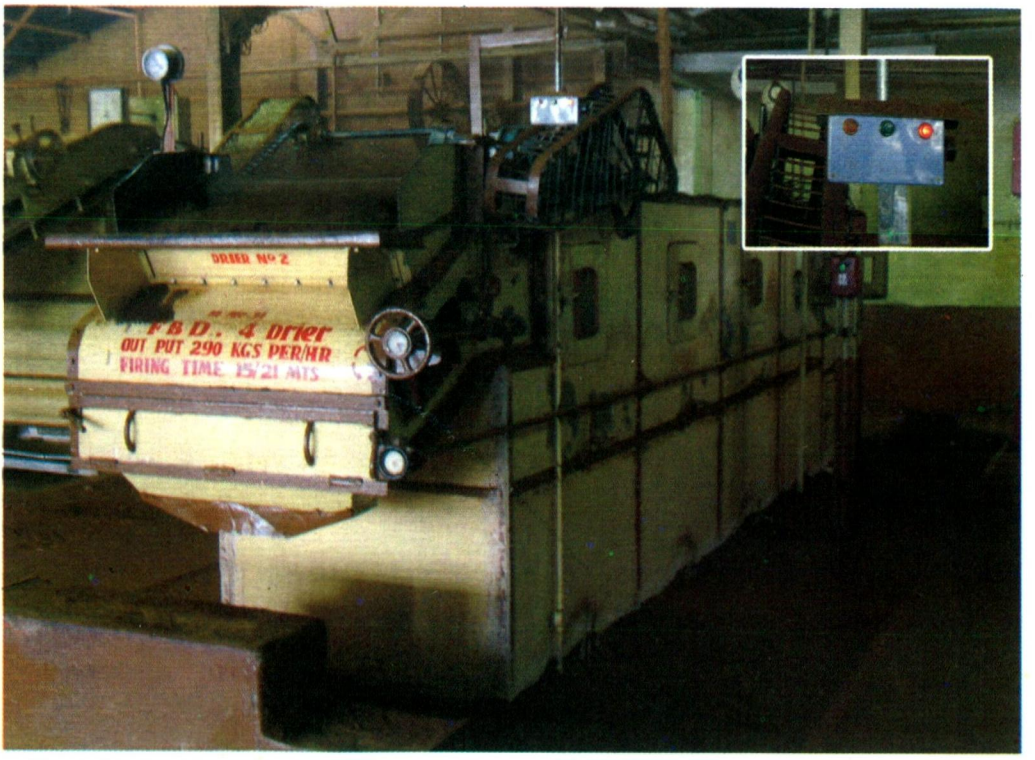

The Tea Research Institute of Sri Lanka
Annual Report 2005

TEA RESEARCH INSTITUTE OF SRI LANKA

ANNUAL REPORT FOR THE YEAR 2005

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THE MISSION OF THE TEA RESEARCH INSTITUTE

To raise the productivity of the tea holdings in both in the estate and small holder sector through the advocacy of

1. Appropriate technologies for improving tea productivity and quality

2. Forward-looking human and resource management practices that will facilitate all-round development of the tea industry including the quality of life of all Sri Lankan people.

In striving to achieve the mission, the goals of the Institute shall be:

1. To accelerate development of location specific planting material with desirable attributes

2. To rationalize and optimize the fertilizer inputs

3. To manage pest and diseases using rational, integrated methods

4. To improve the quality of made tea and development value added products

REPORT OF THE CHAIRMAN
TEA RESEARCH BOARD

The Tea Research Institute (TRI), under the management of the Tea Research Board (TRB), continued to serve the tea sector with government patronage, without a privatisation process, as envisaged in 2003, but with a strong interaction with all the stakeholders of the industry. The Board of Management of the Institute emphasised the importance of efficient technology-transfer programmes, at field and factory levels, in order to reduce costs for a greater competitive advantage.

The Board monitored the re-engineering process commenced in 2004 in relation to Research and Innovation, Technology Transfer and Stake Holder Participation, Human Resource Development and Administrative and Financial Management, for further improvements in cost-effectiveness and efficiency, so as to be the leading Institute in demand for improving productivity and profit in estates, factories and the industry, by making recommendations to growers, factories, industrialists, marketers, policy makers, etc.

During the year 2005, Sri Lanka earned Rs 81,481 million by exporting 308,859 metric tons of tea, but the earnings could have been significant if tea with more value-addition was exported, and this indicates the role the Institute could play in developing new products, in addition to assisting in taking full advantage of the already-existing range.

Special efforts were made to enhance the agronomic condition of tea fields, and to enhance the productivity and profitability of tea factories, managed by the Institute, as an example to the industry. The co-ordinated effort resulted in successfully achieving levels higher than the industry norms, owing to the commitment and hard work of all categories of research, field, and support staff, as indicated by the highest recorded yield of 2527 kg/ha by St Coombs Estate for the year 2005, after a long period of yield stagnation.

Only the important strategies and policy directions, with relevant achievements, are summarised below for easy reference, and to avoid duplication, since the activities of the Institute are given in detail in the reports of the Director and the Research Divisions.

1. Research and Innovations

The Board reiterated the importance of focused Research and Development (R & D) programmes for cost-effective technologies to increase the profit margin of each category in the production process from nursery and cultivation to the processing of tea. Research was also directed to solve field and industry problems with appropriate technologies, while engaged in strategic and focused innovative research for value-addition and supplying niche markets.

The Consultative Committee on Research, comprising industry stakeholders from estates, factories, marketing and export organisations, and management, participated in reviewing research projects and making beneficial suggestions, and also in suggesting new research thrusts.

Some beneficial programmes are summarised below.

1 a. Productivity and Profit through Scientific Fertilizer Inputs

Special efforts were made to popularise the Site-Specific Fertilizer Recommendations (SSFR) for tea estates and tea fields, based on soil- and leaf-nutrient levels and production levels. The objective of the programme is to evaluate deficient and yield-limiting nutrients through chemical analysis of both soil and leaf, and to estimate the optimum fertilizer-input requirement based on established scientific data.

Many companies and estates practised the SSFR programme, given by the scientists of the Soils and Plant Nutrition Division, resulting in significant savings and increased tea yields. The demand for SSFR services is an indication of their benefit and acceptance by the growers.

Tea plantations require a regular input of fertilizers, since 20-50 harvestable young shoots (bud and two leaves) are plucked from each tea bush at 5- to 7-day intervals, throughout the year. About eight young shoots are required to produce one cup of tea (2.5 g of made tea for a cup).

Owing to this 'mining' of soil for nutrients, the fertility status of many tea lands have declined during the last 140 years of tea cultivation in Sri Lanka, resulting in low yield levels and the abandonment of about 10% of the tea lands.

Studies indicate that about 140 kg of fresh leaves from nitrogen-fixing trees (NFTs) is equivalent to 4 kg of urea. Since the annual urea use in tea plantations is about 70,000 mt, there are opportunities for supplementing the nitrogen requirement, with significant savings of foreign exchange, by growing NFTs under the SALT package in tea lands.

Research was also focused on enhancing fertilizer-use efficiency, with minimum losses through surface run-off, by developing simple equipment for injecting fertilizer into the subsoil. A few deep-placement fertilizer applicator models have already been developed by the Institute's soil scientists, and field demonstrations have been made, but further modifications are required before acceptance by growers.

Studies related to fertigation have been carried out. Drip-irrigation using appropriate conveyor and reticulation systems has been developed, with both imported drippers and drippers developed locally by the Coconut Research Institute and the Rubber Research Institute. This project would significantly increase tea yields with reductions in the cost of production, smaller fertilizer losses owing to run-off and minimum environmental pollution.

1 b. Soil and Water Conservation

Research thrusts to conserve soil and water in tea lands, and to arrest the heavy soil erosion that commonly takes place in many tea lands, have received positive acknowledgement from many growers. The planting of nitrogen-fixing shade trees along contours, to establish contour live hedges in the Sloping Agricultural Land Technology (SALT) package, in all lands belonging to the Institute, including St Coombs and St Joachim, has been commended by many visiting growers.

The nitrogen-fixing leguminous creeper, *Arachis pintoi*, has been established in all the tea fields on St Coombs Estate, resulting in less soil erosion and with benefits related to less weed growth, increased rainfall infiltration, enhanced soil organic and fertility levels, etc.

Tea (*Camellia sinensis* L.) is a C3 plant which grows as a tree in the wild. However, it is trained to be a bush in order to obtain many apical leaves for frequent plucking. Although tea is a sun-loving plant, it needs to be grown in a certain amount of shade, in order that it may produce a frequent flush of buds

and young leaves containing larger quantities of theaflavin and other chemical compounds for the production of quality tea, with taste, stimulation, aroma, and health benefits.

Based on long-term studies at the Institute, *Calliandra* (230 trees/ha) and Dadap (230 trees/ha) have been found to be suitable N-fixing shade trees for the hill country. Hence the shade trees in the hill country would provide only a limited part of the fuel wood requirement, as their density is low, unless these trees are incorporated into the SALT system, with adoption of the coppicing technique and planting in degraded and uneconomical tea lands.

However, in the low-country tea lands, *Gliricidia* is found to be the best NFT (225 plants/ha). Owing to its fast growth and flowering habit that attracts bees, *Gliricidia* produces 25-30 mt of fuel wood, which is higher in comparison to the fuel wood production of non-flowering NFTs.

Owing to non-implementation of appropriate soil and water conservation technologies to reduce erosion, land degradation is aggravated in most of the sloping tea lands in the central hill country, where soil erosion is common with a loss, up to the present time, of about 400 mm of top soil. Hence a special extension programme was initiated to popularize the SALT package with NFT trees and the nitrogen-fixing leguminous creeper, *Arachis pintoi.*

1 c. Free Energy and Free Fertilizer through Dendro Power to energize the Tea Industry

As described in last year's Annual Report, a special programme was initiated to shift the use of previously 'cheap', but presently 'expensive', sources of fertilizer and energy towards the 'free' sources provided by nature, and available in abundance locally and *in situ*.

The tea industry is heavily dependent on energy sources for its manufacturing processes (hot air for withering and drying, electricity for powering machinery, fuel for transportation, etc.), with about 30% of the cost of production at the factory level. The total energy requirement to produce one kg of made black tea is about 25 MJ (0.7-1.0 kWh of electricity and 1.4 - 2.0 kg of dry firewood), with the main energy sources being expensive imported petroleum fuel and wood from mature rubber trees. The total electricity requirement for all the country's tea factories would be equivalent to the generation from a 35-MW power plant. The present installed capacity in Sri Lanka is 2172 MW.

NFTs that grow as shade trees, and/or in the SALT package, are pruned (pollarded) at 3- to 5-year intervals, resulting in the formation of hardwood suitable for fire furnaces. Renewed scientific developments in growing fuel wood plantations have emphasized the importance and benefits of frequent Short Rotation Coppicing (SRC) of woody plants 2-4 times a year. The SRC technique provides optimum-diameter stems for easy chopping, and hence it is found to be better than allowing a tree to grow for several years to form wide hardwood, when it has to be cut again into small pieces using extra energy.

The planting of nitrogen-fixing trees as shade trees in tea lands enhance soil and water conservation, while providing stems for thermal energy, and leaves to improve the fertility status of soil which includes the chemical, physical and biological conditions of the soil. Recommended shade trees such as *Calliandra calothrysus* (4500-4750 kcal/kg), *Erythrina lithosperma* (Dadaps) (2600 kcal/kg), *Grevillea robusta* (3200 kcal/kg), *Eucalyptus grandis* (4700-4800 kcal/kg), *Gliricidia sepium* (4900 kcal/kg) and *Albizzia* (5200 kcal/kg) provide the microclimate required for higher tea yields. The spacing of these trees is generally 6 m x 7.2 m (about 230 trees per ha), and depend on the agro-climate, landscape, slope, etc.

Gliricidia is found to be the best NFT (225 plants per ha), considering its fast growth of 25-30 mt of fuel wood, and its flowering habit which attracts bees, compared to the non-flowering NFTs.

Energy plantations, such as of *Gliricidia*, yield more fuel wood in tea fields because the NFTs form the topmost layer, capturing sunlight, while in coconut estates the NFTs are grown at the second tier.

Available data show that about 29 million trees of *Gliricidia* are grown as a shade crop within the mid- and low country tea lands. It is therefore possible to obtain about 725 million mt of fuel wood (4500 kcal/kg dry wood) using the appropriate coppicing technique, with a saving of the equivalent of 240,000 million litres of petroleum fuel (3 kg wood/one litre fuel).

Estimates show that if 10% of the already available *Gliricidia* population in low country tea is managed scientifically, the saving in foreign exchange would be Rs 1,200,000 million or more because of the replacement of imported petroleum fuel for the generation of thermal heat in tea manufacture. Further, the growing of NFTs for supplementary energy would initiate several other

mechanical industries having many employment opportunities in growing, harvesting, transporting, etc.

The tea industry and the country would be benefited by utilizing the potential of shade trees grown in tea lands, specially *Gliricidia* in the low country, for providing free bio energy, for improving fertility and for soil and water conservation in the sector, with the Institute providing the appropriate scientific packages required to suit the individual stakeholder, based on resources and development programmes.

A review research paper on these aspects, entitled 'Free Bio Energy, Fertility, and Soil/Water Conservation in Tea Plantations' (Dr Sunil Jayasekara[1] and Dr A Anandacoomaraswamy) was presented at the First International Workshop on 'Dendro Energy for Development', held in Colombo during 4-6 August 2005.

1 d. Innovations

The encouragement of research scientists to venture into hitherto unexplored areas for enhancing scientific knowledge in tea chemistry, cultivation and manufacture, in order to develop new and beneficial value-added products innovatively, was continued.

Such prominent basic research, commenced during the year, are on (a) molecular markers for breeding tea cultivars for resistance to diseases, and (b) therapeutic agents in tea extracts. During the year, steps were also taken to commercialize the tea wine, developed at the Institute, through a private sector entrepreneur. Since the market is already saturated with many established branded products, the Institute has to pursue with the entrepreneur, during the initial stages, strategies for breaking into the system, and capturing at least a few niche markets with a focused advertising campaign.

2. Technology Transfer and Stakeholder Participation

During the year, special attention was given to transferring the beneficial technologies, already developed at the Institute, to growers' fields and tea factories for successful implementation and a reaping of the benefits by the end users.

2 a. Tea Crop Clinics and 'Ran Dallaka Vidu Nana Tea Sayanaya'

Several district-level Tea Crop Clinics, for the estate sector field and factory staff, were organized, with a high degree of participation from the private sector. The scientific staff of the Institute interacted with the stakeholders in solving field and factory problems, while engaging in services for providing measurements and checks, such as soil pH, conductivity, organic carbon, nematodes, nutritional deficiencies, pest and diseases, etc.

For smallholder tea growers, the Institute conducted many field days and workshops under the 'Ran Dallaka Vidu Nana Tea Sayanaya' programme. Large participation in these field days and workshops indicated the benefits of the Institute's recommendations, and the demand for scientific technologies to improve the tea growing and manufacturing processes.

The Institute's staff also interacted with relevant staff from the Coconut Research Institute, the Rubber Research Institute, the Sugarcane Research Institute, the Department of Agriculture, University lecturers, etc., in order to strengthen the integrated approach and bring about a synergy.

2 b. Policy Directions and Investments

The Institute actively engaged in consultation with the Treasury, the National Council for Economic Development (NCED), the Ministry, the Sri Lanka Tea Board, the Tea Small Holdings Development Authority (TSHDA), and tea sector organizations such as the Ceylon Planters Society, Tea Shakthi, etc. to address issues pertaining to the development of the tea industry, such as low productivity, lack of quality planting materials, low replanting rate, the labour shortage, high fertilizer and energy prices, the revision of the green leaf price formula, refuse tea, factory standards (ISO, HACCP), pesticide residue levels, etc.

The Board emphasized the importance of the Institute for effective contributions in attending to all technical and policy-related issues, which affect all aspects of the tea industry. A survey conducted by the Institute, in the corporate sector, had indicated that 53% of the lands in the sector are under old seedling tea, and the balance 47% under VP tea. About 90% of the seedling tea is older than 60 years, and about 74% of its extent yields less than 1,300 kg/ha. In the case of VP tea, about 30% is older than 30 years, and only 35% yields more than 2,200 kg/ha. The results indicate the importance of replanting seedling tea, re-replanting

old VP tea, and infilling the rest. Hence the Institute emphasized the necessity of initiating investment programmes related to increasing the re-planting rate with quality planting materials, using the already-established mother bushes maintained by the Institute, the TSHDA, and private estates.

2 c. Extension through the Media

During the year, both print and electronic media were engaged in effective and efficient dissemination of Institute recommendations, for the benefit of stakeholders. Extension messages were published in national newspapers on Wednesdays, and the Institute's staff participated in many radio and television programmes, organized with the assistance of the Media Unit of the Ministry of Plantation Industries. Several CDs and posters were prepared relating to many aspects of tea growing and manufacture.

3. Human Resources Development

The Board recognized the knowledge capital in the educated, experienced, and skilled staff, as the most important asset of the Institute. This knowledge capital is required in strategic leadership, and to harness the Institute's potential for the development of the tea industry for competitive advantage.

3 a. Professional Training and Recognition

The Board provided the Institute's scientists with several overseas, postgraduate training opportunities in developed countries. These had previously been suspended. The previous decision not to send officers to developed countries for training was based on the presumption that many such officers had not returned to serve the required mandatory period in the Institute. However, the present Board decided that the Institute should have the best scientists, and hence they should be provided with the best training. Any defaulters and errant officers were to be treated separately with appropriate legal procedures.

The Board also formally approved the implementation of the Merit Award scheme for outstanding contributions by staff.

3 b. Vacancies and Recruitments

The Board implemented the Voluntary Early Separation Package (VESP), as per the Tea Development Project, by granting the VESP only to staff in the support category.

After several discussions, approval was obtained from the Management Services Division of the Treasury to fill, during the year, all the technical grade vacancies which had been vacant for the last several years, as a result of the re-structuring programme under the Tea Development Project. The cadre was also revised to include essential technical categories, with the recruitment of new graduates under the Government Graduate Enrolment Programme.

4. Management (Administrative and Financial)

In principle the Board approved the new Manual of Procedures, prepared as per the Tea Development Project.

Steps were taken to strengthen the Internal Audit Unit of the Institute, and several suggestions made by the Auditor General, relating to the effective management of assets and finances, were implemented.

The Audit and Management Committee, comprised of Ministry and Treasury representatives, assisted the Board in monitoring and evaluating financial operations, with regular checks on debtors.

The Board also closely monitored the progress of legal cases, to the benefit of the Institute.

Dr K Sunil Jayasekara
Chairman, Tea Research Board

REVIEW OF THE DIRECTOR, TEA RESEARCH INSTITUTE

National/Global Tea Scenario

The extent under tea had increased from 189,000 ha in 1994 to 237,000 ha in 2005. This increase was a result of substantial increase in the extent under small holdings according to a comprehensive census on tea smallholdings in Sri Lanka. The productivity in the tea sector for the current year is 1342 kg ha^{-1}. This is based on a production of 318 million kg (in 2005) and an extent of 237,000 ha (approx.). It is a well-known fact that the cost of production of tea is the highest in Sri Lanka compared to other competing countries, mainly due to low field as well as worker productivity.

Furthermore, according to predictions by the Food and Agriculture Organization (FAO), global tea production is to increase by 3 – 4 %, while the exports would increase by only around 2 %, during the next 5 – 10 years. This obviously implies an over-supply situation and hence reduced prices, in the future. In summary, the higher cost of production coupled with poor prices would threaten the sustainability of the sector. Hence to circumvent this situation efforts should be made, to carry out productivity improvements by way of replanting, soil fertility improvements and practicing proper pest and disease control measures, as per our recommendations The applied research program is focused bearing this in mind.

Cess Allocation and Corporate Plan

Research projects for the year 2005 in the revised Corporate Plan of the Institute were formulated considering a budget of Rs 225 million (30% of the cess) initially, but later amended to suit the revised budget. The cess received for the current year was Rs 181.7 million out of an entitlement of Rs 231 million including Rs 39 million spill over from 2004. As in the past, most of the research programmes continued on a multi-disciplinary mode. Despite the restricted flow of cess funds, the Institute had done remarkably well to fulfill its objectives

Achievements

The achievements during the period under review could be summarized under the following headings:

1. Research highlights
2. Patents, Awards and Recognition
3 Advisory & Extension Services
4 Publications
5 New initiatives taken
6 Performances of TRI Estates

1 Research Highlights

The major research highlights during the period under review could be summarized as follows;

Ceylon tea extract as a potential therapeutic agent: The hypothesis that Ceylon Tea extract acts as potential therapeutic agent to reduce oxidative stress in hypoxic cells through its antioxidant properties and its ability to reduce cerebral cellular death was proved. This study demonstrates a great clinical potential and opens a new avenue to prevent stroke using Ceylon tea extract.

Analysis of proanthocyanidins: A HPLC method was developed to analyze in proanthocyanidins in green leaf and black tea.

Alternative Packing materials for Bulk Tea – Two new packing materials were recommended to the industry viz., one comprising of an outer cover (ply) with 300gsm Kraft liner and Metalized Polyester backed with 70gsm Kraft paper and the other a reusable pack with the same feature as above but with a valve at the bottom end

Computer aided withering System: A Programmable Inter-phase Controller microprocessor programming board has been designed and fabricated for measuring temperature and relative humidity and to control the hot air damper and speed of the fan in the withering trough

Green Leaf Pricing Mechanisms – Green leaf pricing mechanism was formulated for the benefits of tea small holders and bought tea factory owners by undertaking a survey on the cost of tea cultivation, cost of tea processing, nett outturn etc. The details were presented to parties concerned and the Ministry authorities

Site Specific Fertilizer Recommendations: The computer model to estimate fertilizer requirement in tea fields was further developed to suit site-specific fertilizer recommendations, recently.

Soil Conservation in Tea Lands A Soil Conservation Index was developed to assess the actual level of soil conservation in the field. The actual soil conservation adopted in tea lands is 11-22% of the required level. Additional investment required to improve soil conservation to the level expected is Rs 10-15,000 ha^{-1}.

An economic evaluation of "out-grower system" in the tea sector was done as a case study, in Mid country. Limitations were identified towards further improvement of the system. At present, the profit for the out grower is very marginal mainly due to very low productivity of the land. However, the estate management gains by a monthly saving of about Rs 1175 ha^{-1} on labour and through income generated by levying management fees.

Tea Wine

Tea wine was successfully produced on a pilot scale through collaboration with a private entrepreneur. The Institute is in the process of exploring market opportunities.

Collaborative Research projects

i. The Biochemistry Division of TRI has undertaken a project on Molecular markers for tea breeding/disease resistance in collaboration with Samuel Roberts Noble Foundation (SRNF), Okalahama, USA under a grant from National Science Foundation of USA. At present Dr Abeysinghe is working on this project at SRNF.

ii. The Biochemistry Division of TRI has undertaken a project on "Ceylon tea extract as a potential therapeutic agent" in collaboration with University of Sri Jayawardenepura and University of Singapore

iii. The Agronomy Division has undertaken a collaborative project with Institute of Fundamental Studies, Kandy on Nitrogen fixation by ***Arachis pintoii:*** Four strains of Rhizobium were isolated from the nodules of *Arachis pintoii* and being tested for their ability to fix atmospheric nitrogen.

iv. The Technology Division has undertaken a collaborative project with Department of Agricultural Engineering, University of Peradeniya on designing a sifter to grade leafy grade teas.

2 Patents, Awards and Recognition

Collapsible Plucking Basket designed and developed by Dr M A Wijeratne, Senior Research Officer won a Gold medal at the International Exhibitions of Inventions in Geneva, Switzerland and also a Presidential Award in Sri Lanka.

Temperature indicator alarm to monitor the temperature at drier mouth was patented.

Director, TRI presented a paper titled ***"Ceylon Tea: cleanest tea with least amount of pesticide residues"*** at the International Tea Conference "The challenge of food safety" Hamburg, Germany in February

Director, TRI was a member of the Sri Lankan delegation for the Intergovernmental Group on Tea (IGG/FAO) meeting held in Bali, Indonesia in July

Director, TRI presented a paper titled ***"Review of progress in pesticide regulation and use for the production of tea in Sri Lanka*** " at Tea and Pesticides Conference, Food and Agriculture Organization, Rome, Italy in December

3 Advisory and Extension Services

As in the past "Crop clinics" were very popular among the stakeholders. There were five "Crop Clinics" organized; two at Kandy, two at Ratnapura and one at Passara for the benefit of tea smallholders as well as personnel attached to Regional Plantations Companies.

As in the past four Experiment and Extension Fora were held for the benefit of the stakeholders from the corporate sector as well as small-holder sector.

4 Publications:

1 Wall chart on Major Pests of Tea in Sri Lanka
2 TRI UPDATE Vol 9: Part 2 December 2004
3 Sri Lanka Journal of Tea Science Volume 70: Part 1 & Part 2, 2005
4 Tea Buelletin Vol 19, Part 1 and 2 , 2004
5 Te Thathu' Vol 4, Part 1 & 2 and Vol 5, Part 1
6 Advisory Circulars (Sinhala Translation) – HP1, HP2, LU1, LU2, SP1-SP6, SI1-SI3, PA1-PA3, PN1, WM1-WM3 DM1-DM6, PT1, PT3, PT5 and PT6
7 TRI UPDATE Volume 10, Part 1 & 2, 2005
8 Summary Annual Report 2004 (Sinhala/Tamil/English)
9 Guidelines on "Cost Management"

5 New Initiatives:

a)The staff had a special meeting with Chief Executive Officers of RPCs and other stakeholders at Colombo to brief them on the latest commercial scale innovations by TRI, in June.

b) Editing of all Advisory circulars in Sinhala/Tamil had been completed and is being printed.

c) Work on the revision of the "Handbook on Tea" continued during the year under review

d) TRI in collaboration with Planters Association of Sri Lanka has launched a program to plant 600 km length of 'vetiver' grass annually for conserving soil along the lateral and leader drains and on the upper edge of the roads bordering the tea fields.

e) "Demonstration areas" highlighting the correct practices were established at Head Office, as well as in almost all the substations

6 General:

6.1 Human Resource Development:

The Institute recruited 22 graduates to fill the vacancies, under the graduate employment scheme, introduced by the Government.

1 Ms P L K Tennakoon, Experimental Officer, Soils and Plant Nutrition Division, Hantana, proceeded for her MSc at the University of Agricultural Science, Dharward, India on Bio Fertilizer under ICAR/CARP project

2 Mr V Sithakaran, Advisory Officer proceeded to Tamil Nadu Agricultural University for his Ph D program in Agricultural Extension under ICAR/ CARP project

3. Mrs B A P Cooray Research Assistant Plant Pathology Division continued her PhD in Molecular Plant Pathology at University of Reading, U.K.

4. Mr J W K K Jayasundera Experimental Officer, Plant Pathology Division continued his M Sc in Microbiology at Punjab Agriculture University, Ludhiana, India.

5. Mr M A B Ranatunga Research Assistant, Plant Breeding Division continued his M Sc in Biotechnology and Molecular Biology at Tamil Nadu Agricultural University, Coimbatore, India

6. Mr S P Rathnayake, Extension Officer TRI Station, Kottawa continued his Postgraduate Training leading to M Phil at Wuhan University of Technology, China

6.2 Mother Bush Project funded by ADB

About 9.7 million cuttings were issued from the site managed by TRI during the period under review. The ADB Review Mission that visited during the latter part of the year had commended, the progress on this project.

6.3 TRI Low Country Station, Ratnapura building expansion project

Hon Anura Priyadharsana Yapa, Minister of Plantation Industries in June, declared the buildings constructed under the above project open. The ADB Review Mission that visited during the latter part of the year had commended, the progress on this project

6.4 Performance of estates managed by TRI:

St Coombs Estate managed by the Institute recorded the highest yield of 2527 kg ha^{-1} in the Western High Grown Sector during the period under review. Unconfirmed reports indicate this to be the highest in the island under the large estate category. This was possible due to better management and implementation of all recommended agricultural practices by the Institute. While achieving higher yield the estate was able to save about Rs 2.50 per kg on the cost of fertilizer, as a result of practicing site-specific fertilizer application, a new concept introduced to the industry by the Institute recently. St Coombs made a profit of Rs.1.6 million.

However, St Joachim Estate managed by the Institute had made losses amounting to about Rs 722,680/= during the period under review, mainly due to difficulties in attracting good leaf for processing.

6.5 Overseas visits:

During the period under review, the following scientists traveled abroad as members of delegations and to attend various seminars/workshops:
Dr M T Ziyad Mohamed, Director,
Ms J A A M Jayakody, Head, Agricultural Economics Division

Dr M A Wijeratne, SRO, Agronomy Division
Dr I S B Abeysinghe, Head, Biochemistry Division
Dr A M T Amarakoon, SRO, Biochemistry Division
Dr A Balasuriya, Head, Pathology Division

7 Issues:

i **Pesticide Residues in Made tea**: The Institute was inundated with queries on pesticide residues in tea from exporters of Sri Lankan tea. Special reference should be made to the Japanese "positive list" of pesticides. The list submitted to us had only about 20 out of the 31 pesticides recommended by TRI. The TRI in collaboration with Tea Board and TASL was able to write several justification papers to Japanese authorities and was successful in accommodating all 31 chemicals in their positive list. This exercise continued for almost nine months during the year under review.

Pesticide residues in tea had already become a non-tariff barrier, as far as export of tea is concerned. Realizing the seriousness of the situation a Steering Committee on Pesticide Residues is constituted under the Chairmanship of Director General, SLTB with scientists from TRI and TASL, ITI, SLSI and Registrar of Pesticides as members of the committee. This committee meets once a month to address issues faced by the industry. Apart from this "Pesticide Residue Group" at TRI meets with the Director **every Wednesday** to address issues of concern.

ii Recent developments in the global scenario, stress the need for introducing food quality standards in local tea factories. The European Union had already made the introduction of HACCP (Hazard Analysis and Critical Control Points) certification mandatory, with a view to ensuring food safety, commencing January 01, 2006. Regrettably, the progress on such certification in our factories is poor, probably due to want of funding.

8 Recommendations:

i. Although the Consultative Committee on Research reviews the progress of research projects carried out by the Institute from time to time, a peer review of research projects by an outside party is long overdue. A recommendation to this effect is forwarded to the Consultative Committee on Research, TRB for its observations and final approval of the Board.

ii. Advisory and Extension Services of the Institute too, needs to be strengthened. Towards this, the skills of the staff need to be developed through training programs and exposure visits. The Institute is in the process of exploring possibilities/ placements.

Dr M T Ziyad Mohamed
Director/Chief Executive Officer

REPORT OF THE ADMINISTRATION DIVISION

1.1 Introduction

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.

According to the above Act which came in to operation on 7th March 1994, 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.

1.2 Functions of the Tea Research Board

The specific functions of the Tea Research Board are:

(a) To conduct, assist and encourage scientific and technological research into, 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 manufactures from tea; and to disseminate and publish at its direction, results of such research.

(b) To conduct, assist and encourage research into the economic viability of the tea industry in Sri Lanka, including future economic trends in such industry.

(c) To establish and maintain relations with research institutions in Sri Lanka and abroad:

(d) To conduct, in the discharge of its functions, joint study programme, seminars or symposia, with foreign research institutions and research institutions in Sri Lanka.

1.3 Tea Research Institute Head Office at Talawakelle

The Head Office at Talawakelle is responsible for the maintenance, administration, overall planning and execution of research and extension

and advisory programmes of its main centre at Talawakelle and five sub-stations located in the different tea growing districts.

1.4 Members of the Tea Research Board – (Up to November 2005)

1. Dr. Sunil Jayasekara - Chairman
2. Dr. M T Ziyad Mohamed - Member
3. Mr. Y G Wijeratna - Member
4. Mr. Tikiri Kobbekaduwa - Member
5. Mr. Malin Goonetilake - Member(up to May 2005)
6. Mr. D V Seevaratnam - Member(from May 2005)
7. Dr. D S A Samaraweera - Member
8. Mr. N M D Nawaratne - Member
9. Mr. Ranjan Dharmawardana - Member
10. Mr. J M B J Bandara - Member
11. Dr. A Anandacomaraswamy - (Convenor/Secretary)

1.5 Members of the Consultative Committee on Research – (Up to November 2005)

1. Dr. Sunil Jayasekara - Chairman
2. Dr. M T Ziyad Mohamed - Member
3. Dr. D T Wettasinghe - Member
4. Dr. D B T Wijeratna - Member
5. Dr. Sarath Samaraweera - Member
6. Mr. Anil Cooke - Member
7. Mr. K G B Obeysekara - Member
8. Mr. Chandra Wickramatunga - Member
9. Mr. D V Seevaratnam - Member (from May 2005)
10. Mr. D H Madawala - Member
11. Mr. Ananda Fernando - Member
12. Dr. A Anandacoomaraswamy - Convenor/Secretary
13. Dr. N Yogaratnam (Special Invitee for 31st CCR Meeting)

1.6 Member of the Consultative Committee on Advisory and Estate Services

1. Mr. D V Seevaratnam - Chairman
2. Mr. G N Bopearachchi - Member
3. Dr. Jayantha Gunatilake - Member
4. Mr. M Ganapathy - Member

5.	Mr. S D Nandasena	-	Member
6.	Mr. Asoka Somaratne	-	Member
7.	Dr. Sunil Jayasekara	-	Member
8.	Dr. M T Ziyad Mohamed	-	Member
9.	Mr. W M P Wijekoon	-	Member
10.	Mr. D A Jayatunga	-	Member (up to August 2005)
11.	Dr A Anandacoomaraswamy	-	Member
12.	Mr. B A D Samansiri	-	Convenor/Secretary

1.7 Members of the Audit & Management Committee

1.	Mr. N M D Nawaratne	-	Chairman
2.	Mr. Y G Wijeratna	-	Member, TRB
3.	Dr. D S A Samaraweera	-	Member, TRB
4.	Mr. R Dharmawardena	-	Member, TRB
5.	Mr. W M P Wijekoon	-	Observer

1.8 Senior Management Staff as at 31st December, 2005

1.	Director	- Dr. M T Ziyad Mohamed
2.	Deputy Director Research (Production)	- Dr. A Anandacoomaraswamy
3.	Deputy Director (Technology)	- Vacant
4.	Deputy Director (Administration)	- Mr. W M P Wijekoon
5.	Dr (Mrs)Kumuduni Amarakoon	- Convenor / Secretary

1.9 Executive Staff (Grade I & II) as at 31st December, 2005

Administration Division

Mr. W M P Wijekoon	-	Deputy Director (Administration)
Ms. S Anusha	-	Administrative Officer
Mr. K G Piyasena	-	Public Relations/Welfare Officer

Finance Division

Mr. M V Mohan	-	Accountant
Ms. D M R Dissanayake	-	Accountant
Mr. K D H Pathirana	-	Stores Executive

Internal Audit Division

Mr. R Kariyawasam	-	Internal Auditor

Engineering Division

Ms. D W Manawadu	-	Resident Engineer

Library

Ms. R W M W K Illangantilake	-	Librarian

Publications Unit

Vacant	-	Publication/Publicity Officer

Advisory & Extension Services Division

Mr. B A D Samansiri	-	Head/Senior Advisory Officer
Mr. V S Sidhakaran	-	Advisory Officer

Agronomy Division

Dr. A Anandacoomaraswamy	-	Head/Senior Research Officer
Ms. M S D L de Silva	-	Senior Research Officer

Agricultural Economics Unit

Ms. J A A M Jayakody	-	Head/Senior Research Officer
Mr. D P B Herath	-	Research Assistant (On overseas study leave)

Biochemistry Division

Dr. I S B Abeysinghe	-	Head/Senior Research Officer
Dr. A M T Amarakoon	-	Senior Research Officer
Mr. P A N Punyasiri	-	Senior Research Officer
Ms. J Jayasundera	-	Research Officer
Ms. W A S N S T Goonatilleke	-	Research Assistant

Entomology / Nematology Division

Dr. M M Keerthi	-	Actg. Head/Senior Research Officer
Mr. R S Walgama	-	Research Assistant (on overseas study leave)
Ms. R M D T Pallemulla	-	Research Officer

Plant Physiology & Propagation Division

Dr. (Mrs) A J Mohotti	-	Senior Research Officer
Ms. T L Wijeratne	-	Research Assistant

Plant Pathology Division

Dr. A Balasooriya	-	Head/Senior Research Officer
Ms. N H L Pradeepa	-	Research Assistant
Ms. B A P Cooray	-	Research Assistant

Plant Breeding Division

Dr.(Ms) M T K Amarakoon	-	Head/Senior Research Officer
Mr. M Rathnayake	-	Research Officer
Mr. M A B Ranatunga	-	Research Assistant
Ms. H A C K Ariyaratna	-	Research Assistant

Soils & Plant Nutrition Division

Dr. L S K Hettiarachchi	-	Head/Senior Research Officer
Dr. A K N Zoysa	-	Senior Research Officer
Ms. S Anandacoomaraswamy	-	Senior Research Officer
Mr. G P Gunaratne	-	Senior Research Officer

Biometry Unit

Ms T U S Peiris	-	Research Assistant

Technology Division

Mr. K Raveendran-	-	Actg. Officer-in-Charge/ Chemical Engineer
Mr. W S Botheju	-	Senior Research Officer
Mr. S Koneswaramoorthy	-	Mechanical Engineer
Mr. M H C Perera	-	Electronic Engineer

TRI Sub-Station Deniyaya

TRI Low Country Station, Ratnapura

Dr. M A Wijeratne	- Officer-in-Charge/Senior Research Officer
Dr. K G Prematthilake	- Senior Research Officer
Mr. G L C Galahitiyawa	- Research Officer
Mr. N P S N Bandara	- Research Assistant
Ms. S M Samarasinghe	- Research Officer
Mr. M K S L D Amaratunga	- Advisory Officer
Mr. S R W Pathiranage	- Research Assistant

TRI Sub - Station, Hantane

Mr. P B Ekanayake	- Officer-in-Charge/Senior Research Officer

TRI Sub-Statio, Kottawa

Mr. K D Dahanayake	- Officer-in-Charge/Advisory Officer

TRI Sub-Station, Passara

Mr. J C K Rajasinghe	- Officer-in-Charge/Advisory Officer

1.10 Other Administration, Scientific, Research & Advisory Staff- Grade III-V as at 31st December 2005

Directors Office

Ms. S M Jayasingham	- Secretary to the Director
Mr. R J Rayappan	- Office Attendant

Deputy Director Research (Production) Office

Ms. D Ratnayake	- Stenographer/Typist (English)

Administration Division

Mr. R Nandasena	- Administrative Assistant
Ms. S Shunmuganathan	- Stenographer/Typist (English)
Mr. W P A N Jayasinghe	- General Clerk

Ms. S G N C Kumari	-	Information/Documentation Officer
Mrs. I Jayawickrama	-	Clerk/Typist
Ms. W M S R Wanasinghe	-	Clerk/Typist
Mrs. C Jeyaram	-	Clerk/Typist
Mr. I W Nihal Kumara	-	Office Attendant
Mr. S Dharmalingam	-	Office Attendant

Purchasing Unit

Mr. B Thilakeratne	-	Purchasing Officer
Mr. P D S L de Silva	-	Clerk/Typist

Transport Division

Mr. M L H Perera	-	Transport Officer
Mr. S H Chandrasena	-	Clerk/Typist

Engineering Division

Mr. V Shanmuganathan	-	Clerk/Typist
Mr. C J B Abeykoon	-	Works Supervisor
Mr. W C K Fernando	-	Chief Plumber Mechanic
Mr. J G Gamage	-	Filter Plant Assistant
Mr. P T Perera	-	Clerk/Typist
Mr. U D W Ratnasiri	-	Filter Plant Attendant

Motor Garage

Mr. G G E H Gamage	-	Chief Motor Mechanic
Mr. R Gabriel	-	General Mechanic
Mr. W G Wijeratne	-	General Mechanic

Electrical Division

Mr. U A Wickramasinghe	-	Electrical Forman
Mr. J M R K Bandara	-	Electrician
Mr. R W Rengasamy	-	Electrician

Telephone Exchange

Mr. K M Seneviratne Banda	-	Telephone Operator
Ms. P K N Damayanthi	-	Telephone Operator cum Receptionist
Mr. S Karuppiah	-	Telephone Linesman

Finance Division

Mr. C B Koswatte	-	Senior Accounting Assistant
Mr. S G Punchibanda	-	Accounting Assistant
Ms. V Pahalage	-	Accounts Clerk
Ms. G A S Gunasekera	-	Accounts Clerk
Mr. Saman Hewasiliyan	-	Accounts Clerk
Mr. K T U Kulatunga	-	Assistant. Store Keeper
Mr. W A Nishantha	-	Data Entry Operator/Accounts Clerk
Mr. R Godage	-	Clerk/Typist
Mr. H P W Gunasekara	-	Stores Assistant
Mr. H B Talgahagoda	-	Cashier cum Accounts Clerk
Ms. A A A P Amaratunga	-	Accounts Clerk
Mr. M G Weeratillake	-	Cashier
Mr. H N Dharmapala	-	Office Attendant
Ms P V D Chandrakanthi		Accounts Clerk

Internal Audit Division

Mr. P S Wickramasinghe	-	Internal Audit Officer
Ms. N C Jayaweera	-	Internal Audit Clerk
Ms. W N K I Ariyaratna	-	Internal Audit Clerk

Library

Mr. R W M S K Amunugama	-	Library Assistant

Publications Unit

Ms. A P V Kalyani	-	Stenographer/Typist (English)

Advisory & Extension Services Division

Mr. M A J S Fernando	-	Extension Officer
Ms. M A H Nishanthi	-	Extension Officer
Mr. A L R U Kumara	-	Extension Officer
Mr. C P Malawige	-	Extension Officer
Mr. H Jayaweera	-	Extension Officer
Ms. C S K Kiribathgoda	-	Stenographer/Typist (English)
Mr. K G R Niroshan	-	Photographer
Mr. J T Thevadasan	-	Photography/Dark Room Attendant
Mr. N S Ekanayake	-	Audio Visual Attendant

Agronomy Division

Mr. A R Amarasekara	-	Experimental Officer
Mr. U P Abeysekara	-	Experimental Officer
Ms. L A S P Jayasinghe	-	Experimental Officer

Agricultural Economics Unit

Ms. H W Shyamalie	-	Experimental Officer
Mr. W M J C Bandara	-	Experimental Officer

Biochemistry Division

Mr. M D L P Gunatilaka	-	Experimental Officer
Mr. K M Mewan	-	Experimental Officer
Mr. G A A R Perera	-	Experimental Officer
Ms. G H Thotawattage	-	Experimental Officer
Mr. P K P Muthukumarana	-	Experimental Officer
Mr. P J C Priyantha	-	Technical Assistant
Mr. M W Silva	-	Skilled Mechanic

Entomology / Nematology Division

Mr. D D Liyanage	-	Experimental Officer
Mr. N Nawaratne	-	Experimental Officer
Ms. R D P Dharmalatha	-	Experimental Officer
Mr. M M Jayathilake	-	Experimental Officer
Ms. P G D S Amarasena	-	Experimental Officer
Ms. S S C J de Seram	-	Technical Assistant

Plant Physiology & Plant Propagation Division

Ms. D M S Nawaratne	-	Experimental Officer
Ms. V Sidhakaran	-	Experimental Officer
Ms. M M N Damayanthi	-	Experimental Officer

Plant Pathology

Mr. J W K Jayasundara	-	Experimental Officer
Mr. R M A Ratnayake	-	Experimental Officer

Plant Breeding Division

Mr. R Paskaradevan	-	Experimental Officer
Mr. J D Kottawa Arachchige	-	Experimental Officer
Mr. K K Ranaweera	-	Experimental Officer

Soils & Plant Nutrition Division

Mr. R G A Wijayawardana	-	Experimental Officer
Mr. C S K A Rathnayake	-	Experimental Officer
Mr. T C N Peiris	-	Experimental Officer
Mr. O G K A Gunaratne	-	Technical Assistant
Mr. D M B N Dissanayake	-	Technical Assistant

Technology Division

Mr. L Jayasinghe	-	Experimental Officer
Ms. S H P Waduge	-	Experimental Officer
Mr. U D Alagiyawadu	-	Experimental Officer
Mr. A M M V Abeykoon	-	Experimental Officer
Ms. W M S Weerawardana	-	Experimental Officer
Mr. P K S P Dayananda	-	Experimental Officer

Mechanical Workshop

Mr. A Nandasiri	-	Workshop Mechanic
Mr. P D L B de Silva	-	General Mechanic
Mr. M C Gabriel	-	General Mechanic
Mr. D L J Weerasooriya	-	General Mechanic

TRI Low-Country Station, Ratnapura

Mr. H J M de Silva	-	Extension Officer
Mr. T G N Mahinda	-	Extension Officer
Mr. H S N Peiris	-	Experimental Officer
Mr. E R Perera	-	Experimental Officer
Mr. P D Upali	-	Experimental Officer
Mr. W N U A B Marapana	-	Experimental Officer
Mr. A K Prematunga	-	Experimental Officer
Mr. A G Gamage	-	Experimental Officer
Ms. B S N Vithana	-	Experimental Officer
Mr. J H N Piyasundara	-	Experimental Officer

Ms. E W T P Prematunga	-	Experimental Officer
Mr. D W Vitana	-	Experimental Officer
Ms. K B N Sripalika	-	Experimental Officer
Mr. M G S Liyanage	-	Experimental Officer
Mr. M A Chamindra	-	Experimental Officer
Mr. A K Mudalige	-	Experimental Officer
Mr. K A D Mervin	-	Accounting Assistant
Ms. P V G Karunanayake	-	Stenographer (English)
Mr. K A S Kumarapperuma	-	Clerk/Typist
Ms. H K Seetha	-	Accounts Clerk
Mr. K Gunawardana	-	Works Supervisor
Mr. J S K de Silva	-	Electrician
Mr. M A B de Silva	-	General Mechanic
Mr. N A Bowie	-	General Mechanic
Mr. U W K Munasinghe	-	Asst. Plumber Mechanic

TRI Mid-Country Station, Hantane

Mr. K R W B Kahandawa	-	Extension Officer
Mr. T M Sarathchandra	-	Experimental Officer
Mr. A P D A Jayasekara	-	Experimental Officer
Mr. U B Herath	-	Experimental Officer
Mr. B Sureshkumar	-	Experimental Officer
Mr. S Wijetunga	-	Experimental Officer
Ms. S N Wijesekara	-	Experimental Officer
Ms. P L K Tennakoon	-	Experimental Officer
Ms. P V A R Abeysekera	-	Experimental Officer
Mr. G P Udumulla	-	Experimental Officer
Ms. C N K Edirisinghe	-	Station Assistant
Ms. B K S Herath	-	Accounts Clerk
Ms W R P de Silva	-	Clerk / Typist
Ms. R M D K Ratnayake	-	Clerk / Typist
Mr. K Palathanthrige	-	Works Supervisor

TRI Sub-Station, Kottawa

Mr. P K Jayawickrama	-	Experimental Officer
Mr. S P Ratnayake	-	Extension Officer
Mr. C J Liyanarachchi	-	Extension Officer
Mr. H K M S Kumarasighe	-	Extension Officer

Mr. M Sarath	-	Field Supervisor
Mr. P S Kulasiri	-	Field Supervisor

TRI-Sub Station, Passara

Mr. W M R B Wijesekara	-	Extension Officer

TRI Sub-Station, Deniyaya

Mr. K G J P Mahindapala	-	Extension Officer/Actg. OIC
Mr. O W Jayawardana	-	Station Assistant

Walahanduwa Laboratory Complex

Mr. W T B Priyantha	-	Experimental Officer
Mr. S M Dissanayake	-	Experimental Officer
Mr. J R Y Abeywardana	-	Experimental Officer

Estates

Mr. J U Hulangamuwa	-	Superntendent (St. Coombs)
Mr. M S E Perera	-	Superintendent (St. Joachim)

1.11 Retirements during the year

1. Mr. V Shanmugarajah Head/Senior Research Officer, retired on 21.06.2005.

2. Mr. S T Yatawatte, Advisory Officer retired on 30.09.2005.

3. Mr. S Sivalingam, Painter, retired on 12.01.2005.

4. Mr. R W Suwaris, Field Supervisor, retired on 04.07.2005.

5. Mr. D P Edwin Peiris, Painter, retired on 07.08.2005.

6. Mr.W V Dhanapala, Hostel Caretaker, retired on 10.04.2005.

7. Mr. M Rengasamy, Guest House Keeper, retired on 17.08.2005.

8. Mr. M A Wijedasa, Experimental Officer, retired on 13.02.2005.

1.12 Resignations during the year

1. Mr. L P Wickramarachchi, Driver, resigned on 15.01.2005.
2. Mr. K M N K Karunathilaka, Experimental Officer, resigned on 31.05.2005.
3. Mr. U Siridharan, Experimental Officer, resigned, on 31.03.2005.
4. Ms. D M Damayanthi, Technical Assistant, resigned on 31.05.2005.
5. Mr. D A Jayathunga, Senior Accountant, resigned on 15.05.2005.
6. Ms. K Sarathchandra, Experimental Officer, resigned on 31.05.2005.
7. Mr. M D L P Gunathilaka, Experimental Officer, resigned on 30.06.2005.
8. Mr. D L D H Dahanayaka, Experimental Officer, resigned on 30.07.2005.
9. Ms. R W T Dharshani, Technical Assistant, resigned on 15.07.2005.
10. Mr. H P Baddage, Experimental Officer, resigned on 21.10.2005.
11. Mr. R G W Kaludiyawela, Experimental Officer, resigned on 01.10.2005.
12. Mr. D V D Vithanage, Clerk of Works, resigned on 28.11.2005.
13. Mr. J M D Abeysinghe, Experimental Officer, resigned on 11.11.2005.
14. Ms. D G S C Bodhipala, Experimental Officer, resigned on 01.11.2005.
15. Mr. S M A R Karunaratne, Experimental Officer, resigned on 18.10.2005.
16. Mr. B A Rathnagoda, Experimental Officer, resigned on 03.02.2005.

1.13 Staff Recruitments

The following staff were recruited during the year

a) Deputy Director Research (Production) - 1

b) Deputy Director (Administration) - 1(Recruited to the permanent
c) Accountants - 2 cadre w.e.f. 08/02/2005)
d) Research Assistants - 4
e) Electrical/Electronics Engineer - 1
f) Experimental Officers - 17
g) Extension Officers - 5
h) Information/Documentation Officer - 1

1.14 Overseas Training/Seminars/ Conferences etc.

Dr. A M T Amarakoon, Senior Research Officer, Bio-chemistry Division, and Ms M A H Nishanthi, Extension Officer, Advisory & Extension Division followed a training course on Management Development Programme on Tea Plantation at the Kothari Agricultural Management Centre, India from 21st March to 17th April 2005.

Dr. M T Ziyad Mohamed, Director TRI, proceeded to Germany, from 22nd February, 2005 to 26th February, 2005 to participate at the International Tea Conference " The challenge of food safety"

Dr. M A Wijeratne, Senior Research Officer, TRI, Low Country Station Ratnapura proceeded to Switzerland to participate at the International Exhibition of Inventions from 04th April 2005 to 12.04.2005.

Dr. M T Ziyad Mohamed, Director TRI, participated at the 16th Session of FAO Inter Governmental Group on Tea, held from 20th July 2005 to 22nd July 2005 at Bali, Indonesia.

Dr. I S B Abeysinghe, Head, Biochemistry Division, proceeded to Sweden, from 24th August 2005 to 01st September 2005 to participate in the Research Review Meeting of the NCRC-SAREC Research project.

Ms. P L K Tennakoon, Experimental Officer, Soils & Plant Nutrition Division, commenced a training at M. Sc Level at the University of Agricultural Sciences, Dharwad, India, from 12th September 2005 for a period of 02 years.

Mr. M S L D Amarathunga, Advisory Officer, TRI Low Country Station, Ratnapura, followed training on advanced program in Tea Plantation Management at the Kothari Agricultural Management Centre, India, from 01st September 2005 to 31 October 2005.

Dr. M T Ziyad Mohamed, Director, TRI and Dr. A M T Amarakoon, Senior Research Officer, proceeded to Hamburg, Germany, to participate ATISO Technical committee meeting held from 17th to 19th October 2005.

Dr. I S B Abeysinghe, Head Biochemistry Division, was granted 06 months No-pay leave and 01 year sabbatical leave to attend a collaborative Research project on an inter grated genomics approach for improvements of disease resistance in tea at the Nobel Foundation USA, commencing from November 2005.

Dr. A Balasuriya, Head, Plant Pathology Division, participated in the 16th session of Intergovernmental Group on Tea meeting from 30th September to 01st October 2005 in India.

Ms. J A A M Jayakody, Head Agricultural Economics Division, participated at the mini Research and training workshop on 03rd and 04th October 2005, in the Institute of Economic Growth, New Delhi, India.

Mr. V S Sidhakaran, Advisory Officer, Advisory & Extension Division commenced a PhD Training programme in Agricultural University, at Thamilnadu in India, under the ICAR and CARP work plan, for 03 years from 26th December 2005.

Dr. M T Ziyad Mohamed, Director, TRI, participated at the FAO IGG Conference on Tea and Pesticide in Rome, Italy, held from 05th to 08th December 2005.

Mr R S Walgama returned to the Institute in March 2005, after the 2nd foreign segment of post-graduate studies in the School of Integrative Biology, University of Queensland, Australia.

Ms B A P Cooray, Research Assistant, Plant Pathology Division, continued her studies in Molecular Plant Pathology at University of Reading, U.K.

Mr J W K K Jayasundera, Experimental Officer, Plant Pathology Division, continued his M.Sc in Microbiology at Punjab Agricultural University, Ludhiana, India.

Mr M A B Ranatunge, Research Assistant, Plant Breeding Division, continued his M.Sc in Biotechnology & Microbiology at Tamilnadu Agricultural University, India.

Mr S P Ratnayaka, Extension Officer, TRI Station at Kottawa, continued his postgraduate training leading to M.Phil at Wuhan University of Technology, China.

1.15 Maintenance Divisions:

ENGINEERING

General

Total work undertaken by the Divisional Staff

Roads/buildings repairs/maintenance	368 Nos
Water supply and maintenance	194 Nos

1. Building Maintenance

a) Details of colour Washing Under Annual Program

A Type - A- 01(External & roof) A 12, A 15 (Internal)	03 Nos
B Type - B- 04,12,13,15,16,17,12,B 01 (Ext)	08 Nos
C Type- C-36,10,33,30,21,06,31,14,49,43,09,06,(ext) 53	13 Nos
D Type- D-59,40,32,24	04 Nos
E Type- E-04,06, 11,12,13	05 Nos
D Type- external colour washing	49 Nos
E Type- external colour washing	13 Nos

The following painting work was also under-taken in addition to the Annual program

Director's office
External Colour washing, Carpentry workshop, Laboratory Buildings
Vehicle Park, TRI Laundry (Internal/external)

All repair work, plumbing /civil were carried out under the colour washing program

b) Special work attended by divisional staff under building maintenance program-in connection with the visit of Honorable former Deputy Minister and new Minister of Plantation Industries.

1. Refurbishing of surrounding & layout of the Institute.
2. Road repairing from Mattekelle to Laboratory
3. Repairs to side drains within the institute
4. Face lift of new building & Guest House
5. Repairs to Summer hut & Pond near Electrical Division
6. Repainting of barriers, road humps, etc

c) Work attended by outside contractors

A Summer hut for the Advisory Division was built near the main office.

2. Maintenance work

a) Balance work of the main water supply line (abandoned by the contractor) has been completed
b) Cleaning of water and sedimentation tanks of the filtration plant has been carried out twice during the year.
c) Plumbing, Tiling renovation work at AI hostel initiated (work pending due to non availability of budget provision)
d) Replacement of Gutters of B & C type quarters were initiated (-do-)
e) Fixing new ceiling for Pathology Division
f) Fixing Aluminium beading to library steps
g) Cushioning of Settee of A type bungalows (which was long overdue) completed
h) Rattaning of chairs in bungalows and offices in progress (-do-)
i) Replacing damaged asbestos roofing sheet of SPND chemical stores (WIP)
j) Repairs to the Fire Hydrant System-completed
k) Assisted the St. Coombs Estate in Civil Engineering works;

3. Work carried out at TRI Sub Stations

a. Renovation work at TRI Kottawa Guest House , Office, D & C Type quarters carried out by the Divisional Staff.

b. New water supply system provided for Kottawa Tea Nursery
c. Renovation of water supply system attended at TRI Passara Station
d. Renovation of water supply system attended at TRI Colombo Guest House
e. Repairing of Roof leak carried out at TRI Colombo Guest House

4. Construction work at Talawakelle

a. Construction of steps and foot path to the Summer Hut.
b. Construction of main water line from filtration Plant – Civil works completed.
c. Construction of Pavement near Auditorium completed
d. Construction of steps leading to visitors toilets
e. Construction of Tea boutique at Museum (work pending due to budget provision)
f. Installed new water supply system at Observatory-Agronomy
g. Installed pipe line to drip irrigation system –Agronomy
h. Assisted in Experimental trials –irrigation system in Estates-Agronomy
i. Installed water supply system in the New Summer Hut
j. Installation of Fire Fighting System
k. Conversion of B'type Bungalow No.15 as a Senior Staff Ladies Hostel
l. Fixing mesh for the Tennis Court/Basket Court of TRI Sports Club

5. General

Mr. C J B Abeykoon, Works Supervisor was appointed as Actg. Clerk of works to cover up the duties of Clerk of Works, w.e.f. 26.11.2005.

Electrical division

1) The Electrical Division completed 247 jobs during the year 2005. They are as follows:

I. Maintenance of TRI Bungalows	-	151
II. Maintenance of Laboratory, office building etc;	-	63
III.Maintenance at Sub-Stations	-	01
IV.Construction at D-Type O.H.	-	03
V. Maintenance of street lights, security lights etc;	-	29

2) Completed the following at TRI, Talawakelle;

I. Re-construction work completed D-Type Bungalows O.H. Line & street lights

II. Re-wiring and fixed new 3 KW water /Geyzers to D-Type Bungalows

3) Completed the following at TRI Stations;

I. Completed wirng street light O.H. Line at TRI Station, Passara

Motor Garage

The Motor Garage completed the following work during the year:

I. Servicing of vehicles	-	176 Nos
II. Replacement of tyres and tubs	-	109 Nos
III. Repairs & replacement of spare parts	-	340 Nos

Telephone

The Telephone Exchange /Test Room personnel attended to the following work:

I. New Telephone Line connection given to Institute Main Exchange Data Internet connection office and Bungalow.

Main Exchange Trunk Line	03
Data Internet	01
Extension TP Connection Office	12
Extension TP Connection Bungalows	08

II. Maintenance jobs 37

Divisions	15
Bungalows	22

III. Repairing and servicing the defective telephone receivers and replacement of new Telephone Instrument.

IV. General maintenance of the Telephone Line Underground and Overhead Lines.

V. Repairs in the Inter-com Telephone Underground Cable Telephone Line and Telephone Instrument at Hantane Station.

VI. Repairs and replacements of Telephone Line, Telephone Instrument and 206 PABX System at Passara Station.

TEA RESEARCH BOARD
BALANCE SHEET AS AT 31ST DECEMBER - 2005

2004 Rs.			Tea Research Institute 2005 Rs. cts.	St.Coombs Estate 2005 Rs. cts.	St.Joachim Estate 2005 Rs. cts.	Total 2005 Rs. cts.
	FIXED ASSETS					
621,441,745	Property, Plant, Equipment etc.	(Anx. I)	720,897,651.82			720,897,651.82
(376,575,530)	Less: Accumulated Depreciation	(Anx. I)	(427,396,210.27)			(427,396,210.27)
244,866,216			293,501,441.55			293,501,441.55
73,390,232	Capital Work in Progress	(Anx. II)	59,032,589.90	1,486,965.43	229,787.30	60,749,342.63
318,256,448			352,534,031.45	1,486,965.43	229,787.30	354,250,784.18
22,550	Other Assets-Patents		22,550.00			22,550.00
318,278,998			352,556,581.45	1,486,965.43	229,787.30	354,273,334.18
	CURRENT ASSETS					
13,453,192	Stocks	(Anx. III)	12,227,523.69	1,142,069.69	2,421,545.50	15,791,138.88
132,221,097	Debtors and Other Debit Balances	(Anx. IV)	116,842,464.36	6,576,958.97	541,400.78	123,960,824.11
16,399,547	Deposits,Pre-Payments & Purchase Advances	(Anx. V)	7,621,756.30	478,134.42	260,867.90	8,360,758.62
34,487,919	Loans and Advances to Staff & employees	(Anx. VI)	28,164,944.74	5,160,008.81	1,365,684.79	34,690,638.34
16,887,282	Short Term Investments-7 day Call Deposits	(Anx. VII)	259,851.81			259,851.81
50,000,000	Short Term Investments-Gratuity Reseves		30,000,000.00			30,000,000.00
9,062,716	Cash and Bank Balances	(Anx. VIII)	15,692,287.64	317,682.19	2,452,423.17	18,462,393.00
272,511,754			210,808,828.54	13,674,854.08	7,041,922.14	231,525,604.76
500,558	Identified Losses	(Anx. IX)	500,557.87	-	-	500,557.87
192,553	Excess & Shortages	(Anx. X)	118,252.68	-	-	118,252.68
273,204,864			211,427,639.09	13,674,854.08	7,041,922.14	232,144,415.31
	CURRENT LIABILITIES					
(37,088,072)	Creditors and Provisions	(Anx. XI)	(17,594,319.44)	(12,306,657.69)	(9,050,121.02)	(38,951,098.15)
236,116,792	Net Current Assets		193,833,319.65	1,368,196.39	(2,008,198.88)	193,193,317.16
554,395,790	**TOTAL ASSETS LESS CURRENT LIABILITIES**		546,389,901.10	2,855,161.82	(1,778,411.58)	547,466,651.34
	REPRESENTED BY					
158,088,328	Grants and Reserves	(Anx. XII)	199,941,597.49	-	-	199,941,597.49
349,723,657	Tea Research Fund		288,007,295.10			288,007,295.10
-	A/C Current St.Coombs Estate		10,069,008.25	(10,069,008.25)		-
-	A/C Current St.Joachim Estate		7,316,583.88		(7,316,583.88)	-
46,570,355	Long Term Liabilities-Provision for Gratuity	(Anx. XIII)	41,040,516.38	12,924,170.07	5,538,172.30	59,502,858.75
13,450	Petrol Deposit Refundable	(Anx. XIV)	14,900.00			14,900.00
554,395,790			546,389,901.10	2,855,161.82	(1,778,411.58)	547,466,651.34

Accountant-TRI
For Senior Accountant

Director-T.R.I

Chairman-T.R.B

TRE RESEARCH BOARD

OPERATING ACCOUNT FOR THE PERIOD 1ST JANUARY TO 31ST DECEMBER, 2005

2004 Rs. Cts		INCOME		2005 Rs. Cts
197,527,449.54	1	Cess	(Note 1)	192,423,325.60
5,878,231.20	2	Income from Other Commercial Activities	(Annx. XV)	6,584,386.00
4,024,506.20	3	Interest on Investments		2,225,199.72
4,925,095.39	4	Miscellaneous	(Annx. XV)	5,694,244.14
212,355,282				206,927,155.46
1,992,572.47	5	Estate Profits/(Loss) - St.Coombs Estate	(Annx. XVII)	954,752.53
2,358,368.91		- St.Joachim Estate	(Annx. XVIII)	(1,073,022.56)
216,706,223.71		**Total Income**		206,808,885.43

Total		EXPENDITURE	Administration Finance and Common Service	Advisory, Extensions & Publicity	Substation Ratnapura Hantane	Research	Total
77,034,428	01	Personnel Emoluments	32,141,979.36	7,948,129.15	10,822,720.92	39,319,830.92	90,232,660.35
5,070,898	02	Travelling	2,628,046.06	923,129.66	449,615.49	2,246,363.91	6,247,155.12
36,856,701	03	Supplies and Requisites	5,549,571.56	3,479,992.16	1,769,105.92	13,076,764.60	23,875,434.24
20,560,789	04	Repairs and Maintenance of Capital Assets	14,532,059.00	1,119,223.12	3,674,612.96	1,472,629.29	20,798,524.37
40,293,204	04	Depreciation of Fixed Assets	17,369,806.68	2,208,199.60	6,672,406.69	20,110,456.61	46,360,869.58
	05	Transportation,Communication,Utility	25,170,146.44	3,587,972.30	10,744,937.58	824,250.41	40,327,306.73
36,283,195		and Other Service					0.00
2,736,263	07	Contributions,Grants and Subsidies	2,548,050.67	102,357.79	70,719.05	260,259.27	2,981,386.78
6,039,046	08	Pensions and Retirement Benefits	2,447,019.16	747,948.08	587,487.99	3,769,886.08	7,552,341.31
8,227,077	08	Gratuity Provision	15,406,574.63				15,406,574.63
1,212,123	10	Media,Advertising,Publicity and Gifts	307,555.28	1,177,591.15	189,616.97	38,356.30	1,713,119.70
8,027,178	11	Cultivation and Field Trials		4,723,028.39	1,943,202.59	2,241,802.90	8,908,033.88
2,095,494	12	Miscellaneous -Other	(Annx. XVI) 1,699,417.08	58,126.20	9,617.50	870,262.00	2,637,422.78
484,233	12.04	-Training- Local	68,940.25	141,021.00		183,232.00	393,193.25
2,380,874	12.05	-Training-Overseas		32,465.00		530,733.00	563,198.00
247,301,503		**Total Expenditure**	119,869,166.17	26,249,183.60	36,934,043.66	84,944,827.29	267,997,220.72

(30,595,278.80)	**Operating Surplus/(Deficit) for the year 2005**	(61,188,335.29)
(894,685.15)	**Less:- Tax Payments**	(528,026.61)
(31,489,963.95)	**Operating Surplus/(Deficit) after the Tax Payments transferred to Tea Research Fund**	(61,716,361.90)

Note: 1. Tea Cess receivable as at 31st December 2005 - Rs. 49,730,775.14

TEA RESEARCH BOARD
CASH FLOW STATEMENT 2005

The following statement show the cash flow of the board during the year under review and in the previous year.

Year ended 31st December

	2005		2004	
Cash flows from	**Rs.**	**Rs.**	**Rs.**	**Rs.**
Operating Activities				
Surplus/(Deficit) for the year excluding interest on investments		(63,941,561)		(35,514,470)
Adjustment for items not involving movement of cash:				
Depreciation	51,073,322		44,126,384	
Provision for Gratuity	12,932,504		6,097,099	
	64,005,826		50,223,483	
Less: Income from sale of fixed Assets	(1,250)	64,004,576		50,223,483
		63,015		14,709,013
Adjustment for items not involving movement of cash:				
Assets Written-off	-	740,490	-	-
Operating surplus before changes in items of working capital		803,505		14,709,013
Changes in items of working capital				
Stocks - (Increase)/Decrease	(2,337,947)		40,614	
Debtors and other balances - (increase)/Decrease	8,260,273		14,631,984	
Deposits, Prepayments and purchase advances-(Increase)/Decrease	8,038,788		7,997,840	
Loans and advances to Staff & employees -(increase)/Decrease	(202,719)		(4,895,281)	
Excesses and shortages -(Increase)/Decrease	74,300		246,742	
Creditors and provisions -(Decrease)/Increase	1,864,476	15,697,171	3,211,624	21,233,523
Cash generated from operating activities		16,500,676		35,942,536

Contd...(2)

Cash generated from operating activities C/F		16,500,676		35,942,536
Cash Flows from Investing Activities				
Interest on investments	2,225,200		4,024,506	
Purchase of fixed assets	(100,449,037)		(25,305,765)	
Proceeds from sale of fixed assets	1,250		-	
(Increase)/Decrease in capital work-in-progress	12,640,889		(34,879,419)	
Cash used in investing activities		(85,581,698)		(56,160,678)
Cash Flows from Financing Activities				
Grants received from :				
NRC	60,500			
ADB	41,792,769		34,259,640	
Cash generated from financing activities		41,853,269		34,259,640
Net Increase/(Decrease) in cash and cash equivalents		(27,227,753)		14,041,498
Cash and cash equivalents at beginning of the year		75,949,998		61,908,500
Cash and cash equivalents at end of the year (Note)		48,722,245		75,949,998
Note:-				
Head Office				
Short Term Investments - 7 Day Call Deposits		259,852		16,887,282
Short Term Investments - Gratuity Reserves		30,000,000		50,000,000
Bank of Ceylon -Corporate Branch		-		958,523
Bank of Ceylon - Talawakelle		12,666,039		6,152,407
Bank of Ceylon - Talawakelle ADB		1,778,551		1,250
Bank of Ceylon - Deniyaya		5,092		5,092
Petty Cash Imprest		1,118,811		1,850,372
Stamp Imprest		23,795		31,184
Cash in Accountant's Safe		100,000		
St.Joachim Estate				
Cash In Hand		10,044		1,509
Cash at Bank		2,442,369		26,300
Stamps		10		29
St.Coombs Estate				
Cash In Hand		39,861		27,849
Cash at Bank		277,820		8,192
Stamps		1		9
		48,722,245		75,949,998

Annex. XVII

TEA RESEARCH BOARD

ST.COOMBS & LAMILIERE ESTATES WORKING ACCOUNT FOR THE PERIOD 1ST JANUARY TO 31ST DECEMBER 2005

2004		INCOME	2005		
Rs.	Kg.	Tea Sales Gross Proceeds	Kg.	Rs.	
52,117,170.21	283,775.25	Tea Sales Ex Brokers(Gross)	328,765	60,507,594.46	(Note 1)
4,080,933.27	31,046.75	Tea Sales Local & Graties	27,467	5,048,256.53	
56,198,103.48	314,822.00		356,232	65,555,850.99	65,555,850.99
		Add-			
534,040.00		Tea Lost (417Kg)Mr.E.M.Dayaratne		73,403.60	
213,550.44		Miscellaneous Income		70,905.68	144,309.28
56,945,693.92		Total Income			65,700,160.27
		EXPENDITURE			
		Less: Estate Expenditure			
14,689,713.96		General Charges		17,341,005.37	
5,633,163.26		Field work & Cultivation		6,171,066.96	
29,453,418.49		Production		33,464,661.88	
655,486.16		Bought Leaf(including transport charges)		1,260,458.77	58,237,192.98
50,431,781.87					
		Administration & Finance			
1,700,327.08		Bonus and Holiday pay		3,181,287.41	
1,781,196.01		Depreciation		1,833,305.96	5,014,593.37
3,481,523.09					
		Sales Tax & Distribution Expenses			
1,115,351.88		Brokerage,Handling chgs.,& Sales Expenses		1,291,291.48	1,291,291.48
55,028,656.84		Total Expenditure			64,543,077.83
1,917,037.08		**Profit /(loss) for the year 2005**			1,157,082.44
75,535.39		Less: Over valued tea last year			202,329.91
1,992,572.47		**Profit /(loss) tranferred to TRI Operating A/c**			954,752.53

Notes:- (1) 6525 Kgs unsold Teas valued NSA @ 180.12

Prepared by:- S.G.Punchibanda

TEA RESEARCH BOARD
ST.JOACHIM ESTATE WORKING ACCOUNT FOR THE PERIOD 1ST JANUARY TO 31ST DECEMBER 2005

2004		INCOME		2005	
Rs. cts.	Kg.		Kg.	Rs. cts.	
114,320,952.88	628,535.00	Tea Sales Gross Proceeds	624,200	111,388,419.82	(Note 1)
563,577.88	6,504.50	Tea Sales Ex Brokers(Gross)	8,420	1,139,521.39	
114,884,530.76	635,039.50	Tea Sales Local & Graties	632,620	112,527,941.21	112,527,941.21
		Add:			
526,570.85		Nursery Working A/c(Net) & Sale of Cuttings		605,709.75	
38,533.78		Miscellaneous Income		54,304.91	
838,869.06		Income from Rubber		1,308,341.00	1,968,355.66
116,288,504.45		Total Income			114,496,296.87
		EXPENDITURE			
		Less: Estate Expenditure			
2,643,792.92		General Charges		1,525,429.54	
1,705,707.46		Field work & Cultivation		1,514,138.55	
3,224,102.38		Production		3,880,068.80	
929,911.53		Expenditure on Rubber		808,457.58	
99,579,549.83		Bought Leaf(including transport charges)		101,353,576.78	
108,083,064.12				109,081,671.25	
		Administration & Finance			
752,507.90		Bonus and Holiday pay		964,738.69	
2,051,984.87		Depreciation		2,879,146.90	
		Sales Tax & Distribution Expenses			
2,375,263.33		Brokerage,Handling chgs., & Sales Expenses		2,382,094.80	
113,262,820.22		**Total Expenditure**		6,225,980.39	115,307,651.64
3,025,684.23		**Profit/ (Loss) for the year 2005**			(811,354.77)
(667,315.32)		**Less- Over valued Tea last year**			(261,667.79)
2,358,368.91		**Profit /(loss) tranferred to TRI Operating A/c**			(1,073,022.56)

Note:- (1) 6224 Kgs unsold Teas valued NSA @ 174.70

Prepared by:- S.G.Punchibanda

BOND DEFAULTERS

Dr U K Wickramasinghe
Mr Sri Ramaratnam
Mr A K Basnayake
Mr T Thevathasan
Dr T S Gunasekera
Dr W A D P Wanigasundera
Ms S M Nagahaulla
Ms S K J Liyanage
Ms R M S S Rajapakse
Dr G Ganewatte
Mr M D L P Gunatillake

AGRONOMY DIVISION

Head - A Anandacoomaraswamy

Research Activities (see Corporate Plan)

1. Thrust A 9. Development of an economically viable system to eliminate/ reduce the soil rehabilitation period, prior to replanting, in the up-country.

Project A 9.1. Evaluating soil rehabilitation techniques.

The objective of the thrust is to develop an economically viable system to eliminate or reduce the soil rehabilitation period, prior to replanting, in the high, mid and low elevations.

The systems tested were:

(1) soil organic carbon enrichment by incorporating coir dust, refuse tea and compost;
(2) *in situ* soil rehabilitation with grasses;
(3) growing economic crops such as cowpea, 'tur-dhal', green gram, citronella and sweet
corn in-between the replanted tea;
(4) rehabilitating with nitrogen fixing trees such as *Flemingia congesta.*; and
(5) rejuvenation pruning of existing seedling bushes with subsequent infilling after *in situ* soil reconditioning with a grass.

The above systems were compared with traditional soil rehabilitation with mana for two years.

There are seven experiments located at high, mid and low elevations. The experiments at New Peacock Estate and Concordia Estate have completed two cycles. In all the trials, none of the alternative systems matched traditional soil rehabilitation in terms of establishment, growth and yield of tea, except one at Ratwatte Estate, Matale. Only in this trial, incorporation of coir dust and refuse tea, at 2 kg per planting hole, gave a yield comparable with traditional soil rehabilitation. The trials at New Peacock and Concordia Estate have shown that the benefits of soil reconditioning with grass, for two years, may be seen even at the end of the second cycle.

2. Thrusts A 12 – A 14. Development of intercropping systems for tea lands in the estate and small holder sectors.

The results of the tea and rubber intercropping experiment at St. Joachim Estate showed no significant differences between rubber yields under the different systems of planting or spacings tested. However, the tea yields under monocropping was significantly higher than that with intercropping.

The tea bushes in the experiment at RRI, Kuruwita were pruned in May 2005. The tea yield under rubber was significantly lower than that with monocropped tea.

The new experiment where rubber was intercropped with tea, fruit crops and cinnamon was continued. There was no significant difference in tea yield, during the first cycle, under the different intercropping systems.

3. Thrust A 19. Evaluation of different irrigation techniques.

Irrigation demonstration blocks with sprinkler and drip irrigation have been installed at St. Joachim Estate, Ratnapura, and at the Institute's station at Kottawa, Galle

Three studies were conducted on fertigation: in the low country (St Joachim Estate), in the Uva (Damaria Estate), and in the up-country (St Coombs Estate). In all the trials, the yield response to fertigation was considerably lower (8-25%) compared to the first-cycle response (50-100%).

At low elevations, results have shown that there was a 8-20% yield improvement with TRI 2023 and TRI 3025, under different systems of planting.

The studies on fertigation at Somerset Estate, comparing different levels of N (120 kg ha^{-1} $year^{-1}$ and 180 kg ha^{-1} $year^{-1}$) with a control receiving the recommended dose of N (360 kg ha^{-1} $year^{-1}$), showed that there was no significant yield difference between N levels. Yield improvement with fertigation was about 20%

The studies on fertigation, conducted in the Uva, with TRI 2025 at different frequencies of water application (daily, every other day and every two days) with a constant level of N (180 kg ha^{-1} $year^{-1}$), showed that the highest yield was obtained when fertigation was undertaken at an interval of every two days. The percentage yield improvement was about 25%

4. Thrust A 20. Development of harvesting devices to improve labour productivity.

An experiment at Galabode Estate, to compare manual and mechanical harvesting (using a motorized machine) at different rates of $ZnSO_4$ foliar application, is in progress. Yield data have shown that motorized machines give reduced tea yields, irrespective of increases in the rate of application of Zn.

The effect of different methods or systems of planting, on yield of tea, were assessed at Balangoda Estate, Ratnapura. In order to assess the suitability of planting systems for motorized machines, three replicates were harvested by machine, while two other replicates were manually harvested. The results showed that the harvesting machine reduces tea yield.

Further assessments are in progress.

The effect of manual harvesting, at intervals of 7 days and 14 days, was compared with machine harvesting at an interval of 14 days, and during the rush crop period, for two different cultivars, TRI 2025 and N 2, at higher elevations. The results indicate that machine harvesting reduces the yield by 50%.

The results of the experiment at Raigama Estate showed that the motorized machine significantly reduces tea yields, at both 14- and 21-day rounds.

5. Thrust A 24. Development of weed management strategies in tea.

Screening of the new herbicides, Rapid and Master™ Carfentrazone (20.5%) for Passali Kodi.

Field trials were conducted with the above herbicides in the up-country (St Coombs Estate, Talawakele), the mid-country (Hantane), and the low-country (St Joachim Estate and Balangoda Estate), for the control of Passali Kodi, Getakola and Morning Glory. The results have shown that in all the locations, Master™ at 4.4-5.5 L ha^{-1} , with and without ammonium sulphate at 3g L^{-1}, reduces the growth of Passali Kodi.

At St Joachim Estate, both formulations effectively controlled the Caladium weed and other common weeds.

Management of problem weeds

In the Venture Estate trial, cover crops have been established as a strategy to suppress the growth of couch grass, and slash-weeding using the wire cord is continuing. A weed sample, sent to Kew Gardens in the UK, by the National Herbarium has not yet identified as *Panicum* species.

At Balangoda Estate, cover crops and mulch materials, and herbicides, are being used for the suppression of growth of Passali seedlings.

Studies on plant extracts. The effect of seed extracts of *Michelia champaka*, incorporated with various additives, for the control of Passali Kodi weed.

12.5-25% of the above solution, incorporated with 0.4% ammonium sulphate or urea, were found to be effective in the control of Passali seedlings.

Divisional Activities (Project D/AGRY)

1. Determination of optimum shade level for tea in the low-country wet zone of Sri Lanka.

Two separate studies were carried out. Study 1 was multi-locational study in which data were collected from several tea estates in the Ratnapura, Kegalla and Kalutara districts.

Assessment of shade level versus productivity of tea under high-shade trees was the main objective of this study. In addition, micro-climatic parameters and soil parameters, under different shade levels, were also measured. The maximum production of green leaf was recorded under the 30% shade level, and then decreases with the increasing shade level.

Studies on micro-climatic and soil parameters under shade are in progress.

Study 2 was carried out at St Joachim Estate, Ratnapura. The effect of shade provided by high-shade trees (Albizzia) on tea, with varying distance from the shade tree, was studied. Pluckable-shoot density increases with the increasing distance from the shade tree, reaches the maxima at a distance of 10.6 m from the shade tree, and decreases thereafter. The relative humidity and soil pH also follow a similar pattern. Transpiration rate, soil-moisture content and organic carbon content decreases with increasing distance from the shade tree, reaches a minimum, and again increases with distance.

2. Observation trials on the 'Deniyaya problem'.

Two experiments were started at Richiland Estate, Deniyaya, to identify the causes of bush debilitation in the Deniyaya region. The trials are in progress.

3. Evaluation of plant growth, and soil nutrient status, of deep fertilizer application.

The effect of deep fertilizer application on growth of young tea was evaluated at Field No. 6, St. Joachim Estate, using the newly designed Deep Fertilizer Applicator.

In this trial, manual and deep application of fertilizers using the fertilizer applicator was compared. Preliminary results show that deep fertilizer application improves both shoot- and root growth of young tea. However, the difference was not statistically significant.

Further observations are in progress.

4. Study on the tipping height and growth of shoots.

This observation was carried out at the Low Country Station, Ratnapura, to study the growth of shoots and bush-spread after tipping, leaving 2, 4 and 6 leaves.

It was observed that the number of new shoots, developed after tipping, increased with increase in the tipping height. However, those originated at the base of the tipped shoots became dormant early, and were found to be of less vigour.

5. Evaluation of the nitrogen-fixing ability of *Arachis pintoi*.

Cover crops are widely grown in tea plantations, especially during the period of young tea establishment. The Tea Research Institute has recently introduced an exotic cover crop, a legume *Arachis pintoii* (wild ground-nut), in tea plantations. It provides a complete ground cover in vacant patches. Being a legume, it fixes nitrogen in the soil. With escalating fertilizer costs and depreciation of the rupee value, even partial substitution of nitrogen with other equally-efficient nitrogen sources will help the country to spend less money for fertilizer import. Further, there is a controversy whether a legume could fix nitrogen in the presence of fertiliser nitrogen.

Two studies were conducted (1) at St Coombs Estate, and (2) at St Joachim Estate The objectives of the study conducted at St Coombs Estate were (1) to confirm whether *Arachis* fixes nitrogen in the presence of fertiliser N; (2) to estimate the amount of nitrogen fixed by *Arachis pintoii* in an ultisol under different fertility levels; (3) to find out the soil fertility level for nodulation by *Arachis pintoii*; and (3) to study the impact of *Arachis pintoii* on the growth of young tea

A glasshouse pot trial was established in June 2005 with a six months-old vegetatively propagated tea cultivar, DT1. The treatments were a combination of *Arachis pintoii* and tea, DT1, with three application levels of N fertilizer (0, half and full recommended nitrogen levels for young tea) in three-factor factorial in CRD.

The amount of nitrogen fixed by *Arachis pintoii* was measured in terms of the number of nodules formed. The growth of tea was measured in terms of plant height and leaf area. The growth of *Arachis* was measured in terms of total biomass. The soil organic carbon, pH, and soil- and leaf nitrogen of tea and of *Arachis*, were measured.

The highest number of nodules was found at half the recommended fertilizer level, followed by zero fertilizer level. There was no nodulation in the presence of tea and at the highest fertilizer level tested. The maximum amount of N was fixed when the soil-N level was at half fertiliser level and at the pH of 5.87. There was no difference in organic carbon among the fertilizer levels tested. The application of fertilizer reduced the soil pH. There was a significant improvement of soil pH without tea and at zero nitrogen fertiliser level. Tea with *Arachis* showed a higher pH than tea without *Arachis*. There was no significant difference in soil nitrogen with the fertiliser levels, and with and without tea and *Arachis*. The growth of tea, in terms of height and leaf area, was highest at the full fertilizer level in the presence of *Arachis*.

This study suggests that *Arachis* could be planted in the middle of the inter-row spaces between young tea, for fixing nitrogen and acting as a cover crop.

The objective of the study at St Joachim Estate was to quantify the amount of nitrogen present in soils, with and without *Arachis pintoii*. The total nitrogen content was analyzed using the Micro Kjeldal method. The results showed that the soils under *Arachis pintoi* had 0.235% total N, compared with 0.182% total N in the adjoining areas without the cover crop. In addition, soil pH was also found to be less under the cover crop: 5.2 and 5.4 with, and without, the cover crop, respectively.

BIOCHEMISTRY DIVISION

Acting Head – A M T Amarakoon

Research Activities (see Corporate Plan)

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

Proanthocyanidins are known to be potent inhibitors of cell wall degrading enzymes, which are secreted during the germination of *E. vexans*. In order to study the effect of proanthocyanidins on the cell wall-degrading enzymes, methods of analysis have to be developed to quantify proanthocyanidins in tea leaves, in addition to assays for cell wall-degrading enzymes secreted by *E. vexans*. A HPLC method was developed for the analysis of proanthocyanidins in tea leaf and black tea. Assay methods were optimized for pectate lyase, polygalacturonase and cellulose (cell wall-degrading enzymes). Work on the effect of proanthocyanidins on cell wall-degrading enzymes is in progress.

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

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

RAPD-PCR was continued on 46 tea cultivars selected using 15 primers. The primers were OPA 7, OPA 10, OPA 16, OPB 10, OPB 13, OPB 17, OPB 19, OPC 9, OPC 10, OPC 14, OPC 17, OPD 03, OPD 15, OPD 07 and OPE 06. Analysis of RAPD data for all the primers (20) was carried out using Rapdistance software (version 104). A dendrogram was constructed using the RAPD profiles.

In addition, according to the pedigree, 11 tea cultivars were identified as the ancestors of most TRI developed tea cultivars, and these were subjected to RAPD-PCR analysis. A dendrogram was constructed to find the genetic relationship between them. The dendrogram divided the 11 cultivars into two main clusters, one comprising predominantly TRI cultivars and their common ancestor ASM 4/10, and the other comprising estate cultivars and TRI 777.

This showed that most of the cultivars developed by the TRI originated, directly or indirectly, from ASM 4/10, and that all these cultivars demonstrated close genetic relationships which could lead to in-breeding depression. The importance of characterizing germplasm genetically, and of using this information in future tea breeding programmes, is thus indicated.

Screening of tea cultivars using Amplified Fragment Length Polymorphisms (AFLP)

AFLP studies for all 39 selected cultivars were continued using eight sets of primers. Analysis of these data to find genetic relatedness is in progress.

Screening of tea cultivars using Simple Sequence Repeat Polymorphisms (SSRP)

DNA extracted from the cultivar TRI 2023 was partially digested and fragments in the size range 400 – 1000 bp were ligated into ë zap vector arms. The phages having simple sequence repeats were selected using end-labeled SSR fragments. Two hundred recombinant phages were selected as positive for simple sequence repeats. Out of that, 20 phages were secondarily screened and subjected to sequencing. The lengths of the sequences obtained were 600 – 900 bp in length, and sequences generated so far were subjected to the National Centre for Biotechnology Information (NCBI) blast search. It was found that all these contain SSRs that aligned with SSRs of rice and *Arabidopsis thaliana.*

3 B 19. Biological effects of tea consumption.

Aluminium content in black tea and blood levels in rats following oral administration

The tea plant is known to accumulate aluminium (Al) in its mature leaves, and this fact had led to the misconception that tea drinking could cause Al toxicity. A study was therefore conducted to determine the Al content in tea produced in three major tea-growing areas of Sri Lanka (high-, mid- and low country), and the extent of extraction of Al into the brew.

The levels of Al in the blood were measured following oral administration in a rat model. There were significant differences in the Al content in teas produced in the different regions. However, these were not reflected in the brew, the extraction of Al into the brew being low. The percentages extracted into the brew were 0.9%, 1.1% and 1.4% for high-grown, mid-grown and low-grown teas, respectively.

There was a slight increase in blood Al levels when rats were fed a dose of tea equivalent to 12 cups per day for humans (3.43 μg/dl for high-grown tea, 3.15 μg/dl for mid-grown tea, and 3.48 μg/dl for low-grown tea), when compared with a control group (2.84 μg/dl). These values are within the normal range of blood Al levels, and far below the level at which there would be a risk (100 μg/dl, WHO).

Copper (Cu), Zinc (Zn), Iron (Fe) and Manganese (Mn) in black tea produced in different regions of Sri Lanka

In Sri Lanka, different tea-growing regions have different climates and soil conditions, and different types of manufacturing procedures are adopted which produce different types of teas. The international standards for made tea are becoming more stringent with time. With this in mind, this study was carried out to find the heavy metal (Cu, Zn, Fe and Mn) content of teas produced in the different tea-growing regions. The regions were Nuwara Eliya (NE), Udapussellewa (UP), Lindula/Talawakelle (L/T), Bogawantalawa (BT), Agarapatana (AP), Malwatta Valley (M.V.), Bandarawela (BA), Mid-Country (M.C.) and Low Country (L.C.).

Samples were obtained from the estates at monthly intervals, in March, April and May of 2005. Samples were digested with nitric acid, followed by perchloric acid, and the Cu, Zn, Fe and Mn content was measured using atomic absorption spectroscopy.

The content of these metals was well below the levels stipulated by international standards. There were significant variations in levels with respect to the growing region. Tea produced in the low country had significantly lower Cu and Zn than tea produced in the up-country, the Uva and the mid-country. The highest Mn content was found in teas produced in the Uva and the mid-country regions, while the lowest content was found in teas produced in Bogawantalawa, Nuwara Eliya, Lindula and Agarapatana. Tea produced in Nuwara Eliya and Udapussellewa had the highest Fe concentrations, while tea produced in Lindula, Bogawantalawa and Agarapatana had the lowest.

This study was carried out in collaboration with the Institute's Soils and Plant Nutrition Division (SPND).

Effect of black tea on stroke

Ischemic cerebrovascular disease (stroke) is one of the leading causes of death and long-time disability. Studies have shown that the generation of reactive oxygen species (ROS) plays an important rôle in the pathogenesis of cerebral ischemia.

A collaborative project was initiated with the University of Sri Jayewardenepura (USJP) and the National University of Singapore (NUS) to study the effect of black tea and green tea on stroke, using an *in vitro* brain-cell model. Initially, the antioxidant activity of Ceylon black tea was measured *in vitro* using trolox

equivalent antioxidant capacity (TEAC) and the pyrogallol red bleaching assay. Ceylon black tea and Chinese green tea had comparable antioxidant activities, which were slightly lower than that of the positive control ascorbic acid.

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

In 2005, different extraction and clean-up methods were studied to optimize the analysis of carbofuran, phenamiphos, propagite and propiconasol. However, only carbofuran could be analyzed with an acceptable level of recovery (more than 70%), using ethyl acetate extraction and gel permeation chromatography.

5 Project A 1.5. Screening lines for quality.

Preliminary screening of 21 selections belonging to the Phase II stage of the breeding programme, from the up-country, was carried out four times during the year. Green leaf samples were supplied by the Plant Breeding Division, and manufacture of the samples were carried out using an environmentally-controlled miniature manufacturing facility. Made tea samples were evaluated by three professional tea tasters, and ranked on the basis of quality, using the hedonic scale procedure. The results of the study are being analyzed.

6 Project A 29.2. Extraction of proteins from black tea.

In black tea manufacture, 3% of the harvested tea leaf is discarded as refuse tea. Refuse tea contains 20-30% of crude protein. This project was carried out with the objective of establishing procedures for extracting protein from refuse tea, and purifying the protein so extracted.

Studies were carried out to compare the nutritional composition of refuse tea (RT) and leaf protein concentrations (LPC), obtained at different stages of purification. Leaf protein concentrate (LPC-1) was obtained from RT using the established method. LPC-2 was obtained by purifying LPC-1 with boiled distilled water (1:6 solid to solvent ratio), and LPC-3 was obtained by washing LPC-2 with 70% methanol (1:6 solid to solvent ratio). The yield of LPCs per unit weight of RT was calculated on a dry-weight basis. Crude protein, crude fiber, total polyphenol, total ash content, and ether extract of RT and LPCs, were determined.

The yield of LPC-3 was 207 g per kg of refuse tea. It had the highest crude protein content, with the lowest crude fiber and total polyphenol content.

ENTOMOLOGY DIVISION

Acting Head - Keerthi Mohotti

Research and development activities and the research projects carried out in the up-country, the mid-country, the Uva, the low country, and in the Kottawa and Deniyaya regions by the Entomology and Nematology staff are summarized here. Some of the projects were conducted in collaboration with Plant Breeding, Plant Physiology, Biochemistry and Technology Divisions as per the Corporate Plan.

The activities were prioritized based on industry needs during the period under review. These include cultivar and pesticide screening against various tea pests, miscellaneous entomological and nematological problems especially in the Deniyaya region, biological control, and 'organic' and 'biodynamic' tea cultivation.

Research Activities (see Corporate Plan)

1 Cultivar screening

The following trials on 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
Shot-hole borer	A 1.2		Different locations in the mid-country
	A 4.2	LE 91/LVP 75 LE 92/LVP 74 LE 98/LVP 87	St Joachim Estate TRI Station, Deniyaya TRI Station, Kottawa (Phase III trial)
Livewood termite	A 4.2	LE 78	Hadaraganga Division Hapugastenna Estate
		LE 81 LSP 1	Upper Wewelketiya Division, Hapugastenna EstateSt Joachim Estate
		LVP 80, 81, 82, 83	St Joachim Estate
Pratylenchus loosi	A 1.6	N 1A	Nematology experimental area, Talawakele
		N 1A	TRI Station, Passara
Radopholus similis	A 2.5	N 1B	Hantane Estate, Hantane
		N 1B	TRI Station, Passara

The data generated during the year are presented. Final recommendations on cultivar selections will be done in consultation with the Plant Breeder after further evaluations where necessary.

During the period under review, nematode screening tanks in Talawakele and Hantane were under developmental, nematode population build-up and monitoring stages.

2 Screening germplasm and seed stocks for shot-hole borer.

Two germplasms at Passara (74 cultivars) and Ratnapura (127 cultivars), and a seed stock at Passara (800 seedlings), were sampled for levels of shot-hole borer infestation. Varied borer infestation levels will be investigated further.

3 Performance of recommended cultivars against shot-hole borer in different locations in the mid-country.

The field performance of a few cultivars was evaluated for shot-hole borer infestation at Sooriyagoda, Imboolpitiya, Hope, Greenwood, Monte Christo, Loolecondera, Gomera, Rangala and Kurugama Estates in the mid-country. Different borer infestations, observed on cultivars in different locations, will be studied further.

LE 91/LVP 75, St Joachim Estate (Phase II trials).

Cultivar numbers 241, 379, 288, 10/1 and 1145 were found to be free of shot-hole borer infestation.

LE 92 / LVP 74, TRI Station, Deniyaya (Phase II trials).

Eight shot-hole borer assessments, on 42 cultivars, were carried out during the year .

LE 98/LVP 87, TRI Station, Kottawa (Phase III trials).
The results of the SHB assessment of nine cultivars, done at 23 months after planting, revealed very low infestation levels in four cultivars, numbers 93, 168, 85 and TRI 4042.

4 Livewood termite

Experiment No. LE 78.
Thirty-seven cultivars (HG 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 27, 28, 30, 32, 33, 35, 38, 42, 43, 44, 45, 47, 48, 49 and 50), selected

from Field No. 4, Handaraganga Division, Hapugastenna Estate, were maintained for the second pruning-time assessment.

Experiment No. LE 81.
Twelve cultivars in the Upper Wewelketiya Division, Hapugastenna Estate, were assessed at second pruning.

Experiment LSP 1.
None of the seed stocks of Anhettigama P.C, Reucastle B.C, Aislaby, St Coombs, Sapumalkande P.C, TRI 2023, Karadupona, Poonagala, TRI 4046, Halpe P.C, Salawa P.C, El-Teb B.C, DG 39 and Densworth B.C, established at St Joachim Estate, exhibited any signs of termite attack.

LVP 80,81,82,83 (Phase II trials at St Joachim Estate).
The results of the first pruning-time assessment showed no signs of termite attack of the cultivars tested.

5 Screening of synthetic pesticides

Field evaluations were carried out for screening new pesticides against shot-hole borer, in different locations (Table 2).

Table 2. Screening synthetic pesticides against shot-hole borer in different locations.

Project	Region	Location
A 22.1	Low country	Hapugastenna Estate
	Mid-country dry zone	Haputale Estate
	Mid-country wet zone	Nayapana and Loolcondera Estates
	Up-country	Abbotsleigh Estate

Since the results of the preliminary experiments with Fipronil were inconsistent, trials with lower dosages of Fipronil against shot-hole borer were repeated, in locations representing all the agro-ecological regions.
The experiments are in progress.

6 Scavenging termite

ME 27. Screening of two dosages of fipronil and 'Burnt Engine Oil' to control scavenging termite.

Fipronil at 2 l and 3.5 l per ha, and the burnt oil application, were tested under field conditions, in a scavenging termite-affected field, viz. Field No. 3 Lower Division, Imboolpitiya Estate, Nawalapitiya. Assessments of the infestation levels are in progress.

Observation trial on scavenging termite control
An observation trial is being maintained at the Mid-Country Station, Hantane, on controlling damage to tea by scavenging termite using Fipronil, lime, grease and burnt oil applications as chemical alternatives.

Observations made two months after treatment showed no termite activity in the bushes treated with Fipronil and burnt oil.
This trial is in progress.

7 Pesticide use in tea

Owing to recent developments in major tea markets, namely the European Union and Japan, with regard to restrictions on the use of insecticides, nematicides, fungicides, acaricides and herbicides for tea, in relation to pesticide residues, activities in the Division were strengthened to assist tea exporters to meet the new requirements.

The work involved frequent meetings and discussions with local agencies and representatives (SLTB, TASL, PA, producers, exporters, ROP), and foreign representatives (importers, buyers) and policy-makers.

Initial steps for setting up field trials, to generate data on MRLs of the chemicals concerned in the Institute's recommended list, were begun in collaboration with the Biochemistry Division.

8 The Central Biological Laboratory

The central facility for mass-culturing of insect and nematode bio-control agents was monitored. Negotiations on establishing collaborative research programmes, for formulating techniques for myco-insecticides concerned with the bio-management of insect pests in tea, are in progress with experts at CABI Biosciences, UK and in the Tokyo University of Agriculture and Technology, Japan.

9 Indigenous and natural pest-control methods and techniques

Scientific validations of some of the best practices against managing tea pests are in progress. Isolation of chemicals from various pesticidal and medicinal plant species are in progress, in collaboration with the ITI, Colombo.

10 Nature Farming Research and Demonstration Area

Ecological and traditional agricultural practices, demonstrated at the Nature Farming Research and Demonstration Area, were used in research on sustainable crop production and crop protection in tea.

11. Biological Control

11.1. Project A 22.2. Biological control of shot-hole borer damage in tea.

Mass-rearing of strains of the fungus, *Beauveria bassiana,* obtained from CABI, UK were continued *in vitro* for experimental purposes. Field application and bio-formulation techniques were to be perfected with support from CABI, UK, and hence no field-testing was done during the period under review.

11.2. E 333. Isolation of local strains of biocontrol agents to control shot-hole borer.

Fungal types, with similar morphological features to *B. bassiana*, were recovered locally and subjected to further confirmation of efficacy. Locations having greater potential for bio-management of the pest were identified. Further screening of specimens is in progress.

11.3. Screening of local viruses from tea tortrix larvae.

A survey was conducted to screen tea tortrix larvae of various locations for different types of viruses: EPVs (Entomopoxviruses), GVs (Granuloviruses), and NPVs (Nucleopolyhedroviruses). Viruses and protozoa detected in dead larvae, and mortality percentages due to EPV, were studied in the preliminary survey. Further work is in progress in collaboration with scientists at the Tokyo University of Agriculture and Technology, Japan.

11.4. N 369. Mass propagation of nematode biocontrol agents.

Laboratory and pot cultures of local isolates of nematode biocontrol agents were maintained for experimental use.

11.5. N 371. Monitoring naturally-occurring nematode antagonists of tea nematodes.

Soil populations of *Pratylenchus loosi* and *Radopholus similis*, and nematode biocontrol agents, in Needwood and Stassens estates in Haldummulla, and the Institute's Kottawa Centre, were periodically monitored.

12. Thrust A 22.

12.1. Population dynamics model for shot-hole borer

The model, 'SHBMODEL', was developed using the modelling software, DYMEX, to describe the population dynamics of the beetle in relation to the pruning cycle. The model also explains the approximate number of generations and the pest damage in the different agro-ecological regions.

The validation of this model against field data, prior to it being considered as a fully functional population dynamics model, is in progress.

12.2. Survey on the distribution and levels of infestation of shot-hole borer across the tea-growing areas.

Shot-hole borer damage levels in all plantations in the mid-country (dry and wet zones), low country and up-country were determined.

The infestation levels, relating to the general abundance of the beetle, have been used to compare the different population changes obtained from the SHBMODEL simulations. Distribution maps based on the infestation levels have also been prepared.

12.3. Spatial distribution of shot-hole borer in relation to the pruning cycle.

Spatial distribution of shot-hole borer has been studied in locations representing different agro-ecological regions. Taylor's Power Law (TPL) was used to analyze infestation levels, which provide an index of dispersion of shot-hole borer in a given location. The data will be subjected to further analysis, in order to generate regionally based sampling procedures for shot-hole borer, with a view to improving the existing sampling procedure.

12.4. Establishment of threshold levels for shot-hole borer.

An experiment was laid down at Craig Lea Estate, Kotagala, in order to estimate the damage coefficient (the damage function which relates the level of attack to

crop loss), and the mortality coefficient (the control function which relates the reduction in attack to the control strategy applied). Both coefficients are necessary to deduce the economic threshold of shot-hole borer attack. This work is in progress.

12.5. Project A 22.5. Modifying potassium fertilizer to reduce shot-hole borer damage.

Post prune shot-hole borer assessments were made in the experimental plots with different fertilizer levels, at St. James Estate, Hali Ela, maintained by the Soils and Plant Nutrition Division.

13. Project A 23.5.
Bio-remediation of agricultural pollutants in tea plantations.

Five plant species, Kang Kong *(Ipomea aquatica)*, Giant Reed *(Arundo donax)*, Water Hyacinth *(Eichhornia crassipes)*, Bullrush *(Scirpus lacustris)*, and Kumbuk *(Terminalia arjuna)*, were evaluated for their bio-remedial properties in tea lands. Water quality (biological and chemical parameters) in the St Coombs lake, along with several glasshouse and laboratory experiments, were monitored for validating the results.

As a demonstration site, the surroundings and the inlets of the St Coombs lake were planted with Kumbuk and tree ferns to eliminate most of the pollutants, fortified with erosion and run-off control agronomic measures as a cost effective, environmentally- and worker-friendly, and sustainable approach having an aesthetic value.

14. Project A 23.8.

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

Field establishment of nursery plants (cultivar DN), raised by mass-scale production, was tested under estate practices at the Great Western Estate, Talawakelle.

Eucalyptus and *Pinus* soils can be successfully used as a substitute for Mana soil. Data on growth and establishment of the plants, and response to nematode infestation under field conditions, will be monitored periodically.

15. Project A 32.3. Pest and disease incidence management under organic tea cultivation.

Post-prune assessments on growth, and pest and disease incidence, in the experimental plots of the 'TRIORCON' trial at St Coombs were completed. Yield and quality of tea will be monitored in collaboration with the Plant Physiology and the Technology Divisions.

15.1. Scientific validation of yield, and pest and disease resistance, in organically and biodynamically grown tea.

Growth, and pest and disease incidence, in three-year-old 'Assam Hybrid' tea grown under biodynamic, organic and conventional management systems, in the on going 'BIDORCON' trial at the Tea Research Institute, Talawakelle, were monitored.

Organic and biodynamic tea plants showed high initial growth compared to conventional tea. They were also better endowed with nutritional attributes and other positives, such as micronutrients and soil biological status, than were tea plants in conventional systems. Organic and biodynamic treatments enhanced the soil biological properties. In addition, organically and biodynamically grown tea exhibited greater growth, and pest and disease resistance, than did conventionally grown tea. Greater mechanical resistance to adverse conditions, such as stresses from pest and diseases, and drought and cold, in organically and biodynamically managed tea, over the conventionally managed plants, was attributable to a significantly increased thickness of the leaf epidermis and of the cork in the roots.

15.2. Screening natural herbicides for managing weeds in tea lands.

The effects of pine oil, cow's urine, vermiwash, pine leaf and root extractions on economically important weeds, namely broad leaves (*Crassocephalum crepidiodes)*, grasses (*Panicum repens*), sedges (*Cyperus rotundus*) and problematic weeds (Pasily kodi or *Andredera cordifolia*), were monitored under glasshouse and field conditions, and compared with the effects of conventional herbicides.

The potential for the exploitation of pine oil for weed suppression in tea lands, especially in organic and biodynamic tea cultivation, was evident, but warrants further trials, with reduced dosages and different formulations, before environmentally friendly and cost effective measures can be arrived at.

16. C 2. Nematode analysis

The nematology laboratories at Talawakele, Hantane, Ratnapura and Kottawa continued to assist the tea plantations in analyzing soil- and root samples from nurseries and fields for possible contamination with plant-parasitic nematode populations, in addition to routine experimental work.

17. D 17. Management of nematode pests in tea lands.

17.1. MeBr 9. Development of a steam chamber for soil sterilization in nurseries.

A steam chamber with boiler was perfected for testing for use as a model soil-sterilizing unit. Evaluations will be performed to check its efficacy.

17.2. Survey of tea lands at low elevations for nematodes.

A survey covering nurseries, fields and rehabilitation lands of small holder and corporate tea estates, in the Ratnapura and the Kalutara districts, was initiated.

17.3. Survey of tea lands in St Coombs Estate for nematodes.

After a lapse of many years, all the fields in St Coombs Estate were sampled for the presence of nematode species. The infestation levels of *Pratylenchus loosi* in the different fields were determined, and mapped for use for research and pest-management purposes.

17.4. Nematode incidence in 'direct-planting' field trials.

Samples were drawn from experimental plots, monitored by the Agronomy Division, that had been set up for rehabilitation and for direct planting at Handford Estate (Project A 11) and New Peacock Estate (Project A 10), in Deniyaya and Pussellawa, respectively. Data on nematode incidence need to be periodically monitored under different weather conditions for confirmations of the results.

18. D 19. Insect identifications

The entomology staff assisted many tea-packaging and exporting companies by identifying insects found contaminating made tea and the ingredients used for value addition and in warehouses.

Steps were initiated, in collaboration with the officials of Tea Commissioner's Department of the SLTB and of the Quarantine Department of the Department of Agriculture, for mitigating such contamination with possible corrective measures.

In addition, information on and the history of the longhorn beetle, declared by America and Canada as a potential insect pest in the tea-packaging process, were studied. The possible existence of this pest in Sri Lanka was partly ruled out, although additional work is in progress for confirmation, in consultation with the Quarantine Department.

19. Project D 20.

19.1. Incidence of hyperparasitism in up-country region.

The level of hyperparasitism and its effects on tortrix populations was studied in the Lindula and the Pundalu Oya areas, in the up-country region. Hyperparasitism was identified as the major cause that affected the efficient control of tortrix occurring during dry and wet weather.

19.2. Occurrence of the nematode parasitizing tea tortrix

The nematode, described as *Mermis nigrescens* and belonging to the family Mermithidae, was observed recently in the Lindula and the Pundalu Oya areas in the up-country region.

20. Unusual build-up of insects on tea bushes in Park Estate.

Two groups of insects, hitherto unknown and not recorded as tea pests, were found to be causing crop losses in Park Estate, Ragala during March - May. The pests were identified as (1) *Phlepsius divaricatus*, a leafhopper, and (2) *Bibio* sp., a fly. The infestation was found to be spreading during the dry months. Stunted growth caused by the pest damage leads to crop loss. The cultivar, Park 2, was heavily affected. No natural predator or parasitoid has been found. Any possibility of virus association with the pest incidence was ruled out, following assistance by the National Virus-Indexing Centre of the Department of Agriculture.

21. Evaluation of local materials, having pesticidal and termicidal properties, as non-chemical alternatives in managing up-country livewood termites on tea lands.

Field studies were launched at Gouravilla Estate, Upcot, in search of alternative methods having economical and practical benefits for the control of UCLWT, and for the expanded rehabilitation of affected tea lands.

The neem-oil cake + tea waste treatments showed biocidal (pesticidal and termicidal) effects. Formalin and *Alocasia* acted as a termite repellent in tea soils.

The correlation between UCLWT and micro-arthropod densities suggested a potential for the natural management of tea termites.

Also, the non-chemical soil treatments assured crop sustenance through improved green leaf yield in UCLWT-affected tea fields. Further experimentation is in progress to explore the predatory action of various micro-arthropods on UCLWT.

22. The impact of *Gliricidia* plants on infestation of LCLWT in tea fields.

The impact of the presence of *Gliricidia* plants, on infestation of LCLWT in tea fields, was assessed in Field No. 7 at the Kottawa Centre. Further monitoring will be made in many other locations.

23. Project B 30.

Biochemical resistance of tea cultivars towards low country livewood termites.

Certain biochemical parameters of different tea cultivars, and insecticidal properties of tea-seed fractions, were screened against LCLWT. Bioassays have been performed.

24. Anatomy of tea stems exposed to different fertilizer treatments.

The histology of stems of tea bushes, exposed to different fertilizer treatments at St. James Estate, Hali Ela, monitored by the SPN Division, was studied. The cell morphometrics and morphological characters will be correlated with plant-nutrient status and shot-hole borer damage levels.

25. Miscellaneous studies

Entomological and nematological attributes leading to yield decline and bush debilitation in the Deniyaya region.

A field survey was conducted, in collaboration with the staff of the Advisory and Extension Division, and of the Tea Small Holder Authority, to find the attributes leading to yield decline and bush debilitation in small holder and corporate tea estates in the Deniyaya region, with special reference to the association of insect and nematode pest problems, in affected tea lands.

Debilitation and death of bushes were found to have expression as a 'complex', in the different locations of the area, resulting in various attributes. Among the pests, incidences of nematodes, shot-hole borer and low country livewood termite were identified as the causal factors, in different locations in the area. Also, inappropriate departure from cultural practices recommended by the Institute was seen to make the tea plant susceptible to various pests and diseases.

PLANT BREEDING DIVISION

Head – M T K Gunasekare

Towards meeting the objectives of the Institute's Corporate Plan, the following activities were undertaken by the Division in the year 2005.

Research Activities (see Corporate Plan)

1 Thrust A 1. Development of VP cultivars for the up country.

The emphasis was placed on four priority areas in the programme for the year 2005, in order to streamline germplasm and cultivar development and release:

Priority I. Interim release of TRI 5000-series cultivars for commercial evaluation on multi-location trials,

Priority II. Identification of promising seed progenies as an alternative source of planting material.

Priority III. Strengthening the controlled hybridization programme to obtain new breeding lines having a combination of desirable attributes.

Priority IV. Systematic characterization and documentation of genetic resources, conserved in regional gene banks, for the rational utilization of germplasm in the breeding programme.

1.1. Project A 1.1. Evaluation of VP cultivars for the up-country.

A total of 404 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 twenty-three accessions are currently under evaluation in Phase I trials in the up-country region. Two evaluation trials (VP 77 and VP 82) have been concluded after recording the first-cycle yield, and promising selections and accessions have been identified for further testing. Of the 141 accessions included in these two trials, only one accession recorded a significantly higher yield than the control cultivar, TRI 2025. The first-cycle

yield average of some 30 other accessions were found to be comparable to the control cultivars used.

Weekly yield recordings, and other trait evaluations, of another three trials in Phase I (VP 84, VP 88 and VP 90) have been continued.

Evaluation of accessions: Phase II.

One hundred and fifty six accessions in Phase II trials, and 11 accessions in clonal observational rows, are under evaluation in the up-country region, in order to identify potential cultivars for further testing on a commercial scale.

First-cycle yield assessments have been completed for two Phase II trials (VP 81 and VP 85). One evaluation trial has already been concluded, and promising accessions have been identified and established in commercial-scale evaluation trials (see Phase III trial). Weekly yield recordings, and other trait evaluations, of another three trials in Phase II (VP 83, VP 87 and VP 89), at various stages, have been continued.

Commercial evaluation of cultivars in the process of preparation: Phase III.

(Interim release of TRI 5000-series cultivars for commercial evaluation in multi-location trials)

The objective of making an interim release of new TRI 5000-series cultivars, which are in the process of preparation, was to provide an opportunity for progressive tea growers to have an early access to new potential cultivars, and evaluate them under estate-managed conditions. Once the preferences of the tea growers have been elicited, the transparency of the cultivar development programme can be improved, before the materials are formally released or made commercially available.

Potential cultivars (advanced breeding lines) for pre-release have been identified, based on their performance as evaluated for regional adaptability, in Phase II (VP 80) in the up-country region. The potential cultivars identified were established in a commercial evaluation trial, in collaboration with Mattakelle Estate, to confirm the performances of potential TRI 5000-series cultivars adaptable to the up-country region.

1.2. Project A 1.2. Screening accessions for shot-hole borer, blister blight, collar canker and Poria.

Shot-hole borer

VP 85. Assessments were carried out to evaluate the resistance to blister blight and SHB, in collaboration with the Pathology and the Entomology Divisions. (Refer relevant sections of the Plant Pathology Division report.)

VP 87. Assessments were carried out to evaluate the resistance to blister blight, in collaboration with the Pathology Division. (Refer relevant sections of the Plant Pathology Division report.)

Shoots of the cultivars issued in 2003 are being screened for Poria by the Pathology Division.

1.3. Project A 1.5. Screening accessions for quality.

VP 85. In collaboration with the Biochemistry Division, sampling of 22 accessions, together with the standard DT 1, for quality testing was begun in May, and four batches have been completed. (Refer relevant sections of the Biochemistry Division report.)

1.4. Project A 1.6. Screening accessions for plant parasitic nematodes.

According to the Nematologist, owing to some technical problems in the nematode-testing pits, plants raised from the cuttings supplied by the Plant Breeding Division in 2003/2004 (comprising 32 accessions from VP 80, as well as TRI 3016, 3047, 3072, 3073, 4014, 4046 and 4049) have not been made use of for screening for nematode resistance or susceptibility.

1.5. Project. Evaluating cultivar response to applied nutrients.

For the first time, a collaborative study was initiated, with the Soils and Plant Nutrition Division, to evaluate the crop response of potential TRI 5000-series cultivars to native and applied nutrients. Two hundred and forty plants, from each of four accessions (VP80/5, VP80/99, VP80/208 and VP 80/272), selected from 15 accessions from VP 80 (Phase II), together with a control cultivar, TRI 2025, have been issued to the Soils and Plant Nutrition Division, for the purpose of establishing a field trial to estimate the response of the accessions to applied nutrients. (Refer relevant sections of the Soils and Plant Nutrition Division report.)

2. Other Activities for Generating Information for Plant Breeding Research Programmes.

2.1. Controlled hybridization programmes, up-country

A total of 1704 single crosses, involving 58 different parental combinations, were carried out in the 2005 programme. Two hundred and seventeen hybrid seeds have been harvested and planted in the nursery. On an average, a seed-setting success of 12.7% percent was achieved.

Seventy-four hybrid seedling plants, generated from crosses of the 2004 programme, were planted in the field, and are now being evaluated for performance.

A database was constructed to facilitate easy retrieval of information relating to the hybridization programmes of 2004 and 2005.

Parental cultivars, selected for the 2006 hybridisation programme, were studied in detail in relation to their floral and pollen biology.

2.2. Co-ancestry analysis of cultivars recommended by the Institute.

Information about the true genetic contributions of the different tea ancestral lines, in cultivar development, would be extremely valuable in selecting diverse parents for breeding and genetic enhancement. Hence, the relative genetic contribution of ancestral lines in the development of recommended cultivars of the TRI 3000- and 4000-series was determined, using the coefficient of parentage (COP), to increase the efficiency of the breeding programme. A COP data matrix was constructed, and the genotypes were clustered to form genealogically similar groups. The true genetic picture of the relatedness among the cultivars, developed so far, has revealed that there is considerable genetic potential to be tapped and utilized in future breeding programmes for obtaining promising new cultivars. Further, it has now become possible to identify, with more confidence, the parents for future hybridization programmes, based on the information generated.

2.3. Germplasm.

Measures were taken to expand the existing germplasm at St Coombs with the aim of preserving useful genetic resources. Six accessions (UH 9/3, PLLG I, MT 35, AMAH 3/12, PD 14 and AMA5/60) were added to the collection this year.

All the germplasm accessions in the field gene bank, in Fields No. 8 and No. 9, were pruned in September, leaving the bushes rested for hybridization work.

2.4. Polyploid breeding

Monitoring the performance and morphological differences in 17 colchicine-treated TRI 2027 plants have been continued in Field No. 9, St Coombs Estate.

2.5. Mutation Breeding

Plants raised from VP cuttings of TRI 2025, exposed to gamma rays and planted in the field, were assessed for yield and other morphological characters, along with untreated plants.

2.6. Estate Cultivar Selection Programme

Seedling selections from:

(a) Labukelle Estate (in Field No 13, St Coombs Estate)

As there were many casualties in some accessions, this trial was abandoned.

(b) Fairlawn Estate

Plant raised in the Plant Breeding nursery, Talawakelle, from seedling selections, made from Fairlawn Estate, were established in Fairlawn Estate, Field No. 10, in July. Fifty-two selections were planted in clonal rows, together with standard cultivars of TRI 2025, DT 1 and N 2. The outside area was planted with some PB accessions and with two VP 80 selections.

3 Thrust A 2. Development of VP cultivars for the mid-country wet zone.

3.1. Project A 2.1. Evaluation of cultivars for the mid-country wet zone.

A Phase II trial (MVP 12) was established in May at the Mid-Country Station, Hantane, Field No. 2, using 27 potential selections made from the VP 80, LVP 74 and LVP 75 evaluation trials, together with two standard cultivars (TRI 2025 and TRI 4042).

4 Thrust A 3. Development of VP cultivars for the mid-country semi-dry zone (the Uva).

4.1. Project A 3.1. Evaluation of cultivars for the mid-country semi-dry zone.

Evaluation of accessions: Phase I

UVP 10: Bushes were tipped and the tipping weights were recorded. Yield recording was not performed as the trial is now in its second cycle.

Evaluation of accessions: Phase II

UVP 9: Bushes were rested to raise cuttings for establishing a commercial trial at Gonakelle Estate in order to assess potential TRI 5000-series cultivars.

Clonal observation rows, TRI 5000 series

This trial was established in Field No. 2 at the Uva Regional Centre in order to assess the performance of nine selected potential cultivars, obtained from UVP 9 (Phase II).

Germplasm, the Uva (Passara)

Infilling of accessions, conserved in a field gene bank, was undertaken to revive the germplasm at Passara. Thirty accessions were re-supplied. In November, the Entomology Division undertook the screening of 74 germplasm accessions for SHB.

4 Thrust A 4. Development of VP cultivars for the low country.

Project A 4.1. Evaluation of cultivars for the low country.

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

One hundred and ninety accessions tested in the Phase I trial were concluded, and potential selections have been identified for further testing.

Of the 229 accessions tested continuously in the Phase II trails, evaluation of the first-cycle yield has been completed with 116 accessions, of which two have given significantly higher yields than the control cultivars. A further 21 showed comparable yields to the controls used.

The assessment of the first-cycle yield of other accessions under evaluation is being continued.

Evaluation of accessions: Phase III

Phase III evaluations of TRI 5000-series cultivars were continued in trials at the Kottawa Station, at Cecilton Estate, Balangoda and at Deniyaya Estate, Deniyaya. In addition, another new Phase III trial was established at Indola Estate, Deniyaya, to evaluate the potential of TRI 5000-series cultivars under commercial settings.

Accession Nos. 1, 59, 72, 84, 93, 157, 168 and 195, derived from LVP 74 (Phase II), was used, together with standard cultivars TRI 2026, 2027 and 4042 for comparison.

Project A 4.2. Evaluating accessions for resistance to LCLWT, stem canker and SHB

Macrophoma canker

Accessions in Phase II trials of LVP 80, LVP 81, LVP 82 and LVP 83 were assessed for Macrophoma canker by the Pathology Division.

The Entomology Division undertook screening accessions in LVP 74, LVP 75, LVP 80, LVP 81, LVP 82 and LVP 83 for SHB, and LVP 80, LVP 81, LVP 82 and LVP 83 for LCLWT.

Controlled hybridization, low country

Over 2860 crosses, involving 19 different parental combinations, were carried out during the year. From last year's programme, 72 hybrid plants have already been planted in Field No. 2, St Joachim Estate. These plants were given the first tipping.

Another 53 seeds, derived from the 2005 hybridization programme, were propagated in the nursery.

Germplasm, low country

The Entomology Division undertook the screening of 126 accessions conserved in the field gene bank

5 Thrust A 5.1. Development of biclonal and polyclonal seed cultivars for the up-, mid-, and low country regions and the Uva.

The performance of the seed stocks in the four field trials, established during 2000 in the different regions, was monitored with the aim of developing seed progenies suitable for commercial planting.

Up Country

Evaluation of seed progenies. Field No. 6, St. Coombs Estate, Talawakelle, 2000.

Yield recording of 11 seed stocks in the up country was continued, and the first-cycle yield recording was completed. The average first-cycle yields of 11 seed progenies, derived from different seed gardens, compared with four control cultivars (TRI 2025, TRI 3020, TRI 4006 and DT 1), showed that seed progeny obtained from the seed garden at Reucastle Estate was superior, with yields almost comparable to yields from TRI 2025 and TRI 3020. Two seed progenies (Reucastle and Sapumalkanda) gave significantly higher yields than the control cultivar, DT 1.

Mid-Country

Evaluation of seed progenies. Field No. 6, Mid-Country Centre, Hantane (2000).

First-cycle yield recording was completed, and the bushes were pruned after resting. Pruning weights were recorded and recovery assessment was undertaken. The first-cycle yield records are being analyzed. Bushes were screened for SHB resistance or susceptibility by the Entomology Division at the pruning time (May 2005).

The Uva

Evaluation of seed progenies. Uva Centre, Passara (2000).

First-cycle yield recording was completed, and the bushes were pruned after resting. Pruning weights were recorded and recovery assessment was undertaken. Bushes were screened for SHB resistance or susceptibility by the Entomology Division at the pruning time (December 2005).

Average cycle yields of the 10 seed progenies, tested in comparison with the control cultivars, TRI 2023 and DN, showed that the two seed progenies (St Coombs and Anhettigama) are comparable to the average cycle yield of DN. However, none of the seed progenies recorded significantly higher, or comparable, yields to the control cultivar, TRI 2023.

The Physiology Division conducted a study on the behaviour of tea root systems in V.P cultivars vs. seed progenies, using the material established in the above seed evaluation trial. (Refer relevant sections of the Physiology Division report.)

Low Country

Evaluation of seed progenies. Field No. 2, St Joachim Estate, Ratnapura.

First-cycle yield recording was completed (January 2002 to December 2004). Bushes were rested, and pruning weights were recorded. According to the first-cycle yield averages, none of the seed progeny recorded significantly higher, or comparable, yields as compared to the controls, TRI 2023 or TRI 4046. However, five seed progenies (Salawa, Halpe, Karadupona, Sapumalkanda and St Coombs) showed yields comparable to that of the control cultivar, DG 39.

Individual seedling bushes were screened for SHB and LCLWT resistance or susceptibility by the Entomology Division, and for stem canker by the Pathology Division.

Mid-Country

Commercial evaluation of seed progenies. Hesal Lanka Ltd, Galaha.

A seedling evaluation trial on a commercial scale was established in June, using seed progenies obtained from four seed gardens (St Coombs, Sapumalkanda, Anhettigama and Rambukkanda). Seedlings originating from different parents in each seed garden were planted separately. The cultivars, DG7, TRI 4042 and TRI 4046, have been used as standards.

The Uva

Commercial evaluation of seed progenies. Uva Centre, Passara.

Seedling bushes were centered twice, and visual growth performances were monitored. Of the five seed progenies tested (Rambukkanda, Salawa, Reucastle, Halpe and Kiriporuwa), parental seed stock from TRI 2016, derived from three seed gardens (Halpe, Salawa and Karadupona), performed better than the other seed stocks.

Low Country

Commercial evaluation of seed progenies. Endana Estate, Kahawatta.

A new seed trial was initiated at Endana Estate on a request made by Kahawatte Plantations Ltd.. Seeds collected from Kiriporuwa, Sapumalkanda, Anhettigama, Rambukanda, Maliboda and Reaucastle seed gardens were propagated in the Endana nursery. Plants are to be planted in the field in the early part of next year. About 300 plants from each seed progeny, and two standard VP cultivars, TRI 4042 and TRI 4004, have been prepared for planting.

Seed tea reserves

Seedlings, comprising nearly 470 plants raised from the first batch of seeds collected from tea seed reserves at Gouravilla, were supplied for infilling tea reserves and old seedling tea blocks at Gouravilla.

On a request made by Dunsinane Estate, Pundaloya, two seedling fields (Fields Nos. 6 and 7) have been earmarked for establishing tea reserves.

Seed gardens in the low country.

Follow-up visits were made to Salawa, Maliboda, Anhettigama, Reucastle, Rambukkande, Halpe, Rygama, Sorana, Karadupona, Sapumalkanda, Urumiwella and Kiriporuwa Estates to monitor the seed-setting and flowering pattern of parental cultivars. Various cultural practices, such as removal of unproductive branches and fertilizer application, undertaken with the assistance of the respective estates, were continued.

The seed garden at Urumiwala Estate, Bulathkohupitiya, was infilled with cultivars which were originally planted in order to revive the polyclonal seed garden.

New seed progeny

A new seed progeny, derived from an isolated biclonal seed garden (TRI 4004 x TRI 4006) at Riygama Estate, was propagated at the Plant Breeding nursery in Talawakelle, for the purpose of establishing a progeny trial as a source for selecting new cultivars.

Biclonal seedling progeny for a Marker Assisted Selection (MAS) study

Morphological characterization of mapping population. Bushes were tipped, and the tipping weights were recorded for each plot separately. Resistance to blister blight was assessed visually, in order to correlate the systematically-evaluated data with the visual scores, at the time of tipping. The tipped branches were given to the Pathology Division for carrying out a systematic evaluation of blister blight.

6 Project D 1. Use of *in vitro* techniques

Leaf cultures were established in order to obtain callus for suspension cultures, for the project formulated by the Biochemistry Division. Leaf callus was initiated and suspension cultures were established successfully. Some leaf callus was sub-cultured to use in future experiments.

Sub-culturing of micro shoots was continued, and micro shoots were used for *ex-vitro* rooting experiments. Different rooting substrates were tested in different proportions. Preliminary results showed that there is a great potential in using a combination of sand, nursery soil and coir dust as a rooting medium. Further studies are needed to confirm the results of the preliminary study, and to monitor gradual reduction of RH in the polythene tent to reduce casualties.

7 Model tea block, BMICH

Fifty plants, from each of five cultivars (TRI 4006, 4042, 4047, 4061 and 2043), were planted in the BMICH premises in September, as a model tea block, on a request made by the BMICH and TSHDA.

8. Correspondence

The Division communicated 71 times with growers and other stakeholders on various matters.

PLANT PATHOLOGY DIVISION

Head – A Balasuriya

Research Activities (see Corporate Plan)

1 Project A 1.2. Screening for resistance, up-country.

Screening for resistance to *Poria*

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

After a long wait, the filling of the third inoculation pit was completed. The inoculum was added to the existing pits at two-monthly intervals to replenish the inoculum levels. A few casualties were found in TRI 3015 due to *Poria*. Regular fertilization was undertaken for maintaining the plants.

Screening and selection for resistance to blister blight.

PP/BB1/03. Assessment of progenies on their resistance or susceptibility to blister blight leaf disease under nursery conditions (St Coombs Estate).

Ten composite samples, collected block-wise and provided by the Plant Breeding Division, were assessed. Any further activity was not possible owing to limitations of staff.

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. The selections in the field are 25, 71, 80, 82, 107,113, 117 and X. Of these, the selections 117 and X showi vigorous growth and have the least number of blister infections.

Special undertakings. Blister infections were assessed in 28 accessions in two replicates (Trial: VP 87, estate selections, Field No. 12 B, Pedro Estate, Nuwara Eliya). Blister infections were also assessed in 22 accessions (Trial: VP 85, Phase II, Field No. 6, St Coombs Estate.

2 Project A 3.2. Screening and selection for resistance, Uva.

Screening in Phase II trials. The assessment of 128 lots for resistance to blister blight, in two Phase II trials, UVP 9 (46) and UVP 10 (82), in the Plant Breeding trials maintained at the Passara Station, was completed.

3 Project A 4.2. Screening for resistance, low country.

Screening for resistance to *Macrophoma* canker disease.

The assessment of the seed stock of LSP (2000) in the Plant Breeding trial maintained at St Joachim Estate, Ratnapura was completed. This consisted of 14 treatments, three replicates of each with 40 bushes per plot. Another 38 accessions of the Plant Breeding Phase II trials, LVP 80, 81 and 82 in Field No 1, St Joachim Estate, were screened on a scale of 0 to 9. These trials consisted of two replicates each, with 24 plants in each replicate.

Selection for resistance to *Macrophoma* canker disease and wood rot.

PP/MC1/00. Selection of OST bushes for their resistance to *Macrophoma* canker disease (Hulandawa Estate, Akuressa).

This activity could not be undertaken owing to limitations of staff.

4 Project A 23.1. Screening and evaluation of biological control organisms.

Biological control of root and stem diseases of tea.

Stock cultures were maintained. Bulking and preservation of the spores of the antagonistic fungus *Trichoderma harzianum*, using talc powder, were continued. This provided inoculum for the *Poria* control trial in Moray Estate, and the Horse Hair Blight control trial in St Joachim Estate. A presentation using the data gathered so far was made at the 211th E & E Forum.

5 Project A 23.3. Role of VAM in reducing root-disease incidence and as a mineral-nutrient improviser.

PP/VAM1/04. Nursery inoculation experiment (St Coombs Estate).

Assessments of the roots and the rooting media of the remaining plants in the nursery, for spore counts and root infections, was continued. Subsequently these had to be discontinued owing to lack of staff.

SUPPORTIVE PROJECTS

6 Project D 21 (D/LEAFDC). Leaf disease control

A project proposal was submitted to the Council for Agricultural Research Policy (CARP) on blister blight, entitled 'Risk assessment model for tea diseases', in

collaboration with the Biometry Unit and the University of Peradeniya. The proposal was formally accepted, but there was no communication from CARP following this.

PP/BB1/05. Effect of the spraying interval of Champ DP [$Cu(OH)_2$] (Champion), on blister blight incidence; Field No. 13, St Coombs Estate.
Date commenced: 2nd June 2005.
Tea cultivar: TRI 2025
Four treatments: Champ DP at 7-, 10- and 14-day intervals, and an untreated control.
Design: RCBD with 4 replicates.
Completed 12 spraying rounds, and 14 blister assessment rounds, at weekly intervals. This trial was discontinued. Planned residue analysis test trials, using Champ DP [$Cu(OH)_2$], could not be proceeded with owing to lack of staff.

PP/BB2/05. Screening of new and existing fungicides for blister blight; Field No. 14, St Coombs Estate.
Date commenced: 7th June 2005
Tea cultivar: TRI 2024
Five treatments: Champ DP (Champion), Pyraclostrobin (F500), Propiconazole (Tilt) and an untreated control.
Design: RCBD with 4 replicates.
Completed 12 spraying rounds, and 14 blister assessment rounds, at weekly intervals. This trial was discontinued.

PP/BB3/05. Effect of NaCl (common salt) in the control of blister blight disease at field level.
Date commenced: 14th June 2005
Tea cultivar: TRI 2024
Three treatments: NaCl at 0.1% weekly and at 2.5% weekly, and an untreated control.
Design: RCBD with 4 replicates.
Completed 12 spraying rounds, and 14 blister assessment rounds, at weekly intervals. This trial was discontinued.

7 Project D 22 (D/STEMDC). Stem disease control.

Wood rot control trials

PP/WRG1/03. Testing of RRI latex-bitumen protective paint (St Coombs, Field No 8).

The final assessment was completed approximately four months after the treatments, using the number of shoots, length to the bud breaking point, and

the degree of callusing. In the assessments, the degree of callusing, the number of buds per shoot, and the length of snag to the bud breaking point, were considered. The treatment, amended with Hexaconazole (Contaf), showed slightly increased callusing and better protective properties.

The summary results were presented to the RRI for their consideration.

8 Project D 23 (D/ROOTDC). Root disease control.

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 10^5 spores, Hexaconazole at 1%, and a control) were repeated every two months. The first assessment was taken one month after the first treatment. The fungicide Hexaconazole and *T. harzianum* performed better. The second disease assessment was performed during the last quarter.

***In vitro* screening of fungicides**

In vitro screening of fungicides and *T. harzianum* against black root-causing *Rosellinia arcuata* was continued. Propiconazole and F-500 proved to be very effective in controlling the fungus *in vitro*.

9 Project D 24 (D/HHB). Management of Horse Hair Blight

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 Advisory Staff.

The treatments (control; cleaning + hydrated lime at 10% on the frame only; cleaning + *T. harzianum*; cleaning + $Cu(OH)_2$; cleaning + propiconazole; cleaning + hydrated lime onto frame and litter) were repeated once (3rd). Plot yields were recorded weekly. Disease severity and viability of HHB fungus, on Rose Bengal-streptomycin agar, were monitored at monthly intervals. After three spraying rounds, the lowest disease severity was observed with the Propiconazole treatment.

Some plants or replicates were lost as part of this trial was damaged by lightning injury. The damaged plots were shown to Ms T U S Peiris, Research Assistant in Biometry, for her observations. It was decided to continue the trial to collect at least some meaningful data.

Cost of analysis of samples were claimed at Rs 750/= per sample, including samples from the Tea Commissioner.

10 Project D 25 (D/MISCEL). Miscellaneous Activities.

Microbial analysis of made tea

Altogether 142 tea samples were analysed for percentage moisture, total aerobes at 30±1°C, total moulds at 30±1°C, total coliforms at 35±1°C and *E.coli* at 44±1°C. The findings were reported to the respective agencies.

The majority of samples out of 104 were from the Tea Commissioner, Sri Lanka Tea Board, 35 from a trial of the Technology Division at St Joachim Factory. The remainder were from individual estates.

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

Addressing the pathological aspect of the problem, the fungicides Propiconazole (Tilt) and Pyraclostrobin (F-500), were sprayed at 0.1% concentration of the product. A second field experiment, using Propiconazole, Tebuconazole (Folicur), controlled irrigation and an untreated control, were initiated at St Joachim Estate. Three applications were given at monthly intervals. Disease severity was assessed using a scale of 0 to 5.

Stem samples were collected, from affected and non-affected cultivars in the same vicinity, for the study of anatomical features.

The Superintendent, St Joachim was instructed to spray 2-3 rounds of Hexaconazole (Contaf) as a prophylactic, in the commercial areas, for the purpose of naking observations.

HACCP standards for tea factories

A series of investigations were initiated, at the request of some factories, for the purpose of targeting the establishment of HACCP standards. This included the testing of water samples for contamination by the bacteria *Salmonella* and *Escherichia coli.* Two reports were produced for the concerned factories.

i. Factory hygiene. Twenty-five swab tests were performed, in two rounds, in order to monitor factory hygiene at Balmoral Estate, including that for a few samples of fired dhools. The samples were analysed for microbial contamination.

ii. Hand hygiene, workers. Twelve swab tests were performed, in two rounds, to monitor the hand hygiene of workers. The samples were analyzed for possible microbial contamination involving total coliforms, *Salmonella* and *Escherichia coli* bacteria.

iii. Water samples. Five water samples, including drinking water, submitted by individual estates were analysed for contaminations by total coliforms, *Salmonella* and *Escherichia coli* bacteria.

In assessing the respectve qualities of above sources, the following conditions were determined: total aerobes at 30±1°C, total moulds at 30±1°C, total coliforms at 35±1°C, *E.coli* at 44±1°C and *Salmonella* at 35±1°C.

Reports were made on these tests, and the costs of analysis were recovered.

Disease diagnostic service

During the year, the incidence of Black Root, *Rosellinia arcuata*, and Violet Root, *Sphearostilbe repens,* diseases was on the increase in up-country tea plantations.

There were several reports of Charcoal Root, *Ustulina deusta,* disease, Hypoxylon Stem Blight, *Nemania diffusa*, and Red root, *Poria hypolateritia*, disease, from several up-country estates.

The Division has also attended to several diseased plant-samples, received from miscellaneous entrepreneurs in the area, for the purpose of identification and diagnosis. The following were diagnosed: Black Rot of strawberry, caused by *Colletrotrichum acutatum*, Flower and Leaf Blight of carnations, caused by a *Helminthosporiun* sp., and a bacterial brown spot of *Nepanthus* sp., caused by *Burkholderia cepacia*..

Divisional Activities (D/PLPA)

Estate visits

Eight estates were visited in association with the Advisory and Extension staff in the respective regions. Eighteen estates were visited in connection with experimental work undertaken during the year.

PLANT PHYSIOLOGY AND PROPAGATION DIVISION

Acting Head - A J Mohotti

Basic Research Projects (see Corporate Plan)

The experiments relating to Plant Propagation were taken over by the Agronomy Division.

1 Project B 11. Studies on Photosynthesis and Dry Matter Partitioning.
1.1. Partitioning of assimilates in relation to aging of clonal tea in a pruning cycle (St Coombs Estate, 1992).

In this study, variation in several parameters (yield, canopy architecture, leaf morphology, etc.) was studied in two cultivars, TRI 2025 and DT1, in relation to age in the pruning cycle.

1.2 Yield with age in the pruning cycle

Comparatively, TRI 2025 gave a higher yield than DT 1, the highest yield being in the third year. The lowest yield obtained during the fourth year in both cultivars is significantly different from that in the other years.

1.3 Total dry matter production, harvest index and nutrient profile of the tea bushes.

Bushes of the cultivars, DT1 and TRI 2025, were excavated in January 2005, separated into roots, stems and leaves, and the dry weights determined. Using the yield and dry weight, the Harvest Index (HI) was determined.

Comparatively, TRI 2025 gave a higher HI than DT 1, and more dry matter is partitioned towards the building of the frame during the first year, resulting in a low HI in both cultivars. The highest HI was obtained during the third year in both cultivars.

Further, the plants that were excavated were separated into different parts as follows: flush, mature leaves, branches and roots.

The branches were separated into five categories: type 1, consisting of the collar region; type 2, secondary branches emerging and dividing from the collar region; type 3, branches emerging and dividing from secondary branches; type 4, branches emerging and dividing from type 3 branches; type 5, all the branches emerging and dividing from type 4 branches.

The roots were separated into categories: feeder roots in the uppermost 45 cm from the surface of the ground; roots below 45 cm from the surface of the ground; roots that are less than 0.25 cm in diameter (small roots); roots that are between 0.25 and 0.5 cm in diameter (medium roots); and roots that are more than 0.5 cm in diameter (big roots).

The dry weights were determined in each category, and N, P, K, total soluble sugar and starch content were determined.

In cultivar TRI 2025, the differences in the dry matter were evident only in fallen leaves, leaves, types 5 and 6 branches, and big roots, and, in cultivar DT1, in fallen leaves, mature leaves, types 4, 5 and 6 branches and big roots. The N, P, K content showed no difference between the years. The sugar and starch content also showed no difference between the years.

2 Experiments on shade effects and shade trees

2.1 Effect of shade on yield of mature tea

Since there was a delay in obtaining the netting required, the experiment had to be discontinued for a short period.

2.2 Photoinhibition of photosynthesis in tea

Since there was a delay in obtaining the netting required, the experiment had to be discontinued for a short period.

2.3 Possible alternative shade tree species

Eighty four species were initially selected from the comprehensive database of possible shade tree species. These were selected depending on the rankings given for the following characters: climatic suitability and natural habitat, plant height, root characteristics, pollarding and lopping ability, and leaf shedding. The species are being further screened in collaboration with the Department of Forestry, the Royal Botanical Gardens, and the Universities of Peradeniya and Jayawardenapura. The database is also being developed for user-friendly use.

The experiment is in progress.

3 Tea Root Physiology

Under this project, the following experiments were carried out.

Root studies in field-grown tea

3.1 Study of the tea root system in cultivars vs seedling tea, young tea

This study was carried out with plants of the Seedling Trial at the Institute's Uva Centre, Passara, which was established for evaluation of different seed stocks in comparison with the cultivars TRI 2023 and DN. Measurements were taken of the root system of young, field-grown tea, in order to understand the behaviour of the root system of young tea. The trial was established in the year 2000, with two cultivars and plants of 10 different seed stocks.

The mean values of root depth of the two cultivars studied were greater than the mean value of root depth of all the seedlings. However, there was a significant difference in the root depth between different seedlings. The seedling type, Halpe, had the deepest root system, which was comparable with the cultivar DN and seedling type, Sapumalkande. The active root depth was larger in the cultivars, TRI 2023 and DN, than in all the seedlings. Between different seedlings, there was no significant difference in the active root depth.

The fresh and dry weights of the roots of the two cultivars used, TRI2023 and DN, were significantly different ($p < 0.0001$). DN always had greater fresh and dry root weights compared to TRI 2023. There were also significantly different, mean total fresh and dry root weights, among the different seedling progenies. The change in the mass of roots with the depth of soil was greater in seedlings than in cultivars. The total root length (TRL) of the two cultivars used was not significantly different (CV = 14.7). However, there was a significant difference in the TRL between the different seedling varieties ($p< 0.0001$, CV=18.9).

3.2 Study of the tea root system in cultivars vs seedling tea, mature tea

This experiment, which was initiated to study the behavior of the root system in different agro-climatic regions, was continued in Gonakelle, Hopton and Aislaby Estates. In addition to the measurements detailed above, root fresh weight and dry weight, and root length, were also measured. There were significant differences in total and active root depth, root fresh and dry weight, and root length, between seedlings and cultivars in all the agro-climatic regions where the measurements were made.

The experiment is in progress.

3.3 Study of the tea root system in organic vs inorganic tea, in relation to shoot growth

In 2003, root windows were installed in the 'TRI-ORCON' trial at the Tea Research Institute, in order to make undisturbed measurements in the root system. The feeder- (or fine-) root dynamics were studied in field-grown tea, in organic and conventional management systems, using the root windows, two months after instalment in the field.

Similar values were obtained for feeder-root length, mortality, extension rate and regeneration rate, in both conventionally- and organically-managed tea, but there was a trend towards greater values in conventionally-managed tea roots. The shoot measurements too showed no significant differences between treatments.

The fact that there were no significant differences in the root- and shoot measurements, due to organic and inorganic management, emphasizes that growth and yield would not be affected by organic cultivation vis-a-vis conventional cultivation. The results also show the potential of organic manures in tea cultivation under sustainable agriculture programmes.

The above study was continued using the root windows, one year after instalment in the field.

These results also showed that there was no significant difference between organic and conventional treatments in terms of feeder-root length, extension and regeneration rate, and mortality, but there was a tendency towards greater values in conventionally-managed tea roots. The root mortality was highest in plants to which compost had been added.

Shoot measurements too did not show a significant difference between treatments. The highest shoot length, and shoot extension rate, were recorded in neem oil cake-treated plants. The pluckable-shoot dry weight was generally higher in organically- managed than in conventionally-managed plants. The dry weight was highest in compost-treated plants.

The soil and leaves were analyzed for macro nutrients. There were no large variations in the nutrients supplied by different manures and fertilizer, as shown by soil- and leaf analysis. This study further emphasized that yield is not affected by organic cultivation when compared to conventional cultivation. The similar root- and shoot growth, observed in both organic and inorganic systems, show the potential for using organic manures in tea cultivation under sustainable agriculture programmes.

The above study was continued further, to observe the root- and shoot growth pattern, under organic and conventional management systems in mature tea.

The bushes were separately plucked, measured and weighed. These measurements were correlated with the root measurements.

There were no significant differences between organic and conventional treatments in feeder-root length, root extension rate and root mortality. The highest and lowest root mortality was shown in compost- and neem oil cake treated plants, respectively. The tea waste and conventional treatments gave the highest, and comparable, total root lengths, and the neem oil cake treatment the lowest. The highest and lowest root extension rates were observed in neem oil cake, and tea waste, treated plants, respectively.

Shoot measurements did not show a significant difference between treatments. The highest shoot length, and shoot extension rate, were recorded in neem oil cake treated plants. The pluckable-shoot dry weight was higher in organic management systems than in conventional management systems.
The study is in progress.

4 Tea leaf anatomy

This study was conducted to investigate the stomatal and transpirational differences of plucked (detached) tea flush of some selected up-country tea cultivars, namely DT1, TRI 2025, TRI 3019, TRI 3013 (drought-tolerant cultivars), TRI 3015, TRI 3018, TRI 2023 and TRI 2043 (moderately drought-tolerant cultivars), which are most commonly grown in the region.

Stomatal index, and length, width and area of the stomatal aperture, were measured in stomatal impressions, using a light microscope and an eyepiece graticule. The transpiration rates were measured using a steady state porometer.

The results showed that there is a tendency for the transpiration rate to increase after about 10 hours, and then to decrease after about 20-22 hours. The different cultivars behaved differently. In both 1st and 2nd leaf of the flush in TRI 2023 there was a higher transpiration rate, and this cultivar can be ranked as the most drought susceptible as well.

The experiment is in progress.

5. Studies on organic tea

5.1 Yield of organic tea vs. conventional tea

The plucking commenced in March 2005, after pruning. .

The yield was monitored in the 'TRI-ORCON' organic vs inorganic field experiment. It showed no significant difference between the treatments.

The experiment is in progress.

5.2 Studies on 'The Conversion Period and Organic Tea'

The experiment, initiated at Giragama Estate, Pilimatalawa, was continued with some modification. The experiment at Kirimetiya Division (a seedling trial) had to be terminated owing to the presence of a large number of infilled VP plants, which were mainly bushes recovering after a collar prune. The number of bushes recovering in collar-pruned plots was less than 16, which is the minimum number desirable per plot for monitoring yield, so the collar-prune treatment was also terminated. According to the yield data of the first year after pruning, there was no significant difference between treatments.

6 Studies on drought mitigation

6.1 Effect of spraying K on drought tolerance

An experimental area was marked out in Field No. 5, St Coombs Estate, Talawakele, for elucidating the effect of spraying K on drought tolerance in tea. The effects of spraying KCl and K_2SO_4 have been studied in detail by several workers, although with many contradictory results. However, the effect of KNO_3 on drought tolerance in tea has not been studied. Hence, this experiment was designed to compare the effects of KNO_3, KCl and K_2SO_4.

The pre-pluck was commenced in December, 2005. The treatments will be imposed in January 2006, prior to the dry period anticipated in late January/ early February 2006.

6.2 Sap-flow measurements in tea

As differences in the root system were observed in tea bushes in different treatments in the 'TRI-ORCON' trial, sap-flow measurements were made in the bushes in the 'tea waste' and 'conventional' treatments, using sap-flow sensors.

Sap flow was measured using the heat-pulse technique: a heat pulse is given by a heater needle, and the rise in temperature in the xylem sap is detected by a thermocouple needle, inserted 5 mm above the heater needle (Thermal Logic, USA). The data were recorded every 60 minutes using a data logger connected to the needles. The total volume of water transported per plant per day is calculated using the collected data. The bushes were plucked separately at weekly intervals, and the soil-moisture content monitored.

The experiment is in progress.

SOILS AND PLANT NUTRITION DIVISION

Head – L S K Hettiarachchi

Applied Research

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

Project A 15.1 Characterization of soils to series level in the tea-growing areas of Sri Lanka.

A detailed description of the work carried out, along with the objectives, tangible outcomes, publications, etc., appeared in the Institute's Annual Reports of 1996 to 2004.

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.

Project A 15.2 Estimating crop response to macro-nutrients (N, K, Mg, S and P) at regional level.

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.

Rates: N 240, 420 and 600 kg ha^{-1} yr^{-1}
K_2O 120, 210 and 300 kg ha^{-1} yr^{-1}
MgO 60, 105 and 150 kg ha^{-1} yr^{-1}

(1) Cultivar PK 2, Field No 15 B, Court Lodge Estate, Kandapola (1999)

As there was no significant variation in yield from increasing rates of N, treatment rates in this trial was altered to 200, 400 and 600 N, 100, 200 and 300 K_2O, and 50, 100 and 150 MgO, from March 2005. The yield data obtained during the last three months of the 2nd year, following treatment alteration, and rectification of shortcomings encountered in recording regularly-harvested yield, increased significantly with increasing rates of N, but not with K and Mg fertilizer. There was no interaction between any of the treatments.

Soil pH, determined in the 1st year (July 2005), after pruning and applying dolomite at 1500 kg per ha at depths of 0-15 and 15-30 cm, decreased significantly with

increasing rates of N, as in most years. So far, no variation has been seen with increasing rates of either K or Mg.

As in previous years, the soil ex: K level, estimated in the 2nd year of this cycle, showed that the levels increased significantly at both depths with increasing rates of potash fertilizer, from 100 to 300 K_2O kg ha^{-1} yr^{-1}. In fact in terms of magnitude, soil K levels at the 15-30 cm depth are either higher, or similar, when compared to 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, and the rate of potash fertilizer exceeds the rate of 100 K_2O kg ha^{-1} yr^{-1}. Also, the soil K level was significantly reduced by the application of increasing rates of N, but not of Mg fertilizer. There was no interaction between N and the potash or Mg fertilizer rates. Unlike in the 1st year, soil Mg levels estimated in the 2nd year showed that these levels increased significantly with increasing rates of kieserite, at both depths. Although Mg levels did not vary significantly with increasing rates of potash, Mg levels decreased slightly with increasing N rates.

Leaf nutrient concentrations, estimated in the 2nd year, showed that N concentration increased significantly with increasing rates of N fertilizer, and at the same time Mg concentration decreased, although there was no change in K and Ca. With increasing rates of potash, leaf K concentration increased significantly and Mg decreased, although with no change in N and Ca. Leaf Mg concentration increased significantly with increasing rates of kieserite, as observed earlier, and at the same time N concentration was somewhat affected, but again with no change in K and Ca.

The experiment will continue with modified fertilizer rates.

(2) Cultivar TRI 2026, Field No. 1, Tokatiyamulla Estate, Galle (1999)

Overall data analyses continue following termination of the trial.

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

Overall data analyses continue following termination of the trial.

(4) Cultivar TRI 2025, Field No. 85, Houpe Estate, Kahawatte (1999)

Overall data analyses continue following termination of the trial.

(5) Cultivar TRI 2026, Field No. 4 B, Lumbini Estate, Deniyaya (1999)

Overall data analyses continue following termination of the trial.

(6) Cultivar TRI 3019, Field No.2, Ury Estate, Passara (1999)

There was no significant variation in yield from increasing rates of any of the treatments, during any of the 12-month periods in this trial as well. Hence, rates of nutrients supplied as fertilizers were altered to 160, 320 and 640 N, 80, 160 and 320 K_2O, and 40, 80 and 160 MgO, with the commencement of the on-going cycle. This was to accommodate wider ranges, with a view to finding out whether treatment effects can be seen.

This trial will continue with altered rates of nutrients.

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

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

Unlike in the 2nd year observation, estimations made in the current year showed that soil pH levels, at both depths, decreased significantly with increasing rates of N, as observed in the 1st year. As expected, no variation was seen with increasing rates of either potash or kieserite.

As in the previous years, the exchangeable K level in the soil, in this year also, increased significantly with increasing rates of K at both depths. Here again, it is clear that the K percolates down to the bottom layer of the soil with the lowest rate of applied potash, 120 kg ha^{-1} yr^{-1}, upwards, as the available K levels at both depths increase along with increasing rates of potash. Also, the potassium level was significantly decreased by application of increasing rates of N fertilizer.

However, there was no variation with increasing rates of kieserite.

This time, unlike last year, no variation in soil Mg levels was seen with increasing rates of kieserite. The exchangeable Mg level, in a soil depth of 0-15 cm, decreased significantly with increasing rates of potash, although no such change was seen in the case of the 15-30 cm depth. Soil Ca levels appeared to be decreasing with increasing rates of N fertilizer, perhaps owing to increasing degrees of acidity associated with increasing rates of N.

Estimations of leaf-nutrient concentrations showed that the N increased significantly with increasing rate of fertilizer N. So far, the concentrations of other nutrients did not show variations at this site. However, a tendency for leaf K to increase with increasing rates of potash fertiliser was seen. So far, with increasing rates of fertilizer,

leaf N, K, Mg and Ca concentrations did not change significantly, except that there was a decreasing pattern of leaf K concentration with an increasing rate of N fertilizer.

The trial continues.

(8) Cultivar TRI 2025, Field No. NC 5, Midlands Estate, Ratthota (2000)

At this site, as observed also in the previous years, yield increased significantly with increasing rates of N fertilizer, but not with increasing rates of K and Mg fertilizers.

Soil pH levels, at 0-15 and 15-30 cm depths, decreased significantly with increasing rates of N, as in the last two years, but increasing rates of K or Mg had no effect on soil pH, as is to be expected.

Although up to the end of the 2nd year, soil ex: K level did not vary significantly, this year's estimation showed significant variation in ex: K. However, the Mg and Ca levels did not vary.

Soil ex: K level increased significantly, at both depths, with increasing rates of potash fertilizer from 120 to 300 kg ha^{-1} yr^{-1}. In terms of magnitude, K levels at the 15-30 cm depth are either higher or similar to the K levels at the 0-15 cm depth. This shows that, under mid-country conditions, a considerable amount of K in the soil moves down the profile when the top layer is saturated with K, and potash is applied at, or above, 120 K_2O kg ha^{-1} yr^{-1}.

As in the previous year, this year's estimation of leaf N, K, Mg and Ca did not show any great variation, although a tendency for leaf N to increase with increasing rate of N was seen.

The trial continues.

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

(1) Cultivar TRI 2025, St James Estate, Hali Ela (1990)

Rates: N 100, 200, 300, 400 and 500 kg ha^{-1} yr^{-1}
K_2O 100, 300 and 500 kg ha^{-1} yr^{-1}

This long-term trial was concluded in October 2005 with a five-cycle progression. Overall data analyses continue. Additionally at the time of conclusion, specimen

samples for SHB assessments, and of parasitic nematodes, were taken in collaboration with the Entomology Division. The results will appear in the report of the Entomology Division.

(2) Cultivar TC 9, Brunswick Estate, Maskeliya (1998)

Rates: N 240, 420 and 600 kg ha^{-1} yr^{-1}
K_2O 120, 300 and 480 kg ha^{-1} yr^{-1}

Frequencies: 6, 8 and 12 weeks

Increasing rates of N fertilizer increased yield significantly, although in the 2nd year only a tendency for an increase in yield was seen. However, so far, no interaction was found with increasing rates of either N or K fertilizers and the frequency of applications.

Soil pH levels, at 0-15 and 15-30 cm depths, decreased significantly with increasing rates of N as in previous years. Also, as previously, soil ex: K levels estimated this year 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, K levels at the 15-30 cm depth are either higher or similar to the levels 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, and the rates of potash application exceed 120 kg ha^{-1} yr^{-1}. However, unlike last year, the K levels did not show increases with increasing rates of N, although decreasing trends were seen. Soil Mg and Ca did not change significantly with increasing rates of treatment.

With increasing rates of N fertilizer, leaf N concentration increased significantly as previously observed, while it decreased with increasing rates of potash. However, there were no significant changes in leaf Mg. With increasing rates of K fertilizer, leaf K concentration increased significantly, while both leaf Mg and Ca concentrations decreased.

The trial continues.

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

Cultivar DT1, St Coombs Estate, Talawakelle (1992)

Rates: N Seven levels ranging from 0 to 720 kg ha^{-1} yr^{-1}
Compost 0 and 5 t ha^{-1} yr^{-1}

As observed earlier, yield in the 2nd year also showed a significant increase with increasing rates of N. So far, compost appears not to have shown a significant overall effect, except for the fact that the yield averaged over N rates, with compost treatment, was somewhat higher than the yield without compost application.

The trial continues, and plans are also under way to measure nitrate reductase activity in pluckable shoots.

Effect of three different levels of N with different levels of manure on growth, soil- and plant-nutrient status and yield.

Cultivar TRI 2026, Kallebokke Estate (2002)

Rates: N 200, 400 and 600 kg ha^{-1} yr^{-1}
Compost 0, 10, 20 and 30 t ha^{-1} yr^{-1}

Yields increased significantly with increasing rates of N fertilizer, and the pattern of increase appeared to be linear, even this year. Compost application had not shown any significant influence on yield so far.

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.

The seven trials, detailed below, are being carried out as part of a post-graduate study on S nutrition, with specific objectives. Detailed investigations with each trial are continuing.

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

Rates: N (as urea and as S/A) 200 to 500 kg ha^{-1} yr^{-1}
Urea: SA ratios 100-0, 75-25, 50-50, 25-75 and 0-100

The yield obtained during the 1st year of the 7th cycle from this long-term trial was noted. The mean yield was low in comparison to that of the 1st year of the last cycle. Unlike the 1st year findings of the previous cycle, there were no significant differences in yield between the two rates of N fertiliser applications. This is probably due to frost damage affecting the plants in the experimental plots. In this year too, no variations were seen between the different proportions of SA and urea.

As before, both the rate of N fertilizer, and the proportions of sulphate of ammonia, in the N combination significantly altered the soil pH and sulphate

sulphur, at both depths. This is despite 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 increased in the combination, sulphate sulphur in the soil too increased. So far, the leaf S concentration was not affected, either by the urea + S/A combinations, or by the N rates.

The experiment continues.

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

As with the first-year yields of other trials, the first-year yield did not show any significant variation, either owing to increasing rates of N, or to application of N in different proportions of urea and sulphate of ammonia.

No soil- and leaf-nutrient data are presented because samples were not obtained as scheduled.

The trial continues.

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

As previously observed, yields increased significantly with increasing rates of N fertilizer, but there was no variation with the different proportions of urea and SA.

As expected and observed from the above trials, both the rate of N fertilizer, and the proportions of sulphate of ammonia in the N combination, significantly altered the soil pH and the sulphate sulphur, at both depths.

The pH levels decreased with increasing rates of N, and as well as when the proportion of sulphate of ammonia increased in the urea: S/A combination. At the same time, when the proportion of sulphate of ammonia increased in the combination, the sulphate sulphur in the soil too increased.

However, at this experimental site too, leaf S concentration was not yet affected either by the urea + S/A combinations, or by the N rates.

The trial continues.

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

The yield in the second year increased significantly with increasing rates of N, but no effect was seen from the application of N in the different proportions of urea and sulphate of ammonia.

Both the rates of N fertilizer, and the proportions of sulphate of ammonia in the N combination, significantly altered the soil pH and the sulphate sulphur, at both depths, as seen from the trials above.

The pH levels decreased with increasing rates of N, as well as when the percentage of sulphate of ammonia in the urea: S/A combination increased. The sulphate sulphur at both depths increased with increasing rates of N.

However, even at this experimental site, leaf S concentration was not yet affected, either by the urea + S/A combinations, or by the N rates. As seen previously, this year's estimation also showed that the leaf S concentration in the TRI 2023 cultivar is relatively higher than in the others.

The trial continues.

(5) Cultivar TRI 2026, Field No. 7, St Francis Division, Millakande Estate, Horana (2001)

Although the yield did not vary significantly, even with the increasing rates of N, an increasing trend was seen with increasing rates of N fertilizer.

Though the soil pH levels estimated last year did not show significant variations, this year's estimations, at both depths, showed that soil pH levels vary significantly with the application rates of N fertilizer, and also when the proportion of sulphate of ammonia in the urea: S/A combination increases.

The soil pH levels decreased with increasing rates of N, and also when the proportion of sulphate of ammonia in the combination increased. As in other trials, at this trial site too, sulphate sulphur in the soil increased significantly, with increasing rates of N fertilizer, and with increasing proportions of sulphate of ammonia in the urea: S/A combination. Leaf S did not show significant variations.

The trial continues.

(6) Cultivar TRI 2026, Field No. 13, B Division, Kiriwangange Estate, Deniyaya (2001)

The yield in the first year did not vary significantly, either with increasing rates of N, or with the application of N in different proportions of urea and sulphate of ammonia.

No significant variations in the soil pH level, at both depths, were observed with the different rates of application of N fertilizer, and with the different proportions of sulphate of ammonia in the N combination, unlike during the last year of the previous cycle. This is probably due to the effect of the application of dolomite at a rate of 2000 kg per ha, at the time of pruning. However, sulphate sulphur in the soil increased significantly when the proportion of sulphate of ammonia in the combination increased, but not with increasing rates of N as in some other trials.

Leaf S concentrations, estimated this year, did not show significant variations, unlike in the last year of the previous cycle. However, an increasing trend in S concentrations was seen with increasing proportions of sulphate of ammonia in the urea: S/A combination.

The experiment continues.

(7) Cultivar TRI 2025, Field No. 3 A, Lower Abbotsford Division, Dessford Estate, Nanu-Oya (2001)

The second-year yield, obtained during October 2004 - September 2005 in the first cycle, did not vary significantly, either with increasing rates of N, or with application of N in the different proportions of urea and sulphate of ammonia.

As seen from the trials above, both the rates of N fertilizer, and the proportions of sulphate of ammonia in the N combination, significantly altered the soil pH and sulphate sulphur at both depths. The pH levels decreased with increasing rates of N, and also when the proportion of sulphate of ammonia in the urea: S/A combination increased, while the sulphate sulphur at both depths increased. Leaf S concentrations did not show significant variations.

As before, it is worth placing on record that the coefficients of variation (CV%) in the sulphate sulphur measurements in the soil were exceptionally high, being in the range of 22 – 42 %, and 21 – 59 %, for depths of 0-15 and 15-30 cm, respectively. Moreover, CV% values at the Kiriwanagange site were extraordinarily high owing

probably to an inadequate time gap between the treatment application and the sampling. This is despite significant increases shown in the soil sulphate sulphur levels, with increasing proportions of sulphate of ammonia in the urea and sulphate of ammonia combinations, at all the sites. It indicates the inherent variability of the present method of extraction, and its interaction with the soil types.

An evaluation of widely-accepted test methods was completed for assessing plant-available soil sulphate sulphur, using a tea cultivar, TRI 4052, grown under glasshouse conditions with major soil series.

The data of the glasshouse trials are being analysed, and investigations are being carried out for the selection of a suitable method.

The trial continues.

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

Effect of foliar application of "Humate" on the growth and yield of tea.

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

The application of normal Humate to the ground and spraying of Super Humate with increasing rates did not significantly affect the yield. In the presence of urea in the Super Humate solution, also the increasing rates did not significantly affect the yield. This trial continues.

Effect of application of "Humate"-treated waste tea compost (a rapid method of composting) on soil chemical and physical properties, and growth and yield of tea.

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

Rates: Chemically-treated waste tea compost 5 and 10 Mt ha^{-1} yr^{-1} Control

In general, it appears that the yields, following application of "Humate"-treated refuse tea, are considerably higher than in the control plots, the higher yields being 530 and 206 kg Mt ha^{-1} for the application of treated waste tea at 5 and 10 kg Mt ha^{-1}, respectively, although no significant variations were found.

Also, no significant effect was seen, from the application of treated waste tea, on soil pH, C %, P, K Mg and Ca, as well as leaf N, P, K, Ca and Mg concentrations and pruning weights, although no data is presented.

The activities continue.

(f) Development of a protocol for site-specific fertilizer recommendations (SSFR) for improvement of productivity and made tea quality

A protocol for site-specific fertilizer recommendations for mature tea was established after carefully study of:

a) The available body of experimental data on yield and growth responses to applied nutrients, together with soil and plant nutrient status;
b) nutrient adsorption and desorption characteristics, nutrient release patterns and budgets, and survey data;
c) results of the soil- and leaf analytical data of the last two to three decades; and
d) sufficiency/deficiency leaf nutrient ranges for diagnostic purposes.

These values will assist the growers to adopt site-specific nutrient input schedules, for optimizing returns, while managing resources economically and rationally, rather than using the traditional strategy of applying a standard mixture.

Project A 15.3 Estimating crop response to micro nutrients (Zn, B, Mn, etc.) at regional level.

The results of field trials to compare the efficiency of foliar spray solutions of conventional zinc sulphate and/or commercial Epsom salt, with commonly used foliar spray formulations, are presented below.

Micronutrient foliar feeds: Multiplex, Kiecite and Zinc Sulphate (two solution combinations of 11 kg Zn ha^{-1} yr^{-1}).

(1) Cultivar TRI 2025, Field No. 3 B, St Coombs Estate, Talawakelle (1999)
(2) Cultivar TRI 2025, Field No. 9, Madulkelle Estate, Madulkelle (2000)
(3) Cultivar TRI 2025, Field No. 3 B, Greenwood Estate, Nawalapitiya (2000)
(4) Cultivar TRI 2027, Field No 3 D, Second Division, Dammeria Estate, Passara (2004)

At site 1, with the completion of a cycle, the plants in the experimental plots were pruned in September 2004, and yield records were maintained without imposing treatments over the first 12 months. This was in order to test blocking of plots, based on pre-treatment yield distribution, with a view to minimizing block variability. Basal fertilizer applications were carried out. The rates of N and K_2O supplied were 270 and 120 kg ha^{-1} yr^{-1} respectively.
The trial continues.

At site 2, treatments with foliar sprays were made, following each ground fertilizer application. The rates of N and K_2O supplied were 270 and 120 kg ha^{-1} yr^{-1}, respectively. The yield, averaged over three years following pruning, varied significantly with treatments. At this site, the average yield of all the treated plots gave significantly higher yields than the control. The application of commercially-available foliar formulations, such as Multiplex and Kiecite, gave relatively higher yields.

The trial continues.

At site 3, plants in the experimental plots were pruned in May 2005, following the completion of a cycle. Yield records will be maintained without imposing treatments over the first 12 months, in order to test the blocking of plots based on pre-treatment yield distribution, with a view to minimizing block variability. Basal fertilizer applications were carried out. The rates of N and K_2O supplied were 270 and 120 kg ha^{-1} yr^{-1}, respectively.

The trial continues.

At site 4, following the blocking of plots based on pre-treatment yield distribution, during September 2004 to August 2005, for minimizing block variability and randomizing, foliar treatments were carried out together with each basal fertilizer application. The rates of N and K_2O supplied were 280 and 140 kg ha^{-1} yr^{-1}, respectively.

The trial continues.

Project A 15.4. Evaluating the effects of macro and micro nutrients on colour and strength of tea liquor

Cultivars DT 1 and CY 9, St Coombs Estate, Talawakelle (1992)

Rates: Foliar application of P at 0, 1, 2, 3 and 4 % DAP and TSP.

The trial concluded in October 2005 owing to resource limitations.

Project A 15.6 An island-wide survey for identifying factors affecting response to potash, K (and S).

The survey was completed, and soil and leaf samples collected were analyzed for nutrient status. A part of the data set was critically analysed, and ranges of leaf-nutrient concentrations have been determined for N, K, Mg, S and P for diagnosing nutrient sufficiency and deficiency. A peer-reviewed research paper was published. The other part of the data set are yet being analyzed statistically.

2 Thrust A 16 Development of regional and site-specific dolomitic limestone recommendations for ameliorating soil-acidity and enhancing soil-productivity.

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

Cultivar TC 9, Field No. 4, St Coombs Estate, Talawakelle (1989)

Rates of dolomitic limestone: Increasing levels
Frequencies: Cycle, Mid-cycle and Yearly

Plants in the experimental plots were pruned in June 2005, following the completion of three cycles. Fresh pruning weights did not vary significantly, either with the rates of dolomite application or with strategies. The fresh weights of tipped shoots varied significantly with the rates of dolomite application. The plots that received dolomite at the rate of 2500 kg per ha gave significantly higher weights compared to the plots where no dolomite was applied, and where the dolomite application rates were 1250, 5000 and 10,000 kg per ha per cycle, regardless of application strategies.

Activities continue as a long-term trial.

3 Thrust A 17 Development of fertilizer and/or dolomite applicators for improving broadcasting efficacy and overcoming labour shortage.

Project A 17.1 Evaluating and improving the efficiency of fertilizer applicators.

A detailed description of the work carried out, along with the objectives and milestones, appeared in the Annual Reports for 1998 to 2004.

A manually-operated applicator for granular fertilizers was designed from the results of feasibility studies, and accordingly a prototype applicator was fabricated. The fertilizer container, or hopper, of the applicator (dimensions: 30 x 30 x 20 cm) accommodates about 10 kg of fertilizer; the upper part was

made from PVC, and the bottom part from stainless steel sheets. A lid, placed on top of the opening, protected spillage of the material inside the hopper. The bottom part was made, according to the repose angles of the materials, with a V-shaped, rounded bottom edge. A screw conveyor made of stainless steel was mounted, horizontally to the vertical sides of the hopper, along the rounded base of the bottom part. The dimensions of the screw (pitch size, outer diameter, diameter of the shaft) were determined taking into consideration the amounts of fertilizer to be spread per tea bush.

Two sheets were mounted at the interior of the bottom part, with an appropriate repose angle, in order to expose 1/3rd of the screw conveyor length to prevent excessive load and free flowing. An arm, of about 40 cm, was mounted perpendicularly at one end of the conveyor. A small handle was also mounted at the far end of the arm, in order to be able to rotate the conveyor manually.

The manual power is transmitted to the conveyor by means of a timing-belt and gear system fixed along the arm. The arm can be adjusted according to the operator's convenience. A circular opening was made at the bottom of the rounded base, opposite to the arm of the conveyor, in order to allow egress of the granules pushed forward along the conveyor upon rotation. A discharge tube consisting of a flexible hose (20 cm long), guided by a stainless steel spring and a straight conduit tube (50 cm), was fabricated. A corrugated, triangular-shaped end was made from a stainless steel sheet, as an attachment to the delivery edge of the discharge tube, in order to obtain a better spread. The entire unit was mounted in a frame for suspension from the shoulders of the operator, and fastened with lockable belts as in a backpack.

Operation

When the handle is turned clockwise, the conveyor rotates in the same direction. This causes fertilizers, filled in the exposed part of the conveyor screws, to be pushed towards the discharge opening and go through the discharge tube. The gravitational force, which depends on the free-flowing rate of the fertilizer material, feeds the screw. The discharge rate (grammes per bush) is determined by the turning angle of the handle.

Laboratory and field tests, together with necessary refinements, are underway.

4 Thrust A 1.3 Screening lines for cultivar response to native and applied nutrients.

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

A field trial was laid out to screen lines for cultivar response to native and applied nutrient in Field No. 13 of St. Coombs. Four chosen cultivars, namely VP 99, VP 272, VP 208 and VP 5, together with TRI 2025, were planted in June 2005 according to a split plot design, where cultivar was considered as the main treatment and mineral fertilizer as the sub-treatment. At the same time, TRI 2043 was planted along the guard rows.
The activities continue.

5 Thrust A 22.5 Modifying potassium fertilization for reducing SHB damage.

1. Field No. 9 A, Factory Division, Hantane Estate, Kandy (1997)
2. Field No. 13, First Division, Attampitia Estate, Attampitia (1997)

At site 1 (above), plants in the experimental plots were pruned in May 2005 and tipped later. No significant variation in the fresh weight of the prunings was found as yet, either owing to an increasing rate of potash or to the cultivar. Data collected during the new-clearing period are being analysed.
Routine activities continue.

At site 2 (above), plants in the experimental plots were pruned in October 2004 and tipped later. Even at this site, no significant variation in the fresh weight of the prunings was found as yet, either owing to an increasing rate of potash or to the cultivar. However, it appeared that the fresh weight of the TRI 2025 cultivar was relatively high compared to the other two. Data collected during the new-clearing period are being analysed.
Routine activities continue.

The Entomology Division monitors the incidence of SHB from both these trials and the results will appear in the Entomology report.

6 Thrust A 32.1 Evaluating soil fertility in organic tea lands.

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

Gami Seva Sevana. Farmer-centred organic tea research.
Cultivar TRI2023/2025, Gamiseva Seva Sevana, Nilambe.

The early yields (May 2004 – April 2005) were obtained from the farm-centred lands receiving different treatments. 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 differences were apparent between the treatments.
The activities continue.

Basic Research

7 Thrust B 35. Establishment of critical nutrient levels for better growth of cultivar tea.

Overall data analyses continue with a view to drawing conclusions.

8 Thrust B 15 Environmental studies.

Project B 15.1 Impact of variation of weather conditions on crop environment and productivity of tea: assessment of the effects of wet- and dry-depositions from the atmosphere.

The monitoring of rainwater quality continued in collaboration with the meteorological centres of the Institute's Centres at Talawakelle, Ratnapura, Hantane, Passara, Kottawa and Deniyaya. Parameters such as rainfall, *in situ* pH, NO_3^--N, SO_4^{2-}-S, Mg^{2+} and Ca^{2+} are being monitored on a continuing basis. In addition, since March 2005, NH_4-N and Na have also been included.

9. Thrust B 'New'. Evaluation of the effect of fertilizer application in up-country tea estates on down-stream pollution of water bodies.

A study was conducted to assess the effects of applying mineral fertilizer nutrients in up-country tea lands in the Agra-Kotmale Oya region, originating from the Horton Plains and flowing through several tea estates, and the effect of nutrient losses in downstream pollution.
The outcome was presented at the PGIA Scientific Sessions.
Plans are under way to extend the monitoring in the downstream tributaries to the Maskeliya Oya.

Supportive Projects

Adaptive fertilizer trials

(a) Collaboration with Advisory and Extension Division

Six trials were laid out at the Institute's Advisory and Extension Centres (Ratnapura, Kottawa, Hantane and St Coombs), in order to compare the present and the former fertilizer recommendations, with a view to raising grower confidence.

The site at Kottawa showed a significant increase in yield with the present fertilizer recommendation, compared to the former. However, at all the other sites, there was no significant difference between two recommendations.
The activities continue.

(b) Collaboration with Balangoda and Madulsima Plantations, 2002.

Effect of applying fertilizer mixtures with a N to K_2O ratio of 1:1 (U 877), and 2:1 (U 709), on soil- and plant-nutrient status, growth and yield in seedling and VP tea

1) Kew
2) Kirkoswald,
3) Mahadowa
4) Wewessa
5) Telbedde
6) El Teb
7) Balangoda

Details of the trials appeared in the Annual Reports, 2002 to 2004. In place of the trials abandoned at Balangoda Estate, new trials recommenced in January 2005. The trial at Cecilton terminated owing to treatment non-compliance.

The yield data collected over the fourth 12-month period for the Telbedde Estate showed no significant difference. No result is presented for the Balangoda trials because the data gathered represents a short period. So far no significant yield differences were found between the two ratios of N to K_2O treatments.

The activities continue.

(c) Collaboration with Nayabedde Estate: comparison of the present fertilizer recommendation, estate fertilizer practices, and site-specific fertilization.

Of the three fields chosen, treatments were commenced only in Field No. 2 B at Meiyan Division.

The activities continue.

(d) Collaboration with Uvakellie Estate: an observation trial on recovery from S-deficiency following application of different S sources.

A mature-tea field, that presented with S-deficiency symptoms, was chosen for investigating recovery following sulphur inputs. Twenty-one plots each consisting of 20 plants (TRI 2025) were demarcated in September. The treatments were micronized sulphur, Kieserite, and sulphate of ammonia, at 20 and 40 kg S ha^{-1} yr^{-1}, with a control. These treatments were replicated thrice.

The trial continues.

10 Thrust A 18 Development of regional analytical laboratories for soil, plant and fertilizer analysis.

(a) Analytical laboratory service

The mean, mode, minimum and maximum values, along with the number of some routinely carried out tests in the Talawakelle and Walahanduwa laboratories, are given in Tables 1 to 4, respectively.

(b) Analytical laboratory accreditation.

The Division's Analytical Laboratory at St Coombs, Talawakelle participated with international laboratory evaluation programmes, on chemical analysis of soil (International Soil-Analytical Exchange - ISE) and plants (International Plant-Analytical Exchange - IPE). Four soil and 04 plant samples were received quarterly over the year. They were subjected to test methods, such as for pH (water, $CaCl_2$ solution), % C (Walkley and Black), E.C., Na, K, Mg and Ca in soil samples, and for Cu, Fe, Mn, Zn, Ca, K, Mg, Na, P, and Cd in plant samples. The results were submitted to the Wageningen University for evaluation.

Evaluation reports, issued by the Wageningen Evaluation Programme for Analytical Laboratories, during 2004, showed that, most of the time, the soil analytical results from the Division's Laboratory at St Coombs, such as for pH (water), pH ($CaCl_2$), 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, $+2 \geq 7 \geq -2$. In addition, the total plant analytical results, such as for Ca, Mg, Cu, K, Mn, 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.

TABLE 1. Soil Analysis (Talawakelle)

AER	pH					C %					P (ppm)					K (ppm)					Mg (ppm)				
	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode
WU1	295	6.7	3.25	4.84	4.73	224	3.9	0.15	2.0	1.5	204	204	0.1	37	9	173	422	58	183	125	266	248	11	95	57
WU2	2228	7.88	3.75	4.77	4.60	1867	7.2	0.50	2.6	2.3	1326	474	0.2	35	5	1446	650	15	183	175	1375	576	1	103	43
WU3	137	6.25	3.16	4.34	4.32	137	8.3	1.6	4.5	3.8	116	485	5	52	13	116	838	58	230	116	116	664	8	81	21
IU2	359	6.77	3.29	4.70	4.74	309	7.4	0.38	3.1	2.1	217	423	0.1	52	0.1	222	692	31	153	108	209	315	7	94	52
IU3	273	7.22	3.82	4.87	4.73	173	6.6	0.21	2.4	2.1	41	20	1.5	9	4.6	105	435	41	139	75	50	295	22	89	67
WM1	95	6.97	3.45	4.93	4.31	95	2.8	0.38	1.4	0.96	57	152	0.4	39	78	57	192	33	82	67	57	310	22	111	40
WM2	33	6.90	4.33	4.95	4.61	-	-	-	-	-	33	148	1	32	4	33	758	8	103	42	33	221	14	71	34
WM3	49	5.66	4.01	4.70	4.26	87	4.3	0.67	1.6	1.4	17	27	2	10	4	17	150	25	72	33	9	85	12	55	12
IM2	270	7.74	3.81	5.23	4.63	143	6.0	0.60	2.4	2.3	33	258	2.2	69	2.2	33	448	60	213	124	33	405	13	100	52
IM3	24	5.82	4.02	4.70	4.17	3	3.4	2.86	3.2	2.9	-	-	-	-	-	18	292	17	118	108	21	217	12	72	50
WL1	76	7.56	3.92	4.61	4.18	57	2.0	0.38	1.3	1.1	754	194	0.3	33	0.6	51	163	17	48	42	76	111	6	34	14
WL2	99	7.19	4.04	5.08	4.47	104	2.6	0.23	1.3	1.0	104	468	0.6	81	150	104	383	24	99	108	89	335	5	76	27

TABLE 2. Leaf Analysis (Talawakelle)

AER	N%					P%					K%					Mg%				
	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode
WU1	95	4.30	2.58	3.01	2.93	95	0.44	0.06	0.20	0.15	95	2.28	1.05	1.55	1.48	95	0.40	0.16	0.26	0.25
WU2	11	4.63	2.54	3.85	4.11	54	0.36	0.11	0.20	0.19	54	2.70	1.40	1.71	1.58	54	0.41	0.16	0.26	0.21
WM1	13	3.60	2.81	3.26	3.60	13	0.22	0.12	0.16	0.16	13	1.97	1.13	1.50	1.13	13	0.20	0.14	0.16	0.15

TABLE 3. Soil Analysis (Walahanduwa)

AER	pH					C %					P (ppm)					K (ppm)					Mg (ppm)				
	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode
WM1	152	6.35	3.45	4.69	4.87	152	2.2	0.25	1.2	1.0	94	53	8	32	28	142	465	20	90	70	94	186	25	83	70
WM3	12	6.67	4.02	4.82	4.02	12	1.68	0.59	1.2	1.1	12	25	12	19	19	12	140	90	112	100	12	92	35	62	50
WL1	67	8.30	3.75	4.83	4.54	67	9.0	0.33	1.1	0.69	39	82	4	20	19	39	808	20	85	50	18	184	42	76	75
WL2	117	7.12	3.91	4.64	4.52	-	-	-	-	-	56	117	2	19	2	56	110	20	53	40	42	104	6	24	11
WL4	25	5.48	3.93	4.48	3.93	25	1.45	0.60	0.8	0.75	25	35	2	15.7	8	25	175	55	102	95	25	186	50	96	108

TABLE 4. Leaf Analysis (Walahanduwa)

AER	N %					P %					K %					Mg %				
	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode	Count	Maximum	Minimum	Mean	Mode
WM1	40	3.8	3.0	3.42	3.5	40	0.23	0.10	0.17	0.13	40	1.78	1.03	1.45	1.23	40	0.28	0.17	0.21	0.19
WL2	56	2.7	2.1	2.4	2.3	56	0.36	0.13	0.24	0.28	56	1.93	0.85	1.33	1.35	47	0.68	0.31	0.54	0.39

WU1 Up-country wet zone 1

WU2 Up-country wet zone 2

WU3 Up-country wet zone 3

IU2 Up-country intermediate zone

IU3 Up-country intermediate zone 1

WM1 Mid-country wet zone 1

WM2 Mid-country wet zone 2

WM3 Mid-country wet zone 3

IM2 Mid-country intermediate zone 2

IM3 Mid-country intermediate zone 3

WL1 Low country wet zone 1

WL2 Low country wet zone 2

WL4 Low country wet zone 4

TECHNOLOGY DIVISION

Officer-in-Charge – K Raveendran

Research Activities (see Corporate Plan)

1 Project A 27. Development of alternative packing materials for bulk tea

The cost of packaging material makes up a considerable portion (Rs 2.00 – 3.00/kg MT) of the total cost of tea manufacture. This project was designed to test and recommend newly-produced low-cost packing materials for teas, in order to reduce the cost of tea manufacture. During the year, two trials were conducted on paper sacks obtained for testing from Messrs. Quick Pack (Pvt) Ltd. and Messrs. Abdulla Industries & Packaging (Pvt) Ltd.

One of the sacks supplied by Messrs. Abdulla Industries & Packaging (Pvt) Ltd. comprises one outer cover with a 300 gsm Kraft liner and Metalise Polyester backed by 70 gsm Kraft paper, with the use of adhesive lamination as an inner layer. This sack has a double flap closure at the filling end, which helps to prevent any chemical contamination by the glue used for pasting the flaps after teas have been packed.

The second type of sack supplied by Messrs. Abdulla Industries & Packaging (Pvt) Ltd. comprises one outer cover with a 300 gsm Kraft liner and Metalise Polyester backed by 70 gsm Kraft paper, with the use of adhesive lamination as an inner layer. The feeding end of the sack has an open type mouth and a valve at the bottom end. If necessary, the filled teas can be taken out by opening this bottom valve. As a result of this arrangement, this sack may be re-used to pack teas.

During the year, a collaborative project was started with Asia Siyaka Commodities (Pvt) Ltd. to test a vacuum-packing system for packing teas. Trials were conducted with up-country teas as well as with low-country teas. After a period of three months, the quality of the teas and variations in its moisture content will be compared with that of teas packed in normal paper sacks used as controls.

2 Project B 47. Developing tea bulking machines

The prototype unit, which was designed and fabricated, in collaboration with the Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya, to bulk low-country teas, was redesigned in order to reduce its size. The new design will be fabricated and tested at St Joachim Estate.

Other Divisional Research

1 ISO 9001: 2000 certification for tea processing at the St Coombs factory

The ISO 9000 consultant submitted all the manuals, that are required for the ISO 9001: 2000 quality management system, for implementation at the St Coombs tea factory. The staff of the Technology Division supported the staff of St Coombs Estate in implementing the system at the factory. In order to ensure the effective implementation of the system at the St Coombs tea factory, a final audit is to be organized to obtain certification for the system.

2 Development of a sand separator for low-country tea factories

A commercial-scale sand separator was developed at the Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya. This unit was tested in the Technology Division. The performance of the unit will be fine-tuned further, before its introduction for use in tea factories.

3 A computer-aided withering system

The simple system to control the withering process in troughs, which was designed, fabricated and tested at the St Coombs tea factory, was further developed during the year. The new design incorporates a RH/ temperature sensor for measuring the withering air capacity. A circuit was designed and fabricated to display the measured RH and temperature of the withering air. A system was designed to control the hot-air damper of the trough. A PIC (programmable inter-phase controller) microprocessor programming board has been designed and fabricated, for the purpose of processing the RH and temperature measurements, and controlling the hot-air damper, as well as the speed of the trough fan.

A suitable software-programme, for the automation of the system, to be incorporated in the PIC microprocessor programming board, was under development during the year.

4 Monitoring the standard of leaf and tea manufacture at the St.Coombs and the St.Joachim tea factories

The staff continued to monitor the standard of green tea leaf received at the St.Coombs and the St.Joachim tea factories. Also, the staff supported the management to improve tea manufacture at these factories.

5 Miniature tea manufacture

Three hundred and fifty-four green tea leaf samples, obtained from several experiments conducted in different Research Divisions of the Institute, were manufactured, and the made teas chemically analysed or sent to professional tea tasters for evaluation. The results of the evaluations were sent to the respective Divisions.

6 Development of a temperature indicator and alarm unit for the FBD-4.

A patent was obtained for the temperature indicator and alarm unit, which was developed to monitor the weir-end temperature in the Fluidized Bed Drier and control the feeding rate of dhool.

Sixteen units were fabricated and installed in tea factories during the year.

7 A new and efficient approach for removing surface moisture from tea leaves.

The design of the pilot-scale unit to remove surface moisture from green tea leaves, contained in a leaf bag, was further worked on. A variable speed drive system is to be incorporated for controlling the speed, and stopping the unit at the end of the period of time set for its operation.

8 Reduction of the cost of electrical energy in withering, using an improved low-horsepower, motor-driven withering fan.

A 38"-size fan driven by a three horsepower motor, supplied by RTS Engineers (Pvt), Ltd., was tested for withering green tea leaf in a 70' trough at St.Joachim Estate. The performance of the system was found to be satisfactory for green leaf, at a loading rate of 2.5 and 3.0 kg per sq.ft The energy saving was found to be 26.8 and 32.3%, respectively.

9 Design and development of a rotary sifting machine for leafy-grade teas.

The grading of low-country teas in the Michie Sifter was found to be difficult owing to clogging of teas in the meshes. A machine was designed and fabricated in collaboration with the Department of Agricultural Engineering, Faculty of Agriculture, University of Peradeniya, to sift teas avoiding this shortcoming. The performance of the machine was found to be satisfactory, and action was taken to modify the unit for use in tea factories.

10 Field testing of the gasifier system at St.Joachim Estate

The Becekara gasifier system at St Joachim Estate was not operated for more than 10 years for various reasons, such as high running costs. With increases in the price of fuel and electricity, the need for dendro energy in Sri Lanka has been realized. In this context, it was decided to repair the gasifier system and start field-testing it at the Estate.

The repairs to the gasifier system were completed, and action was taken to repair the air-heater to be used for thermal energy application. Also, action was taken to repair the electricity generating system, to be used for electricity generation with the system.

11 Design of efficient air-heaters for tea driers

The heat-transfer efficiency of most of the furnaces and air heaters, coupled with tea driers, is low.

A preliminary discussion was held at the NERD Centre, with officials from the University of Moratuwa and the NERD Centre, to design a collaborative project in this regard. As requested by the Director, Tea Research Institute, the officials visited the St Joachim tea factory to study the tea manufacture and drier air-heater arrangement.

Another meeting was held with the officials in Colombo to discuss the research requirements in detail. At this meeting, a working group was identified for different tasks regarding the project.

12 Survey on the cost of tea manufacture

The sharing of the net sales average according to the present price formula is 32% to the factory owner, and 68% to the leaf suppliers. The cost of production of green leaf has increased owing to various reasons, such as the increased costs of labour and fertilizer. Also, the cost of tea manufacture has increased, owing to reasons such as increased cost of fuel and labour wages. It was therefore decided to study this, and revise the price formula.

The Technology Staff made 189 visits to conduct a survey on COP, in the districts of Ratnapura, Kegalle, Kalutara, Galle and Matara.

13 Advisory and other Services

- The staff made 101 advisory visits to factories on various aspects of tea manufacture.

- The number of samples received from estates for moisture determination was 362. These were reported with advice for correction of defects wherever necessary.

- The number of made tea samples received for chemical analysis was 87.

- The number of moisture meters calibrated was 13.

BIOMETRY

Research Assistant - T U S Peiris

1 Project D. Biometry.

(a) Evaluation of autocorrelation of weekly harvestings as a covariant in long-term fertilizer experiments in tea.

The occurrence of spatial variability makes experimental designs inefficient, especially when there are a large number of treatments. As trials consume large amounts of resources and considerable time, repetition is not feasible. Therefore, formulation of methods accounting for spatial variability is of prime importance.

A preliminary analysis of weekly tea harvestings showed significant interdependency of two adjacent harvestings. The objective of this study is to evaluate this interdependency as a covariate to increase the precision of long-term fertilizer experiments.

(b) The impact of spatial analysis on the selection of superior lines in tea cultivar evaluation trials.

The feature common to most plant breeding experiments is the presence of systematic heterogeneity among the experimental units. Typically, the nature of this heterogeneity is such that there is appreciable correlation among neighbouring units. This makes the widely-used Randomized Complete Block design unsuitable for such trials.

According to the analysis of results of Project D (c), it would seem possible to improve tea cultivar evaluation trials using spatial techniques.

Therefore, the objective of this project is to evaluate whether these alternative models show full agreement with the conventional Randomized Complete Block model, in terms of the selection of the top lines.

(c) Efficiency of spatial analysis in improving Phase I and Phase II varietal trials, and long-term fertilizer experiments, in tea.

The objective of this study is to evaluate the efficiency of model-based techniques that exploit the information on plot positions, with design-based control of error variation in removing the field trends.

The results are shown below:

Location	Average Efficiency					
	Pre Yield	Pap1	Pap2	MA1	MA2	AR(1)
N, K and Mg trials						
Court Lodge	34.86	28.62	23.44	50.14	38.1	
Houpe	39.77	28.88	28.88	40.37	36.1	
Lumbini	40.80	0.310	1.42	7.73	9.1	
Talgaswala	-	23.14	13.0	25.57	15.6	
Tokatiyamulla	51.30	17.56	18.94	29.68	24.9	
Ury	2.45	15.02	15.0	23.21	20.3	
Micro nutrient trials						
Baddagama	53.78	0.33	15.19	6.2	1.22	-0.90
Greenwood	11.1	15.66	41.94	17.43	34.96	-0.04
Indola	8.95	24.95	38.03	11.51	29.5	1.33
Madulkelle	21.8	18.21	45.95	10.8	23.7	-0.74
St Coombs	38.4	21.94	70.78	3.26	33.3	0.58
Phase I cultivar evaluation trials						
St Coombs (VP 82)		0.51	1.93	8.92	20.2	5.34
Phase 11 cultivar evaluation trials						
St Coombs (VP 81)		8.16	8.59	1.48	2.11	1.42
Passara (UVP 9)		7.71	8.22	1.66	2.53	0.34
St Joachim 1 (LVP 75)		25.1	32.8	18.1	23.55	5.02
St Joachim 2 (LVP 76-79)		16.7	11.36	12.0	9.69	4.34

Covariate Pre Yield and NNA methods (original Papadakis, modified Papadakis, Moving Mean 1 and Moving Mean 2) were found to be good covariates as error-reducing techniques in perennial crop experiments. The Auto Regressive Technique is the least efficient method of error reduction for all the trials studied.

The modified Papadakis method is the most effective method of error reduction in micro nutrient trials, with the average relative error reduction efficiency being 42%. The Pre Yield is the best in reducing error in N, K and Mg trials, with the average relative error reduction being 42%, whereas the modified Papadakis method was the best error reduction method in cultivar evaluation trials with the average relative error reduction being 15%.

2. Project B 31. Rainfall variability and its impact on tea in the Uva region of Sri Lanka.

(b) Assessment of predictability of seasonal rainfall in the Uva region using the El-Nino/Southern Oscillation (ENSO) phenomenon.

A knowledge of the impact of global climatic change on the weather patterns of Sri Lanka is essential, because knowing aspects of global climatic change will facilitate the prediction of unexpected extremes of rain, and of changes in weather patterns. The El Nino/Southern Oscillation (ENSO) is a global climatic change phenomenon that influences the climate of half of the planet. The Southern Oscillation Index (SOI) is a simple index used to study the pressure variation in the atmosphere. There is potential to use the SOI and the rainfall correlation for long-term predictions of rainfall fluctuations in a region.

The study was completed on Welimada Estate, and is presently continuing on other selected estates in the Uva region. Data collection is continuing.

(c) Development of a Drought Index for obviating the problems involved in prediction of crop using rainfall.

A past study confirmed that the total amount of rainfall has not been affected over the last 20 years, although distribution of rainfall was severely affected. As a result, the prospects for forecasting crop using only the amount of rainfall are not good.

In view of the problems mentioned above, this project is focusing on a new approach which promises to obviate the problems outlined above. Instead of the amount of rainfall, a Drought Index, based on the distribution of rainfall, is in the process of being developed.

In order to develop the Drought Indices, the following tables were developed, based on the critical values of rainfall variability for tea.

1. Scores for the length of the dry spells (months) vs. the level at which the wet spells are broken.
2. Scores for the residual effect of the previous heavy rain.
3. Adjustment for increased droughtiness during periods of longer day length.

The project is continuing.

(d) Modeling daily sunshine hours and temperature: a univariate stochastic approach.

The objective of the study is to assess the predictability of variation in daily sunshine hours, and the minimum and maximum temperatures, using an univariate stochastic approach.

One of the significant features of this analysis was the statistical dependence of the observations. The statistical dependence in the data could be expressed by the autocorrelation between successive observations. This dependence enables the prediction of future values.

In the present study, the best ARIMA model that can be used to forecast monthly minimum and maximum temperature values, and sunshine hours for selected locations, was found to be as follows.

Location	Maximum T°	Minimum T°	Sunshine Hours
Ratnapura	ARIMA $(1,0,0)\ (0,1,1)_{12}$	ARIMA $(1,0,0)\ (0,1,1)_{12}$	ARIMA $(2,0,0)\ (0,1,1)_{12}$
Talawakelle	ARIMA $(1,0,5)\ (0,1,1)_{12}$	ARIMA $(1,0,0)\ (0,1,1)_{12}$	ARIMA $(1,0,0)\ (0,1,1)_{12}$
Passara	ARIMA $(1,0,0)\ (0,1,1)_{12}$	ARIMA $(3,0,0)\ (0,1,1)_{12}$	ARIMA $(1,0,0)\ (0,1,1)_{12}$
Hantana	ARIMA $(1,0,0)\ (0,1,1)_{12}$	ARIMA $(1,0,0)\ (2,1,1)_{12}$	ARIMA $(2,0,0)\ (0,1,1)_{12}$

Without using any external variables, precise forecasting can be made up to a one-year period, using the above models. When new observations are obtained, forecasting can be implemented for extended periods, using certain modifications.

3 Project. A risk assessment model for major diseases in tea.

Tea Blister Blight.

Epidemics of Tea Blister Blight (TBB) result in severe losses through direct attack on harvestable shoots. TBB causes a reduction in important precursors that determine the final quality of black tea. If timely control measures are not adopted, the crop losses due to the disease can be enormous.

Though chemicals are normally applied on a regular schedule throughout the blister season, rising costs of control using chemicals, and increased stringency in food regulations, are forcing growers to consider more rational approaches using advanced technology in disease management, with the final objective of reduced dependency on chemical control.

Therefore, this study aims at identifying the best combinations of weather variables associated with the development of epidemics, using hourly records of temperature, relative humidity, the amount, intensity and duration of precipitation, the direction and velocity of wind, and solar radiation, in order to develop an advanced model to directly assess the risk of TBB. Further, the study aims at providing information important to disease management, and at developing computer software of the model for easy access and decision making by end-users

This project is a collaborative project with the Plant Pathology Division and the Faculty of Agriculture, University of Peradeniya.

The collection of preliminary details of the project was completed. The project is continuing.

Designing Field Experiments, and Data Analysis and Interpretation.

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

AGRICULTURAL ECONOMICS DIVISION

Head - J A A M Jayakody

Research Activities (see Corporate Plan)

Thrust A 35. Development of an appropriate financial support system for soil conservation in tea lands.

The project was started in the year 2004. Technical and financial support for the study was received from the South Asian Network for Development and Environmental Economics (SANDEE). The project was completed within the set time period of two years.

The actual level of soil conservation in two locations, in the two sectors, and for the two types of tea categories, were computed as a Soil Conservation Index (SCI). The actual level of soil conservation in both locations, in both sectors, is far below the expectation (or standard level), being in the range of 11 ñ 22 %.

The conservation effort also varied with the slope of the land. Since the majority of tea fields in the sample belonged to the slope category, 31 ñ 40 %, the standard (or expected) cost of conservation was computed for that slope category (Tables 4 and 5) .

With Option I, Stone Terraces and other Measures: the standard cost = Rs 12,485/ ha/year

With Option II, Live Terraces and other Measures: the standard cost = Rs 18,530/ ha/year

The actual cost of soil conservation in Location I, with Option I in the plantation sector, is Rs 1,748, and in the small holder sector Rs 1,498.
In Location I, with Option II in the plantation sector, the cost is Rs 2,594, and in the small holder sector Rs 2,224.
In Location II, with Option I in the plantation sector, it is Rs 1,998, and in the small holder sector Rs 2,498.
In Location II, with Option II in the plantation sector, it is Rs 2,965, and in the small holder sector Rs 3,706.

The additional investment requirement in the 31-40 % slope category in both locations, and in both categories, is of the order of Rs 10,000 per hectare, if Option I is used. If Option II is used, the average investment requirement is about Rs 15,000 per hectare.

The results of the production function show that the actual level of soil conservation, and the investment in soil conservation, have a positive impact on production and that the impact is significant. This justifies tea growers increasing their private investment in soil conservation.

Conclusions

- The actual level of soil conservation in tea lands is in the range of 11 ñ 22 %.
- The additional investment requirement, to improve the soil conservation level up to the expected level, is in the range of Rs 10 ñ 15, 000 per hectare.
- The level of soil conservation (SCI), and the variable cost of tea production (which includes the cost of soil conservation), have a positive impact on the productivity of tea lands.
- Investment in soil conservation improves the productivity of tea lands.

D 35. Tea sector studies

Economics of blister blight control

Blister blight is the most economically important leaf disease in tea.

The objective of the present analysis was to assess the economic losses that could occur due to blister blight disease at each stage, namely, nursery, young tea, tea in plucking and tea recovering from pruning, and to estimate the cost of control by adopting TRI recommendations.

The results show that the economic losses are much higher than the cost of disease control. Table1 gives the cost of control and the saving of income from blister control at the national level.

Table 1. National level costs, and benefits of blister blight control
Category Economic loss Rs mn /year Cost of control Rs mn /year Net benefit of control Rs mn /year Tea in plucking 1, 5241971,327 Pruned tea 77174697 Young tea 1759166 Nursery 160.7515 Total 2,4872822,203
The analysis shows that the economic benefit of controlling the disease is much higher than the cost of control..

Gross margin calculation
A calculation of gross margin was done in the estate sector and in the smallholder sector, separately for VP and seedling tea lands. Average productivity levels

were considered for different elevations. The variable cost was calculated using the current wage rate of Rs. 220 per day, and the current market prices of inputs.

Capital stock depreciation; tea smallholder sector

A computation of the cost of green leaf production in the smallholder sector was undertaken, and the above analysis was undertaken to provide necessary information for that exercise.

The annual depreciation of the capital stock in the up-country and the low country was Rs 2.83/kg and Rs 1.96/kg of green leaf, respectively.

Undergraduate students projects and industrial training programmes

D 35.

Growth performance and its decomposition analysis, relevant to the tea industry in Sri Lanka.

The growth performance of tea in the estate sector was analysed for the period 1980 ñ 2004, considering the situation before and after privatization. The results of the analysis show that the production, area and yield have changed significantly at rates of 2.3, -1.0, and 3.6 percent per annum, respectively, over the period.

The growth rate of the tea area was at a negative rate, ñ1.0, during the period of pre-nationalization, but it was at a positive rate, 0.88, during the post-privatization period.

The growth rate of production was also positive, and significantly higher in the post-privatization period than in the pre- privatization period. The growth rate of yield is also positive, but was at a significantly lower rate during the post-privatization period

This was a study undertaken by H A S K Hettiarchchi, an undergraduate student in the University of Colombo, Faculty of Arts, Department of Economics, for his Industrial Training programme in the Agricultural Economics Division.

Ecological and economical analysis of tea-based home gardens in the mid-country.

The objectives of this study were to evaluate the economic efficiency of tea-based home gardens, with respect to the monoculture of tea, and to evaluate the

ecological aspects (dominance, comparison, diversity and distribution) of tea-based home gardens, with respect to floral populations. Out of the 23 home garden units surveyed, only seven farmers were found to be fully involved in agriculture, and 17 partially involved, representing 30.43 % and 73.91 %, respectively.

Out of the 26 crop species, tea, cloves, pepper and nutmeg are the main income-generating crops, contributing 52.13 %, 17.72 %, 16.28 % and 5.58 %, respectively, to total farm income.

Considering only the major cash-generating crops in all the home gardens surveyed, five farming systems (or crop combinations) could be identified. Mean gross margins were calculated for each of them separately.

Crop combination Size categoryMean farm size Type of tea %Mean gross margin/acre Tea as a mono crop 0-52.5VP 90%14,911Tea + pepper 0-52VP 80% 21,846Tea + coffee>55.6SD 45%13,090Tea + pepper + coffee 0-54VP 50%10,970>57.2SD 40%15,186Tea + pepper + coffee + nutmeg0-54SD 56%15,190>510SD 45%32,044

This study concludes that a combination of cash-generating crops is more economically and ecologically sustainable than tea as a monocrop, in the mid-country home gardens.

This was a study undertaken by U K Abeysinghe, an undergraduate student at the University of Peradeniya, Faculty of Agriculture, Department of Crop Science, as a final-year research project.

3 Application of attribute-mapping techniques for managing tea information.

The objective of this study was to develop a database for tea lands, where new tea cultivars are planted as a source of parental material for multiplication purposes, on a commercial scale. There are 83 hectares of land under this Parent Material Cultivation Project, which are distributed in different locations in large plantations and in smallholder fields.

For the data collection and mapping, St Coombs Estate was selected. It can be used as a guide to develop a database for the entire Mother Bush Development Project. A digital map of the location was generated using the Global Positioning System (GPS) instrument. The database is to be created with the digitized map and necessary attribute data, which could be used for monitoring purposes. Field selection and mapping was completed.

This study was undertaken by R Sjeesen, an undergraduate student at the University of Sabaragamuwa, Faculty of Geomatics, in collaboration with the Plant Breeding Division, for completion of the Industrial Training component of the Degree programme.

D 35. Economic evaluation of the out-grower system for the tea industry.

The objective of this study was to assess the economic benefits, to tea landowners and to the growers/workers, of the out-grower system which has been introduced to some mid-country tea plantations.

Data collection was done at the Pitakanda Estate, Matale, which is managed by the Elkaduwa Plantations Ltd, and where this system was initiated

The benefits of this system to the out-growers and to the estates were calculated. The average monthly cost of production of the out-grower sample was calculated as Rs 2,350 per hectare, and the average income per out-grower per month was calculated as Rs 2,485.

The benefits to the estate were the saving of out-grower working days, and getting an income as a management fee for the estate. The total saving on labour is about Rs.104, 760 per month.

For each kilogramme of green leaf harvested, a management fee of one rupee is charged. Over the last eight months, the total harvest of green leaf amounted to about 73,609 kg, with a monthly average of about 9,201 kg. As a result, the estate earned a monthly management fee of Rs 9,201.

Accordingly, the estate's total monthly earnings/cost savings, as a result of the out-grower system, is about Rs 113,965. The monthly income/cost saving per hectare is about Rs1,175.

The identified limitations of the system are as follows.

- ☐ The system has not taken into account the population of unemployed youth on the estate.
- ☐ Contract documents were not signed at the beginning of the project.
- ☐ The variation in the quality of lands has not been considered in land allocation, every participant being given one hectare, irrespective of the type of tea or productivity.

ADVISORY AND EXTENSION SERVICES DIVISION

Head – B A D Samansiri

A. Routine Advisory and Extension Activities

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

B. Special Extension Activities

1. Experimental & Extension Forum (Sinhala)

The 15th and 16th Experimental & Extension Fora meetings for the tea small holdings sector was held on 16th May and 9th December at the Institute's Low Country Station in Ratnapura. Mr J C K Rajasinghe, Senior Advisory Officer, was appointed Convener/Secretary to the Experimental & Extension Forum (Sinhala) with effect from September 2004.

2. Regional Scientific Committee Activities, Corporate Sector

The following RSC seminars were conducted during the year.

- The RSC Seminar for the Ratnapura region (RSC VI) was held in the Auditorium of the Low Country Station, Ratnapura, on 27th May.
- The RSC Seminar for the Galle and Matara regions (RSC VII) was held at Wackwella on 16th August.
- The RSC Seminar for the corporate sector tea plantations (Nuwara Eliya region) was held in the Institute's Auditorium at Talawakelle on 13th December

3. Tea Crop Clinic/ "Randallaka Vidu Nana"

The following crop clinics were held during the year.

A crop clinic was conducted at the Station for Managers and Assistant Managers of mid-country tea estates. The same programme was conducted at the Danture Maha Vidyalaya for small holders in the region.

A crop clinic was held for small holders of the Hambantota District on 9th and 10th July, with the participation of the Chairman, TRB, Director TRI, senior scientists and advisory staff. The Prime Minister, Hon. Mahinda Rajapaksha, the Minster of Plantation Industries, Hon. Anura Priyadarshana Yapa, and the Deputy Minster of Plantation Industries, Hon. Chamal Rajapaksha, also participated.

A crop clinic was held for tea small holders in the Ratnapura, Kalutara and Kegalle regions on 08th May, in the Institute's Low Country Station in Ratnapura. The Chairman, TRB, Director, TRI, and scientific and advisory staff, actively participated in this event. More than 400 tea growers, private tea factory owners, and bought-leaf suppliers participated in this event.

4. Regional Technical and Extension Forum Meetings

Seven RTEF meetings were held during the year;

The Regional Technical and Extension Forum meeting for the Badulla region was held on 7th July in the Auditorium of the Institute's Passara Centre.

Two Regional Technical and Extension Forum meetings for the small holdings in the Ratnapura region, and the Kalutara/Kegalle regions, were held on 28th July and 4th August, respectively.

The Regional Technical and Extension Forum meeting for the Nuwara Eliya region was held on 12th July, at the Institute's Auditorium at Talawakelle.

The Regional Technical and Extension Forum meeting for the Kandy region was held on 2nd August, in the Auditorium of the Institute's Mid-Country Station, Hantane.

The Regional Technical and Extension Forum meeting for the Galle region was held on 7th September, in the Auditorium of the Institute's Kottawa Centre.

The Regional Technical and Extension Forum meeting for the Matara region was held on 08th September in Akuressa.

Based on the discussions, several conclusions were reached which will be taken up for policy decisions concerning the Institute's research involvements for the tea small holdings sector.

5. The Mother Bush Project

A guideline on the maintenance of mother bushes, intended for the mother-bush site managers, was prepared and distributed by Mr B A D Samansiri, Mr Kamal Obesekara, DGM, TSHDA, and Mr M B Cyril, Mother Bush Coordinator, TDP.

An educational programme was conducted on 2nd December, at the Kottawa Regional Centre, to educate the private mother-bush site managers, and the tea

Inspectors of the TSHDA, on maintaining mother bushes and issuing cuttings of new cultivars from them. This programme was organized by the Tea Development Project and the Institute.

The numbers of cuttings from the TRI 3000- and the TRI 4000-series cultivars, issued from the Institute's sites during the year, are given below.

Site	St Coombs	St Joachim	Kandy	Passara	Kottawa	Deniyaya
No of cuttings	3,364,251	4,915,855	1,043,950	148,768	73,025	189,750

6. Demonstration Blocks

It was decided to establish demonstration blocks in all the regional centres, for the purpose of demonstrating good and bad cultural practices in tea fields.

The first demonstration block was established at the Low Country Station by Advisory and Extension staff, in collaboration with the research staff of the Agronomy, the Entomology and the Plant Breeding Divisions.

The establishment of a demonstration area, and the "Tea Extension Park", was initiated by the Advisory Division. The construction work on the pavilion is nearing completion. Mr Haran Jayaweera is overlooking the activities for establishing the demonstration area and the "Tea Extension Park.

7. TRI Section of Ceylon Tea Museum

The Institute's section at the Ceylon Tea Museum in Kandy was completed. Several posters, depicting historical events of the Institute, past Directors, breakthroughs and milestones in the Institute's history, were set up. Old laboratory instruments were also put on display in this section.

8. Tea Technology Information Centre and Regional Network

The feasibility of establishing a Tea Technology Information Centre and Regional Network in the Institute was investigated. This would have the objectives of disseminating tea information using latest communication technologies, establishing a link between various input suppliers in the tea sector, and providing facilities for getting standard tea products, inputs, etc. to the general public.

Further studies are being undertaken on the establishment of the Tea Technology Information Centre and Regional Network.

9. Investigation of the Gradual Yield Decline, and Debilitation and Death of Tea Bushes in the Deniyaya region (the 'Deniyaya Problem')

A survey was conducted, covering the Kotapola, Pitabeddara and Pasgoda AGA Divisions where the above condition was reported, mainly by the Entomology and the Advisory staff, from 21st to 26th February.

Basic information about the tea lands were gathered, and soil and plants samples were collected in order to check for the presence of nematodes. In addition, several tea lands where the above conditions were suspected to be present, were also inspected in order to identify the possible causes of this problem.

Problem sites were identified, and more information on soil and plants conditions, the cultural practices adopted, and the levels of SHB and LCLWT infestation, were collected from such sites. Approximate measurements of the affected extents were also made.

The following conclusions were reached from the outcome of study.

- General debilitation of tea that could happen owing to natural causes and general conditions prevailing in the area.
- General problems caused owing to management and other abiotic factors that are specific to different sites.

General debilitation could be due to senility (in tea planted after the 1980s), genetic characteristics of TRI 2026, bad plants used in new clearings, owing to the unavailability of good plants to meet the heavy demand, during boom periods since the 1980s, and damage caused to the root system during transport and at the time of planting. Skipping of soil rehabilitation in the expectation of short-term benefits, and the increasing incidence of SHB damage have also been identified, as possible causes for the general debilitation of tea in this area.

Site Specific Problems: There were several causes identified for failure of tea at various sites. Some of the causes were use of bad plants resulting in surface rooting, unsuitable soil conditions, water-logging or water saturation owing to continuous rains, severe SHB incidence, nematode infestations, and excessive use of herbicides.

Based on the findings of the survey, the following awareness programmes were initiated to educate tea growers in the region, about the measures that could be adopted to minimize possible damage from the conditions associated with the 'Deniyaya Problem'.

The several research activities were initiated by Mr Jaanaka Mahindapala, OIC, Deniyaya Station, in collaboration with the Agronomy Division, Ratnapura.

10. A Study of the Level of Adoption of the New Plucking Basket (basket with head cap) in Tea Plantations; St Coombs Estate

In order to promote the new Plucking Basket among tea growers, a social study was initiated, and is presently being carried out at St Coombs Estate. The following main objectives were drawn up for achieving the targets.

1. Studying the level of adoption of the new plucking basket in tea plantations, with special reference to conditions;
2. suggesting necessary improvements; and
3. organizing promotional campaigns to promote the innovation.

11. COP Survey in the Tea Small Holdings Sector

The survey on the cost of production of green leaf in the small holdings in the Ratnapura, Kegalle, Kalutara, Galle and Matara districts was completed. The final report is being prepared.

12. Die Back of TRI 4053 Shoots in the St Joachim Mother Bush Area

The outbreak and development of the problem is being monitored by the Advisory staff of the Ratnapura station, under the guidance of Dr A Balasuriya, Head, Pathology Division.

13. Adaptive Trials. Comparison of fertilizer mixtures VP/LC 880 vs U 709

Recording the yield data from the adaptive/observation trial (three replicates), using the new fertilizer mixtures, VP/LC, VP/UM and VP/Uva, vs U-709, is being continued in the St Joachim and the St Coombs Estates, and in the Kottawa, Passara and Kandy regional stations by the Advisory staff, in collaboration with SPND.

14. Activity-based Working Groups

Three activity groups were formed to organize production of videos, to formalize extension research and other collaborative research activities with the other research divisions, and to produce publications for extension activities in the Division.

15. Special In-plant Training Programmes for Undergraduate Students

Two undergraduate students from the Faculty of Agriculture, University of Peradeniya, underwent a special 10-day, in-plant training programme in the Division. They conducted a survey on two identified problems: a shot-hole borer problem in Mayfield Estate, Kotagala, and a Mn-deficiency problem in Strathspy Estate, Upcot. Two CDs were produced under the titles, "Manganese Hunger" and "Small Insect that Makes a Big Impact". The students presented their findings to the staff of the Institute, in the Institute Auditorium.

16. Policy of the Institute on Training and Educational Programmes

The Advisory and Extension Division initiated a policy document on the Institute's training and educational programmes, in order to improve the training capacities with the human resources available in the Institute.

The Institute will conduct three types of training and educational programmes.
(i) Routine Training Programmes which include the latest technologies and tea information;
(ii) Customized Training Programmes at the request of clients, which will be conducted to develop skills, and to refresh knowledge on tea cultivation and processing; and
(iii) Educational Programmes for schoolchildren, school leavers and the general public.

17. Model Commercial Nurseries in Tea Small Holdings

In order to formalize the inspection of commercial nursery activity and the supply of suitable tea plants, a model nursery project was initiated as a pilot project. The objectives of this project were to motivate nursery owners and tea growers to raise a good-quality plant in their nurseries, under the direct supervision of the Institute and the TSHDA. Under this project, about 20 enthusiastic, registered nursery owners were selected, to whom technical know-how, improved planting materials, and some inputs, were given. Nursery performance was monitored regularly in order to identify the problems encountered.

Under this pilot project, the Institute transported tea cuttings from Ratnapura and Talawakelle, and supplied them to the selected nursery holders. Mr Samansiri and Mr Jaanaka Mahindapala organized this activity, with the help of TSHDA officials in the region.

It was decided at the Advisory Officers' Forum meeting to identify about 20 commercial nurseries among registered commercial nursery holders, having about 50,000 plants, from each region, to monitor them throughout the nursery period, and to certify their plants.

18. Printed Extension Materials

A Tea Information Monthly. The feasibility of issuing a monthly information sheet to managerial staff of all corporate and private tea estates was investigated. The main objective of this activity is to establish a link, and have a continual information flow, between the Institute and its clients. Basic information was collected in order to initiate this activity as from January 2006.

Guide for Tea Mother-Bush Site Managers (in Sinhala); by Mr B A D Samansiri, Mr Kamal Obesekara, DGM, TSHDA, and Mr M B Cyril, Mother Bush Coordinator, TDP.

Te Thatu. A special issue, edited by Mr B.A.D. Samansiri, on the development of the low country regional stations, and the opening of the new Auditorium by the Hon. Minister of Plantation Industries, was produced.

19. Exhibitions

The Advisory and Extension Officers participated in the following exhibitions organized by the Ministry of Plantation industries.

- Mahapola Exhibition at Paduwasnuwara from 8th to 15th March.
- Science Exhibition at St Thomas College, Matale, from 17th to 20th May.
- Madamulana Coconut Cultivation Exhibition, from 9th to 10th July.

20. Sulphur Deficiency Problem in Uva Estates and Small Holdings

A sulphur deficiency problem was observed in company estates and in several small holder properties, in the Haliela area. This matter was attended to by Mr J C K Rajasinge and Mr Rohana Wijesekara, under the guidance of the Head of the Soils and Plant Nutrition Division.

C. Regional Activities of the Advisory and Extension Services

Advisory and Extension Services,Low-country station, RatnapuraSpecial awareness programmes and field investigation on nematode infestation and associated problems

A field investigation was conducted with the assistance of the staff of the Entomology Division to assess the current status of nematode infestation and associated problems, in tea fields of the corporate and small holding sectors in the Bambarabotuwa, Balangoda, Rakwana and Ratnapura regions. Special awareness programmes were also conducted for tea growers in these regions, on sampling techniques for nematode analysis, nematode management strategies, fumigation of nursery soils, etc.

Group discussions and field demonstrations

Ten group discussions and field demonstrations were held for the Managers, Assistant Managers and field staff of Agalawatte, Kahawatte, Hapugastenne, and Balangoda Plantations Companies. Demonstrations on soil fumigation and nursery management at Miyanawita and Udapola Estates, and plucking, weed management, and identification of common pests and diseases at Agalawatte Plantations, were conducted. Field demonstrations and group discussions on plucking at Mohamedi Estate, and on sampling techniques for nematode analysis, nematode management strategies, and fumigation of nursery soils, etc. at Balangoda Plantation were also conducted..

Discussions with foreign delegates

Three special group discussions were conducted with foreign delegates from India, Canada and the Asian Development Bank, on field problems, on the constraints of the tea industry, and on development strategies for low country tea estates.

Skill training programmes, workshops and seminars

Four skill training programmes on nursery techniques, four workshops on the identification of common problems, and limitations in nursery management, for registered commercial nursery holders, and seven seminars on rush-crop management and minimizing post harvest damage for bought leaf suppliers, were conducted.

Client-originated training programmes

Four client-originated training programmes were conducted to meet the requests of small holders on the practical problems on plucking, pruning, fertilizer application, and pest and disease control. These programmes were organized by the Labour Department, the Divisional Secretariat at Ayagama, the Pelwadiya SH Society, and the Dumbara SH Society.

Educational programmes

Seven programmes on tea cultivation were conducted for University diploma students, NAITA students, agriculture and science teachers, and for school children. Eleven diploma students from the School of Agriculture, and from the Hardy, Niwala, Kundasale, Pellwehera, and Aquinas Agricultural Schools, underwent four months in-plant training program on tea cultivation. Two students from NAITA, Ratnapura, underwent training programmes on stenography, typing and data entry, for a period of six months.

A study on the role of leaf supervisors in reducing the knowledge gap, in the tea small holding sector.

A study was made to assess the possibility of knowledge transfer, through leaf supervisors appointed by bought leaf factories, to identify drawbacks and limitations of the transfer process in operating as a communication channel, and to propose appropriate measures to improve this process as an effective communication channel.

Both primary and secondary data were used in the study. A total of 30 leaf supervisors and 100 related small holders were interviewed, and a case study was undertaken to collect the primary data of the leaf supervisors who had been exposed to training programmes at the Institute.

The results of this study show that there is potential to use leaf supervisors as communicators to transfer technical information from a technology source to tea small holders, and to feed back field problems to the technology source.

Collaborative research activities

The following studies are being carried out:

- A comparative study on the effectiveness of different control measures for Horse-Hair Blight (HHB);
- Mapping and assessment of land-use patterns in the Ratnapura District;
- A programme for popularization of cultivars;
- Die back of tea shoots in mother bushes of the cultivar, TRI 4053;
- An observation trial on the fertilizer mixtures, VP/LC 880 vs U 709.

Commercial nursery inspections

Eleven Commercial nurseries were inspected in the Ratnapura, Kalutara, and Kegalle Districts.

Printed extension materials

Six leaflets in Sinhala, addressing the common problems related to the low country, were produced, and free distribution to tea growers who attended the crop clinic and other training programmes, was arranged.

These leaflets were:

1. Guidelines to control Redspider mite (SLD);
2. Guidelines for pre- and post pruning operations (SLD);
3. Guidelines to minimize post harvest losses (SLD/GG);
4. Guidelines to control Hose-Hair Blight damage (A BAL/SLD/TGN);
5. Guidelines to minimize the casualties in the flood-prone tea lands (SLD); and
6. Guidelines to minimize tea bush debilitation, with special reference to the nematodeprone areas in the low country (Keerthi Mohatti/SLD/TGN/Ajith Premathunga).

Display boards

Twenty banners with technical messages, highlighting the key cultural operations for improving productivity of tea lands in the low country, were produced.

Advisory Services, Mid-Country Regional Station

'Crop clinic' activity.

The Advisory staff organized 'crop clinic' activities, with the collaboration of OICs in the Stations, for planters in the Mid-Country region, and for small holders at Danture Maha Vidyalaya.

A Regional Technical and Extension Forum, organized for STIs, TIs and Small Holder Society Office-Bearers in the Mid-Country, was held at the Mid-Country Station.

Demonstrations and field days

Five field days on plucking were held for the benefit of management and field staff, and for pluckers, of JEDB, SLSPC and private estates in the Mid-Country.

Educational programmes

A group of NDT students from the Naiwala Agriculture School attended a practical training programme on tea cultivation practices at the Station. Two NDT students were trained at the Division.

The Senior Advisory Officer and the Extension Officer attended a science exhibition held at St Thomas' Collage, Matale.

The Extension Officer attended the James Taylor Day ceremony at the Ceylon Tea Museum, Hantane, Kandy. A parlour for the Institute was opened at the Museum during the ceremony.

Extension research activities

Project 1. The adaptive trial on the use of the fertiliser mixtures, U 709 and VP/ UM, at the Station was continued for the third year.

Project 2. Mr Bandara Kahandawa, Extension Officer, participated in the survey, conducted by the Economics Division, to study the present status of the soil conservation practices, in mid-country tea lands.

Project 3. The Institute's display parlour at the Ceylon Tea Museum was developed, and opened to the public.

Project 4. Clonal mother bushes of the new TRI clones of the 3000 and 4000 series were established at the Station, with the assistance of the OIC.of the Station.

Project 5. Nursery demonstrations using deferent nursery media were continued, using different cultivars of the TRI 3000 and 4000 series.

UVA ADVISORY AND EXTENSION CENTRE, PASSARA

Collaborative Studies and Field Trials

Polyclonal and biclonal seedlings, from Salawa, Kiriporuwa, Halpe, Reucastle and Rembukkanda Estates, were planted at the Centre, in order to allow the Plant Breeding Division to evaluate their performance under Uva conditions. The first cut was given to the plants.

Monitoring activities of the clonal observation trials, UVP 7, UVP 8 and 2/VP 37/Uva, are in progress.

Plucking weights are being recorded from the seed-variety evaluation trial plots established at the Centre. Seed varieties were evaluated for SHB infestation by the Entomology Division.

The drip-irrigation trial at Dammeria Estate is being monitored jointly with the Agronomy Division.

The field trial, initiated by SPND on high potash, is being monitored.

Infilling the vacancies in the germplasm area was completed.

The root depth study, initiated by the Plant Physiology Division in the seed-tea trial, was completed.

Demonstration plot activities, on shear/hand-plucking and different fertilizer mixtures (U 709, VP/Uva 945 and T 1130), in Field No. 01 at the Centre, are in progress.

Evaluation trials of the TRI 5000 series, Phase III trial blocks, were established in Field No. 01 at the Centre.

Special problems in the Uva.
Sulphur-deficiency problems were further observed in company estates, such as Leangahawela, and in several small holder properties in the Haliela area.

ADVISORY AND EXTENSION CENTRE, KOTTAWA

There were 80 seminars, training programmes and field days on various aspects of tea cultivation, for tea smallholders, green leaf suppliers and factory owners in the region.

RSC Seminar was organized at the Wackwella Management Centre.

Twelve informal discussions on finding solutions for various problems encountered in the tea industry, such as labour shortage and pest and disease control, were held. Eight awareness programmes were organized for small holders.

Video Programmes

Thirty-two video shows were made on plucking, land preparation, soil conservation, and pests and diseases of tea, at and outside the Kottawa Centre.

Collaborative Experiments and Observations

- Shear plucking observation block
- TRI 4000 series observation block
- One hundred cinnamon plants in boundaries (intercropping)
- Growth performance of Grevillea (reported by Talawakelle and Ratnapura)
- Clonal Mother Bush Project, TRI 3000 and 4000-series clones
- Seed garden trial, in Field No. 07
- Fertilizer demonstration trial, in Field No. 04 (VP/LC 880 and U 709)

ADVISORY AND EXTENSION CENTRE, KOTAPOLA, DENIYAYA

On-going experiments conducted under the Corporate Plan, 1999-2003, by the Plant Breeding and Advisory staff on cultivar evaluation.

LVP 74, Phase II.

This trial was concluded by the Plant Breeding Division with the assistance of the Advisory Division. However, SHB and various assessments were being continued by the Entomology Division and Advisory staff. Based on the results of these trials and other parallel experiments, two Phase III trials and one observational trial have been established at Deniyaya Estate (WM 1a) (2004), Indola Estate (WL 2a) (2005) and Kiruwanaganga Estate (WL 2a) (2005), in order to further evaluate their regional suitability.

On-going experiments conducted under the Corporate Plan, 1999-2003, by the other research disciplines with the assistance of the Institute's Deniyaya Centre.

Agronomy Division. Thrust A 11. Development of an economically viable system to eliminate/reduce the soil rehabilitation period, prior to replanting, in the low country. The experiment conducted on Handford Estate, Deniyaya, was concluded.

Soil and Plant Nutrition Division. Evaluation of crop response to different proportions of SA and urea. On Kiruwanaganga Estate.
The trial is in progress.

Soil and Plant Nutrition Division. Estimation of crop response to micro nutrients at different levels. On Indola Estate.
The trial has been terminated.

Demonstration trial

Demonstration trial on irrigation in tea-growing areas of Hambantota District. The design of the trial was given to the proprietor. However, the trial could not be begun owing to socio-economics reasons.

Observational trial

A trial was started in a small holding tea field at Halpantenna (600 m amsl), in order to evaluate the possibility of using low-level pruning and collar pruning for rejuvenating debilitated primary branches. Such debilitation is very common in this region, WM 1a.

Result:

Treatment	Observation
Collar pruning	*60% recovered
Pruning at 12"	>80% recovered

Trial on the Deniyaya Problem

Two collaborative experiments were started with the Agronomy Division and the Low-country Station, on the Deniyaya problem, in Richiland Estate, Deniyaya. (Details are given above.)

Problem Specific Trials

An experiment on the use of compost from solid city waste, for young tea plants, was commenced in Willie and Kadigala Estate. SPND and Deniyaya Centre.

Site selection was made for commencing a trial to determine the effect on root growth of the application of different sources of P, during pruning of shallow-rooted tea bushes.

Mass Media Activities

Radio Programmes. Two news items were broadcast on Ruhunu FM and on Sirasa FM, on extension activities organized by the Advisory and Extension Centre, Deniyaya, for tea growers in the Matara District.

Newspaper Article. One news item was published in the Divaina paper on the use of healthy nursery plants.

Video Shows. A series of video shows was organized for the small holders in the Morawakkorale area, with the assistance of Kotapola MPCS, in the afternoons, so that the small holders could participate without disturbance to their routine activities.

Audio Visual Activities

Official AV/Video Coverage of Special Events

- Video facilities were provided at the following special events: 'Crop Clinic' Activities at Ratnapura, Kandy and Talawakelle
- Opening of new Auditorium at the Low Country Station, Ratnapura
- May Day Celebrations at Talawakelle
- Tree-Planting Programme at Talawakelle
- Visit of Minister of Plantation Industries, Hon Milroy Fernando, to the Institute at Talawakelle

Other Official AV/Video Coverage

Field experiments, factory/tea processing activities, field practices.

Preparation of Video Clips

- Method for mixing fertilizers, Soil and Plant Nutrition Division, 10 min.
- Shot-hole Borer, and manganese-deficiency symptoms, for In-Plant Training programme, 15 min and 10 min, respectively.
- Fertilizer sampling, and soil- and leaf sampling, Soil and Plant Nutrition Division, 18 min.

- Recording of video programmes and preparation of VCDs for Institute Centres and Divisions, tea estates, plantations and tea growers.
- Preparation of video-cassette storage system.

AV/Video Facilities for Seminars, Meetings and Training Programmes

E & E Forum; Staff Seminars. - 8
Workshop and training programmes for APL, KPL, MPL, BPL and WPL. - 7

Recording and sale of video CDs on tea cultivation and processing

	VCDs	No of Films
Tea Small Holders	33	113
TSHDA Head Office	40	80
Trainees	13	41
Tea Plantations	36	107
Crop Clinics (3)	149	572
Institute Divisions	42	76
Sub stations	160	620
Total	**473**	**1609**

Summary Annual Report 2005 Advisory and Extension Services

	Activity	T'kelle	R'pura	Kandy	Passara	Kottawa	Denlyaya	Total
1.0	**Estates Visits**							
1.1	Oncall Adv-Visit- Estates	116	24				51	191
1.2	On-call Advisory Visit- Small Holdings	13	73				77	163
1.3	Extension Visit	24						24
1.4	Collaborative research Visit	19	5				39	63
1.5	Familiarization visits	7					2	9
	Total Visits Made **	176	102	71	73	75	169	666
2.0	**Individual Contacts**							
2.1	Office calls **	540	222				124	886
2.2	Inquiries through telephone	1080	416				250	1746
	Total	1620	638				374	2632
3.0	**Documents sent**							
3.1	Advisory Documents	1280	1205					2485
3.2	Administrative matters	1063	171					1234
	Total **	2343	1376	192	73	248	549	4781
4.0	**Documents received**	1785						1785
5.0	**Training Programme**							
5.1	Training Programs-Estates	4	3	2				9
5.2	Familiarization progammes -Estates	6	5					11
5.3	Tarining progammes -small holders	3	6	7				16
5.4	Educational programmes	11	7	6				24
5.5	Custamized training programs	9	4	7				20
	Total **	33	25	22	32	80	25	217
6.0	**Meetings**	86	29				22	137
7.0	**Com.Nursery Inspections**		11	27	164		23	225
8.0	**Exhibitions**	4			1	1	2	8
9.0	**Visitors**							
9.1	Tea Growers (Estates/SH)	157	1160	667		962	634	3580
9.2	Higher educational students	464	46				41	551
9.3	School students	7377	284			278		7939
9.4	Foreign personnel	208	23	7				238
9.5	General visitors	1066	162				61	1289
	Total **	9272	1675	674	231	1240	736	13828
10.0	**Group Extension activities**							
10.1	Demonstrations	12	24					36
10.2	Video shows	17	154				201	372
10.3	Field Trips							
10.4	Field Days	2	4					6
10.5	Informal Discussions		105					105
10.6	Lecture/Seminar/worshops		11					11
10.7	Crop Clinic Conducted		2	1	1		1	5
	Total **		303					303
11.0	**Mass Media Extension**							
11.1	Newspapers articles	2	4				1	7
11.2	Newsletters	2						2
11.3	Folders / Leaflets / Pamphlets/CDs	4	6					10
11.4	Radio/TV/Video programme	9					2	11
11.5	Posters / Wall charts	26	36					62
12.0	**Publication distributed**							
12.1	Free issuing	1445	3040	112		1443	2369	8409
12.2	Priced publication		2028				695	2723
	Total		5068					5068
13.0	**pH testing**		878	491	8	448	249	2074

MID-COUNTRY RESEARCH, ADVISORY AND EXTENSION CENTRE, KANDY

Officer-in-Charge – P B Ekanayake

1 General

There are 14 technical and 13 administration staff, and two graduate trainees, at the Centre. They conduct research in agronomy, entomology, plant-breeding, and soils- and plant-nutrition. The technical staff, in addition to their research activities, assist the Advisory Division in transferring technology to the plantation and small holder sectors. Other research activities in the mid-country are carried out by staff from the main station at Talawakelle.

2 Hectarage as at 31st December 2005

Type of land use	ha
Seedling tea	2.00
VP tea (mature)	5.50
VP (young)	3.50
Mother bushes	2.75
Nursery (tea)	0.20
Under mana grass	0.50
Fruits trees	0.40
Coconut	0.81
Forestry	1.20
Marshy land	0.62
Buildings, gardens, paths and roads	5.77
Total	23.25

4. Crop

Green leaf harvested (kg)

Month	Crop harvested	Crop sold	Rate paid/kg, Rs. cts	Total, Rs. cts
January	1966	1966	26.50	52099.00
February	1820	1820	26.50	48230.00
March	2297	2297	26.50	60393.50
April	3803	3803	25.00	95975.00
May	2722	2722	25.00	68050.00
June	1958	1958	25.00	48950.00
July	2098	2098	23.50	49303.00
August	2494	2494	23.50	58609.00
September	1792	1792	23.50	42112.00
October	2523	2523	19.50	49198.50
November	2508	2508	19.50	48906.00
December	2485	2485	19.50	48457.50
Total	**28466**	**28466**	**23.63**	**670283.50**

5. Total Income for the year 2005

No of cuttings sold	1, 043,950
Income from sale of cuttings	313,185.00
No of VP plants sold	15,050.00
Income from sale of plants	112,875.00
Total crop harvested (kg)	28,466.00
Income from sale of green leaf	670283.50
Guest-house occupation charges	32,250.00
Soil testing (for pH) charges	14,790.00
Sale of TRI publications	22,025.00
Miscellaneous	4,300.00
Total Income	**2,257,174.50**

LOW COUNTRY RESEARCH, ADVISORY AND EXTENSION CENTRE, RATNAPURA

Officer-in-Charge – M A Wijeratne

1 Research, Advisory and Extension Programmes

Experimental activities of the Agronomy, Plant Breeding, Entomology and Technology Divisions, and of advisory and extension activities, were continued. 'Crop clinics', E & E seminars for smallholders, and RSC seminars and workshops for smallholders, managers, assistant managers and field officers, were conducted. Training of trainers, apprentices and undergraduates was also undertaken.

2 The Low Country Centre Expansion Project (Phase II)

The Centre received Rs 42 million for the construction of a fully-equipped seminar hall with two lecture rooms, six living quarters, and a glasshouse. The buildings were ceremonially opened by the Minister and the Deputy Minister of Plantation Industries on 8th May 2005, with the participation of other Ministers and stakeholders in the region.

3 Building and Layout Maintenance

Repairs and maintenance of office, laboratory, living quarters and other buildings were satisfactorily undertaken. Repairs to the vehicle washing-bay were completed. Repairs to the roof of the gasifier room, and of the bus garage, were completed. Water taps and irrigation pipes were installed at the experimental and demonstration sites of the Agronomy Division. The fertilizer shed of the Plant Breeding Division and the security mess were repaired. Fencing of the newly-built living quarters, and painting of the fence posts, were completed.

4 Electrical Maintenance

Re-wiring of bungalows, Nos. C-4, C-5, C-8, C-9, and the St Joachim Estate living quarters, were completed. With financial assistance from the ADB, a new transformer was installed. Electricity was supplied to the newly-built living quarters. Other electrical maintenance of the buildings, living quarters and scientific divisions was satisfactorily continued.

5 Transport

At the request of head office, the ambulance received by the Centre under the ADB grant was transferred to the head office, Talawakelle, and in return a Pajero jeep (32/1807) was assigned to the Centre. Repairs, general maintenance and servicing of the vehicles at the Centre were carried out satisfactorily.

LIBRARY

Wasantha Illangantilake - Librarian

Main function of the library is collection and dissemination of information on tea and allied subjects which have been carried out throughout the year. The library provided regular and satisfactory services to the staff. In addition , reference service were made available to students, outside scientists etc., on request.

The total number of new accessions of books during the year was 26. Library subscribed for 38 journals and about 26 were received on a gift/exchange basis. The number of Annual Reports received was 23.

The library continued its normal routine work such as classification, cataloguing, Indexing, lending materials and .maintained a news clipping collection. 102 copies of news clippings were distributed to the relevant divisions/substations.

In addition to the quick reference queries made by the staff, 14 literature searches were made from internet. 9 CD-ROM searches were made from Council for Agricultural Research Policy and 2 searchers were made from SAIC (SAARC Agricultural Information Centre)

Inter –library loan activities continued satisfactorily. On request 30 articles were sent to various agricultural libraries while 25 articles were received for our users.

The library continued to maintain its relationship with AGRINET (Agricultural Information Network) with a view to resource sharing. About 11 journal content pages were received according to our user requirements and 28 content pages were forwarded to AGRINET member libraries on SDCP services. A further 12 articles were received from other libraries and 8 articles were sent to other libraries through AGRINET. Computerized bibliographic data were sent to the CARP for compilation of the Sri Lanka National Agricultural Bibliography.

11 publications were sent to Low Country Station Library at Ratnapura.10 publications were sent to Mid Country Station Library , Hantana.

Proceed to collection of library book which were borrowed by TRI staff.

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

AWARDS, PATENTS AND RESEARCH PUBLICATIONS

AWARDS

M.A.Wijeratne received presidential awards for inventing the collapsible tea plucking basket. He also participated in the international exhibition of inventions, Geneva, Switzerland and received a Gold Medal for the same invention.

PATENTS

A manually operated Fertilizer Applicator designed by .M.A.Wijeratne was patented.

RESEARCH PUBLICATIONS

Sri Lanka Journal of Tea Science Vol 70 (1) 2005

Mewan K, Liyanage A, Jayamanne E, Gunasekare M T K and Karunanayake E 2005. Studying genetic relationships among tea (*Camellia sinensis L.*) cultivars in Sri Lanka using RAPD markers. 42-53.

Sri Lanka Journal of Tea Science Vol 70 (2) 2005

Gunasekare M T K and Kumara J B D A P 2005. Tea Genetic Resources in Sri Lanka: 1. Genetic resources originating from estate selections. 69-81.

Walgama R S and Pallemulla R M D T The Distribution of Shot-hole Borer *Xyleborus fornicatus* Eichh. (Coleoptera: Scolytidae), Across Tea Growing Areas in Sri Lanka: A Reassessment, 105-120.

Sri Lanka Journal of Tea Science Vol 71, Part 1

Tennakoon P L K, Hettiarachchi L S K, Gunaratne G P, Wijayawardhana R G A W and Gunaratne, O G K A, An assessment of rainwater quality from the tea growing areas of Sri Lanka. (in press)

Peiris T U S, Samita S and Kumari W M R. Variability in rainfall pattern and its impact on tea in the Uva Region of Sri Lanka. (in press).

Punyasiri P A N, Tanner G J, Abeysinghe I S B, Kumar V, Campbell P M and Pradeepa N H L, *Exobasidium vexans* infection of *Camellia sinensis* increased 2,3-cis isomerisation and gallate esterification of proanthocyanadins. (in press)

Tea Bulletin Vol 19 (1&2) 2004

Zoysa A K N and Wickramaratne C W, Fundamental principles of composting. 22– 27.

Wijeratne M A.(2004). Contamination of tea during field operations. 10-14

Wijeratne M A. (2004). Post harvest losses in tea production. 18-21.

TRI Update Vol 10 (1) 2005

Balasuriya A and Ranasinghe C P, TRI 2025 Dieback syndrome (High Forest Problem), the probable cause! 1-2

Liyanage D D and Walgama R S Pheromone Trapping of Tea Tortrix, *Homona coffearia* Nietner (Lepidoptera: Tortricidae), 3-4

TRI Update Vol 10 (2) 2005

Balasuriya A. Maximum Residue Limits (MRLs) in made tea? 5-6.

Gunaratene G P, Hettiarachchi L S K and Rajasinghe J C K, Sulphur deficiency: A note to tea plantations in Uva Region., 1-2.

Walgama R S, Jayathilake M M, Liyanage D D and De Seram C, Effect of hyperparasities on the efficiencvy of *Macrocentrus homonae* on tea tortrix, 7.

Walgama R S, Pallemulla R M D T, Liyanage D D, De Seram C and Jayathilake M M, Shot-hole borer "Going up the hill", 4-5.

International Publications and Communications 2005

Ekanayake P B and Prematilake K G. (2005). Impact of some wed management strategies on the productivity of tea plantations of Sri Lanka. Proceeding of the Asia-Pacific Weed Science Society Conference, November 7-11th 2005, Vietnam.

Guneratne, H M A.C, De Silva, M.S.D.L, and Marambe, B. (2005) Changes of microbial activity with recommended use of herbicides in grown tea in Sri Lanka. (2005). Proceedings of 20th Asian – Pacific Weed Conference, 7th -11th November, Ho Chi City, Vietnam pp 677-684.

Guruge, K S, Taniyasu, S, Yamashita N., Wijeratne S, Mohotti K M, Seneviratne H R, Kannan K, Yamanaka N. and Miyazaki S. (2005). Perfluorinated organic

compounds in human blood serum and seminal plasma: a study of urban and rural tea worker populations in Sri Lanka, *Journal of Environmental Monitoring,* 7, 371-377.

Nissanka, S. P., Mohotti, K. M. and Wijetunga, A. S. T. B. (2005). Allelopathic influences of Pinus caribea on vegetation regeneration and soil biodiversity. Proceedings of the Fourth World Congress on Allelopathy, August 2005, Wagga Wagga, Australia, 336-338.

Prematilake K G (2005) Impact of infestation of Passali kodi weed (*Andredera cordifolia*) on the productivity of high-grown tea of Sri Lanka, Proceeding of the Asia-Pacific Weed Science Society Conference, November 7-11th 2005, Vietnam.

Ranamukaarachchi, S.L, Thevachandran, S., Rivas A.A, Michael Zobisch, Clemente, R.S, Dan Gupta, A., Khin Mar Cho, Luxmei de Silva, M.S.D.L (2005). Soil Quality Changes under Varying Cropping Patterns in the Uma Oya Watershed, Sri Lanka. The proceedings of the Tropentag Conference on " The Global Food and Production Chain-Dynamics, Innovations, Conflicts, Strategies", held in Hohenheim, Stuttgart, Germany on 11th -13th October, 2005.

Seran T, Hiriburegama K and Gunasekare M T K 2005. Encapsulation of embryonic axes of *Camellia sinensis L.* (tea) and subsequent *in vitro* germination. Journal of Horticultural Science and Biotechnology 80, 154 – 158.

Walgama R S and Zalucki Evaluation of Different Models to describe Egg and Pupal Development of *Xyleborus fornicatus* Eichh. (Coleoptera: Scolytidae), the Shot-hole borer of Tea in Sri Lanka. *Insect Science* (formerly Entomologia sinica)

National Publications and communications

Beddage H P and Mohotti A J, (2005). A compilation of potential alternate shade tree species for tea plantations. Proc. Tenth Annual Forestry & Environmental Symposium, department of Forestry & Environmental Science, University of Sri Jayewardenepura, Sri Lanka; p. 23.

Senanayake, D.S.U., Marambe, B., and De Silva, M.S.D.L (2005) Influence of legume *Arachis pintoii* on growth of young tea. Crop Science Student Research Abstract. Proceedings of the final year research sessions. Dept. of Crop Science. 7thSeptember, 2005 pp.33-34.

Wijayawardhana R G A W, Zoysa A K N and Dharmagunawardhane H A (2004) Effect of fertilizer application in up country tea lands on downstream pollution, Proceedings of the University Research Sessions, Sri Lanka on 10 November 9: 2004 pp 192.

Weerasinghe, K. W. L. K., Mohotti, K. M., Herath, C. N. Samarajeewa, A., Liyanagunawardena, V. and Hitinayake, H. M. G. S. B. (2005). Biological and chemical properties "Vermiwash", a natural plant growth supplement for tea, coconut and horticultural crops. Proceedings of the Tenth Annual Forestry and Environment Symposium 2005 held in Thulhiriya, Sri Lanka 2– 3 December 2005, 70-71.

Wijeratne, M.A. & Premathunga, E.W.T.P. (2005) Effect of refuse tea on soil properties and yield of mature tea in low country wet zone of Sri Lanka. *J. Plantation Crops*, **33 (1):** 44-47.

Books

Gnanapragasam N C and Mohotti K M Nematode Parasites of Tea. *In:* Plant Parasitic Nematodes in Subtropical and Tropical Agriculture, 2nd Edition (eds. M Luc, R A Sikora and J Bridge), 581-609.

Serial Publications

1. Sri Lanka Journal of Tea Science Vol 70 Parts 1&2
2. Tea Bulletin Vol 19 Parts 1&2
3. 'Te Thathu' Vol 5 Part 1
4. TRI UPDATE Vol 10 Parts 1&2

Other Publications

Advisory Circulars (Sinhala translation) – Nos. PN1, HP1 & HP2, LU1 & LU2, SP1 to SP6, PA1 to PA3, WM1 to WM3, DM1 to DM6, PT1, PT3, PT5 & PT6.

Guidelines on Cost Management

RECOGNITIONS

J Mohotti served as external examiner for the following Ph D candidates:

Mr S Mahendran, Post Graduate Institute of Agriculture, University of Peradeniya;

Ms P A K A K Panditharathna, Faculty of Graduate Studies, University of Sri Jayewardenepura.

J Mohotti continued to serve in the Board of Study, Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya.

Dr L S K Hettiarachchi served as

a) a member of the Working Group on Fertilizer to the Sri Lanka Standards Institute; and

b) a member of the Technical Committee on Organic Fertilizer to the Sri Lanka Standards Institute.

Dr A K N Zoysa served as

a) a member of the Board of Study in Environmental Science, Post Graduate Institute of Science, University of Peradeniya;

b) a Visiting Lecturer in the Faculty of Agriculture, University of Ruhuna; and

c) the Chairman of the Publications and Presentations Panel of the Institute.

SEMINARS, WORKSHOPS AND TRAINING PROGRAMS

Agronomy Division

Dr.M.A.Wijeratne has made more than 20 presentations addressing estate managers and Small holders at PA meetings, RSC seminars, field days and workshops on proper agronomic practices and mechanization. He also made presentation at other training programmes organized by the NIPM, TSHDA and Sabaragamuwa Chamber of Commerce.

Dr.M.A.Wijeratne supervised 2 research projects of undergraduates from the Faculty of Agriculture, University of Ruhuna and University of Peradeniya

Ms. Luxmei De Silva addressed managers and assistant managers of Watawala Plantations (Ltd) on" Management of problem weeds in upcountry" on 27th May.

Entomology Division

Many awareness programmes were conducted on sustainable tea pest management strategies at several one-day workshops, 'crop clinics' and training sessions, for small holder and corporate-sector planters and growers.

Plant Breeding Division

Dr (Ms) M T K Guansekare and M Ratnayake participated in the workshop on "Future Directions of Crop Improvements", organized by the CARP, Sri Lanka, 4th April.

Mr M A B Ranathunga underwent a familiarization in 'Biotechnology and Molecular Biology' for two weeks, at the Institute of Biochemistry, Biotechnology and Molecular Biology, Sri Lanka, to fulfill the requirements of the MSc programme being followed at the Tamil Nadu Agricultural University.

Dr (Ms) M T K Guansekare attended four committee meetings of the National Committee on Plant Breeding and Biotechnology, and the "Expert Consultation on Agricultural Biotechnology in Sri Lanka", organized by the CARP, 19th –20th December.

Mr M A B Ranathunga continued his M.Sc (Biotechnology) programme at the Tamil Nadu Agricultural University, India.

Dr (Ms) M T K Gunasekare made a presentation on "The Present Status and Future Direction in Breeding Tea" at the Workshop organized by the CARP at the In-Service Institute, Gannoruwa, 4th April.

Dr (Ms) M T K Gunasekare held a seminar, at the training programme organized by the Institute on 27th May, for the Superintendents and Assistant Superintendents of Watawala Plantations, on "Tea Cultivars suitable for the Mid- and Up-Country Regions".

Mr M Ratnayake held seminars on:

"The suitability of new tea cultivars and their identification", at the Regional Technical and Extension Forum for the Uva region on 7th July.

"The suitability of new tea cultivars and their identification", for the commercial nursery holders in the Kottawa region on 10th July.

"The suitability of new tea cultivars and their identification", at the Regional Technical and Extension Forum for the Mid-Country region on 13th September.

Members of the Division took part in demonstrating activities related to the Plant Breeding Programme at the "Crop Clinics" conducted at the Low-Country Station, Ratnapura, for smallholders, and at Passara for RPCs.

A K Mudalige participated in the "Crop Clinic" conducted at Warapitiya.

One post-graduate candidate completed her bench work leading to the Ph.D.

Ms A M L R Abeysinghe, Agriculture Diploma student trainee, completed her four-months training in July.

Mr K H Rajapaksha, undergraduate student trainee, from the Faculty of Agriculture, University of Peradeniya, underwent 10 days In-plant training in September.

Mr J D K Arachchi completed his B.Sc (Natural Science) degree at the Open University of Sri Lanka

Plant Physiology & Propagation Division

J. Mohotti, T L Wijeratne, S Navaratne and Nalika Damayanthi attended the 17th Annual Congress of the Post Graduate Institute of Agriculture, University of Peradeniya, held on 24-25 November, at the PGRC, Gannoruwa.

J Mohotti judged presentations in the Technical Session on Plant Physiology and Plant Protection.

Soils & Plant Nutrition Division

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

a) Low Country Station, Ratnapura on 08th May.
b) Buddhist Temple, Kirama, Middeniya during 09th - 10th July.
c) Uva Management Training Centre, Pelagahantenne, Passara on 02nd December.

Dr L S K Hettiarachchi, Dr A K N Zoysa, Mr G P Gunaratne and Mrs S Anandacoomaraswamy attended the 210th E & E Meeting, where Dr L S K Hettiarachchi presented a paper entitled "Towards site specific fertilizer recommendations for mature tea"; Institute Auditorium, Talawakelle, 25th January.

Dr L S K Hettiarachchi, Dr A K N Zoysa, Mr G P Gunaratne and Mrs S Anandacoomaraswamy attended the 211th E & E Meeting, where Dr A K N Zoysa presented a paper entitled "Rapid decomposition of refuse tea using dilute alkaline solution of humate"; Institute Auditorium, Talawakelle, 29th July.

Dr L S K Hettiarachchi, Dr A K N Zoysa, Mr G P Gunaratne and Mrs S Anandacoomaraswamy attended the 15th and 16th Forums (Small Holder Sector); Institute Auditorium, Talawakelle, 19th May and 21st November, respectively.

Dr L S K Hettiarachchi presented the protocol on Site Specific Fertiliser Recommendations (SSFR) for mature tea to the workshop on the theme, "Recent Contributions of TRI", to the Chief Executive Officers of Regional Plantation Management Companies, held at the Sri Lanka Tea Board Auditorium on 06th June.

Dr L S K Hettiarachchi conducted the workshops on Site Specific Fertilizer Recommendations (SSFR), together with soil- and leaf sampling demonstrations,

for the Managers and Assistant Managers of the following Plantation Management Companies:

a) Agalawatte Plantation Company, on 06th July
b) Bogowanthalawa Plantation Company, on 07th July
c) Kegalle Plantations Company, on 12th and 27th July
d) Hapugastenne Plantations Company, on 12th August
e) Talawakelle Plantations Ltd, on 21st December.

Dr A K N Zoysa conducted a workshop on Site Specific Fertilizer Recommendations (SSFR) for the Managers and Assistant Managers of the Maskeliya Plantations Company on 11th April.

Dr L S K Hettiarachchi conducted workshops on TRI Fertilizer Policy and its Recommendations for the Managers and Assistant Managers of the following PMCs:

a) Agrapathana and Kotagala Plantations Companies, on 18th February and 15th March
b) Kellani Valley Plantation Company, on 06th April and 20th October
c) Agalawatte Plantation Company, on 14th June.

Dr L S K Hettiarachchi delivered a lecture on 'Functions of Plant Nutrients of Tea and its Importance', for the Managers and the Assistant Managers of Kellani Valley Plantation Company, on 06th April.

Dr A K N Zoysa demonstrated a computer model developed for estimating fertiliser requirements of tea, for the Managers and the Assistant Managers of Kellani Valley Plantation Company, on 06th April.

Mrs S. Anandacoomaraswamy demonstrated soil- and leaf sampling techniques at field days, organised by the Advisory and Extension Division for Managers and Assistant Managers of the following Plantation Management Companies:

a) Balanagoda Plantation Ltd,, on 26th and 28th September
b) Kelani Valley Plantation Ltd ., on 20th October
c) Talawakelle Tea Estates, on 21st December

Mrs P L K Tennakoon was awarded a two-year postgraduate programme for training on Bio Fertilizers, by the Sri Lanka Council for Agricultural Research Policy (CARP), under the joint Indian Agricultural Research Council and CARP Work Plan, at the University of Agricultural Sciences, Dharwad, Karnataka, India, with effect from 12th September.

Mr W T B D Priyantha attended a workshop on 'Writing Research Proposals, Conducting and Publishing Research', held at the SLAAS Auditorium on 14th July.

Dr L S K Hettiarachchi attended a workshop on Agricultural Research Management, held at the In-Service Training Institute, Department of Agriculture, Gannoruwa, on 07th October.

Dr L S K Hettiarachchi attended a short course on Environmental Toxicology and Computational Modelling, organised by the Post Graduate Institute of Agriculture, University of Peradeniya, together with the Lincoln University, New Zealand, held on 03 – 04th December

Technology Division

The staff of the Division supported the NIPM in conducting training programmes and related activities.

They supported the Tea Commissioner's Divisions (Galle and Ratnapura) and the Regional Plantation Companies in conducting seminars and workshops on tea manufacture.

They participated in RSC seminars held in Galle.

They supported the conducting of seminars on tea manufacture at the Akuressa and Delgoda tea factories.

They were involved in organizing and conducting workshops on tea manufacture for Managers, Assistant Managers and Factory Officers at Kahawatte Plantations Ltd., Horana Plantations Ltd. and Watawala Plantations Ltd.

They participated in a "Crop Clinic" held at Passara.

Agricultural Economics Unit

Mrs J A A M .Jayakody delivered a lecture on Introduction to the Tea Sector and the Economic Significance of the Tea Industry in Sri Lanka, at the National Institute of Plantation Management, Athurugiriya, on 31st January.

Mrs J A A M .Jayakody presented a paper on "Policy Proposals for Tea Policy – Cultivation Aspects", at a seminar in Colombo, organized by the SLTB and the TASL on 10th February.

Mrs J A A M .Jayakody, Mrs H W Shyamalie and Ms G Geethani attended the crop clinic for the estate sector, in the mid-country, on 11th February at the Advisory and Extension Centre, Hantana.

Mrs J A A M .Jayakody, Mrs H W Shyamalie and Ms G Geethani attended the crop clinic for smallholders, in the mid-country, on 12th February at Danthure.

Mrs J A A M .Jayakody delivered a lecture on "Cost of Tea Cultivation", on 21st February at the Institute's Auditorium, Talawakelle.

Mrs J A A M .Jayakody attended a Seminar on "Climatic Changes" on 18th March at the University Grant Commission, Colombo.

Mrs J A A M .Jayakody presented a report on the visit to India in November 2004, and a report on "Green Leaf Transportation System of Kenilworth Estate" to the Tea Research Board, on 31st March in Colombo.

Mrs H W Shyamalie and Mr W M J C Bandara attended the crop clinic for small holders in the low country, on 8th February, at the Low Country Station, Ratnapura.

Mrs J A A M .Jayakody presented a paper on "Activities of the TRI to arrest Land Degradation in Tea Lands", at a workshop on 'Identification of the Activities of the Agencies involved in Land Degradation', organized on 5th August by the Ministry of Environment and Natural Resources, Colombo.

Mrs H W Shyamalie and Mr W M J C Bandara attended the crop clinic held on 4th December at the Training Centre, Ury, Passara.

Mrs J A A M .Jayakody attended the 9th Biannual Workshop of SANDEE, held in Sri Lanka at Waikkala. from 6th to 14th December.

Mrs J A A M .Jayakody attended the 20th Smallholder E&E Forum held on 15th December, at the Low Country Station, Ratnapura.

A presentation was made at the Institute's 212th E&E Forum on "The Economics of Soil Conservation in Tea Lands in the Upper Watersheds".

Presentations were made at the 20th Smallholder E&E Forum, and the 212th E&E Forum on "The Economics of Blister Blight Control"

Advisory & Extension Services Division

Four skill training programmes on nursery techniques, four workshops on the identification of common problems, and limitations in nursery management, for registered commercial nursery holders, and seven seminars on rush-crop management and minimizing post harvest damage for bought leaf suppliers, were conducted.

Four client-originated training programmes were conducted to meet the requests of small holders on the practical problems on plucking, pruning, fertilizer application, and pest and disease control. These programmes were organized by the Labour Department, the Divisional Secretariat at Ayagama, the Pelwadiya SH Society, and the Dumbara SH Society.

Seven programmes on tea cultivation were conducted for University diploma students, NAITA students, agriculture and science teachers, and for school children. Eleven diploma students from the School of Agriculture, and from the Hardy, Niwala, Kundasale, Pellwehera, and Aquinas Agricultural Schools, underwent four months in-plant training program on tea cultivation. Two students from NAITA, Ratnapura, underwent training programmes on stenography, typing and data entry, for a period of six months.

The Advisory staff attended meetings organized by the PA, the RS Committee, the District Agricultural Committee, ADB, SLAAS, the PGIA Congress, and the CARP Social Studies group.

Mr T G N Mahinda attended the workshops on science communication organized by the NSF.

Mid-Country Station, Kandy

Two 'crop clinics' were held for the benefit of mid-country planters and small holders.

Two Regional, Technical and Extension Forum seminars were held for tea Inspectors and selected small holders.

17 Field days/seminars were held for the benefit of tea Inspectors, small holders, and undergraduates and diploma holders.

Library

Ms Wasantha Illangantilake, Librarian attended the AGRINET and SLSTINET meetings.

Advisory & Extension Centre, Deniyaya

Twenty-five programmes for plantation sector, small holding sector and students were conducted.

Advisory & Extension Centre, Kottawa

There were 80 seminars and Training Programs/Field Days at Kottawa station and outside. The target groups were tea smallholders, green leaf suppliers and factory owners.

ST.COOMBS / LAMILIERE ESTATE

Superintendent – J V Hulangamuwa

1. Staff as at 31st December 2005

Mr. Jayantha Hulangamuwa	Superintendent

Office Staff

1.	Mr.D.H.Jayatillake	Chief Clerk
2.	Mr.R.W.Kitnasamy	Junior Assistant Clerk
3.	Mr.N.G.L.Dayatillake	Junior Assistant Clerk
4.	Mrs.T.G.S.Chandrakanthi	Junior Assistant Clerk
5.	Miss.H.M.Badra Jayathilake	Junior Assistant Clerk

Field Staff

6.	Mr.Nimal De Silva	Field Officer
7.	Mr. N.Illangeswaran	Field Officer
8.	I.W.M.D.Alahakoon	Junior Assistant Field Officer
9.	Mr.U.V.Dayananda	Junior Assistant Field Officer
10.	Mr.S.Suresh	Junior Assistant Field Officer
11.	Mr.S.D.Perera	Junior Assistant Field Officer

Factory Staff

12.	Mr.E.M.Dayaratne	Factory Officer
13.	Mr.H.M.R.Kuladasa	Junior Assistant Factory Officer
14.	Mr.S.M.Sunil Shantha	Junior Assistant Factory Officer
15.	Mr.J.R.Yapa	Junior Assistant Factory Officer
16.	Mr.A.D.C.Premalal	Junior Assistant Factory Officer

Medical Staff

17.	Mr.K.Ramesnath	Estate Medical Practitioner
18.	Mr.S.Fernando	Estate Medical Practitioner
19.	Mr.D.Puniyamoorthy	Welfare Officer

Drivers

20.	Mr.K.Selvaraj	Driver
21.	Mr.S.Christopher	Driver
22.	Mr.T.Ramanathan	Driver
23.	Mr.R.Udayakumar	Driver

2. Weather and Rainfall

A rainfall of 2,081.2 mm was recorded on 205 wet days against 2,068.5 mm on 223 days in 2004.

3. Field work & cultivation

3.1 Hectare statement as at 31st December 2005

	St.Coombs	Lamiliere	Total
Old Seedling Tea in Bearing	9.60	2.00	11.60
V.P.Tea in Bearing	80.72	45.50	126.22
V.P.Tea Immature	-	-	-
ADB Project	11.39	2.62	14.01
Nurseries	1.20	0.10	1.30
T R I Experimental Area	2.50	-	2.50
Total in Tea	**105.41**	**50.22**	**155.63**
Labour Housing	1.09	-	1.09
Ravines & Grass Land	31.00	1.00	32.00
Buildings, Roads, Workers' Gardens etc.	34.28	14.70	48.98
TOTAL	**171.78**	**65.92**	**237.70**

3.2 Crop and Yield

	2005		2004	
	Crop (kg)	Yield (kg/ha)	Crop (kg)	Yield (kg/ha)
St.Coombs	226,177	2,513	200,872	2,259
Lamiliere	122,099	2,570	112,316	2,415
Total	348,276	2,527	313,188	2,313
Bought Leaf	8,373	-	4,514	-
Grand Total	356,649	2,527	317,702	2,313

Highest yield recorded in St.Coombs / Lamiliere Estate is 2,527 kg/ha. in 2005.

3.3 Cultural Operations

All agricultural practices were undertaken as programmed.

3.4 ADB mother Bush Project

487,575 shoots of TRI 3000 and 4000 series were issued to Tea Small Holders and Corporate Sector.

4. Factory and Manufacture

4.1 Top Prices

Silver Tips teas were sold at Rs. 6,500.00

5. General

Mr.Mahen Madugalle, the Visiting Agent visited the Estate on 7th September 2005.

M/s. Asia Siyaka Commodities (Pvt) Ltd. continued auctioning St.Coombs teas.

The following Daily paid Supervisors and Drivers were taken to permanent Category with effect from 15th September 2005.

Mr.S.Suresh	Junior Assistant Field Officer
Mr.S.D.Perera	Junior Assistant Field Officer
Mr.D.Puniyamoorhty	Welfare Officer
Mr.S.Christopher	Driver
Mr.T.Ramanathan	Driver
Mr.R.Udayakumar	Driver

Mr.N.Illangeswaran promoted as Field Officer, Lamiliere Division w.e.f. 15th September 2005.

6. Working Results

The Estate should make a profit of approximately Rs.1,157,082/=.

ST. JOACHIM ESTATE

Superintendent – M S E Perera

1. General

Mr. M S E. Perera functions as the Superintendent since, 15/12/2001.

The Visiting Agent Mr. Devan S. Warusavitarne, made his first visit to this estate on 14/7/2005.

2. Hectarage as at 31st December 2005.

	Ha	
Mature tea	46.64	
Major infilled areas	1.68	
Nursery	1.58	
Land under coconut (TRI)	3.89	
ADB Project	30.00	
Land under paddy	8.74	
Crop - Tea /Rubber	3.68	
Rubber	7.12	
Mana Grass	13.02	**116.35**

Other Lands

Acquisition by Government	
Buildings/roads/ravines and jungle	**25.63**
Total extent	**141.98**

3. Crop (made tea kg)

The production on St.Joachim Estate in 2005, compared to the previous year was as follows:-

Year	Estate Crop (Kg)	Bought Crop (Kg)
~~2004~~	56,059	585,486
2005	58,336	574,284

The production on the estate registered an Increase of 2,277 kg or 4.06%, in comparison to the previous year.

3.1 Bought Leaf.

The bought leaf manufactured at St Joachim factory showed a decrease of 11,202 kg. or 1.91% in comparison to the previous year. Severe drought conditions were experienced during the 1st two months of the year, and work was disrupted due to the elections too.

4. Prices.

All teas produced at St Joachim factory were sold at the Colombo Auctions in the Low Grown catalogue. M/s Bartleet & Co Ltd. and Forbes and Walker Tea Brokers (Pvt) Ltd. sold the teas in an equal proportion.

The Nett sales average to end December was Rs.180/34. The working of St Joachim Estate resulted in a loss of Rs.128,772/- as at 30/11/2005.

5. Infilling of vacancies

Estate: 14372 plants were infilled in fields No.1B,2A,2F,4 and 6

ADB Project: 17235 plants were infilled in field Nos.1,3,4,5,8 and 10.

6. Cultural Operations

Pruning, Mossing & Ferning, Draining, and Fertilizing & Weeding Operations as per the estimates were carried out. No major Pests & Disease problems were encountered.

7. Nursery

The supply of planting materials to small holders in the District continued this year too. Sale of Planting materials compared to the previous year was as follows:-

Year	Cuttings	Proceeds Rs.	Plants	Proceeds Rs.
2004	1582945	474883/=	34510	261085/=
2005	4912500	1473750/=	38570	327845/=

8. General

The upgrading of the Crèche (2004 programme), re-roofing two sets of worker quarters as completed with funds received from the Plantation Human Development Trust. 25% of the expenditure was borne by the estate.

The construction of a 'D' type staff quarters is in progress which contract was awarded by Head Office to Mr. Chaminda Sampath, of Hidellana 90% of the work being completed.

The construction of the Manure shed was completed (2004 programme).

A new Colour Separator was purchased in March, 2005 at a cost of Rs.10,402,767/35.

An increase of 5% salary to staff members was approved as per Collective Agreement, effective from October,2005 and same increments were paid along with October 05, salaries.

The following work has been carried out in the factory during the year:-

1. Fixing of floor tiles in the area of packing room was completed.
2. Repairs to 6' CCC Drier was carried out.

Staff Vacancies: The following vacancies were filled subsequent to the interviews held on 17/8/05 and appointments were made with effect from 15/9/05:-

Senior Assistant Clerk, Mrs.N.D.A. Gunewardena,
Junior Assistant Clerk, Miss. Nilani Koralage,
Junior Assistant Field Officers, M/s. Jayantha Senadeera and V. Ariyaraj,
Lorry/Tractor Drivers, M/s. A.V. Somaratne and Jagath Anura Kumara,
Senior Assistant Factory Officer, Mr. P.H.G.K. Jayaratne,
Assistant Factory Officer, Mr. S.K. Edirisingha,
Junior Assistant Factory Officers. , M/s. P.P. Wickremaratne, M.D. Rohana Premalal and W.N. Perera,

Mr. T.A. Karunanayake, Storekeeper/Clerk, retired from the service with effect from 15/3/05 and Mr. M.W. Jayasekera was transferred from St. Coombs to this estate with effect from 1/3/05.

Miss. J.C. Pragnaratna, Junior Assistant Clerk resigned from her post with effect from 15/11/05 and the vacancy remains vacant..

A D B Project:- The funding for 30 ha. of ADB Planting project, ceased from July, 2005.

VAT:- The estate had to borne an additional expenditure of approximately Rs.2,650,000/- with the withdrawal of the VAT Input Refund from January, 2005. (To end Nov' 05).

Table 1.

WORKING ACCOUNTS OF ST. JOACHIM ESTATE FOR 2005 IN COMPARISON WITH PREVIOUS YEARS

YEAR	TOTAL CROP SOLD MADE TEA TEA - KG	YIELD (MADE TEA) KG/HA	NET SALE AVERAGE RS./KG	ESTIMATED C.O.P RS./KG	ACTUAL C.O.P RS./KG	+ PROFIT - LOSS (Combined) Rs.
1999	^ 746,768 # 78,197	1446	120/22	100/30	117/33	8,262,014/=
2000	711,325 75,336	1393	138/70	82/98	75/62	9,360,576/=
2001	609,732 66,459	1140	137/23	89/48	89/13	(424,423/=)
2002	658,619 65,071	1358	147/84	96/26	100/56	(1,306,425/=)
2003	648,692 62,484	1293	143/37	130/09	93/46	155,325/=
2004	585,486 56,059	1160	177/12	164/74	168/69	2,637,456/=
2005	574,284 58,336	1249	80/34	* 165/97	* 180/22	* (128,772/-)

^ Bought Crop Made Tea
# Estate Crop Made Tea

* To end November -05

Table 2.

Monthly yield (kg/ha) rainfall and average "N" applied from 2000 to 2005 - St. Joachim Estate.

Month	2000	2001	2002	2003	2004	2005
January	117	123	102	106	79	113
February	105	115	81	88	71	65
March	139	122	109	105	89	107
April	141	113	109	131	117	126
May	143	118	127	116	90	107
June	118	87	130	112	111	106
July	95	86	116	124	103	107
August	100	88	130	95	103	115
September	101	56	104	100	92	108
October	100	88	113	112	106	96
November	110	78	105	107	104	104
December	124	90	85	97	94	95
Total	1393	1140	1358	1293	1159	1249
Total Rainfall (mm)	3740.6	3593.5	3194.8	3984.6	3914.3	3511.5
No of Wet Days	211	189	206	227	216	189
Average "N" (Kg/Ha/Yr)	162	163	162	124	127	121

MONTHLY YIELD (KG/HA) OF FIELDS WITH FERTILIZER MIXTURE USED AND AMOUNTS OF "N" APPLIED ON ST. JOACHIM ESTATE. – YEAR 2005

Field No.	Extent Ha	Total N	Fert Mixt	Month											
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.68	220	VPLC/880	184	83	183	291	220	215	165	-	-	-	34	82
1B	0.80	400	-do-	-	96	109	161	279	139	355	347	375	295	405	406
2A	0.93	400	-do-	-	35	106	105	101	141	185	202	239	225	173	141
2F	6.00	140	-do-	67	43	47	40	16	-	-	06	36	51	45	48
3	8.40	160	-do-	78	43	66	103	57	73	71	81	92	54	96	69
4	5.85	180	-do-	40	25	57	49	64	66	520	86	74	102	53	76
6	1.00	270	-do-	142	72	214	151	35	-	-	34	62	72	42	137
6B	1.10	270	-do-	164	104	177	291	115	218	184	273	218	48	-	-
6C	2.00	270	-do-	272	110	243	207	232	165	161	222	111	-	-	-
8A	6.00	220	-do-	136	73	142	134	97	110	140	150	131	149	147	90
8B	2.02	360	-do-	301	221	213	283	356	360	267	326	324	225	263	333
8C	1.90	200	-do-	58	34	64	67	46	82	45	77	60	46	73	32
2 (TRI)	4.12			24	09	25	61	31	59	58	47	66	76	40	95
3A(TRI)	3.34			45	42	47	57	66	52	50	48	54	53	58	46
6A(TRI)	0.50			306	136	154	184	250	260	220	250	178	220	196	178
Total	46.64			113	65	107	126	107	106	107	115	108	96	104	95

REGIONAL ADVISORY AND EXTENSION CENTRE, DENIYAYA

Acting Officer-in-Charge - K G J P Mahindapala

1 Land Use

Type of land use	ha
VP tea (mature)	6.79
VP (young, under ADB)	0.50
ADB mother bushes	0.50
Other mother bushes	0.50
Rehabilitated abandoned area (under ADB)	1.00
Nursery (tea)	0.1
Coconut area	0.1
Forestry	0.42
Marshy land	0.50
Building, gardens, roads	1.44
Pepper	0.05
Encroachment	0.36
Uncultivated area	0.96
Total extent	**13.22**

2 Green Leaf

	Factory	Kg	Rate/kg	Total (Rs)	Full Amount
January	Deniyaya Estate	1941	29.920	58074.72 Incentive: 320.00	
	MKTP Co-op, Kotapola	1090	31.15	33953.50	92348.22
February	Deniyaya Estate	979	28.294	27699.83	
	MKTP Co-op, Kotapola	1517	30.103	45666.25	73366.08
March	Deniyaya Estate	2193	29.098	63811.91	
	MKTP Co-op, Kotapola	985	30.987	30522.20	94334.11
April	Deniyaya Estate	1348	27.488	37053.82	
	MKTP Co-op, Kotapola	1088	31.150	33891.20	70945.02
May	Deniyaya Estate	1454	28.306	41156.92	
	MKTP Co-op, Kotapola	1470	29.247	42993.09	84150.01
June	Deniyaya Estate	1537	27.076	41615.81	
	MKTP Co-op, Kotapola	914	27.589	25216.35	66832.16
July	Deniyaya Estate	1160	27.120	31459.20	
	MKTP Co-op, Kotapola	1078	26.742	28827.88	60287.08
August	Deniyaya Estate	2071	28.244	58493.32	
	MKTP Co-op, Kotapola	962	28.873	27775.83	86269.15
September	Deniyaya Estate	2045	29.656	60646.52	
	MKTP Co-op, Kotapola	1159	31.092	36035.63	96682.15
October	Deniyaya Estate	1522	30.120	45842.64	
	MKTP Co-op, Kotapola	1535	32.389	49717.12	95559.76
November	Deniyaya Estate	1959	29.590	57966.81	
	MKTP Co-op, Kotapola	1597	30.665	48972.01	106938.82
December	Deniyaya Estate	2301	*29	66729	
	MKTP Co-op, Kotapola	2164	*30	64920	131649
Total		**36069**	**29.35**	**1059361.56**	**1059361.56**

* Provisional data

3 Income for the year 2005

No. of cuttings sold	189,750
Sale of cuttings	Rs 56,925.00
No. of plants sold	Nil
Sale of plants	Rs Nil
Crop harvested (kg)	36,069
Sale of crop	Rs.1,059,361.56
Average price (kg/green leaf)	Rs.29.35
Miscellaneous income	Rs.16,945.36
Total Income	**Rs.1,133,231.92**

4 Experiments and Surveys

A. Survey on cost of production of green leaf

A comprehensive survey was conducted in the Matara District in order to work out the cost of production of green leaf in the Matara District, as a part of the national-level survey carried out in all the tea-growing areas in the low-country region. In this survey, 1049 small holders from 20 TI regions were interviewed, and the information required obtained (Director and Deniyaya Centre).

Some of the basic findings of this survey in relation to the Deniyaya Region are:

Productivity	2296 MT kg/ha/year
Average daily wage (Rs.)	189.60
Average daily plucker intake	22.53 kg
Average cost of plucking	Rs. 8.44/kg
Average COP (Rs.)	17.10/kg
Average price of green Leaf	Rs 29.67

R P S Shantha and P A V Anuradha served as enumerators in this project.

B. On-going experiments on cultivar evaluation, conducted under the Corporate Plan, 1999-2003, by the Plant Breeding and Advisory staff

LVP 74 Phase II. This trail was concluded by the Plant Breeding Division with the assistance of the Advisory Division. However, SHB and various assessments were being continued by the Entomology and Advisory Divisions. Based on the results of these trials and other parallel experiments, two Phase III trials and one observational trial were established in Deniyaya Estate (WM1a) (2004),

Indola Estate (WL2a) (2005) and Kiruwanaganga Estate (WL2a) (2005), in order to further evaluate their regional suitability. (Plant Breeding and Deniyaya Centre)

C. On-going experiments conducted under the Corporate Plan, 1999-2003, by different research disciplines with the assistance of the Deniyaya Centre

- Agronomy Division. Thrust 11. Development of an economically viable system to eliminate or reduce the soil-rehabilitation period in replanting in the low country. The experiment, conducted in Handford Estate, Deniyaya, was concluded.

- Soil and Plant Nutrition Division. Evaluation of crop response for different proportions of SA and urea. The trial, being conducted in Kiruwanaganga Estate, is in progress.

- Soil and Plant Nutrition Division. Estimate crop response to micro nutrients at different levels. The trial, conducted in Indola Estate, has been terminated.

D. Demonstration trial on irrigation in the tea-growing areas of the Hambantota District

The design of the trial was given to the proprietor. However, the trial has not yet commenced owing to some socio-economics reasons (Deniyaya Centre and Agronomy).

E. Observational trial

A trial was started on a small holding tea field at Halpantenna, 600 m amsl, to evaluate the success of low-level pruning, including collar pruning, in order to determine if there was any possibility of restoring the debilitated primary branches, which could be seen in most places in the mid-elevation (WM1a) of this region.

Observation

Treatment	Observation
Collar-pruning Height of the prune 12"	*60% recovered >80% recovered

*Note: Pruning was done in the latter part of the monsoon and the drought badly affected shoot generation. Therefore, it is important to undertake a systematic study of this (Deniyaya Centre).

F. Trials on the Deniyaya problem

Two collaborative experiments were started with the Agronomy Division and the Low-Country Station on the Deniyaya problem, in Richiland Estate, Deniyaya. The objectives of these trials are

1. to determine if there was any effect of the source of the planting material; and
2. to determine if there was any effect of soil pathogens or soil physical characteristics.

G. Problem specific trials

An experiment on the use of city solid-waste compost for young tea plants was commenced in Willie and Kadigala Estate (SPND & TRI Den)

Site selection was done to commence a trial to see the effect of root growth on application of different source of P during the pruning for the shallow rooted tea bushes. (Soil and Plant Nutrition Division, and Deniyaya Centre).

Two field surveys were carried out by staff of the Entomology and the Advisory Divisions, in small holding tea fields in Deniyaya, Kolawenigama and Kotapola TI ranges, in order to identify the causative factors of the "Deniyaya Problem".

According to the results, a high % of SHB infestation was present in the affected tea bushes.

5 Advisory and Extension Activities

5.1 Advisory correspondence

- Advisory correspondence, amounting to 549 in total, was despatched on regular Advisory and Extension matters.

5.2 Advisory and Extension visits

Fifty-one advisory and routine visits were made by the Advisory staff to company estates, proprietary plantations and smallholdings.
Seventy-seven extension visits were made in order to monitor the experimental

plots and adaptive research trials, and to collect data, and organise and conduct extension activities.
Thirty-nine collaborative research visits with research staff, and two familiarization visits, were made.
Twenty-three commercial Nursery Inspections were made.

5.3 Advisory and Extension Programmes

Regional scientific activities:

One RSC seminar was conducted at Wackwella, together with the Institute's Kottawa Centre, for Galle and Matara planters.

One Regional Technical and Extension forum was conducted at Akuressa for the Matara District Small Holding Sector. Four presentations and open discussion were conducted successfully.

Field days, seminars, demonstration and awareness programmes.

Twenty-five programmes for plantation sector, small holding sector and students were conducted.

Exhibition

The Officer-in-Charge and the staff attended four crop clinics and one exhibition at Madamulana, organised by the Ministry of Plantation Industries, held on 9-10th July.

Crop Clinic

A crop clinic was held for small holders of the Hambantota District on the 9th and 10th July, with the participation of senior scientists from various disciplines and the Institute's Advisory staff. A large crowd of small holders attended, and knowledge, new techniques and findings were disseminated to the tea growers. The Prime Minister, the Hon. Mahinda Rajapaksha, the Minster of Plantation Industries, the Hon. Anura Priyadarshana Yapa, and the Deputy Minster of Plantation Industries, the Hon. Chamal Rajapaksha, were also present.

Model Nursery Pilot Project

In order to motivate the nursery owners and tea growers to raise a good quality plant in their nurseries, the Institute initiated a pilot project to establish a few

model nurseries in the region. In this project, about 20 enthusiastic, registered nursery owners were selected, and technical know-how, improved planting materials and some inputs were given.

Nursery performances were assessed at the appropriate intervals, and so far they have been found to be satisfactory.

Radio programmes.

Two news items were broadcast on Ruhunu Sevaya and Sirasa on extension activities.

Newspaper article
One news item appeared in the Divayina on nursery plants

Video shows

A series of video sessions were shown in the afternoons to small holders in the Morawakkorale area, with the assistance of the Kotapola MPCS, to enable them to participate more fully in activities.

5.4 Informal discussions

Thirty-five informal discussions were held with planters, 153 with small holders and 12 with students.

Telephone inquiries: 250
Informal contacts: 124

5.5 Meetings attended by the Advisory staff:

Internal meetings: 27
One Advisory Officers' meeting

Four E & E meetings

Twenty-two other meetings (Divisional, HOD, Review meetings, Preview meeting, Mother Bush meeting, etc.)

External meetings: 12

District Agriculture Committee, Regional Coordinating Committee, COP Survey, etc.

5.6 Soil analyses for pH: 249

5.7 Advisory publications distributed.

Free issues	2369
Priced publications	695

5.8 Distribution of planting materials (cuttings).

From the Deniyaya Centre	189,750
Brought from St Joachim Estate	190,000
Brought from St Coombs Estate	16,025

UVA ADVISORY AND EXTENSION CENTRE, PASSARA

Officer-in-Charge – J C K Rajasinghe

1 Advisory and Extension Activities

❖ Advisory letters issued	73
❖ Advisory visits to estates and smallholdings in Uva	73
❖ Seminars, field days and training programmes for estate personnel, small holders and school children	32
❖ Regional seminars held in collaboration with the Uva RSC	01
❖ Crop clinics	01
❖ Visitors to the Centre, including planters and small holders	231
❖ Soil samples tested for pH	08
❖ Soil samples tested for organic carbon content	Nil
❖ VP cuttings issued	154649
❖ Commercial nursery inspections	164

2 Hectarage as at 31st December 2005

Type of land use	ha
Mature tea in plucking	3.44
Mother bushes	1.15
Young tea (Experimental block)	0.30
ADB Clearings	2.06
Buildings and roads	0.50
Forest, scrub and grassland	6.85
Total extent	**14.30**

3 Crop

Green leaf sold

Month	Sold(kg)	Price(Rs/kg)	Income (Rs)
January	770	23.37	17994.90
February	1092	17.00	18564.00
March	3006	15.00	45090.00
April	3561	25.09	89345.49
May	3869	21.89	84692.41
June	4112	20.30	83473.60
July	2228	21.14	47099.92
August	1521	22.15	33690.15
September	1633	24.11	39371.63
October	3218	26.15	84150.70
November	2676	26.68	71395.68
December	2462	26.07	64184.34
Total	**30148**		**679052.82**

The total amount paid as transport charges was Rs 35,876.40
The net income realized from the sale of green leaf was Rs 643,176.42.

4 Income

Income from sale of VP cuttings	Rs 49,299.50
Income from green leaf	Rs 679,052.82
Soil Analysis charges	Rs 240.00
Sale of publications	Rs 13,725.00
Guest-house occupation charges	Rs 10,100.00
Other income	Rs
Total income	**Rs.752,417.32**

5 Check-Roll Workers (as at 31st December 2005)

No. of check-roll workers	21
Out-turn (women)	42.9%
Out-turn (men)	57.1%

6 Field Trials

Polyclonal and biclonal seedlings from Salawa, Kiriporuwa, Halpe, Reucastle and Rambukkanda Estates were planted at the Centre, by the Plant-Breeding Division, for the purpose of evaluating their performance under Uva conditions. The first cut was given to the plants.

Monitoring activities of the clonal observation trials UVP7, UVP8 and 2/VP37/ Uva are in progress.

Plucking weights from the seed variety evaluation trial plots, established at the Centre, are being recorded.

The seed varieties were evaluated for SHB infestation by the Entomology Division.

A drip-irrigation trial at Dammeria Estate is being monitored jointly with the Agronomy Division.

A field trial, initiated by SPND, on high potash is being monitored.

Infilling vacancies in the germplasm area was completed.

A root-depth study, initiated by the Plant Physiology Division, in a seedling-tea trial was completed.

Demonstration plots on shear- and hand-plucking, and different fertilizer mixtures (U 709, Uva 945 and T 1130), started in field No. 01 are in progress.

Phase III trial blocks were established in field No. 01, in order to carry out evaluation trials of TRI 5000 series cultivars.

7 Special Uva Problems

Further sulphur-deficiency problems were observed in company estates, such as Leangahawela, and in several small holder properties in the Haliela area.

ADVISORY AND EXTENSION CENTRE, KOTTAWA, TALGAMPOLA

Officer- in-Charge - K D Dahanayake

1 General

Renovation of Guest house, Staff quarters C1, C2 and D2 was done.

1.1 Mother Bush Project

Issued shoots from 1 ha of mother bush area

1.2 Special Assignments

Mr.K D Dahanayake shared the responsibilities of inspection of tea fields of Walahanduwa TRI in addition to his normal duties.

Mr.C.J.Liyanaarachchi was appointed as an Extension officer with effect from 01.09.2005.

2 Labour force

Number on check-roll	44	
Out turn	38	average

3 Land Use Information

VP tea mature (ha)	7.0
VP tea young - ADB (ha)	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 (ha)	1.5
Forestry (ha)	7.3
Buildings, gardens, roads	9.8
Total extent (ha)	**35.6**

4 Green leaf harvested - 2005

Month	Harvested Kg	Sold kg	Rate paid/kg Rs. Cts.	Total income Rs. Cts.
January	5343	5343	32.140	171724.02
February	3980	3980	30.159	120032.82
March	5 94	5194	31.511	163668.13
April	5051	5051	31.007	156616.36
May	4812	4812	30.330	145947.96
June	5503	5503	28.467	156653.90
July	3958	3958	28.375	112308.25
August	3836	3836	29.343	112559.75
September	3496	3496	31.257	109274.47
October	3397	3397	32.098	109036.91
November	4290	4290	31.836	136576.44
December	4264	4264	31.94 appr.	136192.00 approx.
	53124	53124		1495760.93 approx.

Total Rainfall - 2306.4 mm.
No. of Sunshine Hours - 2174.7

5 Income -

Income from sale of green leaf	- Rs.1495760.93 approx.
Income from sale of 73025 VP Cuttings	- Rs.21907.50
Income from sale of 2000 VP Plants	- Rs.15000.00
Income from sale of Publication	- Rs.37015.00
Income from Testing 448 Soil Samples for pH	- Rs. 13440.00
Miscellaneous income	- Rs. 17830.00
	Rs. 1600953.43 approx

6 Advisory & Extension Services - 2005

6.1. Advisory correspondences

248 Advisory correspondences were made by the Advisory and Extension staff for the year 2005.

6.2. Advisory and Extension Services

6.2.1 Routine Services

a) Advisory Visits

The total number of advisory visits made by the Advisory and Extension staff was Seventy Five (75), which includes routine visits to the estates and smallholdings.

Visited 552 small holders in Galle district for "Survey on reasonable price formula" and collected data by M/s K D Dahanayake and C J Liyanaarachchi.

b) Commercial nursery inspections

The advisory staff had not involved in commercial nursery inspections.

6.2.2 Training programmes

a) Seminars / Training Programs

There were 80 seminars and Training Programs / Field Days at Kottawa station and outside. The target groups were tea smallholders, green leaf suppliers and factory owners.

6.2.3 Video programmes

Thirty two (32) video shows were presented on plucking, land preparation, soil conservation of tea and pest and diseases of tea in and outside Kottawa station.

6.3. Visitors to the station

Hon. Plantation Minister visited the station three times for Tsunami relief work in February 2005

The number who visited the station personally seeking advice and collecting VP shoots.

6.3.1 Estate management and Smallholders	-	**962**
6.3.2 University/Diploma students and others	-	**278**

17 Advanced level students gained information and completed the project report.

6.4. Advisory and Extension programmes conducted

6.4.1 RSC activities

01 RSC Seminar was held at Wackwella Management Centre.

6.4.2 Awareness programmes for staff/workers and smallholders

Eight (08) awareness programmes were organized by the Advisory and Extension staff.

6.4.3 Informal discussions

Twelve (12) informal discussions were held in finding solutions for various problems such as labour shortage, pest/disease control which encountering in tea industry.

6.4.4 Meetings attended

Officers of this station 29 meetings including HOD, Advisory Officers' forums, Grade I-VI, E & E meetings, DDC meetings and Advisory and Research linkage meetings.

6.5. No. of soil samples tested for pH

448 Soil Samples were tested for pH Values

6.6. Advisory publications distributed

1443 nos. of Advisory and extension publications have been distributed.

6.7Adaptive demonstration trials

01 Observation Fertilizer Trial on VP/LC/880 Vs. U 709

6.8 Sale of Planting materials (Clonal Cuttings)

73025 nos. cuttings were distributed (TRI 449,4006, 3025,3055)

6.9 Experiments & Observations

01	Shear plucking observation block
02	4000 series observation block
03	100 plants Cinnamon in boundaries (Intercropping)
04	Growth performance of Gravellia – reported by Talawakelle & Ratnapura
05	Clonal Mother Bush Project - 3000 & 4000 clones
06	Seed Garden trial at field no: 07
07	Fertilizer demonstration trial at Field no: 04 (VP/LC 880 and U 709)

FOREIGN VISITORS TO THE TEA RESEARCH INSTITUTE OF SRI LANKA, HEAD OFFICE AT TALAWAKELLE

Name	Address
Robert Wilson	North Perrott, Crewkerne, Somerset TA1875X
Younal Ali	Bangladesh High Commission, Colombo
Faraj A Elwerfalli	Nasco, Libya
Kim Jung Woom	Korea, Seoul
Yoom Chang Yomg	Korea Jeonnam
Kim Kil Ja	Korea Jeonnam
Hj Wan Hussan Hj Zoohvi	Singapore
Mahamud Muzlan	Singapore
Dr A C Barbora	World Bank
Dina Umai Densinger	World Bank
Louise Robert	Canada
Tomas Saha	University, Tomas Bata, Zlin
Cuche Nathalie	Tea Magazine, France
Saad L Hafel	UNDP, USA
Karin Akernlom	Uppasa University, Sweden
Dennis G Norrie	CROXTON, 46, Albert Rd, Evesham, England WR11 4JZ
L B Basnet	Hotpa, Nepal
Bile F Rigvi	Unliver, Pakistan
Fuddy Price	48, Castle Bar Road, London
Janet Priu	48, Castle Bar Road, London
Lorena Flieizer	Australia
Yoshiaki Saito	Mitai Norin Co, Lcd, Japan
Wintrd Lamer	Frankfurt, Germany
Laurence Resne	F 44000, Nantes, France
Yakub Ali	Bangaladesh High Commissioner
Ayan Otter	Netherland
Kevin Gascoyne	Montreal, Canada
S Scherschel	Germany
Dr Kalyan Dias	O KD Institute of Social change, Assam, India.
Magaret Wilson	48.View Terrace, Aberdeen, Scotland
Clave l Wilson	19, Dunlin Crescent,Love bay, Aberdeen, Scotland
K Rajaculeswara	Germany
Neil Kroeger	Surrey, BC, Canada
Arnis Teteris	Riga-Latvla

Audrea-Nick Diprinzio	Australia
Tharanga Samarakoon	21 Moroak Street, Hawker, Canbera, Australia
Wan Hussain Zoohri	Singapore 458644
Mohomad Mazlan	Singapore 758346
Manji Martini	Australia
R S Senthil Kumar	UPASI, TRI, Koonoor
Trevor Somasunderam	The World Bank, Washington, USA
Ben Taylor	38, Gold Street, Brunswick, Australia
Prof Jayantha Chatterjee	Indian Dept. of Technology, Kanpur, India
Louise Roberge	885, Canada
R Jothinathan	Trichy, S.India
Thomas Saha	Crech Republic
Kuchi Nathali	Tea Magazine, Paris, France
Marshall Malone	Portsmouth Tea Company, U S A
Janaki Sivasooriyathevan	Switzerland
Naota Yamashiro	Okinawa Okinawa City, Takahora
Prinz Melmat	
Tamako Kohda	Okinawa, Japan
Federico Dodero	Italy
Malin Akerblom	International Science Programme, Upsala
Ranjit Bhamadas	Plant Station Melbourne, Australia
Peter Threnes	FA O U.N

LOW COUNTRY STATION, RATNAPURA

Dr D Kirtisinghe	Tea Association of Sri Lanka, Colombo
Dr D N Jayatissa	University of Peradeniya, Peradeniya
Dr N Pallewatte	University of Colombo, Colombo
Mr Anil Cook	
Dr D T Wettasinghe	
Dr D P Verma	India
Mr J A R U Waymonokaltanatas	Dept of Agri, Tailand
Dr A C Barbora	World Bank Expert
Mr R Sasidhar	UPASI, India
Mr G Ramamorthy	UPASI, India
Dr Venkatesa	UPASI, India
Mr Santhic Kumar	UPASI, India
Dr G Wadasinghe	Newzealand
Mr Helpe Bendle	Germany
Mrs M Mongiorgi	ADB, Manila
Mr O H Byung JO	Korea
Mr Lal Perera	Australia

Mr Sian Landis	Canada
Mr Lyno Mercier	Canada
Mr Mark Webba	Canada
Mrs Helen Foster	Canada

MID COUNTRY STATION, KANDY
Special Scientific Visitors

Dr. Rech Bahadur Basnet, Nepal
Mr Ramamoorthi, UPASI, India
Mr Senthikumar, UPASI, India
Mr Venkatesh, UPASI, India
Mr Peter Thomas, FAO/UN

METEOROLOGICAL OBSERVATIONS -2005
TRI - ST.COOMBS, TALAWAKELLE
(Lat. 6.54'N; Long. 80.42E; *1394amsl)

Month	Mean Temperature (^{0}C)				Relative Humidity		Wind Travelled (miles)	Sunshine hrs. (hours/day)	Evaporation (mm)	Rainfall (mm)	Wet days
	Ambient Air		Soil Temp. at 20cm								
	min.	max.	9.00 am	16.00 pm	9.00 am	16.00 pm					
January	13.4	25.5	21.0	22.4	94.5	89.2	1311.29	5.6	64.94	25.9	10
February	10.2	26.2	20.8	22.8	86.9	81.2	1866.98	8.6	123.36	89.25	5
March	10.7	27.2	21.6	23.3	93.0	90.8	1298.79	6.8	91.96	185.2	10
April	13.5	26.6	22.3	23.8	93.9	90.5	1203.97	5.5	78.37	96.2	17
May	14.5	26.6	23.1	24.4	95.5	92.8	971.26	6.4	73.70	89.45	11
June	16.1	22.2	21.8	22.6	97.5	94.8	1362.61	2.7	45.02	224	24
July	16.3	22.6	21.1	21.8	98.2	96.6	2387.21	2.9	35.20	224.3	28
August	14.6	24.6	27.3	22.9	96.0	96.8	1854.09	4.4	71.26	124.9	14
September	14.6	23.0	20.9	21.9	94.8	96.4	2358.72	4.1	48.30	184.3	20
October	14.6	24.6	21.5	22.5	95.1	96.8	1362.57	3.3	55.45	213.2	26
November	15.1	24.1	21.6	22.5	95.8	97.9	1016.04	3.5	51.76	306.7	24
December	15.9	24.4	20.8	22.4	94.1	95.0	1153.95	5.3	65.30	114.4	16
Total									**804.62**	**1877.71**	**205**
Average	14.1	24.8	22.0	22.8				4.9			

* Using the GPS

METEOROLOGICAL OBSERVATION - 2005
LOW COUNTRY STATION, RATNAPURA
(Lat 6° 41' N; Long, 80°E-40°E; 29 m amsl)

Month	Mean Temperature (C')		Relative Humidity %		Sun shine	Rainfall	Evaporation
	Ambient Air		9.00 hrs	16.00 (hrs	Mean	Total (mm)	(mm)
	Min	Max	am	pm)	h'day		
January	22.5	33.4	88	64	4.6	60.9	70.37
February	21.6	35.4	87	71	7.2	92.4	100.24
March	23.5	35.1	90	79	5.8	358.1	93.93
April	23.7	35.1	88	68	4.9	303.7	96.60
May	24.7	33.9	86	60	6.3	255.5	112.53
June	24.3	32.2	87	76	4.2	319	87.90
July	24.1	32.6	86	61	4.2	201.2	88.40
August	23.6	32.4	83	83	5.6	221.7	87.42
September	23.5	31.7	85	68	4.5	225.7	94.50
October	23.2	32.3	87	66	3.4	635.6	87.11
November	23.2	32.2	88	66	3.1	526.6	67.80
December	22.6	32.5	88	62	4.7	203.3	84.63
Total						3403.7	
Mean	23.4	33.2	87	67	4.9		

METEOROLOGICVAL OBSERVATION 2005
TRI, HANTANA. KANDY

(Elevation 762 m amsl)

Month	Mean Temperature (°C), 09.00 hr - 16.00 hr		Relative Humidity(%), 09.00 hr - 16.00 hr		Mean Sunshine (hrs/day)	Rain fall (mm)	No. of wet days	Cum. Evaporation (mm)
January	19.6	25.2	99.3	99.3	5.2	74.0	12	73.24
February	22.0	28.0	99	98.4	8.4	76.5	2	111.20
March	20.7	29.0	99.8	98.4	4.9	193.0	8	112.90
April	20.9	29.0	99.1	98.7	6.5	82.6	11	102.6
May	22.2	25.6	99	99.1	5.5	191.0	18	62.90
June	22.3	25.1	98.4	97.3	4.8	230.6	17	61.48
July	21.4	24.6	98.7	97.2	4.5	104.9	22	54.82
August	21.4	26.2	98.1	95.9	7.1	41.1	8	88.04
September	21.4	24.9	98	96.9	5.3	161.3	13	74.19
October	21.2	24.5	98.3	97.1	4.9	201.9	20	54.50
November	20.3	23.0	99.2	98.8	3.5	379.6	22	36.81
December	19.6	24.2	98.6	96.8	5.3	150.3	13	61.77

METEOROLOGICAL OBSERVATION - 2005
TRI DENIYAYA
(Lat 6^0 43' N; Long 80^0 E 33.3'; Elevation 250 m amsl)

Month	Mean Temperature		Soil at 30.CM		Rainfall	Wet	Total wind	Evaporation	Mean Sunshine
	min C	max C	9.00h	16.00h	(mm)	(days)	(km)	mm/day	(hours/day)
January	21.26	31.0	27.86	27.94	207.5	14	656	67.58	5.6
February	20.2	33.0	28.32	28.64	288.5	07	752	99.68	8.1
March	22.2	32.7	29.25	29.56	240.2	16	827	85.56	6.9
April	22.3	32.3	29.20	29.50	363.8	19	704	70.50	6.4
May	23.9	31.3	28.30	28.50	192.1	14	1240	55.18	7.5
June	24.3	30.2	28.30	28.50	185.0	16	2774	82.80	5.5
July	23.9	30.0	28.02	28.24	238.7	18	2677	NA	4.9
August	23.6	30.5	28.40	28.79	149.7	13	NA	107.88	7.5
September	23.2	29.1	28.04	28.21	175.7	16	NA	95.40	5.9
October	22.8	30.5	28.32	28.47	440.6	22	NA	73.16	5.2
November	NA	NA	*27.62	28.00	283.7	18	NA	NA	4.2
December	NA	NA	*26.40	27.03	343.8	14	NA	NA	6.6
Total					**3109.3**	**187**			
Mean	**22.85**	**31.05**	**28.17**	**28.45**					**6.2**

* Provisional Data

METEOROLOGICAL OBSERVATIONS, 2005
TRI, PASSARA

(Latitude 6°56'N, Longitude 81°07'E, Elevation 1120m amsl)

Month	Mean Temperature °C		Mean Relative Humidity		Mean Sun Shine hrs day $^{-1}$	Mean Wind Speed (km/h)	Total Rainfall (mm)	Total Evaporation (mm)
	Max Dry	Min Dry	9.00 am	4.00 pm				
January	23.6	14.8	92	93	3.4	3.64	199.3	75.25
February	26.55	14.39	83	82	7.5	2.87	57.2	89.81
March	27.0	15.8	83.4	80	6.3	3.7	156.1	103.63
April	26.65	17.36	87.7	89.6	5.41	0.90	279.6	66.33
May	27.5	17.5	84	87	5.9	0.8	120.3	64.93
June	28	24.2	81	83	6.3	2.02	255	81.7
July	27.3	17.5	83.4	81.4	4.4	1.43	74.5	73.42
August	26.7	18.2	81.2	78	5.2	0.8	27.2	91.56
September	24	18.6	84	83	3.7	1.47	135	92.5
October	24.1	18.2	89	87.3	2.3	1.37	361..6	58.00
November	23	17.8	91.3	91	2.16	2.7	369.5	46.46
December	22.4	16.3	91	90	3.2	6.24	93.5	57.14
Total							2028.8	900.73

METEOROLOGICAL OBSERVATIONS - 2005						
TRI - KOTTAWA						
	Mean Temperature		Sunshine Hrs	Rainfall	Wet Days	
	Maximum	Minimum		mm		
January	31.1	21.7	6.4	98.8	6	
February	32.2	22.0	6.8	120.2	5	
March	33.6	22.4	6.5	231.6	9	
April	32.6	22.4	6.2	308.4	8	
May	32.2	23.9	5.4	249.8	16	
June	30.9	24.1	4.9	141.4	15	
July	31.0	23.8	6.0	125.9	14	
August	31.1	23.3	7.4	80.5	7	
September	30.4	23.1	6.3	122.8	9	
October	30.8	23.3	3.7	498.5	18	
November	31.1	22.7	3.5	240.8	15	
December	30.8	21.6	7.0	87.7	4	
Total				2306.4	126	