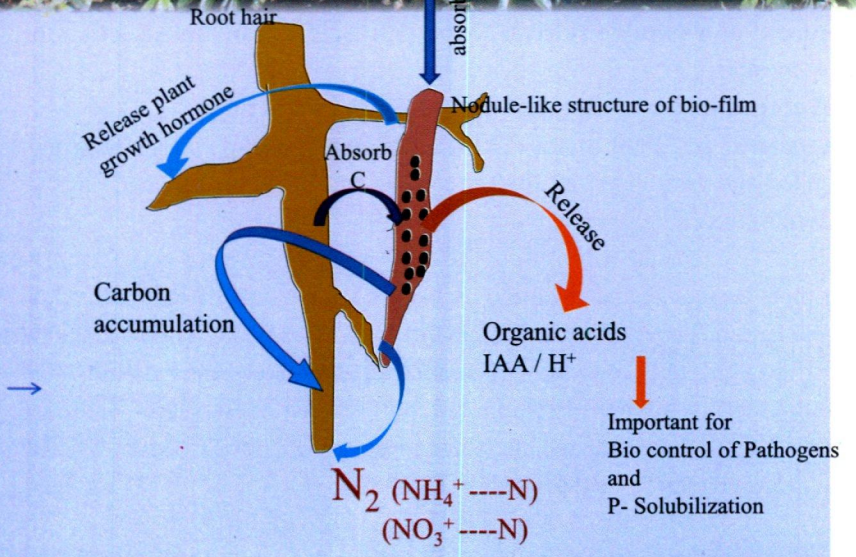
K G Prematilake
B Sc Agric (Ruhuna, Sri Lanka),
M Phil (Peradeniya, Sri Lanka),
Ph D (Reading, UK)
Head/ Senior Research Officer

Research Highlights

Soil Quality Index, a new formula was developed by the division to use as a tool for pre-assessment of the physical, chemical and biological status of soils in tea lands, which are due for uprooting and soil reconditioning before replanting. This will helpful for decision making on soil rehabilitation with grasses or reducing the two year rehabilitation period.

In an investigation on making use of grafting of different tea cultivars as a technique for yield and quality improvement and pest and disease resistance, several graft combinations were evaluated under field conditions of St Coombs estate over a pruning cycle, *i.e.* 5 years. It was reported a significant yield increment of 125% and 82% in TRI 777 on TRI 3019 and TRI 777 on TRI 3020 combinations respectively, in comparison to TRI 777 alone as control. Furthermore, it was reported a significant yield increment of 25% and 15% in TRI 4067 on TRI 3020 and TRI 4067on TRI 4053 combinations, respectively, in comparison to TRI 6067 alone as control. TRI 3072 on TRI 4053 and TRI 4046 on TRI 4053 combinations were found to be the best combinations for Blister-Blight tolerance. TRI 4046 on DN and TRI 4052 on DN were found to be the best graft combinations for drought tolerance.

There are adverse effects on tea bush growth and yield, when tea is harvested using machines. In an investigation, it was found that adverse effects and yield decline were comparatively less, when tea was mechanically harvested from only a half of the plucking table, weekly than harvested from entire plucking table, fortnightly. It was contained about 16 and 27 coarse leaf percentage, when tea was mechanically harvested from half of the plucking table, weekly and entire plucking table, fortnightly, respectively. It was reported only 3% coarse leaf with manual plucking. The tea yield was also fairly high when harvested from half of the plucking table than harvested from entire plucking table.



Comprehensive investigations under the nursery and field conditions for over 5 year duration revealed that the present tea nursery fertilizer mixture, T65, could be half replaced by new bio-filmed bio-fertilizers. Bio-filmed bio-fertilizers developed with a combination of beneficial soil microbes. Hence, distinct economic benefits could be achieved due to the curtailment of artificial fertilizers whilst conforming conservation of tea ecosystem.

Research Highlights *contd.*

A new battery operated light weighed (1.6 kg) plucking machine was tested at TRI Low country Regional Centre, Ratnapura over a period of six month and found that the output of the machine varied from 7.5 - 11 kg of green leaf/hr and the extent covered by the plucking machine was about 0.13 ha/day. The made tea yields harvested by the machine with and without manual removal of banjies were 64% (2187 kg/ha/yr) and 41% (1399 kg/ha/yr) of manual harvesting (3398 kg/ha/yr), respectively. Therefore, it is necessary to remove banjies after each machine operation. It was also observed that about 25% shoots (by weight) were damaged under machine harvesting.

A higher dry matter yield of fuel wood of Gliricidia (stem parts) was recorded from Ratnapura, Horana and Passara (17.5, 17.2 and 15.7 m tons/ha/lopping respectively) from the highest plant density of 10,000 plants/ha (1 m x 1 m) at 3rd year after planting. [However, it was recorded almost 38 mn tons of dry matter of fuel wood from well matured Gliricidia, planted at 1 x1 m spacing under coconut in the Coconut Triangle]. From 1 m x 2 m density it was recorded only 11.1, 10.4 and 12.8 kg/ha/lopping for three locations, respectively. From 2 m x 2 m, it was recorded the lowest dry weight of 6.4, 4.9 and 7.8 kg/ha/lopping of fuel woods, respectively. In all cases, more than 70% - 83% of total dry matter was from fuel woods and the balance 17 - 30% was from green tender stems and leaves.

Thandam pillu (*Crassocephelum crepidiodes*) weed was found to be inclined to tolerance to glyphosate herbicide.

Thrust A 4. Development of a suitable cultivar through hybridization and selection for the Low country

A 4.6 Screening lines amenable for mechanical harvesting (Low country)

This experiment was started in, 2009 at the TRI Low Country Station, Ratnapura and treatments were amended and rearranged in 2010 according to the comments made by the Scientific Advisory Committee.

Eight tea plant descriptors were selected, with the assistance of the staff of Plant Breeding Division, for this investigation. They were yield (high and low), inter-nodal length (long and short), leaf apex habit (straight and down-turned), leaf size (extra-large and medium), leaf angle (droopy and semi-erect), shoot density (high and low) and hardiness (hardy and non-hardy). The tea cultivars having these selected characteristics were TRI 2023, TRI 2027, TRI 3025, TRI 3055, TRI 4014, TRI 4042, TRI 4049 and TRI 4061.

Due to a lack of plants of each cultivar in one location, two treatments *viz.* a) mechanical harvesting and b) manual harvesting (control) were imposed in two replicates. Tea bushes were harvested as per the treatments and yield, growth assessments and other data on plant descriptors were recorded during the year 2010. Of the tested cultivars, mechanically harvested tea bushes of TRI 2023 and TRI 2027 recorded a significantly higher yield reduction with time than TRI 4061 and TRI 3025. Removal of arimbus under mechanical harvesting increased

with time (period of mechanical harvesting). Cut pieces of mature leaves (coarse leaf) were seen to be reduced in cultivars with drooping leaf characteristics. Further, there was a positive correlation between % of dormant shoots and cut pieces of leaf in the harvest.

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

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

a. Field investigations on Bio-filmed biofertilisers (BBF)

Experiments are in progress at the following locations:

Locations: Holyrood Estate, Talawakelle (July 2007), Young/ immature tea trials (two experiments), Holyrood Estate, Talawakelle (2009), Elkaduwa Estate, Matale (July 2007), New Peacock Estate, Pussellawa (June 2008), St. Joachim Estate. Ratnapura (July 2008), Kottawa TRI Station, Galle (June 2009), Passara TRI Station (May 2010).

Treatments are as follows: Recommended fertilizer only (T1), F3B only (T2), F3A only (T3), FR only (T4), F3B + 50% recommended fertilizer (T5), F3A + 50% recommended fertilizer (T6), FR + 50% recommended fertilizer (T7), 50% recommended fertilizer only F3A (T8).

(A: Bacteria from Gliricedia + Bacteria from refuse tea + Bacillus Megatherium; B: Bacteria isolated from Arachis pintoii + Semia + Bacillus Megatherium; F3: Fungi isolated from tea root rhizosphere; FR: Fungi isolated from refuse tea)

Yield was recorded and soil analyses were undertaken. Results indicated that half fertilizer with BBF improved soil parameters and this was reflected throughout in growth, performance and yield.

b. Field observation blocks

Plots having 200 bushes are maintained by application of BBFs at Passara, Kottawa, Ratnapura and New Peacock Estate, Pussallawa and yield of tea is recorded. This experiment is in progress.

c. Two new observation blocks were commenced at Richiland and Nilgiri Estates, Deniyaya for biocontrol assessments and BBFs application is made every two months as a measure on the yield decline problem. This experiment is in progress.

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 diferent irrigation systems for low-grown tea (WL2)

a. Evaluating Drip Irrigation in mature tea at St Joachim Estate (1999)

Growth of tea was studied under drip irrigation system for cultivars TRI 2023 and TRI 3025. Development of main stem parts, leaves and total roots was studied. Root distribution was also studied at different depths.

There was a difference in main stem dry weight between cultivar TRI 2023 and TRI 3025. Dry weights of live and dead twigs were significantly greater with TRI 2023 under no irrigation when compared to that under irrigation, and TRI 3025 irrespective of irrigation. Leaf dry weight was not affected by the cultivar or irrigation.

Root dry weight was significantly higher (< 2 and 2 - 4 mm in size) with TRI 2023 compared to TRI 3025. Root growth was relatively higher under irrigation than no irrigation with TRI 3025. Dry weight of roots (>4 mm in size) was significantly affected by both Cultivar and irrigation method, i.e. a significantly higher root weight was recorded with irrigation than no irrigation with both cultivars.

Coarse root dry weight was significantly higher under irrigation at 0 - 20 cm. Though not significant, the same at 20 - 40 cm depth was also relatively greater with irrigation. Fine root dry weight was significantly reduced under irrigation with TRI 2023 at 0 - 20 cm and 40 - 60 cm compared to no irrigation.

b. Evaluating Drip and Sprinkler Irrigation Systems for mature tea (TRI 2023) at St Joachim Estate

Stem dry weight was not significantly affected by irrigation method. But a higher weight was recorded with roots > 4 mm in size. Root distribution was also not affected by any irrigation method.

c. Study on burying of prunings and pruning height of different cultivars under soil rehabilitated and non-rehabilitated fields at Concordia Estate, Kandapola

This experiment was initially conducted for testing soil rehabilitation techniques. Later, prunings were buried in order to harvest rainwater 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 cultivar PK2 and the lowest with TRI 2025. There was no significant difference in yield between burying and no burying of prunings. Of the two pruning heights, the highest yield was recorded with 22" height. The experiment was pruned in December.

A 19.2 Evaluating growth and yield responses to different levels and methods of fertigation - Investigation at Sommerset Estate with TRI 2023

Tea was fertilized by broadcasting 360 kg N and fertigating with 240 Kg N/ha/yr over a period of 12 months and it was found that there was no significant difference in yield between treatments (6509 Kg and 6596 Kg of MT/ha/yr respectively). The tea was in the 3rd year of the 3rd cycle.

A 19.4 Rain Water Harvesting Trial – Passara

With 1 mm rainfall, it was estimated that about 65 L of rain water can be collected from 100 sq. m area of the roof at Passara station.

Thrust A20. Development of appropriate mechanical devices and agronomic practices to overcome labour shortage

A 20.3 Modifying harvesting intervals to improve harvesting efficiency

A 20.4 Developing, modifying and evaluating harvesting devices

A 20.5 Modifying bush management systems to improve efficiency of harvesting devices

a. Evaluating tea harvesting machines under two different systems of harvesting at Balangoda Estate, Balangoda

The experimental plots of the previous study were used to test harvesting machines on two cultivars after pruning. Two different mechanical harvesting methods were incorporated in addition to manual harvesting as done at Millakande estate (as indicated below). Hence, the treatments in the new study were: three methods of harvesting (manual harvesting at weekly intervals, harvesting of half of the plucking table by machine at weekly intervals and harvesting the whole plucking table by machine at fortnight intervals) and two cultivars namely TRI 2026 and DG 39. Tea yields recorded from March to December 2010 showed that there were significant yield variations between harvesting treatments as well as between the two cultivars. The made tea yield among different harvesting treatments were 727, 559 and 503 kg/ha, respectively. Tea yield of TRI 2026 and DG 39 were 638 and 554 kg/ha respectively, for the 10 months period.

b. Developing and modifying bush management systems suitable for mechanical harvesting at Galaboda Estate, Ratnapura

Three different bush management (pruning) systems combined with plucking methods (i.e. Manual harvesting after lung pruning at 20", Mechanical harvesting after lung pruning at 20" and Mechanical harvesting after cut-across at 26") were tested. The experimental plots were pruned in July 2010 and tipped as appropriate. Tea yields recorded from January to June 2010 were 1161, 806 and 900 kg/ha for the above treatments respectively. The results showed that tea yield under mechanical harvesting was 20 - 30% less than that of manual harvesting irrespective of different pruning methods tested. Pruning assessments showed that the canopy development (pruning weights) of tea bushes harvested by machines was poorer than that of manually harvested bushes. The experiment is in progress.

c. Evaluating tea harvesting machines under two systems of harvesting at Millakanda Estate

Two harvesting machines (Chinese and Indonesian made) are being tested at Millakande Estate Horana 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 plucking) at weekly intervals. The effects of mechanical harvesting were compared with that of weekly manual

plucking. Assessments on the performance of two machines (fuel use, output and area covered by the machine etc), crop yield and quality of the harvested crop were recorded.

The loss of yield under mechanical harvesting was found to be around 50% in comparison with manual harvesting. The adverse effects of mechanical harvesting and yield decline were comparatively less under half-bush plucking than that under full-bush plucking. The mechanically harvested crop contained about 16 and 27% coarse leaf respectively in half bush harvesting and full bush harvesting, in comparison with 3% coarse leaf in manual harvesting. Mean output of the Chinese and Indonesian made machines was 173 and 189 kg/day respectively. Mean fuel consumption was about 5 l/day for both machines. The experiment is in progress.

d. Evaluation of the best time of pruning of TRI 2025 at different elevations at Nayabedda Estate, Bandarawela

Experimental assessments of this study were completed last year and the experiment was terminated.

e. Effect of Mechanical pruning with and without resting on growth and yield of tea, St. Coombs Estate

This experiment consists of different pruning methods (mechanical pruning with and without resting in comparison with manual pruning). Harvesting and other field practices were continued. Tea yield recorded during the second year of the pruning cycle (January - December 2010) showed no significant difference among different pruning treatments tested. The 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 in made tea after spraying in mature tea lands.

A 24.1 Screening of herbicides

a. No new herbicides were screened during 2009.
b. The feasibility of using of Glyphosate (20%) + Carfentrazone Ethyl (0.5%) [Trigger] Glyphosate (39%) +MCPA (7.5%) [Rapid] Glufosinate Ammonium (15%) [Basta] as an alternative to Paraquat (6.5%) [Paroto] was tested under low, mid and up country conditions.

It was found that Trigger @ 6-8 ml/L (3.3-4.4 L/ha), Rapid@ 8ml/L (4.4 L/ha) and Basta @ 2.34 ml/L (1.3 L/ha) and Paraquat (6.5%) @ 6 ml/l (3.3 L/ha) had given promising control of weeds. Therefore, each of them could be used as an alternative to Paraquat.

c. The final report on screening of Rapid and Trigger has been accepted.

A 24.2 Management of problem weeds in tea

a. A new hard-to-kill weed of family Lilliaceae was reported from Queenstown Estate, Hali Ella and it is yet to be identified.

b. Investigating the possiblility of development of resistance in Thandam pillu (*Crassocephelum crepidiodes*) and Alawangu pillu (*Erigeron sumatrensis*) weeds for glyphosate.

Three glyphosate products 'Round up, Weedol and D-Dash were applied at the rate of 2, 3 and 5 ml/L, respectively on weeds at their tender phase. The two former herbicides recorded a significantly higher weed density and dry weight than D-dash. Highly severe and severe damage on weeds were observed with 5 and 3 ml/L compared to 2 ml/L of glyphosate, irrespective of the product.

In the second study, seeds of both weeds were collected from an estate in Norwood where glyphosate has been regularly used for more than 10 years (R type seeds) and from its adjoining estate where tea was organically managed for more than 10 years (*i.e* without using any herbicide) (Rn type seeds). Similarly, seeds of both weeds were collected from two adjoining fields of tea small holdings in Tismada area where glyphosate has been used (R type) and not used (Rn type) for the last 10 years, respectively. Seeds were germinated in pots and seedlings were treated with two glyphosate products each @ 2, 3 and 5 ml/L. The density and dry weight of C crepidiodes seedlings of Rn type were significantly lower than those of R type plants of which seeds were collected from Norwood area. Both parameters of Rn and R types from Tismada area were comparable. Plants of both types of *E. sumatrensis* collected from both locations were totally controlled by Glyphosate.

A 24.3. Integrated weed management strategies

Feasibility study on the ability of weed suppression and improvement of soil nutrients status with regular mulching with crushed empty fruit bunches (CEFB) of Oil Palm in the Low country.

CEFB (at 5 kg/m2) incorporated with compost (at 1 kg/m2) (T1), refuse tea (at 1kg/ m^2) (T2), 2% urea (T3), and CEFB alone (T4) were tested against Gautemala mulch @ 3 kg//m^2 (T5) in the field by placing on ground as a mulch. Weed density and dry weight were significantly lower in all CEFB mulches than that of Control until 4 Weak After Thatching (WAT). [But, the dry weight was comparable in all treatments except for CEFB alone 8 WAT, whereas it was only with CEFB+compost, CEFB+refuse tea and Control 12 WAT. The ground was exposed by 55%, 48% 40% , 40% and 85%, when mulched with CEFB + compost, CEFB +refuse tea, and CEFB +2% urea, CEFB alone, and with Gautemala, respectively.

The rate of breakdown of CEFB incorporated with various media was also investigated by putting them in perforated bags and laying them on an open ground. Treatments were CEFB @ 900 g/ bag with 2% Urea (T1), Cow dung @ 250 g/bag (T2), Gliricidia @ 100 g/ bag (T3), Refuse tea @ 200 g/bag (T4) and CEFB alone @ 900 g/bag (T5) and Gautemala alone @ 900 g/ bag (Control) (T6). Weight loss of CEFB incorporated with 2% urea, cowdung, gliricidia and refuse tea, CEFB alone and Gautemala, was 48%, 51, 48%, 48%, 46% and 96%, respectively, 12 WAT. CEFB was found to be a better source of mulch for tea when compared with Gautemala in terms of durability in the low-grown tea. It also added more organic carbon and Potassium to the soil and reduced soil erosion.

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

A total of 81 species selected were further short listed to 06 species using plant growth indicators. Derris has been raised in a nursery at Ratnapura. Seed and other planting material of selected plant species are being collected for nursery planting.

A 34.2 Evaluation of growth rate of *Derris microphylla* a leguminoious tree species as a shade tree species at Hemingford Estate, Parakaduwa (2007). An observational trial Growth rate of Derris *i.e.* height of the plant and diameter at the base of the plant were measured from planting until they were 10 months old. The plants showed very slow growth, where the height increment was 7.67 cm/month and increment of the base diameter was only 0.14 cm per month. During 10th to 20th month period after planting however, growth rate was somewhat faster *i.e.* height and diameter were 17.27 cm and 0.27 cm/month, respectively. From 20th month onwards, plants showed the fastest growth rate *i.e.* 25.4 cm and 0.46 cm/month, respectively. The mean plant height at 18th month was 2.5 m and the shade provided on tea was around 40%. This study is in progress.

A 34.2. Effect of shade on shoot growth and yield of mature tea at St Coombs

Artificial shade with nylon nettings at 60% and 30%, no shade and Grevillea shade were used as treatments. The tea yield, rate of shoot growth, tea shoot dry weight per unit area and active and banji shoot percentage were not significantly different between treatments.

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

The objectives of these studies were to identify agronomic practices suitable for cultivation of gliricidia and other trees species as energy plantations and to quantify the biomass yield under different field management systems.

A 42.1 Evaluating agronomic practices of potential fuel wood species in different regions

a. Cultivation of Gliricidia in the Low Country

Two experiments were started in 2007 at St. Joachim Estate, Ratnapura and Raigama Estate, Ingiriya to evaluate different planting spacings (1 x 1 m, 1 x 2 m and 2 x 2 m) of Gliricidia sepium cultivated as energy plantations.

i. St. Joachim Estate

Loppings of branches were done at around 8 month intervals. Results showed that 1 m x 1 m, 1 m x 2 m and 2 m x 2 m spacings (10000, 5000 and 2500 plants per ha) have given dry matter fuel wood (stem) yield of 17.5, 11.1and 6.4 t/ha/ lopping respectively. The dry weights of leafy portions were 3.5, 2.0 and 1.3 t/ ha/lopping, respectively for the same spacings. The mean dry matter content of stem and leafy portions were estimated as 45% and 27% respectively. The experiment is in progress.

ii.Raigama Estate

The experiment commenced in 2007 and casualties were infilled in 2009. In this experiment, dry matter fuelwood (stem) yield of 17.2, 10.4 and 4.9 t/ha/ lopping were recorded under the spacings of 1 m x 1 m, 1 m x 2 m and 2 m x 2 m respectively (10000, 5000 and 2500 plants/ha/lopping). The dry matter leaf yields were 4.50, 2.35 and 1.37 t/ha/lopping respectively for the same spacings. The experiment is in progress.

b. Cultivation of Gliricidia in Mid country at Hantana Station

The experiment compared the production of fuelwood and green matter by Gliricidia at three different spacings *i.e* 1 m x 1 m, 1 m x 2 m and 2 m x 2 m. The trees were lopped in 2010 and loppings were separated as fuelwood and green matter (leaf). The average dry matter yield of fuelwood (stem) was 2.154, 1.693 and 1.016 t/ha/lopping, respectively, for the above spacings and that of green matter leaf yield was 2.497, 1.666 and 1.486 t/ha/lopping. The experiment is in progress.

c. Cultivation of Gliricidia and Cassia spectabilis in Uva

i. TRI, Uva Station, Passara

C. spectabilis was planted in September 2008 at 1 m x 1 m, 1 m x 2 m and 2 m x 2 m spacings. Re-supplying of casualties was done during 2010. Establishment of *C. spectabilis* plants was very poor in the selected block of lands where the soil was marginal, hence testing of the same is planned at Glen Alpin estate along with Gliricidia.

ii.Glen Alpin Estate, Hingurugamuwa

Gliricidia was planted at 1 m x 1 m, 1 m x 2 m and 2 m x 2 m spacings in three replicates in November 2008. Weeding and re-supplying of casualties was carried out in 2010. Second lopping was done in October and dry weight

of fuelwood obtained was 15.7, 12.8 and 7.9 t/ha/lopping for three spacings, respectively. In addition, from the above densities, dry weight of green matter (leaves + tender stems) was recorded as 7.0, 4.6 and 2.5t/ha, respectively. Thus, the highest fuel wood and green matter were produced from the highest density of Gliricidia (1 m x 1 m).

d. Cultivation of Caliandra (*Caliandra calothrysus*) in Up country

Caliandra was planted at 1 m x 1 m, 1 m x 2 m and 2 m x 2 m spacings in three replicates at St. Coombs Estate, Talawakelle in September 2008. The plot size was 48 m^2. Second lopping was done in June 2010 and each density supplied 2.9, 1.86, and 1.32 t dry matter of fueldwood/ha, respectively. The dry weight of green matter supplied from each density was 4.29, 2.93 and 1.9 t/ha, respectively.

Basic Research Projects

B 64. Physiological behavior of the tea root system - Studying physiological behavior of the tea root system under different shade levels

The objective is to understand interactions between the tea root system and rhizosphere. Root windows were installed in the shade experiment at field No 8, St. Coombs Estate, to get undisturbed measurements of the root system. Root dynamics were studied in field-grown tea under different shade levels.

Roots maps were drawn at two weeks intervals, and root growth rate, root regeneration rate and root mortality were measured using root windows.

Results showed that there were no significant differences between different shade levels (60%, 30%, 0% & Gravillea) in terms of root regeneration rate [0.023, 0.058, 0.054 and 0.049 root tips/cm^2/week] and root growth [0.026, 0.578, 0.536 & 0.485]. The study is in progress.

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

Two field experiments for validation purpose (at Ratnapura and Kottawa) were commenced in October, 2010. Several contrasting cultivars in terms of their drought tolerance ability were used. In Kottawa, TRI 2025 and H1/58 were used as drought tolerant cultivars and TRI 2026 and TRI 4006 as drought susceptible cultivars. In Ratnapura, TRI 2023 and TRI 4046 were used as drought susceptible cultivars and TRI 2025, DG 39 and TRI 4049 as drought tolerant cultivars.

These were evaluated using physiological parameters, *i.e.* photosynthesis rate, transpiration rate, stomatal conductance, relative water content, leaf water potential and stomatal density, and biochemical parameters, *i.e.* total soluble sugar content and chlorophyll content. The study is in progress.

The paper was presented at the 221st E & E forum at Talawakelle. A Poster presentation was also made at the 3rd Plantation Crop Research Symposium held in Colombo on 30th September - 1st October 2010.

B 66. Evaluating bio-filmed biofertiliser (BBF) technology for nursery plants

Confirmation study on BBFs was carried out using nursery plants in tea nurseries at TRI Station, Passara (March 2010).

Treatments T65 standard (T1), ½ T65 (T2), F3B + ½ T65 (T3), and PB + ½ T65 (T4) were tested and the soil analysis and growth analysis were recorded at 8 months after planting. F3B: (B: Bacteria isolated from *Arachis pintoii* + Semia + BM + TB1; TB1: Bacteria isolated from tea roots + F3; F3: Fungi isolated from tea roots and PB: Bacteria isolated from Gonakelle Estate, Passara)

Results indicated that the PB + ½ T65 performed well compared to other treatments.

a. Adaptive trials were established at nursery stage at Ratnapura TRI Station (May 2010), Hantana TRI Station (June 2010), Kottawa TRI Station (July 2010) and St. Coombs Estate (Dec.2010) and experiments are in progress.
b. Evaluating BBF technology for organic tea (November, 2009)
   A new experiment was commenced at Stassen Estate, Haldummulla in immature tea (cultivar TRI 3019)

   Treatments were BF (F3A) + Compost (T1), BF (F3B) + Compost (T2), BF (F3A) (T3), BF (F3B) (T4), Compost alone (T5), (T6) Compost (standard) (T6) and the experiment is in progress.

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

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

i. Grafting on quality and productivity of tea at St. Coombs Estate

Scions as high quality and stocks as drought tolerant cultivars were selected and single node cutting from selected scion cultivar has been planted as control treatment. Plants were in 5th year of the 1st cycle. Graft combinations such as TRI 777/ TRI 3019, TRI 777/TRI 3020, TRI 4067/TRI 3020 and TRI 4067/ TRI4053 showed a significantly higher yield in comparison to TRI 777, TRI 4067 and TRI 4079 as 'Control'. The experiment is in progress.

ii. Grafting on high yield and pest and disease resistance

In grafting, Scion was selected from Blister blight and Shot hole borer resistant and high yielding cultivar. Stock characters are high rooting, drought tolerance, resistance to Nematode (*Pratylenchus loosi*), and stem canker.

TRI 3072 on 4006, TRI 3072 on 4053 recorded significantly higher growth performances compared to the control TRI 3072. The graft combinations TRI 4046 and TRI 4046 on TRI 4053 also showing high growth performances than the control TRI 4046, although they are not statistically significant.

After the nursery period, grafted plants were shifted to the field and plucking was undertaken and yield recorded.

iii. Grafting for drought resistance and high yield in Uva region

Objective of this study was to overcome yield declinine caused by drought conditions particularly in Uva region by grafting drought resistant cultivars with high rooting cultivars. The combinations of TRI 3018/DN (T1) - TRI 3019/DN (T2), TRI 4042/ DN (T3), TRI 4046/DN (T4), TRI 4052/DN (T5), were selected for trial. TRI 3018(T6), TRI 3019(T7),TRI 4042(T8), TRI 4046(T9) and TRI 4052(T10) which were used for Scion were the 'Control' treatments.

TRI 4046/ DN and TRI 4052/ DN showed promising results in growth and physiological parameters for drought tolerance at the nursery stage.

iv. Investigation on rejuvenation of seedling tea through grafting at the nursery

The following scion and stock combinations were selected for rejuvenating the seedling tea nursery plants. Stocks were Raigama 4006, Peen 2023 and Reucastle S/06 and scions were TRI 2043, TRI 4006, TRI 4055 and TRI 3015. This experiment was commenced at TRI LCS, Ratnapura in July 2010. Investigations on Rejuvanation of seedling tea nursery plants at St. Coombs are 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 underlying 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

Studies were undertaken in collaboration with the staff of Advisory Division, LCS, Ratnapura. One section was uprooted and planted with grasses. Resting of tea has not yet given any satisfactory results. Some allelopathic effects were detected in severely and moderately affected soils.

b. Allelopathy in tea (*Camellia sinensis* L.)

This study was conducted to determine the presence of allelo chemicals in affected tea soils. Allelo chemicals were extracted from soils around tea bushes using neutral EDTA. *In vitro* bioassays were carried out using lettuce (*Lactuca sativa*) seeds to confirm the presence of allele chemicals in the soil extracts. The responses were evaluated using visual observations on the germination of seeds.

Severely affected field soil had more germination inhibitory compounds compared to moderately and non-affected field soil (5%, 56% and 90%, respectively). Root length and radicle length were also reduced significantly. It is thus evident that some allele chemicals are present in affected tea soils of Meddakanda Estate. The study is in progress.

c. Investigations on Bush Debilitation and yield decline in Deniyaya region
Experiment 1: Evaluation of different soil preparation and amendment techniques to alleviate the bush debilitation problem at Richiland Estate, Deniyaya. There was no specific pest damage or bush debilitation reported following treatment of bushes for Shot-hole borer.

B 88. Evaluating herbicidal effects of different plant extracts

Evaluating aqueous solution of Ginisapu seeds as a natural herbicide
Isolation of chemicals with Hexane was found to be promising, based on the bioassys. Hence, fractionation process is to be continued with Hexan extraction method at the ITI.

B 90. Developing and refining intercropping systems of tea with coconut 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.

Intercropping tea with coconut at St. Joachim Estate, Ratnapura (2009). A demonstration block of Coconut was planted in May/ June 2009 at two spacing 30' x 8' and 40' x 8' and at the recommended spacing of 24' x 24' for comparison. A few coconut seedlings were damaged by wild boar and infilled. Area for tea has been rehabilitated with Mana grass. The study is in progress.

Supportive Divisional Projects

C-MET. Meteorological data were gathered from the met stations of St Coombs, Talawakelle, TRI, LCS, Ratnapura, MCS, Hantana, TRI Uva center, Passara and TRI southern center, Kottawa. A new automated weather station installed by JAICA at TRI station at Deniyaya was removed in mid 2010.

D/Agry. High density planting to develop tea hedges for machine harvesting at St. Clair Estate. A preliminary study

The 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 regular trimming with a machine similar to ornamental hedges.

TRI 4052 cultivar was planted at a spacing of 10.3 m x 12.3 m on 15th October. Plants were closely spaced at 15 cm x 20 cm intervals along the rows and between rows. This gives six times more plants than conventional single row planting. Growth measurements were

undertaken by destructive sampling. Results indicated that middle row plants had deeper root systems with lower vertical distribution. Growth measurements showed that growth of middle row plants were severely affected compared with plants of either side of the middle row. Number of plants per row had been reduced by 33%, compared to the initial plant density.

D/Phys. Effect of spraying K on drought tolerance of Mature Tea (TRI 2023) at Wevessa Estate, Passara

The experiment was repeated in July 2010. Three different K sources at 897.3 g K+, /100 L of water (Potassium sulphate, P. chloride (MOP), P. nitrate); Calcium nitrate and Water were given as foliar sprays at fortnightly intervals. No spray served as the control. Yield was monitored weekly. The rate of transpiration, diffusive resistance, relative water content and the leaf potassium content were measured 7 and 14 days after spraying. Leaf K content was significantly higher in K treated plots than in other treatments. Mean Relative Water Content was significantly higher in potassium and Ca. nitrate treatments and water spray treatments than that of no spray treatment. Transpiration rate was significantly reduced in Potassium and Ca nitrate treatments compared to water spray and no water spray treatments. Unusual weather conditions interrupted the continu-ation of the experiment. Mean monthly rainfall during July and August were 65 and 75 mm respectively.

Effect of spraying K on drought tolerance on Young Tea

A pot trial on spraying of K based chemicals as a measure to mitigate drought effects in young tea at St Coombs, Talawakelle (2010).

The trial was initiated in August with young tea (20 months old) of cultivar TRI 2023. Three different K sources - K2SO4 (T1), KNO3 (T2), KCl (T3), and water only (T4) were foliar sprayed fortnightly as treatments. No Spray (T5) served as the Control. Watering of soils in these pots was stopped after foliar spraying. Another Control treatment (T6) was also included where soils in pots were watered as necessary. It was not possible to gather data due to bad weather conditions. Hence this experiment is to be repeated. Design was an RCB with 4 Replicates, Blocking was done according to the variation of light regime.

Collaborative Projects

Testing of a battery operated plucking machine

A battery operated plucking machine supplied by Messrs Forbes & Walkers (Pvt.) Ltd. was tested at TRI Low Country Station, Ratnapura over a period of six month in collaboration with the faculty of Agriculture, University of Ruhuna. The weight of the machine was about 1.6 kg and the length of the blade was 19 cm. The output of the machine varied from 7.5-11 kg of green leaf/hr. The extent covered by the plucking machine was about 0.13ha/day. Experimental observations showed that manual removal of banjies (dormant shoots) after using the machine is extremely important to minimize adverse impact on tea yield. The made tea yields of experimental plots harvested by the machine with and without manual removal of banjies were 64% and 41% of manual harvesting [(i.e. 2187, 1399 and 3398kg/ ha/yr) respectively. Although, there was no difference in the coarse leaf % of manually and

mechanically harvested crop, it was observed that the % of damaged shoots under machine harvesting was around 25% (by weight).

General

Mr N P S N Bandara left for Adelade University, Australia for the completion of final component of his Ph D degree programme on 30th September

Training programs/ Advisory visits/Exhibitions/ Seminars/ Visitors/Workshops

- All staff actively participated in the 4th Crop Clinic held at LCS, TRI Ratnapura during 5 - 6th October 2010 and second Crop Clinic held at the Deniyaya TRI Station on 7th December, 2010.
- Dr. M A Wijeratne made more than 17 presentations on agronomic practices for Managers, Assistant Managers of plantation companies and smallholders at E & E fora, RSC seminars and workshops organized by the TRI. He also addressed the Dickoya Planters Association general meeting and conducted several field days on plucking, pruning and mechanical harvesting on tea estates. He was also engaged as a resource person in NIPM training programs
- Dr. M A Wijeratne served as an Assistant Commissioner to the Sri Lanka Inventors' Commission and continued as a member of the Faculty Board of Agriculture, University of Ruhuna, and a visiting lecturer of the Uva Wellassa University and Ruhuna Univeristy. He also served as an evaluator/ Judge of symposium presentations organized by the Postgraduate Institute of Agriculture, University of Peradeniya and Faculty of Agriculture, University of Ruhuna.
- Dr. K G Prematilake served as a visiting lecturer of the Uva Wellassa University and as an evaluator/ Judge of the International Symposium of the Faculty of Agriculture, University of Ruhuna.
- Dr. K G Prematilake and Dr. Laxmi De Silva conducted an awareness program on divisional research activities for third year students of Wayamba University on 13th September.
- Dr. K G Prematilake addressed the Managers/Assistant Managers of the Kahawatte Plantations and at Regional Technical & Extension forum in Kandy on Integrated Weed Management, and Soil Fertility Management and seminar and field demonstration at Kottawa on burying of pruning and on safe use of herbicides for field officers and spray gang of Keliwatte Estata, Patana.
- Dr. M S D L De Silva delivered a lecture on "Use of organic fertilizers in tea" for Managers of Kahawatta Plantation PLC on 16th August 2010.
- Mr. N P S N Bandara conducted four field days on different irrigation methods it tea at Urubokka, Sarnia Estate, Hali Ela, Baddegama, Galle and Kande Nuwara, Matale and a seminar on drought mitigation measures for TSHDA officers and Smallholders at TRI Hantana.
- Dr. K G Prematilake, Dr. M A Wijeratne, Dr. Laxmi De Silva and Mrs. L A S P Jayasinghe delivered lectures to NIPM students during December.
- Ms. M M N Damayanthi participated at a workshop on Vector Transfer at the CARP Secretariat, Colombo 07.

- Dr. M S D L De Silva attended a conference on 'Global Climate Change and its Impacts on Agriculture, Forestry and Water in the Tropics' sponsored by the Department of Crop Science, Faculty of Agriculture, University of Perdeniya, in collaboration with the Ministry of Environment and Natural Resources and United Nations Development Program held on 10th-11th September 2010.

Peer-reviewed Publications

- Wijeratne, M A (2009). Agronomic practices towards enhancement of tea quality: A way forward to combat high cost of production. J N.I.P.M. 23 (2): 25-27.
- Amarathunga, M K S L D and Wijeratne, M A (2009). Effect of variation of some of the ecological factors on sustainable productivity of Ceylon tea. J.N.I.P.M. 23 (2): 28-35.
- Amaraweera, U, Wijeratne, M A and Palihakkara, I R (2010). Effect of methods of plucking, resting and potassium nutrition on root starch reserves of tea in low country. Proc. International Symposium: Sustainable Agriculture for Prosperity. Faculty of Agriculture, University of Ruhuna, November 16, 2010
- Jayasinghe, L A S P and Prematilake K G (2010). Evaluation of growth of grafted tea plants in sealed polythene propagator at nursery and performances of stock-scion combinations at the nursery and early stage in the field, A Poster Presentation at the 3rd Plantation Crop Research Symposium held in Colombo during 30th Oct - 1st November.
- Damayanthi, M M N, Mohotti A J and Nissanka S P (2010). Physiological responses as a tool for screening for cultivars for drought tolerance: An investigation with nursery tea. A Poster Presentation at the 3rd Plantation Crop Research Symposium held in Colombo during 30th September -1st October 2010.
- Damayanthi, M M N, Mohotti A J and Nissanka S P (2010). Comparison of tolerant ability of mature, field grown tea cultivars exposed to a drought stress in Passara area. Tropical Agricultural research, volume 22 (1): 66-75pp.
- Damayanthi, M M N, Mohotti A J and Nissanka S P (2010). Use of physiological and biochemical parameters for early screening of tea cultivars for drought tolerence. Proc. of the 221st meeting of E & E Forum, TRI, 30th July.
- M A Wijeratne (2010). Impact of climate change and land degradation on productivity of tea. Proc. of the 221st meeting of E & E Forum, TRI, 30th July.
- Seneviratne, G, Thilakaratne, R M M, Hettiarachchi, L S K, Tennakoon, P L K, Seneviratne, G, Jayasekera, A P D A, De Silva M S D L, Jayasinghe, L A S P and Prematunge E W T P (2009). Bio fertilizers: Preliminary Investigations on tea. 218th Experiments and Extension forum held on 30th January 2010 at Tea Research Institute, Talawakelle. 7-23 pp.
- Seneviratne, G, Thilakaratne, R M M S, Jayasekara, A P D A, Seneviratne, K A C N, Padmathilake, K R E and De Silva, M S D L (2009) Developing beneficial microbial biofilms on roots of non-legumes: A novel biofertilizing technique. In, Khan, M S, Zaidi, A and Musarrat, J (eds.) Microbial Strategies for Crop Improvement. Springer-Verlag, Germany, pp. 51-62.
- Prematilake, K G (in press). Alternatives to Gramoxone, TRI UPDATE, Dec. 2010
- Prematilake, K G (in press). 'Gramoxone sandaha Adeshakayak', Thei Thathu , Dec. 2010

The Report on Soil Quality Index

Dr. K G Prematilake and Dr. G Gunaratne amended two circulars on Drought Mitigation in Tea Plantations Jan, 2001 and Fertilizer Recommendation for mature tea, July 2000 in December. Dr. K G Prematilake drafted and amended two circulars on Soil & moisture conservation in tea lands and Planting of tea in new clearing in September.

Awards

Dr. K G Prematilake received the Commendation Award of the NSF for Popularization of Science for the period of 2005-10, at a ceremony held in Colombo on 12th November.

All Agronomy staff followed a two-day workshop on scientific writing conducted by Prof. A N Jayakody held at TRI Talawakelle during the end of August and early September.

Training

15 training programs for tea small holders and school children were undertaken by the division at Ratnapura.

Training of students

- Two undergraduates of University of Ruhuna and Wayamba joined the Head Office and one joined the Low conutry station to undertake their final year research projects. Thesis completed and submitted to the division by University undergraduates.
- Investigating the development of resistance in Thandam pillu and Alawangu pillu weeds for glyphosate herbicide by Mr W P A S Nawaratne of the Fac. of Agriculture, University of Ruhuna
- Feasibility study on the durability of mulch, ability of weed suppression and improvement of soil nutrients status when mulching young tea with crushed empty fruit bunches of Oil Palm.
- The potential application of biofilm biofertilisers for tea nursery in High grown tea".
- Mr. B C Wijayamunige, Faculty of Agriculture, University of Sabaragamuwa The potential application of biofilm biofertilisers for mature tea in High grown tea".
- Ms. L A T S Wimalasinghe, Faculty of Agriculture, Wayamba University
- Testing of a new battery operated tea harvester in comparison with manual harvesting
- Four students of NAITA, HNDT Agriculture and School of Agriculture were trained at the Head office.
- Seven trainees of Agriculture schools were attached to LCS, Ratnapura and TRI, Head office for training.

Visitors

2nd year students of the Faculty of Animal Science and Export Agriculture, Uva Wellassa University visited the Station for practical sessions in November

Collaborators:

Dr. G Seneviratne, Senior Research Officer, IFS, Kandy for the Project B 66
Dr. S Premakumara, Senior Research Officer, ITI, Colombo for Project B 88

Biochemistry Division

M J Jayasundara

Acting Officer in Charge/ Senior Research Officer

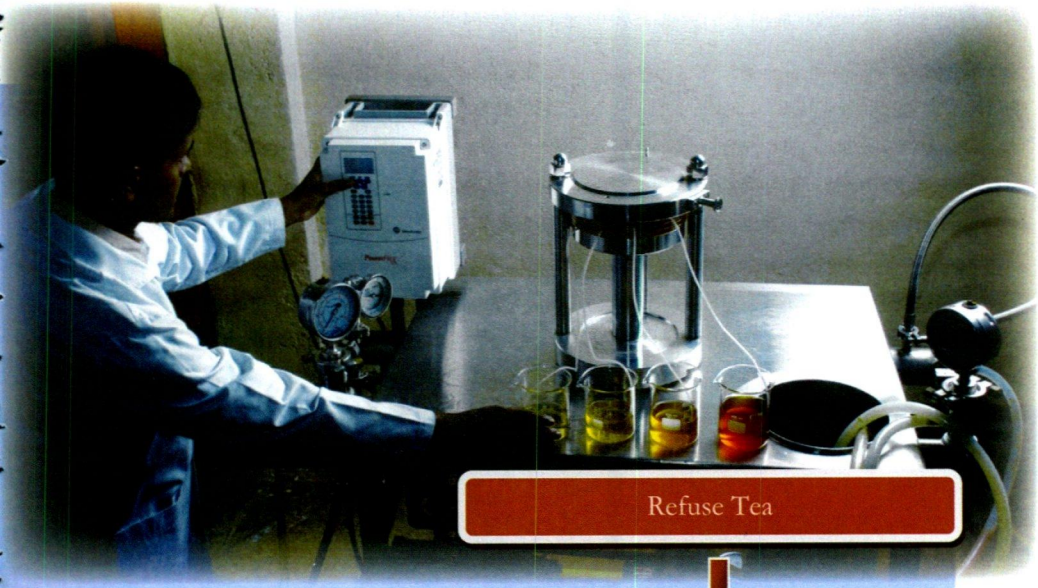
Research Highlights

It is possible to prepare a protein rich feed from spent tea through membrane filtration technique at a cost of Rs. 115 per kg. It includes high level of proteins (24.2%) which consisted of all the essential amino acids, low level of polyphenols (7%), caffeine (0.9%), crude fibre (0.44) as well as 12.3% of total ash.

A new type of white tea was developed using an improved TRI cultivar and is currently being marketed by the St. Coombs Estate, TRI as 'Sri Lankan White Tea: Bud-Plus'

Research Publications

- Punyasiri, P A N, Somasiri, H P P S, Thotawattage, G H, Abeysinghe, I S B and Amarakoon, A M T (2010). L-Theanine Content in Sri Lankan Tea, An Effective Marketing Tool. Proceedings of the Symposium on Molding Chemical Education for National Development in Sri Lanka, 17th June 2010, Mt. Lavinia, Colombo, Sri Lanka, 17-18.
- Abeysinghe, I S B, Punyasiri, P A N, Pradeepa, N H L, Kumar, V. (2010) Preformed and Induced Chemical Resistance of Tea (Camellia sinensis) against Exobasidium vexans infection. Proceedings of the International Symposium on Natural Products, 26th June 2010, Peradeniya, Sri Lanka.
- Kumari, W M S S, Kumara, K L W, Jayasundara, J K K, Mewan K M, Premathilaka and Abeysinghe, D C (2010). Morphological, cultural & molecular differences of Exobasidium vexans Massee causing blister blight disease of tea. Proc. 10th Agric. Res. Symp. (2010), Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), Sri Lanka, 12th – 13th August, 2010. 198-202.
- Gunewardena, L N, Thotawattage G H, Punyasiri, P A N, Abeysinghe, I S B and Abeysinghe C (2010), Improving the quality of Sri Lankan Silver tips and white tea Proceedings of the 10th Symposium of the Wayamba University, 12-13th August 2010.
- Mewan, K M, Priyantha, P G C, Goonatilleke, W A S N T, Abeysinghe, I S B. (2010). Use of molecular Biological Tools in Sri Lankan Tea *(Camellia sinensis* L.) Industry: Achievements and resent Status. Abstracts of Posters. Fifth Asian Biotechnology Conference, 15 - 17 December 2010, Hotel Amaya hills, Kandy. Published by Sri Lanka Council for Agricultural Research Policy, Sri Lanka.



Refuse Tea

Extract with water

Residue (Spent Tea)

Extract

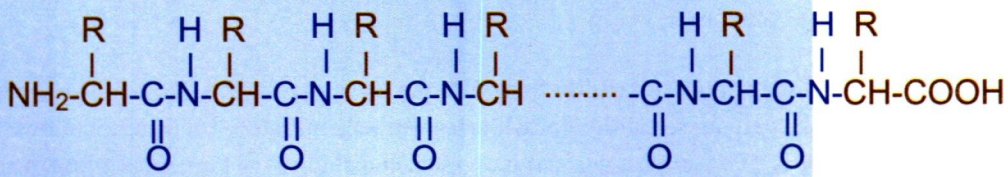
Extract

Extract

Instant Tea Preparation

Membrane Filtration

Protein



Thrust A 30. Development of value-added tea products

A 30.1 Improving the process for instant black tea production - Application of membrane filtration technique for concentration of tea extract

This experiment was carried out to study the possibility of improving the quality of instant black tea by applying membrane filtration technique to concentrate tea extract instead of conventional thermal concentration.

Membranes were screened to select a suitable membrane for concentration of tea extract and operating parameters (pressure and temperature) were optimized for the selected membrane.

A 30.5 Extraction of protein from refuse/ spent tea

Application of membrane filtration techniques in the preparation of protein rich feed from refuse/ spent tea

The experiment on screening of membranes for protein separation was repeated with a set of new membranes and it was found that membrane with 100,000 MWC was the best for the separation of protein from refuse tea/ spent tea.

Feed samples were prepared from refuse tea using selected membranes and under optimized operating parameters. These samples were analyzed for approximate composition and amino acid composition. Preliminary economic assessment was done to work out the cost of production of feed.

Purified feed contained 24% protein, 12% total ash, 0.4% ether extract, 0.4% crude fiber and 7% polyphenols. It also contained all essential amino acid except Threonine.

Basic Research Projects

B 16. Identification of parameters in green leaf to predict black tea quality

The ability to predict made tea quality in black tea, 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 polyphenol, amino acids, individual catechins, flavor profiles, chloroform test 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 polyphenols (TF, TR),flavor profiles, total polyphenols, amino acids, individual catechins and tea tasting for the organoleptic properties. This study was carried out during the wet season. Analysis of data is in progress.

Identification of cultivar suitability for white tea

Evaluation of tea cultivar suitability for white tea has been initiated. Total anthocyanins, total polyphenols, total amino acids and individual catechins have been determined for the selected cultivars. A new white tea type was developed using of bud + first leaf of

TRI 2043. This product is now marketed by St.Coombs Estate as "St. Coombs Bud Plus".

B 18. Use of DNA markers for molecular characterization of tea - Genetic diversity and conservation

Screening of seedling populations using SSR markers to identify diverse individuals

The objective of this study is to identify genetically diverse individuals within old seedling tea population to be used as progenitors towards better selection and widening of the tea gene pool. The collection of green leaf samples from seedling tea bushes from pre-selected estates in the up country wet zone (WU – WU1, WU2a, WU2b and WU3) is in progress.The collection of samples from old seedling tea bushes selected from St. Coombs Estate, TRISL and from improved tea cultivars, which will be used as standards to compare genetic diversity values is completed. DNA was isolated from these samples and pre-screened with SSR primers. Genotyping of St. Coombs seedling and improved cultivars, using SSR primers was commenced. This work is in progress.

Analysis of parentage of tea cultivars

The primary objective of this study is to confirm parentages of tea cultivars using simple sequence repeat polymorphic markers (SSRPs). It will also generate additional information to tea breeders 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 progenitors. Initially 56 tea accessions were selected for the study and it was planned to to be carried out in two phases. The first phase of the study, which included 28 cultivars, was completed and the results confirmed origins and parentage of most of the cultivars. The 2nd phase of the study which includes 28 cultivars is in progress.

Use of SSR markers for genetic characterization and finger-printing of recommended tea cultivars and for tagging blister blight disease resistance in tea

As a world leading producer with a considerable amount of un-tapped genetic resources, assessment of genetic variability of tea cultivars is one of the fundamental steps required towards identification of diverse individuals, prioritizing parents in breeding programs, planning of efficient conservation strategies and effective utilization of germplasm *etc*. Therefore, application of comparatively rapid and precise system, such as DNA markers, will generate a gamut of information which will be very useful to tea breeders to enhance tea breeding programs. In addition, as a predominantly out-breeding perennial, application of marker assisted selection (MAS) will be of paramount importance to improve efficiency of tea breeding programs.

This proposal was forwarded to NRC and accepted for funding commencing from 15th Nov 2010 for a period of 3 years. Accordingly, an action plan for the project is already prepared. The list of cultivars that are to be studied in the project is also prepared and collection of literature on selected cultivars is in progress. Collection of leaf sample will be commenced soon.

QTL mapping and marker assisted tea breeding

Use of marker assisted breeding (MAB), which will be of immense importance to tea breeders to enhance effectiveness and efficiency of existing cultivar improvement program is the long term objective of the project. To achieve this objective several projects have been formulated and are now in progress.

Construction of frame-work map for tea

Towards construction of a frame-work map for tea, re-scoring genotyping of data generated by genomic and EST SSRs for F1 mapping population is in progress.

Morphological characterization of F1 population of TRI 2043 x TRI 2023

As a part of the QTL mapping project, characterization of F1 population using 14 morphological characters was completed. Arranging and tabulation of these data is also completed. Further work is in progress to develop a data base for F1 population using morphological characters.

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

The chemical characterization of the F1 population is completed and data analysis is in progress.

Establishment of chemical profiles for Blister Blight (BB) susceptible and tolerant cultivars

The objective of this study is to establish chemical profiles (total catechins and individual catechins levels) for BB susceptible and tolerant cultivars using 20 Blister Blight (BB) susceptible and tolerant tea cultivars. HPLC analysis was completed for the leaf samples collected during the dry season and data analysis is in progress. HPLC analysis of the samples collected during the wet season is in progress.

Field assessments for BB disease resistance and mapping of QTLs responsible for BB resistance in tea

The objective of this study is to identify and locate QTLs responsible for BB resistance in the tea frame-work map. Field assessments were carried out from 2007 to identify BB susceptible and tolerant individuals using F1 population (300 plants of TRI 2043 x TRI 2023) segregating for BB disease resistance. The assessment was completed and analysis of data is in progress.

Development of a database for F1 population segregating for BB disease resistant

Development of a database using morphological, biochemical, BB field assessment data and corresponding climatologic data for the individuals of F1 population segregating for BB disease resistance, is also in progress.

Duplication of mapping population

The F1 population segregating for BB disease tolerance was subjected to pruning and arrangements have been made to establish approx. 6000 nursery plants (15 cuttings/ individual) at a central nursery in St. Coombs Estate.

Molecular Plant Pathology

Assessment of molecular differences of Exobasidium vexans Massee causing blister blight disease of tea

This is a collaborative work with the Plant Pathology Division. The objective of the work is to study the genetic diversity of the fungal pathogen Exobasidium vexans using DNA markers. A RAPD based preliminary study was carried out using 11 fungal isolates collected from several tea cultivars in different locations to evaluate the suitability of RAPD technique for the study. Conditions to extract sufficient quantity of high quality fungal DNA from the spores of the fungi was established. RAPD-PCR technique was also established. According to the results of the preliminary study, fungal spore isolates collected from different tea cultivars and from different locations demonstrated considerable degree of genetic diversity within and between isolates; suggesting a comprehensive RAPD based study using more number of isolates representing diverse tea cultivars as well as different locations. Therefore, a new project was initiated, which includes 40 fungal isolates representing 8 geographically diverse *E. vexans* populations. The project is in progress.

B 19. Establishment of biological effects of tea

New experiment - Determination of antioxidant capacity with DPPH (2, 2-diphenyl-1-picrylhydrazyl), TEAC, (Trolox equivalent antioxidant capacity), FRAP (Ferric reducing antioxidant power) and ORAC (Oxygen radical absorbance capacity) assays

Determination of antioxidant capacity of tea by using four assays DPPH, FRAP, TEAC and ORAC. Only the DPPH assay has been used to determine the anti oxidant capacity. But there should be the data expressed based on other assays, (at least one) in publishing data. Therefore it is important to establish three other assays in the Biochemistry Division to be used in future studies. FRAP assay method was tested for the first time using existing resources. It needs less time than the DPPH and the chemicals and reagents used are not hazardous. It is expected to conduct TEAC and ORAC assays when the resources required are available. It is planned to carry out both TEAC and ORAC assays in the near future.

D 30. Development of standards for tea

Development of multi residue methods for the analysis of pesticide residue in tea

The S19/E9 method from the German protocol was evaluated and adopted for 4 fungicides namely hexaconazole, propiconazole, tebuconazole and bitertanol. The confirmation and quantification was done by using Gas Chromatography-Mass Spectrometry (GC-MS).

Determination of 2,4-D and MCPA simultaneously with derivatization- GC/ECD

This method was studied to optimize the analysis of 2,4-D and MCPA. The recovery studies for 2,4-D in made tea was poor using this derivatization method. As soon as boron tri fluoride is received as the derivatization reagent work will be continued.

A database for L-Theanine and other amino acids in Sri Lankan black tea
Method for the determination of L-Theanine was optimized and validated in collaboration with Industrial Technology Institute, Colombo. In Phase-1, the Sri Lankan black tea, green tea, white tea and teas from other countries were analysed for their L-Theanine content. In the Phase-2, it is planned to analyse L-Theanine content in tea cultivars.

Inter-laboratory testing programs
TRI participated in the inter-laboratory ring test for Theanine which was organized by the International Organization for Standards.

Quantification of micro nutrients in black tea brew from different regions of Sri Lanka
This project was successfully completed in collaboration with Soil and Plant Nutrition Division. Micro nutrients Ca, Mg, Zn, Cu, Fe, Mn, N, P, Al, Na and K were analysed. (The samples were collected from Nuwara Eliya, Udapusselawa, Dimbula, Bogawantalawa, Malwatte Valley, Bandarawela, Mid Country and Low country). It was found that N, P and Mg content were not significantly different while Zn, Na, K, Mn, Cu, Al and Ca were significantly different among up country, uva, mid and low country. Variation of Fe content in the tea brew was observed to be highly significant between main regions and sub regions.

Chemical characterisation of Sri Lankan tea in different agro climatic regions
This project is completed and the results reiterated that cultivar, environmental factors and manufacturing conditions influence the final composition of the infusion. Total polyphenols, individual catechins, caffeine and theanine content of selected regional teas were analysed.

According to the results of the above study, Low country tea showed the highest amount of total polyphenols, theflavins, caffeine and total catechins. These variations could mainly be due to the climate and manufacturing process. Further studies with more samples would be needed to ascertain the outcome of this study.

Determination of individual Theaflavins using HPLC
A HPLC method was used to quantify the four main theaflavins (Theaflavin, Theaflavin-3-gallate, Theaflavin-3'-gallte and Theaflavin-3, 3'-gallate). The authentic standards of these compounds were a kind gift from Professor. Larkin Liu, Department of Tea Science, University of Hunan, China.

Awards and Recognitions

- A paper on "Quantification of L-Theanine in Sri Lankan black and green tea using high performance liquid chromatography" by Punyasiri, P A N, Somasiri, H P P S, Thotawattage, G H, Abeysinghe, I S B and Amarakoon, A M T was selected as the best paper presentation and awarded a gold medal at the 3rd Symposium on Plantation Crop Research, 30th September - 1st October, 2010.
- A paper on "Application of membrane filtration technique in the preparation of protein rich feed from spent tea" by Perera, G A A R, Amarakoon, A M T, Illeperuma, D C K, Mannaperuma, Jatal, D, Muthukumarana, P K P and Bandara, H M S, was selected as the best paper presentation in the tea sector and awarded a silver medal at the 3rd Symposium on Plantation Crop Research, 30th September -1st October, 2010.
- Dr. P A N Punyasiri received presidential awards based on peer-reviewed publications.
- The National Research Council of Sri Lanka awarded a grant of Rs. 4.4 million to conduct a project on "Use of SSR markers for genetic characterization and fingerprinting of recommended tea cultivars and for tagging of blister blight disease resistance in tea". Mr. K M Mewan is the principal investigator of this project.

Visitors

- A group of students from University of California – Davis, USA visited the Division, and this was organized by the Agricultural Education Unit of the University of Peradeniya on 19th July 2010.
- Mr. Elke Christophe Behre from Germany underwent a training programme in the Division on 2nd December 2010.

Collaborators

- Prof. E. Karunanayake, Institute of Biochemistry, Molecular Biology and Biotechnology (IBMBB), University of Colombo, on Use of DNA markers for molecular characterization of tea.
- Mr. J M D T Everard, Deputy Director Research, Coconut Research Institute, Lunuwila on Use of DNA markers for molecular characterization of tea.
- Dr. (Mrs.) T L S Tirimanne, Faculty of Science, University of Colombo on Use of DNA markers for molecular characterization of tea.
- Dr. Lalith Perera, Head, Plant Breeding Division, Coconut Research Institute, Lunuwila on QTL mapping
- Dr. (Mrs) C. Perera, Senior Research Officer, Plant Breeding Division, Coconut Research Institute, Lunuwila on QTL mapping.
- Dr. O V D S J Weerasena, Institute of Biochemistry, Molecular Biology and Biotechnology (IBMBB), University of Colombo on NRC project 09-66 'Use of SSR markers for genetic characterization and fingerprinting of recommended tea cultivars and for tagging of blister blight disease resistance in tea".
- Mr. Chaminda Oliver, Superintendent, St. Coombs Estate, Talawakelle.

Staff news

- Mr. P K P Muthukumarana participated in the "Deyata Kirula Exhibition" from 4th to 10th February, 2010, at Pallekelle, Kandy.
- Ms. M J Jayasundara and Dr. P A N Punyasiri attended a seminar on Advanced Mass Spectrometry, organized by Techno Instruments (Pvt) Ltd. Colombo, on 10th March 2010. at Galadari Hotel, Colombo.
- Ms. G H Thotawattage attended a workshop on Bioassays for natural products research, organized by Institute of Fundamental Studies, Kandy from 25th to 26th March 2010.
- Mr. K M Mevan attended a workshop on Fundamentals of Bioinformatics organized by Wayamba University of Sri Lanka, Makandura from 29th to 30th April 2010.
- Ms. M J Jayasundara and Dr. P A N Punyasiri attended a workshop on the importance and benefits of GC-MS for the analysis of residues in food, land and environmental applications, organized by Analytical Instruments (Pvt) Ltd, Colombo on 5th May 2010.
- Mr. K M Mewan attended the 10th Agricultural Symposium, Wayamba University of Sri Lanka, Makandura, 12th – 13th August, 2010.
- Mr H N S B Heenkenda attended a workshop on "Radiation safety in using radioisotopes for research and industrial applications" organized by Atomic Energy Authority from 17th - 20th August 2010.
- Mr. G A A R Perera attended a workshop on "Biosafety: risk assessment and management of genetically modified organisms, Food, Feed and Processed Products" organized by Postgraduate Institute of Agriculture, Peradeniya from 7th to 9th September 2010.
- Ms. G H Thotawattge underwent a training programme on botanical extract processing technology in Hunan Agricultural University, Changsha, China from 7th September to 26th September.
- Ms. M J Jayasundara, Mr. G A A R Perera and Mr. P K P Muthukumarana participated in the "Crop Clinic" held at Low Country Station, Ratnapura from 5th - 6th October, 2010.
- Mr. K M Mevan attended a workshop on "Research conducted on vector transmission studies in the agricultural crop sector" organized by Sri Lanka Council for Agricultural Research Policy Secretariat, on 30th November 2010.
- Mr. P K P Muthukumarana participated in the "Crop Clinic" held at Deniyaya station on 7th December.
- Ms. M J Jayasundara, Mr. K M Mevan, Mr. G A A R Perera, Dr. P A N Punyasiri, Ms. G H Thotawattage and Mr. P K P Muthukumarana attended the 3rd Symposium on Plantation Crop Research.

Communications and Presentations

- Mr. G A A R Perera, delivered a talk on technology transfer programme on "Flavoured Tea and Herbal Tea" on the 8th December 2010, at Industrial Development Board, Moratuwa.
- Mr. K M Mewan presented a poster titled 'Use of molecular Biological Tools in Sri Lankan Tea (*Camellia sinensis* L.) Industry: Achievements and Present Status to the 5th Asian Biotechnology Conference, 15th - 17th December 2010, Hotel Amaya Hills, Kandy organized by Sri Lanka Council for Agricultural Research Policy, Sri Lanka.

- Dr. P A N Punyasiri delivered a guest lecture titled Chemistry of Tea Manufacture at the Department of Chemistry, University of Sri Jayewardenepura on invitation.
- Dr. P A N Punyasiri carried out a presentation on "Health promoting effects of tea" at the John Keels Holdings.
- Mr. G A A R Perera delivered the lectures on "Principals of tea manufacture, Tea product diversification, Value addition and market trends" at the 13th programme of NIPM.

Peer-reviewed publications

- Mewan, K M, Saha, M C, Pang, Y, Abeysinghe, I S B and Dixon R A (2009) Construction of a genomic and EST Simple Sequence Repeats (SSRs) based genetic linkage map of tea (*Camellia sinensis* L.). S.L.J. Tea Sci, 74(1), 09-18.
- Ananthacumaraswamy, S, Hettiarachchi, L S K, Jayasundara, M J and Abeysinghe, I S B (2008) Effect of long term application of urea and sulphate of Ammonia on soil acidity, soil and plant sulphur status, yield and processed black tea quality. S.L.J.Tea Sci.73 (2), 74-89, 2008.

Trainees

- Mr. K Pradeepkumar a trainee student from University of Peradeniya carried out his industrial training research project from 4th January to 18th May 2010.
- Mr. P G T Chamara a trainee student from University of Uva Wellassa carried out his industrial training research project from 9th February to 5th July 2010.
- Mr. Y I G M Gayan Rangana a trainee student from Institute of Hardy, Ampara, carried out his industrial training research project from 9th February to 5th July 2010.
- Ms. L N Gunawardana a trainee student from, University of Wayamba, Makandura, carried out her industrial training research project from 9th March to 22nd July 2010.
- Mr. W G N Jayaratna, a trainee student from University of Peradeniya, carried out his project from 20th April to 21st June 2010. This was a collaboration project with the Soil and Plant Nutrition Division.
- Ms. D T D Kondasinghe a trainee student from University of Peradeniya, carried out her industrial training research project from 5th July to 13th August 2010.
- Mr. N B W P Sandaruwan a trainee student from University of Sri Jayewardenepura carried out his industrial training research project from 21st July to 27th August 2010.
- Ms. G I Kumari, an undergraduate from University of Kelaniya, completed her project in the Biochemistry Division.
- Mr. M L Kumara Mudiyanse a trainee from Technical College, Dambulla carried out his training from 16th August 2010 to 24th December 2010.
- Ms. W K V L Perera a trainee student from University of Kelaniya carried out her industrial training research project for six weeks from 11th October 2010.
- Ms. W M S S Kumari, a trainee student from University Wayamba, Makandura carried out part of her research project in the Biochemistry Division.
- Mr. Amila Premathilaka, a graduate from University of Colombo continued his research training in the Biochemistry Division.
- Ms. Thakshila, a trainee from Technical College, Dambulla is continuing a part of her project in the Biochemistry Division

Entomology and Nematology Division

Dr K M Mohotti
B Sc (Peradeniya, Sri Lanka), Ph D (Reading, UK), C. Biol. (Sri Lanka)
Head/ Senior Research Officer

Research and Divisional Highlights

- Provision of 24 nematode (Pratylenchus loosi) tolerant cultivars for Up country and Uva regions.
- Speeding up of experimentations through perfection of mass culturing methodology of shot hole borer on artificial diets.
- Early screening of cultivars and control treatments against shot hole borer with the perfected laboratory bioassay technique.

Academic Awards

- Dr. K Mohotti received a Presidential Award for research on Environmental medicine aspects in relation to organic tea cultivation in Sri Lanka quoted in citation index 2006.
- Mrs. P G D S Amarasena was awarded the best student presentation at the Session on Plant Protection of the Post Graduate Institute Agriculture held in November 2010.

Publications

- Mohotti, K M, Priyadarshani, K C, Amarasena, P G D S, and Nugaliyadda, L (2010). Potential Use of Soil Organic Amendments for the Management of Up country Live-wood Termites. Proceedings of the Third Symposium on Plantation Crop Research, 276-285.
- Amarasena, P G D S, Mohotti, K M and Ahangama, D (2010). A Locally Isolated Entomopathogenic Fungus to Control Tea Red Spider Mites (Oligonychus coffeae acarina -tetranychidae) – A preliminary laboratory results. Abstracts of the Twenty Second Annual Congress of the Postgraduate Institute of Agriculture, Peradeniya, Sri Lanka, 24.

Shot-hole Borer

One week

Assessment of
nibbled points

Assessment of
total galleries

Thrust A 22. 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

Efficacy of locally available materials against SHB attack

Location: Field No. 3B, Wirawa Estate, Dolosbage (Cultivar: TRI 2025, Last pruned January 2009).

Periodic assessments of shot-hole borer damage after spaying of the two by-products from Nakiyadeniya Palm oil factory, two natural adhesives proved to be effective in organic tea cultivation (Project A 32.3) and fenthion as standard and the untreated control were continued. This experiment is in progress.

Evaluation of natural protectants for control of shot-hole borer (*Xyleborus fornicatus* Eichhoff) in tea

The stem protectants of natural origin having herbal base pesticidal properties were tested under conventional tea growing systems to minimize SHB damage. Studies were carried out on a newly developed olfactometry model using laboratory bred SHB virgin females.

For preliminary bioassays, Neem oil based paint (NO), Dorana oil based paint (DT), Oil palm waste with oil (OP+O), Oil palm waste without oil (OP-O) and Lime – sulfur aqueous solution (LS) were used. Also, the studies were furthered for scientific validation of tea stem protection against SHB.

The thickness of protective stem cover was found to be immaterial and single layer of protectants were adequate to protect the tea stems from the SHB beetle.

Among the treatments, NO showed the lowest mean count of nibble points (0.833) and the highest drop of the damage incidence (76.36%) than other protectants and untreated control. NO proved to be the protectant with insecticidal properties of both contact and repellent actions than other natural protectants.

Field testing of the treatments against SHB was conducted at Haputale Estate (Uva), Weerawa Estate (Mid country) and Hapugastenna Estate (Low country). Results were comparable with bioassays.

Post-treatment pest assessments were carried out monthly. Significant stem protection by SHB was evident in NO, OP and LS over Fenthion which are to be retested for confirmation.

To test the efficacy of locally available adhesive materials against SHB attack
Field No. 7, Haputale Division, Haputale Estate, Haputale (Cultivar: TRI 2025, Last pruned 2009 March).
Treatments: Two by-products from Nakiyadeniya Palm oil factory, two natural adhesives (Resulted in Project A 32.3), Fenthion as standard and the untreated control; 50-55 bushes/plot in 3 replicates.

Pre-treatment pest assessment and chemical treatment were carried out. This experiment is in progress.

To test the efficacy of locally available adhesive materials against SHB attack
Field No. 2, LAT Division, Hapugastenne Estate, Ratnapura (Cultivar: TRI 2026, Last pruned March, 2009).

Treatments: Two by-products from Nakiyadeniya Palm oil factory, two natural adhesives (Resulted in Project A 32.3), fenthion as standard and the untreated control; 50-55 bushes/plot in 3 replicates.

Pre-treatment pest assessment, chemical treatment and one post treatment pest assessment were carried out. This experiment is in progress.

To test the efficacy of soil treatments against SHB attack
Field No. 3B, Wirawa Estate, Kurunduwatte (Cultivar: TRI 2025, Last prune 2009 January). Treatments: Furadan @ 10g/ bush, Neem oil cake 500g/bush and the untreated control; 50-55 bushes/plot in 6 replicates.

Pre-treatment assessment and chemical treatment was carried out. This experiment is in progress.

To test the efficacy of locally available adhesive materials against SHB attack
Field No. 3B, Wirawa Estate, Kurunduwatte.

Two Post-treatment assessments were carried out during the period under review. This experiment is in progress.

Testing efficacy of soil treatments against SHB
Location: Wirawa Estate, Kurunduwatte.
Furadan @ 10g/ bush, Neem oil cake @500g/bush and untreated control were tested in a shot-hole borer infested field following pruning in order to study the effect of soil trements on resident SHB population in immature tea.

Two post-treatment assessments were carried out during the period under review. This experiment is in progress.

A 22.3 Evaluating plant species as diversionary hosts for SHB

Using the new laboratory bioassay technique, Montanoa and Queen of the Night were screened for host status of shot-hole borer. Live and semi dried wood of Montanoa proved to be a non-host of SHB while TRI 2025 and Queen of the Night attracted SHB beetles.

As per Indian practice, semi dried wood of Montanoa was placed in fields with high SHB pressure. However, none of the stems attracted SHB except a few wood borer species. Trials were repeated with different placement positions of sticks and placing bundles of Montonoa stems at two heights. As there was no evidence of SHB attraction/infestation, the Indian experience would perhaps be effectivewith the Indian SHB species.

As Queen of the Night was found to be as good a host as TRI 2025, further work is in progress to study the brood development and damage levels *etc.*

Thrust A 32. Development of sustainable organic farming systems for tea

A 32.2 Evaluating crop responses to organic amendments

Sustainability of tea during 'The Conversion Period of Organic Tea' under mid-country conditions

Location: Geragama Division, Geragama Estate, Pilimathalawa.

Results on comparative monitoring of growth and environmental indicators under organic, integrated and conventional crop management systems revealed insignificant differences in the yield of tea. Physiological and growth parameters of tea under different tea growing systems continued and need to be repeat for confirmation purpose. The experiment is in progress.

A 32.3 Evaluating and managing pests, disease and weed incidence

Central Biological Control Laboratory

Rearing of insect, mite and nematode biocontrol agents in the Central Biological Control Laboratory in Talawakelle was continued. During the period under review, Beuvaria bassiana and an unidentified entomopathogenic fungal isolate for mites were maintained.

Pest, disease and weed incidences and natural pest balance mechanisms in TRIORCON and BIDORCON trials established at Talawakele and Geragama under different systems were periodically monitored. The experiment is in progress.

Elemental sulphur to ameliorate organic and biodynamic tea soils

Productivity of organic tea lands is reported to be limited owing to many reasons i.e. land selection, age and health of tea, management status etc. Continuous application of organic materials including various oil cakes and incorrect use of manures has resulted in higher soil pH than optimum range (4.5 -5.5). However, organic and biodynamic tea fields showed increasing levels of pH > 6.0.

An experiment was therefore conducted to ameliorate organic tea soils using elemental sulphur. Additionally, non target effects of elemental sulphur on soil microbial activity and phyto-toxic effects were also evaluated.

All rates of elemental sulphur (200, 300, and 500 g/m^3 of soil) reduced the soil pH significantly ($P > 0.0001$) over control. The same trend was observed in conventional tea soils as well. Further, none of the doses of elemental sulphur caused any non target effect on the soil microbial activity nor phyto toxic effect on plant performance over control. Elemental sulphur at 300 g/m^3 of soil basis was identified as economically feasible treatment for reducing soil pH to optimal range. For practical feasibility and human and environmental safety, mixing sulphur with compost would be ideal.

Thrust A 45. 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

Development of biofumigation Prototype for nematode eradication in tea and potato soils

The study examined three Prototypes developed for soil biofumigation using raddish waste materials for their efficiency of nematode control. The total gas production of Prototype I and Prototype II was 245 ml and 248 ml gas volume whithin six days respectively. The higherst gas production was initiated within 24 hours and gas production rate decreased with time. Prototype I ($P>0.0001$) and Prototype II ($P>0.0002$) showed a significant effect in controlling nematodes both in tea and potato soils. Raddish treated tea soil by Prototype I showed at 97% reduction of nematodes. Mean invasion of nematodes in to roots within a sample of 1g of roots of tea and potato were 0.16 and 1.23 respectively. These results indicated that Prototype I was of higher efficiency in soil biofumigation than Prototype II. Biofumigation reduced CO_2 production in treated soil compared to that of untreated. Raddish treated tea and potato soil using Prototype I and Prototype II showed lower reduction of CO_2 volume. Biofumigation resulted in higher mean seed germination percentage (74 %) than untreated soil (67%). Quantification of gases using raddish showed higher gas production with a mean of 45 ml at 35 ^{0}C than traditional cabbage types. Amongst raddish varieties, Ball raddish showed the highest gas production with a mean of 28ml compared to oil raddish varieties of Boss, Colonal and Defender. The gas production at 35 ^{0}C was higher than under glasshouse conditions.

A 45.2 Evaluating methods for managing nematodes in young tea

Screening of Biofilm formulations against *Radopholus similis*

Preliminary in vitro bioassays and pot experiments on efficacy of Biofilm formulations against *Radopholus similis* were initiated at Hantane.

Screening of Arecanut varieties against *Radopholus similis*
Location: Nematology Experimental Area TRI, Hantana.
Out of the Thirteen (13) varieties of Arecanut screened against *Radopholus similis* only variety O23 was found to be susceptible.

Screening of Coconut varieties against *Radopholus similis*
Location: Nematology Experimental Area, TRI, Hantana.
The two varieties of coconut coded as C 60 and C 65 were being screened against *Radopholus similis.*

Screening of Pepper varieties against *Radopholus similis*
Location: Nematology Experimental Area, TRI, Hantana.
Eight pepper varieties coded as IW 5, MN 1, TG 7, KW 31, MN 18, KW 30, MB 12 and GK 49 were screened for *Radopholus similis.*

A 45.3 Evaluating methods for managing nematodes in mature tea

Evaluation of different species of Lemon grass in lowering P. loosi populations of tea soils
Location: Nematology Experimental Area, Talawakele.
Soil populations of *P. loosi* in soils filled in pots planted to five different species of Lemon grass were monitored periodically under glasshouse conditions. The experiment is in progress.

Demonstration/ model area for integrated management of Radopholus similis in mid Country
Location: Kurugama Estate, Pilimatalawa.
An old tea field in Kurugama Estate with pervious history of *Radopholus similis* infestation was subjected to all TRI recommended GAPs with respect to integrated management of *P. loosi* including grass rehabilitation with mana, planting with a recommended cultivar and other TRI recommended practices.

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.

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 made. It is envisaged to monitor and maintain this area as a demonstration cum model area in close association with the TSHDA staff and tea smallholders in the area.

A 50.1 Effects of global warming on population dynamics of tea pests, natural enemies and their interactions and to understand weather dependent pest incidences and study alterations of pest biology and bionomics due to climate change

To study the correlation of periodic changes in weather parameters with respective pest incidences in the tea ecosystems, pest dynamics in relation to climate change were identified. During the period under review, past literature on biology and behavior of nematodes, shot-hole borer, live-wood termites, tea totrix and mites was surveyed. Reported information in other crop systems was also collected.

Preliminary experimentations were identified to study establishment of climate change effects under controlled conditions, determination of any potential physiological race, pathotype and/ or isolate of tea pests owing to climate change *etc.*

Work on climate change mitigation and environment manipulation with respect to tea pest management and forecasting of unusual pest incidences in tea ecosystems is envisaged for the future.

Basic Research Projects

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

***In- vitro* culturing of SHB**

Laboratory culturing of SHB on artificial diets was perfected in order to use in bio assays. The life cycle stages of SHB under different media were seen progressive. Further work on mass culturing is in progress.

Development of laboratory bioassay techniques for screening of cultivars and control treatments against SHB

Two new laboratory prototype models were fabricated and validations were done.

B 30. Biochemical analysis of roots of tea cultivars

During the period under review, two in-depth studies on biochemical and histopathological parameters of the test cultivars under Project A 1 were carried out and the results are given below.

Evaluation of biochemical parameters in roots of different tea cultivars screened against *Pratylenchus loosi*

The biochemical studies with various chemical compounds have been conducted in view of harnessing better parameters for a short-cut method of cultivar screening against tea nematodes In this study, nematode tolerance/ susceptibility in cultivars on the basis of biochemical factors was tested out using twenty test cultivars and nematode tolerant (DT1, TRI 4052), moderately tolerant (TRI 2025) and susceptible (TRI 2024) cultivars. Root extracts of tea cultivars were analyzed for total polyphenols and total soluble amino acids using colorimetric method. Nematode Index established for each cultivar was correlated with the biochemical parameters.

The results obtained were comparable with that of previous studies, with the total polyphenol of resistant cultivars being higher than susceptible cultivars. The correlation between nematode infestation and root polyphenols and Amino acid was high. The potential harnessing of biochemical parameters studied in screening of tea cultivars against nematode infestation was proved. According to the results obtained, 9, 8 and 3 cultivars could be categorized as tolerant, moderately tolerant and susceptible respectively.

Evaluation of histopathological parameters in roots of different tea cultivars screened against *Pratylenchus loosi*

Location: Nematology Experimental Area, TRI, Talawakele

The studies were carried out to evaluate histopathological changes occuring in tea roots due to infestation by *P. loosi* and to identify the parameters for screening process. Microtome cross sections (10 - 20 µm) of infested and healthy roots were prepared and examined under the microscope to determine the severity of damage. Measurements on thickness of epidermis, cortex, epidermal cell wall, cortical cell wall and diameter of cortical cell were taken. The test cultivars were categorized into different resistant levels by using morphometric and morphological parameters studied.

There was a significant difference in variation in thicknesses of epidermis ($Pr > 0.0001$), cortex ($Pr > 0.0001$), epidermal cell wall ($Pr > 0.005$), cortical cell wall ($Pr > 0.0001$) and cortical cell diameter ($Pr > 0.0001$) of nematode infested roots of test cultivars and those grown under healthy conditions.

Epidermal thickness and cortical cell wall thickness exhibited a relationship with the P.loosi resistant level in the different cultivars. The percentage change in cortical cell wall thickness is found to be the best parameter. Further studies are necessary to validate the histopathological parameters in cultivar screening of tea.

D Ent 2. Management of LCLWT

Screening of prune cut dressings on the protection of prune cuts

Field No. 19, UWK Division, Hapugastenne Estate.

Results of three assessments carried out during the period under review revealed no termite infestation in any of these plots .The experiment is in progress.

Screening of two locally available waste materials as prune cut dressings for LCLWT

Field No .27, Upper Division, Hapugastenne Estate.

Results of three assessments carried out during the period under review revealed no termite infestation in any of these plots .The experiment is in progress.

Use of Light traps to study the colonization patterns of LCLWT. St. Joachim Estate

Two light traps (18 W florescent) were fixed 4 feet and 6 feet above ground level and at a distance of 20 feet apart. Traps were checked daily for trapped swarmers. Traps were kept lit from evening to following day morning. Daily checks were made for any trapped swarmers (winged forms of termites) of *Glyptotermes dilatatus*. This experiment is in progress.

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

For the preliminary study, six termite infested bushes (six replicates) of the susceptible cultivars TRI 2023, TRI 3063 and TRI 4042 and tolerant cultivars TRI 2027, TRI 3025 and TRI 4049 were chosen from St. Joachim Estate. Rotted stumps and the termite colonies were sampled.

Fungal isolation from rotted stems

Nine pieces of rotted tea stems from each of six replicates were cultured in sterilized Potato Dextrose Agar (PDA) plates supplemented with 1% Streptomycin. Three live termites (workers) from six colonies (six bushes) from each cultivar were also cultured on PDA.

Identification of pure cultures is in progress for understanding the role of the fungi in their colonization.

During the period under review, fifteen pure cultures of wood rot fungi were isolated and thirteen isolates were identified using identification keys. Confirmation of the identity of fungi needs to be done.

Eight pure cultures isolated are kept in sterilized distilled water for identification and the role in colonization of termites.

To find out volatile attractant from the rotted stump of tea

Wood rot extracts of TRI 2023 and TRI 2027 and six fungal extracts in ethyl acetate were obtained. The chemical compounds need to be exposed to laboratory bioassays with healthy LCLW termites.

The studies are continued as a component in a Post-Graduate study program at Kelaniya University.

D Ent 1. Identification of safe insecticides, acaricides and designing of IPM methods for control of seasonal pests

Adaptive trials with Lauric Acid (resulted from Project A 32.3) continued in Mid and Low elevations and Uva which resulted in comparable bioefficacy in field.

Flubendaimide and Chromfenozide were tested against tea tortrix, and Flubendaimide showed potential. Hence, the trials need to be repeated.

Screening of Thiochloprid against scavenging termites on young tea at Hatale Estate, Hatale was continued. Termite attack was not seen at the post treatment assessment.

Screening of chemicals against Mites

Field No. 6, LPG Division, Balangoda Estate, Balangoda.

Two concentrations of Milbemectin (1000 and 750 ml/ha), Sulphur as standard and the untreated control; 30-35 bushes/plot in 3 replicates. Two post-treatment mite assessments were carried out. This experiment is in progress.

Screening of chemicals against Tea Tortrix

Field No. 4, DT Division, Drayton Estate, Kotagala.

Treatments: Flubendiamide four concentrations (250,125,100 and 75 ml/ha), Chlofluazeuron as standard and the untreated control; 50-55 bushes/plot in 3 replicates. Reduction in larvae population was seen in all the dosages tested compared to untreated control. This experiment is in progress.

Screening of chemicals against Deniyaya Ant

Location: Smallholder's field at Galdola, Deniyaya.

Treatments: Sulphur @ 100g/sqm; Diazinon @ 10g/sqm; Bleaching powder @ 25g/ sqm; Phostoxin 1 tablet (3g)/sqm and untreated control in 3 replicates.

Diazinon and Sulphur at 10g/sqm and 100g/sqm basis respectively were seen to be effective and were supported by results of laboratory bio assays. The experiment is in progress.

Assessment of White grub infestation in tea fields in different agro ecological regions

Sampling of tea, mana, vetiver and gautemala fields was carried out in Kottawa TRI station, Homodola, Mahagadra and Gahalawila Estates for collection of different white grub specimens. Different species at varying degree of infestation have been found. The species identification and confirmation of host specificity of the collected samples are in progress.

Attack by *Indrabela* on stems/ barks of Gliricidia

Location: Kottawa Station

Indrabela attacked stumps of Gliricidia were collected from the field and placed in boxes. Chemicals were applied to the individual stumps. Final assessment was carried out one week after the application of Chloroflurozon, Imidacloprid, Lime and untreated control.

Service Projects

Project 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 smallholdings, in analyzing soil- and root samples from nurseries and fields. A Nematology analytical laboratory was established at Deniyaya TRI Station.

Number of samples analysed for nematode estimation during the year 2010 is shown in the Table.

Sector	Region	Field	Nursery	Total
Plantations	Up country	83	21	104
	Mid Country			
	Low Country	42		42
	Southern	8	15	23
	Uva	26	12	38
Smallholder	Nuwara Eliya			
	Kandy	7		7
	Ratnapura	3		3
	Deniyaya	14		14
Total		**183**	**48**	**231**

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

Insect pest diagnostic service continued to function at Talawakele, Hantane and Ratnapura and 101 samples from the smallholder, corporate sector and tea exporters were analysed during the period under review.

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.

a. increased incidences of *Pratylenchus loosi* in nurseries, immature and mature tea lands in Up and Low elevations which was associated with unusual yield decline and death of tea in Deniyaya and Balangoda areas,
b. frequent incidences of White Grubs in Udapussellawa, Galle and Dimbula,
c. *Acrophyga* ant incidences in smallholder tea lands in Deniyaya and
d. incidence of Tsunami fly menace in tea factories in Galle.

Technical expertise to control Root knot nematode damage in Guava and Eucalyptus Gall Wasp damage on eucalyptus was rendered.

Eucalyptus Gall Wasp

Eucalyptus is grown as a monoculture. The newly recorded Eucalyptus Gall Wasp and unidentified leaf diseases seem to cause erratic injuries to young growth stages of the

plantations. Hence, the damage will retard establishment, growth and final performance of the tree stand of Eucalyptus.

Presently, although not fully estimated and validated, a significant percentage of vacancies in the field is reported. Any failure in a Eucalyptus plantation or clearing is attributed to dry weather or planting time. It seems that the pest and disease incidences have not been established in general plantation management.

Irrespective of the pest and or disease, the damage is significant as well as economically important in terms of the land value, final output and cost in connection with control methods etc. The spread of the pest and disease incidence is crucial as it appears to have occurred in nurseries as well as young and immature trees. Since different clearings and or blocks of Eucalyptus of different ages could possibly be found in the same vicinity, the chances of transmission of the pest and or disease are greater. Further, biological and cultural control methods pose limitations under practical situations. Control of pest and disease organisms by chemical means would be effective but serious attention should be given towards understanding the potential damage to the surrounding environment and the economically important tea cultivation.

In this respect, a long term and short term control strategies are envisaged giving more weightage for a sustainable management of pests and diseases in Eucalyptus.

Integrated Management of Guava Nematodes

TRI assisted in finding solutions to the outbreak of root knot nematode on guava in different regions in the country. Preventing introduction and spread through use of nematode free planting materials, clean soil/ planting media, containerized nursery seedlings and establishing new orchards in virgin sites etc. were found to be important in curtailing the problem as cultural and physical control methods.

Further, screening Psidium species, local host range studies, awareness and training, nursery hygiene and fumigation and restriction of chemicals and integrated cultural control methods were given as long term approaches towards managing the nematodes in guava under the purview of the Department of Agriculture.

Training

Mrs. P D Senanayake, Experimental Officer continued her 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 Dr. Mrs. Priyani Paranagama of the University of Kelaniya and Dr. K M Mohotti of the TRI.

Positions

- Dr K M Mohotti continued to serve as the Convener/ Secretary of the Institute's Experiments and Extension Forum, as a member of the TRI Pesticide Residue Monitoring Committee, PeTAC and Agro-Chemical and Machinery Screening Committee, as the Vice President of the Institute of Biology, Sri Lanka and Executive Committee Member of the Organic Agriculture Movement (LOAM) and of the SLAAS Environment Committee (Section E), as a member of the Thematic Committee on Alternate Agriculture of the National Science Foundation (NSF), as the chairman of the National Steering Committee of the Global Environment Facility (GEF) of the UNDP on voluntary basis, 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.
- Dr K M Mohotti supervised 5 and 2 undergraduate and postgraduate research projects respectively.

Participation at conferences and seminars

Dr. K Mohotti was a member of the Sri Lankan delegation to participate at the FAO IGG meeting held in Delhi, India.

Training programs

- A seminar on 'Management of Tea Totrix' was conducted for the Planters' Association of Nuwara Eliya at Golf Club, Nuwara Eliya.
- A presentation on "Management of Low Country Livewood Termites" by Dr. K Mohotti at the E & E – Sinhala, held in TRI Low Country Station.
- A presentation on "Safe use of Pesticides" by Dr. K Mohotti at the RSC, held in TRI Low Country Station.
- Divisional staff participated in two Crop clinics held at Deniyaya and Ratnapura, and a mini crop clinic at Deniyaya.
- A practical training on Applied Entomology for final year zoology special degree students, University of Peradeniya.
- Training programme on pest management and nursery fumigation for 20 smallholders from Gemidiriya project, in Ratnapura.
- A practical training on tea cultivation for students from University of California Davis, USA.
- Awareness discussion and exchange of practical needs on implementation of Rain Forest Alliance certification in tea lands with special reference to restricted pesticide use and record keeping were conducted with plantation executives of Kelany Vally Plantations Ltd.
- Two NIPM programs and several awareness programs for plantation companies and smallholders were conducted.

Advisory circulars

During the period under review, the following Advisory Circulars were released with initiations and inputs from the Nematology Staff.

- Protection of Young Tea from Nematodes (No. PM 4)
- Sampling for Nematode Analysis (PM 5)

Plant Breeding Division

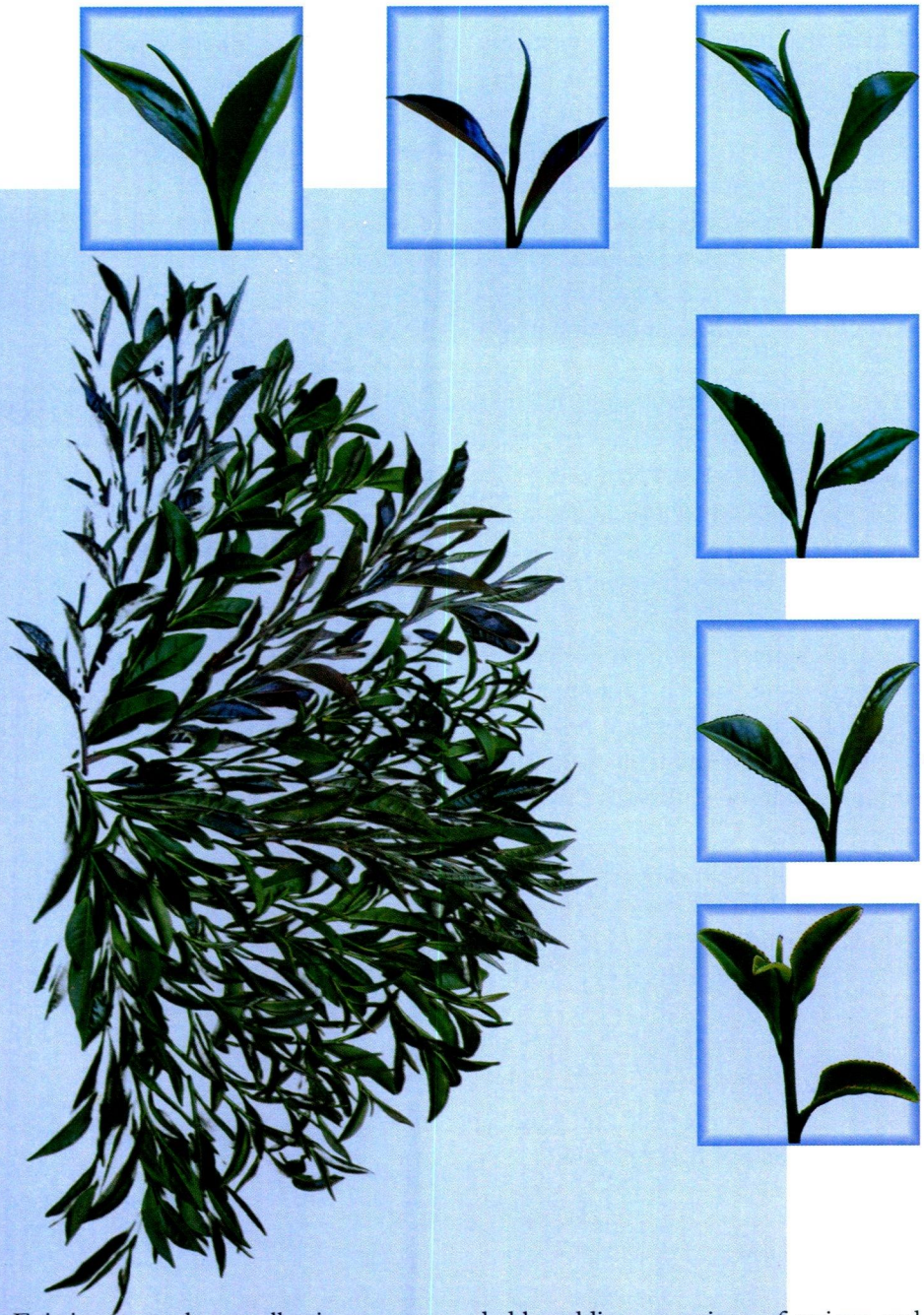
M T K Gunasekare
B Sc Agric. (Ruhuna, Sri Lanka) Ph D (Southampton, UK)
Head/ Senior Research Officer

Research Highlights

The long time (20-25 years) taken to develop new tea cultivars through conventional means is a serious impediment to release new cultivars to the growers. In order to shorten this time, tissue culture plants that were raised through the protocol perfected previously was effectively integrated into the current breeding program. Tissue culture plants were field planted and evaluation has been commenced, aiming to accelerate the release of new tea cultivars in future.

Considering the FAO projection regarding green tea production in 2017 which predict that it is expected to grow at considerably faster rate than black tea, prompted to investigate on tea cultivars that have the potential of making good green tea produce. Available exotic type germplasm was evaluated for their suitability and green tea was processed at small scale while attempting to establish a relationship between morphological, biochemical characteristics related to superior green tea quality.

A wide array of genetically diverse materials that does not represent in the existing germplasm collection was assembled by incorporating special characteristics from distantly related germplasm of exotic origin by adopting non-conventional breeding techniques to create novel plant types to face the future challenges and to cater the ever-changing preferences of the consumer in the global tea market.



Existing germplasm collection was expanded by adding accessions of unique and exotic origin to increase the efficiency of the future breeding programs. Well focused program was initiated to conserve the elite germpalsm aiming to achieve diverse breeding objectives to directly cater the needs of the end-user by developing cultivars that match their needs.

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 is reported under the relevant thrust and project.

The main focus of thrust A1, A 2, A 3, and A 4 was on incorporating desirable attributes, which is not present in the existing high yielding cultivars to increase the grower acceptability. It is also intended to implement an agro-ecology based cultivar recommendation to facilitate growers to choose the best possible cultivars for their specific localities with more confidence. 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 special emphasis on wide and inter-specific hybridization and (4) Systematic characterization and evaluation of germplasm to promote its use in the breeding program

Thrust A 1. 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.

A 1.1 Developing suitable cultivars through hybridization, non-conventional breeding methods and selection.

Controlled hybridization program – Up country

2009 Program

Immature seeds of inter-specific hybrids between TRI 3019 x *Camellia sasanqua* that were propagated *in vitro* were multiplied to get sufficient number of clonal lines (See Project D 1 for details).

Hybrid plants of 2008 Program

104 hybrids generated from the 2008 program together with control, TRI 2025, were planted in Field No. 9, St. Coombs Estate in May in single plant randomization design for progeny evaluation.

Hybrid plants of 2007 Program

Tipping was carried out and plucking and yield recording of individual bushes were commenced in August.

Hybrid plants of 2006 Program

Plucking and yield recording of individual bushes were commenced in July. Planting of vegetatively propagated 57 hybrid accessions of 2006 controlled hybridization program was undertaken in July/ September in field No 13, St. Coombs Estate.

Hybrid plants of 2004 and 2005 Program:
Progenies were pruned in May and propagation of cuttings from 60 selected bushes was done in September. Centering of hybrid VP progenies generated from 2004 and 2005 crosses was carried out in December.

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.

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. Tipping was carried out in observational block of TRI 5000 series at Somerset Estate in April and yield recording was commenced in July.

Three new large-scale adaptive trials were established in collaboration with Glasgow Estate, Agarapatana, Dayagama West, Dayagama and Pedro Estate, Nuwara Eliya in the Up country in May/ June. Using same accessions, a multiplication plot was also established at Glassgow Estate in November.

Nine TRI 5000 series accessions and two control cultivars were propagated in the nursery at Delmar Estate, Udapussellawa to establish a new large scale adaptive trial in 2011.

Nurseries raised using potential TRI 5000 series accessions at Carolina Estate, Watawala and Waltrim Estate, Lindula are being monitored.

Estate Cultivars selection program:
Propagation of cuttings of Pedro, Labukelle and Liddesdale selections were done in September and pruning of bushes of Fairlawn selections planted on Fairlawn Estate was undertaken in September/ October.

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 sufficent to conduct screening in Phase I and II trials located in St Coombs Estate, most of the screening work for SHB was confined to other regions by the Entomology Division.

A 1.4 Screening lines for resistance to Root-lesion Nematode (P. loosi)
Twenty accessions of VP 83 are being screened for nematodes by the Nematology Division.

A 1.5 Screening lines for response to applied nutrients

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 are undertaken together with activities of Project A 4.6 and reported accordingly.

A 1.7 Screening lines for made tea quality

Testing for quality of new materials was carried out during the year under review under the seed thrust (A 5.1).

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.

Germplasm conservation, characterization and evaluation

In 2010, activities related to germplasm have been focused on chemical characterization and also strengthening the collection by adding exotic germplasm and their evaluation, especially to select cultivars suitable for green tea.

26 unique accessions collected from Passara germplasm and some material of Indian origin were added to the gene bank collection in June. Another 19 accessions duplicated from Kottawa and Passara germplasms were also added to the germpalsm collection at Talawakelle in August to ensure safe duplication.

Biochemical characterization of selected germplasm accessions

A research project on biochemical characterization of selected tea gemplasm accessions (40) has been continued in collaboration with Technology Division.

A new experiment was initiated to characterize vegetatively propagated exotic germplasm stocks aiming at utilization in future tea breeding program. Sixty five exotic germplasm accessions were characterized for 31 vegetative traits and 8 floral traits. Resultant analysis enables separating the accessions into morphologically distinct 7 groups and this would provide a reasonable foundation for parental selection in hybridization programs. Biochemical characterization based on parameters such as chlorophyll content, total polyphenols and fermentation rate revealed that there is a considerable variation present in the exotic germplasm collection.

Development of cultivars suitable for green tea manufacturing

A study was initiated to evaluate exotic germplasm collection for their suitability for green tea production in collaboration with St. Coombs Estate. As an initial step, green tea was produced

with exotic accessions and quality was compared with locally available estate cultivar PK2. Evaluations are being continued to identify the promising accessions for green tea manufacturing and to identify relevant morphological and biochemical parameters connected to quality of green tea.

Thrust A 2. 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.

A new trail was established using nine promising accessions selected from the mutation breeding trial to study the second generation performance of mutated materials is in progress.

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

A new large scale adaptive trail of TRI 5000 series was established in collaboration with Greenwood Estate, Nawalapitiya covering WM2 agro ecological region. Nursery plants raised using potential TRI 5000 series accessions at Telbedda Estate, Badulla has been monitored.

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

A 2.4 Screening lines for resistance/tolerance to Root-lesion and Burrowing Nematodes

Materials for screening were issued from the Low country Plant Breeding trials and are reported under A 4.4.

A 2.5 and **Project A 2.6** are pursued under Projects A 1.5 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 A 3. 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
Phase 1 and II trails were handed over to the TRI Station, Passara after completing yield recording for two cycles.

Ten potential cultivars of TRI 5000 series are under evaluation in five locations in Uva region at various growth stages.

First cycle yield recording has been continued in TRI 5000 series adaptive trials at TRI, Passara and Glen Alpine Estate, Badulla. First cycle yield recording was started and has been continued in the trial at Craig Estate, Bandarawela. Two new large scale adaptive trials of TRI 5000 series were established in collaboration with Haputale Estate, Haputale and Verellapathana Estate, Madulsima representing IU3b and IU2 agro ecological regions respectively.

A 3.4 Screening lines for resistance/tolerance to Root-lesion and Burrowing Nematodes
Shoots from accessions (No. 21, 22, 497, 43, 53, 225 and Control - TRI 2025) that were issued in May/ June 2009 are being screened by the Entomology Division at TRI, Passara and results are pending.

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

3.7 Screening lines for made tea quality
Made tea quality assessment of potential TRI 5000 series cultivars grown in Uva region was commenced.

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 A 4. 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

Evaluation of Accessions: PHASE I & II
49 Promising accessions selected from phase I (LVP 84) and II (LVP 80, 81, 82 and 86) trials were planted in Field No. 2 St. Joachim Estate in June, to secure the materials for future selection work to produce improved cultivars for the Low Country.

Weekly plucking and recording of the yield in the 3rd cycle has been continued in trials, LVP 76, LVP 77, LVP 78 & LVP 79 and LVP 83. Third cycle yield recording was commenced in LVP 85 in October.

Hadaraganga selections for LCLWT

Recording of the Yield in the 1st Cycle has been continued in Phase II trail at Kottawa. After considering the performances of the accessions, it was decided to continue recording of yield only in 5 promising selections (HG 3, HG 33, HG 42, HG 45 and HG 49) together with control plots, TRI 4049 and 4042 in the future. Other accessions were excluded in yield evaluation and replaced with TRI 4049 plants in November.

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.* Kottawa (Agro-ecological zone: WL 2). Cecilton Estate, Balangoda (agro-ecological zone: WM 3); Deniyaya Estate and Indola Estate, Deniyaya (agro-ecological zone: WM 1) have been continued.

First pruning was carried out in April in the trial at Deniyaya Estate and in May in the trial at Indola Estate. Accessions in the Indola trial were morphologically characterized. Yield recording in the 2nd cycle has been continued in the trial at Kottawa and second cycle yield recording was commenced in July in the trial at Cecilton Estate, Balangoda.

First centering was done in the observational/ multiplication plot of TRI 5000 series trial at Balangoda Estate in April. The trial is managed entirely by the Estate including raising nursery plants. Nursery raised plants using potential TRI 5000 series accessions at Balangoda Estate, Balangoda have been monitored.

In the trial establish with the partnership of smallholder in Batapola, first centering was carried out in July and 2nd centering and infilling was carried out in November. After considering the performances of the accessions it was decided to infill some of accessions with some known cultivars and were excluded from the evaluation process.

Controlled Hybridization program – Low country

Hybrid Seedlings of 2003-2005 Program:

Recording of the yield of individual bushes of hybrid progenies in the 1st Cycle and assessment on active and banji shoots were completed. Visual observations under dry weather condition were carried out in March and pruning was carried out in June. Forty three promising seed progenies were propagated vegetatively in October to obtain materials for future evaluations.

Hybrid Seedlings of 2006-2007 Program

Centering of progenies was carried out in June.

Germplasm

A new gene bank block was established in Field No. 2 at St. Joachim, Ratnapura in order to safe-guard the available germplasm that has already been established in Field No. 5, at St. Joachim. In addition, some unique accessions that were available in Kottawa and Passara field gene banks were also added to the new gene bank at Ratnapura. Of the 150 accessions

propagated, 134 accessions have been planted in the new field gene bank from September – December.

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

A 4.2 Screening lines for resistance to Ccanker

None of the accessions that were screened in LVP 85 (Phase II) trial in August 2009 by the Pathology Division were found to be resistant.

All accessions sampled from the trial at Cecilton (Phase III) in October, 2009 by the Pathology Division were free from canker infection and hence, reported to be unable to screen using the available protocol. All accessions sampled from the trial at Deniyaya (Phase III) in June, 2010, were in the range of extremely resistant to moderately resistant to Canker.

Of the accessions sampled in the trial at Indola (Phase III), one highly resistant; one resistant and two moderately resistant accessions were identified.

A 4.3 Screening lines for resistance to Shot hole borer and Low country Live-wood Termite

Results of the accession screened for SHB in the trial at Cecilton (Phase III) in September 2009, two (17 and 142) resistant and five (89, 101, 146,163 and 294) moderately resistant accessions were identified.

Accessions in LVP 75/ Phase II in June and accessions in Phase III trials at Deniyaya and Indola Estates in March/ April were screened for SHB and LCLWT by the Entomology Division.

A 4.4 Screening lines for resistance/tolerance to Root-lesion and Burrowing Nematodes

Activities related to this project are combined with projects A 2.4.

LVP 75: Shoots of 7 selected accessions (29, 62,107, 131,139, 12/11, 23/5) from LVP 75 that were issued in two batches to Nematology Division in May and in November 2009 and 30 accessions from LVP 74 collected by the Entomology and Nematology Division (Hantana) are been assessed for nematodes in their nursery at different locations.

A 4.5 Screening lines for response to applied nutrients

Activities related to this project were combined with Project A 1.6 and reported accordingly.

A 4.6 Evaluating lines amenable for mechanical harvesting

The experiment commenced by the Agronomy Division using Plucking Shear (non selective) on TRI 2023, 2027, 3025, 3055, 4014, 4042, 4049 and 4061 to select cultivars amenable for mechanical harvesting has been re-commenced using Motorized Harvester.

Thrust A 5. Development of bi- and ploy-clonal seed stocks for drought prone areas in different agro-ecological regions

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

Second cycle yield recording in the Uva regional trial and third cycle yield recording in the Mid country regional trials were completed. Harvesting and yield recording in the 3rd cycle has been continued in the up country and in the low country trials.

Commercial scale evaluation of seed stocks – Adaptive trials

First cycle yield recording has been completed in the trial at TRI, Passara, and seedling trial at Hesal Lanka (Pvt) Ltd, Galaha in August and the bushes were pruned. A visual assessment of growth performances was undertaken during the dry spell experienced in February in the seedling trial at Galaha. First cycle yield recording was continued in the trial at Endana Estate, Kahawatta. Yield recording of seedling trial established at Craig Estate was commenced in April 2010.

Three new large-scale (commercial scale) adaptive trials were established in collaboration with Delmar Estate, Udapussallawa and Verellapathan Estates, Madulsima and also in a small holding in Hangurugamuwa Estate, Medamahanuwara using seeds collected from 4 seed gardens (Salawa, Halpe, Rambukkanda and Kiriporuwa).

Monitoring of seedling blocks established by growers with their own initiatives:
A seedling block established in Houpe Estate in Field No. 38D in 2006/07 was visited in April and it was noted that the seedlings are performing well. As per the estate records, seeds were collected from poly-clonal seed garden at Karadupona and this is a good example of grower initiative for adopting seed materials.

Seedling nurseries were established by both Sorana and Rygama Estates with the assistance offered by the Plant breeding Division. Raygama Estate planted some seedlings in field No 2010/11 NC in May 2010 and those seedlings were raised from seeds collected from Rambukkanda seed garden.

Over 2000 seedlings were raised in the nursery by Sorana Estate, Horana from seeds collected from their own seed gardens in May 2010. Seedlings have shown very good performances in the Nursery.

Biclonal and polyclonal seed gardens:

Seed garden at Anhettigama was badly affected and bush vigor has badly deteriorated due to heavy infestation of LCLWT. Although the maintenance of Raygama and Sorana Tea seed gardens were taken over by the respective estate managements, fertilizer has been provided to them by the Plant Breeding Division. It was noted that the gardens have been maintained properly by those estates and they were able to raise seedling plants in the nursery in sufficient quantities.

Quality assessment of promising seed progenies (6 seed stocks with DT 1 and TRI 2025 as controls) in the Up country trial was commenced in May 2010. Samples were provided three times for replicating the testing. Results are being analyzed.

A 5.3 Screening lines for resistance to Shot-hole borer

Seed stocks at Hesal Lanka (Pvt) Ltd, Galaha and at Passara Sub-station were evaluated for Shot-hole borer resistance by the Entomology Division at the time of first pruning carried out in October 2010 and results are being analyzed.

D 1. Use of In vitro techniques to supplement the conventional breeding program

Micropropagted plants generated from embryo cultures of open pollinated seeds were planted in the field in April. Immature embryos isolated from seeds (approx. 4 months after pollination) collected from inter- specific hybridization *C. sasanqua* and *C. sinensis* of 2010 were cultured in vitro to rescue embryos. Materials cultured in vitro from seeds obtained from inter-specific crosses carried out (TRI 3019 x *C. sasanqua*) in 2009 were continued in sub culture.

Hybrids of 2007 program, nearly 20 hybrids, were raised directly into plantlets in vitro. Microshoots obtained from the above that were maintained in the polyhouse have been transferred to nursery/ outside environment. Rest of the 2006 hybrid micro shoots were also transferred to the nursery under normal conditions.

Field evaluation of tissue culture plants

Evaluation of growth performance of three batches of micropropagated plants established in the field has been continued. Second batch of micropropagated plants (83 Nos.) raised from 6 hybrid plants from the 2006 controlled hybridization program that was planted in the field in August have been monitored together with micropropgated plants of exotic origin. 150 micropropagated plants of 07 hybrids derived from 2006 hybridization programme with controls and 3 micropropagated plants from 2008 hybridization programme were planted in field No 09 in September and another 150 micropropagated plants treated with different hormone treatments to enhance ex vitro rooting with controls were planted in field No. 09 in December. Centering of field planted tissue culture plants was carried out and field evaluations were started.

Publications and Presentations

Publications

- Ariyarathna H A C K, Kottawa Arachchi J D, Paskarathevan R, Bandara Y G S C, Gunasekare M T K (2010) Genetic analysis of cultivar response to dry weather induced stress conditions in tea (Camellia sinensis (L.) O.Kuntze) In: Proc. of the 3rd Symposium on Plantation Crop Research, (Eds. R S Dharmakeerthi and A M W K Seneviratne), 129-137.
- Ranatunga M A B and Gunasekare M T K (2010) Stratification of Camellia germplasm to facilitate construction of core collection: A prerequisite for tea crop improvement. In: Proceedings of the Third Symposium on Plantation Crop Research (Eds. R S Dharmakeerthi and A M W K Seneviratne), p 340.

- Ranaweera K K and Gunasekare M T K (2010) In vitro rapid clonal propagation of hybrid seeds of tea (*Camellia sienesis* L.) to reduce time taken to produce new tea cultivars In: Proc. of the Fifth Asian Biotechnology and Development Conference, (Eds. P Girihagama, T Thilakewardene and C Nanayakkara), 31-32.
- Silva K W K I, Ranatunga M A B, Gunasekare M T K and Wickramasinghe I P (2010). Characterization and evaluation of exotic tea germplasm stocks for utilization in the breeding program. In: Proc. of Undergraduate Research, Dept. of Agricultural Biology, No. 1, 34-37.
- Gunasekare M T K Achievements, Challenges and Perspectives on Breeding of tea plant (*Camellia sinensis* L.) in Sri Lanka, In: Global Tea Breeding: Achievements, Challenges and Perspectives of Breeding Tea Plant: (Eds. Liang Chen and Zeno Apostolides), Springer - Verlag, GmbH, In press.

Presentations

- M T K Gunasekare presented the Progress of Plant Breeding research activities at the CCR on 2nd February 2010.
- H A C K Ariyaratna presented a paper on "Genetic analysis of cultivar response to dry weather induced stress conditions in tea (Camellia sinensis)" and M A B Ranatunga made a poster presentation on "Stratification of Camellia germplasm to facilitate construction of core collection: A prerequisite for tea crop improvement" at the 3rd Symposium on Plantation Crop Research.
- M T K Gunasekare made a presentation on "Improved tea seeds as a source of planting material: A strategy for adaptation to climate change" at the E & E Forum (English) held in Talawakelle on 30th July.
- J H N Piyasundara made a presentation on "Possible causes for inability to achieve expected productivity from new cultivars" at the RTEF (Sinhala) held in Ratnapura on 29th November.
- M A B Ranatunga made a presentation on "New Cultivars - Experiences from Uva Region" at the RTEF (Sinhala) held in Bandarawella on 10th December.
- J H N Piyasundara made a presentation on "Strategies to achieve expected productivity from new cultivars" at E & E (Smallholder sector) on 17th December in Ratnapura.

Awards and Recognitions

- M T K Gunasekare, was invited to serve as a member of the organizing committee of the "5th Asian Biotechnology Conference – 2010" hosted by CARP in collaboration with Research and Information System, New Delhi and Michigan State University, USA.
- M T K Gunasekare received Presidential awards for Scientific Research for 2005 and 2006 at the Temples Tree on 27th July.

Workshops/ Training programs/ meetings attended:

- M T K Gunasekare attended three meetings ofn the National Committee on Agricultural Biotechnology and two National Committee meetings on Plant Breeding; three Organizing committee meetings for 5th Asian Biotechnology Conference – 2010; three TSHDA – TRI

interaction meeting at TRI Talawakelle; two FAO meetings on "Capacity Building and Regional collaboration for enhancing conservation and plant genetic resources in Asia organized by PGRC; Consultative meeting on safeguarding Biodiversity organized by NSF; Meeting chaired by Hon. Minister, MPI to discuss issues related to fertilizer and new tea cultivars at the MPI.

- M A B Ranatunga participated in RSC seminar at Passara on 1st April 2010.
- M A B Ranatunga and H A C K Ariyaratna attended a two day workshop on "Fundamentals of Bioinformatics" organized by the Department of Biotechnology, Faculty of Agriculture and Plantation Management, Wayamba University: 29th and 30th April 2010.
- H A C K Ariyaratna attended a workshop on "Chromosome counting, karyotyping of Sri Lankan plants", at the Royal Botanical Garden, Peradeniya: 10th -14th May.
- M T K Gunasekera and K K Ranaweera attended the 5th Asian Biotechnology Conference held in Kandy on 16th - 17th December and made a poster presentation.
- Grade I and II staff of the Division participated in the E & E Forum held at TRI, Talawakelle in February; E & E (Smallholder) forum held at TRI, Ratnapura in May and E & E Forum (English) held in Talawakelle on 30th July.
- Progress of divisional research activities from 2008-2009 were reviewed by Scientific Advisory Committee on 16th March 2010.
- Divisional staff attended a two day in-house workshop on "Scientific/ Technical writing" in August.
- Grade I and II staff of the Division participated in the E & E forum (Sinhala) held in Ratnapura on 12th December.

Services/ Materials offered to growers and other research disciplines

By Plant Breeding Division, Talawakelle;

- Cultivar identification and familiarization program for Waltrim Estate; Awareness programme for NIPM trainees.
- Cultivar identification at Dickwella Estate, Hali-Ela, Bearwell Estate, Talawakelle, Hollyrood Estate, Agarapathana, Telbedda Estate, Passara, Rosette Estate, Hali-Ela.
- Familiarization programme on Plant Breeding activities for undergraduate students from Faculty of Agriculture, University of Peradeniya; Faculty of Agriculture, Sabaragamuwa University; Faculty of Agriculture, Eastern University; Faculty of Agriculture, Rajarata University; Wayamba University; Jaffna University; Aquinas College and for a graduate student from Germany on 1st December.

Low country Plant Breeding staff conducted demonstration on the following:

- Improved cultivars - to a group of small holders from Ratnapura; Yatiyantota; Matugama; Alapatha and Bulathkohupitiya areas.
- Cultivar identification - for a group of Students from Sabaragamuwa University; Students from Karapincha Farm School; Small holders from Alapatha, Ratnapura, Yatiyantota and Matugama areas,
- Hunuwala Estate, Opanayaka and Eduragala Estate, Ingiriya.

Demonstration by the Mid country Plant Breeding staff:

- Familiarization program by the Mid country staff on Plant Breeding and Tissue culture activities to the final year students of OUSL – 31st March and 12th May.

Materials offered:

- 40 nursery plants, 10 plants of each of PK2, TRI 4052, 4071 and 2043 were issued to the Pathology Division in July for Blister Blight screening work.
- 1kg of Seeds from Kiriporuwa and Sapumalkanda gardens were provided to a small holder Mr. P N K De Silva of Pitigala/ Elpitiya on his request. Technical assistance in raising a nursery was also offered to him by the low country Plant Breeding staff.
- 3.5 kg of seeds collected from Halpe seed garden was issued to a smallholder in Waduraba.
- J H N Piyasundara and P D Upali participated at the Educational exhibition at Ferguson College, Ratnapura in February and R Paskaradevan at "Dayata Kirula" exhibition in February.
- Plant Breeding staff visited several small holder sites in Deniyaya region to investigate the performances of new TRI cultivars in clarifying matters raised in the media recently.
- M T K Guansekare and J Rajasinghe visited ADB sites at Nelligola and Tispane to investigate the indiscriminate formation of side shoots in mother bushes.
- Plant breeding staff took part in the Crop Clinics conducted at Ratnapura, TRI on 5th and 6th October and at Deniyaya Extension Centre on 7th December 2010 for stakeholders from RPC estates and smallholdings.

Trainees

Ms. K M R D Abayapala, Undergraduate student from Rajarata University and Ms. K W K I Silva undergraduate student from Faculty of Agriculture, University of Peradeniya completed their final year project and Ms. E U M D Z Dissanayaka, HNDT Agriculture student from ATI Naiwala, commenced her vacation training at the Division at Talawakelle. Mr. T M Jayaratna, Agri. Diploma student from Aquinas College, Colombo, underwent his 5 months in–plant training at the Division in Ratnapura.

General

- Progress of research carried out in Plant Breeding research program (Projects A1 – A5 and D1) was reviewed on 16th March 2010 by two external scientists appointed for Scientific Advisory Committee.
- Y G S C Badara, Technical Assistant resigned on 28th January 2010.
- A K Mudalige continued his undergraduate studies on full time basis at Sabaragamuwa University.

Plant Pathology Division

P N H Liyanage
B Sc (Ruhuna, Sri Lanka), M Sc (GBPUAT, India)
Acting Officer-in-Charge, Senior Research Officer (up to 01st March 2010)

Research Highlights

- There are maximum residue limits (MRL) for pesticides set by tea importing countries such as EU and Japan. It is vital to determine minimum effective dosage and determine pre-harvest intervals for pesticides to achieve the MRLs. For that, residue trials were carried out on the new generation fungicide Pyraclostrobin following the Food and Agriculture Organization (FAO) guidelines.

- Stem canker caused by Macrophoma theicola is a serious disease of tea in Low country areas. Developing molecular tools (Primers) for rapid identification of the pathogen is necessary to device proper control methods. To enable molecular studies a method was developed for large scale extraction of high quality genomic DNA from frozen mycelial mats of the pathogen.

Staff News

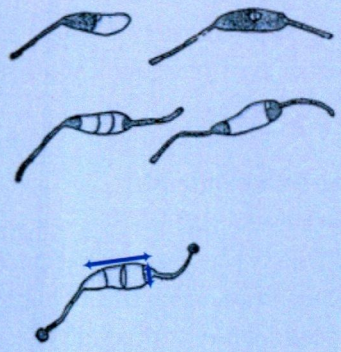
- Dr K L Wasantha Kumara assumed duties as Senior Research Officer (Contractual) with effect from 02nd February 2010
- Ms P N H Liyanage relinquished duties from the post of Acting Officer-in-Charge, Plant Pathology Division, with effect from 01st March 2010 in order to continue her post graduate studies at the Institute of Biochemistry, Molecular Biology and Biotechnology, University of Colombo.
- Mr J W K K Jayasundera and Ms D G N P Karunajeewa served as resource personnel at the Crop Clinic held in Deniyaya on 07th December 2010.
- Ms P N H Liyanage and Mr J W K K Jayasundera participated at the 3rd Crop Research Symposium held during 30th Sept – 01st Oct 2010 at the Cinnamon Grand Hotel, Colombo.

Variability of *Exobasidium vexans* based on

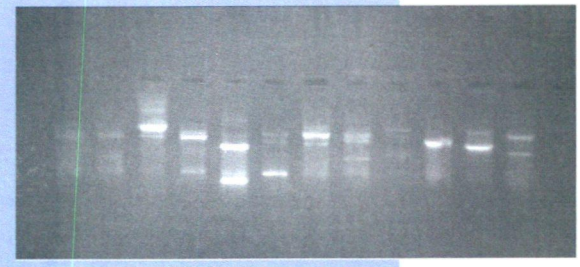
Blister Blight infected tea leaf

Morphology of basidiospores

Genetic make up



Different lengths and widths of basidiospores



Agarose gel showing polymorphic banding patterns

Blister blight cause by *Exobasidium vexans* is serious foliar dieses of Tea which cause about 40% yield loss annually. Tea cultivars show varying degree of resistance/ susceptibility to this disease. Resistance/ susceptibility of the tea cultivars also varies with locations. The studies showed there are genetic and morphological variations (length and width of basidiospores) in the pathogen among the tea cultivars and in different tea growing areas. These information would be helpful to devise future disease control strategies in terms of location and pathogen virulence.

Thrust A 23. Development of integrated management stratergies to control major diseases
A 23.4. Screening synthetic fungicides, and establishing maximum residue levels (MRLs) and pre-harvesting intervals (PHIs), for managing Blister blight

The objective of this project is to achieve effective Blister blight control in the field, using synthetic fungicides with a lowest effective dosage, which will ensure minimum residue levels in made tea.

Field trials were conducted according to the FAO guidelines for a new generation fungicide pyraclostrobin which was found to be effective. This included the two declining trials carried out at St.Coombs, Talawakelle during dry and wet seasons along with the six regional trials which were completed at Hantane, Ratnapura and Uva during both dry and wet seasons.

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. A method was developed for large scale extraction of high quality genomic DNA from frozen mycelial mats of *Macrophoma theicola* isolates as the traditional fungal DNA extraction protocols failed to yield adequate amounts of good quality DNA from *M. theicola*. It was possible to extract 20 µg of DNA from 1 g of frozen *M. theicola* mycelia using this method. The PCR amplification of the internal transcribed spacer (ITS) region of rDNA was performed using the ITS1F + ITS4R primers. Both *M. theicola* and *Fusarium solani* isolates produced single DNA fragments after amplification. These fragments were approximately 630-650 bp in length. The amplified products were purified and the sequencing of the fragments is in progress.

B/ New 1. Development of disease assessment keys for Blister Blight intensity

A disease assessment key was developed to assess the severity of Blister blight disease, caused by the fungus *Exobasidium vexans* Massee, on tea. Four alternative assessment methods were validated by six raters viz. three without previous experience in assessing Blister blight severity and three with previous experience in the disease assessment. Actual severity was estimated using ASSESS® 2.0 software. Data analysis is in progress.

The susceptibility of the leaf stage was also determined by estimating the disease severity of 220 detached tea shoots randomly picked from TRI 2025 cultivar infected with the pathogen. The disease was high in third and fourth leaf stages compared with first and second leaves. In addition, TRI 2024 cultivar was used to study disease progress over the time in order to understand changes in disease severity. Data analysis of this experiment is also in progress.

B/ New 2. Development and/ or modification of disease assessment keys for *Macrophoma* Canker (Stem and branch canker) intensity

The objective of this study was to develop an assessment method to estimate severity of stem and branch canker caused by *Macrophoma theicola*. An assessment key was prepared based on percentage of stem and branch area covered with cankers. Seven tea cultivars were

evaluated by six raters using both newly developed method and assessment technique in use in order to study accuracy and precision of each method. Data analysis is in progress.

B/ New 3. Development of disease severity assessment training software for Blister blight

An accurate and precise estimation of disease intensity is an important prerequisite for the development of any agricultural research program that has Plant Pathology as a component. This is needed to statistically evaluate the benefits associated with specific disease control tactics such as evaluation of disease resistance, in addition to quantifying relationship between disease intensity and yield. Accuracy and precision of disease assessment can be improved by training "raters" to assess the disease with the assistance of computerized disease assessment training programs. Therefore, the objective of this study was to develop a computer and web-based training program/s for accurate and precise disease assessment training of Blister blight disease. Large amount of images representing different disease levels were collected from different tea cultivars. The actual estimate of the disease in each image is determined with the assistance of ASSESS 2.0 image analyzing software. The work is in progress to develop a training program.

B/ New 4. Morphological and Molecular characterization of *Exobasidium vexans*

This study was carried out with the objective of understanding the morphological and genetic variation of tea Blister blight causal organism, *Exobasidium vexans*, in different agro-climatic locations and cultivars. Blister blight infected plant samples collected from selected locations *viz.* St. Coombs, Hantana, Madulkelle (Kandy) and Passara showed promising results as there were some indications of different forms of the pathogen according to the PCR-RAPD study carried out with two primers; OPD 3 and OPB 17 and morphological observations on size of the blisters, spore length and width.

Based on molecular analysis and morphological characteristics, variability in the fungus isolated from different regions of tea growing areas was observed. Since number of samples collected and analyzed was insufficient to perform statistical analysis, to make valid conclusions, further plans are underway to continue molecular characterization of different isolates covering different agro-climatic regions. Diseased leaf samples collected from several tea growing estates were subjected to the DNA extraction and have been preserved for PCR amplification. The work is in progress.

D/PlPa 1. Activities of the Plant Pathology Division

Microbial status in the factory environments were assessed on request.

C/Path. Analytical Services. Developing and maintaining facilities for performing microbial analysis of made teas, and the factory environment.

The following microbiological tests were performed as per the requests made by stakeholders. Sixty swab samples were analysed for APC, total moulds, total coliforms and *E. coli* (Test Method SLS 516. Parts 1, 2 and 3).

Process Technology Division

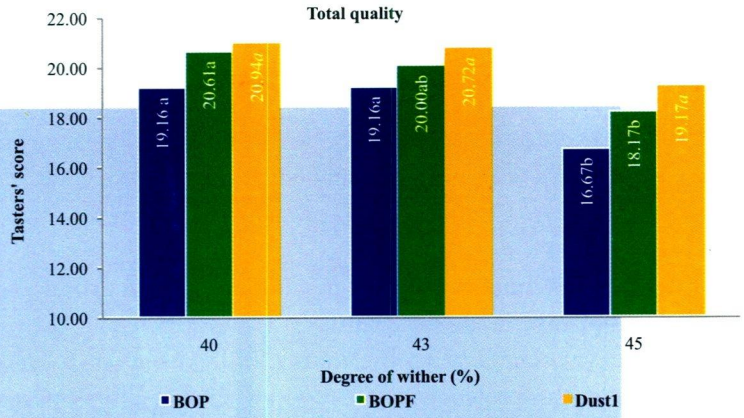
W S Botheju
B Sc (Colombo, Sri Lanka), M Phil (Peradeniya, Sri Lanka) Ph D (Peradeniya, Sri Lanka)
Acting Head/ Senior Research Officer

Research Highlights

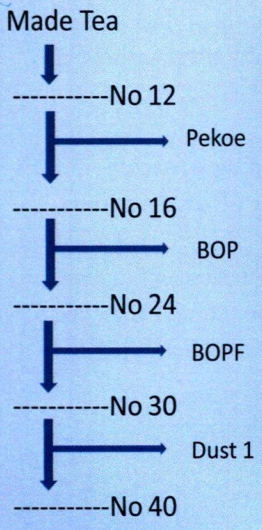
Orthodox and RV mix tea processing is the most popular in Up country Western and Nuwara Eliya regions and over 50% tea factories in Uva are also now adapted to this manufacturing method. Because of the huge demand for small type of grades, the rolling process of the factories has changed drastically including several macerations before extraction of dhool. Therefore Tea factories mainly in the Western region adapt to use softer wither (wilting) to produce tea with more blackness for Orthodox & RV mix type of tea manufacture. To verify this concept a research was conducted with several wither percentages to find out the most suitable wither in Orthodox rotorvane mix type of tea processing. Results showed that 40 – 43% wither was more suitable to produce better quality tea improving the tea characters like blackness, liquor colour, liquor strength and infused leaf colour etc.

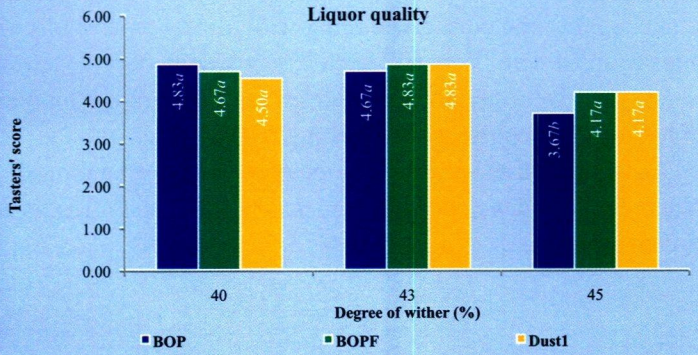
Publications

- Study the quality characteristic of tea produced at different degrees of wither using Orthodox Rotavane type tea manufacture – Proceedings of 10th Agricultural Plantation Management (2010) D C J Suduwellage, W S Botheju and D C Abeysinghe.
- Prevention of fire accidents in tea factories. Mr Koneswaramoorthy, L Jayasinghe & W M S Weerawardena TRI Update (Vol. 13 No 2).



Significantly higher total quality was achieved for BOPF when the degree of wither is 40 %.





Significantly higher liquor quality was achieved for BOP when the degree of wither is 40 and 43%.

Thrust A 46. 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 and 4 meshes in roll breaker

The objective of this study was 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 processing. In this experiment a 4-roll programme 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 completed and tasting of 576 samples was also completed. This project is in progress.

Thrust A 47. 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 self-cleaning Sifting Machine for leafy grade teas

The objective of this project was to develop a suitable sifting machine to replace the Michie sifter in Low-country tea processing with the view to increase the output, reduce particle degradation and to automate the sifting process. Optimizing of rotary speed and inclination angle of the existing Michie sifter with standard gauge mesh was initiated. Eleven different speeds (220 – 270 rpm) and inclination angle of the existing Michie are tested using OP1 grade. Fabrication of one deck ball tray arrangement is also in progress.

Thrust A 48. Development of strategies to automate the tea manufacturing process

A 48.1 The importance of fluidization parameters for the production of quality black tea at higher efficiencies

The objective of this study was to develop a drying model for FBD to save energy and to improve the quality of made tea by optimizing the process parameters. Prototype FBD was already fabricated and study on drying model development is being carried out.

A 48.3 Automation of withering process

Project 1: Optimization of Electrical Energy Efficiency in trough withering using a Real time Heat and Mass transfer Mathematical Model

The objective of this project was to develop a set of mathematical equations to predict the required airflow rate at real time during withering with a view to save electrical energy. A 5.5 Hp motor coupled with 'Woods' impeller was used to develop required equations using the test-rig. Static pressure and electrical energy consumption at different flow rate of air and different frequencies using VSD coupled with the motor were measured. Two mathematical equations were developed. Incorporation of the two equations into the previously developed one dimensional heat and mass transfer mathematical model is in progress.

Basic Projects

B 91. Optimizing withering parameters in trough withering system

The objective of this study was to establish a user friendly set of guidelines on withering with a view to save electrical energy. Seven trials were conducted using trough No 5 at St Coombs factory. Initial moisture content, static pressure in the plenum chamber at 15 min time intervals, inlet and exhaust dry and wet bulb temperatures of air and electrical energy consumption throughout withering were measured. Out of seven trials, two trials were done with the spreading rate of 3.0 kg/sq.ft and other five trials with 2.5 kg/sq.ft. When leaf comes with surface moisture, the hygrometric difference was maintained at 8 - 10 ^{0}F and also 10 - 14 ^{0}F until surface water was removed. Thereafter, hygrometric difference was maintained at 4 – 6 ^{0}F and 6 – 8 ^{0}F in different trials. Electrical energy consumption kWh/kg moisture removed basis was compared in different trials.

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

The objective of this study was to optimize/ minimize the use of machinery, increase the worker productivity and to develop a programme for 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 to validate the program.

D/TECH – Divisional Activities

1. **Evaluating new type of paper sacks**

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

2. **Study the effect of softer wither on the quality of made tea against harder wither in Orthodox Rotorvane mix manufacture**

   The objective of this experiment was to find out the most suitable degree of wither for Orthodox and Rotorvane mix type of tea processing in present style of manufacture which produces more small grades. The experiment was conducted in miniature scale and commercial scale tea manufacture. Five replicates in miniature scale were tested for five different degrees of wither (36, 40, 43, 45 and 47%). Statistically analysed data showed that overall quality of BOPF and Dust 1 produced at 36% degree of wither was found to be inferior compared to other four degrees of wither. It was concluded that very soft wither was not suitable to produce good quality small grades. Moreover, appearance of Dust 1 produced at 47% degree of wither was poor compared to 40 – 45% degrees of wither studied. Based on results of miniature scale experiment, a commercial scale experiment was conducted for three different degrees of wither (40, 43 and 45%). Three replicates were completed and data showed that a more suitable degree of wither to produce good overall quality was in the range of 40 – 43%.

3. **Miniature tea manufacture**

   The staff supports other research divisions of the Institute in manufacturing experimental samples using the miniature tea manufacturing facility at the Division. During the year 426 experimental leaf samples were manufactured at the Division.

During the period under review,

1. **Advisory Services**
   - The staff made 144 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 & M A Chamindra participated at the crop clinic held on 3rd December 2009 at Kottawa TRI substation, Thalgampola.
   - Mr M A Chamindra & Mr W M U A B Marapana conducted a training program for the students of Distance Education Modernization Project in July.

2. **Analytical Services**
   - The number of tea samples received from estate for moisture determination was 638.
   - Number of moisture meters calibrated was 40.
   - Number of thermometers calibrated was 54. This includes standard glass thermometers and digital thermometers.
   - Number of Hygrometers calibrated was 131.

3. **Training programs**
   - Dr W S Botheju, Mr K Raveendran and Mr G L C Galahitiyawa conducted two days training program for factory officers coordinated by Mr Fred Amarasinghe from Forbes & Walker Ltd.
   - Mr G L C Galahitiyawa conducted lectures for factory officer training program held in NIPM Bogawantalawa on 20th January 20 2010.
   - Mr M A Chamindra conducted a training program for 'Gamidiriya' leaf suppliers on post harvest damage on 23rd June 2010.
   - Mr Raveendran, Mr Koneswaramoorthy and Mr P K S P Dayananda conducted lectures for Managers' training program at TRI, Talawakelle organized by NIPM on December 4, 10 and 11.

Mr G L C Galahitiyawa attended the following activities

- Participated in Estate & Advisory Services meeting in Colombo on January 12, 2010.
- Participated in an awareness program held on March 12, 2010 at SLSI in Colombo.
- All Ratnapura Technology staff attended "Gami diriya" program held on January 20, 2010 held in Ratnapura.
- Attended a discussion about leaf improvement of St Joachim factory under Gamediriya program on May 25, 2010.
- Participated at the RSC in Galle on August 19
- Attended two meetings on Gammidiriya program on August 26 and 31.
- Participated at the CCASE meeting held on August 20 at TRB.
- Participated in a discussion with brokers regarding the current situation of St Joachim tea factory on October 11.
- Participated in a seminar on 'Tea manufacture and factory processing' at Lellopitiya on December 03.
- Participated in a seminar on 'Tea manufacture and factory processing' in Galle on 10th December 2011.

Dr W S Botheju attended the following activities

- Attended a seminar organized by SLSEA held on March 10, 2010.
- Participated at the CCASE meeting held on August 20 at TRB.
- Participated in a conference themed 'Climate on Edge' organized by German Alumni Association of Sri Lanka in November 26 – 28.
- Attended a meeting on 'Moisture in tea exported to Libya' on December 21.
- Attended the Mid country RSC meeting (panel discussion) on December 14.

Mr K Raveendran attended the following activities

- Attended the meeting on machinery development for the Tea and Rubber sector held on June 15, 2010 at the Plantation Ministry Board Room.
- Attended a program organized by Mid country sub program unit under Smallholder Plantations Entrepreneurship Development Program (SPEnDP) on June 19.
- Attended meeting on 'Machinery development in tea and rubber sector' held in MPI on July 14.
- Made a presentation on "Strategy to manage cost of processing" to Planters in Maskeliya area at Maskeliya planters' Club on September 8.

4. Other Activities

- Mr Raveendran presented a paper on "Strategies to Manage Cost of processing" at 220th E & E forum held on February 12, 2010.
- Dr W S Botheju and Messers G L C Galahitiyawa, K Raveendran & S Koneswaramoorthy participated to seminar and also 'Vidulka' exhibition held in BMICH on August 5 – 8 organized by SLSEA.
- Dr W S Botheju (Chairman) and Mr G L C Galahitiyawa attended TEC meeting for purchasing three colour sorters for factories managed by TSF on August 16.
- Mr K Raveendran, Mr P K S P Dayananda and Mrs Sripalika presented their PhD and Mphil project proposals to CCR members held on September 27 at TRB.
- Dr W S Botheju presented a research paper titled 'Modeling trough withering system to predict moisture content of tea leaves" in the 3rd Crop Symposium held in Cinnamon Garden Hotel, Colombo on September 30 and October 1. Messers G L C Galahitiyawa, K Raveendran & S Koneswaramoorthy also attended.
- Mr M A Chamindra conducted a presentation on 'Post Harvest Losses in tea processing' for a group of small holders of Tea Shakthi Society on November 17.
- Messers G L C Galhitiyawa and Mr Marapana participated to the 'Crop Clinic for small holders' in Deniya on December 07.
- Dr W S Botheju and Mr Koneswaramoorthy participated in the CCR meeting held on December 13 at TRB.

5. Human resource development

- Mr M A Chamindra attended one day training program on 'HACCP' organized by National Chamber of Commerce on December 16.

Soils and Plant Nutrition Division

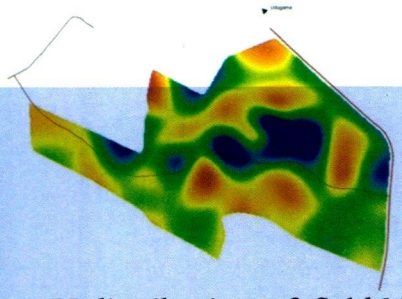
G P Gunaratne
B Sc Agric. (Peradeniya, Sri Lanka) M Phil (Peradeniya, Sri Lanka)
Ph D (Peradeniya, Sri Lanka)
Acting Head/ Senior Research Officer

Research Highlights

- Issued an interim fertilizer recommendation for tea small holders sector
  The issues raised during last decade in the small holdings sector were related to potassium (K), magnesium (Mg) and/ or sulphur (S) nutrition. Hence, regular use of balanced N P K mixture fortified with important plant nutrients which is coupled with an appropriate strategy would be the most suitable prophylactic measure because of poor adoption rate of good agricultural practices in the small holdings sector. Therefore, interim recommendation is made, to address the current soil fertility status of tea small holder lands.

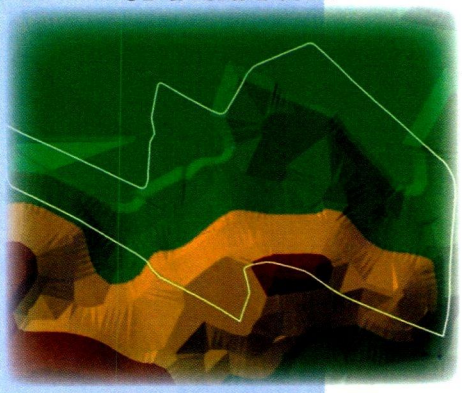
- Micro nutrient status were characterized in tea growing soils
  Micro nutrients (Manganese, Ferrous, Copper, Zinc, Boron and Molybdenum) are essential for better tea plant growth, but required in small quantities. Micro nutrient status in major tea growing soil series can be used as a tool to formulate micro nutrient package for mature tea in different tea growing regions of Sri Lanka.

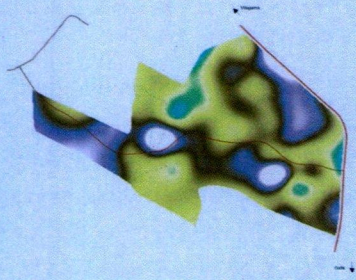
- Spatial variability of some soil chemical properties in tea growing landscapes were studied
  Understanding the spatial characteristics of soil chemical properties would be helpful in the development of site-specific fertilizer management. Uniform management results in over-application in areas with high nutrient levels and under-application in areas with low nutrient levels.



pH distribution of field No. 06

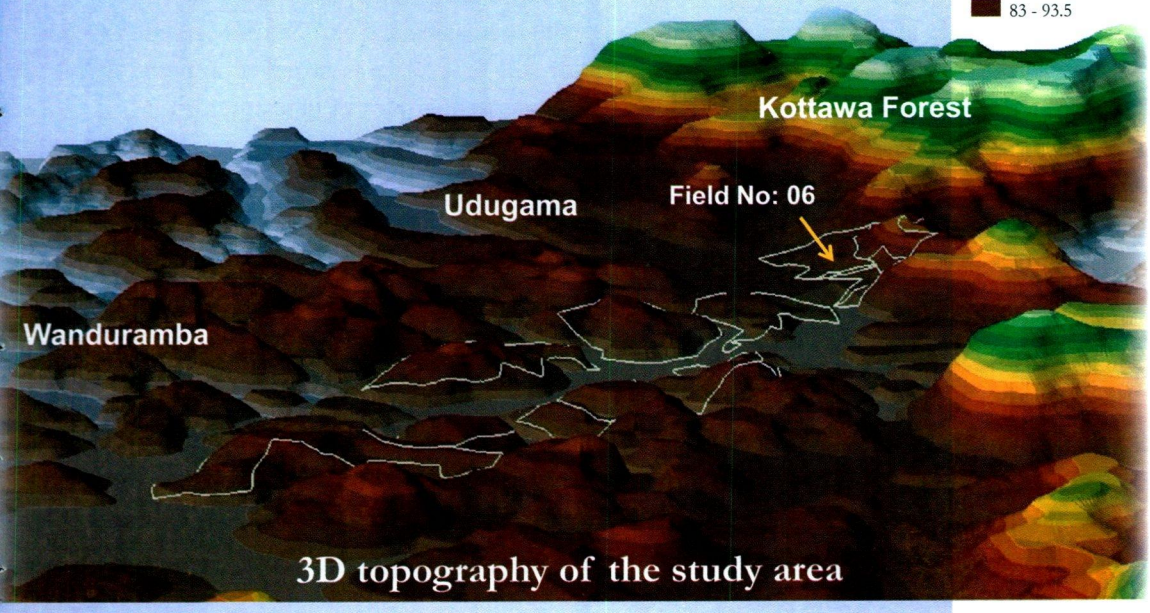
Terrain elevation representation of Field No. 6





Organic carbon distribution of field No. 06

Boundary
Elevation (meters)
20 - 30.5
30.5 - 41
41 - 51.5
51.5 - 62
62 - 72.5
72.5 - 83
83 - 93.5



3D topography of the study area

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

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

The objectives of this research are to develop regional information and fine tune site specific fertilizer recommendation by characterizing the bench-marked soil series in the tea growing areas of Sri Lanka Twenty bench-marked soil series were collected representing all tea growing Agro Ecological Regions (AER) in Sri Lanka and theywere analyzed. The Quantity- Intensity (QI) Isotherms relation to Soil K for selected soil series were plotted as the characterization tool. The results showed a variation of subjected soil series based on their K dynamics. Finally they were categorized based on their Potential Buffering Capacities of K (PBCK) and K specific sites (Kx) available in soil. Furthermore it is important to concentrate on this categorization when fine tuning the existing K fertilizer recommendations for tea growing soils in Sri Lanka.

A 15.2 Estimating crop response to macro nutrients (N, K, Mg, S and P) at AER level

A 15.2.1 Fertilization experiments

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

1. 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 TC9, Brunswick Estate, Maskeliya, AER: WU2 (1998)

Significant increase in yield with increasing rates of N was observed. No significant change of yield was observed with increasing rate of potash fertilizers, even though an increasing trend in yield was observed.

Soil pH levels decreased significantly with increasing rates of N as observed in previous years. An increasing trend of soil K levels was observed at both depths [INDICATE THE DEPTHS], with increasing rates of potash fertilizer from 80 to 120 kg ha^{-1} yr^{-1}.

With increasing rate of Urea (N) fertiliser, leaf N concentration significantly increased. Leaf K concentration increased with increasing rates of MOP (K) fertilizer. The trial continues.

2. 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 yield did not show any significant variation with increasing rates of either urea (N) or MOP (K) fertilizer.

Soil pH decreased significantly with increasing rates of N from 180 kg to 600 kg N ha^{-1} yr^{-1}. With the increase in MOP (K) rate, the soil Ex. K values increased significantly. The soil Ex. Mg and Ca concentrations did not show any variation due to increasing rates of urea or potash.

Increasing rates of N fertilizer has increased the leaf N concentration significantly. The leaf K concentration did not vary significantly with increasing rates of K fertilizer but an increasing trend was seen. Also, there was no significant change in leaf Mg concentration with increasing rates of urea and potash fertilizers. The trial continues.

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 (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 yield increased significantly with increasing rates of N fertilizer. Compost application did not show any significant influence on yield. Increasing rates of N fertilizer did not increase the leaf N concentration significantly. Soil pH levels decreased significantly with increasing rates of N. Soil P, Mg and Ca increased significantlywith compost application. The trial continues.

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)

This trial concluded in 2010 following completion of a cycle. The data collected over six cycles are being analysed in detail with a view to publishing the overall findings.

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)

First year yield was severely affected by drought and infestation of Blister blight during recovery, after pruning.

The increase in the proportion of sulphate of ammonia in the N fertilizer combination, as well as increasing rates of N fertilizer, significantly reduced

soil pH at both depths. The soil sulphur concentration did not significantly increased with increased proportion of sulphate of ammonia in the N fertilizer combination, or with increasing rates of N fertilizer. However, an increasing trend was seen with increase in proportion of sulphate of ammonia in the N fertilizer combination.

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. The trial continues.

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 - (2001), AER: WM (2001)

   The yield did not significantly vary with increasing rates of N, and no effect was also seen for the application of N in different proportion of urea and sulphate of ammonia.

   Both increasing rates of N fertilizerand increased proportions of sulphate of ammonia in the urea and sulphate of ammonia combination, significantly altered soil pH. The pH levels decreased with increasing rates of N, as well as when the proportions of sulphate of ammonia in urea:S/A combination increased.

   This year's estimation showed that sulphate sulphur at both soil depths increased significantly with the proportions of sulphate of ammonia in the urea and sulphate of ammonia combination more than with the increasing rates of N.

   Leaf S was not significantly affected due to increased proportions of sulphate of ammonia in the urea and sulphate of ammonia fertilizer combination. The trial continues.

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 proportions of urea and sulphate of ammonia as well as with increasing rates of N. But an increasing trend was seen with increase of sulphate of ammonia in urea and sulphate of ammonia combination.

Soil pH levels decreased significantly with increasing rates of N fertilizer but not with increasing proportions of sulphate of ammonia in the urea and sulphate of ammonia combination. Soil sulphate sulphur concentration in the soil increased, at both depths, with increased proportions of sulphate of ammonia in the urea and sulphate of ammonia combination.

Though the leaf S concentration did not show any significant variation due to the different proportions of urea and sulphate of ammonia, an increasing trend was observed with increased proportions of sulphate of ammonia in the urea and sulphate of ammonia combination. The trial continues.

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

1. **Effect of ground application of "Normal Humate" with foliar application of "Super Humate" in the presence or absence of urea on growth and yield of tea,** Cultivar TRI 2027; Field No. 1999/3 ha Raigam Estate, Ingiriya, AER: WL1 (2003)

   The yield wasnot significantly affected with application of normal humate to the ground and spraying of super humate at increasing rates, in the presence or absence of urea sprayed over the foliage. The trial continues.

2. **Effect of application of "Humate" treated waste tea compost (A rapid method of composting) on chemical and physical properties of soil, and growth and yield of tea**
   Cultivar TRI 2027, Field No. 1999/3 ha Raigam Estate, Ingiriya, AER: WL1 (2003)

   The yield did not significantly increse with the application of humate treated compost compared to the plots that were applied with refuse tea without treating with humate for the rapid composting. The trial continues.

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, TalangahaEstate, Nakiyadeniya, AER: WL2 (2005)

The application of Humate treated compost did not significantly increase yield compared to the plots that were applied with refuse tea without treating with humate for the composting activity. The trial continues.

A 15.3 Estimating crop response 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 region (Badulla and Bandarawela districts) regions for evaluating soil micro nutrient status in soil series. Determination of Micro Nutrient status was completed. The results showed a variation of micro nutrient status in different soil series in tea growing regions.

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 Rhizobacteria in tea soils. (2009)

Collection of soil samples from all agro ecological regions of the Mid country tea estates and isolation and purification of PGPR were completed. Isolation of nitrogen fixing bacteria (Azospirillum) from collected tea root samples was done by using semi solid N free malate medium. Phosphate solubilizing bacteria were isolated from rhizosphere soil samples by following serial dilution and plating technique on Pikovskaya's agar medium. This study 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, buffering capacity of pH and rainfall.

Soil samples were collected from tea growing soils representing 30 locations, giving priority for prominent soil series. pH buffering capacities were determined from selected soil series.

A key could be prepared to characterize the soils under study pertaining to soil pH buffering capacities. This key may help in deciding the lime requirement of the soils in tea growing areas. Therefore, soil in the tea growing regions can be characterized into three main groups according to their pH buffering capacities. This activity is in progress.

A16.4 Establishing dolomitic limestone requirements for better growth of mature plants in different tea growing regions at soil-series levels.

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

F/N 17, Lower Division Midlands Estate, Rattota AER: WM3 (2009)

The yield did not vary significantly with application of different rates of dolomite. Application of increasing levels of dolomite significantly increased soil pH and soil Exchangeable Mg and Ca at (0-15 and 15-30 cm) depths. The trial continues.

Thrust A 49. Applications of Geographic Information System (GIS) in tea sector

A 49.2 Identifying spatial and temporal variability in soil fertility properties in variable landscapes of the tea growing regions

Galle Extension Centre was selected to carry out a preliminary study. Grids were demarcated using GPS. Spatial variability in soil chemical properties, at this Centre were evaluated and mapped. It was observed that Organic Carbon and available nutrients (P, K, Mg, S) levels change spatially.

Support Projects

Adaptive Trials on Fertilizer in collaboration with TSHDA

Twenty six sites were selected for laying out adaptive trials on tea smallholders sites representing all STI regions to compare present interim recommendation for tea small holders with previous fertilizer recommendations by TRI, with a view to raising grower confidence.

C/SPN: Development of regional analytical laboratories for soil, plant and fertilizer analysis.

Analytical laboratory service

The analytical laboratory at Talawakelle participated with the international laboratory evaluating programmes on chemical analysis of soil (International Soil-Analytical Exchange-ISE) and plants (International Plant-Analytical Exchange-IPE). Four soil and 04 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 mean, mode, minimum and maximum values along with the number of some routinely carried out tests at Talawakelle and Walahanduwa laboratories are given in Tables 1 to 4 respectively.
b. The total number of soil, leaf, fertilizer, organic manure and water samples analyzed at Talawakelle SPND and Walahanduwa laboratory are 6400, 66, 1400, 45, 1; 537, 53, 89, 4 and 0 respectively.
c. The total number of analysis performed on soil, leaf, fertilizer and organic manure at Talawakelle and Walahanduwa SPND are 21310 and 2690 respectively.
d. Out of these analyses the highest number of analysis were performed for soil pH (5820) and soil organic carbon (3711).

General

- Mrs. Saroja Ananthacumaraswamy retired from the services of this Institute with effect from 06th January 2010.

- Prof. A. N. Jayakody assumed duties as a Senior Research Officer (Contractual basis) with effect from 01st February 2010.
- Mr. W M J C Bandara Experimental officer was transferred to Soils and Plant Nutrition Division with effect from 01st February 2010.
- Mr. W M S Wijayathunga was transferred back to Soils and Plant Nutrition laboratory at Mid Country Regional Centre from 20th September 2010 and Mr. D M B N Dissanayake was transferred back to Soils and Plant Nutrition laboratory at the Head Office with effect from 20th September 2010.
- Mr. D M B N Dissanayake resigned from the post of Experimental Officer of the Tea Rresearch Institute with effect from 01st November 2010.

Dr G P Gunaratne served as,

a. A member of the working group on Fertiliser Advisory Committee at the National Fertiliser Secretariat, Ministry of Agricultural Development.
b. A visiting lecturer/resource person to the National Institute of Plantation Management, Athrugiriya.
c. A member of the board of Soil Science Society of Sri Lanka

Training programs, Advisory visits, Exhibitions, Visitors, Seminars

- Dr G P Gunaratne made presentations on:
  a. "Scientific Basis behind the Fertilizer Recommendation" and "Rational Approach for Fertilizer Application to Tea" for Elpitiya and Pussellawa PlantationCompany Managers and, Asst Managers at TRI, Talawakelle Auditorium on 17th March.
  b. "Soil Degradation and Soil Nutrient Availability" at the Regional Technical and Extension Forum (RTEF) at Deniyaya on 17th June 2010.
  c. "Scientific Basis behind the Fertilizer Recommendation" and "Tea Growing Soils in Sri Lanka and issues in relation to Soil Fertility" for Kahawatta Plantation Company Managers and Asst Managers at TRI, Head office Auditorium, 16th and17th August.
  d. "Scientific Basis behind the Site Specific Fertilizer Recommendation" and "Foliar Applications for Tea" for Elpitiya Plantation Company Managers, Asst Managers and Field Supervisors at TRI, Head Office Auditorium on 15th September.
  e. "Scientific Basis behind the Site Specific Fertilizer Recommendation" and "Foliar Applications for Tea" for Horana Plantation Company Managers, Asst Managers and Field Supervisors at TRI, Head office Auditorium on 17th November .
  f. Physical and Chemical Soil Fertility Management in Tea Lands" and "Tea Fetilizers & Fertilizer Application" for Plantation Executives from NIPM at the TRI Head Office Auditorium, on 4th December 2010.
  g. "Interim Fertilizer Recommendation for Mature Tea in Low Country Tea Smallholdings" for the 25th Experiments & Extension Forum (Sinhala) held at Low Country Regional Centre, Ratnapura on 17th December.
- Mr. Dananjaya de Silva, a student from National Institute of Plantation Management (NIPM) underwent training on soil fertility and fertilizers at SPND 21st January 2010.

- Messers. S.M. Dissanayake and S. Wijethunga conducted a workshop on compost preparation with refuse tea and spent tea for Watawala Plantation Company Managers and Asst Managers in Lindula region at Lippakelle Estate 31st March.
- Mr. S M Dissanayake attended a Mini Crop Clinic held at Deniyaya on 2nd August 2010.
- Dr G P Gunaratne, Prof. A N Jayakody, Messers. L R M C Liyanage, W M S Wijethunga, S M Dissanayake, J R Y Abeywardane, W T B D Priyantha, O G K A Gunaratne and D M B N Dissanayake participated at the Crop Clinic held at TRI Low Country Regional Centre, Ratnapura on 5th and 6th October.
- Dr G P Gunaratne, Prof. A N Jayakody, Messers. L R M C Liyanage, S M Dissanayake, J R Y Abeywardane and W T B D Priyantha participated at the Crop Clinic held at TRI Deniyaya Extension Centre on 7th December.
- Dr G P Gunaratne participated in the Regional Scientifc Committee (Kandy) Seminar held at Royal Mall Garden, Kandy on 14th December.
- Mr. WMS Wijethunge attended a Regional Technical and Extension Forum UVA held at TSHDA auditorium, Bandarawela on 10th December 2010.

Awards

Mrs. Saroja Ananthacumaraswamy, Mr. S M Dissanayake and Dr. L S K Hettiarachchi received presidential awards for the research paper published in National Citation Index Scientific Journals and a certificate of recognition.

Visitors

- A group of undergraduate students from the University of Moratuwa visited the Division on 31st March to get some exposure in planning aspects of research buildings for a research centre.
- Groups of tea smallholders from Ratnapura, Kithulgala and Kobbekaduwa areasvisited the Division to acquire knowledge and exposure on tea plant nutrition on 31st March, 12th May and 13th May 2010 respectively.
- A group of Media Personnel MTV channel visited the Division on 4th June to produce a video documentary programme about the TRI.
- Groups of undergraduate students from the Faculty of Agriculture of the Eastern University, University of Jaffna and the University of Wayamba visited the Division in order to familiarize themselves on Soil Fertility and Nutritional Aspects on tea cultivation on 5th March, 16th June and 14th September respectively.

Trainings

- Mr. M D K Thilakasiri, Ms. H M K G S R Herath and Mr. R A I W K Ranathunga, all HNDT students, Ms. R Munasinghe, an undergraduate student from the University of Peradeniya and Ms. U W N M Ariyasinghe, an undergraduate student from the University of Kelaniya successfully completed their in-plant training in the Division.
- Mr. P C K Ranathungamage, an undergraduate student from the University of Ruhuna and Ms. D M S G Thanayamwatta, an undergraduate student from the University of Sabaragamuwa successfully conducted their final year projects at the Division
- Mr. K M S S K Kahawatta, a NDT student continues his training at the Division.

Biometry Unit

T U S Peiris
B Sc Agric. (Peradeniya, Sri Lanka), M Phil (Peradeniya, Sri Lanka)
Senior Research Officer

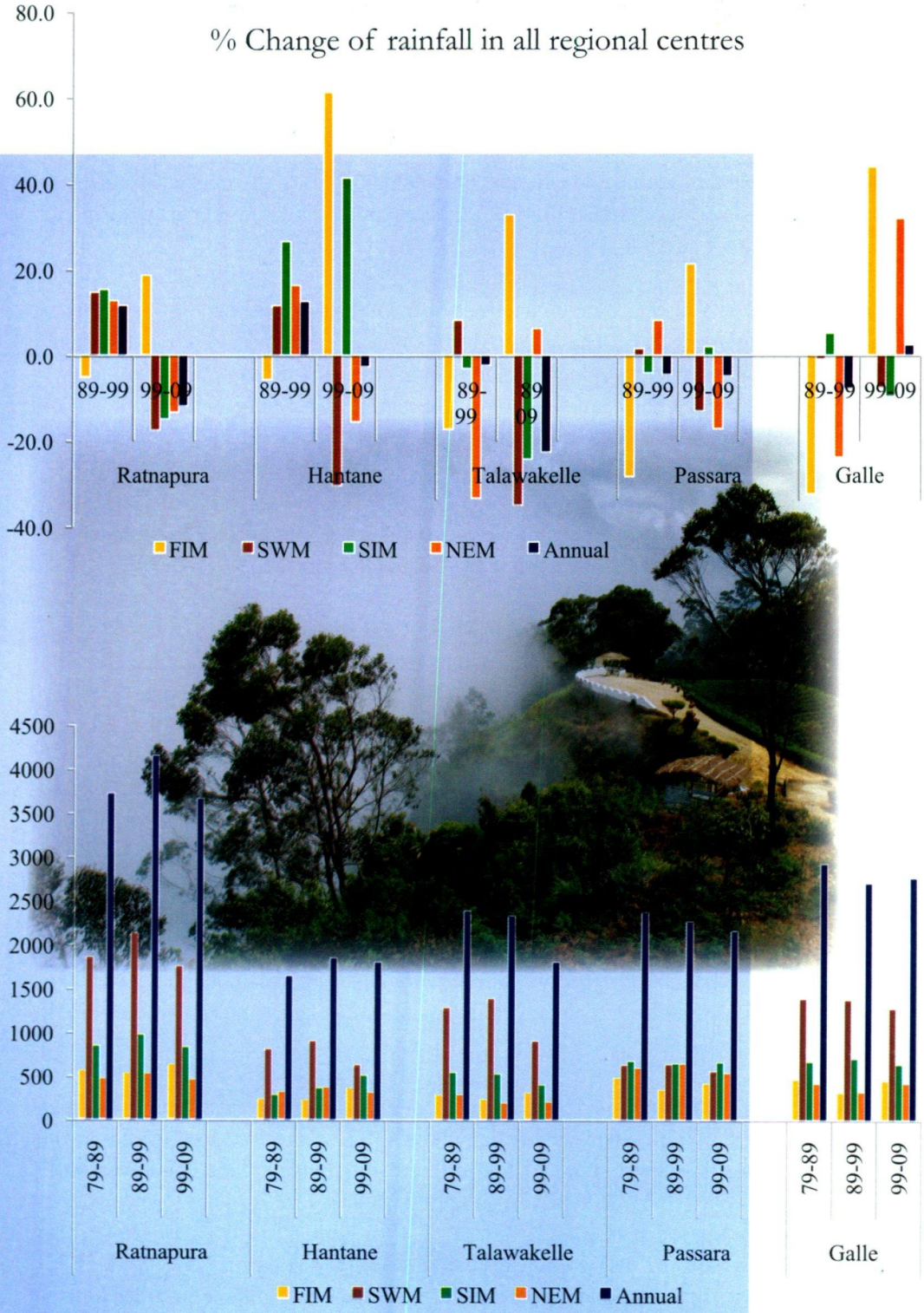
B 81. Assessing the Impact of Climate Change on the Growth and Productivity of Tea

Development of weather data base for the agro-met stations maintained by TRI for tea growing areas was completed.

This study was conducted to investigate long term changes in seasonal rainfall in tea growing areas. 30 years seasonal rainfall data from 1988 to 2009 were analyzed for 5 locations viz. Ratnapura, Hantana, Talawakalle, Passara and Galle.

Results indicated that rainfall received in FIM has been reduced in all five locations. Highest reduction was recorded from Hantana (61%) in 1998-08 period compared to previous 10year period. SWM rainfall increased in all locations and highest percentage increase was observed in Talawakalle (35%).

Rainfall received in SIM also increased in all locations except Hantana and Passara where no significant change was recorded. NEM also showed an increasing trend except for Talawakelle and Galle. Overall annual rainfall has been increased in all locations except Galle.


% Change of rainfall in all regional centres
80.0
60.0
40.0
20.0
0.0
-20.0
-40.0
89-99
99-09
89-99
99-09
89-99
89-09
89-99
99-09
89-99
99-09
Ratnapura
Hantane
Talawakelle
Passara
Galle
FIM
SWM
SIM
NEM
Annual
4500
4000
3500
3000
2500
2000
1500
1000
500
0
79-89
89-99
99-09
Ratnapura
Hantane
Talawakelle
Passara
Galle
FIM
SWM
SIM
NEM
Annual

B 95. Artificial Neural Networks for Predicting and Classifying Tea Flavor/Quality in Regional Teas in Sri Lanka

The main objective of the project is to develop two separate profiles in terms of chemical compositions and orgonoleptic characters for Sri Lankan black teas of different geographical origins and also, to develop an artificial Neural Network (pattern recognition) Model to identify geographical origin of any unknown tea sample.

Before training the neural network, all orgonoleptic data were evaluated for self consistency (Intra Rater Reliability) of panel members and for mutual agreement among them (Inter rater reliability).

Results indicated that on average panelists show low self consistency on two liquor characters; brightness and strength. Also, results indicated that it is impossible to find subsets of panelists who have high self consistency in all attributes. According to the results on agreement among panelists, they show very low agreement on brightness and strength and then quality. No parameter exceeds average reliability coefficient across months 0.5 except color.

In order to identify the best agreed group of panelists and bias correction of panelists with the application of suitable statistical methods is in progress.

D/Biomet: Risk Assessment Model for Blister Blight Leaf Disease in Tea

This study aims to develop a Risk Assessment Model (RAM) in order to predict the level of risk due to Blister blight damage. This would help the end user to predict the risk levels in the field directly and well in advance, thereby reducing expenditure in the control of Blister blight.

Installation, configuration and standardization of automated weather systems and seven-day recording spore traps at Helboda and Waltrim Estates were completed.

Data collection (weekly assessment of disease severity and incidence and measuring of flush weight from 192 plots consisting of six tea bushes across different micro environmental conditions, daily assessment of blister spore concentration in the air and collection of weather data) for a single disease season has already been completed and basic analysis was carried out.

Based on the severity results observed, significantly different disease intensity and spreading pattern according to the micro environmental conditions (top of the hill, face to sun dawn direction, sun set direction and bottom of the hill) and different climatic conditions was identified.

Development of data base for disease incidence and severity was carried out. Work is in progress to summarize different weather parameters recorded every minute in order to use those data for the development of forecasting model.

This project is funded by National Research Council of Sri Lanka as a collaborative project with Division of Plant Pathology and Faculty of Agriculture, University of Peradeniya.

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

The objective of this study was to estimate the magnitude of error that occurs due to extrapolation of small plot yields to per ha basis and to estimate a correction factor capable of giving reliable treatment potentials in experimental yields.

After the preliminary study at Moragolla, Diddenipotha and Wilpita Estates, data collection was completed at Moragolla estate for one year period with the assistance of SPN Division, Walahanduwa. Data analysis continues.

B 82. Improvement of Methodologies for Pest, Diseases and Cultivar Screening Using a Biometrical Approach

Researchers generally experience high variability in SHB field experiments. Current sampling technique used in these experiments is standard unit sampling. This sampling method does not consider the spatial pattern of the pest. Therefore this study was conducted in collaboration with Entomology Division to improve sampling techniques for SHB experiments.

The experiment was conducted in three tea fields at 12, 15 and 18 months after pruning in the Mid country (WM2a). More than 1000 bushes were selected from each field. This study reveals that the spatial pattern of the pest is clustered or patchy in nature and it seriously affects the estimates. High variability is the consequence of the clustered spatial pattern and to get precise estimations, optimum plot size for SHB experiments should be 40 bushes per plot and optimum number of bushes to be sampled should be 25 bushes.

D-Biometry: Designing of field experiments, Data Analysis and Interpretation

Services on adapting efficient protocols for experimentation, use of sound statistical methods for data analysis and drawing statistical inferences were provided at the requests of relevant divisions.

Research Publications

A research paper was submitted based on the outcome of project B-81

Title: Analysis of climatic parameters to determine the optimum time for cultural practices in Tea (*Camellia sinensis* (L.) O. Kuntze) - The case of pruning in the Uva region of Sri Lanka

General

Ms. T U S Peiris participated in International Statistical Conference organized by Applied Statistical Association of Sri Lanka at Sri Lanka Foundation Institute Colombo, 08th – 09th January 2010.

Advisory and Extension Division

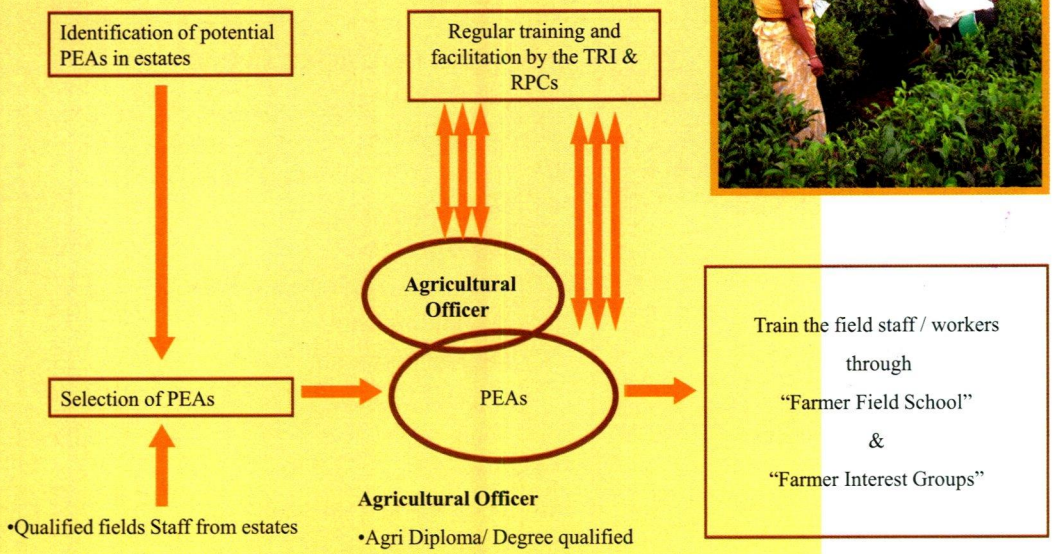
V S Sidhakaran
B Sc Agric. (Peradeniya, Sri Lanka),
M Sc (PGIA, Sri Lanka), PhD (TNAU, India),
Diploma in Development Research in Agriculture (ICRA, Netherlands),
Diploma in Plantation Management (India)

Highlights of the Year

Pilot project on Para Extension Approach (PEA) for Corporate Tea Sector, a novel approach to empower the field staff and workers of tea estates with agricultural knowledge and technologies was introduced. The project was implemented in Watawala Plantations PLC with collaboration in order to narrow down agriculture knowledge gap at grass root level employees of six tea plantations. Primary objectives of the project are improving accessibility to agricultural knowledge, improving the efficiency of training, developing positive attitudes in field staff and workers towards their job and implementation of Good Agricultural Practices. Reduction of below norm pluckers and improvement in their work standard were the main tangible impact of the project.

A part of the outcome of the diagnostic study which was conducted covering 307 tea plantations coming under 20 RPCs was presented to the senior management of the plantations as "the deployment of Workers for Major Cultivation Practices in the Corporate Te Sector". The findings on "the current status of land use and the impact of the rate of replanting on the sustainability of tea industry" were presented to the Minister of Plantation Industries and the CEOs of RPCs, for enabling them to devise the policy directives, to maintain the sustainability of the industry.

Operational model of Para Extension Approach



•Qualified fields Staff from estates

•Innovative / influential persons

Agricultural Officer

•Agri Diploma/ Degree qualified

•Employed by RPCs

•Main operational link between TRI & Plantations

Advisory and Extension activities organized and conducted by the Advisory and Extension staff at the Talawakelle, Kandy, Ratnapura, Passara, Kottawa and Deniyaya regions for achieving the objectives given in the corporate plan for the year 2010 are reviewed in this report. In addition, special activities requested by the institute, the government and the stakeholders were also undertaken.

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

Activity	Nos.	Activity	Nos.
On call Advisory Visits-Estate	192	Commercial Nursery Inspection	1
On call Advisory Visits-Smallholdings	01	Exhibition	3
Extension Visits	10	Crop Clinics	3
Total Advisory & Extension Visits	203		
Collaborative Research Visits	03	Visitors	
Familiarization visits	05	Tea Growers	103
Total Visits	211	University/Diploma students	477
		School Students	4572
		Foreign personnel	56
		General Visitors	796
Advisory Correspondences		Total	6004
Advisory Documents	1553		
Administrative Matters	1446	Mass Media Extension	
Total	2999	Posters/Wall charts	
02			
Training Programs			
Lecture/Seminar/Field days/Work shops	25	Total	02
Familiarization programs: Estates & SH	05		
Skill Training Program	10		
Educational Programs	09	Adaptive trials	01
Training Para Extension Aides	10	Publications distributed	
Total	59	Free issues	345

Special problems in the Up country region

Severe white grub attacks were reported mostly in new clearings of Glentilt, Gampaha, Bogahawatte, Bearwell, Kotiyagala and Hollyrood Estates. White grub damage was also severe in the tea nursery at Gampaha estate. These problems were investigated in collaboration with Entomology Division and, appropriate recommendations were made.

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	19
Advisory visits to estate	27	Exhibition	01
Advisory visits to smallholdings	30	Visitors	
Extension visit		Tea growers	561
Total visits	57	University /Diploma students	23
Individual Contacts		School students	10
Office calls	417	General visitors	25
Telephone inquiries	417	Total	619
Total	834	Mass media activities	
Advisory Correspondence		Newspaper articles/letters	01
Advisory documents	1176	Research articles	01
Extension services reports	319	Video films shown	61
Publications	68	Posters, Wall charts	01
Administrative matters	51	Total	64
Total	1614	Soil Testing	719
Training Programmes		10. Distribution of Publications	
Skill training programmes	01	Free issues	500
Educational programmes	07	Publications sold	641
Customized training programme	01	Total	1141
Demonstrations	14	Meeting attended	
Group Discussions	04	Internal meeting	12
Lectures, seminars, Field-days etc.,	20	Outside meeting	26
Crop Clinics attended	03	Total	38
Total	50		

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	39
Advisory Visits to Estates	45	Exhibitions	3
Advisory Visits to Smallholdings	71	Adoptive trials	2
Familiarization/collaborative visit	104	Visitors	
Total Visits Made	220	Tea Growers	573
		Students	210
		Foreign Personnel	13
		General Visitors	24
		Total	820
Advisory Correspondences			
Advisory Documents	72	Mass Media Extension	
Publications	120	Posters/Wall Charts	1
Administrative Matters	24		
Total	216	Soil Testing	487
Training Programs		Publication Distributed	
Skill Training Programs	5	Free Issuing	
Educational Programs	8		
Customized training Programs	3		
Group Discussion	7	Meetings	
Lecture/Seminar/Field-days etc.,	6	Internal meeting	29
Crop clinic attended	3	Outside meeting	26
Total	32	Total	55

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.	Activity	Nos.
Estates Visits		Soil Testing	
Advisory visits to Estates/			
Smallholdings	66	pH	914
Total Visits Made	66	Organic carbon	478
		Publication Distributed	
Correspondences		Free Issuing	148
Advisory matters	164	Priced publications	101
Administrative matters	495	Total	249
Total	659		
Training Programs			
Lecture/Seminar/Field days/workshops	13		
Commercial Nursery Inspections	08		
Exhibitions participated	01		
Crop Clinics held	01		
Crop clinic Attended	03		
Visitors			
Tea growers (Estates & Small holders)	308		
School students	30		
University students	177		
Other visitors	317		
Total	832		

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	0
On-call Advisory Visits-Estate	7	Visitors	
On call Advisory Visits: Small Holdings	10	Tea Growers	606
Routine Advisory Visits	6	University/Diploma students	23
Extension Visits	35	School students	23
Collaborative Research Visits	24	Foreign visitors	14
Familiarization visits	8	General Visitors	127
Social Visits	9	Total	793
Total Visits Made	99	Mass Media Extension	
Individual Contacts		Video films showed	19
Office calls	280	Total	
Inquiries through telephone	390	Soil Testing (pH)	264
Total	670	Publication Distributed	
Advisory Correspondences		Free Issuing	1552
Advisory Documents	41	Priced Publications	343
Extension Services Reports	44	Total	1895
Publications	3	Crop Clinic/Exhibition	4
Administrative Matters	156		
Total	249		
Training Programme			
Lecture/Seminars/Symposium	18		
Familiarization programs - Small holders	6		
Skill Training Program	38		
Customized training programs	21		
Demonstrations	25		
Group Discussion	64		
Total	172		

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

Activity	Nos.	Activity	Nos.
Estates Visits		Visitors	
Advisory Visits-Estate	23	Tea Growers- Estate Sector	1342
Advisory Visits-Small Holdings	32	School Students	394
Extension Visits	29	Foreign visitors	2
Collaborative research visits	03	General Visitors	106
Total	87	Total	1734
		Commercial nursery inspection	07
Advisory & Extension correspondences	431	Meetings attended by Advisory staff	
		External	36
Administrative letters	267	Internal	20
Total	698	Soil testing for pH	295
Training Programs	7	Soil Testing for nematodes	36
Field days/demonstrations	10	Publications Distributed	
Mass media extension	01	Free Issues	1035
Lecture/Symposium/Seminars	27	Priced Publications	450
Crop Clinics attended	03	Total	1485

Special issues/problems in Deniyaya region

Development of brown spots on tea leaves was reported in small holder lands and this condition was identified as being due to algae which could be successfully controlled by copper fungicides.

2. Training and Technology Dissemination

Para Extension Approach

Eleven PEA training programs were successfully conducted for selected qualified field staff of Watawala PLC (Lindula region). Twenty five members were trained as Para Extension Associates under this scheme and they are expected to be used as trainers to train the pluckers by the estates themselves.

Public–Private Partnership (PPP) Extension approach

PPP extension approach which was introduced in 2009 has been progressively continued in collaboration private organizations.

Regional Scientific Committee (RSC) Seminars

Five RSC seminars were conducted for the corporate sector during the year under review in the following RSC regions.

RSC I: Dimbula/Nuwara Eliya Region

RSC II: DickOya/Maskeliya Region

RSC III: Uva Region
RSC IV: Kandy Region
RSC V: Ratnapura and Kalutara Regions
RSC VI: Kegalle Regions
RSC VII: Galle/Matara regions

Approximately 130 Superintendents and Assistant Superintendents from the RPCs participated in each program organized in these regions.

Experiment and Extension Forum (Sinhala) for Smallholdings sector
Two E & E sessions were conducted for the smallholdings sector on 21st May 2010 and 17th December 2010 at TRI, Ratnapura. Approximately 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 participated.

Regional Technical & Extension Forum (RTEF) for Smallholdings sector
Seven Regional Technical & Extension Fora (RTEF) were held in Kandy, Bandarawela, Ratnapura, Galle and Deniyaya with the participation of TRI officers and RTEF members of smallholdings sector during the year. Approximately 50 members attended each forum.

a. Ratnapura, Kalutara and Kegalle Regions: Two fora
b. Deniyaya Region: One forum
c. Kandy Region: One forum
d. Galle Region: Two fora
e. Uva Region: One forum

Training programs for undergraduates, School children and other special visitors
- Twelve educational programs were conducted for undergraduate students of Sabaragamuwa, Peradeniya, Wayamba, Uva-Wellassa, Jaffna, Moratuwa and open universities,
- Five educational programmes were conducted for students of Karapincha, Aquinas, Naiwala, Palwehera, Kuliyapitiya and Kundasale Agricultural schools.
- Five educational and awareness programs were offered to Officers of various organizations and senior level school students.

Crop Clinics and Exhibitions
Two major crop clinics were conducted for both corporate and smallholding sector in Deniyaya region and Ratnapura/Kegalle regions and, one mini crop clinic was held for small holders in Waturawa, Deniyaya. Tea machinery exhibitions were also organized along with the major crop clinics in collaboration with private agro machinery companies. Details of crop clinics are given below;

Place	Theme	No of participants attended
TRI/Ratnapura	Good agricultural practices	1500
TRI/Deniyaya	Tea bush debilitation	650
Waturawa/Deniyaya	Tea bush debilitation	175

Exhibitions

Five public exhibitions and two school educational exhibitions were organized and conducted;

1. Dayata Kirula National Exhibition at Pallekelle, Kandy
2. Tea Exhibition at the Tea Museum, Hantana
3. Haritha Navodaya Exhibition at Deniyaya
4. Science and Technology exhibition at Kandy
5. Mahajana Praja Saviya at Badulla
6. Educational exhibition at Ferguson National School, Ratnapura
7. Educational exhibition at Leeds International School, Galle

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. Missing table

TRI Regional centre	No of nurseries inspected
Ratnapura	19
Deniyaya	07
Uva	08
Kandy	39

A 37.1 Identifying levels of adoption of TRI recommendations

Identifying levels of adoption of TRI recommendations in tea smallholdings in Deniyaya area

A survey to assess factors related to bush debilitation in Deniyaya region was conducted.

The final report has been compiled on Diagnostic Census conducted in the Corporate Sector Tea Estates.

D/ADV 3 Monitoring the Agricultural performance of tea plantations and smallholdings

a. Five case studies were conducted in Up country and Mid Country Region related to yield decline in RPC estates.

b. 'Para Extension Aide" (PEA) approach:

In view of reducing the technology adoption gap in the corporate sector plantations, "Para Extension aide" approach was introduced on a pilot scale. The approach aimed at training middle level employees (supervisory staff) as "Extension Assistants" on needy subject areas, and to use them effectively to narrow down the gap that exists between managerial and grass root level employees with respect to awareness, knowledge and adoption of agricultural technologies. The pilot project is implemented in collaboration with Watawala Plantations.

C/ADV1: Production of Extension and Teaching materials

Revision of Advisory Circulars: Circulars on Protection of young tea from nematodes, Sampling for nematode analysis, drought mitigation in tea plantations and Burying of pruning in tea lands were finalized. An Advisory circular on soil fertility management is in preparation.

C/ADV2 Supply of new clonal cuttings

Mr. J C K Rajasinghe, Senior Advisory Officer coordinated the ADB Mother Bush Project sites in Galle, Matara, Ratnapura, Kandy, Nuwara Eliya and Badulla districts to streamline the activities of each site in order to achieve the targets of issuing TRI 3000 and 4000 series cultivars.

D/ADV 2 Upgrading Extension Centers

New Regional Advisory and Extension Centre at Deniyaya

The construction of a circuit bungalow and OIC bungalow was completed.

Approximately two hectare block has been planted with Mana grass and a commercial tea nursery was established.

New Advisory and Extension Centre of the TRI at Matugama

TRI Advisory and Extension Regional Centre was opened at Nivitigala kelle, Matugama for the benefit of both tea small holder and large tea estate sector in Kalutara and Colombo districts with the patronage of the Minister of Plantation Industries, Hon Mahinda Samarasinghe. The new centre which is located in the building of the Rubber Research Institute's Advisory Centre was declared opened by Hon. Mahinda Samarasinghe on 27th November 2010 in commemoration of the second term office of his Excellency Mahinda Rajapaksha, President of the Democratic Socialist Republic of Sri Lanka.

Mr. T G N Mahinda/Advisory Officer was appointed as Acting Officer In-charge of this centre with effect from 15th November 2010.

Regional Tea Development Councils: TRI was represented by the following members of the Advisory & Extension Division 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.

Ratnapura, Kalutara and Kegalle regions:	S L D Amarathunga
Nuwaraeliya Region:	Haran Jayaweera,
Matara Region:	T G N Mahinda
Bandarawela Region:	K R W B Kahandawa
Kandy Region:	J C K Rajasinghe,
Galle Region:	K D Dahanayake,

Resignations

- Mr. V G A Vishvajith, Technical Assistant resigned from the services of the TRI with effect from 1st March 2010.
- Mr. D Hettiarachachi/Extension Officer resigned from the services of the TRI with effect from 17th May 2010.
- Mr. S L D Amaratunge/Senior Advisory Officer resigned from the services of the TRI with effect from 15th December 2010.

Study Programs attended by the staff

- Mr. S L D Amaratunga continued the research component of his Ph D program at the Post Graduate Institute of Agriculture, University of Peradeniya on Private-Public Extension approaches in smallholdings sector in low country.
- Mr. C J Liyanarachchi completed a six-month post graduate diploma program on tea cultivation at the Kothari Plantation Management Institute on 1st March 2010.
- Mr. B A D Samansiri continued his PhD study program at the Post Graduate Institute of Agriculture, University of Peradeniya, on ICT use and information retrieval among stakeholders in the tea sector.
- Mr. K G J P Mahindapala completed his M Sc program in Agriculture Extension (Organizational Management) at the Postgraduate Institute of Agriculture, University of Peradeniya and obtained the degree with effect from 5th April 2010. Further he enrolled and commenced a postgraduate diploma in applied statistics at PGIA from October 2010.
- Ms. Hiromi Nishanthi progressively continued her M Sc program in Agriculture Extension (Development Communication) at the Postgraduate Institute of Agriculture, University of Peradeniya. She has completed 30 out of 34 credit units required for the course.
- Mr. J C K Rajasinghe attended a three day study tour in Germany in response to an invitation by K + S Kali Fertilizer Company from 22nd November 2010.
- Ms Kumari Kirtibathgoda, Stenographer attended a one day workshop titled 'Super Secretary' on 9th July 2010 in Colombo, organized by Institute of Industrial Techno-management (Pvt) Ltd.

Research Publications & Poster Publications

- Amarathunga M K S L D and Wanigasundara W A D P (2010) Strengthening Links among the Key Stakeholders of Public–Private Partnerships Extension Approach: Lessons Learnt from Tea Small Holding Sector in Sri Lanka, Proceedings of the Third Symposium on Plantation Crop research. Page 311, 30 September and 1 October, 2010.
- Sidhakaran V S (2010), Awareness Knowledge and Adoption of Agricultural Technologies by the Corporate Tea Sector in Sri Lanka, Proceedings of the Third Symposium on Plantation Crop research. Page 289, 30 September and 1 October, 2010.
- Rajasinghe J C K and Samansiri B A D (2010) Assessment of Levels of Adoption of some Important Cultural Practices Recommended to the Corporate Sector Estates by the Tea Research institute of Sri Lanka, Third Symposium on Plantation Crop research. Page 335, 30 September and 1 October, 2010.

- Samansiri B A D, Rajasinghe J C K and Nishanthi M A H (2010) Forecasting Productivity of VP Tea under varying Rates of Replanting in the Corporate Sector of Sri Lanka, Third Symposium on Plantation Crop research. Page 338, 30 September and 1 October, 2010.
- Sidhakaran V S (2010), Clientele Satisfaction towards the TRI Extension Services Rendered to the Corporate Tea Sector in Sri Lanka, Third Symposium on Plantation Crop research. Page 339, 30 September and 1 October, 2010.

Special Presentations by the Advisory Staff

- Dr. Sidhakaran presented a paper on Awareness Knowledge and Adoption of Agricultural Technologies by the Corporate Tea Sector in Sri Lanka, at the Third Symposium on Plantation Crop research on 1st October, 2010 at Cinnamon Grand Hotel, Colombo.
- Mr. Amarathunga presented a paper on Strengthening Links among the Key Stakeholders of Public–Private Partnerships Extension Approach: Lessons Learnt from Tea Small Holding Sector in Sri Lanka, at the Third Symposium on Plantation Crop research on 1st October, 2010 at Cinnamon Grand Hotel, Colombo.
- Mr. Samansiri made a presentation at 220th E & E forum on Deployment of Workers for Major Cultivation Practices in the Corporate Te Sector.
- Mr. B A D Samansiri made a presentation on Diagnostic Census on Corporate Tea Sector in Sri Lanka at the Ministry of Plantation industries, Colombo on 29th Octorber.

Special Assignments

- Dr. V S Sidhakaran continued as the Actg. Head of the Advisory and Extension Division with effect from October 2009.
- Dr. V S Sidhakaran and Mr. B A D Samansiri served as the visiting lecturers for the Tea Technology and Value addition degree program of the University of Uva-Wellassa.
- Dr' V S Sidhakaran, Mr. B A D Samansiri Mr. J C K Rajasinghe, Ms. Hiromi Nishanthi, Mr. Haran Jayaweera and Mr. Rohitha Kumara served as resource persons for the program of National Diploma in Plantation Management conducted by the NIPM.
- Dr. V S Sidhakaran served as the coordinator of NIPM programs conducted by TRI
- Mr. 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. J C K Rajasinghe continued as Actg. Officer-in-charge of Mid country Regional Centre
- Mr. J C K Rajasinghe continued to be the coordinator of ADB Mother Bush Project.
- Mr. K G J P Mahindapala continued to work as the Convener/ Secretary of the Advisory and Extension Officers' Forum.
- Mr. S P Rathnayake continued to serve as the Convener/ Secretary of the E& E Sinhala forum.
- Dr. V S Sidhakaran continued to serve as the Convener/ Secretary for the Consultative Committee of Estates & Advisory Services, a member of Publications and Presentation Panel, Agrochemicals and Machinery Screening Committee.

- Mr. B A D Samnsiri 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.
- Mr. B A D Samnsiri continued to work as the coordinator of technology dissemination project on alternatives for Methyl Bromide for tea industry
- Dr. V S Sidhakaran continued as the coordinator for revision of TRI Advisory Circulars and to coordinate the Research and Extension Linkage meetings.
- Mr Haran Jayaweera continued to serve as the Chairman of the Regional Tea Development Council in the Nuwara Eliya region
- Mr. Janaka Mahindapala was appointed as coordinator of the Tea Tathu with effect from 29th Sept 2010.
- Mr. Saman Ratnayake was appointed as the coordinator of the TRI update with effect from 29th Sept 2010.

C/AV: Audio Visual Services: Neville S Ekanayake, Technical Assistant

Mr Neville .S. Ekanayake attended to all audio and video related activities of the TRI. He attended to preparation of several video clips on field and laboratory experiments, crop clinics, seminars, training programs and other the special events of the TRI.

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.

Publications and Publicity Unit

K P H Liyanage
B Sc (OUSL, Sri Lanka)
Publications / Publcity Officer

Publications Issued

- Sri Lanka Journal of Tea Science Volume 73, Part 1
- Sri Lanka Journal of Tea Science Volume 73, Part 2
- Sri Lanka Journal of Tea Science Volume 74, Part 1
- Annual Report 2008 (Sinhala)
- Annual Report 2008 (Tamil)
- Advisory Circular No. SP 10 Fertilizer Recommendation for Mature Tea in Small Holdings
- Cautionary note on Use of Glyphosate

Sale of Publications

Income generated through the sales of publications was Rs. 479,805.00.

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 fora, leaflets for free distribution at crop clinics, etc.

Website

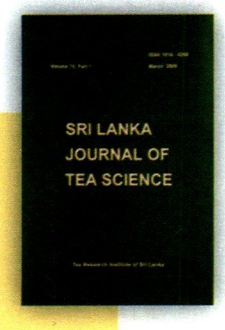
Development of the upgraded TRI website was started by the selected web developer (LankaCom (Pvt) Ltd) and completed the requirement analysis of the site development.

Photography

Photography Unit covered all the functions of the institute and captured 4676 digital photographs. An income of Rs. 21,475.00 was earned by selling photographs.

General

- Publications/ Publicity Officer served as a member of the Publications and Presentation Panel of the Institute
- Mr. U D Alagiyawadu attached to the IT Unit continued his support in graphic designing works undertaken by the Publications Unit.
- Mr. N S Ekanayake attached to the Advisory and Extension Division bore the responsibility of smooth functioning of main photocopy services. He extended his support in the sale of publications at crop clinics.
- Mr. R Krishan Kumar has been undergoing a training at the unit. He has been playing a vital role in computer graphics and typesetting and pagesetting of publications.



Library

R W M S K Amunugama – Library Assistant
Diploma in Library Science (Sri Lanka Library Association)

Main function of the library is the collection and dissemination of information on the requirements of TRI scientist for work connected to their research & publications.

The Library renders its service to TRI staff, undergraduate and diploma students who are doing their projects at the TRI, and on official requests to outside libraries and individuals.

The Library was involved in the following activities during the year.

- Acquisition, collecting and maintaining of library materials
- Lending library materials
- Maintaining a collection of News Clippings
- Photocopy Service
- Inter Library Loan Service

Acquisition

During the year the available book collection, of 4659, was expanded by 18 new books, as 5 purchase and 13 free of charge. The Library procured 30 journals/serials through subscription, gift and exchange. It subscribed to 13 foreign journals. One M Phil thesis and 1 Ph D thesis of TRI officials were added to the library thesis collection during the year.

Services

During the year 351 news paper articles were sent to the Director. Under Inter Library Loan Service (ILL) one request was received by the Library from outside libraries. Only 5 articles were received from outside libraries for 6 ILL requests of TRI staff. 4102 Papers were photocopied for TRI staff from bound periodical collection and other library materials.

Nineteen students from Universities and Technical Colleges used the library for their reference work during the year.

IT Unit

Udeni D Alagiyawadu
Experimental Officer

During the year, Information Technology unit rendered following services to the TRI as and when required.

- Administration and maintenance of internet, file servers and computer network
- Installation and troubleshooting of computers, accessories and Local Area Network (LAN)
- Installation and maintenance of Finger Print Scanners
- Preparation of technical specifications to purchase computers and accessories

Seminar/ Trainings

Mr. U D Alagiyawadu completed a four months certificate course on computer networking and administration conducted by the National Institute of Business Management.

General

Mr. U D Alagiyawadu

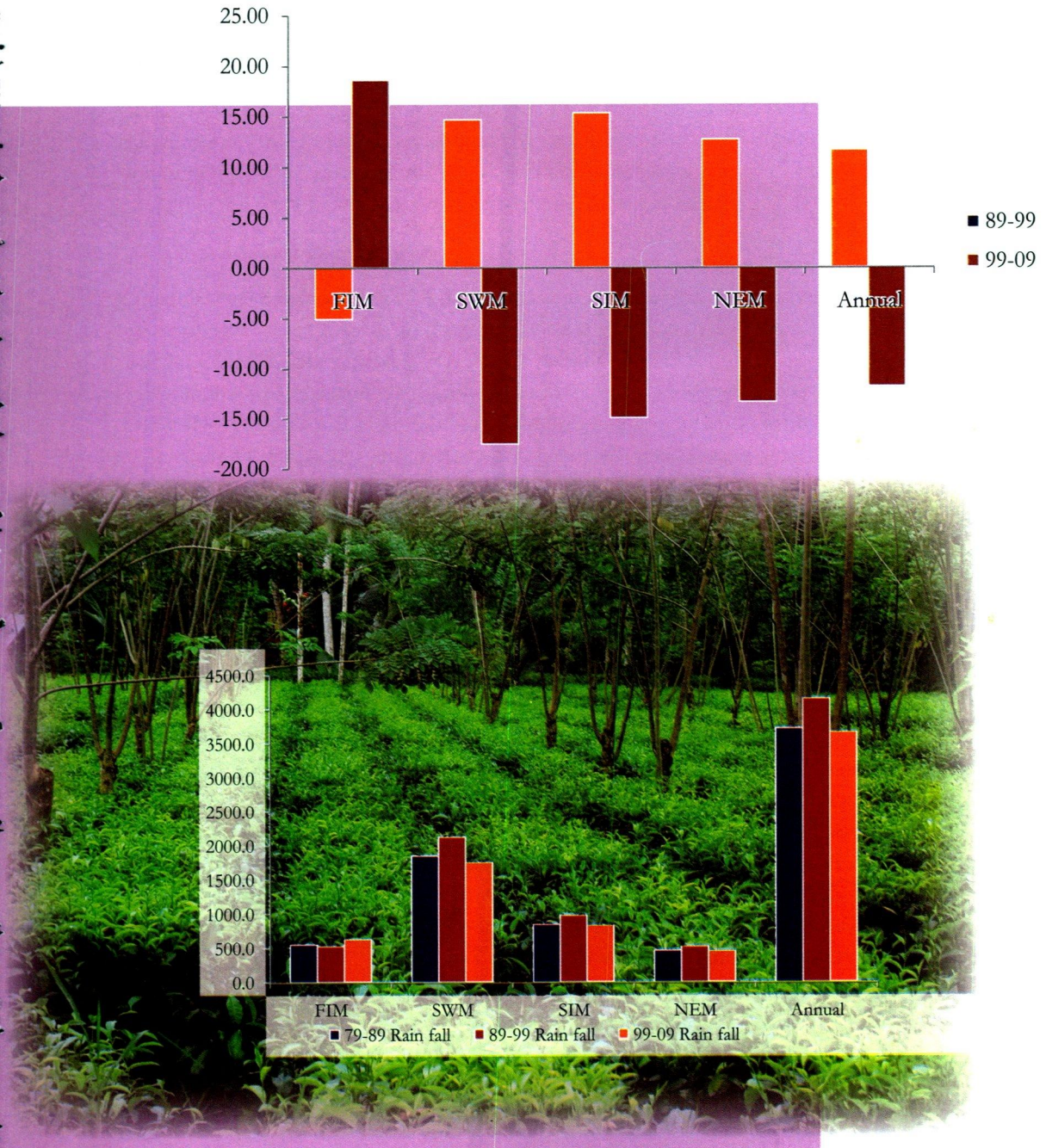
- assisted Publications/ Publicity Officer in developing TRI Web-site, designing computer graphics and printing materials throughout the year.
- served as a member of several Technical Evaluation Committees for purchasing of computers and accessories, etc.
- assisted for multimedia and computer arrangements in special occasions.

Low country Regional Centre

M A Wijeratne
B Sc Agric. (Ruhuna, Sri Lanka), Ph D (London, UK)
Officer-in-Charge/ Senior Research Officer

General

The TRI Low Country Regional Centre, Ratnapura is equipped with 4 research divisions namely Agronomy, Entomology, Plant Breeding and Technology Divisions and an Advisory and Extension Division. The total number of staff members attached to the TRI Low Country Regional Centre in 2010 was 38 of which 19 were in the Research Divisions, 2 in the Advisory and Extension Division and others were supportstaff attached to the Administration section. Research Divisions, conducted more than 60 field and laboratory experiments in different disciplines in Low country tea estates. Advisory and Extension services was mostly confined to corporate sector estates and smallholdings in Ratnapura, Kalutara and Kegalle districts. Research staff of the Technology Division conducted their experiments and fact finding/problem solving investigations at St.Joachim Factory and other Low country tea factories. Research staff of the TRI Low Country Station also conducted short-term collaborative experiments with universities. Advisory and Extension officers conducted training programmes, field days and workshops on tea cultivation and processing at TRI Low Country Station and on estates. Research staff also participated as resource persons in extension and training programmes organized by the tea related institutes such as Tea Board, Tea Smallholdings Development Authority (TSHDA) and National Institute of Plantation Management and other government Institutes. TRI Low Country Station also provided training facilities to graduates, undergraduates and students from agriculture schools and other apprentice training institutes. Tea shoots of new TRI cultivars and planting materials of rehabilitation grasses, shade trees, cover-crops and hedgerow species etc were also issued to tea growers in collaboration with the St. Joachim Estate.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Crop Clinic and Machinery Exhibition

The TRI Low Country Station, Ratnapura successfully organized a "Crop Clinic" during October 5 & 6, 2010 to disseminate new technology to tea growers and find solutions to their field and factory problems. The two days were dedicated to both corporate sector estates and tea smallholders. The tea machinery exhibition held along with the Crop Clinic provided a great opportunity to tea growers and factory owners to meet with suppliers and discuss current issues on tea machinery and mechanization and also acquire knowledge on different types of machines available in the market. A large number of participants (around 1500) representing corporate sector estates, proprietary estates, smallholdings, tea factories, other government and private sector organizations dealing with tea related business attended the Crop Clinic.

Research, Advisory and Extension Program

TRI Low Country Station staff carried out more than 60 field and laboratory experiments, 57 advisory and extension visits and 48 extension and training programs. In addition, the Technology Division at theLow Country Station made 58 factory visits on manufacture & machinery related problems. They also conducted training sessions on low country tea manufacture at TRI Low Country Station, Ratnapura. The details of the experiments conducted and their findings have been discussed elsewhere in the reports of the respective Heads of Divisions. TRI Low Country Station conducted Experimental and Extension Fora and Regional Extension and Technical Fora for the tea smallholders and Regional Scientific Committee Fora for executives of corporate sector estates. The subjects under discussions were focused on new fertilizer mixtures & soil fertility management, low country tea pests and diseases, new tea cultivars, bush debilitation in the low country, drought mitigation, rational use of pesticides, management of rising cost of production and international brand marketing of tea. A number of one-day training sessions on tea cultivation were also conducted for the members of tea smallholder development societies in collaboration with TSHDA. Tea smallholdings were selected for a set of new adaptive trials on newly introduced fertilizer mixtures to the smallholder sector. Around 20 commercial nursery inspections in Ratnapura, Kegalle and Kalutara Districts were carried out by the Advisory and Extension Officers of the TRI Low Country Station in collaboration with the TSHDA officers. The number of soil samples tested for soil pH exceeded 700 and more than 1100 TRI publications were distributed to the stakeholders. With the opening of new TRI Advisory and Extension Centre in Matugama, documents and advisory correspondences relating to tea estates (13 estates) in Kalutara District were handed over to the new centre.

Appointments, retirements, resignations, transfers and overseas training

- Dr. M A Wijeratne continued to serve as an Assistant Commissioner to the Sri Lanka Inventors Commission until May 2010. He also served as a member of the Faculty Board of Agriculture, University of Ruhuna and visiting lecturer of the Uva Wellassa University and University of Ruhuna.
- Mr. K A D Mervin (Accounting Assistant), Mr. M A B de Silva (General Mechanic) and Mr. D A Lionel (Driver) retired from the services of the TRI. Mr. S L D Amarathunga (Senior Advisory Officer) resigned from TRI service with effect from 15th December 2010.

- Mrs. R A P D Senanayaka, Experimental Officer of Entomology Division, TRI, Talawakelle was transferred to the TRI-Low Country Station to carry out her postgraduate research study with effect from March 8, 2010. Mr. A J Gamage Experimental Officer attached to the TRI Low Country Station, Ratnapura was transferred to the Agronomy Division, TRI, Talawakelle.
- Mr. N P S N Bandara Research Assistant, Agronomy Division, resumed his postgraduate studies at Adelaide University, Australia with effect from October 1, 2010. Mr. Asoka Mudalige, Experimental Officer attached to Plant Breeding Division continued his undergraduate studies at the Sabaragamuwa University.

Undergraduate and Apprentice Training

Three undergraduates from Ruhuna, Peradeniya and Sabaragamuwa Universities and one NIPM trainee carried out their short-term research projects on tea at the TRI-Low Country Station as partial fulfillment of their degree/ diploma programmes under the supervision of Dr. M A Wijeratne and Mr. M K S L D Amarathunga. Six apprentices from NAITA and 5 students from Hardy Technical School and School of Agriculture also completed their on-the-job training on tea.

Building and Layout maintenance

The painting and roof repairs of the guest house and bungalow No.C-9, C-12, D-3, D-6, and D-8 were completed. Carpentry repairs of the ground floor of the sports club was completed. The roof and gutters of the office, laboratory building, hostel, D-5 and D-7 quarters were repaired. Permanent water supply lines to the Technopark (field demonstration block) were laid. Security point (No. 3) was shifted to a new location closer to the TRI sport club building to strengthen security of the campus. Minor repairs and face-lifting of circuit bungalow and the office building were completed.

Electrical Maintenance

A new KWh meter was fixed to St.Joachim factory. Other repairs and routine maintenance work of electricity supply to office buildings, bungalows and street lights were satisfactorily attended. Overhead main cable for supplying electricity to the TRI Low country station was repaired and electrical wiring for the bus garage was completed.

Transport

Vehicle fleet of the TRI Low country station consists of 9 vehicles including one bus.

Visitors

Hon. Minister of Plantation Industries Mr. Mahinda Samarasinghe, MP visited TRI Low Country Station, Ratnapura on December 28, 2010. He met staff and workers of the Station and discussed issues related to research and development and other common problems faced by the staff. Hon. Minister also had a meeting with factory owners and managers of Ratnpura and Kegalle Districts on the same day and discussed current issues faced by the industry with regard to tea production and marketing.

The TRI Low country station received foreign visitors of the World Bank, China, Goizper Asia Pte Ltd, Spain, STIHL AG Co. Ltd, Germany and QuickCorp, Australia. The TRI Low country station also received more than 2200 local visitors during the year 2010.

Mid country Regional Centre

J C K Rajasinghe
B Sc Agric. (Peradeniya, Srilanka), M Sc (Peradeniya, Sri Lanka)
Acting Officer-in-Charge

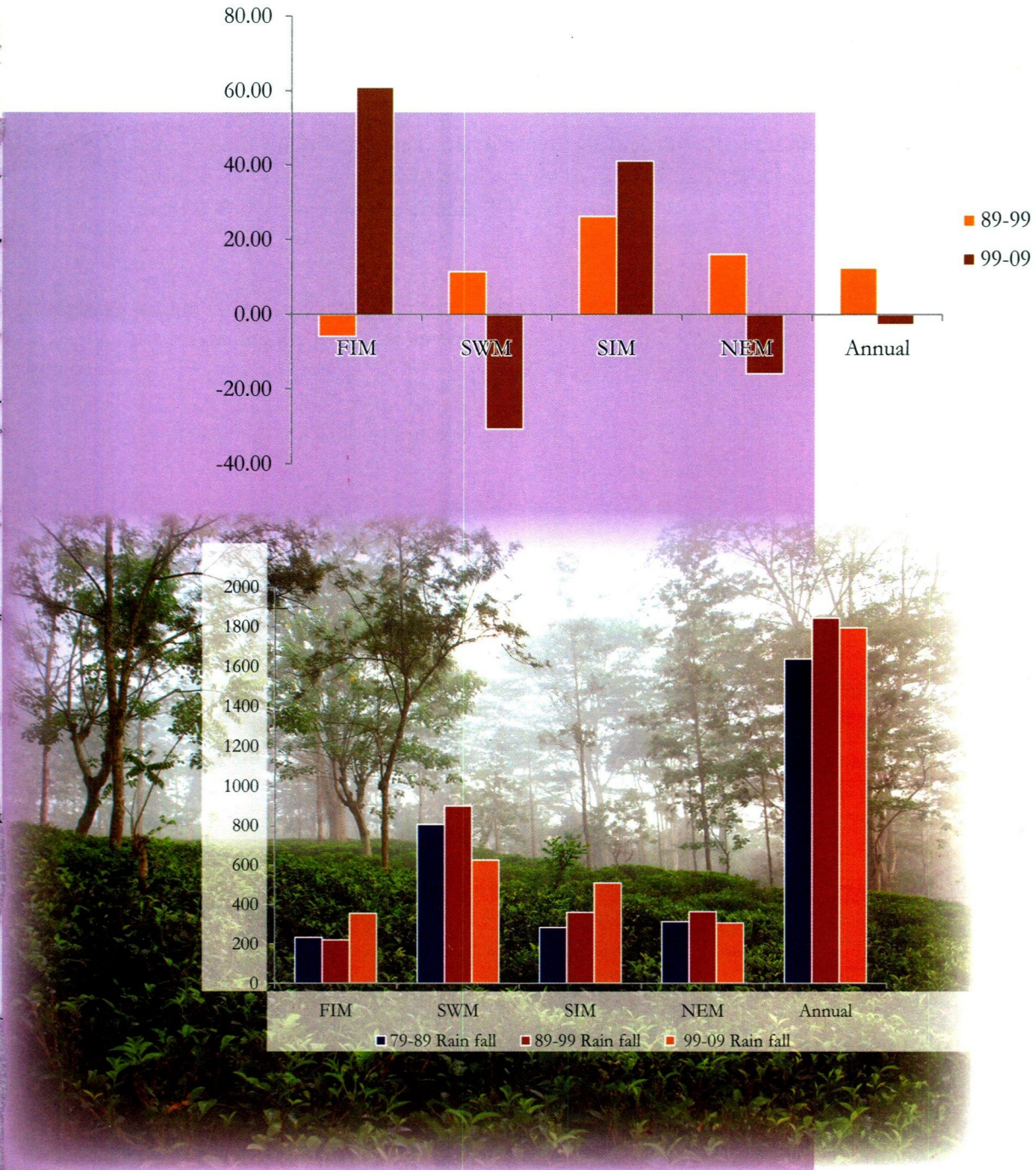
Research Advisory and Extension Programmes

Research programmes of the Agronomy, Entomology, Soils and Plant Nutrition and Plant Breeding Divisions are in progress. There are 28 experiments managed by the Mid Country Station.

A well attended Regional Scientific seminar (RSC) was held on 14th December at Royal Mall Hotel, in to a new format where the whole period was devoted for a question and answer session in order to increase the level of interaction between TRI scientists, Estate Managers, Assistant Managers and Proprietary Estate Managers in the Mid country region. DDR (P) delivered the keynote address, stressing the key issues that needed urgent attention in Mid country plantations. Questions were mainly focused on fertilizer usage, productivity improvement, weed management, pest & disease management and cultural practices such as plucking and pruning.

Regional Extension and Technical Forum (RETF) was held on 14th October 2010 at TRI Hantana and presentations on "Criteria's in selecting lands for replanting" and "soil fertility management through improvement of soil fertility through non chemical approaches" were made for the benefit of Tea Inspectors and the officials of Tea Development Societies in Kandy and Matale districts.

Two Nursery training programmes were conducted on request for the 1st year students of the Faculty of Agriculture, University of Peradeniya for the first time at TRI, Hantana. Two special educational programmes on Plant breeding/Tissue culture techniques were conducted for the students of Open University of Sri Lanka on 30th March and 06th April, 2010, in response to a request made by them.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99-09 Rain fall

Advisory Staff coordinated the activities on the part of TRI and actively participated in the "Deyata Kirula" National Development Exhibition held at Kundasale, Kandy, in February. An exhibition stall was set up and operated at the Tea Museum, Hantana from15th to18th July, 2010 which was coordinated by the Governor's Office in Central Province. TRI Advisory Divisional staff attached to Hantana participated in the two day Exhibition organized by Ministry of Science and Technology at Kandy District Secretariat premises in November.

The Senior Advisory Officer also got actively involved in conducting a Mini Crop Clinic at Pallegama, Deniyaya on 02nd August, 2010.Advisory Staff of Hantana actively participated in two other Crop Clinics held at TRI Ratnapura and TRI Deniyaya in October and December, 2010 respectively.

The Senior Advisory Officer and Advisory Officer got actively involved in compiling the "Diagnostic Survey" report and the Senior Advisory Officer presented the Summary of the report to the Tea Research Board on 30th August, 2010.

SAO conducted a Nursery Training programme for the NIPM trainees at TRI, Talawakelle on 14th November, 2010.

Staff News

Mr. M. S Wijethunga, Experimental Officer was transferred back to Hantana Centre with effect from 15/10/2010 and Mr. D M B N Dissanayaka (Experimental Officer) was transferred to Talawakelle, with effect from 15th October, 2010.

Special Activities

- Senior Advisory Officer, in his capacity as the Coordinator of ADB Mother Bush project, visited all the mother bush sites in Galle, Matara, Rathnapura, Kandy, Nuwara Eliya and Badulla district to streamline the activities of each site in order to achieve the targets.
- Senior Advisory Officer went on a three day study tour to Germany in response to an invitation received from K +S Kali fertilizer company.
- The SAO participated in a meeting convened by the Dept.of Agriculture on "Introduction of rice flour for bakery products" to represent the TRI. He was also selected as a member of the special National Committee formed to popularize rice based bakery products in the plantation sector.

Summary of Advisory and Extension Activities

Advisory correspondence: 216

Advisory & Extension visits

Estate Sector	: 45
Small Holding Sector	: 71
Extension Research Visits, Inspection Visit & Collaborative research visits	: 104

Advisory and Extension Programmes
Field days, Seminars, Demonstration and Awareness programmes: 29

Commercial nursery inspections: 39 commercial nurseries

Publications and Newspaper Article:
Senior Advisory Officer presented a poster on "Assessment of levels of adoption of some important cultural practices recommended by the Tea Research Institute" at the Crop symposium held from 30th September to 01st October, 2010.

Experiments conducted with the collaboration of research disciplines
Phase III trials on TRI 5000 series cultivar – Collaborative research with Plant Breeding Division:
Field planting has been completed in Green Wood Estate, Nawalapitiya.

Adaptive trials
An adoptive 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) which were in the nursery at TRI Hantane were planted on Hingurugama estate in mid November. Site selection for fertilizer adaptive trials was completed jointly with SPND staff.

Demonstration Trials
The work on live demonstration plots at the station, for Good Agricultural Practices (GAP), is in progress.

Extent
The extent at the Station as at 31st December 2010 is given below

Type of land use	**ha**
Seedling tea	2.00
VP tea (mature)	5.5
VP tea (young)	3.5
Mother bushes	2.75
Tea Nursery	0.2
Under Mana grass	0.5
Fruit trees	0.4
Coconut	0.81
Forestry	1.2
Marshy land	0.62
Building, gardens, paths and roads	5.77
Total	**23.25**

Crop

The green leaf (kg) harvested, during the year 2010, is given below.

Month	Crop harvested/Sold	Rate paid (Rs.)	Income (Rs.)
January	1354	50.98	69026.92
February	1979	52.97	104827.63
March	1149	50.47	57990.03
April	1511	46.74	70624.14
May	2425	53.42	129543.50
June	1938	46.25	89632.50
July	1657	45.26	74995.82
August	1079	48.24	52050.96
September	1251	47.56	59497.56
October	885	51.18	45294.30
November	1087	49.70	54023.90
December	737	49.42	36422.54
Total	17052		843,929.80

Income

No. of VP cuttings sold	737515
Income from sale of cuttings	4, 81,010/50
No.of VP plants sold	30,482
Income from sale of VP plants	3, 69,996
Total crop harvested (kg)	17052
Income from sale of green leaf	843929/80
Guesthouse occupation charges	47350/00
Charges for soil testing (pH)	105655/00
Sale of TRI publications	84300/00
Miscelaneous	8895/00

Visitors to the station

Tea Growers	573
Students/ School Children	210
General Visitors:	24
Foreign Visitors	13
Total	820

Experiments by the Research Divisions

Results and details of the experiments are reported under respective 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 centred research on organic tea:Soil fertility studies
Providing laboratory analytical services to the stake holders
SA/Urea trial
Fertilizer adaptive & designed trials

Plant Breeding Division

Evalution of cultivars for the 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 and Nematology 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.
Management of Nematodes pests in tea.
Nematological analytical service to estates.

Agronomy Division

Effect of surface application and incorporation of Gliricidia loppings 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 loppings on soil properties, yield and growth of tea.
Effect of bio fertilizer inoculation on growth of nursery plants.

Buildings and constructions

Full colour washing of C-3, D-1, D-2 , D-3 and a partial colour washing of A-1, C-2, ARP-C, ARP B-1,-and D-2 was completed during the year.

Uva Extension Centre

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

General

Mr.V G A Vishwajith (Technical Assistant) resigned w.e.f 1st March 2010

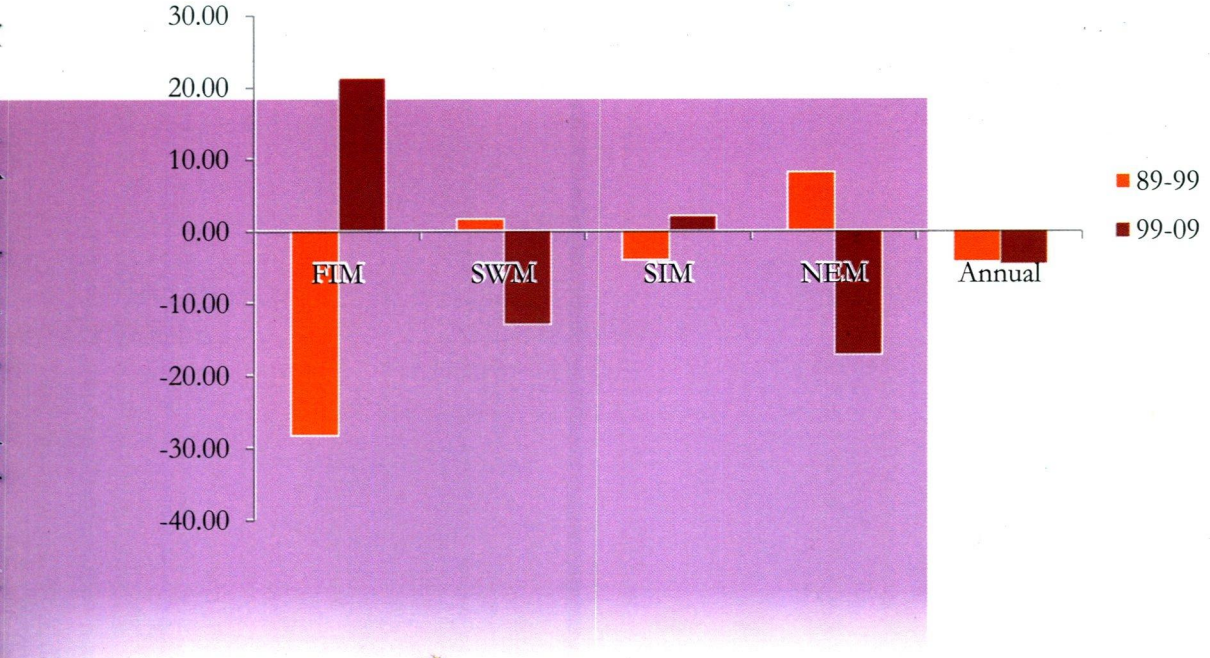
Infrastructure Development and Capital items

New Clearing work of 0.4 ha is in progress.

New laptop computer was received as a replacement for the old one.

Advisory and Extension Activities

Advisory visits made to Estates and Smallholdings in Uva	66
Advisory letters issued	196
Seminars/Field days/Training programs held for Estates / Small holders / Students	20
Crop Clinics	-
Regional seminars held in the area	02
Meetings/Seminars attended	36
Soil samples tested for pH	914
Soil samples tested for Organic Carbon content	428
VP cuttings issued 373120	
VP Plants sold	4450
No. of Publications sold	126
Commercial Nursery Inspections	08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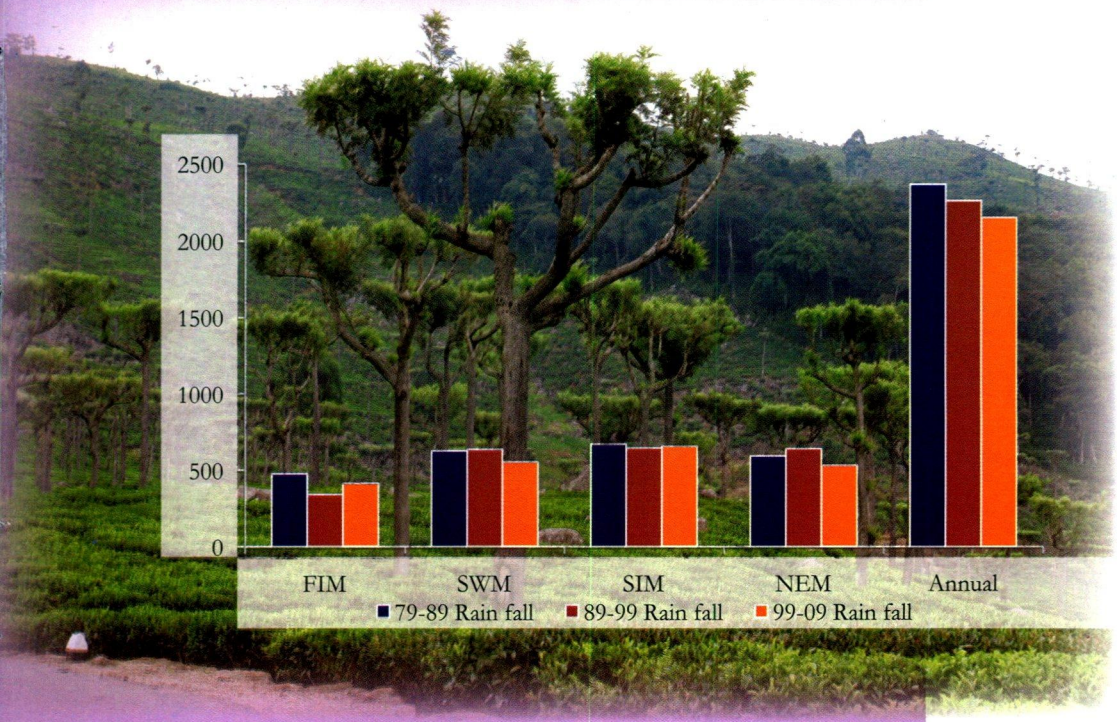
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General

Mr.V G A Vishwajith (Technical Assistant) resigned w.e.f 1st March 2010

Infrastructure Development and Capital items

New Clearing work of 0.4 ha is in progress.

New laptop computer was received as a replacement for the old one.

Visitors

Foreign	-	-
Planters	-	135
Small Holders	-	189
Students	-	38
Undergraduates -	-	179
Others	-	363
TRI Officers	-	193
Total	-	1097

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	1868	46.72	87272.96
February	2340	39.19	91704.6
March	2806	47.78	134070.68
April	4487	50.82	228029.34
May	5880	46.87	275595.60
June	4569	41.11	187831.59
July	4219	38.07	160617.33
August	3670	42.26	155094.2
September	2952	43.48	128352.96
October	4068	44.88	182571.84
November	3242	43.40	140702.80
December	2120	45.21	95845.20
Total	42221		1867689.10

Income

Highest ever total income at the station was recorded this year.

Sale of Green leaf	Rs 1867689.10
Sale of VP Cuttings	Rs 216300.00
Sale of VP Plants	Rs 79200.00
Soil Analytical charges	Rs 195970.00
Sale of Publications	Rs 32585.00
Guest House accommodation charges	Rs 19250.00
Other	Rs 56585.00
Total income	Rs 2467579.10

Field Trials

- UVP 9 & UVP 10 PPPB trials are in progress in F/No.04
- Upkeep of 5000 series phase III Trial in field No.02
- Upkeep of Germplasam in F/No.03
- 02 Seedlings trials in Field No.03 & 04 are in progress.
- Upkeep of Grafted plant block in field No.04 & 02
- Evaluation trial of 30 and 40 series cultivars on their tolerance to nematodes. The trial is on going.
- Rain water harvesting trial (Agronomy Div.) in F/No.02
- Dendro power experiment (Agronomy Div.) in F/No.03
- Nursery trial on Bio Fertilizer (Agronomy Div.)
- Trials on Bio Fertilizer (Agronomy Div.) at F/No.02

Special Events/Issues

- Large extents of land selection for new clearings was done in the estates of Uva under Agarepatna, Maskeliya, Hapugastenne and Madulsima Plantations.
- Three Adoptive Trials were initiated for exploring the fertilizer problems in smallholdings and site selection and marking of plots were completed.
- An RSC seminar and an RTEF seminar were held for the estate and smallholding sector tea growers.
- Two programs were organized on plucking and pruning for the executives and field staff of the estates of Balangoda Plantation.

Galle Extension Centre

K D Dahanayake
Diploma in Agricultural Engineering
Officer in Charge

Research/Divisional Activities

Advisory correspondences

The Advisory and Extension staff sent out 249 Advisory correspondences for the year 2010.

Advisory and Extension Visits

The total number of advisory visits made by the Advisory and Extension staff was 58, which includes all on-call/ trouble shooting visits to estates and the smallholdings.

Commercial nursery inspections

The Advisory & Extension staff were not involved in any commercial nursery inspections.

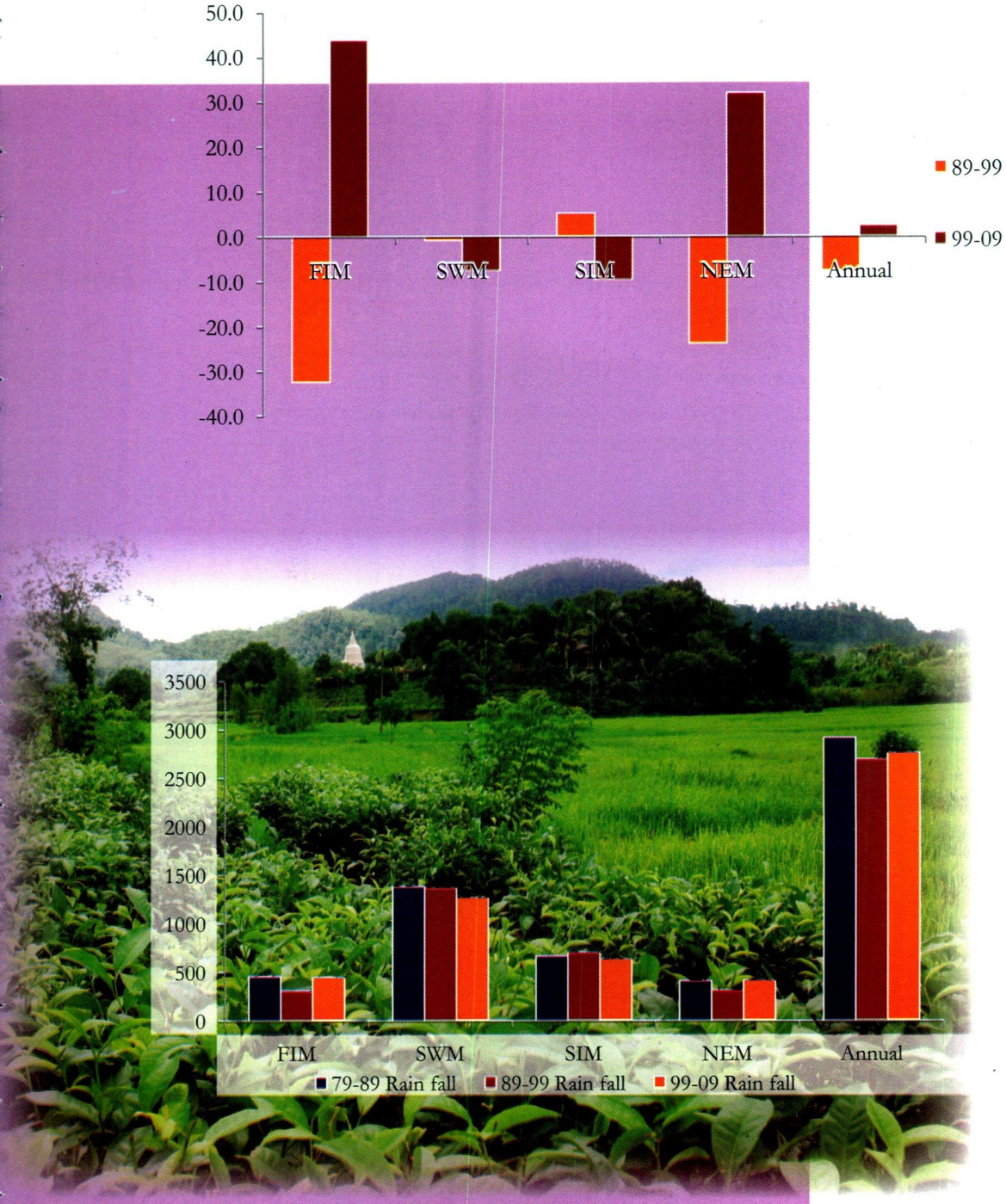
Training programs: Seminars/field days/workshops

Conducted 141 Seminars and Training Programs/ Field Days at Kottawa Station and other locations. The target groups were tea Smallholders, Green leaf suppliers and Factory owners, RPC Managers and field staff.

a) 01 RSC Seminar was organized at Akuressa for Galle & Deniyaya RPC Management staff.
b) 02 RTEF meetings were organized at Kottawa, TRI for Galle district TSHDA Officers.
c) 01 Factory based extension programme was held at Kottawa, TRI for the Factory and Extension officers.

Video programs

19 video shows were presented on plucking, land preparation, soil conservation, Pest and Diseases of tea at Kottawa Station and other locations.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Annual
79-89 Rain fall
89-99 Rain fall
99-09 Rain fall

Video programs

19 video shows were presented on plucking, land preparation, soil conservation, Pest and Diseases of tea at Kottawa Station and other locations.

Visitors to the station

- Estate management and smallholders - 606
- University/Diploma students and others - 187
- 02 Students from University of Jayawardenapura and Ruhuna (Faculty of Managemnt and Faculty of Agriculture) gained information and completed their Thesis successfully under the supervision of Mr. S P Rathnayake.
- 4 Students from Advance Technical Institute of Labuduwa, gained information and completed their Thesis reports successfully under the supervision of Mr. S P Rathnayake.
- 2 Agriculture Diploma students, gained information and completed their project reports successfully under the supervision of Mr. S P Rathnayake.
- 4 Advance Level Students gained information and completed their project reports successfully under the supervision of Mr. S P Rathnayake.
- 2 HNDE students were given the in-plant training under the supervision of Mr. S P Rathnayake and Mr. K D Dahanayake.

Meetings attended

Attended 51 meetings including HOD, Advisory Officers' forum, E & E, DDC meeting etc

Basic Research Projects (Ongoing Trials, Experiments & Observations)

a. 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 at F/No: 03.

b. Collaboration with Soils and Plant Nutrition Division
   i. Organic fertilizer trial at Field No.07
   ii. 04 Adaptive fertilizer trials at Tea smallholder sites

c. Collaboration with Nematalogy and Entomology Division
   i. Nematode population monitoring trial at F/No.04

d. Collaboration with Agronomy Division
   i. Bio film/ Bio fertilizer trial at F/No.02

Service Projects

i. Mother Bush Project
   Approximately 3.5 ha Mother Bush area used to issue new cultivars among the stakeholders and more than 421615 cuttings have been sold. (Cultivars issued: TRI 3025, 3055, 3069, 4006, 4042, 4049, 4052, 4053, 4054, 4059, 4061)

ii. Commercial Nursery
4630 VP Plants were sold @ 13 Rs. (upto Nov.2010) & 18 Rs (Nov.2010 onwards) Plant. (Cultivars raised: TRI 2043, 3025, 4006, 4042, 4049)

iii. Soil samples tested for pH
264 Soil Samples were tested for pH Values

iv. Advisory publications distributed
343 nos. of Priced and 1552 nos. of free Issuing extension publications have been distributed.

General

i. Replanting of Fiedl No.06 (02 ha) almost completed by using 3000/ 4000 cultivars
ii. Repairs to the roof of Guest House initiated
iii. TRI Kottawa land survey & sampling for leading to present a model for site specific fertilizer (SSFR) completed.

Research/ Divisional Highlights

- Mr. S P Rathnayake continued as the Convener/Secretary of the E& E Sinhala forum and successfully conducted the 02 fora scheduled for the year.
- Mr. S P Rathnayake was appointed as the coordinator of the TRI update and Tea Bulletin.
- Mr.S.P.Rathnayake served as a member of Technical Evaluation committee for fertilizer of the Institute.
- Mr. S P Rathnayake served as a member of Deniyaya Guest House construction inspections and taken over committee.
- Mr. S P Rathnayake made a presentation to the PTOA members after the successful completion of the yield decline survey. (PTOA: Private Tea Factory Owners' Association)
- Mr. S P Rathnayake made a presentation to the Galle TSHDA officers (RTEF) based on the studies carried out with regard to the new disease (Liken/Algae) found in some of the Smallholder Tea lands in Galle and Matara.
- Mr. S P Rathnayake attended the scientific writing workshop at the TRI.
- Mr. S P Rathnayake attended & presented the work done for the Small Holder sector at the TRI / TSHDA interaction monitoring committee at the TRI.
- Mr. K D Dahanayake, Mr. S P Rathnayake, Mr. M Sarath and Mr. P S Kulasiri successfully organized and presented Two exhibitions at Leads International collage, Galle and Lumbini Tea Factory, Deniyaya.
- Mr. K D Dahanayake and Mr. S P Rathnayake attended, the Galle Tea Smallholder meeting chaired by the Hon. Minister of Plantation Industries, 3rd Crop Symposium at Colombo, TRI, Deniyaya Guest House opening, TRI, Kalutara station opening.
- Mr. K D Dahanayake attended the Southern provincial meeting chaired by his excellence, the President.
- Mr. S P Rathnayake attended the Adaptive fertilizer trial discussion meeting at Rathnapura TRI.
- All staff participated at the meeting chaired by the Hon. Minister of Plantation Industries at the Head office.

- Mr. K D Dahanayake and Mr. S P Rathnayake actively involved in the Deniyaya Mini-crop clinic, Rathnapura and Deniyaya crop clinic activities.
- Mr. K D Dahanayake shared the responsibilities of walahanduwa, TRI field inspections in addition to his normal duties.

General

Land Use Information

VP tea mature (ha)	5.0
New clearings	2.4
VP tea Mother Bushes- ADB (ha)	5.0
Nursery (tea)	1.0
Seed garden (tea)	1.0
Under Rehabilitation (Mana &Guatemala)	1.6
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	-	31

Green leaf harvested

Month	Harvested	Sold Kg	Rate paid/ kg kg	Total Income Rs.cts.
Rs. Cts.				
January	2698	2698	61.064	164,750.67
February	2801	2801	60.027	168,135.63
March	2159	2159	60.119	129,796.92
April	3073	3073	59.797	183,756.18
May	2504	2504	60.005	150,252.52
June	3235	3235	57.695	186,643.33
July	2304	2304	58.000	133,632.00
August	2600	2600	60.700	157,820.00
September	2368	2368	62.286	147,493.25
October	2227	2227	62.001	138,076.23
November	2351	2351	60.825	142,999.58
December	2277	2277	62.000	141,174.00
	30597	**30597**		**1,844,530.31**

Income	
Income from sale of Green Leaf	Rs 1,844,530.31
Income from sale of 421615 VP Cuttings	239,257.50
Income from sale of 4630 VP Plants	79,470.00
Income from sale of Publication	21,855.00
Income from Testing 264 Soil Samples for pH	22,230.00
Miscellaneous Income	40,056.05
Total	**2,247,398.86**

Deniyaya Extension Centre

T G N Mahinda (up to 21st November 2010)
B Sc Agric. (Peradeniya, Sri Lanka) M Sc (Peradeniya, Sri Lanka)
S P Rathnayake (from 22nd November 2010)
B Sc Agric. (Ruhuna, Sri Lanka) MBA (Wuhan, China)
Officer-in-Charge

Research/Divisional Activities

Advisory correspondences

The Advisory and Extension staff made 431 Advisory correspondences for the year 2010.

Advisory and Extension Visits

The total number of advisory visits made by the Advisory and Extension staff was 87, which includes all on- call/ trouble shooting visits to the estates and the smallholdings visited.

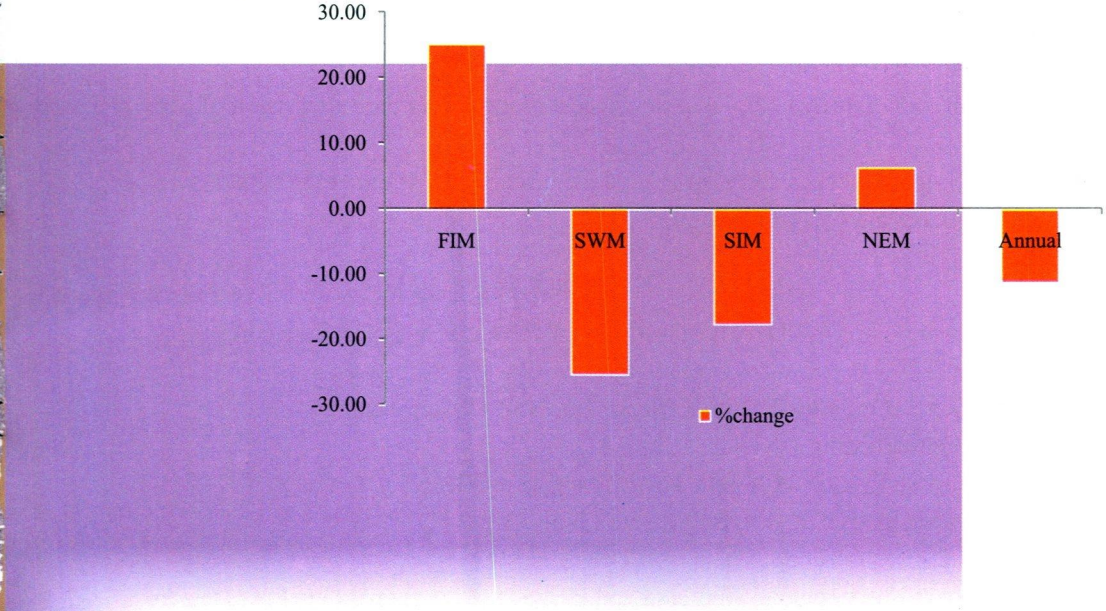
Commercial nursery inspections

The Advisory & Extension staff were involved in 07 commercial nursery inspections.

Training programs: Seminars/field days/workshops

Conducted 39 Seminars and Training Programs / Field Days at Deniyaya station and outside. The target groups were tea Smallholders, Green leaf suppliers & Factory owners, RPC Managers and field staff.

- 01 Factory based extension program held in Deniyaya, TRI for the Factory & Extension officers.
- 01 RTEF meeting organized at Deniyaya, TRI for Matara district TSHDA officers.
- 01 RSC Seminar organized at Yakkalamulla for Galle & Deniyaya RPC Management staff.
- 01 Crop Clinic held successfully with the participation of more than 650 stake holders
- 01 Mini crop clinic held successfully with the participation of more than 200 stakeholders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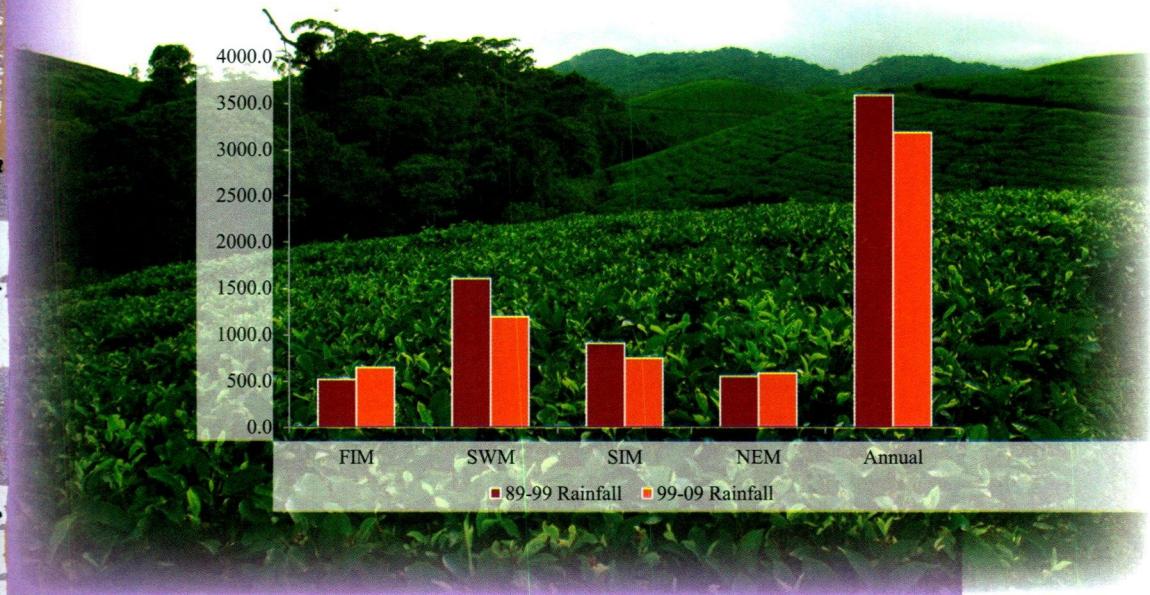
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99-09 Rainfall

Video programs

17 video shows were presented on plucking, land preparation, soil conservation, Pest and Diseases of tea in and outside Deniyaya station.

Visitors to the station

Estate management and Smallholders - 1342

University/Diploma students and others - 394

- 1 Diploma Student successfully completed the Project report under the supervision of Mr. S P Rathnayake.
- 4 Advance Level Students successfully completed the project reports under the supervision of Mr. T G N Mahinda and C E Munasinghe.

Meetings attended

Attended 36 meetings including HOD, Advisory Officers' forum, E & E, DAC meeting etc.

Basic Research Projects (Ongoing Trials, Experiments and Observations)

Collaboration with Plant Breeding Division

i. 5000 series: LVP phase iii trials at Indola, Kiruwanagaga and Deniyaya estates.
ii. Improved seedling plants trial at Warapitiya Small holder's field
iii. Collaboration with SPN Division
Fertlizer adaptive trials at Kotapola, Akuressa and Pasgoda STI ranges - Fertilizer Design trial at Kuruduwatta Proprietary Estate, Kotapola.

Collaboration with Nematalogy and Entomology Division

iv. 5000 series monitoring trial at Deniyaya, TRI nursery
v. Collaboration with Agronomy Division
vi. Bio film/ Bio fertilizer trial at Richiland and Nilgiri Proprietary estates.

Service Projects

Soil samples tested for pH

295 Soil Samples were tested for pH Values

Advisory publications distributed

450 nos. of Priced and 1,035 nos. free Issuing Advisory and extension publications have been distributed.

General

Approximately 02 acres block planted with Mana for soil rehabilitation.

Commercial nursery started to accommodate 5000 plants and already 2270 cuttings have been laid down with new cultivars.

Guest House and OIC Bungalow constructions were completed.

Research/ Divisional Highlights

Mr. T G N Mahinda and Mr. C E Munasinghe initiated the Deniyaya Bush debilitation Survey.

General

Land Use Information

New clearings	0.5
Under Rehabilitation (Mana)	2.2
Buildings, gardens, roads	2.5
Total extent (Acres)	05.2

Labour force

Number on check-roll	3
Out turn	3

Income

Income from sale of Publication	27,370.00
Income from Testing 295 Soil Samples for pH	28,025.00
Miscellaneous Income	3,772.32
Total	59167.32

St.Coombs Estate

U C Oliver
Superintendent

Factory and Manufacture
New Developments

- The rolling room was expanded and the machinery upgraded and resited at a cost of Rs.4,083,712.59.
- Following the factory developments and improvements of the leaf standard, the "ST COOMBS" mark was elevated in the "WESTERN HIGH GROWN" category to the 3rd position which is significant.
- The Gross Sale Average for 2010 was Rs. 402.68, which is Rs. 52.75 above the Western High Grown elevation average.
- St.Coombs Dust 1 grade achieved "7 TOP PRICES" in the Auctions.

Hectarage

	St Coombs	Lamiliere	Total
Old Seedling tea in bearing	1.60	2.00	3.60
VP tea in bearing	79.14	45.50	124.64
VP tea (immature)			
ADB Project	11.39	2.62	14.01
New planting/ Replanting	6.92	-	6.92
Nurseries	1.20	0.10	1.30
TRI Experimental Area	2.50	-	2.50
Total in Tea	102.75	50.22	152.97
Labour Housing	2.09	-	2.09
Ravines and Grass Land	32.66	1.00	33.66
Buildings, Roads, workers Gardens etc	34.28	14.70	48.98
Total	171.78	65.92	237.70

A yield of 2,011 kg/ha was recorded in the year 2010.

Cultural operations

- All field work was done as per the estimate following TRI guidelines.
- Fertilizing done was based on TRI Site-Specific fertilizer recommendations

Replanting

- 2 .00 ha of old seedling tea was uprooted and rehabilitated.
- 2.00 ha of rehabilitated land was planted with new TRI cultivars.

ADB Mother Bush Project

4,857,935 cuttings from TRI 3000 and 4000 Series cultivars were issued to Tea Smallholders and the Corporate Sector.

This project was transformed into a viable venture since its inception in the year 2000, recording a profit of Rs. 805,699.66.

General

Visiting Agent - Mr. M Madugalle, General Manager, Agarapatnana Plantations Ltd

Working Results

The Estate made a profit of Rs. 5,240,610.97 for the season.

St.Joachim Estate

P S Habaragoda
Superintendent

General

- The Hon. Minister of Plantations Industries Mr. Mahinda Samarasinghe (MP) visited the tea factory on 28th December 2010.
- Ms. Forbes & Walker Tea Brokers (Pvt) Ltd and Bartleet & Co. Ltd. continued to be the Brokers of St. Joachim teas.
- The following work was carried out in the factory.
  - Repairs to heater for 6' CCC drier
  - Repairs to Radiator for Generator
  - The Tempest drier - work is in progress
- The Visiting Agent Mr. Nimal M Amarasekara made two visits to the estate on 31st May 2010 and 7th October 2010, respectively.

Hectarage as at 31st December 2010

VP Tea in bearing	46.34
Major In-filled Area, Field No.2f	1.18
Major In-filled Area, Field No.8A	0.50
TRI Coconut area	3.89
Nurseries	1.58
Estate Rubber	7.12
Mature Rubber (Inter Crop area)	5.68
Paddy Fields	8.74
ADB Fields – N.C. Tea	30.00
TRI Buildings and Exp. Use Field No.9	11.02
Buildings, Roads, Jungle and Patna	25.93
Total	141.98

Crop and Yield (Made tea kg)

The production in 2010, compared to the previous year was as follows

Tea

Year	Estate Crop (kg)	Yield (kg)	Bought Crop (kg)
2009	41,138	888	204,063
2010	46,991	1,014	449,016
Variance	+ 5,853	+ 126	+ 244,953

Rubber

Year	Crop (kg)	Yield
2009	6,563	608
2010	9,047	838
Variance	+2484	+230

800 new rubber plants were planted in field No's 3 and 10

Cultural Operations
The normal GAPs were undertaken, with the inclusion of burying of pruning in pruned fields.

Tea Infilling
Block Infilling in Field No. 2F was carried out with a total of 11,080 Tea plants.

ADB Mother Bush Project
A total of 370,050 Shoots were issued to smallholders and the corporate sector as against 513,350 in 2009.

Factory Manufacture
An NSA of 379.79 was achieved in the year 2010 as against 380.79 in 2009.

Bought leaf
The Bought leaf manufactured at St.Joachim factory showed an increase of 244,953 kg as against 2009. Ruwanpura Gamidiriya joined us to supply Green Leaf from February 2010.

Timber Block
Field No. 6 Vacant Block adjacent to the Village was planted with Mahogany & Hora Plants.

Weather and Rainfall
Rainfall of 4968.40 mm was recorded on 184 wet days, as against 3921.4 mm on 210 days in 2009.

Trading results
The working results of St. Joachim Estate resulted in a Profit of Rs 557,315.76 as at 31st December 2010 compared to a trading loss of Rs (6,243,435) in the previous year.

Staff Appointments
- Office - Mrs. Nilani Koralage the Junior Assistant Clerk was promoted as the Senior Assistant Clerk from 1st November 2010. And Mrs. A Sivanandini and Miss Lankika Lakmali Dias were appointed as Junior Assistant Clerks.
- Mr. M Hasantha Rangana was appointed as a Lorry Driver from 1st November 2010.

Administration Division

Special Highlights

- The Hon'ble Minister Mahinda Samarasinghe, Minister of Plantation Industries visited TRI on 14th May, 2010 after he took over appointment as the Minister of Plantation Industries.
- Hon'ble Minister had meetings with HODs/OICs/SROs. Presentations were given by the Chairman, TRB on "Principles of Governing TRI" and on R & D activities by Actg. Director, TRI. Structured discussion was held on "Scientists Perspectives of Development of Tea Industry". All Staff Meeting was held at the Auditorium. Meeting with RPC, CEOs and Planters at the Auditorium.
- To commemorate the Second term induction of His Excellency Mahinda Rajapaksha, President of the Democratic Socialist Republic of Sri Lanka the following programme were conducted at TRI.
- Tree planting to conserve water on 15th November, 2010
- All religious ceremony at the Auditorium on 18th November, 2010
- Sramadana work at Lindula Hospital on 19th November, 2010
- The Regional Advisory & Extension Centre, Kalutara was declared open by Hon. Mahinda Samarasinghe, Minister of Plantation Industries on 27th November, 2011 for upliftment of the tea industry in Kalutara and Colombo Districts.

Staff Strengthening and Motivation

Staff Recruitments

Prof. A N Jayakody was appointed as Senior Research Officer (Contract), Soils and Plant Nutrition Division with effect from 1st February, 2010.

St Coombs Estate

Name	Designation	Date of Appointment
Mr. S Suresh	Field Officer	01.11.2010
Mr. P Selvendran	Junior Asst. Field Officer	01.11.2010
Mr. M K Rajkumar	Junior Asst. Clerk	01.11.2010
Mr. S Sivan	Factory Mechanic/Electrician	01.11.2010
Ms. T Ponmany	Creche Attendant	01.11.2010
Ms. K Jothi	Creche Attendant	01.11.2010

St Joachim Estate

Name	Designation	Date of Appointment
Ms. K Nalini	Senior Asst. Clerk	01.11.2010
Ms. K M G L L Dias	Junior Asst. Clerk	01.11.2010
Ms. A Sivanthini	Junior Asst. Clerk	01.11.2010
Mr. A W S W Peiris	Junior Asst. Field Officer	01.11.2010
Mr. E A P Fernando	Driver	01.11.2010
Mr. M H Rangana	Driver	01.11.2010

Resignations

Name	Designation	Date
Mr. Y G S C Bandara	Technical Assistant, Gr. V	2010.01.08
Mr. V G A Vishwajith	Technical Assistant Gr. V	2010.03.01
Mr. D Hettiarachchi	Extension Officer Gr. IV	2010.05.17
Mr. K B V Piyasena	Driver Gr. VI	2010.05.31
Mr. D M B N Dissanayake	Experimental Officer Gr. IV	2010.11.01
Mr. M S K L D Amarathunga	Senior Advisory Officer Gr. I	2010.12.15
Ms. W R P de Silva	Clerk/Typist	2010.12.31

Retirements

Name	Designation	Date
Ms. S Anandacumaraswamy	Senior Research officer Gr. II	2010.01.06
Mr. K A D Mervin	Accounting Assistant Gr. III	2010.06.17
Mr. A R Amarasekara	Experimental Officer Gr. III	2010.07.15
Mr. M A B de Silva	General Mechanic Gr. III	2010.08.24
Mr. D Illesinghe	Watcher Gr. VI	2010.08.30
Mr. D A Lionel	Driver Gr. VI	2010.09.12
Mr. C B Koswatte	Senior Accounting Assistant Gr. III	2010.09.12
Mr. K D H` Pathirana	Stores Executive Gr. II	2010.12.19

Human Resource Development Activities

Staff Training

Overseas Training /Seminars /Conference-2010

- Dr. I Sarath B Abeysinghe, the Director, TRI and Dr. K .M. Mohotti, Head, Entomology Division, participated at the Tocklai Tea Centenary Conference from 10th to 11th May 2010 and attended FAO/IGG meeting from 12th to 14th May 2010, in New Delhi, India, as members of the Sri Lankan delegation.
- Dr. I Sarath B Abeysinghe, the Director ,TRI ,attended and delivered the keynote address at the China Cross –Straits Symposium on Green Agriculture in Fujian, China which was held from 19th June 2010 to 20th June 2010.
- Ms. Ganesha Harshani Thotawattage, Experimental Officer, Biochemistry Division, Participated at the "2010 International Training Workshop Of Botanic Extracts Processing Technology", Human Agricultural University Human, China from 07th September 2010 to 26th September 2010.
- Mr. N P S N Bandara, Research Assistant, TRI Low country Station Ratnapura, Proceeded to Australia to attend the final part of his P h D Program including submission of the thesis at the University of Adelaide, commencing from 12th September 2010 to 17th September 2011
- Ms. T L Wijeratne, Research Assistant, Agronomy Division, Proceeded to United Kingdom to follow the foreign component of her P h D program at the University of Sheffield for a period of one year commencing from 20th October 2010.
- Dr. L S K Hettiarachchi, Deputy Director Research (production) and Mr. J C K Rajasinghe, Senior Advisory Officer, attended a Study tour to visit Mines and Processing Units of natural Kieserite in Germany from 22nd to 27th November 2010, to gain Knowledge on future Fertilizer recommendations.

Local Training/ Seminars/ Workshops

- Ms Kumari Kiribathgoda, Stenographer/ Typist (English) has sent on one day Workshop on "Super Secretary" on 9th July, 2010 conducted by the Institute of Industrial Techno-Management (Pvt) Ltd at Hotel Ramada.
- Trainees/University Students trained at TRI - 27
- Trainees Diploma students - 34

Structural Development of the Institute

Maintenance Work

- The construction work of the Circuit Bungalow was completed by the Engineering Unit. The total cost to construct the Circuit Bungalow was Rs. 8 Million. The Circuit Bungalow was declared open by the Hon'ble Minister Mahinda Samarasinghe, Minister of Plantation Industries on 1st August, 2010. All repairs completed at the Deniyaya Sub Station.
- The construction work of the OIC Bungalow, Deniyaya was completed by the officers of the Engineering Division, TRI. The total cost to construct the OIC Bungalow was Rs. 3.9 Million.

- Old building belongs to RRI was renovated for the Kalutara Extension Centre Matugama, and all repairs to the building was completed.
- Annual colour washing programme including TRI Museum, Publication Unit, Deniyaya Office Lab, Circuit Bungalows, Duke's Bungalow, Ladies Hostel, Camelia Hostel, TRI Sports Club, A, B – 3, 4, 8, 13, - C 4, 6, 7, 8, 12, 16, 25, 26 54, 51, 40, 53, 24, 43, 40, 33, 35, - D 25, 16, 28, 22 E – 1, 4, 9, 14 type Bungalows, Hostels C H R 1, 2 3 and Security hut were completed. Roof repairing work at Agricultural Economics, Accounts Divisions, TRI Bungalows etc replacing gutters, down pipe at TRI Bungalows, Office and Laboratory, repainting of TRI Name Boards, road maintenance from Main Gate to TRI Office were completed. Minor repairs and External Colour Washing of Administration and Laboratory Building were also completed.
- Piping/ New pump unit (solex) installed to the pump house near the TRI play ground.
- Cleaning of Filtration Plant sedimentation, storage tanks, water storage tanks situated in different locations, over head water tanks of TRI Bungalows, Guest House, hostels were completed. Plumbing/ Renovation of hot water system in Guest House, main pipe line repairs of the Filter Plant, A, B C type Bungalows were completed.
- Raw water piping system for B and C type quarters was repaired. An additional Over Head water tank was fixed at the Biochemistry Division.
- Electrical unit provided the wiring, installation and maintenance support at laboratories, office buildings, hostels, Circuit Bungalows, Duke's Bungalow, St Coombs Estate staff Bungalows, Deniyaya and Mathugama Sub Station and completed the work. Installation of a panel of voltage Relay to the Filter Plant. Wiring and installation of 6 KVA UPS in the IT Unit. Completed 3 Phase wiring and installed the miniature drier in the Technology Division. Wiring & installation of new 3 Phase Water Pump Motor at the Junior Staff Pump House. Maintenance of street Lights and Security Lights at TRI Head Office.

Transport

Vehicle Fleet mileage done was 921306 km. Overhauling of Engines, Service and Lubrication and Tubes and miscellaneous repairs related to wear and tare were completed.

Telephone Exchange and Test Room

Telephone Exchange attended to the maintenance of telephone line connection to offices, bungalows, guest houses, hostels, sub stations. New telephone instruments were connected to offices, bungalows *etc.* Intercom Telephone connection (ADSL) trunk line and internal wiring at Hantana Sub Station was attended.

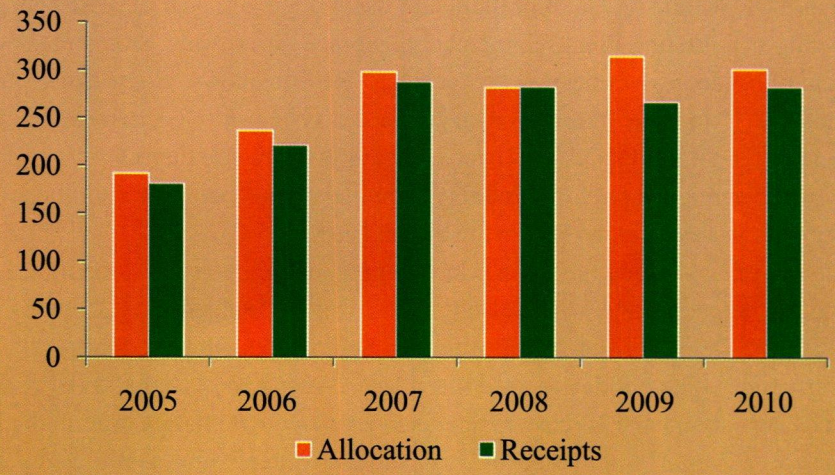
Procurement Activities

Major Procurement

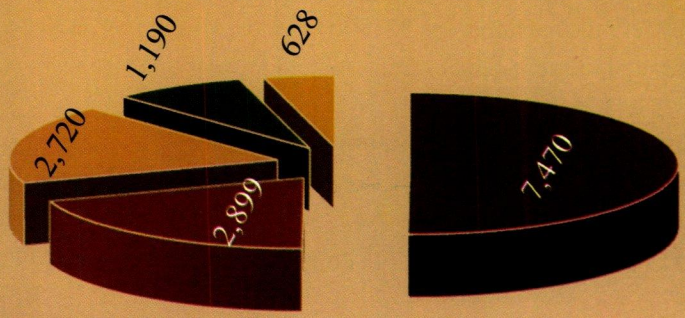
Purchase of capital and local items for 16 Million including 04 Wheel Lorry to St Joachim Estate, Ratnapura.

Finance Division

D M R Dissanayake
AAT (Sri Lanka) Associate
Accountant



Capital Expenditure up to November 2010 (Rs.'000)



- Building and Structures
- Plant Machinery and Lab Equipment
- Office Equipment and Furniture
- Roads, Water supply, Electricity and Telephones
- Other Fixed Assets

Tea Research Board of Sri Lanka
Statement of Financial Position as at 31st December 2010

ASSETS	2010 Rs. (000)		2010 Rs. (000)	2009 Rs. (000)	
Non-current assets					
Property,plant and equipment	963,274	(Annex II)		933,406	
Less:- Accumulated Depreciation	(586,963)	(Annex II)		(554,895)	
	376,311			378,511	
Capital work-in-progress	8,996	(Annex III)		12,959	
Other Assets	23			23	
			385,330		391,492
Current Assets					
Inventories/Stocks	19,261	(Annex IV)		18,770	
Trade and other receivables	107,164	(Annex V,VI, VII)		107,065	
Less:-Provision for Bad Debts	(90)	(Annex X)			
Prepayments	986	(Annex VI)		740	
Cash and cash equivalents	68,826	(Annex VIII,IX)		63,313	
			196,147		189,888
Others: Identify Losses					
Excess & Shortages			0	(214)	(214)
Total Assets			**581,477**		**581,166**
LIABILITIES					
Current Liabilities					
Payables	19,867	(Annex X)		26,319	
Accrued Expenses	26,002	(Annex X)		22,912	
			45,869		49,231
Non-Current liabilities					
Provision for Gratuity	110,941	(Annex XII)		103,204	
Petrol Deposit Refundable	21	(Annex XIII)		21	
			110,962		103,225
Total Liabilities			156,831		152,456
Total Net Assets			**424,645**		**428,710**
NET ASSETS/EQUITY					
Tea Research Fund	295,526			293,102	293,102
Grants & Reserves	129,119	(Annex XI)		135,608	135,608
Total Net Assets/Equity			**424,645**		**428,710**

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Internal Auditor

.....	.....	.....
Chairman TRB	**Director-TRI**	**Accountant for Senior Accountant**

Tea Research Board of Sri Lanka
Statement of Financial Performance for the Year ended 31st December 2010

		2010 Rs. '000	2009 Rs. '000
Operating Revenue			
Recurrent Grant- Cess	Annex. XIV	282,974	267,245
Other Income	Annex. XIV,XVI,XVI	24,307	22,028
Other Income- Deferred Income	Annex. XIV	5,153	5,308
		312,434	294,581
Operating Expenses			
Personal Emoluments	**Annex. I**	153,844	158,617
Travelling	-do-	6,750	6,250
Supplies and consumable used	-do-	21,149	18,403
Maintenance	-do-	24,272	20,486
Contractual Services-Security / Insurance	-do-	14,906	15,208
Electricity & Heating	-do-	14,066	13,612
Communications	-do-	2,587	3,523
Research and Development	-do-	23,140	28,033
Depreciation	-do-	26,656	29,585
Other operating expenses	-do-	22,135	19,737
Total operating expenses		**309,505**	**313,454**
Surplus/(Deficit) from operating activities	-do-	**2,929**	**(18,873)**
Finance Cost			
Gain on sales of property plant and equipment			3,132
Total non operating revenue (expenses)			
Net surplus/(Deficit) before extra ordinary items		**2,929**	**(15,741)**
Extra ordinary items			
Prior year Adjustments	**Annex XVIII**	(505)	(4,700)
Net surplus/(Deficit) for the period		**2,424**	**(20,441)**

Tea Research Board of Sri Lanka
Consolidated Cash flow for the year ended 31st December 2010

Cash Flow from Operating Activities	2010 Rs '000	2009 Rs '000
Surplus/(deficit) from ordinary activities	897	(23,451)
Non- Cash movments		
Depreciation	32,113	35,074
Increase in provision for Bad Debts	(146)	(413)
Increase/(Decrease) in Payables	(3,125)	13,778
Increase in provisions relating to employee costs	7,737	15,666
Gains sale of fixed assets	_	(3,132)
(Increase) in other current assets(stocks) depo/prepay	899	3,873
Assets writ-offs	(1)	(3)
Refund for Fixed Assets	(229)	
Decrease/(Increase) in receivables	(1,571)	3,172
Prior Years Adjustments	(505)	(4,700)
Accounting adjustment in capital reserve	(6,454)	(3,293)
Net Cash Flow from operating activities	**29,615**	**36,571**
Cash Flow from Investing activities		
Purchase of fixed assets	(30,097)	(35,643)
Interest on investments	2,032	4,442
(Increase)/Decrease Capital working-in-progress	3,963	(4,615)
Proceeds from sale of fixed assets	_	3,132
Cash Flow from Investing activities	**(24,102)**	**(32,684)**
Net Cash Flow from Financing activities		
Capital Grants- PHDT	_	866
- Energy conservation Fund	_	152
PLDP	_	3,211
Net Cash Flow from Financing activities		**4,229**
Net Increase/(decrease) in Cash and cash equivalents	**5,513**	**8,116**
Cash and cash equivalents at beginning of period	**63,313**	**55,197**
Cash and cash equivalents at end of period	**68,826**	**63,313**

Tea Research Board of Sri Lanka
St. Coombs and Lamiliere Estates Working Account for the Period 1st January to 31st December 2010

2009		INCOME	2010		
Rs.	Kg.	Tea Sales Gross Proceeds	Kg.	Rs.	
95,456,615.82	264,663	Tea Sales Ex Brokers(Gross)	212,658.5	86,013,381.04 (Note 1)	
10,327,918.00	32,912	Tea Sales Local & Graties	34,265.5	12,681,125.00	
105,784,533.82	297,575		246,924	98,694,506.04	98,694,506.04
		Add-			
		Sale of Green Leaf		4,626,876.88	
190,547.19		ADB Profit (Sale of VP Cuttings)		805699.66	
445,725.31		Miscellaneous Income		177,173.49	
		Deferred Income		445,725.31	6,055,475.34
106,420,806.32		Total Income			104,749,981.38
		EXPENDITURE			
		Less: Estate Expenditure			
24,204,700.17		General Charges		37,121,848.46	
15,361,701.85		Field work & Cultivation		11,503,289.07	
46,304,652.61		Production		41,732,735.61	
5,040,234.75		Bought Leaf(including transport charges)		2,210,127.26	92,568,000.40
90,911,289.38					
		Administration & Finance			
4,020,957.28		Bonus and Holiday pay		4,012,229.29	
1,957,827.97		Depreciation		1,733,717.51	5,745,946.80
5,978,785.25					
		Sales Tax & Distribution Expenses			
1,311,414.88		Brokerage,Handling chgs.,& Sales Expenses		1,195,423.21	1,195,423.21
98,201,489.51		Total Expenditure			99,509,370.41
8,219,316.81		**Profit /(loss) for the year**			**5,240,610.97**
39,680.46		Less: Over Value Unsold Tea 2009		218,872.37	
		W/Off Prior Years		521,408.03	740,280.40
		Profit /(loss) tranferred to TRI Operating A/c			**4,500,330.57**
8,258,997.27					

Note:- 1. 2980.5 kgs unsold Teas valued NSA @ Rs.398.84

Tea Research Board of Sri Lanka
St. Joachim Estate Working Account for the Period 1st January to 31st December 2010

2009			2010		
		INCOME			
Rs. cts.	Kg.	Tea Sales Gross Proceeds	Kg.	Rs. cts.	
93,241,012.91	241,229.00	Tea Sales Ex Brokers(Gross)	491,679	186,700,139.10	(Note 1)
641,939.12	3,972.00	Tea Sales Local & Graties	5,168	1,174,804.75	
93,882,952.03	245,201.00		496,847	187,874,943.85	187,874,943.85
		Add:			
59,950.00		Sale of V.P.Plants		146,268.25	
97,739.42		Miscellaneous Income		543,052.92	
1,139,385.00		Income from Rubber		3,207,640.00	
855,719.52		Deferred Income		855,719.52	4,752,680.69
96,035,745.97		Total Income			192,627,624.54
		EXPENDITURE			
		Less: Estate Expenditure			
4,701,167.98		General Charges		4,190,072.14	
4,115,456.28		Field work & Cultivation		3,552,727.27	
5,151,643.72		Production		6,118,518.28	
938,652.01		Expenditure on Rubber		1,129,431.57	
81,126,848.23		Bought Leaf(including transport charges)		167,450,897.43	182,441,646.69
96,033,768.22					
		Administration & Finance			
1,188,267.95		Bonus and Holiday pay		1,600,245.41	
3,530,843.88		Depreciation		3,677,024.89	5,277,270.30
4,719,111.83					
		Sales Tax & Distribution Expenses			
1,526,301.52		Brokerage,Handling chgs., & Sales Expenses		3,774,941.15	3,774,941.15
102,279,181.57		**Total Expenditure**			191,493,858.14
(6,243,435.60)		**Profit for the year**			**1,133,766.40**
(460,636.75)		**Less- Over Value Unsold Tea 2009**			(552,833.51)
(6,704,072.35)		**Profit (Loss) transferred to TRI Operating A/C**			580,932.89

Note:- (1) 43737 Kgs unsold Teas valued C.O.P. @ Rs.365.11

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)

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 Pathiranage
  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
- D W Viithana
  Diploma in Agriculture
  Experimental Officer *(Low country Regional Centre)*
- U P Abeysekara
  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 Prematthunga
  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 Goonathileke
  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 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 Breeding Division

- M T K Gunasekare
  B Sc Agric. (Ruhuna, Sri Lanka),
  Ph D (Southampton, UK)
  Head/ Senior Research Officer
- M A B Ranathunga
  B Sc Agric. (Peradeniya, Sri Lanka),
  M Sc (TNAU, India)
  Research Assistant
- H A C K Ariyarathna
  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

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

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
- Prof. A N Jayakody
  BSc Agric. (Leipzig, Germany),
  M Sc (Leipzig, Germany),
  Ph D (West Berlin, Germany)
  Senior Research Officer (Contractual)
- 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 Gabrial
  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
  B Sc Agric. (Peradeniya, Sri Lanka),
  M Phil (Los Banos, Philippines)
  Senior Advisory Officer
- J C K Rajasinghe
  B Sc Agric. (Peradeniya, Sri Lanka),
  M Sc (PGIA, Sri Lanka)
  Senior Advisory Officer / Actg. Officer-in-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
  B Sc Agric. (Ruhuna, Sri Lanka),
  M Sc (PGIA, Sri Lanka)
  Senior Advisory Officer *(Low country Regional Centre)*
- K G J P Mahindapala
  B Sc Agric. (Peradeniya, Sri Lanka)
  Advisory Officer *(Mid country Regional Centre)*
- S P Rathnayake
  B Sc Agric. (Ruhuna, Sri Lanka)
  M BA (WHUT, China)
  Advisory Officer *(Galle Extension Centre)*
- T G N Mahinda
  B Sc Agric. (Ruhuna, Sri Lanka)
  M Sc (Peradeniya, Sri Lanka)
  Advisory Officer / Actg. Officer-in-Charge, Deniyaya Extension Centre
- H J M De Silva
  B Sc Agric. (Peradeniya, Sri Lanka)
  Extension Officer *(Mid country Regional Centre)*
- H Jayaweera
  Extension Officer
- K R W B Kahandawa
  B Sc Agric. (Peradeniya, Sri Lanka)
  M Sc (Peradeniya, Sri Lanka)
  Extension Officer / Actg. Officer-in-Charge, Uva Extension Centre
- M A H Nishanthi
  B Sc Agric. (Peradeniya, Sri Lanka)
  Extension Officer
- A L R U Kumara
  B Sc Agric. (Peradeniya, Sri Lanka)
  Extension Officer
- C J Liyanaarachchi
  B Sc Agric. (Wayamba, Sri Lanka)
  M Sc (Peradeniya, Sri Lanka)
  Extension Officer
- D Hettiarachchi
  B Sc Agric. (Peradeniya, Sri Lanka)
  Extension Officer
- P K R C E Munasinghe
  B Sc Agric. (Peradeniya, Sri Lanka)
  Extension Officer
- V G A Vishvajith
  Technical Assistant *(Uva Extension Centre)*
- 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 Thevadasan
  Photographer

Library

- R W M S K Amunugama
  Diploma in Library Science
  Library Assistant

Information Technology Unit

- U D Alagiyawadu
  Experimental Officer

Low country Regional Centre

- M A Wijeratne
  B Sc (Ruhuna, Sri Lanka),
  Ph D (London, UK)
  Officer-in-Charge, Senior Research Officer (Agronomy Division)
- G L C Galahitiyawa
  B Sc (Kelaniya, Sri Lanka)
  Senior Research Officer
- M K S L D Amarathunga
  B Sc Agric. Ruhuna (Sri Lanka)
  M Sc (Peradeniya, Sri Lanka)
  Senior Advisory Officer
- N P S N Bandara
  BSc Agric. (Peradeniya, Sri Lanka)
  Research Assistant
- S R W Pathirange
  BSc Agric. (Ruhuna, Sri Lanka)
  Research Assistant
- H S N Peiris
  B Sc Agric. (Peradeniya, Sri Lanka)
  M Phil (Peradeniya, Sri Lanka)
  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
  B Sc Engineering (Peradeniya, Sri Lanka)
  Experimental Officer
- W M U A B Marapana
  B Sc (J'pura, Sri Lanka)
  Experimental Officer
- M G S Liyanage
  BSc Agric. (Peradeniya, Sri Lanka)
  Experimental Officer
- C J Liyanaarachchi
  B Sc Agric. (Wayamba, Sri Lanka)
  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 Prematthunga
  Experimental Officer
- M A Chamindra
  Experimental Officer
- E W T P Prematthunga
  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
- 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 Pallethanthrige
  Works Supervisor
- Shanthilatha Gunasekara
  Accounts Clerk
- C N K Edirisinghe
  Station Assistant
  Driver
- R C A Jayasinghe
  Driver
- P K Wijerathne
  Driver
- K M T Senewirathne
  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

- 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)
- P V D Chandrakanthi
  Accounts Clerk
- M Sarath
  Field Supervisor
- P S Kulasiri
  Field Supervisor
- 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 Sundareson
  Driver

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 (Lindula)
- 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

Telephone Exchange

- K M Senevirathna Banda
  Telephone Operator
- P K N Damayanthi
  Telephone Operator-cum-Receptionist
- S Karuppiah
  Telephone Linesman

Purchasing Unit

- B Thilakaratna
  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 Ariyarathne
  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

Motor Garage

- G G E H Gamage
  Chief Motor Mechanic
- W G Wijaratne
  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
- U K A B Uduwella
  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

Finance Division

- D M R Dissanayake
  AAT (Sri Lanka) – Associate
  Acting Senior Accountant
- M V Mohan
  CIMA (London) - Interim,
  AAT (Sri Lanka)
  Accountant
- C B Koswatte
  Diploma in Business Studies
  Senior Accounting Assistant
- S G Punchibanda
  Senior Accounting Officer
- V Pahalage
  Accounts Clerk
- M G Weerathilake
  Cashier
- B K S Herath
  Accounts Clerk
- A A A P Amartunge
  Accounts Clerk
- H B Thalgahagoda
  Accounts Clerk cum Cashier
- S Hewasiliyan
  Accounts Clerk
- W A Nishantha
  AAT - Sri Lanka (Part 1 & 2)
  Data Entry Operator cum Accounts Clerk
- I Jayawickrama
  Clerk/ Typist
- H N Dharmapala
  Clerk/ Typist
- K A D Sudath Pradeep
  Accounts Clerk

විගණකාධිපති දෙපාර්තමේන්තුව
கணக்காய்வாளர் தலைமை அதிபதி திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT

මගේ අංකය / எனது இல / My No. PY/I/TRB/FA/2010

මගෙ අංකය / உமது இல / Your No.

දිනය / திகதி / Date 20 July 2011

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 2010 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 2010 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 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 12 May 2011.

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.

சுதந்திர சதுக்கம், கொழும்பு 07, இலங்கை
INDEPENDENCE SQUARE, COLOMBO 07, SRI LANKA
தொலைபேசி / Telephone. 2691151
பக்ஸ் இல / Fax No. 2697451
மின்னஞ்சல் / E-mail. oaggov@sltnet.lk

1.3 Scope of Audit and Basis of Opinion

My responsibility is to express an opinion on these financial statements based on my audit. Audit opinion, 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 polocies 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 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 2010 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 2010 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 (SLAS)

(a) Fully depreciated assets which are being used at present had not been revalued in terms of SLAS -18.

(c) Contingent liabilities which could be occurred from the court cases filed against the Board had not been disclosed in the financial statements in terms of SLAS 12.

2:2:2 Accounting Deficiencies

Following observations are made.

(a) Action had not been taken to transfer the goods in transit valued at Rs.2,903,347 relating to the year 2009 to the relevant accounts which were received subsequently.

(c) Grant and Reserves for the assets donated by Plantation Development Project had been overstated by Rs. 465,211 due to a calculation error .

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 amounting to Rs.57,945 had remained more than two years without being recovered.

(b) According to the age analysis, trade and sundry debtors amounting to Rs. 322,267 remained unrecovered for more than 3 years.

(c) Advances amounting to Rs.304,161 given to 30 external Institutions for procurement of goods and services had remained for over five years without being recovered.

(d) According to the Financial Statements, balance amounts under on going Projects totalling Rs.256,561 had been remained without being utilized for more than 05 years.

2:2:4 Unreconciled Balances

Following unreconciled balances were observed in audit.

(a) A difference of Rs. 99,303,166 had been observed between the balance as per ledgers and balance as per related schedules submitted along with financial statements.

(b) Differences amounting to Rs. 680,669 and Rs. 148,911 were observed between the debtors schedule of the Board (St.Coomb's Factory accounts) and financial statements of Sri Lanka Tea Board and Tea Small Holdings Development Authority as at 31 December 2010.

(c) Fixed assets valued at Rs. 823,889,400 could not be able to reconcile or verify with the Board of Survey Reports for 2010 to confirm the existencies of the assets.

2: 2:5 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) Payment of Gratuity Act No 12 of 1983.	Out of the total provision amounting to Rs.110,941,480 made for gratuity, only a sum of Rs.36,833,349 or 33.2% had been invested up to 31 May 2011. Hence the Board had not invested adequate funds for face future liability.

(a) Public Enterprises Circular No PED/12 of 02 June 2003	
(i) Paragraph 6:5:1	Draft Annual Report had not been furnished to the Auditor General along with the Financial Statements.
(b) Treasury Circular No IAI /2002/02 of 28 November 2002	A fixed assets register for the computers and computer accessories and software 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 under review had resulted in a net surplus of Rs. 2.93 million as against the net deficit of Rs.15.74 million for the preceding year, thus indicating an improvement of Rs.18.67 million in the financial results.
The increase of cess income by Rs.15.73 million and an increase of the profit of St. Joachim's Estate had mainly attributed for the improvement of the financial results.

3:2 Operating Results of the Estates

The Board had managed two estates namely St. Coombs 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. Coombs & Lamilier Estates		St. Joachim Estate	
	2010	2009	2010	2009
Tea Sales				
Quantity (Kilograms)	246,924	297,575	496,847	245,201
Sales Value (Rs.'000)	98,695	105,785	187,875	93,883
Other Income (Rs.'000)	6,055	636	4,753	2,153
Total Income (Rs.'000)	104,750	106,421	192,628	96,036
Less :				
Total Expenditure (Rs.'000)	99,509	98,201	191,494	102,279
Profit /(Loss) (Rs.'000)	5,241	8,220	1,134	(6,243)
Cost of Production per Kilogram of Tea (Rs)	371.92	331.07	365.11	387.25
Yield per Hectare (Kilograms)	2,011	2,105	1,016	888
Net Sales Average (Rs.per Kilogram)	394.85	351.03	372.72	380.79

The sales quantity of the St.Coombes Estate had decreased by 50,651 kilograms in the year under review as compared with the preceding year and the profit of the year under review had also decreased by Rs.2,978,706 as compared with the preceding year. The sales quantity of St.Jochims Estate had increased by 251,648 kilograms as compared with the previous year and the profit also had increased by Rs.7,377,202 as compared with the preceding year.

3.3 Performance Review

An Action Plan for the year under review had been prepared with the financial targets only without mentioning the physical targets. Therefore, the physical performance of the Board could not be satisfactory compared with the targeted performance. However, according to the information made available, the financial performance of the Board is given below.

Programme	Allocation for the year			Actual Expenditure			Progress as a Percentage
	Recurrent Rs. M	Capital Rs. M	Total Rs. M	Recurrent Rs. M	Capital Rs. M	Total Rs. M	%
i. Crop Improvement	12.69	6.35	19.04	12.33	4.18	16.51	86.71
ii. Land Productivity Improvement	8.70	6.72	15.42	10.09	6.52	16.61	107.71
iii. Crop Management	23.81	7.32	31.13	23.50	4.95	28.45	91.39
iv. Post – Harvest Technology	11.66	2.93	14.59	12.61	2.89	15.50	106.23
v. Resources Planning	2.77	0.73	3.50	2.11	0.17	2.28	65.14
vi. Services to Stake holders	34.23	19.34	53.57	33.57	8.73	42.30	78.83
vii. Research Management	110.37	17.69	28.06	109.20	5.88	115.08	89.86
viii. Internal Services and Maintenance	51.39	8.92	60.31	51.80	8.27	60.07	99.60
Total	**255.62**	**70.0**	**325.62**	**255.20**	**41.60**	**296.80**	**91.15**

3:4 Operating Inefficiencies

Following observations are made.

(a) According to the information made available to audit, it was observed that a sum of Rs.27,152,046 were receivable from 10 officers who had obtained study leave with full pay and failed to serve the compulsory periods of service. This amount had not been recovered from the relevant parties up to 31 May 2011.

(b) The Board had signed a Memorandum Of Understanding (MOU) with Ruwanpura Gamidiriya Ekabadda Samagama (Gamidiriya) on 02 February 2010 to supply green leaf to St Joachim Tea Factory.

Following observations are made in this regard.

(i) As per the agreement, the Gamidiriya had agreed to supply 1,635,000 kilograms of green leaves from February to December 2010. However it was observed that the Gamidiriya had supplied only 1,077,058 kilograms (65.87%) of green leaves during the said period.

(ii) At an audit test check, it was observed that the Gamidiriya had not supplied the green leaves with agreed quality as per Para C(2) of the MOU.

(iii) Although the Gamidiriya had supplied less quantity and low quality of green leaves, a sum of Rs. 1,008,000 had been paid by St. Joachim Estate as management fee and 33 per cent of the profit amounting to Rs. 1,168,079 without considering the requirements of the MOU.

According to the Chairman's comments, the Estate was not in the position to exactly follow the conditions in the MOU it would be difficult to retain M/S Gamidiriya which could be effected the intake of green leaf quantity.

(c) Contractual activities aggregating Rs.7,089,920 shown in the work in progress account since 2007 had not been completed up to the end of the year under review. However, the amount paid for these incompleted activities had been written off from the profit of the year under review without getting the approval of the Board of Directors and parties concerned.

3:5 Assets 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.According to the Board of Survey Reports dated 23 July 1997, six machines had been imported by the Board and installed in six factories in up country. According to the information made available, these machines were brought

to test the suitability of Sri Lanka Tea Processing and resulted that Lowery Tea Processing (LTP) machineries were not suitable for the tea production process in Sri Lanka and therefore the project was abandoned.
However it was observed in audit that those machines were idling up to the date of this report and action had not been taken to remove those machines from the factories where they were installed.

(b) According to the land survey plan prepared by the 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.

(d) At an audit inspection it was observed that about two hectares of land belonging to St. Joachim Estate had not been utilized for any purpose.
According to the Chairman's comments, the soil of the said land was not suitable for tea cultivation and the Estate has already earmarked for planting rubber at the 3rd quarter of 2011 and in the year 2012.

(e) It was observed that the external parties who were not allowed by the Tea Research Board or St. Coombs Estate had cultivated vegetables in large extent of land and earning large 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.

3:6 Human Resourse Management

The cadre position of the Board excluding St. Joachim and St.Coombs Estates was321 and out of that 103 posts were vacant as at 31 December 2010. It was observed in audit that 20 vacancies out of 103 were Research, Research Development and Experimental officers. Information regarding casual labourers deployed for factory works were not made available for audit.

4. Systems and Controls

Observations made in systems and controls during the course of audit were brought to the notice of the Chairman of the Board from time to time. Special attention is needed in respect of the following areas of control.

(a) Settlement of Advances
(b) Receivables and payables
(c) Cash control
(d) Assets management
(e) Physical Performance

H.A.S.Samaraweera
Acting Auditor General