Annual Report 2007

Tea Research Institute of Sri Lanka

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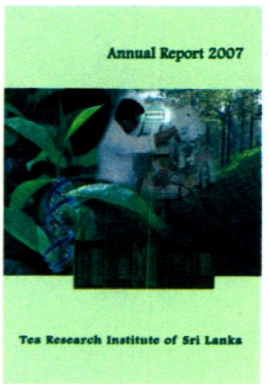
Cover



Conventional methods for genetic improvement of tea are comparatively slow and costly. Construction of saturated genetic linkage maps is a necessary and fundamental step towards increasing precision and speeding up the process. For the first time in Sri Lanka, two high resolution genetic maps for the cultivars TRI 2023 and TRI 2043 were constructed using EST and Genomic SSR markers.

Mr KM Mewan received the "Best Researcher Award" at the 3rd International Conference on O-CHA (Tea) Culture and Sciences, Shizuoka, Japan, for this research work.

Contents

Tea Research Board

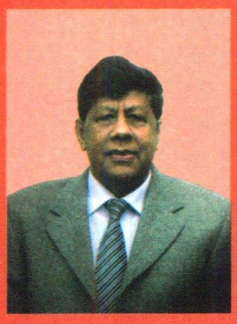
The Tea Research Board of Sri Lanka was established on 12th November 1993 under the provisions of the Tea Research Board Act No. 52 of 1993. In, 2007 Tea Research Board act was amended, and a Supplementary Act No. 43 of 2006 was approved by the Cabinet.

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.

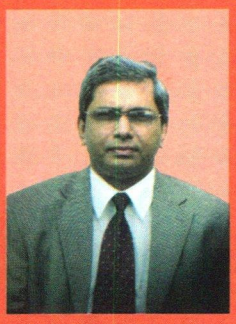
Functions of the Tea Research Board

- 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; and
- To conduct, in the discharge of its functions, joint study programmes, seminars or symposia, with foreign research institutions and research institutions in Sri Lanka.

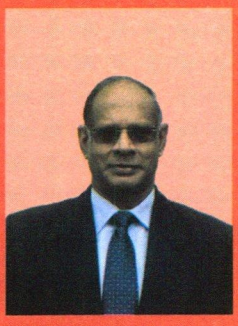
Members of the Tea Research Board of Sri Lanka



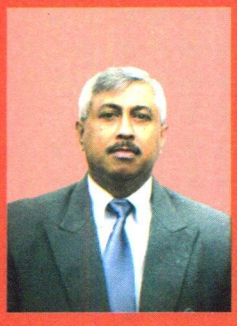
Dr Gerry Jayawardena
Chairman
Tea Research Board



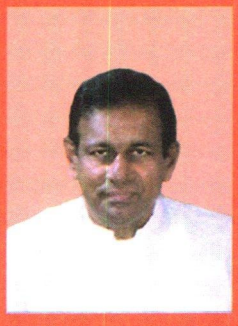
Dr I Sarath B Abeysinghe
Director
Tea Research Institute



Mr Dan Seevaratnam
Chief Executive Officer
Kahawatta Plantations Ltd.

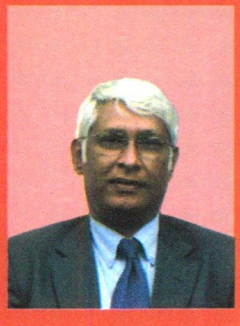


Dr D S A Samaraweera
Head, Operations
Tea Smallholders' Factories Ltd



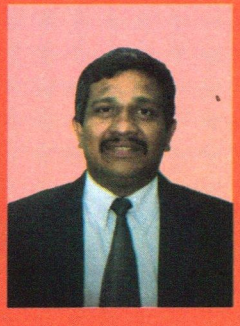
Mr N Padmasiri Kariyawasam
Chairman
Tea Smallholdings
Development Authority

Mr R M P S Bandara
Assistant Director
Dept. of External Resources
Ministry of Finance & Planning



Prof Kapila Gunasekare
Dept. of Agricultural Engineering
Univeristy of Peradeniya

Mr J M B J Bandara
President
Sri Lanka Federation of Tea
Smallhodings (Ratnapura)



Mr K D S Ruwanchandra
Senior Assistant Secretary
Ministry of Plantation
Industries

Convenor/ Secretary: Dr. A M T Amarakoon - Head, Biochemistry Division, Tea Research Institute

Consultative Committee on Research

Dr D S A Samaraweera	Chairman of the Committee Head - Operations, Tea Smallholders Factories
Dr Gerry Jayawardena	Chairman, Tea Research Board
Dr Sarath Abeysinghe	Director, Tea Research Institute of Sri Lanka
Mr D V Seevaratnam	Chief Executive Officer, Kahawatte Plantations Ltd.
Dr D T Wettasinghe	Ex-Deputy Director Research, Tea Research Institute of Sri Lanka
Prof W A J M De Costa	Department of Crop Science, University of Peradeniya
Mr N Pilapitiya	Proprietor, New Vithanakanda Tea Factory
Mr Russel Tennakoon	Director/ General Manager, Ceylon Tea Brokers
Mr M B Cyril	Deputy Genral Manager (Development), TSHDA
Mr S K L Obeseykare	Director/ CEO, Balangoda Plantations Ltd.
Mr Parakrama Jayasinghe	Director - Engineering, Heycarb (Pvt) Ltd
Mr Melwin Samarasinghe	Vice President, Agro Technica Ltd.
Prof Kapila Goonasekara	Department of Agricultural Engineering, University of Peradeniya
Mr G D V Perera	Director, Lankem Tea & Rubber Plantations (Pvt) Ltd.
Convenor / Secretary	Dr A Anandacumaraswamy Deputy Director Research (Production) [upto August 2007] Dr L S K Hettiarachchi Actg. Deputy Director Research (Production) [from Sept. 2007]

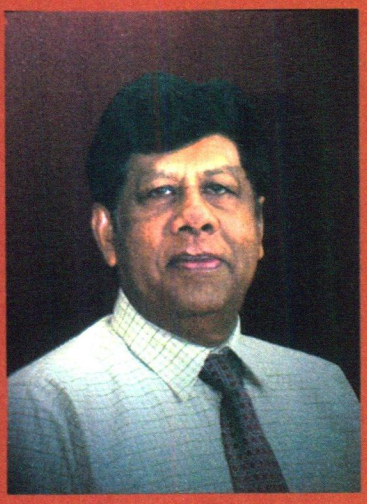
Consultative Committee on Advisory and Estates Services

Mr D V Seevaratnam	Chairman of the Committee Chief Executive Officer, Kahawatte Plantations Ltd.
Dr Gerry Jayawardena	Chairman, Tea Research Board
Dr Sarath Abeysinghe	Director, Tea Research Institute of Sri Lanka
Mr Mohan Ganapathy	General Manager, Kelani Valley Plantations Ltd.
Mr R K Nathaniel	Ex-Head, Advisory and Extension, Tea Research Institute
Mr Asoka Somaratne	Ex-Deputy General Manager, TSHDA
Mr Dhayan Madawala	Chief Executive Officer, Hapugastenna Plantations Ltd.
Mr S Wirasinghe	Ex-Director, Department of Agriculture
Dr D S A Samaraweera	Head, Operations, Tea Smallholders' Tea Factories Ltd.
Mr S D Nandasena	General Manager, Tea Smallholdings Development Authority
Convenor/ Secretary	Mr B A D Samansiri, Head, Advisory and Extension, TRI

Audit and Management Committee

Mr R M S P S Bandara	Chairman of the committee, TRB Member
Mr K D S Ruwanchandra	TRB Member
Mr J M B J Bandara	TRB Member
Convenor/ Secretary	Mr R Kariyawasam, Internal Auditor, TRI

Report of the Chairman, Tea Research Board



During the year 2007, the Governing Board of the Tea Research Institute continued to guide the Management and scientific staff of TRI to enhance the quality of research and development, administration and financial management and its services to the tea industry stakeholders including the vital smallholder sector. 1st quarter of the 2007 was a crisis period for the industry in general due to the worker strike during the later part of 2006 resulting in yield decline. Situation became aggravated due to drought prevailed during the 2nd quarter of 2007, while TRI too seriously suffered due to a water scarcity compelling the Management to close down the Institute for two weeks.

Tea Research Board took serious note of the importance of filling the vacant positions of Deputy Director (Administration), Senior Accountant, Publications / Publicity Officer, Librarian, Resident Engineer and Technical Assistants which affected the overall performance of the Institute's research and development activities. During 2007, the Institute took action to fill the positions of Deputy Director (Administration), Publications / Publicity Officer, Resident Engineer and Technical Assistants.

Tea industry continued to face many economic challenges due to increasing cost of fertilizers, worker wages and increasing cost of energy due to escalating prices of fuel. The Tea Research Board directed the Tea Research Institute Management to be alert to emerging challenges and take appropriate action in making technical recommendations to the relevant stakeholders in mitigating the effects of increased fertilizer cost.

The Tea Research Board paid special attention to the possibility of saving millions of rupees through energy saving in the tea manufacture by fixing light weight fans in withering troughs. Tea Research Institute organized a workshop with the Sri Lanka Sustainable Energy Authority supported by the Plantation Development Project to create an awareness among the stakeholders on the potential of reducing cost of production by saving electrical energy in tea manufacture by using light weight fans in the withering troughs.

Tea Research Board continued to monitor the implementation of the Peer Review Committee recommendations and the Action Plan. The Tea Research Institute successfully completed the process of preparing the Corporate Plan for the 2008 – 2012 period and presented to the stakeholders.

Tea Board emphasized the importance of regular research programme reviews and TRI continued to review divisional programmes with participation of all scientists bringing about inter-disciplinary interaction to generate stakeholder focused research output.

During 2007, the declining trials were completed for systematic herbicides and fungicides generating valuable and reliable information on MRL issue. For the first time in tea biotechnology research, a high resolution genetic map of tea was constructed using SSR markers. Three inter-specific hybrids out of five were recovered through perfection of an *in vitro* embryo rescue protocol for the first time by the Plant Breeding Division. Techniques have been perfected to extract a protein from a refuse tea and the studies are continuing to examine the quality of leaf protein extracted from refuse tea.

The Consultative Committees on Estates and Advisory Services and on Research had regular meetings to review the progress of performance of estates and Advisory Division and research, respectively. As a result of continuous monitoring of the Management of St Coombs and St Joachim Estates, it is noteworthy to report that during 2007, St Coombs made a net profit of Rs. 10 million and St Joachim Rs. 7.5 million. Performance of the Advisory Division continued to improve and the emphasis was to evaluate the impact of technology developed and its adoption. For this purpose, a diagnostic survey was conceptualized for its implementation during the following year. Significant progress has been made in drafting, reviewing and translating Advisory Circulars and Guidelines.

TRI continued to strengthen its linkages with TSHDA through regular meetings to ensure Institutes continued commitment and involvement in transferring the technology through TRI Regional Extension Centres at Hantane, Passara, Deniyaya, Kottawa with the involvement of TSHDA while Ratnapura research station played a major role in serving the needs of smallholder sector and the Regional Plantation Companies in the Low country.

The Mother Bush Project, which is designed to multiply new cultivars continued to issue large number of cuttings to the smallholder sector and the registered nursery men. However, demand for quality planting material is increasing and TRI is strongly promoting the importance of a planting material certification programme for Tea under the National Seed Act.

A total of 10.4 million cuttings of improved tea cultivars of the TRI 3000 and 4000 series were issued from TRI and TSHDA mother-bush sites during 2007.

The Tea Research Institute scientists continued to play a direct role in establishing adaptive research programmes setting up of demonstrations and crop clinics. These programmes have been very effective in reducing the gap in technology adoption by Tea small holders.

The Tea Research Board continued to acknowledge and recognize the outstanding contributions of TRI scientists by inviting them for regular research reviews and acknowledge the achievements of scientists. Tea Research Board encouraged organizing leadership and management training for its staff. Details of research achievements and awards received are given in the Director's report.

The Board to emphasized the importance of good governance and efficient utilization of state resources and carefully monitored the general audit queries and the Audit and Management Committee recommendations.

The Board closely monitored the progress of legal cases and directed the TRI administration to recover its dues from various defaulters. The Tea Research Board while facilitating the smooth administration of the Tea Research Institute by the Director/Chief Executive Officer, the externally controllable matters were taken care of by the Chairman and the Board of Governess.

Dr S S B D G Jayawardena
Chairman
Tea Research Board

Tea Research Institute of Sri Lanka

The Tea Research Institute (TRI) of Sri Lanka was established in 1925 to enrich the tea industry through professional tea research. TRI, which was started as an arm of the Planters' Association of Ceylon, is presently governed by the Tea Research Board subsequent to gradual transformation.

TRI operates from head office at Talawakelle and extended its services through regional centres situated at Ratnapura, Kandy, Passara, Galle, and Deniyaya covering all tea growing areas.

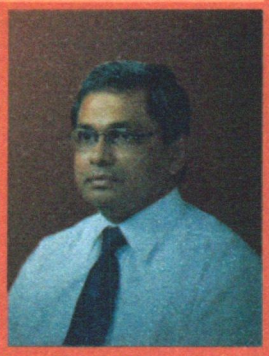
Vision

To achieve excelence 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, Tea Research Institute of Sri Lanka



General

Honourable D M Jayaratne, Minister of Plantation Industries visited the Institute in March 2008.

A delegation from the Tea Research Association, Tocklai, India visited Sri Lanka and discussions were held on signing an MOU for collaborative research and training.

The TRI-TSHDA linkage forum was reactivated after a lapse of several years and the areas indentified for collaborative work were:

Adaptive trials in small holdings, demonstration areas, training of trainers, record keeping on pesticide usage and data base for small holder sector.

Amendment to the Tea Research Board Act

The Tea Research Board Act No. 52 of 1993 was amended, and a Supplementary Act No. 43 of 2006 was approved by the Cabinet.

Tea Sector Policy

The investment needs of the development of the tea sector was computed taking into consideration development targets planned under the proposed tea policy by the Ministry and the total amount needed is Rs 83,690mn for the period 2007- 2016. Gains expected from the proposed policy mix, and the associated investment, were also estimated for the same period. This information is included in the National Plantation Policy Document, published by the Ministry of Plantation Industries.

Corporate Plan

TRI Corporate Plan for the period, 2008 – 2010 was prepared and submitted to the Tea Research Board.

Implementation of circulars on salary revision and new Scheme of Recruitment

The salary revision recommended by the National Salaries & Cadre Commission was implemented as specified in the Management Services Circular No. 30, dated 22nd September, 2006.

As proposed by the National Salaries & Cadre Commission, a common Scheme of Recruitment for all crop research institutes were developed to fulfill the conditions of the proposed restructuring and submitted to the National Salaries & Cadre Commission.

Succession Plan

As per PED Circular No. 44, a succession plan has been drawn up to fill vacancies in senior management and other key positions.

A training programme on administration and financial regulations was held in November for the staff.

Land Matters

The title deed for the Lameliere Division of St. Coombs land was obtained from the Land Reform Commission.

The former Deniyaya station at Diyadawa was handed over to the Sri Lanka State Plantations Corporation. The voluntary retirement scheme for the workers at the Diyadawa was implemented, after a Tri-Partied Agreement.

A piece of land from Deniyaya Estate, 2.25 hectares in extent, has been released by Talawakelle Plantations for the purpose of establishing a new Deniyaya Station and construction work had commenced.

Action has been initiated for an outright purchase of the Walahanduwa laboratory complex from the Sri Lanka State Plantations Corporation, based on government valuation.

Water Crisis at the Institute

The functions of the Institute had to be restricted due to the water crisis as a result of drought conditions during the period 31st May and 25th June 2008.

Cess Allocation

TRI budget estimate for 2007 was 375Mn. However the treasury allocation for TRI was 299.4Mn. Total funds received for 2007 was 288.2Mn. This situation forced us to restrict the capital investments and most of the maintenance and repair work at the TRI.

Research Highlights

1. **Tea Crop Improvement**

   Controlled hybridization

   In order to generate wide hybrids for the breeding programme, a total of 2212 single crosses, involving 46 different parental combinations, including 17 cross combinations were performed at Talawakelle. One thousand three hundred and twenty crosses, involving 20 different cross combinations, were carried out at Ratnapura.

   New additions to the field gene bank

   Two hundred and forty seedling plants, raised from seed stock received from Zagatala in Russia, were added to the germplasm collection as an initial step towards expanding the exotic collection.

   Germplasm Characterization

   Characterization of 203 accessions using 20 morphological descriptors was completed. Accessions were categorized into seven well-defined groups. Of the 20 descriptors studied, six were found to be the most useful in separating the accessions into groups.

   Genetic contribution of the ancestral lines used to develop improved cultivars in Sri Lanka was estimated for the first time in tea and also in tree crops.

Three interspecific hybrids were recovered through perfection of an in vitro embryo rescue protocol for the first time. This introgressing will help to transfer genes and broaden the genetic base.

Genetic linkage map

A high resolution genetic map of tea was developed using SSR markers. The linkage map was completed using 148 accessions from a segregating population from TRI 2023 x TRI 2043, two diverse cultivars having resistance to blister blight leaf disease.

2. **Evaluation of tea harvesting machines**

Two plucking machines (K Tech and Kawasaki NV 60H) were tested and compared with manual harvesting.

The total yield of manually-harvested plots was significantly higher than that of mechanically-harvested plots. The harvesting efficiency of the K-Tech harvester was about 3-4 mandays/ ha, and the coarse leaf percentage was 20-35%. The efficiency of the Kawasaki machine was about 2-3 mandays/ha, and the coarse leaf percentage was 15-30%.

3. **Economic evaluation of the revision of fertilizer subsidy scheme**

Further to the analysis done in the previous year, the financial requirement for providing a uniform fertilizer subsidy for the entire tea sector was assessed, and submitted to the Ministry of Plantation Industries, for a Cabinet proposal.

4. **Fine-tuning of nursery fumigation methodology**

In our efforts to find cost effective and user-friendly nursery fumigation methods, it was found that the TRI recommended doses of Basamid and Metham Sodium could be reduced by 50% with improved fumigation methodologies.

5. **Outbreak of Red Slug Caterpillar**

An outbreak of Red Slug Caterpillar, Eturesiaedea cingala (Moore), causing severe defoliation in mature tea occurred in Brambly Estate, Ragala. The pest outbreak was successfully controlled. New information on the life-history and biology of the pest was generated.

6. **Isolation of local viruses from tea tortrix larvae**

Four naturally-occurring entomopox viruses (EPV) were isolated from tea tortrix (Homona coffearia) from Hatton and Lindula Estates. They were characterized at the DNA level and through bioassays. This was recorded as the first confirmation of EPV on tea tortrix.

7. **Test- Rig for withering fans**

A collaborative project with Energy Conservation Fund was initiated in 2006 to fabricate a testing facility for withering fans according to ISO5801. The fabrication of the test-rig is completed and testing of withering-trough fans is in progress.

8. **The flat-plate solar collector system at St Joachim Estate.**

Repairs to the flat plate solar collector system was initiated in order to couple it to a firewood-fired air-heater system and make it available for use by the Estate.

9. Tea and Health

The work carried out on Copper levels in the tea brew confirmed that tea is a good source of copper, and regular tea consumption does not lead to excessive levels of serum copper and to copper toxicity.

10. Establishment of standards for Good Agricultural Practices (GAP) and Good Manufacturing Practices for tea

The Institute participated in the formulation of Good Agricultural Practices (GAP) and Good Manufacturing Practice (GMP) standards for tea by the Sri Lanka Standards Institute (SLSI). (SLS 1315, 2007, Code of practice for the tea industry. Part 1: Good agricultural practices for the cultivation of tea. Part 2: Good manufacturing practices for the processing of black tea).

11. International Standards Organisation (ISO) Ring Tests for chemical parameters of tea

The Institute participated in the ISO ring test for total polyphenols and catechins. Total polyphenols and catechins in regional teas, and in Sri Lankan white tea ('Silver Tips' and 'Golden Tips'), were analysed and submitted to the ISO.

Stakeholder Interactions

This year focus was mainly on the soil-fertility management, safe use of agrochemicals, plucking techniques, nursery management techniques and to promote the use of appropriate tea cultivars. Objectives were achieved through Training of Trainers' (TOT) Programmes(9), E and E forums(4), RSC seminars(13), workshop and field day programmes (16) and crop clinics(3). TRI had participated in six public educational exhibitions to educate tea growers, school children and the general public on new developments in the tea industry.

Review of Commercial Nursery Inspection Procedures for recommending Healthy, Quality Nursery Plants for Planting

A committee comprising TRI and TSHDA official was appointed to review Commercial Nursery Inspection Procedures. The committee submitted a comprehensive report with suggestions to improve the present inspection procedures.

Special Problems in the Uva region

Sulphur deficiency symptoms were observed in a few smallholdings in Passara and Demodara. These were confirmed subsequently by soil testing. Severe manganese deficiency symptoms were also detected in the Madulsima area.

ADB Mother Bush Project

The Mother Bush Project, which was designed to supply new cultivars belongs to TRI 3000 and 4000 series, continued to issue cuttings for the stakeholders during 2007. Total number of cuttings issued during 2007 was approximately 10.4 million.

Pesticide residue and MRLs

A meeting of the Inter governmental Group (IGG) pesticide working group was held in August. The TRI recommended pesticides ,2,4-D, MCPA, Bitertanol, Tebuconazole, Chlorfluazuron and Tebufenozide were included in the IGG priority list.

Field trial on TRI recommended pesticides, tebufenocide, imidachloprid chlorfuazeuron, Hexaconazole, Propiconazole, Bitertanol, Tebuconazole, MCPA and Paraquat were carried out according to FAO guidelines.

Performance of TRI estates

- **St. Coombs Estate**
  An average yield of 2,280 kg/ha was recorded for the year 2007. The Estate made a profit of 10,319,812.98 Rupees during 2007.

- **St. Joachim Estate**
  The production on the estate registered a decrease of 11,457 kg or19.09 %, in comparison to the previous year, owing to a severe drought in the area. The bought leaf manufactured at the factory also showed a decrease of 189,129 kg or 37.62%, partly owing to the severe drought. The nett sale average was Rs.275/48 and St.Joachim made a profit of 7,426,648 Rupees.

Patents and awards

- Drs. A Anandacoomaraswamy, L S K Hettiarachchi, , Mrs A J Mohotti and Mrs P Tennakoon had received presidential awards for research.
- Mr KM Mewan received the "Best Researcher Award" at the 3rd International Conference on O-CHA (Tea) Culture and Sciences, 4th – 7th November 2007, Shizuoka, Japan, for a presentation entitled "Construction of a genomic and EST SSR based saturated genetic linkage map of tea".
- The patent was obtained for the use of Ginisapu seeds, as a weed control from the Patent Office in Colombo in December.

Publications

- Annual Report for the year 2006 (English)
- Annual Report for the year 2005 (Sinhala and Tamil)
- Detailed Annual Report for the year 2004
- Sri Lanka Journal of Tea Science (Volume 71, Part 2, September 2006)
- TRI Update (Volume 11, No.2, December 2006)
- TRI Update (Volume 12, No. 1, June 2007)
- Peer Review Report of the TRI
- A leaflet on Tea Seeds as Planting Material (Sinhala),
- Reprints of three extension pamphlets on good agronomy practices (Sinhala),
- A sticker on New Tea Cultivars (Sinhala),
- TRI Update (Volume 12, No. 2, December 2007) was finalized.
- A poster on "Safe Use of Pesticides in Tea Fields"
- Pamphlets on services of the Tea Research Institute
- Guidelines to produce standard VP nursery plants

Collaborators (Non-TRI)

The Institute worked in collaboration with the following institutions on multidisciplinary research projects

- Department of Chemistry, University of Peradeniya, on the Biological Pest Control Project.
- Department of Molecular Biology and Biochemistry, Faculty of Medicine, University of Colombo, and Coconut Research Institute on "Use of DNA Markers for Molecular Characterization of Tea".
- Faculty of Dental Science, University of Peradeniya, on "Effect of Black Tea on Oral Health".
- Department of Zoology, University of Colombo, on the biological effects of tea consumption.
- Department of Anatomy, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda on the biological effects of tea consumption..
- Department of Pharmacology, National University of Singapore, Singapore, on the biological effects of tea consumption.
- Energy Conservation Fund on fabricating Test- Rig for withering fans

Dr I Sarath B Abeysinghe
Director

Senior Management of Tea Research Institute of Sri Lanka

Director
Dr I Sarath B Abeysinghe
B Sc (Hons) (Peradeniya) PhD (Sheffield)

Deputy Director Research (Production)
Dr A Anandacumaraswamy
B Sc (Colombo) M Phil (Peradeniya) PhD (WSU, USA)
[up to August 2007]

Acting Deputy Director Research (Production)
Dr L S K Hettiarachchi
[from September 2007]
B Sc (Peradeniya) PhD (Aberdeen)

Acting Deputy Director (Administration)
Ms Anusha Sabanathan
B Sc (Hons) (Jaffna)

Deputy Director Research (Technology)
Vacant

Staff Members

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Mr R J Rayappan	Office Attendant

Office of the Deputy Director Research (Production)

Ms Devika Ratnayake	Stenographer (English)

Agricultral Economics Division

Ms. J A A M Jayakodi
B Sc (Agriculutre) M Sc, M Phil (Agri. Econ., UK)
Head, Agricultural Economics
Senior Research Officer

Staff Members

Ms. H W Shyamalie
Research Officer (on overseas studies)
B Sc, M Phil

Project D 35. Tea Sector Studies

D 35.1 Impact of the Fertilizer Subsidy Revision

Further to the analysis done in the previous year, the financial requirement for providing a uniform fertilizer subsidy for the entire tea sector was assessed, and submitted to the Ministry of Plantation Industries, as per the input for a Cabinet proposal.

Table 1. Corporate sector

Fertilizer mixtures	Corporate sector requirement		
	Total quantity ('000 Mt)	Quantity of urea in the mixture ('000 Mt)	Total urea requirement ('000 Mt)
VPUM	15.5	10.0	
VPLC	5.5	3.6	
VPUVA	5.1	3.2	
STUM	7.9	3.9	
STLC	1.3	0.7	
STUVA	7.9	3.6	
Urea	5.2 (a)		
		25 (b)	(a+b) 30.2

a - Extra amounts of urea to be applied with the above mixtures for high-yielding tea fields
b - Urea requirement in the formulation of mixtures

Annual fertilizer requirement in the tea sector

Considering the tea land distribution at different elevations and their productivity, and assuming that TRI-recommended fertilizer mixtures would be used in all mature tea lands, the annual fertilizer requirement of the sector is estimated to be as follows.

Table 2. Smallholder sector

Fertilizer mixtures	Corporate sector requirement		
	Total quantity ('000 Mt)	Quantity of urea in the mixture ('000 Mt)	Total urea requirement ('000 Mt)
VPUM	11.5	7.4	
VPLC	66.5	44.5	
VPUVA	9.4	5.8	
STUM	2.9	1.5	
STLC	1.4	0.8	
STUVA	1.3	0.6	
Urea	1.3 (a)		
		60.4 (b)	(a+b) 61.7

a - Extra amounts of urea to be applied with the above mixtures for high-yielding tea fields
b - Urea requirement in the formulation of mixtures

General

- The necessary technical input was made by way of economic analysis for the paper, presented at the 215th E & E Forum in January, on "Thermal Energy from Energy Plantations for the Tea Industry".
- The first draft of the TRI's Second Corporate Plan for the period, 2008 – 2010, was completed by the 30th of June.

Project D 35. Tea Sector Studies

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Further to the analysis done in the previous year, the financial requirement for providing a uniform fertilizer subsidy for the entire tea sector was assessed, and submitted to the Ministry of Plantation Industries, as per the input for a Cabinet proposal.

Annual fertilizer requirement in the tea sector

Considering the tea land distribution at different elevations and their productivity, and assuming that TRI-recommended fertilizer mixtures would be used in all mature tea lands, the annual fertilizer requirement of the sector is estimated to be as follows.

Total subsidy requirement for the tea sector

With the estimates given above for the urea requirement, the amount of money that the government would have to spend on the fertilizer subsidy for the smallholder sector is about Rs 338 mn. (at a subsidy rate of Rs. 12,000/MT of urea). If the same subsidy is to be extended to smallholders, owning more than 5 Ac of the land category, government expenditure would be another Rs192 mn. If the estate sector also were to be facilitated at the same subsidy rate, the additional expenditure requirement would be Rs. 313 mn. If the entire tea sector is to be given urea at the same subsidy rate, government expenditure would have to be increased by about Rs 505 mn, making the total expenditure requirement for the fertilizer subsidy to the tea sector about Rs 843 mn.

Therefore, by not giving the fertilizer subsidy to small holders owning more than 5 Ac of land, and to the corporate sector, the saving to government is about Rs 505 mn at present.

A technical contribution, to a paper on "Rational use of Nitrogen (N) and Potash (K2O) fertilizers in mature tea" was made, by analyzing the economic impact of N- and K-fertilizer use in the tea sector. This paper was presented at the 216th E & E Forum held on 27th July.

D 35.2 Performance Evaluation of St Coombs Estate

A study was undertaken to evaluate the performance achieved by St Coombs Estate over the last three years (2004 – 2006). It was found that the Estate was making heavy losses during the period prior to the change of management, but thereafter there was a gradual improvement to a profit-making level.

The major factors contributing to the situation were improved field productivity due to an improved plucking standard, better fertilizer application based on yield potential, and regulation of pruning practices, etc.

A report was submitted to the Estates and Advisory Committee of the TRB on 5th June, and a report, entitled "Development of a Performance Evaluation System for Up-Country Commercial Tea Plantations – A Case Study of St Coombs Estate and Factory, Talawakelle", was submitted to the Department of Agricultural Economics and Extension, Faculty of Agriculture, University of Ruhuna by Ruchira Somasiri, in partial fulfillment for the Degree of B.Sc. in Agriculture, 2007.

D 35.3 Tea Sector Policy

The investment needs of the tea sector was assessed, considering the development targets planned under the proposed tea policy. After receiving the observations of the Plantation Policy Formulation Committee, the investment needs for the development of the tea sector was computed as totaling Rs 83,690 mn for the period 2007- 2016: Rs.56,811 mn for field development activities (infilling Rs 1,313 mn, replanting Rs.50,886 mn and diversification Rs.4,613 mn); Rs.4,414 mn for factory development and quality certification, Rs 3,984 mn for Human Resource Development in the sector, Rs 5,180 mn for R & D and technology-transfer activities, and Rs13,301 mn for tea marketing and promotional activities.

Gains expected from the proposed policy mix, and the associated investment, were also estimated for the same period. With the investment of Rs 70.8 billion on field development activities, R & D and Human Resource Development activities in the sector, it is expected that Rs 136 billion would be gained from an improvement in average field productivity from 1650 kg/ha to 2057 kg/ha, from a total tea production of about 340 mn kg, from diversification of 36,000 ha of uneconomical tea lands, and from improved skills and empowerment of the work force. It is important to note that the full benefit of the field development programme will be realised over a period of more than 10 years.

By investing Rs 17.7 billion on factory modernization, quality certification, and marketing and promotional activities, it is expected that Rs 530 billion will be generated from an improved average export price for tea from $ 2 to $ 4 per kg, an increased market share, and an increase in the export volumes of value-added tea by 40 % to 65%.

The information given above, with necessary details were published in the National Plantation Policy Document, which was published and launched by the Ministry of Plantation Industries in June.

D 35.4 Smallholder Sector Study

A study in the smallholder sector, for identifying development needs in the different administrative districts, was carried out.
Writing of the final report is in progress.

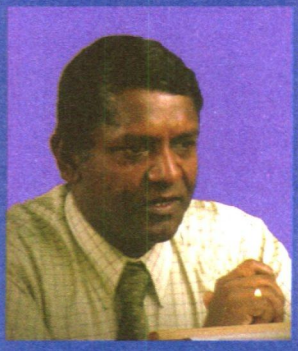
B 1 Economic Evaluation of Land Use

The collection of data from RPC estates, and computation, continued. Based on the initial data analysis, a paper entitled "Rational Land Use for Economic Viability and Sustainability of the Sri Lanka Tea Industry" was presented at the 215th E & E Forum held in January.

B 5 Cost of Tea Cultivation

In view of the recent wage increase in the plantation sector and revision of the fertilizer subsidy, an up-date of the cost of tea cultivation was made.

Agronomy Division



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Thrust A 14. Development of intercropping systems (with rubber and coconut) for the Low country and Uva

A 14.1 Evaluating the most compatible crop combinations

i. Effect of intercropping tea and rubber on productivity, RRI, Kuruwita (1990).

This experiment is being conducted in collaboration with the Rubber Research Institute (RRI) of Sri Lanka. There are 6 treatments in 4 replicates (blocks). The treatments are monocropping of tea (T1), monocropping of rubber (18' x 12') (T2), tea (rehabilitated) under rubber (27' x 8') (T4), tea (rehabilitated) under rubber (40' x 8') (T6), tea (unrehabilitated) under rubber (27' x 8') (T5), and tea (unrehabilitated) under rubber (40' x 8') (T7). Unrehabilitated tea and rubber was planted in 1990, while rehabilitated tea was planted in 1992.

As there were a large number of casualties with tea under rubber, and poor growth, data collection by the TRI was discontinued. The experiment is being continued by the RRI.

ii. Effect of intercropping tea and rubber on productivity, St. Joachim Estate, Ratnapura (1990).

There are three treatments, viz. tea alone (stand of tea 100%), tea (stand of tea, 75%) under rubber (40' x 8'), and rubber alone (20' x 12'), in three replicates. The rubber was planted in 1990 and the tea was introduced in 1993.

It was observed that the yield under the monocropped tea plots was higher than that in the intercropped plots. Tea bushes were pruned in June 2007 after resting for two

months. Pruning and tipping weights of the tea bushes under rubber was less than that of the pure tea stand. The trend was for the yield of rubber planted with tea to be higher than for the pure stand.

iii. **Effect of intercropping tea and rubber on productivity, Demonstration Plot, St Joachim Estate, Ratnapura, (1989).**
Field practices of the demonstration plot of rubber and tea intercropping, started in 1989, were continued during the year 2007.

iv. **Effect of intercropping tea and rubber on productivity, Observation Block, St. Joachim Estate, Ratnapura. (1995).**
This observation, which commenced in 1995, comprised of four plots. They are: rubber (20' x 12'), tea, tea in rubber (40' x 8'), and tea in rubber (60' x 8' x 8'). Rubber rows were located in the east-west direction.

Harvesting of tea and rubber continued with other recommended field practices. The yield records of tea showed that tea yield under rubber was less than that with the pure stand of tea. The trend was for the yield of rubber planted with tea to be higher per tree than for the pure stand of rubber.

v. **Effect of intercropping tea with rubber, rambutan, durian and cinnamon, on productivity, RRI, Kuruwita (2003).**
This experiment was commenced in collaboration with the RRI, the Department of Agriculture, and the Export Crop Department. Rubber was intercropped with tea, rambutan, durian and cinnamon under 4 systems of planted rubber (double-hedge rows). Planting of tea under rubber was done with, and without, rehabilitation.

The spacings of rubber in the different planting systems were:
1). 3 x 3 x 15 m 2). 3 x 3 x 18 m 3). 3.5 x 3.5 x15 m 4). 3.5 x 3.5 x18 m.

The yield records of tea (yield per bush) under the different spacings of rubber show that the yields of tea under rubber spacings of 3 x 3 x 15 m, 3 x 3 x 18 m and 3.5 x 3.5 x15 m have been significantly higher than under 3.5 x 3.5 x18 m. There was no significant difference in tea yield under rubber spacings of 3 x 3 x 15 m, 3 x 3 x 18 m and 3.5 x 3.5 x15 m.

The experiment is in progress.

Thrust A 9. Development of an economically viable system to eliminate / reduce the soil rehabilitation period prior to replanting tea in the Up country

A9.1 Evaluating soil rehabilitation techniques

In situ rehabilitation did not give successful results. The experiment was terminated in June.
A study on burials of prunings, and pruning height of different clones under soil rehabilitation and non-rehabilitation (2006).

The treatments are;
main factor: two levels, rehabilitation and non-rehabilitation

The sub-treatments are;

Factor 2.	five clones , PK 2, TRI 2024, NAY 3, DT1, TRI 2025
Factor 3.	two levels, burial of prunings, yes/no
Factor 4.	two levels, pruning height, 18" and 22"

Total no. of treatments	40
No. of replicates	02
Total no. of treatments	80
Design	RCBD with factorial

Tea yield under rehabilitation was significantly greater than that without rehabilitation. Also, the yields from different clones were significantly different. The highest yield was recorded with NAY 3, and the lowest with TRI 2025. There was no significant difference in yield between plots with burial and without burial of prunings, or between two heights of pruning. There was also no significant interaction among the different factors, apart from the clones and the pruning heights.

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

A study on soil water balance under low-country conditions, St Joachim Estate (2007)

This study commenced in August using sap-flow sensors. The objective is to estimate actual water use by tea plants during dry spells. The experiment is in progress.

A study on rainfall partitioning in tea fields, St Joachim Estate

Rainfall partitioned into through-fall, canopy interception, and stem fall in the tea plant, and in the shade plants, Gliricidia and Albizzia, was studied during May-June, in the south-west monsoon. The highest stem fall, 11.27% (± 2.38), was recorded from tea plants. Both Albizzia (1.22% ± 0.5) and Gliricidia (1.78% ± 0.52) showed more or less same percentage of stem fall. Through-fall (as a percentage of total rainfall) varied significantly with tea plants under shaded and non-shaded conditions. Non-shaded tea plants recorded 3.19% (± 1.25), while under Gliricidia and Albizzia 0.54% ± 0.12 and 0.012% ± 0.003, respectively, were recorded. The major soil-water replenishment comes as stem fall of the rainfall.

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

A 32.2. Evaluating crop responses to organic amendments.

Effect of mulching materials and soil amendments on soil properties and tea yield; St. Coombs Estate, Talawakelle.

Mature tea, TRI 4071, was continued in the 2nd year of the 2nd cycle (Field No. 10). All combinations of the following treatments were tested. Treatment combinations were applied at the time of pruning in August 2005

Mulch treatments and soil acidity amendments were as follows.
Control (No mulch)
Control (No pH amendments)

Refuse tea. Surface application @ 25 tonnes ha-1 yr-1
Dolomite @ 2500 kg ha-1
Mana (Cymbopogan confertiflorus) @ 35 tonnes ha-1 yr-1
Minplus (Crushed basaltic rock) @ 5000 kg ha-1
Wild Sunflower (Tithonia diversifolia) @ 35 tonnes ha-1 yr-1
Refuse tea, incorporated @ 25 tonnes ha-1 yr-1

Refuse tea was applied twice per annum, and Mana and Wild Sunflower were applied three times, starting from 2006. Application of pH amendments was done once in a cycle.

Mulching treatments significantly affected soil OC, MBC, and yield of tea. However, pH amendments did not significantly affect soil N, OC, and soil MBC.

Mature tea, TRI 2025, was continued in the 2nd year of the 5th cycle (Field No. 03). All treatment combinations, as given below, were imposed at the time of pruning in August 2005.

Mulch treatments and soil acidity amendments were as follows.
Control, no mulch
Control, no pH amendments
Refuse tea, surface application @ 25 tonnes ha-1 yr-1
Dolomite @ 2500 kg ha-1
Burial of pruning @ 15 tonnes ha-1 yr-1
Minplus (Crushed basaltic rock) @ 5000 kg ha-1
Dadap (Erythrina lithosperma) @ 35 tonnes ha-1 yr-1
Refuse tea, incorporated @ 25 tonnes ha-1 yr-1

Refuse tea was applied twice, and Dadap thrice per annum, starting from 2006. Burial of prunings and application of pH amendments were done once in a cycle.

Tea yield was significantly increased in plots mulched with Dadap and refuse tea, and buried with prunings. There was no significant difference in yield between control and refuse tea incorporated in the soil treatments.

The potential use of biomass of Gliricidia sepium shade plants, as an alternative source of N-fertiliser, in tea fields in the Low, Mid and Up country.

Gliricidia mulching experiment, Sirinivasa Estate (2007).
The treatments were:
T1 – Fertilizer 100%, at recommended level + Gliricidia loppings.
T2 – Fertilizer 75% + Gliricidia loppings.
T3 – Fertilizer 100%, alone.

This experiment was begun in April, with four replicates. The plots, each consisting of two Gliricidia trees, were selected for T1 and T2. No Gliricidia trees were present in the plots used for T3.

Pre-plucking was done for four months. There were no significant difference in yield between the plots to be subjected to the above treatments.

Treatments were first imposed in September. T1 and T3 showed the highest yield at four MAT. There was an increase in yield in all three treatments above the initial yield. This was particularly so with T1. The experiment is in progress.

Establishment of Gliricidia; Carolina Estate, Ginigathhena (2007).
Plots were demarcated in a mature tea field in July. Each plot included four trees of Gliricidia. The plot size was 28 x 28 ft. Pre-plucking was recorded, and the plots were pruned.

The treatments were:
T1 – Gliricidia (35 t/ha/yr in FW) + full fertilizer
T2 – Gliricidia (35 t/ha/yr in FW) + 3/4th fertilizer
T3 – Without Gliricidia + full fertilizer
T4 – With Gliricidia + full fertilizer, but without added loppings of Gliricidia.

The experiment is in progress.

Mid country – Ratwatta Estate (2007)
There were four treatments with, and without, mulching using Gliricidia. Design is RCB with four replicates. Plots were mulched with Gliricidia. @ 35 tonnes/ha/yr every two months. The Gliricidia. was supplied from elsewhere.

Plots, mulched with Gliricidia and fully treated with the recommended fertilizer (VPUM) level (T1), recorded the highest yield of 6600 kg MT/ha. This was followed by Gliricidia + treatment with 3/4th of the recommended fertilizer (T2) which recorded a yield of 6482 kg MT/ha. Gliricidia mulch alone (T3) recorded the least yield, 5948 kg/ha, a lowering of 9%. The full recommended fertilizer (VPUM) alone (T4) recorded a yield of 6089 kg/ha.

Mid country – Geragama Estate
This experiment included the same treatments as for Ratwatta Estate, but the Gliricidia materials are supplied in situ. with two Gliricidia trees in each plot to supply the materials. The experiment was in the pre-plucking phase.
There was no difference in tea yield between the treatments.

The experiments are in progress.

Study on bio-dynamic farming; Stassen bio-tea project, Haldummulla (2000).
There was an increase in yield in cycle 1 with lunar-based applications of biodynamic preparations under bio-dynamic farming, compared with conventional (non-lunar) farming. The 1st year of the 2nd cycle is in progress.

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

A 42.1 Evaluating agronomic practices of potential fuelwood species in different regions

Cultivation of Gliricidia in the low country.

A series of new experiments were begun to examine the feasibility of planting Gliricidia as energy plantations, and to identify suitable agronomic practices in field planting and management. Two experiments with three spacings and two levels of fertilizers were started on St. Joachim Estate and on Raigama Estate during 2007.

Spacings: T1 – 1 x 1 m; T2 – 1 x 2 m; T3 – 2 x 2 m

Fertilizers: with, and without, the application of fertilizers

Experimental plots were arranged in a RCB design with five replicates.

Field operations from land preparation to planting were done at the end of 2007. Planting was completed in September 2007

Cultivation of Gliricidia in the mid-country.

The spacing trial with Gliricidia was established in the mid-country on Carolina Estate, Ginigathena, in September 2007.

Spacings: 1 x 2 m2 , 2 x 2 m2, 2 x 3 m2 with five replicates Design RCBD with buffer zone.

The experiment is in progress.

Basic Research

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

A collaborative research study with IFS, Hantane; 2006

New nursery plants treated with inoculum were raised at the LCS, Ratnapura, the MCS, Hantana, and the Main Station, Talawakelle. Plants treated with T 65 + inoculum thrive well at Ratnapura and Hantana compared to plants treated with inoculum alone and the control plants.
The experiment is in progress.

New nursery plants treated with inoculum are found to perform well compared to the untreated controls and the plants treated with T 65.

The experiment is in progress.

Screening N-fixing bacteria and bio-film technology (beneficial bacterial/fungal

colonization), improving the biological status of soil and determining nitrogen-fixing ability using bio-film.

The treatments were:
T1 – Tea rhizosphere fungi –TR1
T2 – Tea rhizosphere fungi –TR 4
T3 – Nitrogen fixing bacterium Bradyrhizobium elkanii 5019 SEMIA -S
T4 – Fungus-forest soil – F
T5 – Bacteria from Arachis pintoii – B'
T6 – Control-growth media YMB
Potting mixture: sterile gravel. Nutrient source: Mac nights

Three-months-old nursery plants were initially used for this study. Relative growth rate (RGR) based on plant height was measured 5 WA inoculation showed that the highest RGR was recorded with inocular TR4S (0.0124). S, TR4, TR4B'S and TR1S also gave higher growth.

Hantane nursery trial
- Tea rhizosphere fungi, TR1
- Tea rhizosphere fungi, TR 4
- Nitrogen-fixing bacterium, Bradyrhizobium elkanii 5019 SEMIA-S
- Fungus-forest soil, F
- Bacteria from Arachis pintoii , B'
- Control: growth media, YMB
- Potting mixture: Sub soil

Four-months-old tea plants were used for the study. Relative growth rate (RGR) was measured 10 weeks after inoculation. TR4 BS, TR4 'B and B' showed the best performance in terms of RGR.

Hantane and Ratnapura, new experiments
Tea rhizosphere fungi –TR 4
- Nitrogen-fixing bacterium, Bradyrhizobium elkanii 5019 SEMIA, S
- Fungus-refuse tea, Frt
- Bacteria-refuse tea, Brt
- Bacteria–Arachis, B'
- Bacteria–vermicasts, Bvc
- T65
- Control: growth media, YMB

The highest RGR was recorded with five-months-old tea plants treated with T65, at Hantana 4 WAI. Frt Bvc and Frt 'B also led to a good performance.

The highest shoot dry weight was recorded with T65 and Frt 'B. The root dry weight was highest with TR4 Brt. Higher values were also recorded with YMB, Frt 'B, Frt B, S and Bvc, compared to the control (T65).

The highest root length was measured in plants treated with T65. TR4 B, Frt 'B and S also performed well.

B 67 Propagation

Investigations on the compatibility of stock and scion for grafting for high quality and productivity of tea; St Coombs Estate.

Objective: To Identify different grafting combinations giving high quality and yield

This experiment came under Project A 38.8, but was handed over by the Physiology Division to the Agronomy Division in 2006. The graft combinations, indicated below, were planted in the central nursery, St. Coombs Estate, on 20th March, 2005. After one year, there were no casualties and the plants showed satisfactory growth. Plucking was started on June 2007. The experiment is in progress.

TRI 777/2025, TRI 777/3020, TRI 777/4052, TRI 777/4053, TRI 777/3019, TRI 4067/4052, TRI 4067/4053, TRI 4067/3019, TRI 4067/3020, TRI 4067/2025, TRI 4079/2025, TRI 4079/3019, TRI 4079/3020, TRI 4079/4052, TRI 4079/4053, TRI 777, TRI 4067, TRI 4079.

Objective: To identify the most successful graft combinations by grafting high-yielding and common pest- and disease-resistant cultivars with high-rooting and drought-resistant cultivars, and to compare propagation under polythene cover and the conventional nursery method for grafting.

The nursery period was completed, and the grafted plants were planted in the field in August 2007. The scion selected was resistant to Blister Blight and Shot-hole Borer, and was high-yielding. The stock characters were high-rooting, drought-tolerance, and resistance to Radopholus loosi and stem canker.

Ten grafted plants from each treatment were planted in the nursery under polythene cover and the conventional nursery method. After six months, casualties were recorded. More casualties were shown in the conventional nursery method. Recovery percentages of 85% and 57% were recorded for grafted combination under polythene propagation and the conventional method, respectively.

The experiment is in progress.

The following combinations were used in grafting.
TRI 4046/4006, TRI 3072/4006, TRI 4046/3072, TRI 4006/3072, TRI 4046/4053, TRI 3072/4053, TRI 4006, TRI 3072, TRI 4053, TRI 4046;

Experiments and demonstrations are in progress.

B 86 Identifying factors associated with yield decline in VP tea in the up- and the low country.

The effect of alternative methods of soil reconditioning at Handford Estate, Deniyaya.(2000).

Different methods of soil reconditioning are tested. Tea yield in the 2nd year of the second cycle was recorded. In plots rehabilitated with Mana, the highest yield was recorded. This is 70% greater than in unrehabilitated tea.

B 88 Evaluating an aqueous solution of Ginisapu seeds as a natural herbicide for hard-to-kill weeds.

It was found that this solution can be used to kill some of the weeds, particularly Passali kodi. Preliminary arrangements have been made to work in collaboration with ITI, Colombo, for necessary chemical analyses in regard to identification of the active ingredient (A.I) in the solution. The seasonality of seed bearing, and the high cost of picking fruits from large trees, are the major obstacles in undertaking research on these lines.

B 90 Investigating the effect of herbicides on soil microbial properties

B 91 Developing and refining intercropping with coconut in low-country tea lands

Effect of intercropping tea and coconut on productivity; Citrus Estate, Galle (2002).

The observation block was as follows:

T1 – Tea with rehabilitation + coconut at 20' x 40'
T2 – Tea without rehabilitation + coconut at 20' x 40'
T3 – Tea with rehabilitation + coconut at 20' x 30'
T4 – Tea without rehabilitation + coconut at 20' x 30'
T5 – Tea alone with rehabilitation
T6 – Tea alone without rehabilitation

During the 2nd year (2006/07), the highest annual tea yield was recorded from tea alone with rehabilitation, 4835 kg MT/ha, which is higher than that without rehabilitation by 14%. Under tea (4' X 2') with rehabilitation + coconut (20' x 40'), the tea yield increased by 28% when compared to that from non-rehabilitated plots. The yield increase under tea (4' x 2') with rehabilitation + coconut (20' x 30') was only 14%. However, with tea alone, in plots under rehabilitation, the yield increase was 19% when compared to that from non-rehabilitated plots. The yield increase for the six-month period in 2007, in corresponding treatments, was 15%, 62% and 17%, respectively.

Divisional Activities (Project D/AGRY)

i. The demonstration block for cover crops, green-manure crops, SALT, favourable (soft) herbs and vermi-compost is being continued.
ii. The field experiment on factors associated with debilitation and death of tea bushes in the Deniyaya region (2004) is in progress.
iii. The study on the acceleration of branching by disbudding nursery plants (2006) is in progress.
iv. The collection and issue of Flemingia, Crotolaria seeds, and other planting materials, such as vetiver and Arachis pintoii, to stakeholders are in progress.
v. Soil-fertility improvement studies using bio-film technology (a combination of bacteria and fungi), which commenced in 2007, are in progress.
vi. The Corporate Plan for the years 2008-12 was prepared and submitted in June. The budget for applied and basic research under the Corporate Plan, and the Budget for 2008, were prepared and submitted.
vii. Glasshouse pot trial. Decomposition trial with different mulch materials.
The following mulch materials were placed on mesh and kept in pots. Six mulch materials were used with four replications of each. All the pots were kept under 40% field capacity. Mana, Calliandra, Guatamala, Gliricidia, refuse tea and Dadap were the mulch materials used. The biomass remaining was recorded with time. The decomposition rate was calculated. The observed pattern of the decomposition rates of the materials is Mana < Calliandra < Guatamala < refuse tea < Dadap < Gliricidia.
viii. Soil compaction measurements in estates in the Maskeliya and Uva areas coming under Maskeliya Plantations
Soil compactness was measured using a Penetrometer (Model - Field Scout SC 900, Spectrum Technology, USA) in selected fields.

The total extent covered in the Maskeliya area, planted with VP teas, was 139 ha. The soil compaction here was found to range from 143 to 189 lb/in2..

In the Talawakele area, the total hectarage covered was 54, and compaction was reported to be within 130 - 161 lb/in2. In the Bandarawela region, the compaction was reported to be within 143 - 161 lb/in2, from two estates, Poonagala and Craig, which covered only 42 ha.

Meteorological Data (C.MET)

The Meteorological Station at Hantane needs to be renovated.

Patents

The patent certificate applied for, in respect of the new product from ginisapu seeds, was published in the newspapers in September, for the comments of the general public. The patent certificate for the innovative usage of ginisapu seeds, as a weed control tool, was duly awarded by the Patent Office in Colombo in December.

Research Publications

- Prematilake, K.G., Froud-Williams, R.J. and Ekanayake, P.B. (2007). Investigation on the weed seed bank under different weed management methods in young tea (Camellia sinensis (L.) O. Kuntze). Proc., 21st Asian-Pacific Weed Science Soc. Conference, Colombo, October 2-6, p 378-382.
- Dr K.G.Prematilake submitted a paper on "Detection of glyphosate and 2,4-D herbicide residues in made tea" to the Tea Bulletin of the TRI.
- Dr K.G.Prematilake submitted a short communication on "Promotion of rooting ability of Arachis pintoii , 'Mal Ratakaju'" to the TRI Update.
- Prematilake, K.G. and Liyanage, S. (2007). Exploitation of Ginisapu seed as a natural herbicide. In abstract, First Research Symposium of the Sabaragamuwa University, Dec.21-22.
- A Ready Reckoner on "Integrated weed management in tea" in Sinhala and English was submitted to the TRI in April.
- Dr K.G.Prematilake submitted a paper on "The impact of various manual and chemical weed-management practices in young tea on weed seed bank in soil" to the Journal of Tea Science of the TRI.
- Rivas, A.A., Clemente, R.S., Ranamukhaarchchi, S.L., Das Gupta, A., Zoebisch, M.A., Thevachandran, S. and De Silva, M.S.D.L. (2007). Soil hydraulic characterization under different cropping patterns in sloping agricultural lands in Sri Lanka. Asia-Pacific Journal of Rural Development XVII (1), 83-94.
- De Silva, M.S.D.L and Jayasinghe, L.A.S.P (2007). Impact of organic mulches on soil properties in high grown tea soils. 12th international Forestry and Environment Symposium. Proc. Part 1 - Green Solutions. 30 November – 1 December, Tangerine Beach Hotel, Kalutara, Sri Lanka.

Crop Clinics

All the staff actively participated in a Crop Clinic held at the TRI, Talawakelle on 18 October.

All the staff actively participated in a Crop Clinic held at the LCS, TRI, Ratnapura, on 11-12 December.. All the events held at the Divisional Demostration block were highly appreciated by from both sectors. There was also a great demand for seeds and planting materials. The majority of the participants showed interest in the demonstration on the herbicidal properties of ginisapu seeds.

Meetings, Presentations and Lectures

- Dr K.G. Prematilake, actively participated as a session organizer in the 21 Asian-Pacific Weed Science Soc. Conference held in Colombo, October 2-6. He also presented a paper.
- Mrs M.S.L. De Silva also participated as a session organizer in the 21st Asian-Pacific Weed Science Soc. Conference held in Colombo, October 2- .
- Dr M.A. Wijeratne attended a meeting of the NSF in Colombo.
- Dr M.A. Wijeratne attended meetings on "Gemming in the up-country area" organized by the Environmental Ministry.

- Dr M.A. Wijeratne presented a series of seminars on mechanical harvesting in the different regions.
- Dr K.G. Prematilake made a seminar presentation on "Safe and effective use of herbicides in tea" at the RSC Seminar of the Nuwara Eliya region, on 18th December.
- Dr K.G. Prematilake serves as a Visiting Lecturer on Weed Science for M. Sc. students of the University of Ruhuna, as from November.
- Dr K.G. Prematilake gave lectures on "Integrated weed management" to the officers of the Maskeliya Plantation at the NIPM Centre, Bogawanatalawa, in November.
- All Senior Research Officers and Research Assistants actively participated in the RSC meeting held at the TRI, Ratnapura, in April, for the Kalutara, Ratnapura and Kegalle Districts.
- All Senior Research Officers and Research Assistants participated in the E & E meeting held at the TRI, Ratnapura, in May, for the Tea Small Holding Sector.
- Drs K.G. Prematilake and M.A. Wijeratne attended the meeting for submission of the Corporate Plan, 2008-12, held in Colombo on 7 June.
- Dr K.G. Prematilake attended the review meetings of the Entomology, Pathology, Advisory, Technology and Physiology Divisions.
- Dr M.A. Wijeratne attended the Advisory and Extension Forum held in Colombo, in September.
- Dr M.A Wijeratne presented a paper on "Water conservation in agricultural lands" in Colombo, in July.
- Dr K.G. Prematilake made a seminar presentation on " The importance of adopting soil and moisture conservation measures, and safe use of pesticides, in tea lands, in order to maintain the catchments of up-country reservoirs, the major water resources", organized by the Water Resources Board, Kandy in Nuwara Eliya, in August.

Visitors

- Director (Agro Products) of Agro-Technica visited to hand over a new battery-operated Knapsack Sprayer to the Division, for testing under field situations.
- An Engineer of the FMRC, Mahailluppallama visited to demostrate a new 'Swiss Hoe', a mechanical weeder for tea fields.
- The proprietor of Meesan Estate, Ankumbura, .Kandy, visited to collect Flemingia congesta seeds.

Training

- Two Ruhuna University undergraduates were trained for their final year research projects under the supervision of Drs M.A. Wijeratne and K.G. Prematialake.
- NAITA students, who were trained at the LCS, were subjected to their final evaluation.
- A Sabaragamuwa University undergraduate completed his final year research project at the LCS, Ratnapura.
- A Jaffna University undergraduate completed his field studies and thesis writing at the TRI, Talawakelle.
- Ms M.S.D.L De Silva supervised the research project of two undergraduates, Ms W.M.D.K.

Wijeratnayaka from the Faculty of Agriculture, University of Peradeniya, and Mr R. Vijiraj from the University of Jaffna. Their project titles were "Effect of different mulching materials on soil properties and yield of tea", and "Effect of organic farming on soil properties of an ultisol under tea", respectively.

- Two NDT students trained in the Agronomy Division (in the up-country and at the LCS).
- Two undergraduates of the University of Peradeniya are undertaking their final-year research projects at the LCS, Ratnapura.

Reports

The following reports were completed and forwarded as indicated.

- Planting of Avocado, new spp. 'HAS', in the mid-country tea small holdings (to TSHDA).
- Use of Gliricidia as a supplementary N-supplier for urea (to Dr. Sarath Samaraweera).
- Guidelines for lopping of Calliandra calothyrsus.

Activities commenced

- A survey of pruning practices in high-grown tea.
- Review of the results of investigations on rehabilitation of tea lands before replanting.

Biochemistry Division

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Skilled Mechanic

Progress Review

Thrust A 30. Modification of instant tea processing for pronounced tea characteristics

In black tea manufacture, 3% of the harvested tea leaf is discarded as refuse tea. Refuse tea contains 20-30% of crude protein. If this valuable protein were to be utilized in animal feeding, or for direct human consumption, it would reduce, to a certain extent, the widespread protein-energy malnutrition in less developed countries like Sri Lanka. It would also generate additional profits for the tea industry.

This project was carried out with the objective of establishing procedures for the extraction of protein from refuse tea, and for the purification of the protein so extracted.

If the protein extraction could be done using spent tea leaf from instant tea or a tea-concentrate production plant, the operation would be very economical. Improvement of the organoleptic properties of instant tea was also carried out as a part of the project.

Initial studies were made to optimize the extraction of proteins, to precipitate the proteins so extracted, and to purify and characterize the leaf-protein concentrate (LPC) obtained. However, only a fraction of the proteins (78%) were precipitated. Further, co-precipitation of polyphenols made it difficult to purify the LPC obtained.

These difficulties could be overcome using membrane-filtration techniques. Membrane-filtration techniques are more economical for commercial use. Hence, a project proposal was prepared and submitted to the Plantations Development Project (PDP) seeking funds for a pilot-scale membrane filtration system.

In the studies conducted to optimize the organoleptic properties of instant tea, green leaf was subjected to chemical wither, and extracts were made from dhool fermented for different periods of time. Chemical and sensory evaluations of the instant teas obtained are being continued.

Basic Research

B 26 Biochemical and chemical methods in the control of Blister Blight leaf disease of tea caused by *Exobasidium vexans*

This project aims at studying the chemistry and biochemistry of disease-resistance mechanisms in relation to blister blight leaf disease in tea, with the ultimate objective of controlling the disease in an environmentally-friendly manner by exploiting natural disease-resistance traits inherited in the tea plant.

Progress of the project up to 2005 can be summarized as follows.
In 2007, characterization of isolated proanthocyanidins was initiated. However, this project was temporarily discontinued due to lack of staff.

B 18 Use of DNA markers for molecular characterisation of tea.

Screening of tea cultivars using Random Amplified Polymorphic DNA (RAPD)

The Fairlawn seedling study

Genetic diversity in the Fairlawn seedling trial was studied using selected accessions. DNA was extracted using a mini-prep DNA extraction method for RAPD-PCR amplifications. PCR was completed for 10 primers (OPC10, OPC9, OPA9, OPA7, OPB10, OPB17, OPB4, OPB13, OPC17, OPE6). This work is in progress.

In-breeding depression and parentage analysis

To investigate the applicability and readiness of the RAPDs method for parentage analysis of tea cultivars, a set of cultivars was selected (together with their parents) for initial studies. DNA was extracted using the mini-prep procedure. RAPD analysis is being done using 20 primers. Manual calculation of parentage, for the 40 cultivars selected, is also in progress.

Development of SSR markers for blister-blight resistance and genetic mapping

The construction of a EST-SSR-based genetic linkage map was completed using 148 accessions from a segregating population from TRI 2023 x TRI 2043, two diverse cultivars having resistance to blister blight leaf disease.
Out of these accessions, three highly-resistant and highly-susceptible individuals were selected for use in Bulk Segregant Analysis (BSA). DNA was extracted from them, and from another 10 tea cultivars (five resistant, and five susceptible, to blister blight). Bulk Segregant Analysis was initiated to identify a linked marker. The BSA work is in progress.

To facilitate the mapping studies, a set of phenotypical, morphological and biochemical characters were identified for the assessment. A second round of morphological assessments are in progress.

In the first round, significant differences were observed in the number of hairs, leaf length, leaf width and petiole length. Chemical analysis to find catechin profiles is also being continued. The results so far indicate a higher epicatechin content in the resistant accessions.

B 19 Biological effects of tea consumption

Copper content in blood serum of rats following oral administration of BOPF-grade Sri Lankan black tea

A study was conducted using BOPF-grade tea representing high-grown, mid-grown and low-grown teas. A Wistar rat model was used for the study.

Three different concentrations of black tea brew, containing 60, 120 and 480 mg/l tea solids, were fed thrice a day with distilled water as the control. Blood was collected on days 30, 60 and 90 of the treatment, and 45 days post-treatment. The results show a significant increase in serum copper concentration in rats receiving mid- and high doses of tea. The levels returned to the baseline level at 45 days post-treatment. However, serum copper content during the treatments were in the normal range for serum copper. Treatment did not induce any overt signs of toxicity, indicating that tea is a good source of copper, and regular tea consumption does not lead to excessive levels of serum copper and to copper toxicity.

In-vitro thrombolytic activity of high-grown BOPF-grade black tea

The development of novel thrombolytic agents is important, as currently available thrombolytic agents are very expensive and have severe side-effects.

Calcium-induced blood clots were made from citrated goat blood, and thrombolytic activity (blood-clot disintegration) of different concentrations of freeze-dried black tea brew (2.5, 5.0, 10.0, 20.0 mg/ml in saline) was determined. The results indicate that 10 and 20 mg/l of black tea brew significantly increased thrombolytic activity. Thrombolytic activity was dose dependant ($r2 = 0.9887$, $p<0.05$).

D 30 Development of multi-residue methods for the analysis of pesticide residues in tea

The development of residue methods was continued. A method is being optimized for the analysis of the systemic fungicides, propiconazole and tebuconazole. However, the recoveries of these compounds were low. Work is in progress to optimize the methods.

Nicotine analysis in tea flush

In some tea-importing countries, nicotine is a substance banned in food, and should not therefore be present in any food item in these countries.

Analytical methods used for random monitoring in these countries are capable of detecting minute levels of nicotine (µg/kg). However, some plants, which are used as food, naturally contain µg/kg levels of nicotine. Tea also contains trace amounts of nicotine. Therefore, it is important to record the nicotine levels occurring naturally in Sri Lankan tea, in order to resolve any issues that may arise from the detection of nicotine in Ceylon teas.

Twelve cultivars were used in the study: TRI 2025, TRI 2023, TRI 2024, TRI 2026, TRI

777, TRI 2043, PK 2, DT 1, DN, N 2, K 145 and CY 9. Nicotine was detected in all twelve cultivars, in the range 511 – 5464 μg/kg.

International Standards Organisation (ISO) Ring Tests for chemical parameters of tea. The Division participated in the ISO ring test for total polyphenols and catechins.

Total polyphenols and catechins in regional teas, and in Sri Lankan white tea ('Silver Tips' and 'Golden Tips'), were analysed and submitted to the ISO.

Establishment of standards for Good Agricultural Practices (GAP) and Good Manufacturing Practices for tea.

The Division participated in the formulation of Good Agricultural Practices (GAP) and Good Manufacturing Practice (GMP) standards for tea. A draft prepared was made available for public comment, after which It was approved by the relevant committees of the Sri Lanka Standards Institute (SLSI). It was then approved as a Sri Lanka Standard by the Council of the Sri Lanka Standards Institution on 27th August 2007 (SLS 1315, 2007, Code of practice for the tea industry. Part 1: Good agricultural practices for the cultivation of tea. Part 2: Good manufacturing practices for the processing of black tea).

General

- Dr A M T Amarakoon was appointed Head, Biochemistry Division with effect from 13th February 2007.
- Dr A M T Amarakoon continued working as Chairman of the Technical Working Group on Good Manufacturing Practices of Black Tea, Ministry of Plantation Industries in August 2006.
- Dr A M T Amarakoon participated in a meeting of the European Tea Committee's International Working Group on Pesticides, on 7th May 2007, in Hamburg, Germany.
- Dr A M T Amarakoon presented a paper entitled "Maximum Residue Limits (MRL) in Tea", at the Colombo International Tea Convention, 29th August – 1st September 2007.
- Dr P A N Punyasiri, Senior Research Officer, resigned from the services of the Institute with effect from 4th September 2007.
- Mr K M Mewan returned from the Samuel Roberts Nobel Foundation, Oklahoma, USA, on 19th April 2007, after successfully completing part of a project on "A genomics approach to improvement of disease resistance in tea".
- Mr K M Mewan presented a paper entitled "Construction of a genomic and EST SSR based saturated genetic linkage map of tea", at the 3rd International Conference on O-CHA (Tea) Culture and Sciences, 4th – 7th November 2007, Shizuoka, Japan. He was awarded the "Best Researcher Award" at the Conference.
- Mr HMSB Heenkenda assumed duties as a Technical Assistant in the Biochemistry Division, with effect from 20th November 2007.

Collaborators (Non-TRI)

- Prof. V Kumar and Prof. (Mrs) S Kumar, Department of Chemistry, Faculty of Science, University of Peradeniya, in the Biological Pest Control Project.
- Prof. E Karunanayake, Department of Molecular Biology and Biochemistry, Faculty of Medicine, University of Colombo, on "Use of DNA Markers for Molecular Characterization of Tea".

- Mr J M D T Everard, Geneticist/Plant Breeder, Coconut Research Institute, Lunuwila, on "Use of DNA Markers for Molecular Characterization of Tea".
- Dr G J Panagoda, Faculty of Dental Science, University of Peradeniya, on "Effect of Black Tea on Oral Health".
- Prof. W D Ratnasooriya, Department of Zoology, University of Colombo, on the biological effects of tea consumption.
- Dr Ranil de Silva, Department of Anatomy, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda on the biological effects of tea consumption..
- Sherry S H Huang, Department of Pharmacology, National University of Singapore, Singapore, on the biological effects of tea consumption.
- Yi Zhun Zhu, Department of Pharmacology, National University of Singapore, Singapore on the biological effects of tea consumption.

Publications

- Perera, GAAR, Abeysinghe, ISB and Jayaweera, CD (2007). Optimization of conditions for preparing leaf protein concentrate from refuse tea. Journal of Food Science and Technology 44, 413 – 416.
- Perera, GAAR, Abeysinghe, ISB, Hettiarachchi, LSK and Wijewardena, A (2007). Mineral composition of leaf protein concentrate prepared from refuse tea. Journal of Tea Science (in press).
- Abeywickrama, K R W, Amarakoon, A M T, Ratnasooriya, W D (2007). An assessment of copper content in BOPF grade Sri Lankan black teas (Camellia sinensis L.) of different agro-climatic elevations. Proceedings of the 63rd Annual Sessions of the Sri Lanka Association for the Advancement of Science.
- Abeywickrama, K R W, Amarakoon, A M T, Ratnasooriya, W D (2007). In vitro thrombolytic activity of high grown BOPF grade black tea (Camellia sinensis L) on fresh goat blood. Proceedings of the 27th Annual Sessions of the Institute of Biology, Sri Lanka.
- Abeywickrama, K R W, Amarakoon, A M T, Ratnasooriya, W D (2007). Copper content in blood serum of rats following oral administration of BOPF grade black tea (Camellia sinensis L). Proceedings of the 27th Annual Sessions of the Institute of Biology, Sri Lanka.

Awards

Mr KM Mewan obtained the "Best Researcher Award" at the 3rd International Conference on O-CHA (Tea) Culture and Sciences, 4th – 7th November 2007, Shizuoka, Japan, for a presentation entitled "Construction of a genomic and EST SSR based saturated genetic linkage map of tea".

Entomology Division

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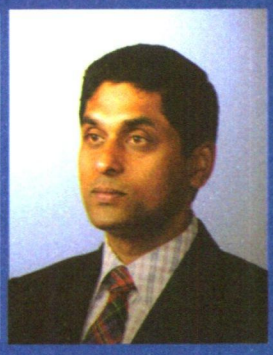

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Mr U B Herath
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Technical Assistant

Progress Review

Cultivar screening

The following trials for screening new cultivars and lines for resistance to various tea pests were monitored in different locations in collaboration with the Plant Breeding Division (Table 1).

Table 1. Screening new cultivars and lines for resistance to various tea pests in different locations.

Pest	Project	Experiment No.	Location/s
Shot-hole borer	A 1.2		VP 83, 84 & 88; St. Coombs Pedro Estate, Nuwara Eliya
	A 4.2		Selected locations in the low country Madulkelle Estate
Live-wood Termite	A.4.2	LE 56	Noragolla Estate
Pratylenchus loosi	A 1.6	N 1 A	Nematology experimental area, Talawakele
			Phase II field trial; S. Coombs
		N 1 A	TRI Station, Passara
Radopholus similis	A 2.5	N 1 B	Hantane Estate, Hantane
		N 1 B	TRI Station, Passara

As regards SHB, the performance of the cultivars was seen to be region-specific, due to varying SHB pressure in the different regions. All screening trials, located in different areas, are in progress for the purpose of generating conclusive data for use of the plant breeders.

Thrust A 22. Development of cost effective control methods for integrated management of Shot-hole Borer

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

A 22.2 Screening of biological control agents for reducing SHB damage in immature and mature tea

Two field trials were initiated at Attampitiya Estate to evaluate the efficacy of the local strain of the fungus, Beauvaria bassiana,, isolated from Welimada (Table 3) (reported in the Annual Review for 2006). The fungus had given about 40% control of SHB, compared to the control.

Table 3. Screening *Beauvaria bassiana* against Shot-hole Borer under field conditions

Project	Expt. No	Location
A 22.1	E 350	Field No. 7, First Division, Attampitiya Estate
	E 357	Field No. 13, Second Division, Attampitiya Estate

Experiment E 350 yielded information and was terminated. Experiment E 357 is in progress.

In another study, the biocontrol agent of shot-hole borer, Monocon spp. (Hymenoptera: Perilampidae), in the Kanneliya jungle area and a few estates, was monitored. None of the species (Monocon senex and Monocon angustum), or their stages, was found during this period.

A 22.3 Identifying plant species as diversionary hosts for SHB

A 22.5 Modifying potassium fertilization for reducing SHB damage

i. Field No. 9 A, Factory Division, Hantane Estate, Kandy, AER-WM 3 (1997)

The yields obtained during June 2006 - May 2007, from the different cultivars grown at the experimental site, varied significantly, but no variation was found with increasing rates of potash fertilizer. At this experimental site, yields from the cultivar DN was lower than that from both TRI 2023 and 2025. No significant variation in leaf K was seen with increasing rates of potash fertilizer, although it varied significantly among the three cultivars. The mother-leaf K concentration in DN was higher than in both TRI2025 and 2023, whilst the K in 2025 was higher than in 2023. This is probably due to nutrient dilution brought about by higher dry matter production. However, available soil K did not vary so far, either with increasing rates of potash or with the cultivars.

The activities continue.

ii. Field No. 13, Attampitia Estate, Attampitia, AER-IU3 (1997)

Activities in this trial continue. The Entomology Division monitors the incidence of SHB from both trials, and the results will be reported on by the Entomology Division.

A 22.6 Identifying and using semio-chemicals for reducing SHB damage

A 22.7 Modeling yield damage relationships for major/ primary pests

All estates, belonging to Kotagala Plantations in the Dimbula planting district, were sampled for shot-hole borer. Preliminary data suggested that the different fields, of both TRI 2025 and DT 1, show varying but high SHB infestation levels. The experiment was terminated.

In another study in Mayfield Estate, Kotagala, the yield loss caused by shot-hole borer attack is being monitored regularly. The experiment is in progress.

Thrust A 23. Rational control of major pests and diseases of tea with a view to reducing the usage of pesticides

A 23.8 Development of integrated pest management programme on tea nematodes

Fine-tuning of nursery fumigation methodology

Eight experiments were conducted to evaluate the effect of half-doses of existing recommendations of Basamid and Metham Sodium with improved fumigation methodologies, under up-country, mid-country, low-country and Uva conditions, for recommendation of cost effective and user-friendly nursery fumigation for smallholder and corporate sector tea plantations.

None of the treatments resulted in detectable nematode counts, following improved and fine-tuned fumigation. Hence the doses were fixed at 250 g of Basamid and 800 ml of Metham for the newly-introduced fumigation methodology. The experiments were terminated.

N 438. Development of bleaching powder application for nematode control

Experiments were carried out to study the effect of bleaching powder as a non-chemical alternative to nursery fumigation, under up-country, mid-country, low-country and Uva conditions. The effect of bleaching powder in various concentrations, in liquid and solid form, was tested against nematodes. The effect of bleaching powder on the biological and chemical properties of soil were also tested. The experiment is in progress.

Varietal effect of radish on fumigation of tea soils

In a continuation study, bio-fumigation properties of some agricultural wastes (radish, cabbage, boiled and unboiled jak seeds) and animal wastes (fish) for effective sterilization of nematode-contaminated tea-, tomato- and potato soils were studied under laboratory conditions. The gases derived from the materials were measured. Tea-, tomato- and potato soils were fumigated using radish, cabbage, fish waste, Basamid and Metham Sodium. Different varieties of radish (Boss, Defender, Colonel and Ball radish) were used to test the varietal effect of radish on soil fumigation.

The volumes of gas produced from the materials were significantly different ($P < 0.001$). Fish waste, followed by unboiled jak seeds, gave significantly higher gas emissions.

All the treatments, except fish waste and cabbage, showed nematicide effects. Radish was the most effective, followed by cabbage and fish waste. The radish variety, Boss, resulted in the significantly lowest mean root-invasion of nematodes from treated tea soils.

Host range studies

Screening of butter-fruit (variety Haise) against Radopholus similis was completed. The results confirmed that the variety Haise does not harbour R. similis and can be grown along with tea.

Incidence of *Radopholus similis*

Suppression of Radopholus similis, and unusual emergence of high populations of Pratylenchus loosi, were evident from smallholder and corporate sector tea lands in the mid-elevations. While giving close attention to nematode-management strategies, the generation of data on soil parameters are in progress.

The monitoring of field data on the incidence of Radopholus similis in the intercropping trial with coconut at Citrus Estate, and in rehabilitated lands in many areas in the low country, were continued. The data are being analyzed.

N 375c. Evaluation of field establishment and growth performance of nursery plants raised on Pinus, Eucalyptus and mana soils.

The field establishment and performance of nursery plants (cultivar DN) raised on Pinus, Eucalyptus and Mana soils were assessed for 19 months from planting, at Great Western Estate, Talawakelle. Similar patterns of growth and establishment of tea were recorded.

The experiment was terminated. The information generated was included in the Advisory Circular on Nursery Management.

Thrust A 32. Development of an organic farming system for tea

A 32.1 Evaluating physical, chemical and biological properties of the soil

i. Effect of the application of different sources of compost on organically-grown tea lands.

Cultivars TRI 2023 and 2025, Gamiseva Seva Sevana, Nilambe

A description of this activity appeared in the Annual Reports for 2004 to 2006. The treatments are 2 kg compost, 40 g ERP and 400 g poultry manure per plant, at two applications per year; and Gliricidia spray over foliage at two-weekly intervals.

No significant variation in yields was found between the treatments during the 1st twelve-month period (July 2006 – June 2007).

Activities continue.

A 32.2 Evaluating the crop response to organic amendments

Effect of mulching materials and soil amendments on soil properties and tea yield; St. Coombs Estate, Talawakelle.

Mature tea, TRI 4071, was continued in the 2nd year of the 2nd cycle (Field No. 10). All combinations of the following treatments were tested. Treatment combinations were applied at the time of pruning in August 2005

Mulch treatments and soil acidity amendments were as follows.
Control (No mulch)
Control (No pH amendments)
Refuse tea. Surface application @ 25 tonnes ha-1 yr-1, Dolomite @ 2500 kg ha-1
Mana (Cymbopogan confertiflorus) @ 35 tonnes ha-1 yr-1, Minplus (Crushed basaltic rock) @ 5000 kg ha-1
Wild Sunflower (Tithonia diversifolia) @ 35 tonnes ha-1 yr-1
Refuse tea, incorporated @ 25 tonnes ha-1 yr-1

Refuse tea was applied twice per annum, and Mana and Wild Sunflower were applied three times, starting from 2006. Application of pH amendments was done once in a cycle.

Mulching treatments significantly affected soil OC, MBC, and yield of tea. However, pH amendments did not significantly affect soil N, OC, and soil MBC.

Mature tea, TRI 2025, was continued in the 2nd year of the 5th cycle (Field No. 03).

All treatment combinations, as given below, were imposed at the time of pruning in August 2005.

Mulch treatments and soil acidity amendments were as follows.

Control, no mulch
Control, no pH amendments
Refuse tea, surface application @ 25 tonnes ha-1 yr-1, Dolomite @ 2500 kg ha-1
Burial of pruning @ 15 tonnes ha-1 yr-1
Minplus (Crushed basaltic rock) @ 5000 kg ha-1
Dadap (Erythrina lithosperma) @ 35 tonnes ha-1 yr-1
Refuse tea, incorporated @ 25 tonnes ha-1 yr-1

Refuse tea was applied twice, and Dadap thrice per annum, starting from 2006. Burial of prunings and application of pH amendments were done once in a cycle.

Tea yield was significantly increased in plots mulched with Dadap and refuse tea, and buried with prunings. There was no significant difference in yield between control and refuse tea incorporated in the soil treatments.

The potential use of biomass of Gliricidia sepium shade plants, as an alternative source of N-fertiliser, in tea fields in the low, mid- and up-country.
Low country – St Joachim Estate and Siriniwasa Estate
Mid-country - Carolina Estate, Ginigathena
Mid-country – Ratwatta Estate and Giragama Estate

Gliricidia mulching experiment, Sirinivasa Estate (2007).
The treatments were:
T1 – Fertilizer 100%, at recommended level + Gliricidia loppings.
T2 – Fertilizer 75% + Gliricidia loppings.
T3 – Fertilizer 100%, alone.

This experiment was begun in April, with four replicates. The plots, each consisting of two Gliricidia trees, were selected for T1 and T2. No Gliricidia trees were present in the plots used for T3.
Pre-plucking was done for four months. There were no significant difference in yield between the plots to be subjected to the above treatments.

Treatments were first imposed in September. T1 and T3 showed the highest yield at four MAT. There was an increase in yield in all three treatments above the initial yield.

This was particularly so with T1. The experiment is in progress.

Establishment of Gliricidia; Carolina Estate, Ginigathhena (2007).
Plots were demarcated in a mature tea field in July. Each plot included four trees of Gliricidia. The plot size was 28 x 28 ft. Pre-plucking was recorded, and the plots were pruned.

The treatments were:
T1 – Gliricidia (35 t/ha/yr in FW) + full fertilizer
T2 – Gliricidia (35 t/ha/yr in FW) + 3/4th fertilizer
T3 – Without Gliricidia + full fertilizer
T4 – With Gliricidia + full fertilizer, but without added loppings of Gliricidia.

The experiment is in progress.
Mid-country – Ratwatta Estate (2007)
There were four treatments with, and without, mulching using Gliricidia. Design is RCB with four replicates. Plots were mulched with Gliricidia. @ 35 tonnes/ha/yr every two months. The Gliricidia. was supplied from elsewhere.

Plots, mulched with Gliricidia and fully treated with the recommended fertilizer (VPUM) level (T1), recorded the highest yield of 6600 kg MT/ha. This was followed by Gliricidia + treatment with 3/4th of the recommended fertilizer (T2) which recorded a yield of 6482 kg MT/ha. Gliricidia mulch alone (T3) recorded the least yield, 5948 kg/ha, a lowering of 9%. The full recommended fertilizer (VPUM) alone (T4) recorded a yield of 6089 kg/ha.

Mid-country – Geragama Estate
This experiment included the same treatments as for Ratwatta Estate, but the Gliricidia materials are supplied in situ. with two Gliricidia trees in each plot to supply the materials. The experiment was in the pre-plucking phase.
There was no difference in tea yield between the treatments.

The experiments are in progress.

Study on bio-dynamic farming; Stassen bio-tea project, Haldummulla (2000).
There was an increase in yield in cycle 1 with lunar-based applications of biodynamic preparations under bio-dynamic farming, compared with conventional (non-lunar) farming. The 1st year of the 2nd cycle is in progress.

A 32.3 Evaluating pest and disease incidence under organic farming

Scientific validation of yield, and pest- and disease resistance, in organically and bio-dynamically grown tea

Yield, growth, pest and disease incidence, and biological, chemical and physical properties of soils, in the long-term experimental plots of the 'TRIORCON' and 'BIDORCON' trials at St Coombs, were monitored. The yield data is presented under Project

A 32.7 Screening planting material suitable for organic farming

i. Yield of organic tea vs conventional tea.

The yield of tea in the 'TRI-ORCON' trial was monitored. The yield of tea bushes given the tea-waste treatment was significantly higher than in the other treatments. The experiment is in progress.

ii. Studies on 'The Conversion Period and Organic Tea'; yield of organic tea vs conventional tea.

The yields in the second and third years after pruning were monitored.
There was no significant difference between treatments.

iii. Studies on carbon sequestration (under Project D/PHYS)

The total carbon content was analyzed in different parts of a tea bush (approximately 9 years old, cultivar DT1).
The experiment is in progress.

iv. Photosynthesis and productivity of tea (under Project D/PHYS)

A study was initiated to study the carbohydrate profile of the tea bush, in collaboration with the Department of Food Science and Technology, Faculty of Agriculture, University of Peradeniya.

Some preliminary experiments were carried out to identify the different carbohydrates in the tea plant.
The experiment is in progress.

Basic Research Projects

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

An experiment was initiated to compare and correlate bio-assays and field assessments on shot-hole borer damage. Selected cultivars of the TRI 2000-, 3000- and 4000-series were used for the bio-assays, and for assessing field performance at the Passara Station where SHB pressure is very high.

B 30. Biochemical and physiological basis of cultivar resistance against tea nematodes

Morphological and growth parameters of the cultivars were studied prior to exposure to nematode infestation. Biochemical and physiological changes in nematode-infested and healthy tea plants, and histopathology of the tea roots, will be assessed with pre-experimental data with a view to developing criteria for a efficacious and shorter nematode-screening procedure. The experiment is in progress.

Supportive Research Projects

D 19. Management of Low-Country Live-Wood Termite (LCLWT)

A survey on the distribution of live-wood termites in the low country was completed. Sampling was carried out in fields in the second prune, and observations of live-wood termite activity was made. The termite infestation levels varied between 2% and 84%.

In order to assess the extent of protection of tea from LCLWT, with a termiticide-fortified prune-cut dressing, a field experiment was initiated at Field No. 19 a and 19 b of the Upper Wewelketiya Division of Hapugastenna Estate. The treatments include Tanglefoot™ adhesive imported from the USA and the termiticide, Imidaclorprid. The experiment is in progress.

In another study, the abundance of Glyptotermes dilatatus was monitored using a light-trap powered by an 18W fluorescent bulb suspended in the field, at St Joachim Estate, Ratnapura. Daily data showed that the swarmers trapped belonged to a species of Coptotermes of the family Rhinortermitidae, but not to G. dilatatus..

D 20. Identification of safe insecticides, acaricides and designing IPM methods for control of seasonal pests

E 355. Pesticide-residue studies were carried out on three recommended insecticides

Tebufenocide and imidachloprid at St Coombs, and chlorfuazeuron at Passara. The

experimental plots were laid according to FAO guidelines. Flush was collected on 0 (pre treatment), 1, 3, 5, 7, 10, 14 and 21 days after spraying in duplicate. Tea, manufactured on a miniature scale by the Technology Division, was sent to an accredited laboratory in Germany for residue analysis.

Based on these results, the Pre-Harvesting Intervals (PHI) for tebufenocide and chlorfuazeuron were established as 21 and 7 days, respectively.

E 353. In an experiment designed to assess the yield loss caused by tea tortrix in Field Number 13 VP at Eildon Hall Estate, Lindula, the tortrix generations and yield were monitored. Tebufenocide treatment gave good control of tortrix, compared to when there was no treatment. This was prominent in the first of the two generations. The yield as a percentage of the control ranged from 5 to 70% due to control of the first generation, and about 24% during the entire period.

Hard plucking did not have any measurable impact on the numbers of tortrix, but regular plucking rounds are shown to be useful in reducing the number and impact of the tortrix larvae.

The relationship between yield loss and population numbers are being analyzed.

The experiment has been terminated.

E 359. Chromafenozide, as an alternative chemical to chlorfuazuron, was tested against tea tortrix in a laboratory bio-assay. The chemical was relatively fast-acting, and resulted in the quick death of caterpillars after abut 10-12 hrs of exposure at high concentrations (1/400 and 1/1000 dilutions), and in growth retardation when concentrations were low (1/1500 and 1/2000 dilutions).

Further experiments are planned in two locations, Eildon Hall Estate, Lindula and Poyston Estate, Dickoya, in order to evaluate field efficacy.

E 358. Imidachlorprid at 2l/ha, fipronil at 2l/ha, and the inoculum of the EPF, Beauvaria bassiana, at 5g/plant, were tested against live-wood termites attacking an Eucalyptus in Alagolla Estate, Udupussellawa.. Monthly observations are being made on the survival of these saplings.

E 356. The efficacy of a miticide, Milbaknock® (active ingredient: milbemectin), a natural substance, produced by the fermentation of an Actinomycetes species, was tested against tea mites in Welimada Group, Welimada, for evaluation purposes. The formulation at

rates of 750 ml/ha, 1000 ml/ha, Kumulus® (sulphur) 5 g/l (as the standard), and an untreated control were included in the trial. The experimentation is in progress.

An interactive CD, named "Pest Manager", was designed to disseminate information on the biology, control and/or management of all insect and mite pests of tea.

All aspects of the biology, ecology, control and management of shot-hole borer are also available on a web site.

Outbreak of Red Slug Caterpillar

An outbreak of Red Slug Caterpillar, Eturesiaedea cingala (Moore), causing severe defoliation in mature tea occurred in Brambly Estate, Ragala. The pest outbreak was successfully managed by close supervision and advice. New information on the life-history and biology of the pest was generated.

Staffing

Dr Keerthi Mohotti was placed as the Head, Entomology and Nematology Division, with effect from 13 February. Mr S Walgama served as Acting Officer-in-Charge of the Division until 12 February. Mrs Seetha Samarasinghe, Research Officer, left the Institute. Mr Amal Athukorale was recruited as a Technical Assistant for nematological projects with effect from 01 November.

Workshops, Seminars and Training

The Entomology and Nematology staff conducted various workshops, seminars, training programmes and crop clinics, towards assisting in finding solutions to regional entomological and nematological problems. During the period under review, many awareness programmes and demonstrations were made for smallholder growers on nursery hygiene and fumigation methodology.

Publications

During the period under review, the staff of the Division produced six publications on Entomology, one on Nematology, and four on Biological Control/Organic Farming.

Plant Breeding Division

Dr (Mrs) M T K Gunasekare
Head, Plant Breeding Division
Senior Research Officer
B Sc (Ruhuna) PhD (Southampton)

Staff Members

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Mr J H N Piyasundera
Experimental Officer
B Sc (OUSL) M Phil

Mr J D Kottawa Arachchige
Experimental Officer
B Sc (OUSL)

Mr K K Ranaweera
Experimental Officer
B Sc (Peradeniya)

Mr A K Mudalige
Experimental Officer (on study leave)
Diploma (Agriculture)

Mr Y G S C Bandara
Technical Assistant

Progress Review

Thrust A 1. Development of high yielding cultivars, towards 3000 kg made tea ha-1 on a commercial basis for the Up country, with high quality and having resistance to Shot-hole Borer (SHB), Blister Blight (BB), Collar Canker (Phomopsis), Poria, Nematodes and suitable for mechanical harvesting

A 1.1 Developing suitable cultivars through hybridization and selection, by evaluating seedling and clonal progeny and through non-conventional breeding methods

Plant Breeding: Evaluation of VP cultivars for the up-country

A total of three hundred and eighty accessions are currently under evaluation in Phase I and Phase II trials, and eight new potential cultivars are under commercial evaluation in the final stage (Phase III), in the up-country region in order to develop region-specific cultivars for the up-country.

Evaluation of accessions: Phase I

Two hundred and thirteen accessions are currently under evaluation in Phase I trials in the up-country region. Weekly yield recordings of the first cycle of Phase I trials (VP 84 and 88) were completed and promising accessions were identified, based on yield and other evaluated traits in order to advance them into Phase II.

Evaluation of accessions: Phase II.

One hundred and sixty seven accessions in Phase II trails are under evaluation in the up-country region, in order to identify potential cultivars for further testing on a commercial scale.

First-cycle yield recordings were completed in two trials (VP 83 and VP 87), and yield data were analyzed. Promising accessions were identified based on the average cycle yields. First-cycle yield recordings have been continued with VP 89 and 91. Second-cycle yield recordings were continued with VP 81 and VP 85, together with other trait evaluations, by a multidisciplinary team.

Adaptive trials - commercial evaluation of cultivars in the process of preparation: Phase III.

Testing the commercial potential of a new series of cultivars in the agro-ecological zone, WU 3

Mattakelle Estate

The commercial evaluation trial established in collaboration with Mattakelle Estate has been continued. First-cycle yield recordings were commenced in October, and weekly yield records have been maintained.

Gartmore Group, Maskeliya

Shoots from nine accessions (Code Numbers: 05, 15, 89, 99, 208, 210, 272, 497, 582) of the TRI 5000 series, selected from VP 80, were issued to Gartmore Group to initiate a collaborative commercial evaluation trial, in 2008.

A1.2 Screening of lines for resistance to SHB, BB, Collar Canker and *Poria*

Accessions in VP 83, 84, 87 and 88 were sampled by the Entomology Division for SHB. The planting material, issued by this Division to the Pathology Division in 2003, is being screened for Poria.

Screening and selection for resistance to Blister Blight

PP/BB3/99. Selection of OST bushes for their resistance to Blister Blight disease (Diyagama East Estate)

Only three visits were possible during the year to monitor the selections 117, 113, 82, X, 71, 107 and 25. The estate was advised to raise some cuttings from the two most promising selections, namely 117 and X, for the purpose of evaluating them in larger plots.

PP/BB1/03. Assessment of progenies on their resistance/susceptibility to Blister Blight under nursery conditions

Source of seeds: Maliboda biclonal seed garden.

The trial in Field No. 13, St Coombs Estate, which is in three replicates, has been assessed through several rounds in order to affirm the findings of 2003 (see Annual Report, 2003). The trial was initiated under nursery conditions. The progenies (274 in number) were compared individually, along with the standards, namely TRI 2023 and TRI 2043 cultivars.

The two sets of readings coming from the nursery and the field compared exactly in 15% of the cases, while another 6% matched very closely. The two categories put together could be considered a good percentage to continue with. The results are being further evaluated for confirmation.

Screening for resistance to *Poria*

PP/POR1/03. Screening of new cultivars for resistance/susceptibility to Poria root disease (St Coombs Estate)

Plants were treated as for regular maintenance. One round of fresh inoculum was added to inter-rows in order to strengthen its potential. An assessment of the vacancies and the vigour of the existing bushes were made. Fresh cultures of P. hypolateritia were obtained and are being multiplied in vitro, using spent tea, for further inoculation of existing pits and to start a fresh inoculum pit (the third). From the existing results, it was observed that the cultivar TRI 3015 was the most susceptible, and the cultivar TRI 4071 the most tolerant of Poria, when compared with TRI 2025.

A1.3 Screening lines for response to native and applied nutrients

Field No 13, St Coombs Estate, Talawakelle (2005)

A description of this trial was given in the Annual Reports, 2005 - 2006.

The activities continue.

A1.6 Screening lines for resistance/ tolerance to the plant parasitic nematodes with special reference to root lesion and burrowing types

Shoots of all accessions of VP 83 (20 accessions and two controls) were issued to the Nematology Division for nematode screening. Soils and roots from some accessions (97, 197, TRI 4052) were sampled by the Nematology Division for nematode assessment.

Following is reported combining P. loosi with R. similis

Tea cultivars raised in the Nematology nursery were exposed to Pratylenchus loosi and Radopholus similis, under controlled conditions, at Talawakele, Passara and Hantane.

Pre-assessments of the plants were carried out, and detailed measurements are to be monitored, under Project B 30. The studies are in progress.

Thrust A 2. Development of high yielding cultivars, towards 2000 kg made tea ha-1 on a commercial basis for the Mid country wet zone, having resistance to Shot-hole Borer (SHB), Blister Blight (BB), Nematodes and suitable for mechanical harvesting

A 2.1 Developing suitable cultivars through hybridization and selection, by evaluating seedling and clonal progeny and through non-conventional breeding methods

Progeny trial: TRI 4004 x TRI 4006 bi-clonal seeds.

Infilling, and first and second centering of the new trial, established to assess the bi-clonal progeny of the above, were undertaken.

MVP 12 (Phase II trial)

Bushes were brought into bearing, and first-cycle yield recording commenced in January. Plucking was continued, and visual growth evaluation was carried out, to identify best-performing cultivars. Of the 27 test cultivars, three cultivars (Code Nos. 139, 12 and 131) were found to be highly promising, compared to the controls.

Mutation Breeding

Weekly yield recordings of individual bushes were carried out. Increased rates of shoot growth were observed in the plants generated from cuttings exposed to gamma rays. Growth measurements are being continued to confirm the changes in irradiated plants.

Thrust A 3. Development of high yielding cultivars, towards 2500 kg made tea ha-1 on a commercial basis for the Mid country dry zone, with high quality and having resistance to drought, Shot-hole Borer (SHB), Blister Blight (BB), Stem Canker, Nematodes and suitable for mechanical harvesting

A 3.1 Developing suitable cultivars through hybridization and selection, by evaluating seedling and clonal progeny and through non-conventional breeding methods

Phases I and II

Fifty-seven accessions in Phases I and II trials, and nine potential cultivars of the TRI 5000-series in observational trials, are currently under evaluation in the Uva region, at various stages. Second-cycle harvesting has been continued in Phases I and II trials. Selected accessions from UVP 9 (Phase II) were propagated to establish another Phase III trial

Adaptive trials - commercial evaluation of TRI 5000-series cultivars in multi-locations in growers' fields: Phase III

A new Phase III trial was established in partnership with Craig Estate, Bandarawella (agro-ecological zone IU3), using potential advanced breeding lines selected from UVP 9 (Code Nos. 05, 21, 88, 89, 199, 208, 210 and 243) with control cultivars TRI 4042, 4052 and CY 9, in a non-replicated large-scale trial.

Centering, infilling and other cultural practices were carried out in commercial evaluation trials, at the TRI, Passara and Glen Alpine Estate (agro-ecological zone IU3). Bushes were brought into bearing and yield recordings will be commenced in January next year.

A3.2 Screening of lines for resistance to SHB, BB, Stem Canker (Macrophoma)

UVP 9 was sampled by the Entomology Division for SHB assessment, and this has been continually carried out at various growth stages in the same pruning cycle.

No activity was possible during the year owing to staff limitations

Thrust A 4. Development of high yielding cultivars, towards 4000 kg made tea ha-1 on a commercial basis for the Low country, preferably with dark green leaves and having resistance to drought, Low Country Live Wood Termite (LCLWT), Stem Canker, Shot-hole Borer (SHB) and suitable for mechanical harvesting

A 4.1 Developing suitable cultivars through hybridization and selection, by evaluating seedling and clonal progeny and through non-conventional breeding methods

The evaluation of 454 accessions in Phases I, II and III has been continued in order to develop region-specific cultivars for the low country.

Evaluation of Accessions, Phases I and II

Second-cycle harvesting has been continued in one Phase I trial (LVP 84) and in four Phase II trials (LVP 80, 81, 82 and 83), while yield recording of the second cycle was completed in four Phase II trials (LVP76, 77, 78 and 79). Second-cycle yield recording was commenced in one Phase II trial (LVP 85). Third-cycle yield recording commenced in LVP 75 (Phase II) to further evaluate the long-term yield potentials of TRI 5000-series cultivars, under experimental conditions.

New Phase II trial

A new Phase II trial was established at the TRI Kottawa Station in June. The 20 accessions included in the trial were the selections made from the Hadaraganga Division of Hapugasstenna Estate by the Entomology Division, for low-country livewood termites.

Adaptive trials - commercial evaluation of cultivars in the process of preparation in multi-locations: Phase III

Phase III evaluation of TRI 5000-series cultivars were continued in trials at TRI, Kottawa (agro-ecological zone, WL 2), Cecilton Estate, Balangoda (agro-ecological zone, WM 3), and Deniyaya Estate, Deniyaya and Indola Estate, Deniyaya (agro-ecological zone, WM 1), in collaboration with the estates concerned. First-cycle yield recording of the trial at Kottawa was completed, and pruning was done in October. The Pathology Division and the Entomology Division assessed accessions for canker and SHB, respectively. First-cycle yield recording was commenced in the trial at Ceceilton Estate.

A 4.2 Screening of lines for resistance to LCLWT, Stem Canker and SHB

Accessions in LVP 76, 77, 78 and 79 were sampled by the Entomology Division for SHB assessment.

Macrophoma

The Pathology Division screened the accessions from the plant-breeding trials in the low country (LVP 80, 81, 82, 83), for Macrophoma tolerance and susceptibility.

Nematodes

LVP 74. Shoots of 29 selections were issued to the Entomology Division in the low country for screening for nematodes.

Other Activities in the Low Country

Controlled hybridization

One thousand three hundred and twenty crosses, involving 20 different cross combinations, were carried out at Ratnapura. Hybrid plants, generated from crossing programmes carried out in 2004 and 2005, have been evaluated in the field for their growth attributes, and characterized using morphological descriptors.

Recording of yields of hybrid seedlings planted in Field No. 2 was commenced in October. Centering of hybrid seedlings planted in Field No. 2 was done on 4 May 2007. Yield component assessments of individual seedlings were also done at the same time.

Owing to problems faced in controlled-hybridization programmes, a study was initiated to assess pollen viability and in vitro germination of four cultivars (TRI 2043, 3047, 4004 and 4053).

Germplasm

Characterization of 203 accessions using 20 morphological descriptors was completed.

Accessions were categorized into seven well-defined groups, using a biometrical approach. Of the 20 descriptors studied, six were found to be the most useful in separating the accessions into groups.

Accessions conserved in the germplasm in the low country were assessed visually for moisture stress, during the dry period. Three accessions (TRI 4047, 4049, HUNSD, PET 13B1) showed no dry-weather effects.

Kottawa; Phase III trial

Nine cultivars, including two controls (TRI 2026 and TRI 4042), were assessed for resistance to Macrophoma canker. Each selection had approximately 150 bushes, and 60 of them were used at random for the assessment based on a scale of 0-9. Two lines were very resistant, while the rest were either highly or very highly susceptible. This trial was undertaken in collaboration with the Plant Breeding Division to which the results were passed on.

Thrust A 5. Development of seed cultivars suitable for different tea growing regions having commercial yield of 2500 kg made tea ha-1 with good quality, resistance to Shot-hole Borer (SHB), Blister Blight (BB), Live Wood Termite (LWT), Canker, Poria, and suitable for mechanical harvesting

A 5.1 Developing suitable seed cultivars through conventional breeding methods

The performance of the seed stocks in the four field trials, in the different regions, was monitored in their second cycle with the aim of developing seed progenies suitable for commercial planting. In the low-country trial, drought assessment based on visual observations were carried out. The control cultivar DG 39, and seed stocks at Poonagala, Halpe and Anhettigama, were severely affected. The Pathology Division screened the seed stocks for Macrophoma..

Adaptive trials - commercial evaluation of seed progenies in growers' fields

First-cycle yield recording has been continued in trials at Hesal Lanka (Pvt) Ltd, Galaha and TRI, Passara. Normal cultural practices, infilling and centering were carried out in trials established at Endana Estate, Kahawatta.

Two new commercial-evaluation trials were established in partnership with RPC Estates (Craig Estate, Bandarawela) in October, and a smallholding at Siththangal (Hambantota District) in July, to assess the performance of bi- and polyclonal seeds on a large scale.

Other Divisional Activities

Research Publications

International

- Gunasekare MTK (2007). Application of molecular markers to the genetic improvement of Camellia sinensis L. (tea): A review. Journal of Horticultural Sciences and Biotechnology 82, 161-169.
- Seran T H, Gunasekare M T K and Hiriburegama K (2007). Production of cotyledon-type somatic embryos directly from immature cotyledonary explants of tea (Camellia sinensis L.). Journal of Horticultural Science and Biotechnology 82, 119-125.

Local

- Seran T H, Hiriburegama K and Gunasekare M T K (2007). Production of embryogenic callus from leaf explants of Camellia sinensis L. Journal of National Science Foundation 35, 191-196.
- Gunasekare M T K (2007). Current status and future directions in breeding tea (Camellia sinensis L.). In: Plant Breeding Research in Sri Lanka (eds. H P M Gunasena, P C Gririhagama), 111-124; Sri Lanka Council for Agricultural Research Policy, Sri Lanka.
- Seran T H, Gunasekare M T K and Hiriburegama K. Germination and subsequent plant development of in vitro cultured zygotic embryos and embryonic axes in comparison to conventional seed propagation of tea (Camellia sinensis L.). Journal of Tea Science 71(2) (In press).

Workshops, Seminars, Training Programmes and Meetings Attended

International

- Dr M T K Gunasekare attended a training programme, "The Commonwealth Executive Management Development Programme in Tea Plantation Management", in Coonor, India, from 12 June to 9 July 2007, conducted by the Kothari Agricultural Management Centre.
- Dr M T K Gunasekare attended "An International Short Course in Agricultural Biotechnology" at Michigan State University, USA, from 9 to 21 September 2007. A Fellowship was awarded from the Cochran Fellowship Program of the USDA/FAS.

Local

- Dr M T K Gunasekare and Mr C Ariyarathna attended a workshop on "Statistical Analysis in Plant Breeding", organized by CARP in collaboration with the PGIA, during 7-9 February 2007.
- Mr M A B A Ranathunga attended a workshop on "Scientific Writing" organized by CARP on 26 March 2007.
- Dr M T K Gunasekare participated in a round-table discussion and public forum on the National Biotechnology Policy at the NSF, on 24 August 2007.
- Dr M T K Gunasekare, Mr M A B A Ranathunga and Mr C Ariyarathna participated in a round-table discussion on Experimental Designs and Data Analysis in Plant Breeding trials with Prof. J Costa, Biometrician, and DDR (P) in December.

- Dr M T K Gunasekare chaired three meetings of the National Committee on Plant Breeding and Biotechnology (NCPBB) organised by the CARP.
- Dr M T K Gunasekare was appointed as a member of the Technical Committee for the FAO project on "Formulating a National Biotechnology R & D Programme and an Investment Plan" (TCP/SRI 3010) by the CARP in January. She attended two meetings.

Workshops, Seminars, Training Programmes and Meetings Conducted

- Dr M T K Gunasekare made a presentation on "Suitability of improved seeds as an alternative planting material" at the E & E Forum for Small Holders held at Ratnapura, on 13 November 2007.
- Divisional staff participated in the "Crop Clinic" conducted for RPCs in up-country region at the TRI, Talawakelle, on 18 October 2007, and for small holders and RPCs in the low country at the TRI, Ratnapura, on 11-12 December 2007.

Services to Growers

- Services were offered by the Plant Breeding Divisional staff based at Talawakelle, on clonal identification at Gartmore Group, Maskeliya, Wattegodde Estate, Watagoda, El-Teb Group, Passara, Mahadowa Group, Madulsima, and Stassens Bio Tea Garden, Haldummulla. Field plans indicating the clones identified were provided to these Estates.
- Plant Breeding staff at Talawakelle and Ratnapura carried out several training programmes for university students, students from agricultural schools, small holders, RPC estate staff and owners of commercial nursery, on a request made by the Advisory Division in the low country.
- Low-country Plant Breeding staff assisted the ADB Mother Bush programme for cultivar identification at the ADB mother bush sites at Neluwa and Weralapanatara.

Correspondence

The Division corresponded 62 times with growers and other stakeholders on various matters.

General

- Mr H S C Udawattage, an NDT trainee, completed a four-month in-plant training, in November 2007.
- Mr M Ratnayaka, Research Officer, resigned from his post on 1st March 2007.
- Mr Y G H C Bandara, assumed duties as a Technical Assistant, on 1st November 2007.
- Ms H A C K Ariyarathna completed her postgraduate course leading to the M. Phil., at the Institute of Biochemistry Molecular Biology and Biotechnology, on 14 December 2007. Her thesis title was "Phytoplasma diseases in Sri Lankan crop species with special reference to phytoplasma diseases in sugarcane".
- Mr J D Kottawa Arachchi and Mr K K Ranaweera enrolled for the M. Phil. programme at the Post Graduate Institute of Agriculture, University of Peradeniya, in November 2007

Plant Pathology Division

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Senior Research Officer

Staff Members

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Ms B A P Cooray
Research Assistant (overseas-study leave)
B.Sc (Agriculture)

Mr J W K K Jayasundara
Experimental Officer
B Sc (Peradeniya), M.Sc (Microbiology)

Ms D G N P Karunajeewa
Technical Assistant
NDT(Agriculture)

Progress Review

D 21. Leaf disease control (D/LEAFDC)

PP/BB2/06. A repeated efficacy trial, using 'Champ DP' (copper hydroxide) at six concentrations (0.05, 0.06, 0.07, 0.08, 0.09 and 0.1%), was commenced to meet the residue limits, which proved to be a little higher when tested at 0.1% which is the existing rate with other copper compounds.

Four replicates were made. Four spraying rounds were completed with disease assays using 2nd-leaf infections. The residue levels were analyzed at the SPND, after each consecutive spraying round.

The base Cu levels inherent in tea leaves were determined. Two sets of samples, processed prior to spraying (without rolling) in order to establish the base copper levels of the tea leaves, were analyzed by the Pathology staff at the SPND, before repeating the residue test trial. One set of four samples (1, 2, 3, 4) were withered, fired and sealed. These were compared with samples taken seven days after spraying.

The results showed that miniature rolling itself could contribute significantly (approximately four times) to the final Cu content in processed teas. The copper levels

in green leaves when processed averaged 88.5 ppm after miniature rolling, and 21.9 ppm without miniature rolling, compared to standard BOPF (26.3 ppm), BOP (26.2), BM (28.1), Fannings (28.7), Pekoe (27.1), Dust 1 (31.8) and Dust 2 (31.4).

PP/BB4/06. The second declining study using Hexaconazole ('Contaf F'), at two concentrations (0.025 and 0.05%), was completed at St Coombs. The samples were analysed at GMBH, Germany.

Two regional trials (one in Hantana, and another in Ratnapura) were completed using Hexaconazole. The test results of the two declining residue trials, and the two regional trials, were received from GMBH, Germany.

One regional trial was completed using Hexaconazole at Passara, and the samples sent to Germany for analysis. The results of the analysis are awaited.

PP/BB5/06. The test results (two sets) of the declining residue trial, using Propiconazole ('Tilt') at two concentrations (0.025 and 0.05%), were received from GMBH, Germany and from the Biochemistry Division.

PP/BB1/07. A declining residue trial (0, 1, 3, 5, 7, 10, 14 and 21), using Bitertanol ('Baycor'), was completed. Two sets of samples were sent to GMBH, Germany and the results were received.

PP/BB2/07. A declining residue trial (0, 1, 3, 5, 7, 10, 14 and 21), using Tebuconazole ('Folicur'), was completed. Two sets of samples were sent to GMBH, Germany and the results were received.

D 22. Stem disease control (D/STEMDC).
Wood rot control trials

PP/WRG1/03. Testing of RRI latex-bitumen protective paint (St Coombs, Field No 8). No activity under this category was possible owing to staff limitations.

D 23. Root disease control (D/ROOTDC)
PP/RDC1/04. Field testing of systemic fungicides and Trichoderma sp. in the control of Poria root disease (Field No. 3, Rajamalai Division, Moray Estate, Maskeliya).

The treatments (Bitertanol at 2%, Trichoderma harzianum at 5g/l of 105 spores, Hexaconazole at 1%, and a control) were repeated three times every two months.

Three visits were made to Moray for an overall assessment of the treatments on the incidence of Poria.. T. harzianum and the 'Contaf' (0.1%) treatments were found to be equally efficacious, and the best performers were compared to Bitertanol and the control treatments.

D 24. Management of Horse Hair Blight (D/HHB)
PP/HHB/01/04. Study of the impact of horse hair blight on the yield and management of tea (Field No. 8, St Joachim Estate, Ratnapura)
This study was carried out in collaboration with the staff of the Advisory Division.

The treatments (control; cleaning + hydrated lime at 10% on the frame only; cleaning + T. harzianum; cleaning + Cu(OH)2; cleaning + propiconazole; cleaning + hydrated lime on frame and litter) were not repeated afresh. Plot yields were recorded weekly.

The trial was discontinued after making one final round of assessments on the tipping weights, bush vigour and HHB status.

PP/HHB/01/07. Incidence of HHB, effect on moisture status and their interdependence
Four extended visits were made to St Joachim. Three sets of branches were collected, for the purpose of monitoring moisture loss from severed branches, with and without HHB under natural environmental conditions. Separated branches in three size categories (small, medium and large) were brought to St Coombs for this purpose, and monitored in three batches, over a period of 8 x 3 = 24 days. Branches were also assessed in three tiers for leaf number, total leaf area, leaf dry weight, total fresh weight and total dry weight.

This study helped to establish that with HHB:

i. non-infested branches always had a higher moisture percentage;
ii. non-infested branches accounted for greater leaf area than infested branches (by 65-80%), while leaf counts were not significantly different;
iii. the bottom tier of the infested branches recorded the smallest leaf area, while the difference between the two categories at the top tier was very marginal; and
iv. a significantly higher rate of moisture loss was recorded from the severed branches that were non-infested. (This is possibly due either to a higher initial percent moisture, or to partial retention of moisture by HHB strands on the infested branches, or to

both these factors.)

D 25. Miscellaneous Activities (D/MISCEL).

Microbial analysis of made tea

i. Twelve tea samples, forwarded by the Tea Commissioner, SLTB, were analysed for percentage moisture, total aerobes and total moulds at 30 ± 1°C. The reports were sent to the Tea Commissioner. This activity has since been transferred to the Tea Board laboratory.
ii. An undergraduate project of four months' duration, on the microbial status of different tea cultivars at different stages of processing, under miniature manufacture, was undertaken in collaboration with the University of Peradeniya.
iii. A second undergraduate project of four months' duration, on the microbial status of made tea, from different factories in a wide range of locations in the low-grown category, with special reference to the potential for aflatoxin production, was undertaken in collaboration with the University of Peradeniya.
iv. Investigations and quantification of the microbial status of made black tea, collected through tea-brokering firms from a large cross-section of factories island-wide, were commenced with a view to establishing microbial standards for black teas. The medium-term project (one year) was undertaken in collaboration with Unilever Sri Lanka Ltd.

HACCP standards for tea factories

i. The microbial status at different stages of processing was continued, aimed at establishing critical points for the HACCP. Two sets of samples were assayed for the presence of contamination in made tea at the drier mouth, and immediately before that with the FBD drier. The objective was to find out a possible source of contamination of made tea at or about the drier mouth.
ii. Investigations were continued at the request of Balmoral and Glasgow Estates. The factories were visited to collect water and swab samples for microbiological analysis. Tested six swabs, four water samples and two dhool samples.

The die-back problem in the ADB mother bush area (cultivar TRI 4053)

No further work was possible owing to staff limitations.

The TRI 2025 die-back syndrome

Pantoea agglomerans, and two other closely-associated bacteria, freshly isolated, were introduced separately to tender tea shoots of TRI 2025 through a sterilized water medium. They were then exposed to a low-temperature regime of 10°C for 12 hr, intermittently over a period of one week, to determine whether the shoots can reproduce the symptoms of the syndrome. No clear-cut symptoms were developed.

This study was repeated in liquid media, mixed with broth cultures of P. agglomerans and the two other associated bacterial isolates, individually and in combination. They were then exposed to a low-temperature regime of 5°C for 4 hr, intermittently over a period of one week. The shoots exhibited some necrosis, irrespective of treatment. This had to be cleared using the same isolates in pure form and mixed with sterilized distilled water.

The experiment was repeated using two bacterial isolates (P. agglomerans and an unidentified one) in pure form, along with sterilized distilled water. Tender shoots of TRI 2025 were immersed in liquid media and then exposed to a low temperature regime of 5°C for 4 hr, intermittently over a period of one week, as before. This time too the tender shoots exhibited some necrosis, irrespective of treatment. Necrosis appeared faster on the shoots with the bacteria.

This is to be re-tested in the field using fresh xylem extracts from affected bushes. Owing to pressure from other undertakings, progress on this has been slowed down.

Use of microbes in tea brew

i. A collaborative study with the Biochemistry Division on tea-wine preparation was completed. The behaviour of yeasts were monitored. The monitoring included sensory evaluations.
ii. The keeping quality of fermented tea brew during aging, and the natural antioxidant properties of the brew, were studied. The brew being monitored is now in the ninth month of a continuing maturing process. Haziness in the brew has been cleared. The non-pasteurized product was checked for possible contamination, and its keeping quality compared with that of fermented pineapple juice ('pineapple wine').
iii. Laboratory tests were initiated to regulate the growth of the bacterium, Acetobacter xylinum, in the yeast/bacterium complex, 'chombucha', using streptomycin sulphate. This study did not produce any positive outcome. Further quality improvements were not possible owing to pressure on time from other work. The culture was maintained in an active form.

Use of microbes on tea residue

The performance of the mushroom fungus, Lentinula edodus, imported from Pennsylvania State University, USA, was tested on refuse and spent tea substrata. The aim was to use the fungus for economic conversion of refuse or spent tea.

The growth kinetics of the fungus was documented with refuse tea used as a substrate. The metabolic by-product of the organism, a liquid exudate, was separated out for future studies.

It was possible to produce mushrooms successfully using L. edodus on supplemented refuse tea substrate, using 1.5 kg refuse tea blocks, the process taking three months. Appropriate alterations to the growth medium, and quantification of the decay of the medium, are being monitored.

Disease diagnosis service

The following were observed.

- Hypoxylon stem blight disease on cultivar S106 (?) at Sandringham Estate, Lindula.
- General debilitation and dying of bushes on St Coombs and Waverley Estates.
- Poria root disease on Mount Vernon, St Coombs, Laxapana and Waverley Estates.
- Two samples of Eucalyptus grandis nursery plants from Blairlomond and Hopton

Estates apparently affected by a bacterial wilt. The seeds had been imported from Australia.

- A sample of Pinus nursery seedlings from Warwick Estate, Hakgala, probably affected by unsatisfactory nursery conditions. The seeds had been imported from Scotland.
- A sample of plants, from a new clearing in Strathdon Estate, affected by Botryodiplodia

Divisional Activities (D/PLPA)

Estate visits

The Mount Vernon, Laxapana, Strathdon and Waverley Estates were visited, together with advisory staff, in connection with tea fields that had become debilitated.

Sixteen visits were made to Nuwara Eliya, Moray, Diyagama East and St Joachim, during the year, in connection with on-going experimental work. Two visits each were made to St Joachim, Hantana and Passara in connection with residue-analysis trials. Visits were made to Giragama Estate to assist in a Plant Physiology trial, and to the Kottawa Station to assist in a Plant Breeding trial.

New Capital Items

- A Bio Safety Cabinet ('Esco') was received through, and installed by, Analytical Instruments Ltd.
- A new computer, UPS and printer was received through E-Wis.

Publications

- Balasuriya A. Significance of biocontrol agents in disease management in sustainable agriculture, with special reference to tea (Camellia sinensis). K S Rangasamy College of Technology, Tamil Nadu, India. By invitation (in press).
- Jayasundara JWKK and Balasuriya A (2007). Exploring the use of a beneficial fungus for the economic conversion of refuse and spent teas. TRI Update12 (1).
- Pradeepa NHL (2007). තේ වගාවේ කඳ සහ අතු පිළිකා පාලනය සඳහා ජීකාබද්ධ රෝග නිවාරන ක්‍රම භාවිතය 18th Meeting, Sinhala Experiments and Extension Forum, June 2007. Tea Research Institute of Sri Lanka, Talawakelle.
- Balasuriya A (2007). Potential of vesicular arbuscular mycorrhiza in tea plantations. 215th Meeting, Experiments and Extension Forum, July 2007. Tea Research Institute of Sri Lanka, Talawakelle.
- Sirisena UGAI, Balasuriya A, Weerasinghe PA and Jayasundara JWKK (2007). Microbial status of tea (Camellia sinensis) during different stages of processing in the up-country. Proceedings, 63rd Annual Sessions, Sri Lanka Association for the Advancement of Science, Colombo, December, 2007; Part I – Abstracts.
- Balasuriya A. A comprehensive update of Divisional information for the TRI website.
- Balasuriya A. Coordination and editing of the TRI Corporate Plan for 2008-2012.

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Progress Review

Thrust A 34. Development and management of shade

A 34.1 Identifying alternative species of shade and establishing nurseries

i. Effect of shade on shoot growth and yield of mature tea.

The yield of tea under different shade treatments was monitored.

The differences in yield between treatments were not significant. However, the number of active and banji buds varied significantly. Heavily-shaded bushes had the least percentage of active shoots and the largest percentage of banji buds, whereas the unshaded bushes had a higher percentage of active shoots and a lower percentage of banji shoots. The total number of shoots per unit weight was smallest with the unshaded treatment (P=0.0008), and largest under 30% and 60% shade.

Shoot growth was monitored in different shade treatments.

The rate of shoot growth did not vary significantly between treatments during a particular set of measurements. Also, the dry weight of pluckable shoots, during each set of measurements, did not show any significant differences between treatments.

Using a grid, the dry weight of the pluckable shoots per unit area was monitored.

There were no significant differences between treatments in shoot dry weight and banji percentage. However, the shoots of heavily-shaded bushes (60%) were the lightest, and had the highest percentage of banji buds. Unshaded treatments, and treatments where shade was provided by Grevillea robusta (L.), had the largest number of pluckable shoots per unit area and the largest percentage of active shoots.

ii. **Photosynthesis and some selected parameters of tea (Camellia sinensis (L.) Kuntz), in relation to shade and position in the canopy.**

Photosynthesis, and some related parameters selected, were monitored in mature, field-grown tea in a shade experiment, in Field No. 8, St Coombs Estate.

On clear, bright days, the differences in PAR between treatments and levels of canopy were significant. Photosynthesis did not change with treatments, but decreased with the depth of the canopy ($P<0.0001$). Differences in RUE were not significant between different depths of the canopy and between treatments. Stomatal conductance was highest with 30% shade, lowest when unshaded. Within the same light treatment, stomatal conductance decreased with the depth of the canopy. These differences were significant, both between treatments ($P=0.0031$) and levels of canopy ($P<0.0001$).

When measurements were taken on a cloudy day, the PAR was significantly different only with the depth of the canopy. The rates of photosynthesis were significantly different both with the treatment and depth of canopy. The highest rates were obtained with unshaded bushes, and the rates decreased gradually with increasing shade. They also decreased with the depth of the canopy. RUE increased significantly with the depth of the canopy, but not significantly with different treatments.

The leaf weight/area ratio was not statistically significant between treatments and canopy depth. However, there was a tendency for the ratio to be lower with increased shade and depth of canopy. The leaf thickness was largest in the medium-shade treatment, followed by high-shade and then unshaded treatments; the differences were significant ($P<0.001$). The differences in the thickness of the palisade layer were not significant ($P=0.0761$), but, as in the leaf weight/area ratio, there was a tendency for palisade thickness to be lower with increased shade and depth of canopy.

The differences in the content of the pigments chlorophyll a and b, the a/b ratio, and total carotenoids, were not significant. However, there was a tendency for these to be higher with increased shade and depth of canopy.

The study is being repeated with more replicates of all the parameters.

iii. Possible alternate shade-tree species.

The experiment was re-commenced with the employment of a new Technical Assistant to the Division. The work is in progress.

Awards

A J Mohotti was awarded a Presidential Award for Research, 2002, and a 'Certificate of Recognition'.

Staff Appointments

- Dr A J Mohotti was appointed Head of the Division with effect from 13 February 2007.
- Ms N N Wellala was appointed a Technical Assistant with effect from 01 November 2007.

Assignments

- AJ Mohotti continued to serve on the Board of Study, Department of Agricultural Biology, Post Graduate Institute of Agriculture, University of Peradeniya.
- AJ Mohotti served as the Co-ordinator, and a resource person, in the 'Short Course on Plant Physiological Techniques', organized by the Boards of Study of Agricultural Biology and Crop Science, Post Graduate Institute of Agriculture, University of Peradeniya, and held at the TRI during 13-18 March, 2007.
- AJ Mohotti served as an examiner at the comprehensive examinations of M/s K G P B Karunarathne, D I D S Beneragama, H T De Zoysa, A Subasinghe, S M I S K Sakalasooriya, H M I U K Herath, W R A W Dharmasena, N S Somaratne, D G N M C K Nawaratne, P L Samantha, S P P Wijesinghe, C S Gunaratne, P G V N Palkadapala, A V C Abhayagunasekara, H M D A Thilakaratne and E R M Wathsala in the Post Graduate Institute of Agriculture, University of Peradeniya.
- AJ Mohotti judged at the technical sessions of the 19th Annual Congress, Post Graduate Institute of Agriculture, which was held during 14-16 November 2007 at the Post Graduate Institute of Agriculture, University of Peradeniya.
- AJ Mohotti chaired a technical session at the International Forestry and Environment Symposium, held in Kalutara, Sri Lanka, during 30 November-01 December 2007.

Seminars, workshops and training programmes

- A 'Short Course on Plant Physiological Techniques', organized by the Boards of Study of Agricultural Biology and Crop Science of the Post Graduate Institute of Agriculture, University of Peradeniya, was held at the Tea Research Institute during 13-18 March 2007. This was inaugurated by Dr G Jayawardena, Dr I S B Abeysinghe, Dr N Jayasuriya (Director, NSF) and Prof A L T Perera (Director, PGIA). Twenty participants from the plantation sector, universities and research institutions participated in the five-day residential course. A J Mohotti served as the Co-ordinator and a resource person of the course. The other resource persons were Prof. W A J M de Costa (University of Peradeniya), Dr S P Nissanka (University of Peradeniya), Dr W Weerakoon (Rice Research and Development Institute, Batalagoda) and Dr A Nainanayake (Coconut Research Institute).
  T L Wijeratne, S Navaratne and V Sidhakaran attended the course.
- A J Mohotti, T L Wijeratne, S Navaratne and N. Damayanthi attended the 19th PGIA Annual Congress during 14-16 November 2007.
- T L Wijeratne and N Damayanthi attended a workshop on 'Global Warming, Climate Change and Carbon Trading', organized by The Planters' Association of Ceylon, in Colombo, on 12 October 2007.

Publications

- Pathirana M, Kandamby SPBJ, Mohotti AJ, Sangakkara UR and Mohotti KM (2007). Feeder root dynamics of tea (Camellia sinensis L.) under organic and conventional management systems. Proceedings of the 27th Annual Sessions of the Institute of Biology of Sri Lanka, held in Colombo, September 2007; p. 32.
- Liyanapatabendi NK, Mohotti AJ and Sangakkara UR (2007). Rooting behaviour of field grown seedling and vegetatively propagated tea (Camellia sinensis L.). Proceedings of the 27th Annual Sessions of the Institute of Biology of Sri Lanka, held in Colombo, September

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Progress Review

Thrust A 15. Development of regional and/or site-specific fertilizer recommendations for the improvement of productivity and made tea quality

A 15.1 Estimating crop response to macro nutrients (N, K, Mg, S and P) at regional level

The information, generated from the project, continued to be used for diagnosing problems associated with tea research and developmental activities in soil fertility and plant nutritional aspects.

A 15.2 Estimating crop response to micro nutrients (Zn, B, Mn, etc) at regional levels

Fertilization experiments

(a) Effect of application of different rates of N, K and Mg on growth, soil- and plant-nutrient status and yield of tea.

i. Effect of different rates of N (200, 400 and 600 kg ha-1 yr-1 N), K (100, 200 and 300 kg ha-1 yr-1 K2O), and Mg (50, 100 and 150 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar PK 2, Field No 15 B, Court Lodge Estate, Kandapola, AER – WU3 (1999)

The yield data obtained during the 4th year, following treatment, alteration and rectification of shortcomings encountered in the recording of regularly harvested yields, as in the 3rd year and 4th year, also increased significantly with increasing rates of N, but so far not with K and Mg fertilizer. There was no interaction between any of the treatments.

As in most years, soil pH levels at 0-15 and 15-30 cm depths, decreased significantly with increasing rates of N. So far, no variation has been seen with increasing rates of either K or Mg.

As in previous years, soil ex: K level estimated in this year of the cycle continued to show that the levels increased significantly at both depths, with increasing rates of potash fertilizer from 100 to 300 K2O kg ha-1 yr-1. In fact, in terms of magnitude, soil K levels at the 15-30 cm depth are similar when compared to that at 0-15 cm, indicating that a considerable amount of K in soil percolates down the profile when the top layer is saturated with K. It appears to occur when the rate of potash fertilizer exceeds 100 K2O kg ha-1 yr-1. Soil K levels, estimated in 2007, did not show any significant variations due to application of increasing rates of N or Mg fertilizer as in 2006, though K levels in 2005 reduced following the application of increasing rates of N. There was no interaction between N, and potash or Mg, fertilizer rates. Unlike in the 2nd and 3rd years, soil Mg levels estimated this year did not show significant variation with increasing rate of kieserite, at both depths. Magnesium levels did not vary significantly with increasing rates of potash. Though, in the last two years, Mg levels were reduced by the application of increasing N rates, surprisingly they did not show significant variation this year.

Leaf nutrient concentrations, estimated this year, showed that N concentration increased significantly with increasing rates of N fertilizer, and at the same time Mg concentration decreased, with no change in K and Ca. With increasing rates of potash, leaf K concentration increased significantly, but at the same time this estimation showed that both N and Mg decreased, with no change only in Ca. Leaf Mg concentration, on this occasion, did show significant variation, unlike on the last occasions where it increased significantly with the application of increasing rates of kieserite. However, leaf K concentration decreased, but with no significant changes in N and Ca. The experiment continues.

ii. Effect of different rates of N (240, 420 and 600 kg ha-1 yr-1 N), K (120, 210 and 300 kg ha-1 yr-1 K2O), and Mg (60, 105 and 150 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TRI 2026, Field No. 1, Tokatiyamulla Estate, Galle, AER - WL2 (1999)

Following termination of the trial, overall data analyses continue.

iii. Effect of different rates of N (240, 420 and 600 kg ha-1 yr-1 N), K (120, 210 and 300 kg ha-1 yr-1 K2O), and Mg (60, 105 and 150 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TRI 2027, Field No. 8, Talgaswela Estate, Galle, AER – WL1 (1999)

Following termination of the trial, overall data analyses continue.

iv. Effect of different rates of N (240, 420 and 600 kg ha-1 yr-1 N), K (120, 210 and 300 kg ha-1 yr-1 K2O), and Mg (60, 105 and 150 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TRI 2025, Field No. 85, Houpe Estate, Kahawatte, AER – WL2 (1999)

Following termination of the trial, overall data analyses continue.

v. Effect of different rates of N (240, 420 and 600 kg ha-1 yr-1 N), K (120, 210 and 300 kg ha-1 yr-1 K2O), and Mg (60, 105 and150 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TRI 2026, Field No. 4 B, Lumbini Estate, Deniyaya, AER – WM1 (1999)

Following termination of the trial, overall data analyses continue.

vi. Effect of different rates of N (160, 320 and 640 kg ha-1 yr-1 N), K (80, 160 and 320 kg ha-1 yr-1 K2O), and Mg (40, 80 and 160 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TRI 3019, Field No. 2, Ury Estate, Passara, AER – IU2 (1999)

The 2nd year yield of the new cycle increased significantly with increasing rates of N, but not with that of K and Mg fertilizers, although the 1st year data did not show significant variations, even after altering the rates of nutrients following the completion of the previous cycle.

Soil pH levels, at depths of 0-15 and 15-30 cm, decreased significantly with

increasing rates of N, and the levels at 320 and 640 kg ha-1 yr-1 N were even lower than the desirable range. This was in spite of applying dolomite at a rate of 1500 kg ha-1 cycle-1 at pruning. No variation was found due to increasing rates of either K or Mg fertilizers as expected.

The soil exchangeable K levels, estimated in the 2nd year, showed that the levels increased significantly at both depths with increasing rates of potash fertilizer from 80 to 320 K2O kg ha-1 yr-1. In fact, in terms of magnitude, soil K levels at the 15-30 cm depth increased, beyond the rate of 80, as did that at the 0-15 cm depth. This indicates that a considerable amount of K in the soil percolates down the profile when the top layer is saturated with K, particularly when potash rate exceeds 80 K2O kg ha-1 yr-1. Potassium levels estimated during the year showed that they were affected by the application of increasing rates of both N and Mg fertilizers. Also, this year's estimations showed that soil exchangeable bases, such as K, Mg and Ca, were significantly reduced by the application of increasing rates of N, possibly due to decreasing soil pH (and therefore increasing acidity) associated with increasing rates of N fertilizer. Though the application of increasing rates of kieserite have not, so far, shown any significant effect on soil Mg and Ca, the K levels appeared to have been affected.

Leaf nutrient concentrations, estimated this year, showed that leaf N concentrations increased significantly with increasing rates of N fertilizer, and at the same time leaf Mg concentration decreased although with no change in K and Ca. With increasing rates of potash, leaf K concentrations remain unaffected but Ca significantly decreased, with no change in leaf N and Mg. Leaf Mg concentration increased significantly with the application of increasing rates of kieserite, although with no change in N, K and Ca.

The experiment continues.

vii. Effect of different rates of N (240, 420 and 600 kg ha-1 yr-1 N), K (120, 210 and 300 kg ha-1 yr-1 K2O), and Mg (60, 105 and 150 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TRI 2025, Field No. NC New Division, Rangala Estate, Karaliyadda, AER – IU1 (2002)

As in previous years, yields increased significantly only with respect to increasing rates of N fertilizer.

Unlike in the 4th year observations, estimations made this year showed that soil pH levels, at both depths, decreased significantly with increasing rates of N, as observed also in the 1st and 3rd years. However, surprisingly, the same trend was not seen in the 2nd year. As expected, no variation was seen with increasing rates of either potash or kieserite.

As in previous years, soil exchangeable K levels this year also continued to increase significantly with increasing rates of K, at both depths. Here again, the indication is that K percolates down to the bottom soil layer from the lowest rate of applied potash, 120 kg ha-1 yr-1 and above, as the available K levels at both depths increase along with increasing rates of potash. Like in the 4th year estimations, where the K levels were significantly decreased by the application of increasing rates of N fertilizer, this year's estimation also showed the same effect, unlike in the 3rd year estimation. As observed, there was no variation with increasing rates of kieserite.

This time again, no variation in soil Mg levels was seen from increasing rates of kieserite, as in the 3rd and 4th years. As in the 4th year, there is no significant variation in Mg levels at both the 0-15 and 15-30 cm depths, though it was seen in the 3rd year that Mg levels at the 0-15 cm depth significantly decreased with increasing rates of potash. Soil Ca levels appeared to be continually decreasing with increasing rates of N fertilizer, perhaps owing to increasing degrees of acidity associated with increasing rates of N.

Leaf nutrient concentrations showed that leaf N increased significantly with increasing rates of N fertilizers. So far, concentrations of other nutrients did not show significant variations at this site. However, a tendency for leaf K to increase with increasing rates of potash fertilizer was seen even this year.

This trial will continue with modified rates of treatments in the new cycle.

viii. Effect of different rates of N (240, 420 and 600 kg ha-1 yr-1 N), K (120, 210 and 300 kg ha-1 yr-1 K2O), and Mg (60, 105 and 150 kg ha-1 yr-1 MgO), on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TRI 2025, Field No NC5, Midlands Estate, Ratthota (2000)

This trial was concluded in 2007 following completion of a cycle owing to prioritization as per the Corporate Plan, 2008-2012. Overall analysis continues.

(b) Effect of application of different rates of N and K (and frequencies) on growth, soil- and plant-nutrient status and yield of tea.

i. Effect of different rates of N (240, 420 and 600 kg ha-1 yr-1 N), K (120, 300 and 480 kg ha-1 yr-1 K2O), and frequencies (6-, 8- and 12-weekly intervals) on growth, soil- and plant-nutrient status and yield of tea.

Cultivar TC9, Brunswick Estate, Maskeliya, AER – WU2 (1998)

The 5th-year yields did not significantly vary with increasing rates of N fertiliser, unlike in the 3rd and 4th years of the cycle. The second-year yields also showed a tendency to increase. So far, no interactions were found with increasing rates of either N or K fertilizers and frequency of the applications. Like last cycle's pruning weights, a significant increase in weights was seen even in this cycle with increasing rates of N. However, there has been no change as far as increasing the rates of potash fertilizers is concerned.

Soil pH, at both depths, continued to decrease significantly with increasing rates of N, as in previous years. Also, as previously, soil ex: K levels estimated in this year also showed that the levels increased significantly, at both depths, with increasing rates of potash fertilizer, from 120 to 480 kg ha-1 yr-1. In fact, in terms of magnitude, soil K levels at the 15-30 cm depth increased together with that at the 0-15 cm depth. This indicates that a considerable amount of K in the soil percolates down the profile when the top layer is saturated with K. So far, K levels did not show greater variations with increasing rates of N though the 2nd year estimations showed a decreasing trend. This year's estimations showed that both soil Mg and Ca appeared to be decreasing with increasing rates of potash fertilizer more than N did.

With increasing rates of N fertilizer, leaf N concentration increased significantly and as markedly as previously observed. However, leaf N showed a no change, unlike in the 3rd year when it decreased with increasing rates of potash. Also, there was no significant change in leaf Mg. With increasing rates of K fertilizer, leaf K concentration increased significantly. This effect was pronounced. Magnesium concentration decreased with K fertilizer, while Ca decreased with increasing rates of both N and K.

This trial will continue, but with modified rates of N and potash fertilizers over the next cycle.

ii. Effect 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- and plant-nutrient status and yield of tea.

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

Increasing rates of N fertilizer did not significantly change 3rd year yields over the wider range of the fertilizer, though there was a tendency for yield increases last year.

Though pH levels did not vary significantly with increasing rates of N fertilizer, there was a tendency for the levels to decrease at both depths, unlike in the early stages of the cycle. As expected, there were no changes with increasing rates of potash. Soil K increased significantly with increasing rates of potash fertilizer, at both depths, 0-15 and 15-30 cm. This is particularly so when the rate of potash exceeds 120 kg ha-1 yr-1 K2O, indicating that greater percolation down the profile occurs between 60 and 120 kg ha-1 yr-1 K2O under low-country conditions. So far, no significant variations in soil Mg and Ca were seen due to increasing rates of either N fertilizer or potash.

Leaf N did not change significantly with increasing rates of N, but appeared to have a tendency to increase with increasing rates of both N and potash fertilizers. Whilst leaf K increased significantly with increasing rates of potash, it decreased with increasing rates of N. So far, no changes were seen in leaf Mg and Ca.

The plants at the experimental site were pruned in November 2007, and the trial will continue with modified rates of N treatments in the new cycle.

(c) Effect of application of different levels of N with different levels of compost manure on growth, soil- and plant-nutrient status and yield of tea.

i. Effect of seven different levels of N (0 to 720 kg ha-1 yr-1), with compost manure (at 0 and 5 t ha-1 yr-1), on growth, soil- and plant-nutrient status and yield of tea. Cultivar DT1, St.Coombs Estate, Talawakelle (1992)

As observed earlier, yield in the 4th year also showed a significant increase with increasing rates of N. So far, compost appears not to have shown a significant overall effect. In fact, this year's data did not even show marginal differences between yields averaged over the N rates with and without compost treatment, and what had been recorded earlier.

The trial continues.

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

Cultivar TRI 2026, Kallebokke Estate (2002)

First-year yields obtained during July 2006 - June 2007 after pruning in July 2006, and applying dolomite at a rate of 1500 kg ha-1 cycle-1, increased significantly with increasing rates of N fertilizer. The pattern of increase continues to be linear even this year. So far compost application has not shown any significant influence on yield. The trial continues.

(d) Effect of application of different rates and proportions of urea and sulphate of ammonia on growth, soil- and plant-nutrient status and yield of tea.

Of the seven trials continued up to the end of 2006, only the five trials detailed below, are now being carried out as part of a study on S nutrition.

i. **Effect 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- and plant-nutrient status and yield of tea.**

Cultivar TRI 2025, St Coombs Estate, Talawakelle (May 1979)

The mean yield, obtained during the 3rd year of the 7th cycle from this long-term trial, was comparatively low compared to the 3rd year of the last cycle, as in the 1st and 2nd year. Analysis of this year's yield showed that there was a significant difference between the two rates of N fertilizer applications. The higher rate of N gave rise to a significantly higher yield. No variation was seen for the different proportions of SA and urea in the year under review as well.

Both the rates of N fertilizer, and the proportions of sulphate of ammonia in the N combination, continued to significantly alter the soil pH and sulphate sulphur at both depths. This is in spite of applying dolomite at a rate of 1500 kg per ha at the time of pruning in June 2004. Lower pH levels were found at the higher rate of N. At the same time, when the proportion of sulphate of ammonia is increased in the combination, sulphate sulphur in the soil increased as well. So far, leaf S concentration was not affected by the urea and S/A combinations or by the N rates.

The experiment continues.

ii. Effect 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- and plant-nutrient status and yield of tea.

Cultivar TRI 2027, Field No. 8, Talgaswela Estate, Galle (1999)

Though second-year yields increased significantly with increasing rates of N, the third year's data only showed increasing yield trends with increasing rates of N. It was also seen, for the first time, that the yields of the plot receiving 100% urea as N was somewhat lower compared to treatments with urea and SA combinations, though the variation was not significant.

This year's estimation showed that both the soil pH and sulphate sulphur levels varied significantly, unlike that of last year. Soil pH decreased significantly with increasing rates of N fertilizer, and increasing proportions of sulphate of ammonia in the combination, whilst sulphate sulphur increased more markedly with increased proportions of sulphate of ammonia. Importantly, as in previous estimations, when data were carefully examined, it was often observed that the significant decrease in pH, with the increased proportion of sulphate of ammonia in the combination of urea and sulphate of ammonia, was much more pronounced than the decreases with increasing rates of N unlike at all the other trial sites.

Leaf S concentration was not affected, either by the urea + S/A combinations or by the N rates.

The trial continues.

iii. Effect 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- and plant-nutrient status and yield of tea.

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

The yields in the 2nd year of this cycle increased significantly with increasing rates of N fertilizer, but there was no variation with the different proportions of urea and SA.

The second-year results of the new cycle also showed that only increasing proportions of sulphate of ammonia in the N combination significantly reduced soil pH at both depths, while sulphate sulphur increased. However, increasing rates of N fertilizer

gave decreasing trends in pH. This is unlike the significant reductions seen in the latter part of the previous cycle, due both to the rates of N fertilizer and increasing proportions of sulphate of ammonia in the N combination. It is likely that the total effect of application of increasing rates of N fertilizer on soil pH is overshadowed by the application of dolomite at the time of pruning.

Importantly, at this experimental site too, this year's estimation showed that leaf S concentration varied significantly with the different urea to SA combinations but, as expected, not with the increasing rates of N. Leaf S appeared to have increased when the proportion of sulphate of ammonia increased in the urea and SA combinations.

The trial continues.

iv. **Effect 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- and plant-nutrient status and yield of tea.**

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

Unlike as in the 2nd and 3rd years, the fourth-year yields did not vary significantly with increasing rates of N. Also, the application of N in different proportions of urea and sulphate of ammonia had no effect.

Both the N fertilizer rates and the proportions of sulphate of ammonia in the N combination significantly altered the soil pH at the depth of 0-15 cm. However, at 15-30 cm, it was only the proportions of sulphate of ammonia in the N combination that altered the soil pH, unlike in previous trials. The pH levels decreased with increasing rates of N, as well as when the percentages of sulphate of ammonia in the urea: S/A combinations increased.

This year's estimation showed that sulphate sculpture, at both depths, significantly increased with the proportions of sulphate of ammonia in the N combinations more than with the increasing rates of N. This is particularly the case when the percentage of sulphate of ammonia in the urea: S/A combinations exceeds 25%. This finding indicates that using percentages of sulphate of ammonia above 25% is not advisable, both in terms of increased acidity and sculpture availability.

This year's estimation at this site showed that leaf S concentration was significantly affected by increased proportions of sulphate of ammonia in the N combinations. It

increased with increasing proportions of sulphate of ammonia. As seen previously, this year's estimation also showed that leaf S concentration in the TRI 2023 cultivar is relatively higher than in the other cultivars.

v. **Effect 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- and plant-nutrient status and yield of tea.**

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

As in the case of the 2nd year yield data, the 3rd year data also showed significant variation with the application of N in different proportions of urea and sulphate of ammonia, but not with increasing N rates unlike in other trials. It is also noteworthy that the yield, averaged over N rates of 0 to 100 urea to sulphate of ammonia combinations, gave rise to higher values.

Soil pH levels estimated this year showed that, like last year, pH decreased significantly with increasing proportions of sulphate of ammonia in the urea and sulphate of ammonia combinations, as well as with the increasing rates of N fertilizer. The first-year data did not show any significant variations, and this was attributed to the effect of dolomite application at a rate of 2000 kg per ha at the time of pruning. As in the 1st year, where sulphate sulphur in the soil significantly increased with increased proportions of sulphate of ammonia in the combination, this year's estimations also showed that sulphate sulphur increased much more with increased proportions of sulphate of ammonia in the combinations than with increasing rates of N.

Interestingly, leaf S concentration estimated this year also showed significant variations with the different proportions of urea and sulphate of ammonia in the combinations, as in some previous trials. Leaf S increased when the proportion of sulphate of ammonia was increased in the urea and SA combinations.

The experiment continues.

vi. **Effect 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- and plant-nutrient status and yield of tea.**

Cultivar TRI 2025, Field No. 3A, Dessford Estate, Nanu Oya, AER-WU2 (2001)

This trial was concluded owing to prioritization as per the Corporate Plan, 2008-2012.

(e) Effect of application of "Humic" substances on soil properties, plant-nutrient status and growth and yield of tea

i. Effect of foliar application of "Humate" on the growth and yield of tea.
Cultivar TRI 2027; Field No. 1999/3 Ha, Raigam Estate, Ingiriya, AER –WL1

Neither ground application of "Humate", nor application of "Super Humate" to the foliage, with or without urea as a source of nitrogen, made any significant improvement to 2nd year yields of tea.

The trial continues.

ii. Effect of application of "Humate"-treated waste tea compost (a rapid method of composting) on the chemical and physical properties of soil, and on the growth and yield of tea.
Cultivar TRI 2027, Field No. 1999/3Ha, Raigam Estate, Ingiriya, AER – WL1

The application of "Humate"-treated compost significantly increased 2nd year mean yields, compared to yields from plots supplied with refuse tea that had not been treated with "Humate" for enhanced composting activity. The reduction of yield in the untreated waste-tea treatment, compared to the control, is probably due to immobilization of nutrients by micro organisms in the soil.

The trial continues.

(f) Development of a protocol for site-specific fertilizer recommendation (SSFR) for improvement of productivity and made-tea quality
A guideline for site-specific fertilizer recommendations for mature tea fields was prepared, and is now in press.

Thrust A 17. Mechanization of fertilizer/ dolomite application

Comparing fertilizer distribution by manual and mechanical application.

A detailed description of the work carried out, along with objectives and milestones, appeared in the Annual Reports, 1998 - 2006.

The yields over four- and six-week periods following six applications were assessed. No significant differences were seen between the two methods of application.

The activities continue.

Thrust A 18. Development of regional analytical laboratories (for soil, plant and fertilizer analysis) at Talawakelle, Kandy, Ratnapura, Passara, Kottawa and Deniyaya

a. Analytical laboratory service

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. Analytical laboratory accreditation

The Division's analytical laboratory at St Coombs participated in 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 four 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 samples, and Cu, Fe, Mn, Zn, Ca, K, Mg, Na, P and Cd in plant samples, depending on convenience. The results were submitted to the Wageningen University for evaluation.

Evaluation reports, issued by the Wageningen Evaluating Programme for Analytical Laboratories, during 2007 showed that, most of the time, the soil analytical results from the Division's laboratory at St Coombs, such as for pH (H2O), pH (CaCl2), pH (KCl), electrical conductivity, soil organic carbon and soil nitrogen, and extractable soil K and Mg, were within the satisfactory range of the Z score, that is $+2 \geq Z \geq -2$ (Table 5). In addition, the total plant analytical results, such as for Ca, Mg, Cu, K, Mn and Zn, and N were also within the satisfactory range of the Z score. As before, this evaluation exercise was helpful in improving the laboratory's performance.

General

- Dr LSK Hettiarachchi was appointed Acting Deputy Director Research (Production) with effect from 1st September 2007.
- Dr LSK Hettiarachchi received a Presidential Award, for the year 2002, for the research paper entitled "Effects of addition of magnesium and calcium supplied in liming and non-liming materials on the growth of Camellia japonica in an acid soil, and its changes, nutrient uptake, and availability".
- Mr RBM Sankhappriya was appointed Technical Assistant with effect from 1st November 2007.
- Mr JCM Bandara Experimental Officer, Agricultural Economics Division was transferred to SPND with effect from 1st September.
- Mr DMBN Dissnayake and Mr OGKA Gunaratne were promoted Experimental Officers from 3rd September 2007.
- Mr CSKA Ratnayake and Mr SM Dissanayake were promoted to Grade III of the TRI Service with effect from 3rd and 1st January, and February, 2006 respectively.
- Mrs PLK Tennakoon was promoted to Grade III of the TRI Service on 4th November 2006.

Dr LSK Hettiarachchi served as:

- A member of the Working Group on Fertilizer to the Sri Lanka Standards Institution.
- A member of the Technical Committee on Organic Fertilizer to the Sri Lanka Standards Institute.
- A member to the National Committee appointed by the Honourable Minister of Agricultural Development, Government of Sri Lanka, to advise the Director of the National Fertiliser Secretariat on matters relating to the administration of the National Fertiliser Regulation Act, Number 68.
- A visiting lecturer/resource person to the National Institute of Plantation Management, Sri Lanka.
- A member of National Advisory Committee on Organic Fertiliser at the Ministry of Agricultural Development, Government of Sri Lanka.
- Chairperson of the TRI's Publication and Presentation Panel from 1st October 2007.

Dr AKN Zoysa served as a member of the Board of Study in Environmental Science, Post Graduate Institute of Science, University of Peradeniya.

Publications

- Ananthacumaraswamy S, Hettiarachchi LSK and Gunaratne GP (2007). Response of a high yielding vegetative propagated tea to urea and muriate of potash application, in wet zone up-country of Sri Lanka. Proceedings of the 3rd International Conference, O-CHA (Tea) Cultural and Science ICOS 2007, Shizuoka, Japan.

- Draft Guideline for Site Specific Fertiliser Recommendations for Mature Tea Fields (2007).
- Perera GAAR, Abeysinghe ISB, Hettiarachchi LSK and Wijayawardhana RGA (2007). Mineral composition of leaf protein concentrate prepared from refuse tea. SLJ Tea Sci 72, 1-8.

Meetings, Seminars and Workshops

The staff of the Division conducted and actively participated in "Crop Clinic" workshops at the following locations.

- Talawakelle Auditorium, on 18th October.
- Low Country Station, Ratnapura from 11th –12th December.

Dr LSK Hettiarachchi attended the following:

- A seminar on "Efficient use of fertilizer with special emphasis on low country conditions", to the Training of Trainers Programme, held at the TRI Low Country Station, Ratnapura, on 25th January.
- Meetings for development of a unified salary structure for the Plantation Crop Research Institutes, and also for the adaptation of a new salary revision, organized by the National Salaries and Cadre Commission, held in Colombo on 16th March, 24th April, 29th June and 11th July.
- Scheduling of a Training of Trainers Programme, held at the Kottawa Station, Galle, on 29th to 30th May.
- A Fertilizer Advisory Committee meeting, appointed to review the present fertilizer subsidy scheme in the tea sector, held at the Ministry of Plantation Industries, Colombo, on 9, 23, 1, 17, 21 and 1 February, July, August, September, and October, respectively.
- A Regional Scientific Committee meeting, held at the Management Development Training Centre, Pelgahetenna, Passara and the TRI Low Country Station, Ratnapura, on 2nd and 11th July.
- A CARP workshop on Establishment of a National ICSU Committee, held at the CARP office, Colombo, on 10th August.
- A meeting on Procedures Forum, and Producers and Consumers Forum, FAO/IGG, held in Colombo, on 29th and 30th August.
- A Directors' Forum and Budget Meeting, held at the Coconut Research Institute, Lunuwila, on 10th September.
- Interviews for recruitment of Technical Assistants to the TRI, held at the Sri Lanka Tea Board, Colombo, on 13th September.
- An Estate Sector and AS meeting, held at the Sri Lanka Tea Board, Colombo, on 21st September.
- A seminar on "Art of Decision Making", held at the Ceylon Chamber of Commerce, Colombo, on 11th October.

- A meeting on the Preparation of Action Plans for the Development of the Tea Industry, held at the Ministry of Plantation Industries, Colombo, on 16th October.
- A meeting on Pesticide Residues, held at the CTTA office, Colombo, on 23rd November.
- The 3rd International Conference, O-CHA (Tea) Cultural and Science ICOS 2007, and presented a paper, entitled "Response of a high yielding vegetative propagated tea to urea and muriate of potash application, in wet zone up-country of Sri Lanka", held in Shizuoka, Japan, from 3rd to 5th November.
- The Regional Technical Extension Forum, held at the Passara Station, on 27th November.
- Dr LSK Hettiarachchi delivered a lecture on "Rational Use of Fertilizer" at the RSC meeting held at Talgaswella Estate, Galle, on 14th September.
- Mrs S Ananthacumaraswamy gave a lecture and demonstration on Soil and Foliar Sampling for Nutrient Analysis, for Superintendents and Assistant Superintendents, Madulsima Plantations, at a workshop held at the TRI Passara Station and the TRI Talawakelle Auditorium on 13th June and 17th July, respectively.
- Mr GP Gunaratne delivered a lecture on "Soil fertility improvements and fertilizer use", in a Skill-Development Programme for Tea Field Officers of Pussellawa Plantations Ltd, held at Talawakelle, on 29th November.
- Dr LSK Hettiarachchi, Dr AKN Zoysa, Mr GP Gunaratne and Mrs S Ananthacumaraswamy attended the 214th and 215th E & E meetings, on 26th and 28th January and July, respectively. Dr Hettiarachchi made a presentation on "Rational use of nitrogen and potassium fertilizer in mature tea", at the 215th meeting, held at the TRI Auditorium, Talawakelle.
- Dr LSK Hettiarachchi, attended the 18th and 19th E & E Forums (Small Holder Sector), held at the Ratnapura TRI Auditorium, on 7th June and 14th November, respectively.

Overseas training programmes

- Mrs PLK Tennakoon, Experimental Officer, successfully completed the MSc degree with a First Class, at the University of Agricultural Sciences, Dharwad, Karnataka, India. Her research topic was "Development of Bio Fertilisers and their potential applications". She returned to the Division on 12th October.

Training programmes

- Mr DMBN Dissanayake attended a workshop on "Proper Use and Management of High End Analytical Instruments", held at the Chemical and Microbiological Industries Technology Institute, from 24th to 28th September.

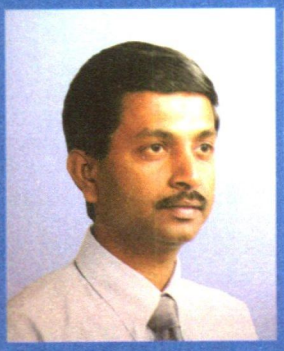
Visitors

The following groups of undergraduate students visited the Division in order to familiarize themselves with soil-fertility and nutritional aspects of the tea plant.

- Students from the Faculty of Agriculture, Rajarata University, on 8 May, Wayamba University on 2nd October, Eastern University on 19 and Ruhuna University on 26 November, respectively.

- Mr KGAI Jayasinghe, Trainee Assistant Manager, Frotoft Group, Ramboda, underwent training in the Division on soil fertility and plant nutritional aspects, on 22 January.
- Ms RMUM Rajapaksha and Ms D Bogahawatte, NDAG students from the Technical College, Dambulla, commenced six months In-plant training on 5 February. They completed their training on 5 August.
- A group of small holders from the Ratnapura region visited the Division, on 23 May, in order to familiarize themselves with soil fertility and plant nutritional aspects.
- A group of Market Promotion Officers from the Sri Lanka Tea Board visited the Division on 9 July, in order to familiarize themselves with soil fertility and plant nutritional aspects.
- Mr DGS Wickramasinghe, a final-year student from the University of Colombo, underwent industrial training on a project entitled "Iron content in major tea cultivars grown in some of the agro-ecological regions of Sri Lanka, with particular reference to its base levels", from 1st August to 21st September.
- A group of trainee Assistant Managers from Uda-Pussallawa Plantation Ltd, visited the Division on 14 August, in order to familiarize themselves with soil fertility and plant nutritional aspects.
- Mr TD Nanayakkara, a trainee student from the Hardy Advanced Technical Institute, Ampara, commenced four months' in-plant training from 1st March. Mr DGSE Samanthilake, from the same Institute, commenced training from 3rd July. They completed their training on 5th July and 2nd November, respectively.
- A group of seven delegates from the Tea Research Association, Toklai, India, visited the Division on 4th September.

Technology Division



Mr K Raveendran
B Sc Engineering (Chemical) M Eng (Energy Technology)
Acting Officer in Charge

Staff Members

Mr S Koneswaramoorthy
Mechanical Engineer
B Sc Engineering (Peradeniya)

Mr W S Botheju
Senior Research Officer
B Sc (Peradeniya)

Mr G L C Galahitiyawa
Senior Research Officer
B Sc (Kelaniya)

Ms S H Priyanthi Wauge
Experimental Officer
N D T (Chemical Engineering)

Mr L Jayasinghe
Experimental Officer

Mr Senaka Prabhath Dayananda
Experimental Officer
B Sc (Peradeniya)

Ms W M S Weerawardena
Experimental Officer
B Sc (Peradeniya)

Mr A M M V Abeykoon
Experimental Officer
B Sc (Peradeniya)

Mr W M U A B Marapana
Experimental Officer
B Sc (J'Pura)

Mr M A Chamindra
Experimental Officer

Ms K B M Sripalika
Experimental Officer
B Sc (Peradeniya)

Mr U D Alagiyawadu
Experimental Officer

Progress Review

Thrust A 27. Development of alternative packing materials for bulk tea

A 27.1 Evaluating new types of paper sacks

The objective of this experiment is to test and recommend low-cost packing materials for packing teas. During the period under review, the drop test was conducted on samples of paper sacks obtained from a particular Company.

It is intended to conduct more tests on these paper sacks to evaluate their suitability for packing low-country teas.

New Experiments

1. Testing alternative energy resources for tea manufacture

The thermal energy sources that are commonly used for the withering and drying processes are auto diesel, furnace oil and firewood. The cost of the thermal energy expended in tea manufacture is high when auto diesel and furnace oil are used. The cheapest fuel source is firewood. However, sources of firewood are not freely available at most factory locations, and firewood prices increase with scarcity. As such, it was decided to test refuse tea as an alternative thermal-energy resource for the manufacturing processes.

The refuse tea produced in tea factories is denatured and either used as fertiliser in tea fields or discarded as waste. Preliminary experiments were conducted, during the period under review, to prepare briquettes from refuse tea.

Refuse tea was collected from St Coombs Estate and taken to Taurus International (Pvt) Ltd. for preparing briquettes by means of a 'wet briquetting' technique. However, the

refuse tea could not be wetted evenly, and briquettes with good strength could not be produced. Experiments will be conducted to overcome this difficulty.

Studying made tea quality from tea leaves plucked in the morning, at noon and in the evening.

The quality of made tea produced from leaves plucked in the morning, at noon and in the evening, could vary. This study was undertaken to determine any variation in quality by manufacturing and evaluating made tea from tea leaves collected in the morning, noon and evening hours.

A suitable tea field was selected at St Coombs Estate for this experiment, paying attention to quality of the cultivar, the extent requirement, the pruning cycle, and proximity to the factory.

Eight trials were conducted during the period under review. The chemical composition of both green leaf and made tea samples were determined. Made tea samples were also sent to professional tea tasters for organoleptic analysis.

The results will be analysed and the experiment will be continued with moderate and poor-quality cultivars.

2. **Design and development of a Rotary Sifting Machine for leafy-grade teas.**
In low-country tea manufacture, difficulties are experienced in grading teas in Michie sifters, such as low output and deleterious changes in tea particle size. Further, automation in tea grading is not possible with this type of tea sifter.

Staff in the Division developed an improved rotary type sifter, and trials were conducted with this sifter.

- For different rotational speeds, the sifting of teas was observed, and the optimum rotating speed for the rotary drum determined.
- For different oscillatory movements and angle of the sifter, the sifting of teas was observed and the optimum oscillatory movement and angle were found.

The sifter was tested first with the No. 8 mesh. The performance of the machine for grading low-country teas with the No. 8 mesh was found to be unsatisfactory. Therefore, the No. 7 mesh was used and any improvements in performance determined.

3. **Testing the characteristic performance curve of newly-introduced withering-trough fans.**
Withering is the prime and most important process in tea manufacture. Nearly 50% of the total electricity consumption, and about 40% of the total thermal energy, are used in this process. The higher electricity consumption is due to operation of a fan motor system coupled to withering units called troughs.

In order to reduce electricity consumption, several newly-designed, low-weight withering fans are introduced in tea factories. These fans are supplied to the factories without proper

performance curves being available. Owing to this, such fans fail to supply the required amount of air for the withering process. As such, withering is delayed and more electrical energy and thermal energy are consumed for the process.

Therefore, It was decided to fabricate a testing facility called the 'Test Rig' to test such fans. The standard, ISO 5801:1997, for the Test Rig was purchased, and after careful study a suitable type of installation was selected. It was decided to carry out the experiment in collaboration with the Energy Conservation Fund (ECF).

A Memorandum of Understanding has been entered into between the TRI and the ECF. As per the MOU, the required funds for fabricating the unit were received from the Energy Conservation Fund, and the fabrication of the unit was started. Several discussions were conducted on improving the design with a member of the Tea Research Board Member, engineers of the Energy Conservation Fund, and the Head of Mechanical Engineering, University of Moratuwa.
The fabrication of the unit according to the improved design has been completed. One withering-trough fan was tested using this unit in a preliminary trial, and the data collected was given to engineers of the Energy Conservation Fund.

4. Testing Gliricidia for hot-air generation for tea drying.

In black tea manufacture, thermal energy is used to generate hot air for drying and the withering processes. Firewood has become the only practical source of thermal energy generation in tea factories. However, firewood supplies are also not adequate and getting good firewood in the right quantities to factory locations is not possible most of the time. Further, firewood prices increase with demand and scarcity.

A project was designed to test energy plantation crops such as Gliricidia and Calliandra for tea drying. Trials were conducted with Gliricidia firewood at St .Joachim Estate, and with Calliandra firewood at St Coombs Estate and Mattakelle Estate. The results of the experiments show that these energy plantations crops could be used efficiently in the air heaters presently available, as well as in the air heaters newly introduced to tea factories, for generating hot air for tea drying.

The results of this study were presented at the Experiments and Extension Forum held on 26 January.

5. The flat-plate solar collector system at St Joachim Estate

A flat-plate solar collector system, that had been tested for tea drying at St Joachim Estate, has not been used for the last six years as repairs to the centrifugal blower fan could not be completed.

It was decided to repair the fan, couple it to a firewood-fired air-heater system, test the system for performance at different load ratios, and make it available for use by the Estate. A combustion control system will also be incorporated in the air-heater to avoid temperature fluctuations due to cloud cover.

The fabrication of the system's blower fan was completed, and the flat-plate collectors cleaned, during the period under review. The system will be tested for tea drying at St

Joachim Estate after installation of the fan.

6. Automation of tea-manufacturing processes.

Human resources are largely used in the production of quality made tea. Most of the human skills required are not up to standard, and as such close supervision is needed for quality tea production. Further, difficulties are experienced in getting the required number of workers at tea factories on a regular basis. Therefore, it was decided to automate, as much as possible, tea-manufacturing processes and reduce the worker requirement. The other aspect of this project is to improve hygienic standards in tea manufacture.

A project was designed to automate rolling and roll breaking, fermentation and the drying operations in up-country tea manufacture. A project proposal has been submitted to the Director, TRI for the purpose of raising funds from the PDP. However, owing to financial constraints, it was decided to reduce the scale of the project and conduct it at the Institute's tea factory.

Optimisation of low-country grade mix using a combination of No. 3 and 4 meshes in the roll breaker.

The objective of this study is to determine the merits and demerits of using a combination of No. 3 and No. 4 meshes, instead of a No. 4 mesh alone, in the roll breaker, in low-country tea manufacture.

One trial was conducted during the period under review at the St Joachim tea factory.

Other Divisional Activities

1. Monitoring tea manufacture at TRI tea factories

The staff continued to support the management in improving tea manufacture, and related activities, at the Institute's tea factories. The staff closely monitored tea manufacture and green leaf-handling operations at the St Joachim tea factory, in order to enhance the quality of made teas. The results obtained from this exercise were found to be encouraging.

The staff also completed manuals relating to SGS-TASL product-certification system for the St Joachim factory.

During the period under review, detailed reports on tea manufacture at the TRI factories were submitted to the Director, TRI and to the Consultative Committee on Advisory Services and Extension.

2. Miniature tea manufacture

Green leaf samples, 730 in all, were received from other research units of the TRI and manufactured in the Division. The made tea samples were given to the respective Divisions for further analysis.

3. Miscellaneous Activities

During the period under review:

- The staff made 147 visits to tea factories on various aspects of tea manufacture.
- Eight hundred and four tea samples were received from estates for moisture determination.
- Thirty seven moisture meters were received from estates for calibration.
- Forty seven thermometers were received from estates for calibration.
- Ninety six hygrometers were received from estates for calibration.
- Mr G L C Galahitiyawa continued to serve as an observer on the Board of Management of the Tea Shakthi Fund.
- The staff supported the NIPM in conducting training programmes and other related activities.
- The staff served as members of Technical Evaluation Committees for purchasing tea-manufacturing items by tea estates belonging to the Sri Lanka State Plantation Corporation.
- The staff conducted workshops and training programme on tea manufacture at three tea factories.
- Mr G L C Galahitiya served as Chairman of a Committee, appointed by the Secretary, Ministry of Plantation Industries, to prepare a report on the activities of Tea Shakthi factories managed by the Tea Shakthi Fund.

Biometry Unit

Ms T U S Pieris
B Sc (Peradeniya), M Phil (Applied Statistics)
Research Assistant

Staff Members

Mr H K K Deshapriya
Technical Assistant

Progress Review

1. Accounting for Spatial Variability in Field Experiments on Tea

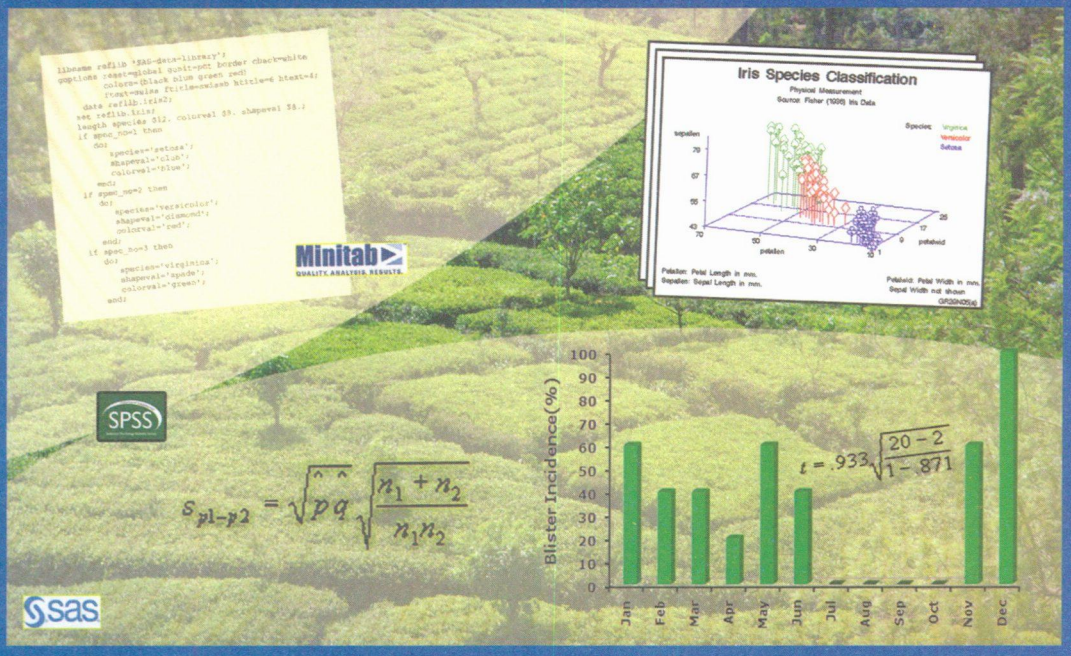
Spatial variability among experimental units is a common problem in field experiments on tree crops such as tea. Spatial variability is partly accounted for by blocks, but a substantial amount remains unaccounted for and this may lead to erroneous conclusions.

In order to capture spatial variability in field experiments on tea, the following six commonly used spatial analysis techniques were investigated: the covariate method with pre-treatment yield as the covariate; the Papadakis and the modified Papadakis nearest-neighbour adjustments; the moving means and the modified moving means methods; and the autoregressive method.

The resulting average efficiencies across locations and years are shown in the following table.

	CCM	PNNM	MPNNM	MAM	MMAM	AR(1)
Experiments with large block sizes	126	112 (139)	110 (137)	122 (146)	115 (140)	123
Experiments with small block sizes	119	110 (126)	145 (158)	102 (119)	115 (131)	101

Values in parenthesis are relative efficiencies for four neighbour methods, in conjunction with CCM.



The precision of experiments on tea may be increased by using CCM, and any one of the four nearest-neighbour adjustments tested, when the block size is large; and the modified Papadakis technique (MPNNM), on its own, when the block size is small.

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

The results of the first part of this project have provided adequate evidence that climatic parameters in tea-growing areas have changed significantly, and available evidence on climate change needs to be taken into consideration and agricultural practices re-scheduled accordingly.

In detailed analysis of climatic parameters for the Uva region, the following results were obtained with respect to climate change.

- From January to May, there is an increase of monthly average temperatures (maximum and minimum). However, the pattern is the opposite during the period of September to December. In terms of optimum growing conditions for tea, the period from January to May shows higher potential than the second period (September to December).
- Though high rainfall favours growth of tea, wind velocity and cloudiness seriously affect growth during the second period.
- Low temperature, low sunshine, and high relative humidity, greatly influence blister attack during September - December in the region.

A diagnostic survey was conducted in 26 estates, representing the Uva region, in order to assess estate practices of time of pruning against the TRI recommendation, over the last 10-year period.

The following table indicates the results of the survey.

	Percentage of pruning extent*	Occurrence, out of 120 times (10 years X 12 months)**
Recommended period	15.0	8.0
Non-recommended period	84.8	34.0

* Average of 13 estates ** Average of 8 estates

The project is in progress

B 82. Improvement of methodologies for pest, diseases and cultivar screening, using the biometrical approach.

The following objectives will be pursued in this project:

- Identifying parameter/s with the most potential for estimating P/D severity by checking consistency using statistical techniques;
- Developing the most precise and accurate sampling techniques taking account of the distribution of P/D;
- Building up a reliable method for identifying risk levels.
  The expected outcome is the establishment of reliable screening methodology for screening cultivars in terms of pest and diseases.
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- Building up a reliable method for identifying risk levels.
  The expected outcome is the establishment of reliable screening methodology for screening cultivars in terms of pest and diseases.

B 86. Prediction of tea flavour and quality characteristics using artificial neural networks.

The objectives of the project are as follows:

- Developing high precision in a tea-flavour/quality prediction model, by training neural networks with experimental data;
- A statistical appraising of the problem in tea-taster sensory analysis, and proposing a statistical approach to estimate the errors associated with taster scores;
- Establishing a statistical relationship between sensory attributes and biochemical parameters, and making use of this to replace sensory analysis.

B 88. Measuring productivity of research in tea.

The profit margin of Sri Lankan tea producers is not very attractive due to the high cost of production. A large percentage of the cost is attributed to labour and fertilizer prices which are determined exogenously. As a result, attempts to reduce the cost of production depend heavily on the development and dissemination of new technology. Applied research, as a means of generating new technology, is a tool widely used by many public and private institutions to reduce cost of production. Therefore, it is worthwhile assessing the impact of applied research on the tea Industry.

On the other hand, measuring research productivity is a current focus in decision- and policy making, as this gives an understanding of the existential situation which can introduce remedies to help increase productivity.

The following objectives will be pursued in this project.

- Assessing the impact of tea research on tea production in Sri Lanka;
- Assessing the efficacy of tea research to investment goals, and in achieving industrial requirements;
- Assessing the efficiency of technology transfer in the tea research;
- Assessing the impact of technology transfer on the tea industry in Sri Lanka.

Designing Field Experiments, and Analysis and Interpretation of Data.

Based on requests from other Divisions, advice was given on efficient protocols for experimentation and surveys, and on sound statistical methods for data analysis and the drawing of statistical inferences.

Publications

International

Peiris T U S, Samita S and Veronica W H D (2007). Accounting for Spatial Variability in Field Experiments on Tea. Journal of Experimental Agriculture (in press).

Local

Peiris T U S, Samita S and Fernando E K N D (2006). Analysis of Variability of Bright Sunshine Hours and Temperature in Tea Growing Areas in Sri Lanka. Sri Lanka Journal of Tea Science 71, 75 - 88.

Supervision

Undergraduate

Profit Efficiency in Tea Smallholding Sector in Sri Lanka. Ms M T Padmajani, Department of Agricultural Economics and Business Management, Faculty of Agriculture, University of Peradeniya.

Post graduate

Statistical Modeling of Tea Yield Using Climatic Parameters. Ms. A S Abeygunaratne, Postgraduate Institute of Science, University of Peradeniya.

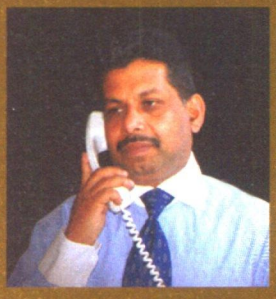
External Collaborators

- Dr S Samita, Senior Lecturer in Biometry, Department of Crop Science, Faculty of Agriculture, University of Peradeniya.
- Dr L H P Gunaratna and Dr. Jeewika Weerahewa, Senior Lecturers, Department of Agricultural Economics and Business Management, Faculty of Agriculture, University of Peradeniya.
- Prof Keerthi Walgama, Department of Engineering Mathematics, Faculty of Engineering, University of Peradeniya.

Staff Training

Ms T U S Peiris participated in a short course, "GIS and its Applications", organized by the Postgraduate Institute of Science, University of Peradeniya, 04th -09th January.

Advisory and Extension Division



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Head, Advisory and Extension
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Mr K G R Niroshan
Photographer

Mr N S Ekanayake
Audio Visual Attendant

Mr J T Thevadasan
Photography Dark Room Attendant

Progress Review

Thrust A 37. Examination of TRI recommendations and grower practices

A 37.2 Identifying and assessing Good Agricultural Practices adopted by growers

1. Review of Commercial Nursery Inspection Procedures for Recommending Healthy, Quality Nursery Plants for Planting

A committee (Mr S L D Amaratunge, Mr Jaanaka Mahindapala and Mr Thilak Fernando, Ratnapura Regional Manager, TSHDA) was appointed to review Commercial Nursery Inspection Procedures. The committee submitted a comprehensive report, with suggestions to make the present procedures an effective.

2. Training Programmes for Developing Nursery Management Skills of Selected Groups of Nursery Workers

Ten special training programmes were initiated, focusing on the training needs of commercial nursery owners, workers of the tea smallholding sector, the corporate sector, and proprietary estates, in the Kalutara, Ratnapura and Kegalle Districts.

The main objectives of these programmes were

- to develop the skills of nursery owners and their assistants, to produce and maintain the standard and quality of nursery plants
- to introduce alternative nursery soil-fumigation techniques and materials in place of MeBr
- to promote the production of TRI 3000- and TRI 4000-series tea cultivars;

3. **Plantation Crops Demonstration Site**

A Plantation Crop Demonstration Site was established at the Ambuluwawa Bio-Diversity Site, Gampola, in collaboration with the CRI, the RRI, the Cashew Development Board and the Sugarcane Research Institute.

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

The main objectives are to disseminate technologies, developed by the Tea Research Institute of Sri Lanka, to facilitate potential MeBr users in tea fields to adopt effective, practical and economically feasible alternatives to the use of methyl bromide in Sri Lanka, and to embark on immediate policy development for meeting the commitment of Sri Lanka as a party to the Montreal Protocol.

The specific objectives are:

1. to train agricultural trainers at the national level to disseminate the technology on phasing out MeBr, and to use alternatives for MeBr;
2. to establish demonstration sites for stakeholders in the tea and agriculture sector on the alternatives to MeBr;
3. to monitor and evaluate the overall sustainability of adopting these alternatives, and specifically scientific evaluation of nematode management methods; and
4. to develop a planting-material certification system, and policy initiatives for producing healthy and vigorous, nematode-free, tea plants.

ADV1. Routine Advisory and Extension Activities

Table 1. Summary of the Routine Advisory and Extension Activities

	Activity	TK	RP	PS	KT	HN	DN	Total
1	Estates visits							
1.1	On call Adv. Visit-Estates	146	35		34	59	51	325
1.2	On-call Advisory Visit-Small Holdings	14	56				49	119
1.3	Routine Advisory Visit							
1.4	Extension Visit	12				4	31	47
	Total visits made	172	91	60	72	63	131	589
2	Individual contacts							
2.1	Office calls	121	232				128	481
2.2	Inquiries through telephone	2016	451				315	2782
	Total	2137	683		753	269	443	4285
3	Adv. & Extension correspondence							
3.1	Advisory Documents	928		97		128	311	1464
3.2	Extension services report	93						93
3.3	Publications	441						441
3.4	Administrative matters	1212		78		54	385	1729
	Total	2674	1338	175	427	182	696	5492
4	Training Programme							
4.1	familirization Programmes Estates	6	43					49
4.2	Familirization Programmes -Small holders	5						5
4.3	Skill training programmes	6						6
4.4	Educational Programmes	14	12					26
4.5	Training programs on request	8	17					25
	Total	39	72	8	97	42	27	285
5	Commercial Nursery Inspections	0	15	48	0	12	29	104
6	Exhibition	1	3			1	1	
7	Visitors							
7.1	Tea Growers	420	371		875	884	684	3234
7.2	Higher Educational Students	297	45		246			588
7.3	School Students	4260	55				77	4392
7.4	Foreign Personnel	47				4		51
7.5	General Visitors	659	45				75	779
	Total	5683	516	615	1121	888	836	9659
8	Group Extension Techniques							
8.1	Demonstrations	3						3
8.2	Field Days	6					41	47
8.3	Informal Discussion with Small Group		111		60		257	428
8.4	Lecture/Panel/Symposium/Seminar	5		2			2	9
8.5	Workshop/'RSC	4	1		1			6
8.6	Crop Clinics conducted	1	2					3
	Total	19	114	2	61		300	496
9	Mass Media Extension Techniques							
9.1	Newspapers articles	1	7				5	13
9.2	Newsletters	6						6
9.3	Folders/Leaflets/Pamphlets/CDs	2	2					4
9.4	TV/Radio Programmes	5	3					8
9.5	Posters/Wall Charts/banners							
	Total	14	12	0	0	0	5	31
10	Soil Testing (pH)	0	547	624	387	232	237	2027
11	Publications							
11.1	Free Issues	525	409				138	1072
11.2	Priced Publications		457	125			349	931
	Total	525	866	125	898	496	487	3397

TK: Talawakelle, RP: Ratnapura, PS: Passara, KT: Kottawa, DN: Deniyaya

Special Advisory and Extension Activities

The advisory and extension activities of the Division were based on the problems and needs identified in the corporate and smallholding sector.

Main Objectives of the Work Programme

- To educate tea growers on soil-fertility management and promote plant nutrition management systems recommended by the TRI;
- To educate tea growers on the safe use of agrochemicals in tea fields;
- To promote plucking techniques recommended by the TRI;
- To promote improved tea nursery management techniques;
- To promote the use of appropriate tea cultivars;

Specific Objectives

- To educate tea growers on the use of green manure, and improve the adoption of TRI-recommended nutrient management schemes;
- To educate tea growers on the safe use of agrochemicals, and especially the following of pre-harvesting intervals in order to minimize pesticide residues in made tea;
- To educate tea pluckers and supervisory staff on the use of the TRI tea harvester and plucking basket, and on the correct handling of green leaf for minimizing post-harvest losses;
- To educate tea nursery holders on the correct use of Basamid and Metham sodium for eradicating nematodes in tea nurseries;
- To supply 12 million new clonal cuttings of the TRI 3000- and TRI 4000-series to small holders and estates.

This report is a review of the major advisory and extension activities, organized and conducted by the Advisory and Extension staff, at the Talawakelle, Kandy, Ratnapura, Passara, Kottawa and Deniyaya regions, for the purpose of achieving the above objectives during 2007. Moreover, routine advisory activities, training programmes, demonstration programmes, etc. were conducted by the staff of the Advisory Division based in each region.

1. Training of Trainers' (TOT) Programmes

Nine one-day programmes were conducted, in collaboration with the research staff, for the purpose of educating the TSHDA's Regional Managers, Assistant Regional Managers, Senior Tea Inspectors and Tea Inspectors. The total number of participants for the programmes was 250. The following subjects were covered during these sessions.

- Plant-nutrition management;
- Soil-fertility management;
- Fertilizer use in tea;
- Participatory activity for the identification of problems in tea fields.

2. **Regional Scientific Committee (RSC) Seminars**

Seven RSC seminars were conducted for the corporate sector during the year under reference. Approximately 125-150 Superintendents and Assistant Superintendents from the RPCs participated in each programme organized in each of the regions.

The following subjects were covered in these Seminars:

- Potential Use of Gliricidia as a Green Manure and an Alternate Energy Source in the Tea Industry;
- Thermal Energy from Energy Plantation Crops in Sri Lanka;
- Rational Land Use for Economic Viability and Sustainability of the Tea Industry in Sri Lanka;
- New International Regulations and the MRL issue in Tea Exporting;
- Safe Use of Herbicides in Tea Fields;
- Safe Use of Fungicides in Tea;
- Safe Use of Insecticides in Tea; and
- New Techniques for Soil Fumigation in Tea Nurseries.

3. **Extension and Experiment Forum for the Smallholdings Sector**

Two sessions were conducted during the year. Approximately 150 E & E Forum members participated in each session.

The following subjects were discussed in the sessions:

- New techniques in nursery soil fumigation;
- Tea nursery management, and standards for nursery plants;
- Tea seeds as alternative planting material; and
- New trends in the tea industry.

Regional Technical and Extension Forum for the Smallholdings Sector

Six programmes of this Forum were conducted in each region under the theme: "Raising a healthy, vigorous tea plant for a sustainable tea industry". Approximately 50 participants attended each of the sessions, conducted in the different regions.

The following subjects were discussed:

- New techniques for soil fumigation in tea nurseries;
- Nursery techniques for raising standard nursery plants;
- Phasing methyl bromide out of the tea industry; and
- Demonstration of soil fumigation with Basamid and Metham Sodium.

4. Workshops and Field-Day Programmes for the Corporate Sector

Sixteen workshops/field-day programmes were conducted, covering all the plantations companies, in order to educate management and field staff on new developments in the areas given below. Approximately 40 - 50 Superintendents, Assistant Superintendents, and Field Staff participated in each programme.

The following subjects were mainly discussed:

- New developments in plant-nutrition management in tea;
- Soil-fertility management in tea fields;
- Scientific harvesting techniques;
- Use of appropriate, recommended tea cultivars;
- Improved tea nursery management techniques; and
- Demonstration of soil fumigation with Basamid and Metham Sodium

5. Crop Clinics

Two crop clinics were conducted for corporate sector tea plantations, in the Nuwara Eliya, Maskeliya, Dimbula, Pundaluoya, Udapussallawa and Dickoya regions in the up-country, and in the Ratnapura, Kalutara and Kegalle regions in the low country. One crop clinic was conducted for smallholders in the low country.

- Up-country corporate sector, 18 October, 401 participants
- Low country smallholders, 11 December, 2080 participants
- Low country corporate sector, 12 December, 350 participants

The main objectives of the crop clinics were to make clients aware of new developments on the following areas:

- New developments in plant-nutrition management in tea;
- Soil-fertility management in tea fields;
- Scientific harvesting techniques;
- Use of appropriate, recommended tea cultivars;
- Scientific pruning techniques;
- Improved tea nursery management techniques;
- Use of Basamid and Metham Sodium for nursery soil fumigation; and
- Other aspects of tea cultivation.

6. Adaptive Trials

Four adaptive trial sites were maintained at St Coombs, St Joachim, and the TRI Kottawa and Passara stations in the following subject areas:

- Ongoing fertilizer adaptive trials on regional specific fertilizer recommendations of the TRI vs. U 709 (St Coombs, TRI Kottawa and Passara stations); and
- Site-specific fertilizer recommendations vs. regional specific recommendations (St Joachim Estate).

7. Educational Exhibitions for the Public

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

- "Dayata Kirula" National Exhibition, BMICH, 4th - 12th February
- Educational Exhibition, Sumanabalika Vidyalaya, 20th - 23rd February
- Educational Exhibition, Gallella Maha Vidyalaya, 27th to 29th March
- "Kingwood Mela" Exhibition, Kandy, 4th -09th April
- "Mahapola" Exhibition, Morawaka Central College, 5th – 11th April
- "Gamideriya" Exhibition, Ratnapura, 12th –13th October

8. Newspaper Articles

The members of the Advisory Division arranged to publish 13 news and feature articles in Sinhala and English newspapers and news bulletins, such as "The Island", "Lankadeepa", "Divaina" and "Ladalumahima", to educate the general public about tea.

The following were the topics of these articles:

- "Minimizing nursery casualties due to rainfall by using poly-tunnels" - S L D Amarathunga
- "Improvement of quality of nursery plants by developing nursery skills of nursery owners and workers" - S L D Amarathunga;
- "Pre and post pruning practices" - S L D Amarathunga;
- "Importance of planting quality nursery plants - S L D Amarathunga;.
- "Answers to inquiries about tea" – B A D Samansiri, December 2007;
- "To improve productivity in the low country - Lalith Amaratunga, November 2007;
- "Correct pruning techniques to improve tea productivity in low country tea" ;
- "Answers to your inquiries about tea" - B A D Samansiri, October 2007;
- "Special cultural operations against drought and canker"
- "Competitive international tea market" – S P Rathnayake;
- "Tea nurseries management" - K D. Dahanayake;
- "Blister Blight disease during rainy season" - B A D Samansiri
- "Planting Vetiver in tea fields" - B A D Samansiri

9. Advisory Circulars

New Advisory Circulars, listed below, were issued during the year under reference. Mr J C K Rajasinghe, Senior Advisory Officer, coordinated their issue.

- Pesticide Use in Tea Fields PU1
- Chemical Control of Diseases PU2
- Chemical Control of Weeds PU3
- Chemical Control of Insect and Nematode Pests PU4
- Mite Control

- Population Monitoring and Sampling of Tea Tortrix
- Management of Tea Tortrix
- Termite Control in High-Grown Tea

10. Pamphlets, Stickers and Posters

Two pamphlets, one sticker and one poster were printed during the year by the Advisory Division.

- Phamphlet on Services of the Tea Research Institute (for "Dayata Kirula" Exhibition)
- Phamphlet on Guidelines to produce standard VP nursery plants
- Sticker on "Plant TRI 3000- and 4000-series tea cultivars for higher productivity"
- Poster on "Safe Use of Pesticides in Tea Fields"

11. ADV Issuance of New Clonal Cuttings

Mr J C K Rajasinghe, Senior Advisory Officer, coordinated the issuance of new tea cultivars (TRI 3000- and TRI 4000-series) from the TRI Mother Bush sites.

Mother bush sites		No. of cuttings issued
TRI sites	St.Joachim	1,538,700
	St.Coombs	2,336,500
	Hantana	660,250
	Kottawa	337,875
	Passara	136,150
	Deniyaya	207,250
	Sub- Total	5,216,725
TSHDA sites	Mawarala	1,497,750
	Vogen	283,750
	Tyspane	312,523
	Walahanduwa	534,725
	Sooriyagoda	157,500
	Hingula	51,195
	Nelligolla	85,905
	Hali Ela	0
	Bandarawela	0
	Hantana Tr. Centre	211,205
	Neluwa	82,575
	Rahatungoda	80,960
	Sub- Total	3,298,088
Private sites	Uva	20,000
	Sabaragamuwa	421,000
	Southern	1,426,600
	Sub-Total	1,867,600
Grand Total		10,382,413

Regional Level Advisory and Extension Activities

Research, Advisory and Extension Centre, Low Country Region, Ratnapura
Senior Advisory Officer: S L D Amarathunge

Routine Advisory and Extension Activities

Table 1. Summary of the Routine Advisory and Extension Activities

Special Advisory and Extension Activities

1. **Methods and Results of Demonstrations for Smallholders**
   Seventeen awareness programmes were conducted for empowering tea smallholders by conducting methods and results demonstrations on technically sound agronomic practices. Approximately 600 tea growers attended the programmes. Tea Inspectors of the TSHDA organized the programme.

2. **Methods and Results of Demonstrations for the Corporate Sector**
   Three training sessions were conducted on harvesting, for management and field staff of Eduragala, Vogan, and Hemingford Estates.

3. **Informal Discussions with Small Groups on Field Problems**
   A total of 111 small groups from the corporate sector and proprietary estates (managers and assistant managers with their field staff), and small groups of small holders, visited the TRI to get expert technical assistance to design and formulate field development programmes.

4. **Nursery Skill Development Training Programmes**
   Ten training programmes were initiated, focusing on the training needs of commercial nursery owners and workers in the tea smallholding sector, the corporate sector and proprietary estates in the Kalutara, Ratnapura and Kegalle Districts.

5. **Educational Training Programmes**
   Nine educational training programmes were conducted. The details are given below

6. **Customised Programmes**
   - A presentation on tea-related agribusiness enterprises for members of the Gamideriya Project, Kuruwita; September 2007 (75 participants).
   - A presentation on Good Agricultural Practices in tea fields organised by the Tea Shakthi Society, Kitulgala, Yatiyantota;. February 2007 (100 participants).
   - An awareness programme for leaf collectors of the Galpaditenna Tea Factory Ltd., Lellupitiya. (15 participants).

7. **Training Programmes for Students of the School of Agriculture and NAITA**
   - For ten diploma students from the School of Agriculture, Hardy, Niwala, Agunakolapelessa.
   - For two students from the NAITA, Ratnapura training programme on stenography, typing and data entering; for a period of six months.

8. **NIPM Programmes for Field Staff**

   Two programmes at the NIPM Bogawantalawa Training Centre for field staff of Maskeliya and Watawala Plantations Ltd., on plucking, bush management, mechanisation of field practices, etc. on 3 November and 1 December, 2007, respectively.

9. **Commercial Nursery Inspections**

   Fifteen commercial nurseries were inspected in the Kalutara and Ratnapura Districts.

   Summary of Commercial Nursery Inspections

District	No of nurseries inspected at CN 6	Total plants available at the CN 5 inspection	% of plants available at the CN 6 inspection	% of suitable plants recommended for sale	% of good plants in the total
Ratnapura	6 (3)	154000	88% (in three nurseries, and the number of plants in the three nurseries)	52%	48%
Kalutara	10	507190	76.44%	56	44%

10. **Observation Trials conducted by Advisory Staff in Collaboration with Research Staff**

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

    A comparative study on VP/LC-880 vs. site-specific fertilizer was begun, at the same location as the former observational trial on VP/LC-880 vs. U-709. Three replicates were made in Field No. 1, St Joachim Estate, TRI, Ratnapura, by Advisory Division staff in collaboration with the SPND and St Joachim Estate, beginning on 20 September, 2007.

    Comparative Study on the Effectiveness of Different Control Measures for Horse Hair Blight (HHB)

    One cycle of the field study, conducted in Field No. 8 at St Joachim Estate, in collaboration with the Pathology Division and St Joachim Estate, was completed. The field data and yield records have been analyzed.

    Land-Suitability Mapping for Tea-Growing Lands

    A collaborative study was undertaken, with the Agronomy Division and the Natural Resources Centre, Gannoruwa, to identify suitable lands in the AGA Divisions for tea-growing, based on information collected on yield, rainfall, soil, etc.

Evaluation of the Impact of the Nursery Skill Development Programme on the Adoptability of Recommended Nursery Practices

A survey was carried out to get feedback information on the adoptability of recommended nursery practices. This study was aimed at assessing the adoptability of disseminated information during the nursery skill development programmes.

Practices investigated	Parameters/ categories	% of responses	Needs identification/Comments
Commencing the nursery at a scheduled period	Correct season (July-Oct)	27%	Reason for late commencement to be reviewed, and the need to follow the nursery calendar to be emphasized
	Late commencement (November onwards)	73%	
Bag size	TRI-recommended size, 9" x 5"	3%	Reason for non-adoption to be reviewed.
	TSHDA minimum required size, 7" x 5"	62%	Positive trend to reach this size at least.
	Less than 7" x 5"	35%	To be given due attention
pH testing prior to using soil for nursery purposes	Tested	27%	Positive trend
	Not tested	73%	To be made aware of the importance of pH testing
Use of new varieties	Only TRI 2000-series	31%	To be given due attention. Attitudes to be changed
	TRI 3000- and 4000-series	46%	Positive trend
	Both TRI 2000-series and new TRI 3000-/4000-series	23%	
Fumigation of soil	Adopted	0%	
	Not adopted	100%	The reasons for non-adoption to be reviewed
Type of water-source for nursery	Well	39%	The reasons for non-use of sedimentation tank to be reviewed
	Gravity-fed water through PVC pipes	38%	
	Overhead tank (but no sedimentation tank)	23%	
Use of soil substitutes	Soil + paddy husk	35%	Positive trend; to be encouraged further
	Only soil	65%	
Raising nursery bed to enhance the draining of excess water	Raised	65%	Positive trend; to be encouraged further
	Not raised	35%	
Use of poly-tunnels	Used	27%	To be made aware of the importance of using poly-tunnels
	Not used	73%	

Publications

- Amarathunga SLD, Balasuriya A, Wanigasundara WADP, Dissanayake NC (2007). A field assessment of the factors affecting Horse Hair Blight (Marasmius equicrinis) in tea in the low country district of Ratnapura.. 1st Annual Symposium of the University of Sabaragamuwa, December 2007, "Bridging the Gaps in Tropical Agricultural Research"; p. 87.
- Amarathunga SLD, Wijeratna MA, et al. (2007). Assessment of impact of climate change on productivity of tea (Camellia sinensis L.) plantations in Sri Lanka. Journal of the National Science Foundation 35,119-126.

Research, Advisory and Extension Centre, Mid-Country Region, Kandy
Senior Advisory Officer: J C K Rajasinghe,

Routine Advisory and Extension Activities

Table 1. Summary of the Routine Advisory and Extension Activities

Special Advisory and Extension Activities

- Two RSC programmes were held at the TRI, Hantane, in January and December, for the benefit of Superintendents and Assistant Superintendents of the region. Nine field-day programmes for the Assistant Superintendents. of Elkaduwa Plantations, and one field-day programme for the field staff of Kellebokke Estate, were also conducted.
- Two training programmes were held at Hare Park Estate, Madamahanuwara, for the executives and field staff of the estate. A workshop on plucking for the field staff of Melfort Estate and Nilloomalay Estate, and a training programme for the executives and field staff of Kellebokke Estate, were conducted at the TRI MCS.
- Two TOT programmes were held at the Centre for TSHDA officials of the Kandy region.
- Two E & E Forums for the smallholder sector was organized and held at the TRI LCS, Ratnapura. The Forums were convened by the SAO.
- The Senior Advisory Officer and the Extension Officers attended the TOT programmes at TRI LCS, as resource persons. Two Regional Technical and Extension Forums were conducted, for the officers of the TSHDA, and officials of the Tea Smallholding Society of the Kandy region, at the TRI MCS.
- The Senior Advisory Officer and the Extension Officers attended two demonstrations held at Kothmale on the rapid decomposing of refuse tea.
- An awareness programme, on cultural practices in tea, were conducted for school teachers in the Kandy region.
- The Senior Advisory Officer/Mother Bush Coordinator visited the mother bush sites at the Galle, Matara, Ratnapura and Passara regions.
- Development work at the Model Tea Cultivation Block at the Centre was continued.
- Fifty members of the Ladalu Mahima movement participated in a two-day training programme at the Centre.
- Seven training programmes/workshops on soil fumigation and soil sampling were held in the Yatigammana, Tyspane and Wattegama areas, for commercial nursery owners.

- Mr J C K Rajasinghe coordinated the following activities:
  - Experimental and Extension Forum for the smallholder sector;
  - ADB Mother Bush activities;
  - Crop-diversity demonstration plots at the Ambuluwawe Biodiversity complex; and
  - Revision of Advisory Circulars

Regional Advisory and Extension Centre, Uva Region, Passara
Actg. Officer in Charge: T G N Mahinda

Routine Advisory and Extension Activities

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

Special Advisory and Extension Activities

1. **Field Trials**

   The following field trials were continued in the Station:
   - Demonstration plots on shear-/hand plucking in Field No. 01.
   - Trial on different fertilizer mixtures (U 709 vs VP/Uva 945) in Field No. 02.
   - UVP 9 and UVP 10 PPPB trials are in progress in Field No. 04.
   - Up-keep of TRI 5000-series Phase III trial in Field No. 02.
   - Up-keep of germplasm in Field No. 03.
   - Two seedling trials in Field Nos.03 and 04 are in progress.
   - Up-keep of grafted plant blocks in Field No. 01.
   - Integrated weed management trial in Field No. 03.
   - Trial on pesticide residues (Entomology Division) in Field No. 02.
   - A trial was initiated at the Station by the Entomology Division to evaluate TRI 300- and 400-series cultivars on their tolerance to nematodes. The trial is ongoing.

2. **Special Problems in the Uva region**
   - Sulphur deficiency symptoms were observed in a few smallholdings in Passara and Demodara. These were confirmed subsequently by soil testing.
   - Severe manganese deficiency symptoms were also detected in the Madulsima area (Verellapatne Estate), compared to the year 2006.
   - A significant drop in annual rainfall was reported. Thus, in the year 2007, the rainfall was 2007 ml, and in the year 2006, it was 2810 ml. Also, the monthly rainfall distribution was not well distributed.

Regional Advisory and Extension Centre, Kottawa, Talgampola
Officer in Charge: K D Dahanayake

Routine Advisory and Extension Activities

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

Special Advisory and Extension Activities

1. Training programmes and Seminars

   Forty-three seminars, training programmes and field days were conducted for tea smallholders, green leaf suppliers and factory owners.

2. Video Programmes
   Thirty-three video shows were presented, at the Kottawa Station and outside, on plucking, land preparation, soil conservation, and pests and diseases of tea.

3. Supervision of Students
   - Six Advanced-Level students visited the Station to get information for their project reports. Mr S P Rathnayake guided them and supervised their project work.
   - One NIPM trainee collected information relating to tea nursery management for a report which was completed under the supervision of Mr S P Rathnayake.
   - Three undergraduate students from the Colombo and Sri Jayawardenapura Universities visited the Station to collect information to complete their undergraduate theses, under the supervision of Mr S P Rathnayake.

4. Awareness Programmes and Discussions
   - The Advisory and Extension staff organized ten awareness programmes for the benefit of smallholders in the region.
   - Sixty informal discussions were held in finding solutions for various problems, such as the high cost of production, labour shortage, damage to leaf during transport, pest and disease control, etc.

6. Experiments and Observations
   The following experiments were continued at the Station.
   - Plant Breeding Division. TRI 5000-series trial (LVP 37) in Field No. 03. Selection of resistant cultivars for the Low Country Live-Wood Termite in Field No. 03.
   - Soils and Plant Nutrition Division. Fertilizer trial, U 709 vs VP/LC/880, in Field No. 04.
   - Entomology Division. Nematode population monitoring trial in Field No. 04.
   - Agronomy Division. Tea and coconut intercropping observation trial in Field No. 02, Citrus Estate.
   - Shear-plucking observation block at the Station.

Regional Advisory and Extension Centre, Deniyaya, Kotapola
Officer in Charge: K G J P Mahindapala

Routine Advisory and Extension Activities

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

Special Advisory and Extension Activities

1. Experiments and Surveys

- Ongoing experiments on cultivar evaluation, conducted under the Corporate Plan, 1999-2003, by Plant Breeding and Advisory staff
  - LVP 74 Phase II.
  - Phase III trials in Deniyaya Estate and Indola Estate.
  - An observational trial was initiated in Kiruwanaganga Estate using the same cultivar
  - A seedling experiment was initiated in Wrapitiya TI region of the Hambantota District (IL1a), to evaluate the regional suitability of nine selected seedlings from different seed gardens.

- Ongoing experiments conducted by different research disciplines with the assistance of the TRI, Deniyaya
  - Soil and Plant Nutrition Division. Evaluation of crop responses to different proportions of SA and urea. (In Kiruwanaganga Estate.)
  - Agronomy Division. Development of an economically viable system to eliminate or reduce the soil rehabilitation period for replanting, in the low country. (In Handford Estate.)

- Observational trial
  An observational trial, to evaluate the success of low-level pruning, was concluded.

- Trials on bush debilitation in the Deniyaya region
  Two collaborative experiments, Richiland Estate, Deniyaya
  - Source of planting material; Deniyaya plants vs Ratnapura plants.
  - Soil physical improvements; Agronomy, TRI Deniyaya.

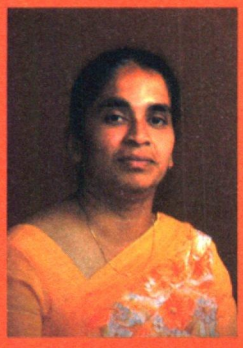
- Trials on specific problems
  - An experiment on the use of city solid-waste compost for young tea plants (SPND and TRI, Deniyaya).
  - Bush debilitation, Willie group (SPND and TRI, Deniyaya).

2. Model nurseries
   The model nurseries started last year, with the assistance of "Save the Children", have been successfully completed in the period, May-July. The TRI initiated a similar programme to establish 12 model nurseries in the Kotapola DS area, to motivate nursery owners to raise good quality plants.

3. Special tasks
   The Officer-in-Charge served in the Advisory Committee of the Southern Development Authority, in the Tea Development Council of the Matara region, and in the Committee for establishing a database for the tea smallholding sector.

4. Factory-based extension programme
   - The Advisory staff participated as resource persons for a factory-based extension programme, initiated by the TSHDA and the Tea Board.
   - Initial discussions were held to establish a network of factory-based Information Centres in Lumbini, Pasgoda and Uruwal Neptune tea factories.

Library



Ms S K Amunugama
Library Assistant

Progress Review

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

Library render its service to TRI staff, undergraduate and diploma students who doing their projects in TRI and on official request of out side libraries and people.

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

- Acquisition, collecting and maintaining the library materials
- Lending library materials
- Circulation of Contents pages of Current Journals
- Maintaining the News Clippings collection
- Photocopy Service
- Inter Library Loan Service

Acquisition

During the year 4619 book collection was expanded by 24 new books, as 17 purchase, 2 by exchange and 5 free of charge. Library procured 70 journals/serials through subscription, gift and exchange. It subscribed 30 foreign journals.

Services

During the year library has circulated 633 photocopied content pages and 295 articles respectively to the staff from current awareness journals . 883 news paper articles were sent to the Director. Under Inter Library Loan Service (ILL) 17 requests were received to the library from outside libraries and 15 articles were supplied. Only 11 articles were received from out side libraries for 26 ILL requests of TRI staff. 3336 papers were photocopied for TRI staff from bound periodical collection and other library materials.

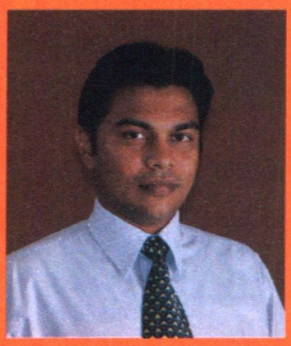
Other

seven publications were sent to Low Country Station library at Ratnapura and 6 publications were sent to Mid Country Station library, Hantana.

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

The Library books/journals were fumigated on 3rd July 2007, by the officers of Plant Protection Services Division, Department of Agriculture, Gunnoruwa using Phosphene gas, as the library books/journals were damaged by insect pest.

Publications and Publicity



Mr K P H Liyanage
B Sc (OUSL)
Publications / Publicity Officer

Staff Members

Ms A P V Kalyani
Stenographer (English)

Progress Review

The following are the publications issued in the year 2007

- Annual Report for the year 2006 (English)
- Annual Report for the year 2005 (Sinhala and Tamil)
- Detailed Annual Report for the year 2004
- Sri Lanka Journal of Tea Science (Volume 71, Part 2, September 2006)
- TRI Update (Volume 11, No.2, December 2006)
- TRI Update (Volume 12, No. 1, June 2007)
- Peer Review Report of the TRI
- A leaflet on Tea Seeds as Planting Material (Sinhala), (රෝපණ ද්‍රව්‍යයක් ලෙස තේ බීජ භාවිතා කිරීම)
- Reprints of three extension pamphlets on good agronomy practices (Sinhala), (තේ දළු නෙලීම, තේ තවාන් පාලනය, තේ පඳුරු කප්පාදු කිරීම)
- A sticker on New Tea Cultivars (Sinhala), (වැඩි අස්වැන්නකට නව තේ ප්‍රභේද)

TRI Update (Volume 12, No. 2, December 2007) was finalized and made ready for printing.

The Publications Unit serves in disseminating research findings of the Tea Research Institute, current trends in the tea industry and all other relevant information, both for the corporate sector and the small holdings, by handling all TRI publications. The Institute releases publications in Sinhala, Tamil and English.

The Publications Unit is the focal point for the proof-reading, editing and finalizing of the Institute's publications, and it also facilitates the Publications and Presentations Panel of the Institute.

In addition, the Publications Unit supports other Divisions and Units in printing their documents by using the digital duplicating machine. The Publications Unit has completed digital duplicating printing work amounting to Rs 87,737.00 within the year.

The Publications Unit has continued its service as the sales counter for TRI publications in the year 2007 as well. The total earnings for 2007 from the sale of publications were Rs 523,778.00.

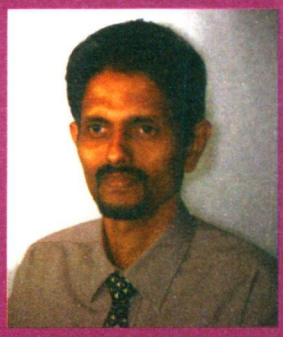
The Publications Unit has actively participated in the Institute's Advisory and Extension programmes, such as Crop Clinics, Experimental and Extension Forums and Regional Scientific Committee Meetings. Documents used in these programmes were printed internally, by the Publications Unit. The Unit has extended its sales at Crop Clinics, and was able to generate an income of Rs. 31,335.00 at the Crop Clinic held at the TRI Main Centre, Talawakelle, and Rs 78,005.00 at the Crop Clinic held at the TRI Low-Country Research, Advisory and Extension Centre, Ratnapura.

Mr K P H Liyanage assumed duties as the Publications/Publicity Officer, with effect from 24th September 2007. The position had been vacant for several years.

Although, the Publications Unit had a disorderly period, owing to unavoidable circumstances in previous years, the Unit was able to recover some of the shortfalls, specially delayed publishing, to a certain extent, by the end of the year. A Work Plan and an Action Plan for the year 2008 were prepared, in the consultation with the management of TRI, to boost the capacity of the Unit. This will lead to the proper functioning of the Unit in the year 2008.

Low country Research, Advisory and Extension Centre Ratnapura

Dr M A Wijeratne
B Sc (Agriculture) PhD
Officer in Charge
Senior Research Officer (Agronomy)



Staff Members

Mr G L C Galahitiyawa
Senior Research Officer
B Sc (Physical Science)

Mr S L D Amaratunge
Senior Advisory Officer
B Sc (Agriculture) M Sc

Mr S R W Pathiranage
Research Assistant
B Sc (Ruhuna)

Mr N P S N Bandara
Research Assistant
B Sc (Peradeniya)

Mr D W Vitana
Experimental Officer
NDT (Agriculture)

Ms K B M Sripalika
Experimental Officer
B Sc (Engineering)

Mr M G S Liyanage
Experimental Officer
B Sc (Agriculture)

Mr M A Chamindra
Experimental Officer

Ms E W T P Prematunge
Experimental Officer

Mr H S N Peiris
Experimental Officer
B Sc (Agriculture) M Phil

Mr E R Perera
Experimental Officer
Diploma in Agriculture

Mr P D Upali
Experimental Officer

Mr J H N Piyasundera
Experimental Officer
B Sc (OUSL), M Phil

Mr W M U A B Marapana
Experimental Officer
B Sc (Peradeniya)

Mr A K Prematunga
Experimental Officer

Progress Review

Research, Advisory and Extension Programmes

The research, advisory and extension activities of the Ratnapura Centre continued satisfactorily during 2007. The Advisory Division, in collaboration with Research Divisions, conducted 91 advisory visits, 233 group extension activities, one RSC seminar, 17 methods-and-results demonstrations, 21 training programmes, 9 nursery skill development programmes, 13 commercial nursery inspections and a Crop Clinic.

Around 2500 participants visited the Centre for the crop clinic on 11 December. They comprised small holders, and staff from 12 corporate sector estates. In addition, the Centre received more than 500 visitors during 2007.

The Centre was involved in testing more than 547 soil samples for pH. More than 850 publications were issued. The Centre participated in three exhibitions in the Ratnapura region. The Agronomy, Plant Breeding, Entomology and Technology Divisions conducted satisfactory field and laboratory experiments.

Mr A J Gamage
Experimental Officer
B Sc (Agriculture)

Ms B S N Vitana
Experimental Officer
Diploma in Agriculture

Mr A K Mudalige
Experimental Officer
Diploma in Agriculture

Mr K A D Mervin
Accounting Assistant

Mr K A S Kumarapperuma
Clerk/Typist

Ms P V G Karunanayake
Stenographer (English)

Mr J S K de Silva
Electrician
NCT (Electrical & Electronic)/Diploma in
Forman

Mr K Gunawardena
Work Supervisor

Ms H K Seetha
Accounts Clerk

Mr U W K Munasinghe
Plumber Mechanic

Mr N A Bowie
General Mechanic

Mr M A B de Silva
General Mechanic

Mr P D R de Silva
Driver

Mr P G Amaratunga
Driver

Mr C Senanayake
Driver

Mr Kapila Chaminda
Driver

Mr S S Sunil
Driver

Mr G V S Jayalath
Driver

Mr D A Lionel
Driver

Mr T A D Gamini
Driver

Mr M D Sarath
Guest House Keeper

Mr A G Samantha Jayasiri
Guest House Caretaker

Building and Layout Maintenance

Painting and roof repairs of staff quarters, and polishing and general cleaning of the Administration building and Circuit Bungalow, were continued. Internal and external colour-washing of Staff Bungalows, Nos. C/01, C/04, and D/02, was carried out. The garden gate and fence-posts were painted, and other maintenance operations of drains and terraces were done, prior to the crop clinic. Other day-to-day repairs and maintenance of buildings and layout were continued satisfactorily.

Electrical Maintenance

A telephone extension line was made to St Joachim Estate for internal communication. Electrical wiring for the extra electricity supply point in the Technology Division was completed.. Servicing and repairs of air conditioners, and the PABX telephone system, were done. The damaged concrete posts of the electricity supply line to bungalows on St Joachim Estate were replaced. A three-phase KWH-meter trough-fan motor was installed in the St. Joachim Factory. Other electrical maintenance of the buildings, quarters and scientific Divisions was continued satisfactorily.

Transport

Vehicle, registration No. GD/7647, was transferred to the Centre from the Talawakelle Main Centre as a replacement for the Pajero jeep, registration No. 32/1808, which was sent to the Main Centre. Repairs, general maintenance and servicing of the vehicles at the Centre were carried out satisfactorily.

Security

'Sharp International Security Service' took over security at the Centre with effect from 17 December, 2007.

Mid country Research, Advisory and Extension Centre
Hantana, Kandy

Dr A K N Zoysa
B Sc (Peradeniya), M Phil, PhD (Massey)
Officer in Charge
Senior Research Officer (Soils and Plant Nutrition)

Staff Members

Mr J C K Rajasinghe
Senior Advisory Officer
B Sc (Peradeniya) M Sc (Agric. Extension)

Mr K R W B Kahandawa
Extension Officer
B Sc (Peradeniya) M Sc (Organizational Management)

Mr H J M de Silva
Extension Officer
B Sc (Agriculture)

Mr W M S Wijayatunga
Experimental Officer
B Sc (Peradeniya) M Sc (Analytical Chemistry)

Ms S N Wijesekera
Experimental Officer

Ms Ajantha R Abeysekara
Experimental Officer

Ms P L K Tennakoon
Experimental Officer
B Sc (Agriculture) M Sc (Agricultural Microbiology)

Mr T M Sarathchandra
Experimental Officer
B Sc (Bioscience)

Mr H M U B Herath
Experimental Officer

Mr Kithsiri Palathanthrige
Work Supervisor (Senior)

Ms G A Shanthilatha Gunasekara
Accounts Clerk

Ms C N K Edirisinghe
Station Assistant

Mr A P D A Jayasekera
Experimental Officer

Mr R C A Jayasinghe
Driver

Mr P K Wijeratna
Driver

Mr K M T Seneviratna
Driver

Mr G Padmasiri
Driver

Mr W D J P Tilak Bandara
Driver

Mr W A D P M U Attanayake
Driver

Mr W M A B Weerawanni
Guest House Keeper

Progress Review

Research Advisory and Extension Programmes

The research programmes of the Agronomy, Entomology, Plant Breeding, and Soils and Plant Nutrition Divisions, are in progress. There are 28 long-term experiments managed by the Mid country Station.

Field days were conducted for smallholder groups from various parts of the region. Training programmes on the theoretical and practical aspects of good agricultural practices were conducted throughout the year for the Assistant Managers of the Elkaduwa Plantation Company Ltd. Educational training programmes were conducted for university students and NIPM trainees. Three undergraduate students (two from the University of Peradeniya and one from the University of Ruhuna) completed their research projects on soil fertility and plant nutrition, under the guidance of the Officer-in-Charge. Four trainees from NAITA have completed their on-job training in the Advisory Division of the Station.

Training workshops were held on cultural operations for smallholder groups who visited the Station. Two Regional Scientific Seminars were conducted to raise the awareness of estate Managers and Assistant Managers on the diversity of soils in the mid-country, and management practices related to them, and also on pesticide use in tea, and the maximum permissible residue limits (MRLs) of pesticides in made tea, including the importance of MRLs in securing markets for Sri Lankan tea abroad.

Four Regional Technical Extension Programmes were conducted, with the cooperation of the TSHDA, to cover both the Nuwara Eliya and the Kandy regions. The staff of the Station actively participated in the Crops Clinics held at Ratnapura and Talawakelle.

The Advisory Division participated in organizing the "Deyata Kirula" Exhibition held at the BMICH, Colombo. The Advisory Division continues developing its information-base system by collecting estate information from mid-country estates. The work on good agricultural practices, using live demonstration plots at the Station, is in progress. The Head of the Advisory and Extension Division, with the collaboration of the advisory staff of the mid-country Station, started a special project in July 2007 for developing a plantation-crop model to grow tea with coconut and rubber, at the Ambuluwawa Bio-Diversity Complex.

Extent

The extent as at 31st December 2007 is given below.

Type of land use	ha
Seedling tea	2.00
VP tea (mature)	5.50
VP tea (young)	3.50
Mother bushes	2.75
Nursery tea	0.20
Under Mana grass	0.50
Fruit trees	0.40
Coconut	0.81
Forestry	1.20
Marshy land	0.62
Buildings, gardens, paths and roads	5.77
Total	**23.25**

Crop

The green leaf harvested (kg) during the year 2007 is given below:

Month	Crop sold kg	Ratepaid Rs./kg	Total Rs.
January	1780	26.00	46,280.00
February	1373	28.00	38,444.00
March	1382	30.00	41,460.00
April	1642	33.90	55,669.76
May	2962	35.10	103,966.20
June	1536	32.29	49,597.44
July	1543	36.55	56,396.65
August	2228	36.60	81,544.80
September	1457	39.47	57,505.79
October	3126	41.42	129,478.92
November	2713	42.40	115,031.20
December	1825	43.29	79,004.25
Total	23,567		854,379.01

Income

No of VP cuttings sold	634,000
Income from sale of VP cuttings	Rs 234,025.00
No of VP plants sold	40,464
Income from sale of plants	Rs 485,568.00
Total crop harvested (kg)	23,567
Income from sale of green leaf	Rs 854,379.01
Guesthouse occupation charges	Rs 71,850.00
Soil testing (for pH) charges	Rs 19,200.00
Sale of TRI publications	Rs 42,100.00
Miscellaneous	Rs 12,095.00

Special Scientific Visitors

Prof. Kapila Dahanayake, University of Peradeniya, Peradeniya
Prof. U Samarajeewa, University of Peradeniya, Peradeniya
Prof. Srilal de Silva, Quality International Certification Service, Colombo 6
Mr Ivano Dilillo, Rome, Italy

Mrs Cora Fischer, Geneva, Switzerland
Mrs Lavelce Fotian, Geneva, Switzerland

Experiments by the Research Divisions
The details and results of the experiments are reported by the relevant Divisions, and only the experimental objectives and the sites of the field trials are given below.

- **Agronomy Division**
  - Effect of intercropping tea and coconut on productivity and land utilization (Citrus Estate).
  - Effect of surface application and incorporation of Gliricidia on soil properties and growth of tea (Ratwatte Estate).
  - Comparison of manual- and shear harvesting of tea.
  - Use of low dosages of herbicides in the management of weeds in young tea (New Peacock Estate).
  - Effect of earthworm casts on growth and yield of tea (Stelenberg Estate).
  - Demonstration of SALT hedgerows.
  - Effect of in situ application of Gliricidia on soil properties, yield and growth of tea (Giragama Estate).
  - Effect of bio-fertilizer inoculation on the growth of nursery plants (Hantana, Talawakelle and Ratnapura).
- **Entomology Division**
  - Screening of insecticides for managing scavenging termites.
  - Screening of insecticides for the control of Shot-hole Borer.
  - Screening of biological control agents for reducing Shot-hole Borer damage in tea.
  - Modifying potassium fertilization with a view to reducing Shot-hole Borer damage.
  - Studying the distribution pattern of Shot-hole Borer in Nayapana and Madulkelle Estates.
  - Management of nematode pests in tea.
  - Analytical services for estates in relation to nematodes.
- **Plant Breeding Division**
  - Evaluation of cultivars for the mid-country.
  - Development of seed stocks/varieties for the mid-country.
  - Controlled hybridization programme.
  - Use of nuclear-related techniques to improve tea cultivars.
  - Progeny trial on TRI 4004 and 4006
- **Soils and Plant Nutrition Division**
  - Estimating crop response to micro nutrients (Zn, B, Mn, etc.) at regional level (Greenwood and Madulkelle Estates).
  - Estimating crop response to macro nutrients (N, K, Mg, etc.) at regional level (Rangala and Midland Estates).
  - Farm-centered research on organic tea: soil-fertility studies (collaborative research project with Gami Seva Sevana).
  - Development of regional analytical laboratories for soil-, plant- and fertilizer analysis.
  - Providing laboratory analytical services to stakeholders in the region.

New Construction
- Colour-washing of quarters D 4 and D 7 were completed.
- Construction of an iron gate near the laboratory was completed.
- Repairing and tarring parts of the roads of the TRI campus were completed.
- Construction of a retaining wall near the guardroom was completed

Uva Advisory and Extension Centre
Passara

Mr T G N Mahinda
B Sc (Agriculture) M Sc (Agric. Extension)
Acting Officer in Charge
Extension Officer

Staff Members

Mr A M Karunasundara
Driver

Mr G Weerapperuma
Guest House Keeper

Progress Review

Advisory and Extension Activities	
Advisory letters issued	97
Advisory visits made to estates and smallholdings in Uva	60
Seminars/field days/training programmes for estates/small holders/schoolchildren	08
Regional seminars	02
Visitors, including planters/small holders/students	615
Soil samples tested for pH	624
Soil samples tested for organic carbon content	224
VP cuttings issued	144,710
No. of publications sold	125
Commercial Nursery Inspections	48

Hectarage (in ha) at the Centre as at 31 December 2007	
Mature tea in plucking	3.44
Mother bushes (old)	1.15
Young tea (experimental block)	0.30
ADB Mother Bush project	2.06
Buildings/roads	0.50
Forest/scrub/grassland	6.85
Total extent	**14.30**

Crop

Green leaf sold in 2007

Month	Sold (kg)	Price Rs/kg.
January	1135	25.29
February	1950	30.00
March	5007	33.38
April	2348	30.81
May	5447	29.73
June	3218	28.66
July	2791	33.23
August	2664	33.63
September	2712	34.19
October	3493	37.12
November	3355	35.85
December	2682	39.15
Total	36995	

Income (Rs)

Income from sale of VP cuttings	44,913.00
Income from sale of green leaf	1,210,842.62
Soil analytical charges	64,290.00
Sale of publications	14,805.00
Guesthouse accommodation charges	13,600.00
Other income	18,515.00
Total income	1,366,965.62

Check-roll workers (as at 31 December 2007)

No. of check-roll workers	21
Out-turn (women)	45%
Out-turn (men)	55%

Field Trials

- Demonstrations of shear-/hand plucking in Field No. 01.
- Trial on different fertilizer mixtures (U 709 vs VP/Uva 945) in Field No. 02.
- UVP 9 and UVP 10 PPPB trials are in progress in Field No. 04.
- Up-keep of TRI 5000-series Phase III Trial in Field No. 02.
- Up-keep of germplasm in Field No. 03.
- Two seedling trials in Fields Nos. 03 and 04 are in progress.
- Up-keep of grafted plants block in Field No. 01.
- Integrated weed management trial in Field No. 03.

- Trial on pesticide residues (Entomology Division) in Field No. 02.
- A trial was initiated at the Centre by the Entomology Division to evaluate TRI 300- and 400-series cultivars for tolerance to nematodes. The trial is ongoing.

Special Uva Problems

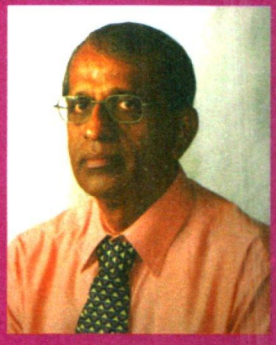
- Sulphur-deficiency symptoms were observed in a few smallholdings in Passara and Demodara. Subsequently this deficiency was confirmed by soil-testing.
- Severe manganese-deficiency symptoms were also detected in the Madulsima area (Verellapatne Estate).
- Compared to 2006, a significant drop in annual rainfall was reported. (in the year 2007: 2007 mm; in the year 2006: 2810 mm). Monthly distribution of the rainfall is also not well distributed.
- The Uva region is categorized as a semi-dry zone, and such unfavourable weather is to be expected in the future too. More research on rainwater harvesting in different locations in the Uva region is therefore of the utmost importance.

Capital Items

One new, 21" colour television set was received for the Guest House.

Southern Province Advisory and Extension Centre
Kottawa, Galle

K D Dahanayake
National Diploma in Agriculture Engineering
Officer in Charge
Senior Advisory Officer



Staff Members

S P Rathnayake
Graduate Extension Officer
B Sc (Agriculture) MBA

P K Jayawickrama
Experimental Officer

P V D Chandrakanthi
Accounts Clerk

M Sarath
Field Supervisor

P S Kulasiri
Field Supervisor

K M J Prasanna
Circuit Bungalow Keeper

H I Meththananda
Driver

Progress Review

General

- The uprooting of old tea and land preparation were completed in Field No. 6 (entrance field, approximately two ha), leading to the production of a model estate with new cultivars.
- The Low-Country Live-Wood Termite resistance trial was successfully established in Field No. 3.
- The renovation of the drivers' room, and the fixing of a new set of curtains, in the Guest House were completed.
- Fifteen check-roll workers were recruited to strengthen the workforce.
- Sharp Security Services took over the responsibility of security in the Centre's premises.

Mother Bush Project

An approximately 2.5 ha mother-bush area is being used for issuing new cultivars to stakeholders.

Special Assignments

In addition to his normal duties, Mr KD Dahanayake shared the responsibility of inspecting the tea fields at the Walahanduwa TRI.

Labour Force

Number on check-roll	53
Average outturn	42

Land Use Information (in ha)

VP tea, mature	5.0
Uprooted for mana planting	2.0
VP tea, young, ADB project	5.0
Nursery tea	1.0
Seed-garden tea	1.0
Under rehabilitation (Guatemala)	2.0
Experimental trials	1.0
Coconut, fruit trees and germplasm	1.5
Forestry	7.3
Buildings, gardens and roads	9.8
Total extent	35.6

Green Leaf Harvested in 2007

Month	Sold (kg)	Rate (Rs/kg)	Total Income (Rs)	
January	1114	35.662	39727.47	
February	2444	37.212	90946.13	
March	2122	39.036	82834.39	
April	2596	41.425	107539.30	
May	4868	43.268	210628.62	
June	3916	43.677	171039.13	
July	4608	48.000	221184.00	
August	3771	49.091	185122.20	
September	3585	49.422	177177.87	
October	3242	54.108	175418.14	
November	2852	53.007	151175.96	
December	2465	56.046	138153.39	
	37583		1750946.60	

Total Rainfall 3140.3 mm

Income (Rs)

Income from sale of green leaf	1,750,946.60
Income from sale of 384,725 VP cuttings	136,495.00
Income from sale of 5,450 VP plants	68,750.00
Income from sale of publications	28,900.00
Income from testing 387 soil samples for pH	18,040.00
Miscellaneous income	26,662.00
Total Income	2,029,793.60

Advisory and Extension Services

Advisory Correspondence

The Advisory and Extension staff made 427 advisory correspondences in the year 2007.

Routine Services

- Advisory Visits
  The Advisory and Extension staff made a total of 34 advisory visits, including visits to smallholdings and routine visits to estates.
- Commercial Nursery Inspections
  The Advisory staff were not involved in commercial nursery inspections.

Training Programmes and Seminars

Forty-three seminars, training programmes and field days were conducted at the Kottawa Centre and at other venues. The target groups were tea smallholders, green-leaf suppliers and factory owners.

Video Programmes

Thirty-three video shows on plucking, land preparation, conservation of tea soil, and pests and diseases of tea, were presented at the Kottawa Centre and at other venues.

Visitors and Students

- The number of visitors coming to the Centre for advice, and for collecting VP shoots, were as follows:

Estate management and smallholders	875
University and Diploma students, and others	246

- Six Advanced-Level students obtained information and completed their project reports successfully, under the supervision of Mr SP Rathnayake.
- One student from the NIPM was supplied with information relating to tea nursery management, and completed his report successfully under the supervision of Mr SP Rathnayake.
- Three students attached to the Colombo and Sri Jayawardenapura Universities were supplied with information and guided to completing their Bachelors Degree theses under the supervision of Mr SP Rathnayake.

RSC Activities

A RSC Seminar was held at Talgaswella Estate.

Crop Clinics

The staff attended two crop clinics conducted at the TRI Talawakelle and Ratnapura.

Awareness Programmes for Estate Personnel and Smallholders

The Advisory and Extension staff organized 10 such awareness programmes.

Informal Discussions

Sixty informal discussions were held for finding solutions to various problems, such as the high cost of production, the labour shortage, damage to leaf in transport, the control of pests and diseases, etc.

Meetings Attended

A total of 37 meetings were attended, including HODs', the Advisory Officers' forum, the E & E, DDC, and Advisory and Research linkage meetings, etc.

Testing of Soil Samples

Three hundred and eighty-seven soil samples were tested for their pH values.

Advisory Publications

About 898 Advisory and Extension publications were sold or distributed gratis.

Sale of VP Cuttings

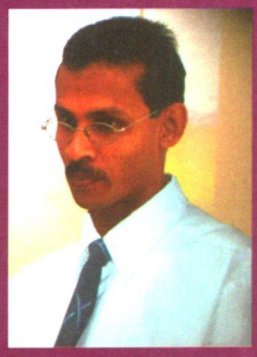
A total of 384,275 VP cuttings were distributed. The cultivars concerned were TRI 3025, 3055, 3069, 4006, 4042, 4049, 4052, 4053 and 4054.

Ongoing Trials , Experiments and Observations

- Plant breeding, TRI 5000 series, LVP 37, at Field No. 03.
- Plant Breeding, Low-Country Live-Wood Termite resistance trial, at Field No. 03.
- SPND, U 709 vs VP/LC/880 trial, at Field No. 04.
- Nematode population monitoring trial, at Field No. 04.
- Intercropping observation, tea and coconut, at Field No. 02.
- Intercropping trial, tea and coconut, at Citrus Estate.
- Shear plucking, observation block

Deniyaya Advisory and Extension Centre
Deniyaya

K G J P Mahindapala
B Sc (Hons) (Agriculture)
Officer in Charge
Advisory Officer



Staff Members

Mr C J Liyanarachchi
Extension Officer
B Sc (Agriculture)

Mr O W Jayawardana
Station Assistant

Progress Review

1. General

Mr. K G J P Mahindapala Advisory Officer has been confirmed in the post of Officer-in-Charge TRI Advisory and Extension Centre, Deniyaya.

2. Establishment of new station

The construction work of the new station has been commenced in the land given by Deniyaya Estate.

3. Income

No of cuttings sold	223,750
Sale of cuttings	Rs 89,500.00
No of plants sold	Nil
Sale of plants	Nil
Crop harvested (Kgs)	30,360
Sale of crop	Rs 1,366,048.67
Average price (Kg/Green leaf)	Rs 44.995
Miscellaneous income	Rs 17,252.62
Total Income	Rs 1,472,801.62

4. Experiments/Surveys

- On- going Experiments conducted under Corporate Plan 1999-2003 by Plant Breeding and Advisory staff on cultivar evaluation.
  - LVP 74 phase II:.
  - Phase III trials in Deniyaya Estate and Indola Estate
  - The observational trial commenced in Kiruwanaganga estate, using the same cultivar
  - A seedling experiment was commenced in Wrapitiya TI region of Hambantota district (IL1a) to evaluate the regional suitability of 9 selected seedling from different seed gardens.
- On going Experiments conducted by different research disciplines with the assistance of TRI-Deniyaya.
  - Soil and plant Nutrition Division: Evaluation of crop response for different proportion of SA and urea. (In Kiruwanaganga Estate).
  - Agronomy Division: Development of an economically viable system to eliminate/ reduce the soil rehabilitation period in replanting in the low country. (Handford Estate)
- Observational trail
  A observational trial to evaluate the success of a low level pruning was concluded.
- Trials on bush debilitation in Deniyaya region
  - Two collaborative experiments Richiland Estate, Deniyaya
    1. On source of planting material – Deniyaya plants vs Ratnapura plants.
    2. On soil physical improvements. (Agronomy TRI Deniyaya)

- Problem Specific Trials
  - Experiment on use of city solid waste compost for young tea plants (SPND & TRI Den)
  - Bush debilitation in Willie group (SPND & TRI Den)

5. Advisory and Extension Activities

- Advisory correspondence 311
- Advisory & Extension visits
  Estate Sector: 51
  Small Holding Sector: 49
- Extension Research Visits, Inspection Visit & Collaborative research visits: 41

6. Visitors to the station

Estate sector	102
Small holders	582
Students/ School Children	77
General Visitors	75
Total	836

7. Advisory and Extension Programmes

- Regional Scientific Activities:
  1 RSC seminar
  1 TOT programme
- Field days, Seminars, Demonstration and Awareness programmes: 41
- Model Nursery:
  The model nurseries stated in the last year with the assistance of "Save the Children" have been successfully completed in the period of May- July. The TRI has again initiated the same programme to establish the 12 model nurseries in Kotapola DS area to motivate the nursery owners to raise a good quality plant in their nursery.
- Newspaper Articles 5
- Informal Discussion:
  53 with planters
  195 with small holders
  9 with students
- Inquires through Telephone seeking the advices on tea 315
  Informal Contacts 128
- commercial nursery inspection : 29
- Exhibition: 1 Mahapola exhibition at Morawaka Central College
- Meeting attended by the Advisory staff:
  Internal -32
  External -37
- Soil analysis for pH: 237

- Advisory publication distributed:
  Free issuing: 138
  Priced Publication: 349
- Distribution of Planting Materials (Cuttings 223,750
  From ADB Mother Bush area 175, 250
  From other mother bush area 48,500

8. Special Task

Officer-in-charge served in SDA Advisory committee, TSHDA Regional tea development council and data based committee of Tea small holding sector. .

9. Factory basis Extension Programme.

- Advisory staff participated as resource persons for the factory base extension programme initiated by TSHDA and Tea Board.
- TRI initiated a separate factory base extension net work in Lumbini Tea factory and Uruwal tea factory.

St. Coombs Estate
Talawakelle

Mr J U Hulangamuwa
Superintendent

Staff Members

Mr D H Jayatillake
Chief Clerk

Mr N G L Dayatillake
Clerk

Ms T G S Chandrakanthi
Clerk

Mr R W Kitnasamy
Clerk

Ms H M Badra Jayathilake
Junior Assistant Clerk

Mr E M Dayaratne
Head Factory Officer

Mr H M R Kuladasa
Junior Assistant Factory Officer

Mr S M Sunil Shantha
Junior Assistant Factory Officer

Mr A D C Premalal
Junior Assistant Factory Officer

Mr P Mohotti
Junior Assistant Factory Officer

Mr Nimal De Silva
Field Officer

Mr N Illangeswaran
Field Officer

Mr I W M D Alahakoon
Junior Assistant Field Officer

Mr S Suresh
Junior Assistant Field Officer

Mr S D Perera
Junior Assistant Field Officer

Mr S Fernando
Estate Medical Practitioner

Mr K Ramesnat
Estate Medical Practitioner

Mr D Puniyamoorthy
Welfare Officer

Mr K Selvaraj
Driver

Mr S Christopher
Driver

Mr T Ramanathan
Driver

Mr R Udayakumar
Driver

Progress Review

Weather and Rainfall

Rainfall of 1,727.3 mm was recorded on 206 wet days, as against 2,495.3 mm on 184 days in 2006.

Field Work and Cultivation

1. Hectare statement as at 31st December 2007

	St.Coombs	Lamiliere	Total
Old seedling tea in bearing	7.60	2.00	9.60
V.P. tea in bearing	80.72	45.50	126.22
V.P. tea immature	-	-	-
ADB Project	11.39	2.62	14.01
Replanting	1.00	-	1.00
Nurseries	1.20	0.10	1.30
T R I experimental area	2.50	-	2.50
Total in tea	104.41	50.22	154.63
Labour housing	2.09	-	2.09
Ravines and grass land	31.00	1.00	32.00
Buildings, roads, Workers' gardens, etc.	34.28	14.70	48.98

Total	171.78	65.92	237.70

2. Crop and Yield

	2007		2006	
	Crop	Yield	Crop	Yield
	(kg)	(kg/ha)	(kg)	(kg/ha)
St.Coombs	202,290	2,290	240,111	2,688
Lamiliere	107,384	2,261	129,582	2,728
Total	309,674	2,280	369,693	2,702
Bought leaf	9,008	-	8,784	-
Grand Total	318,682	2,280	378,477	2,702

A yield of 2,280 kg/ha was recorded for the year 2007

3. Cultural Operations

The following fields were pruned during the season.

Upper Division	Field Nos. 1A, 3B, 6B
Lower Division	Field Nos. 11A, 11B, 15
Lamiliere Division	Field Nos. 5, 6, 9A, 9B

The Nitrogen /Yield Replacement ratio was 12.05.

Uprooted 1.00 ha. in St Coombs, Lower Division, Field No.13 for replanting in 2009.

4. ADB Mother Bush Project

467,100 VP shoots of cultivars TRI 3000- and 4000-series were issued to tea smallholders and to the corporate sector.

Factory and Manufacture

1. Top Prices

Silver Tips teas were sold at Rs 9,000.00/kg.

2. Machinery

The following machines were installed in the factory.

1. Fibre Extractor - Walkers & Sons Co. Ltd, Bandarawela
2. Rotovane 8"– Colombo Commercial Company Ltd, Hatton
3. Rotovane 8" - Colombo Commercial Company Ltd, Hatton
4. Aerator Ball Breaker (Stainless Steel) - Colombo Commercial Company Ltd, Hatton

General

Messrs. Forbes & Walker Tea Brokers (Pvt) ltd continued auctioning St Coombs teas.

Trading Results

The Estate should make a profit of Rs 10,319,812.98 for the season.

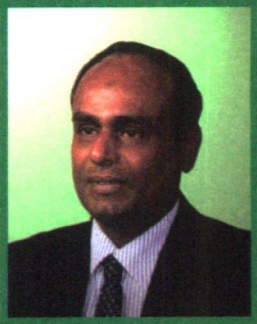
Labour Wages

The labour wages were increased with effect from 01st November, 2007.

	Previous	Current
Basic wage	Rs 170.00	Rs 200.00
Fixed Price Share Supplementary	Rs 20.00	Rs 20.00
15% EPF & ETF	Rs 25.50	Rs 30.00
Attendance Incentive not less than 75% of the days worked: offered per month	Rs 70.00	Rs 70.00

St. Joachim Estate
Ratnapura

Mr Ananda Weerasinghe
Superintendent



Staff Members

Ms N D A Gunawardena
Senior Assistant Clerk

Ms K P Kamanie Udayakanthi
Clerk

Mr M W Jayasekara
Store Keeper / Clerk
Diploma in Agriculture

Ms Nilani Koralage
Junior Assistant Clerk

Mr M Kanagaratnam Pulle
Estate Medical Practitioner

Mr V Ariyarajah
Junior Assistant Field Of?cer

Mr P G Jayantha Senadeera
Junior Assistant Field Of?cer

Mr P H G Kamalanath Jayaratne
Senior Assistant Factory Of?cer

Mr Sarath Kumara Edirisinghe
Assistant Factory Of?cer

Mr Janaka Rajapaksha Yapa
Junior Assistant Factory Of?cer

Mr H T Keerthi Nihal
Junior Assistant Factory Of?cer

Mr D A Janaka Pushpakumara
Junior Assistant Factory Of?cer

Mr W Nimal Wasantha Perera
Junior Assistant Factory Of?cer

Mr M D Rohan Premalal
Junior Assistant Factory Of?cer

Mr P P Wickramaratna
Junior Assistant Factory Of?cer

Mr S H Ariyadasa
Driver

Mr K B Siripala
Driver

Mr A V Somaratne
Lorry/Tractor Driver

Mr M Anura Jagath Kumara
Lorry/Tractor Driver

Progress Review

Hectarage as at 31st December 2007

	ha
Mature tea	48.34
Major infilled areas	1.18
Nursery	1.58
Land under coconut (TRI)	3.89
ADB Project	30.00
Land under paddy	8.74
Inter Crop - tea and rubber	3.68
Rubber	7.12
TRI buildings and experimental areas	11.82
	116.35
Other Lands	
Acquired by Government Buildings/roads/ravines	25.63
Total extent	141.98

Crop (made tea, kg)

The production by St.Joachim Estate in 2007, compared to the previous year, was as follows;

Year	Estate crop (kg)	Bought crop (kg)
2006	59,987	502,678
2007	48,530	313,549

The production on the estate registered a decrease of 11,457 kg or19.09 %, in comparison to the previous year, owing to a severe drought in the area which prevailed for a period of more than four months, from January to April 2007.

Bought Leaf

The bought leaf manufactured at the St Joachim Factory showed a decrease of 189,129 kg or 37.62%, in comparison to the previous year owing to the severe drought which prevailed in the area.

The decrease in bought leaf intake has also been due to competition with the many private tea factories in the area for bought-leaf collection, and to the inability to match the facilities provided to suppliers by these private factories. .

Prices

All the teas produced at the St Joachim factory were sold at the Colombo auctions in the low-grown catalogue. Messrs. Bartleet and Co. Ltd. and Forbes and Walker Tea Brokers (Pvt) Ltd. shared equally in the sale of the teas.

The nett sale average to the end of December 2007 was Rs.275/48, in comparison to 2006 when the nett sale average was Rs. 175/90. There was thus an increase of Rs.99/58 during this year.

The working of St Joachim Estate resulted in a trading profit of Rs. 7,547,338/- as at the end of December 2007, compared to a trading profit of Rs.120,690/- in 2006. The increase in profit between 2006 and 2007 is therefore Rupees Seven Million, Four Hundred and Twenty Six Thousand, Six Hundred and Forty-eight (Rs 7,426,648/-), which is the highest profit achieved over the past six years.

Infilling of Vacancies

Eight thousand plants were infilled in Field No. 2 F of the Estate.

Cultural Operations

Pruning, mossing and ferning, draining, fertilizing and weeding operations as per the estimates were carried out. No major pest and disease problems were encountered. There was a severe drought at the beginning of the year, which affected estate production and bought leaf-growers' production.

Nursery

The supply of planting materials to small holders in Ratnapura District continued this year as well. The sale of planting material, compared to the previous year, was as follows.

Year	Cuttings	Proceeds (Rs.)	Plants	Proceeds (Rs.)
2006	910802	366202.00	29955	359460.00
2007	314940	629880.00	21900	295650.00

Capital Work

The following major capital work and purchases were completed within the year.

- The automation of roller No. 05.
- The purchase of an Elk Arc welding plant.
- The purchase of five dhool carts.
- Computerizing of the accounting system, payroll, etc.

Staff Vacancies

Two vacancies for Junior Assistant Clerk have existed since 15 November 2005.
The Chief Clerk, Mr W M L M Perera, retired on 18th November 2006 and worked for a one-month period on a contractual basis, up to the end of 2006. Presently the Senior Assistant Clerk, Mrs. N D A Gunawardena, performs the duties of Chief Clerk.

Table 1. Working accounts of St Joachim Estate for 2007 in comparison with previous years

Year	Total crop sold (made tea, kg)		Yield (made tea kg/ ha)	Net Sale Average Rs/kg	Estimated COP Rs/kg	Actual COP Rs/kg	+ Profit - Loss (Combined) Rs.
2001	609,732	#66,459	1140	137/23	89/48	89/13	(424,423.00)
2002	658,619	65,071	1358	147/84	96/26	100/56	(1,306,425.00)
2003	648,692	62,484	1293	143/37	130/09	93/46	155,325.00
2004	585,486	56,059	1160	177/12	164/74	168/69	2,637,456.00
2005	574,284	58,336	1251	180/12	165/97	180/02	(68043.42)
2006	471923	55172	1273	175.90	176/44	180/03	120,690.18
2007	362079	48530	1004	275.48	193/95	262/59	7,547,338.00

^Bought crop made tea
Estate crop made tea

Table 2. Monthly yield (kg/ha), rainfall, and average "N" applied from 2002 to 2007; St Joachim Estate

Month	2002	2003	2004	2005	2006	2007
January	102	106	79	113	108	98
February	81	88	71	65	98	63
March	109	105	89	107	122	55
April	109	131	117	126	124	76
May	127	116	90	107	106	90
June	130	112	111	106	104	104
July	116	124	103	107	120	103
August	130	95	103	115	101	97
September	104	100	92	108	101	79
October	113	112	106	96	100	89
November	105	107	104	104	86	99
December	85	97	94	95	102	80
Total	1358	1293	1159	1249	1273	1004
Total rainfall (mm)	3194.8	3984.6	3914.3	3511.5	3927.4	3312.90
No. of wet days	206	227	216	189	192	170
Average "N" (kg/ha/yr)	162	124	127	121	129	110

Administration Division

Ms Anusha Sabanathan
B Sc (Hons) Jaffna
Acting Deputy Director (Administration)
Administrative Officer

Staff Members

Mr K G Piyasena
Public Relations/Welfare Officer

Mr W P A N Jayasinghe
Chief Clerk

Ms S Shanmuganathan
Stenographer (English)

Mr K R M Priyantha
Clerk/Typist

Ms W M G R Jayasinghe
Clerk/Typist

Ms W M S R Wanasinghe
Clerk/Typist

Ms R M D K Ratnayake
Clerk/Typist

Ms C Jeyaram
Clerk/Typist

Mr I W Nihal Kumara
Office Attendant

Mr S Dharmalingam
Office Attendant

Mr R M K Dias
Hostel Caretaker

Mr R M B D Ratnayake
Circuit Bungalow Keeper (Colombo)

Stores

Mr K D H Pathirana
Stores Executive

Mr K T U Kulatunga
Stores Assistant

Mr H P W Gunasekara
Stores Assistant

Purchasing Unit

Mr B Tilakaratna
Purchasing Officer

Mr P D S de Silva
Clerk/Typist

Internal Audit Unit

Mr R Kariyawasam
Internal Auditor

Mr P S Wickramasinghe
Internal Audit Officer

Ms N C Jayaweera
Internal Audit Clerk

Mr W N K I Ariyaratne
Internal Audit Clerk

Progress Review

1. Compensation and Implementation of Circulars on Salary Revision

The salary revision recommended by the National Salaries & Cadre Commission was implemented as speci?ed in the Management Services Circular No. 30, dated 22nd September, 2006. Accordingly, employees were re-grouped according to the previous salary scales without granting percentage increases; that is, different salary scales were broadly re-grouped according to factors such as entry quali?cations, nature of duties assigned to the post, level of responsibilities, and the positions held in the organizational structure.

The anomalies created after the implementation of MSC 30 were discussed with the of?cials of the National Salaries & Cadre Commission, and resolved to a certain extent.

2. Scheme of Recruitment for Tea Research Institute

As proposed by the National Salaries & Cadre Commission, the Scheme of Recruitment for the Tea Research Institute was re-drafted so as to ful?l the conditions of the proposed salary restructuring, without affecting the current status of the employees. This exercise was completed as a common task for all four Research Institutes: the Tea Research Institute, the Coconut Research Institute, the Rubber Research Institute and the Sugarcane Research Institute. The ?nal draft of the Scheme of Recruitment was submitted to the National Salaries & Cadre Commission for their concurrence. The revised salary structure has been formulated so as to provide avenues for schemes of promotion, based on performance.

The organizational structure of the Institute was also prepared and submitted to the National Salaries & Cadre Commission, in accordance with the Scheme of Recruitment.

Engineering Unit

Mr T Vijayakumar
Resident Engineer
B.Sc (Engineering)

Mr J G Gamage
Filter Plant Assistant

Mr W C K Fernando
Chief Plumber Mechanic

Ms Ramani de Silva
Clerk/Typist

Mr C J B Abeykoon
Work Supervisor

Mr P T Perera
Clerk/Typist

Mr U D W Ratnasiri
Filter Plant Attendant

Mr K A F Dharmadasa
Assistant Plumber Mechanic

Mr J M Jothipala
Mason

Mr K Devasagayam
Mason

Mr R Jeyaraj
Carpenter

Telephone Exchange

Mr K M Seneviratna Banda
Telephone Operator

Ms P K N Damayanthi
Telephone Operator cum Receptionist

Mr S Karuppiah
Telephone Linesman

Electrical Unit

Mr U A Wickramasinghe
Electrical Foreman

Mr R W Rengasamy
Electrician

Mr M J R K Bandara
Electrician

Motor Garage

Mr G G E H Gamage
Chief Motor Mechanic

Mr W G Wijeratna
Motor Mechanic

Transport Unit

Mr M L H Perera
Transport Officer

Mr S H Chandrasena
Clerk/Typist

Mr S Bastian
Driver Class I

Mr K B V Piyasena
Driver Class I

Mr P A S L Luxman
Driver Class I

Mr P Sengamali
Driver Class I

Mr W A D P M U Attanayaka
Driver Class II

Mr L Murugesu
Driver Class I

Mr M Kaliyaperumal
Driver Class II

Mr W G Seneviratna
Driver Class II

Mr R M N Prematilake
Driver Class II

Mr Ranjan Gunasekara
Driver Class II

Mr Gamini de Silva
Driver Class II

Mr W S G W Perera
Driver Class II

Mr M Maradamuttu
Driver Class II

Mr K B V U N Gunasena
Driver Class II

3. Staff Strengthening and Motivation

- **Staff Recruitments**

1.	Mr S R P Indrakeerthi	Deputy Director (Administration) (4th May; *served only for two months*)
2.	Mr T Vijeyakumar	Resident Engineer (10th September)
3.	Mr K P H Liyanage	Publications/Publicity Officer (10th September)
4.	Mr V G A Vishvajith	Technical Assistant (01st November)
5.	Mr D A A D Athukorala	Technical Assistant (01st November)
6.	Mr Y G S C Bandara	Technical Assistant (01st November)
7.	Ms K W N Nadeeshani	Technical Assistant (01st November)
8.	Mr R B N Shankapriya	Technical Assistant (01st November)
9.	Mr D G N P Karunajeewa	Technical Assistant (01st November)
10.	Mr H K K Deshapriya	Technical Assistant (01st November)
11.	Mr H M S P Heenkenda	Technical Assistant (01st November)
12.	Mr M D Sarath	Guest House Keeper (01st November)
13.	Mr G Weerapperuma	Guest House Keeper (01st November)
14.	Mr W M Abeybandara	Guest House Keeper (01st November)

- **Staff Promotions**

Grades I & II	06 Scientific officers and 01 Administration
Grades III to V	25 officers (both Scientific and Administration)

- **Human Resource Development Activities**

a) Staff Training

Overseas Short-term Training and Conferences

- Dr I S B Abeysinghe, Director TRI, in India, from 05th to 09th February, to follow short-term training on Leadership Skills for Top Management.
- Dr A M T Amarakoon, Head, Biochemistry Division, attended a meeting of the European Tea Committee's International Working Group on Pesticides, from 07th to 08th May, in Hamburg, Germany.
- Dr (Mrs) M T K Gunasekara, Head, Plant Breeding Division and Mr K Raveendran, Chemical Engineer/Acting Officer-in-Charge, Technology Division, followed a Management Development Programme in Tea Plantation Management, from 12th June to 09th July, at the Kothari Agricultural Management Center, India.
- Mr P K P Muthukumarana, Experimental Officer, Biochemistry Division, followed an Advanced Course in Tea Tasting and Quality Assurance, from 06th September to 30th November, at the Kothari Agricultural Management Center, India.
- Dr (Mrs) M T K Gunasekara, Head, Plant Breeding Division, attended an International Short Course in Agricultural Biotechnology, from 09th to 21st September, at the Michigan State University, U S A.

- Mr K R W B Kahandawa, Extension Of?cer, followed an Advanced Course in Computer Applications for Plantations, from 01st October, 2007 to 31st January, 2008, at the Kothari, Agricultural Management Center, India.
- Dr L S K Hettiarachchi, Head, Soil and Plant Nutrition Division, and Mr K M Mewan, Research Of?cer, Biochemistry Division, participated in and presented research papers at the 03rd International Conference on O – CHA (Tea) Culture & Science, in Shizuoka, Japan, from 02nd to 04th November.

Local Training

Seminars

- Two of?cers from the Administration Division followed local training on administrative functions and human development.
- A one-day seminar on the Art of Decision Making was organized by the Institute and conducted by Dr Errol Weerasinghe.

Workshops

A one-day workshop for all staff, on administrative regulations, was organized at the Institute

b) Succession Plan

As per PED Circular No. 44, a succession plan has been drawn up to ?ll the vacancies in senior management and other key positions.

4. Labour Issues

Compensation to Deniyaya workers

The proposed voluntary retirement scheme for the workers at the Deniyaya Station was implemented and paid, after a Tri-Partied Agreement was entered into.

5. Court Cases

Supreme Court and Court of Appeal Cases

- The Supreme Court Fundamental Rights application ?led by Dr M T Ziyad Mohamed, former Director, Tea Research Institute, against the former Chairman of the TRB and 16 other respondents was concluded on 31st October.
- The Writ Application ?led by Collettes Security Services (Pvt) Limited, for interim relief against the Tea Research Institute, was dismissed by the Court of Appeal on 14th December.

6. Bond Defaulters

Legal action has been initiated against bond defaulters. As a result, two of the defaulters (Dr T S Gunasekera and Ms R M S S Rajapakse).have initiated payment of the bond value in installments.

7. Land Matters

- **Lameliere Division, St Coombs Estate**

  The title deed for the Lameliere Division land was obtained from the Land Reform Commission. Action has been taken to evict the encroacher, Ms Malini Jayasekera, from Lameliere Division.

  Legal action has been taken to recover the rental due from Mr Dean, the lessee of the Lameliere factory and surroundings, which were leased out in 2003.

- **Deniyaya, Diyadawa Estate**

  The Diyadawa Estate was handed over by the Institute to the Sri Lanka State Plantations Corporation.

  Land from Deniyaya Estate, 2.25 hectares in extent, has been released by Talawakelle Plantations for the purpose of constructing an office-building complex and quarters for the Institute.

- **Walahanduwa Laboratory Complex**

  Action has been initiated for an outright purchase of the Walahanduwa Laboratory Complex from the Sri Lanka State Plantations Corporation, based on government valuation.

8. Structural Development of the Institute

- **New Assignments**

  Work undertaken at the Head Office and Sub-Stations

  - Construction of the Advisory and Extension Centre, Deniyaya
  - Construction of the Pump House at Talawakelle
  - Replacement of PVC gutters and down-pipes at the SPND Laboratory, Walahanduwa.

- **Special work attended to**
  - De-silting of the TRI reservoir during the period of the water crisis
  - Cleaning of the filtration plant, and sedimentation and storage tanks, at different locations
  - Repairs to main inlet pipe line at the filtration plant
  - Construction of septic tank and manholes for Duke's Bungalow
  - External colour-washing of administration and laboratory buildings is in progress
  - Erection of 25 nos. roof windows at the tea field of the Plant Physiology Division.
  - Renovation of stores in the laboratory of the Entomology Division

9. Procurement Activities

Major Procurement

- Purchase of 02 nos. double-cabs for the Institute at Talawakelle
- Purchase of laboratory equipment (foreign purchases with DPC approval)

Awarding of Bids

- Construction of the Deniyaya office complex and quarters was awarded to the lowest bidder, M/s N K S Constructions.
- Security services for the Institute was awarded to the third lowest bidder, M/s Sharp International Security Services (Pvt) Limited.
- Insurance coverage for the Institute was awarded to the lowest bidder, M/s Ceylinco Insurance Company Limited.

10. General

- **Staff Turnover during the year 2007**

Retirements

1. Mr T A D Udayakumar	Driver (15th February)
2. Mr P Ranaweera	Driver (30th April)
3. Dr A Anandacoomraswamy	Deputy Director Research (P) (22nd August)
4. Mr K Devasagayam	Mason (9th December)

Resignations

1. Mr K M W Dissanayake	Painter (6th January)
2. Mr M Ratnayake	Research Officer (01st March)
3. Mr M A J S Fernando	Extension Officer (31st May)
4. Mr S R P Indrakeerthi	Deputy Director (Administration) (17th July)
5. Dr P A N Punyasiri	Senior Research Officer (4th September)
6. Mr C P Malawige	Extension Officer (22nd December)

Vacation of Post

1. Mr A Shanmugaraja	Driver (29th August)

- **Water Crisis at the Institute**

Owing to the drought prevailing, the water level of the Institute's reservoir at Talawakelle decreased drastically and water supply had to be limited, thereby restricting the functions of the Institute. Only essential services were carried out between 31st May and 25th June. Thereafter as a corrective measure the reservoir was de-silted.

After the water supply became normal, steps were taken to avoid such situations in the future by allocating funds for the construction of 02 deep wells.

- **Board of Survey**
  Action was initiated to appoint an authorized officer for the Board of Survey to ensure the progress of its work.

- **Amendment to the TRB Act**
  The Tea Research Board Act No. 52 of 1993 was amended, and a Supplementary Act No. 43 of 2006 was approved by the Cabinet.

Finance Division

Ms D M R Dissanayake
Accountant
AAT (Sri Lanka) – Associate

Staff Members

Mr M V Mohan
Accountant
CIMA (London) – Intre,
AAT (Sri Lanka) – Associate

Mr S G Punchibanda
Senior Accounting Officer

Mr C B Koswatte
Senior Accounting Assistant
Diploma in Business Studies (Costing)

Ms V Pahalage
Accounts Clerk

Ms B K S Herath
Accounts Clerk

Mr Saman Hewasiliyan
Accounts Clerk

Ms A A A P Amaratunge
Accounts Clerk

Mr W A Nishantha
Data Entry Operator cum Accounts Clerk
AAT – Part 1 & 2

Mr H B Thalgahagoda
Accounts Clerk cum Cashier

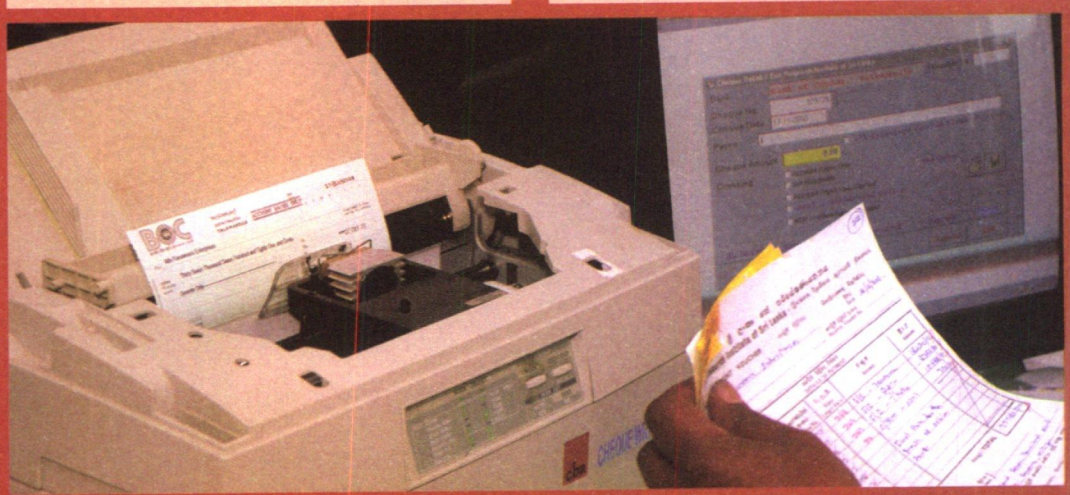
Mr M G Weeratilleke
Cashier

Ms R Godage
Clerk/Typist

Mr V Shanmuganathan
Clerk/Typist

Ms I Jayawickrama
Clerk/Typist

Mr H N Dharmapala
Clerk/Typist



TEA RESEARCH BOARD

Statement of Financial Position as at 31st December 2007

ASSETS	2007 Rs. '000	2007 Rs. '000	2007 Rs. '000	2007 Rs. '000
Non-Current Assets				
Property, Plant and Equipment	829,637		787,063	
Less:- Accumulated Depreciation	(491,155)		(461,591)	
	338,155		325,471	
Capital work-in-progress	6,936		5,166	
Other Assets	23		23	
		345,114		330,600
Current Assets				
Inventories/ Stocks	16,348		16,315	
Trade and Other Receivables	127,123		159,085	
Prepayments	1,044		2,572	
Cash and Cash Equivalents	76,214		81,896	
		220,730		259,866
Others: Identify Losses	8			
Excess and Shortages	(105)	(97)	560	560
Total Assets		**565,747**		**591,086**
LIABILITIES				
Current Liabilities				
Payables	10,995		13,160	
Accured Expenses	22,258		27,052	
		33,253		40,212
Non-Current Liabilities				
Provision for Gratuity	85,184		69,616	
Petrol Deposit Refundable	19		17	
		85,203		69,633
Total Liabilities		**118,456**		**109,845**
Total Net Assets		**447,291**		**481,241**
NET ASSETS/ EQUITY				
Tea Research Fund		307,544		337,161
Grants and Reserves		139,747		144,079
Total Net Assets/ Equity		**447,291**		**481,241**

Accountant
(For Senior Accountant)

Internal Auditor

Director, TRI

Chairman, TRB

TEA RESEARCH BOARD

Statement of Financial Performance for the Year Ended as at 31st December 2007

	2007 Rs. '000	2007 Rs. '000
Operating Revenue		
Recurrent Grant- Cess	288,200	249,838
Other Income	36,904	23,792
Other Income- Deferred Income	4,030	3,899
	329,133	**277,529**
Operating Expenses		
Personal Emoluments	140,304	118,605
Travelling	6,169	4,944
Supplies and Consumable Used	21,361	18,100
Maintenance	21,941	17,939
Contractual Services-Security/ Insurance	13,016	11,886
Electricity & Heating	12,417	14,033
Communications	4,834	4,069
Research and Development	16,361	12,321
Depreciation	27,301	28,376
Other Operating Expenses	17,839	15,172
Total Operating Expenses	**281,544**	**245,445**
Surplus/ (Deficit) from Operating Activities	**47,589**	**32,084**
Finance Cost		
Gain on Sales of Property Plant and Equipment	1,200	2
Total Non Operating Revenue (Eexpenses)		
Net Surplus/ (Deficit) Before Extra Ordinary Items	48,789	32,086
Extra ordinary items		
Prior year Adjustments	(78,406)	17,068
Net surplus/(Deficit) for the period	**(29,617)**	**49,154**

TEA RESEARCH BOARD

Consolidated Cash Flow Statement for the Year Ended as at 31st December 2007

Cash Flow from Operating Activities	2007 Rs. '000	2007 Rs. '000
Surplus/(deficit) from Ordinary Activities	43,150	29,428
Non- Cash movments		
Depreciation	31,205	32,907
Increase in Provision for Bad Debts	(12)	(11)
Increase/(Decrease) in Payables	(6,945)	1,275
Increase in Provisions Relating to Employee Costs	15,569	10,113
Gains Sale of Fixed Assets	(1,200)	(2)
(Increase) In Other Current Assets(stocks) depo/prepay	(27,624)	(3,636)
Assets Writ-offs	(555)	
Decrease/(Increase) in Receivables	61,836	8,528
Prior Years Adjustments	(78,406)	17,068
Accounting Adjustment in Capital Reserve	(3,457)	(56,756)
Net Cash Flow from Operating Activities	**33,561**	**38,914**
Cash Flow from Investing activities		
Purchase of Fixed Assets	(44,282)	(66,165)
Interest on Investments	4,994	2,656
(Increase)/Decrease Capital Working-In-Progress	(1,770)	55,584
Proceeds from Sale of Fixed Assets	1,200	2
Cash Flow from Investing Activities	**(39,858)**	**(7,923)**
Net Cash Flow from Financing Activities		
Capital Grants - PHDT		1,867
- NSF	500	315
- UNDP	75	
- Solar Energy	41	
Net Cash Flow from Financing Activities	**616**	**2,182**
Net Increase/(Decrease) in Cash and Cash Equivalents	(5,681)	33,173
Cash and Cash Equivalents at Beginning of Period	81,895	48,722
Cash and Cash Equivalents at End of Period	**76,214**	**81,895**

TEA RESEARCH BOARD

St. Coombs & lamiliere Estates Working Account for the Period of 01st January to 31st December 2007

2006 Rs. cts.	kg	INCOME	kg	2007 Rs.	Rs. cts.
		Tea Sales Gross Proceeds			
74,649,783.49	339,581	Tea Sales Ex Brokers(Gross)	279,007	79,495,336.43 *	
7,400,165.03	38,896	Tea Sales Local & Graties	39,675	9,652,775.05	89,148,111.48
82,049,948.52	**378,477**	**Add:**	318,682		
92,019.67		Miscellaneous Income		122,988.76	
132,488.50		Deferred Income		243,866.00	366,854.76
82,274,456.69		**Total Income**			**89,514,966.24**
		EXPENDITURE			
		Less: Estate Expenditure			
15,404,094.60		General Charges		21,875,952.64	
7,701,638.25		Field work & Cultivation		10,756,075.05	
42,238,638.03		Production		38,119,111.69	
1,715,959.95		Bought Leaf (Including Transport Charges)		2,013,531.24	72,764,670.62
67,060,330.83					
		Administration & Finance		25,502,518.55	
2,783,260.78		Bonus and Holiday pay		3,626,566.78	
1,535,956.57		Depreciation		1,432,321.45	5,058,888.23
4,319,217.35					
		Sales Tax & Distribution Expenses			
1,316,023.82		Brokerage, Handling charges & Sales Expenses		1,372,024.58	1,372,024.58
72,695,572.00		**Total Expenditure**			**79,195,583.43**
9,578,884.69		Profit /(Loss) for the year			10,319,382.81
(546,012.26)		**Add:** Under Value Unsold Tea 2006		290,798.80	290,798.80
9,032,872.43		**P.Y.A. - Deferred Income**			10,610,181.61
596,827.51		Depreciation			
(422,585.92)					
9,207,114.02		**Profit /(Loss) tranferred to TRI Operating A/c**			**10,610,181.61**

* - 6707 kg Unsold Teas valued NSA @ Rs. 279.12

TEA RESEARCH BOARD

St. Joachim Estate Working Account for the Period of 01st January to 31st December 2007

2006 Rs. cts.	2006 kg		2007 kg	2007 Rs. cts.	Rs. cts.
		INCOME			
		Tea Sales Gross Proceeds			
100,292,773.48	556,412.50	Tea Sales Ex Brokers(Gross)	56,874.00	99,903,181.82 *	
678,669.33	6,252.50	Tea Sales Local & Graties	5,205.00	753,736.39	100,656,918.21
100,971,442.81	**562,665.00**		**362,079.00**		
		Add:			
		Sale of BMF and Refues Tea		1,004,461.00	
36,306.60		Miscellaneous Income		161,178.00	
2,565,868.75		Income from Rubber		2,415,256.75	
348,742.57		Deferred Income		553,691.89	4,134,587.64
103,922,360.73		**Total Income**			**104,791,505.85**
		EXPENDITURE			
		Less: Estate Expenditure			
1,610,841.14		General Charges		2,219,616.23	
1,823,961.82		Field work & Cultivation		2,193,038.07	
3,929,725.87		Production		4,305,341.18	
1,247,525.09		Expenditure on Rubber		1,605,927.36	
89,108,846.43		Bought Leaf (Including Transport Charges)		81,733,136.25	92,057,059.09
97,720,900.35					
		Administration & Finance			
736,427.26		Bonus and Holiday pay		864,471.79	
2,986,292.58		Depreciation		2,471,625.33	3,336,097.12
3,722,719.84					
		Sales Tax & Distribution Expenses			
2,387,358.29		Brokerage, Handling charges & Sales Expenses		1,838,458.77	1,838,458.77
103,830,978.48		**Total Expenditure**			**97,231,614.98**
91,382.25		**Profit for The Year**			7,559,890.87
29,307.91		**Less:** Over Value Unsold Tea 2006		76,663.79	
		Prior Year Adjustment		767,491.44 **	844,155.23
120,690.16					**6,715,735.64**
578,577.11		P.Y.A. - Deferred Income			
(576,235.31)		Depreciation			
123,031.96		**Profit (Loss) tranferred to TRI Operating A/c**			**6,715,735.64**

* - 9209 kg Unsold Teas valued NSA @ Rs. 275.49

** - Write-offs Paper Sacks & Nursery Plants

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கணக்காய்வாளர் தலைமை அதிபதி திணைக்களம்
AUDITOR GENERAL'S DEPARTMENT

මගේ අංකය / எனது இல / MyNo: PY/I/TRB/2007/18

ඔබේ අංකය / உமது இல / Your No.:

දිනය / திகதி / Date: 30 September 2008

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 2007 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 2007 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 15 of the Tea Research Board Act No.52 of 1993 and Section 13(1) of the Finance Act No.38 of 1971. 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.

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.

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 audit coverage as possible within the limitations of staff, other resources and time available to me. The audit was carried

නිදහස් චතුරශ්‍රය, කොළඹ 07, ශ්‍රී ලංකාව
சுதந்திர சதுக்கம், கொழும்பு 07, இலங்கை
INDEPENDENCE SQUARE, COLOMBO 07, SRI LANKA

දුරකථනය / தொலைபேசி / Telephone. 2691151
පැක්ස් අංකය / பக்ஸ் இல / Fax No. 2697451
ඉලෙක්ට්‍රොනික් තැපෑල් / ஈ- மெயில் / E-mail. oaggov@sltnet.lk

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 principles 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 2007 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 2007 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

Depreciation policies adopted, had been changed with the revision of Sri Lanka Accounting standard No. 18 in 2006 and accordingly, depreciation should be provided during the useful life of assets, However the Board had not complied with that policy.

2:2:2 Accounting Deficiencies

Following observations are made.

(a) Over provision of bad debts amounting to Rs.12,646 which should have been treated as income had been erroneously charged against losses thereby understating the income for the year by Rs.12,646.

(b) Net value of Excesses and shortages of stocks amounting to Rs. 104,571 had been shown in the accounts after setting off Excesses of Rs. 444,575 and Shortages of Rs. 549,146

(c) Overstatements and Understatements in the Accounts

(i) Overstatement of depreciation amounting to Rs. 1,800,000 had been observed in the accounts due to over providing depreciation in respect of two vehicles purchased during the year under review.

(ii) Understatements of deprecation amounting to Rs. 18,223 had been observed

in the accounts due to under providing depreciation relevant to a computer purchased during the year under review.

(iii) Losses brought forward from previous years totaling Rs. 554,928 had been written off against the profit for the year under review instead of adjusting it to prior year adjustments

2:2:3 Unreconciled Control Accounts

Unexplained difference amounting to Rs. 5,817,103 has been observed between the balance of Motor Vehicle. – TRB account and the related schedules forwarded.

2:2:4 Accounts Receivable and Payable

The following observations are made.

(a) The analytical charges receivable as at the end of the year under review was Rs. 1,075,802. Out of that, balances amounting to Rs. 644,635 represented outstanding for more than five years, and a sum of Rs. 347,993 represented outstanding for 2 to 5 years

The Chairman informed me that the system of undertaking analytical services also has been changed and according to the new system the fees are recovered in advance.

(b) According to the age analysis of sundry debtors forwarded for audit, a sum of Rs. 3,581,394 or 64 per cent out of Rs. 5,522,218 had been remaining unrecovered for more than 2 years. Out of this a sum of Rs. 1,456,594 had been remaining unrecovered more than five years.

(c) Advances amounting to Rs. 3,157,993 granted to 65 external Institutions for the procurement of goods and services had not been settled for the period ranging from 01 to 16 years. Out of that, a sum of Rs. 2,043,750 represented an advance granted to a private Institution in the year 1993. The recoverability of these amounts are doubtful due to time-bar.

2:2:5 Lack of Evidence for Audit

15,169 kg of disposed refuse Tea stock at St. Coombs Factory could not be satisfactorily vouched due to non availability of proper documentation.

2:2:6. Non-compliance with Laws, Rules, Regulations and Management Decisions

Instances of non-compliance with the following Laws, Rules, Regulations etc., were observed in audit.

Reference to Laws, Rules, Regulations and Management Decisions	Non-compliance
(a) Government Financial Regulations	
(i) F.R. 177(1)	Income of the St. Coombs estate for the 1st 7 months amounting to Rs. 1,584.99 had not been deposited of the bank and used for day to day expenses.
(ii) F.R. 756(2)a	Appropriate action had not been taken on stock shortages brought forward from previous years amounting to Rs. 498,550.
(b) Letter No. NDA/6/2 dated 28 April 2005 of the Chairman, National Council for Administrative and paragraphs 04 and 05 of the Management Service Circular No. 25 of 28 December 2004.	Employees' allowances had been paid even during the year under review without the relevant approvals.
(c) Public Finance Circular No.393 of 16 February 2001 Paragraph 3.3.	Out of two vehicles released to the line Ministry in the previous years only one vehicle had been returned to the Board up to 31 August 2008.
(d) Public Enterprises Circular No.PED/12 of 02 June 2003 Paragraph 7:3 (d)	Identification number had not been stenciled on fixed Assets

3. Financial and Operating Review

3.1 Financial Review

3:1:1 Financial Results

According to the financial statements presented, the operating activities of the Board for the year ended 31 December 2007 had resulted in a surplus of Rs.48.8 million as compared with the corresponding surplus of Rs. 32.1 million for the preceding year, thus indicating an improvement of Rs.16.7 million in the financial results.

Further, the net surplus of the year, under review had become a deficit of Rs. 29.6 million due to write off of the Tea Cess receivable for 2006 amounting to Rs. 78.4 million on the instruction of the Cess committee.

3.1.2 Analytical Financial Review

The following observations are made.

(a) The increase of Rs. 38.4 million in the Board share of the Cess income and increase in Rs.13.1 million in other income had caused for the surplus of the year. The increase of Rs. 36.1 million in the expenditure was due to the increase of personnel Emolument during the year by Rs. 21.7 million.

(b) The total operating expenditure of the Board amounted to Rs. 281.54 million and out of that a sum of Rs. 146.473 million or 52 per cent represented expenditure on personnel emoluments and travelling expenses. Of that, a sum of Rs.118.7 million or 47 per cent had been spent on ancillary services and maintenance. The expenditure on research and development amounted to Rs. 16.3 million or 6 per cent only.

(c) The cash and cash equivalent as at 31 December 2007 amounted to Rs. 76.214 million indicating a decrease of Rs. 5.681 million when compared with the preceding year. This amount comprised of investments in call deposits amounting to Rs. 59.381 million, cash in hand and cash at bank amounting to Rs. 16.337 million.

3.2 Operating Review

3:2:1:1 Research Activities

Following observations are made.

(a) The major function of the Tea Research Board is to conduct scientific and technical research and investigations and assisting such activities relating to the problems and matters connected with the cultivation and production of tea, diversification of production from tea as well as the propagation and publication of results of research works at the directions of the Board including the prevention and control of pests that damage tea cultivation and the improvement of the quality of tea.

Eight Research Divisions and an Extension and Advisory Division are functioned under the board for this purpose.

(b) Performance in Bio-Chemistry Division

Even though patent right for the Tea Wine had been obtained in the year 2006 no action had been taken by the Bio-Chemistry Division to commercialize the Product. The Chairman informed me that the samples were produced for many commercial organizations to assess the marketing possibility in Sri Lanka as well as overseas.

3:2:2 Operating Results of the Estates

The Board is managing two estates namely St Coombes Estate and St. Joachim Estate and the operating results for the year under review, as compared with the preceding year is given below.

	2007	2006	2007	2006
Tea Sales				
Quantity (Kilograms)	318,682	378,477	362,079	562,665
Value (Rs.'000)	89,148	82,050	100,657	100,971
Other Income (Rs.'000)	367	224	4,134	2,951
Total Income (Rs.'000)	89,515	82,274	104,791	103,922
Less :				
Total Expenditure (Rs.'000)	79,195	72,696	97,231	103,831
Profit /(Loss) (Rs.'000)	10,320	9,578	7,560	91
Cost of Production per Kilogram of Tea (Rs)	246.33	189.79	262.70	180.03
Yield per Hectare (Kilograms)	2,545	2,702	1,004	1,273
Net Sales Average (Rs.. per Kilogram)	276.68	214.69	275,48	175.90

Following observations are made in this regard

(a) Although the profit of the St. Coombes Estate was increased by Rs. 740,498 in the year under review the sales quantity had dropped by 59,795 kg or 15 per cent Yield per hectare had decreased by 157 kg. The Chairman informed me that this was mainly due to Trade Union action prevailed in 2006/ 2007.

(b) Even though the profit of St. Joachim Estate was increased by Rs. 7,468,508 during the year under review, its production and net sale price had reduced. The sales quantity when compared with the preceding year had decreased by 200,586 kilograms or 35 per cent. The net sales average prices had increased from Rs. 175 Rs. 275 and the cost of production per kilogram had increased to Rs. 262. Yield per hectare had decreased by 269 kg.

3:2:2 Management Inefficiencies

(a) Even though a sum of Rs. 19,085,825 to be recovered from 12 officers who had granted leave with full pay for education purposes and failed to complete the specified periods of service, no recoveries whatsoever had been made during the year under review.

According to the Chairman,

(i) Cases cannot be preceded or filed in connection with 5 officers due to lapse of time. The value of outstanding bonds relating to those was Rs. 2,121,491.

(ii) Another 3 officers have agreed to pay by installment basis and already paid a sum of Rs. 1,224,000 from the total value of Rs. 4,664,646.

(iii) Legal action was being taken in connection with other four officers to recover the outstanding bonds to the value of Rs. 12,299,687.

(b) The main and important publication of the Board namely "Handbook on Tea" was not made available for customers for more than 6 years.

3:2:3Un-economic Transactions

It was observed that huge amount of large trees with economic value are located in St. Coombs Estates. However, no details were available on those trees at St. Coombs Estates to enable to identify the large trees with economic value is being used for substitute of fuel.

4. Systems and Controls

Deficiencies in systems and controls observed during the course of audit were brought to the notice of the Chairman from time to time. Special attention is needed in respect of the following areas of control.

(a) Granting of scholarships to Research Officers
(b) Advances
(c) Employees' Allowances
(d) Stock Verification
(e) Purchase and issue of Chemicals for Research Projects.

S. Swarnajothi
Auditor General