ANNUAL REPORT - 2002

TEA RESEARCH INSTITUTE OF SRI LANKA

Cover Picture : Tea Nursery prepared for Soil Solarization (SS).
Inset: Sunshine Recorder used in SS experiments.

Stages of SS: 1. Untreated soil bagged and arranged on the ped (front, left)

2. A few bags of soil kept horizontally on the bed, in order to create a space in between the bed and the tarpaulin (back row - 2nd from right)

3. Tarpaulin (polythene sheet) is tucked under the soil to ensure airs - tight conditions (front, right).

TEA RESEARCH INSTITUTE OF SRI LANKA

ANNUAL REPORT FOR THE YEAR 2002

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REPORT OF THE CHAIRMAN
TEA RESEARCH BOARD

The Tea Research Board (TRB) was reconstituted following the change in government towards the end of last year and eight Board meetings were held during the year, commencing May 2002, including one special Board meeting. Immediately afterwards the TRB reconstituted its three consultative committees on research, estates and advisory services, and audit and management. In addition the grievance committee was also reconstituted. In reconstituting these committees, a departure from tradition was followed, by enlarging their membership, particularly in the committee on research, to enable representation by the diverse stakeholder groups within the tea industry.

Midway in the year a change in the management of the Tea Research Institute (TRI) took effect with the ending of the contractual period of service of its director and the subsequent appointment of a successor in early August. Within a month from his appointment the new director in his report to the TRB highlighted the various deficiencies that had bedevilled the TRI, chief among which being the communication gap that had existed between the TRI management and its staff in the various divisions including research, finance and administration. He also alluded to the low morale of the staff resulting from issues related to increments, promotions and filling of vacancies. Inability to fill the vacant position of Senior Accountant was deemed to have affected the smooth functioning of the TRI. Other areas that he considered of importance were the rolling over of the corporate plan of the TRI to accommodate a revised research agenda to meet the emerging challenges of the tea plantation and smallholder sectors; the need to broaden the genetic base of our tea cultivars through accession and incorporation of diverse tea germplasm in their development; development of drip irrigation and fertigation technology to mitigate the effects of drought which occur in increasing frequency and intensity due to climate change resulting from global warming; conducting research on energy saving in tea processing on a prioritized basis; minimizing the delays in issuing publications and advisory leaflets; having a TRI website; strengthening and upgrading TRI's advisory and extension services; strengthening of participatory/ partnership research with the tea plantation and smallholder sectors; and developing a strong administrative and financial management support base.

During the course of the year the major issues that engaged the attention of TRB were: development of a draft policy on tea cultivation and processing for submission to the Ministry of Plantation Industries; developing proposals for restructuring of TRI under the ADB funded Tea Development Project; improved worker welfare through consideration of profit share bonus payments; obtaining

permanency for lent workers from the TRI estates and payment of wages based on the collective agreement between the employers federation and plantation trade unions; review of TRI's new fertilizer recommendations and participatory research with tea plantations and smallholders; upgradation of TRI's corporate plan following interaction with representatives of the tea plantation and smallholder sectors; and participation of TRI scientists as resource personnel in local universities.

Other noteworthy activities include the participation of TRI in the Government's 100 day programme wherein the six projects planned were successfully completed. The projects were:

- Training of estate executives, field supervisors and field workers on the use of the innovated tea plucking and conveyance system for green leaf.
- Adoption of software for computer-based rolling programme developed by TRI in local tea factories.
- Publication of a book on Tea and Health.
- Production and distribution of 4 extension pamphlets for tea smallholders in Sinhala.
- Organizing in Sri Lanka the International Conference on Phasing-out of Methyl Bromide in Tea Plantations.
- Writing a manual on Cost of Tea Cultivation - from Nursery to the Field.

During the year under review TRI scientists were engaged in a number of donor funded projects as detailed below:

- Assessment of the Impacts and Adaptation to Climate Change (AIACC) with special reference to tea and coconut funded by UNDP through the Sri Lanka Association for the Advancement of Science.
- Phase-out of Methyl Bromide for Eradication of Tea Nematodes in Sri Lanka funded by UNDP.
- Biochemical Pest Control funded by SIDA/SAREC.
- Use of DNA markers for molecular characterization of tea funded by SAREC.

As in previous years human resources development received due attention. TRI staff participated in conferences, workshops and training programmes as detailed below:

Conferences:

- International conference on phase-out of methyl bromide in tea plantations held in Sri Lanka.
- International conference in GIS-Map 2002 in Thailand on GIS, remote sensing, GPS and photogrammatry.
- 14th IFOAM World Congress, Victoria, Canada.
- International conference on Asian Research Network for Organic Agriculture, Suwon, South Korea.

Workshops:

- Climate change vulnerability and adaptation in Trieste, Italy organized by the project on AIACC in multiple regions and sectors.
- Econometrics and environment, Dhaka, Bangladesh.
- Regional workshop on use of methyl bromide alternatives at Thailand.

Training programmes/courses:

- In Library Science at Indian Agricultural Research Institute.
- Biotechnology, plant breeding and soil technology at the International Agricultural Centre, Netherlands.
- Biological control of plant parasitic nematodes, at Government Science Centre, Queensland, Australia.
- Post-graduate diploma in chemistry and chemical engineering at Tokyo Institute of Technology funded by UNESCO and Government of Japan.
- Agricultural research for development at International Centre for development oriented research in Agriculture, Wageningen, Netherlands.
- Induced mutation breeding at the National Botanical Research Institute, Lucknow, India.
- Full-time residential course in tea plantation management, tea tasting and quality assurance at Kothari Agricultural Management Centre, India.
- 2nd FAO/IAEA Interregional training course on mutant germplasm characterization using molecular markers, Seibersdorf, Austria.

Dr S D I E Gunawardena
Chairman
Tea Research Board

REVIEW OF THE DIRECTOR TEA RESEARCH INSTITUTE

Corporate Plan and Cess Allocation

Scientists and extensionists continued to work in a transdisciplinary mind-set. The thrusts and projects listed under the Corporate Plan were revised to suit the allocation of funds and also the staff strength. In the meantime, the scientists had discussions with the stakeholders to obtain their views on new areas of research.

There had been an increase of the TRI's share of the cess from 25 to 30 per cent for the year under review. In spite of receiving about Rs 225 million, funds were not adequate for capital purchases. However, that the momentum, which was built up in our activities since we commenced operating our Corporate Plan (1999-2003) in July 1999, was maintained in 2002.

Achievements and Highlights

Major achievements in 2002 are given here in summary form. (The project notation used in the TRI Corporate Plan, 1999-2003, is given in parenthesis.)

Progress on activities identified under "Hundred days - Revolutionary Program"

Six activities were identified under the "Hundred days - Revolutionary Program" proposed by the new Government for implementation during the first 100 days of the year and were successfully completed. The progress on this activity could be summarized as follows:

- Popularizing innovated plucking and leaf conveyance system. The Institute staff trained about 900 staff members and 3000 workers on the use of new system.
- Introduction of the computer software developed to draw/select rolling programs in tea factories. This computer software was installed in about 150 tea factories. In factories, where there were no computers, based on information received appropriate rolling programs were drawn and posted.
- Publication of a book titled "Tea & Health"
- Publication of a manual titled "Cost of tea cultivation - from nursery to the field"

- Publication of extension pamphlets on topics such as nursery, harvesting, pruning and the TRI Selective Tea Harvester, in Sinhala for the benefit of the smallholders
- Organized an International Conference on phasing out of Methyl Bromide in tea plantations in April 2002.

Research Highlights:

Research highlights during the period under review could be summarized as follows:

- A simple device was fabricated to fill the nursery bags with soil.
- A power driven mechanical hand pruner capable of pruning 750-1000 bushes per day was innovated, tested and patented.
- A light weight folding plucking basket was designed and patented.
- Potential new shade tree species have been identified.
- Physiological studies using air enriched with CO_2 (550 ppm) had shown a yield improvement of 15% compared to control (360 ppm).
- Results from fertigation experiments have recorded a yield increase of higher than 100%, in Up country due to fertigation. Substantial yield increases were also recorded from other elevations due to fertigation.
- Construction of a tea genomic library to screen for Simple Sequence Repeat Polymorphism (SSRP) was completed. SSRP's are reliable molecular markers, which will help to characterize diverse tea cultivars and the characters thus identified could be used in plant breeding program.
- Many clones from TRI 3000 and 4000 series and seedling materials were selected for their resistance/tolerance to different pests and diseases.
- 1029 accessions were evaluated to identify potential cultivars and 92 accessions were found to be promising (based mainly on yield levels) in stage II trials.
- Metham sodium, soil solarization and soil substitutes were recommended as alternative to Methyl Bromide.
- Chemical control methods for nematode infested young-tea were recommended.
- *In vitro* screening of recommended fungicides against major root diseases and leaf disease (Blister Blight) was completed.

- Under the Second Small Holder Tea Development Project 57 ha had been planted, as Mother Bush areas.
- Based on experiments carried out variable speed drives for withering fans were recommended. Installation of such fans was proved to result in a saving of about 40% on electrical energy used in withering.
- A method was developed to classify leafy grades of tea.
- Experiments to study the effect of shear plucking on yield and quality of tea produced had shown no significant differences in yield in shear harvested field compared to manual harvested field. Quality of tea produced under both systems is comparable.

Awards and recognition:

- Project on "Conservation of Electrical Energy in Trough Withering" received the "Best energy related study for year 2002", awarded by Sri Lanka Energy Managers Association.
- Hand pruner designed was patented.
- St Coombs Factory managed by the Institute received ISO 9002 certification for tea processing.
- Contribution made by TRI towards organic tea production was acknowledged at the 15th World Organic Tea Celebrations.

Advisory and extension services:

- Staff carried out about 478 advisory visits to plantations and factories to advise on various aspects of tea cultivation and processing.
- Thousands of soil, root, leaf and fertilizer samples were tested for pH, carbon content, nutrient composition, starch content nematode infestation etc.
- 263 made tea samples were tested for moisture contents.
- 11 moisture meters from estates were calibrated.
- Videos on "Selective Tea Harvesting", "Weed Management" and "Shade Management" were prepared.
- Several skill development training programmes were conducted by the staff, for estate personnel, smallholders and factory staff.

Publications:

- A manual on "Cost of Tea Cultivation" was published.
- A book on "Tea and Health" was published
- Extension pamphlets on "Nursery Management". "Pruning", "Plucking" and "Selective Tea Harvester" in Sinhala for the benefit of the smallholders were published.
- A leaflet on "The Tea Leaf to the Cup" describing the unit operations in black tea processing was published.
- Altogether there were 57 papers published during the period under review.
- Two issues of TRI Update (Newsletter in English) and one issue of "Te Thathu" (Newsletter in Sinhala) were published.
- Six Advisory Circulars on following topics were published:
  - Guideline on land suitability classification
  - Protection of tea from blister blight
  - Protection of tea from red root disease
  - Control of nematodes in young tea
  - White grubs on tea lands and their control
  - The suitability of tea clones for the different regions

Other activities:

- Several meetings with senior executives of Regional Plantation Companies and one meeting with Tea Small Holding Development Authority were held with a view to assess the research needs of the stakeholders and to seek their opinion on ways and means of improving the contribution of the TRI towards achieving the stakeholder expectations
- Two draft concept papers with a view to preparing policy documents on tea cultivation and tea processing were prepared.
- A brain storming session on quality of tea produced was organized.

Dr S S B D G Jayawardene
Director

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 into 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 & 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

1.	Dr. S D I E Gunawardena	-	Chairman, TRB	
2.	Dr. W W D Modder	-	Director, TRI	(Until 9th June 2002)
3.	Dr. S S B D G Jayawardena	-	Director, TRI	(w.e.f. August 2002)
4.	Mr. Y G Wijeratne	-	Member	(w.e.f. May 2002)
5.	Mr. C. Ratwatte	-	Member	(w.e.f. May 2002)
6.	Prof. H P M Gunasena	-	Member	(w.e.f. May 2002)
7.	Mr. H. Malin Goonetilleke	-	Member	(w.e.f. May 2002)
8.	Dr. (Ms) Damitha de Zoysa	-	Member	(w.e.f. May 2002)
9.	Mr. K M Opananda	-	Member	(w.e.f. May 2002)
10.	Mr. R Weerakoon	-	Member	(w.e.f. May 2002)
11.	Mr. K P Govindaraj	-	Member	(w.e.f. May 2002)
12.	Mr. M Sunderalingam	-	Member	(w.e.f. May 2002)
13.	Mr. M L M Aboosally	-	Member	(w.e.f. Nov 2002)
	Mr. C C Mawilmada	-	Convenor/Secretary	(up to October 2002)
	Dr. (Mrs.) A C Liyanage	-	Convenor/Secretary	(w.e.f. December 2002)

1.5 Members of the Consultative Committee on Estate and Advisory Services

1.	Mr. D V Seevaratnam	-	Chairman
2.	Dr. S D I E Gunawardena		
3.	Dr. S S B D G Jayawardena		
4.	Mr. Asoka Somaratne		
5.	Mr. Y Ratnayake		
6.	Mr. N Bopearachchi		
7.	Dr. M T Ziyad Mohamed		
8.	Mr. C C Mawilmada		
9.	Mr. M F Y Arafath	-	Observer
	Mr. B A D Samansiri	-	Convenor/Secretary

1.6 Members of the Consultative Committee on Research

1.	Dr. S D I E Gunawardena	-	Chairman
2.	Dr. S S B D G Jayawardena		
3.	Prof. Y D A Senanayake		
4.	Dr. D Kirtisinghe		
5.	Dr. D T Wettasinghe		
6.	Mr. Camillus Silva		
7.	Mr. N F G P Athukorale		
8.	Mr. R K Nathaniel		
9.	Mr. K G B Obeyasekera		
10.	Mr. Deepal Chandrasekera	-	(w.e.f. November 2002)

11. Mr. Anil Perera	-	(w.e.f. November 2002)
12. Mr. Romesh Croos-Moraes	-	(w.e.f. November 2002)
13. Mr. D V Seevaratnam	-	(w.e.f. November 2002)
14. Mr. S K L Obeyasekera	-	(w.e.f. November 2002)
15. Mr. G K Seneviratne	-	(w.e.f. November 2002)
16. Mr. U Gunasinghe	-	(w.e.f. November 2002)
17. Mr. R.W. Harley	-	(w.e.f. November 2002)
18. Mr. S Wickremasinghe	-	(w.e.f. November 2002)
Dr. M T Ziyad Mohamed	-	Convenor/Secretary

1.7 Members of the Audit & Management Committee

1. Dr. (Ms.) Damitha de Zoysa
2. Mr. Y G Wijeratne
3. K M Opananda
4. Mr. R Kariyawasam

Mr. M F Y Arafath, - Convenor/Secretary

1.8 Senior Management Staff as at 31st December 2002

1. Director	-	Dr. S S B D G Jayawardena
2. Deputy Director Research (Technology)	-	Dr. M T Ziyad Mohamed
3. Deputy Director (Administration)	-	Mr. C C Mawilmada

1.9 Executive Staff (Grade I & II) as at 31st December, 2002.

Administration Division

Mr. C C Mawilmada	-	Deput Director (Administration)
Ms. S Anusha	-	Administrative Officer
Mr. K G Piyasena	-	Public Relations Officer

Finance Division

Mr. M F Y Arafath	-	Accountant/Actg Senior Accountant

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

Publication Unit

Vacant	-	Publication/Publicity Officer

Advisory & Extension Services Division

Mr. S Wimaladharma	-	Head, Advisory & Extension Service (on contract)
Mr. B A D Sanmansiri	-	Actg Officer-in-Charge/Advisory Officer
Mr. V S Sidhakaran	-	Advisory Officer

Agronomy Division

Ms. M S D L de Silva	-	Research Officer (On overseas study leave)

Agricultural Economics Unit

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

Biochemistry Division

Dr. A M T Amarakoon	-	Acting Head/Senior Research Officer
Dr. I S B Abeysinghe	-	Senior Research Officer
Dr. (Ms.) A C Liyanage	-	Senior Research Officer
Mr. P A N Punyasiri	-	Research Officer
Ms. J Jayasundera	-	Research Officer

Entomology/Nematology Division

Ms. S I Vitharana	-	Actg. Head /Senior Research Officer
Dr. M M Keerthi	-	Senior Research Officer
Mr. R S Walgama	-	Research Assistant

Plant Physiology Division

Dr. A Anandacoomaraswamy	-	Actg. Head/Senior Research Officer
Dr.(Ms.) A J Mohotti	-	Senior Research Officer

Plant Pathology Division

Dr. A Balasooriya	-	Actg. Head/Senior Research Officer
Ms. N H L Pradeepa	-	Research Assistant (on overseas study study leave)
Ms. B A P Cooray	-	Research Assistant

Plant Propagation & Breeding Division

Mr. V Shanmugarajah	-	Actg. Officer-in-Charge/Senior Research Officer
Dr.(Ms.) M T K Amarakoon	-	Senior Research Officer
Mr. M Ratnayake	-	Research Officer
Mr. M A B Ranatunga	-	Research Assistant

Soils & Plant Nutrition Division

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

Technology Division

Mr. K Raveedran	-	Chemical Engineer
Mr. W S Botheju	-	Research Officer
Mr. S Koneswaramoorthy	-	Mechanical Engineer

TRI Sub-Station, Deniyaya

Mr. J A S K V Jayasinghe	-	Actg. Officer-in-Charge/Advisory Officer

TRI Low Country Station, Ratnapura

Ms. S I Vitharana	- Officer-in-Charge/Senior Research Officer
Dr. M A Wijeratne	- 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 Amaratunghe	- Advisory Officer

TRI Sub-Station, Hantane

Mr. P B Ekanayake	- Officer-in-Charge/Senior Research Officer
Mr. S T Yatawatta	- Advisory Officer
Ms. R M D T Pallemulla	- Research Officer

TRI Sub-Station, Kottawa

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

TRI Sub-Station, Passara

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

1.10 Other Administrative, Scientific, Research & Advisory Staff - Grades III-V as at 31st December 2002

Administration Division

Ms. S Jayasingham	- Secretary to the Director
Ms. S Shanmuganathan	- Stenographer/Typist (English)
Mr. B Tilakeratne	- Purchasing Officer
Ms. Devika Ratnayake	- Stenographer/Typist (English)
Ms. D H Kalikotuwa	- Stenographer/Typist (English)
Ms. A P V Kalyani	- Stenographer/Typist (English)
Ms. C S K Kiribathgoda	- Stenographer/Typist (English)
Mr. M L H Perera	- Transport Officer
Mr. P D S L De Silva	- Clerk/Typist
Mr. R Nadarajah	- Clerk/Typist
Mr. K R M Priyantha	- Clerk/Typist

Ms. R Jayasinghe	- Clerk/Typist
Ms. R Wanasinghe	- Clerk/Typist
Ms. Chandrika Jeyaram	- Clerk/Typist
Mr. S H Chandrasena	- Clerk/Typist
Mr. P T Perera	- Clerk/Typist
Mr. G G E H Gamage	- Chief Motor Mechanic
Mr. U A Wickramasinghe	- Electrical Foreman
Mr. J M R K Bandara	- Electrician
Mr. R W Rengasamy	- Electrician
Mr. K M Seneviratne Banda	- Telephone Operator
Ms. P K N Damayanthi	- Telephone Operator
Mr. S Karuppiah	- Telephone Linesman
Mr. D V D Vithanage	- Clerk of Works
Mr. W P A N Jayasinghe	- General Clerk
Mr. V Shanmuganathan	- Clerk/typist (on 'No Pay' overseas leave)
Mr. C J B Abeykoon	- Works Supervisor
Mr. W C K Fernando	- Chief Plumber Mechanic
Mr. J G Gamage	- Filter Plant Assistant
Mr. S N W M Premaratne	- Tinker/Welder

Finance Division

Mr. K D H Pathirana	- Chief Store Keeper
Mr. S G Punchibanda	- Accounting Assistant
Mr. C B Koswatte	- Accounting Assistant
Ms. D M R Dissanayake	- Accounting Assistant
Mr. B G D Premadasa	- Clerk/Typist
Ms. N Saparamadu	- Stenographer/Typist (English)
Ms. V Pahalage	- Accounts Clerk
Ms. G A S Gunasekera	- Accounts Clerk
Ms. W G Piyaseeli	- Accounts Clerk
Mr. Saman Hewasiliyan	- Accounts Clerk
Mr. K T U Kulatunga	- Asst. Store Keeper
Mr. W A Nishantha	- Data Entry Operator
Ms. R Godage	- Clerk/Typist
Mr. H P W Gunasekera	- Stores Assistant
Mr. H B Talgahagoda	- Cashier/Cum Accounts Clerk
Ms. A P Amaratunga	- Accounts Clerk
Ms. P V D Chandrakanthi	- Accounts Clerk
Mr. W G Weeratillake	- Cashier

Internal Audit Unit

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

Library

Ms. R W M S K Amunugama - Library Assistant

Advisory & Extension Services Division

Mr. L A M R C Liyanarachchi	- Extension Officer
Mr. M J A S Fernando	- Extension Officer
Ms. M A H Nishanthi	- Extension Officer
Ms. I. Jayawickrema	- Clerk/Typist
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 Amarasekera	- Experimental Officer
Mr. U P Abeysekera	- Experimental Officer

Agricultural Economics Unit

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

Biochemistry Division

Mr. M D L P Gunatilaka	- Experimental Officer (On overseas study leave)
Mr. K M Mewan	- Experimental Officer (Study leave)
Mr. G A A R Perera	- Experimental Officer
Ms. J M D Abeysinghe	- Technical assistant
Ms. A D M Damayanthi	- Technical Assistant
Ms. R W T Dharshaini	- Technical Assistant
Mr. P K P Muthukumarana	- Technical Assistant
Mr. M W Silva	- Skilled Mechanic

Entomology/Nematology Division

Mr. D D Liyanage	- Experimental Officer
Mr. N Nawaratne	- Experimental Officer
Ms. P V A R Abeysekera	- Experimental Officer
Ms. R D P Dharmalatha	- Experimental Officer
Mr. G P Udumulla	- Experimental Officer
Ms. S S C J De Seram	- Technical Assistant
Mr. P G C Priyantha	- Technical Assistant

Plant Physiology Division

Ms. V Sidhakaran	- Experimental Officer
Ms. D M S Navaratne	- Experimental Officer
Mr. H P Baddage	- Technical Assistant

Plant Pathology Division

Mr. J W K Jayasundera	- Experimental Officer
Mr. R M A Ratnayake	- Experimental Officer
Ms. W G N Udayangani	- Technical Assistant
Mr. E M C S Edirisinghe	- Technical Assistant

Plant Propagation & Plant Breeding Division

Mr. R Paskaradevan	- Experimental Officer
Mr. B A Rathnagoda	- Technical Assistant
Mr. A K Mudalige	- Technical Assistant
Mr. J D Kottawa Arachchige	- Technical Assistant

Soils & Plant Nutrition Division

Mr. R G A Wijayawardana	- Experimental Officer
Mr. S M Dissanayake	- Experimental Officer
Mr. H A P Warnasiri	- Experimental Officer (on 'No Pay' leave)
Mr. T C N Peiris	- Technical Assistant
Mr. O G K A Gunaratne	- Technical Assistant
Mr. D H B N Dissanayake	- Technical Assistant

Technology Division

Ms. S H P Waduge	- Experimental Officer
Mr. D L D H Dahanayake	- Experimental Officer
Mr. L Jayasinghe	- Technical Assistant
Mr. A M M V Abeykoon	- Technical Assistant
Mr. U D Alagiyawadu	- Technical Assistant

Mechanical Workshop

Mr. A Nandasiri	- Workshop Mechanic

TRI Sub-Station, Deniyaya

Mr. K K P Katulanda	- Extension Officer
Mr. O W Jayawardana	- Station Assistant

TRI Low-Country Station, Ratnapura

Mr. H S N Peiris	- Experimental Officer
Mr. E R Perera	- Experimental Officer
Mr. P D Upali	- Experimental Officer
Mr. W M U A B Marapana	- Experimental Officer
Mr. D S E Weerasooriya	- Chief Clerk
Mr. A K Prematunga	- Experimental Officer
Mr. D W Vithana	- Experimental Officer
Mr. A G Gamage	- Experimental Officer
Mr. K G J P Mahindapala	- Extension Officer
Mr. D G N Mahinda	- Extension Officer
Mr. A K M Jayasena	- Technical Assistant
Mr. K A D Mervin	- Accounting Assistant
Ms. P V G Karunanayake	- Stenographer/Typist (English)
Mr. K A S Kumarapperuma	- Clerk/Typist
Mr. H K Seetha	- Accounts Clerk
Mr. J S K de Silva	- Electrician
Ms. B S N Vithana	- Experimental Officer
Mr. K Gunawardena	- Work Supervisor
Mr. J H N Piyasundera	- Experimental officer
Ms. E W D P Prematunga	- Experimental Officer
Mrs. P I Jayawardena	- Telephone Operator/Receptionist
Mr. M A B De Silva	- General Mechanic
Mr. M A Chamindra	- Technical Assistant
Mr. M M Jayatillake	- Technical Assistant

TRI Mid-Country Station, Hantana

Mr. H J M de Silva	- Extension Officer
Mr. T M Sarathchandra	- Experimental Officer
Mr. K R W B Kahandawa	- Extension Officer
Mr. A P D A Jayasekera	- Experimental Officer
Mr. U B Herath	- Experimental Officer
Ms. B Sureshkumar	- Experimental Officer
Mr. Saman Wijetunga	- Experimental Officer
Mr. A H M L S Abeysinghe	- Experimental Officer
Ms. U Sridaran	- Experimental Officer
Ms. S N Wijesekera	- Experimental Officer
Ms. K Sarathchandra	- Experimental Officer
Mr. H Jayaweera	- Experimental Officer
Mr. K R W B Kahandawa	- Extension Officer
Ms. K M N K Ratnamalala	- Experimental Officer
Ms. P L K Tennekoon	- Experimental Officer
Ms. C N K Edirisinghe	- Station Assistant
Ms. B K S Herath	- Accounts Clerk
Ms. W R P de Silva	- Clerk/Typist
Mr. K Palathantirige	- Works Supervisor
Mr. C.S.K. Ratnayake	- Experimental Officer
Ms. P Marapana	- Stenographer/Typist (English)

TRI Sub-Station, Kottawa

Mr. P K Jayawickrama	- Experimental Officer
Mr. E K Somapala	- Station Assistant
Mr. S P Ratnayake	- Extension Officer

TRI Sub-Station, Passara

Mr. R M A C Rajakaruna	- Extension Officer
Mr. R Nandasena	- Station Assistant

Walahanduwa Laboratory Complex

Mr. M A Wijedasa	- Experimental Officer
Mr. W T B Priyantha	- Experimental Officer
Mr. J R Y Abeywardana	- Technical Assistant

Estate

Mr. S G Ekanayake	- Superintendent (St.Coombs)
Mr. M S E Perera	- Superintendent (St. Joachim)

1.11 Retirements during the year

(a) Mr. S Wimaladharma, Head, Advisory & Extension Services, retired after 36 years of service on 15/01/2002.

(b) Mr. M Bowatte, Accountant, retired after 33 years of service on 09/04/2002.

(c) Mr. P B Chandradasa, Technical Assistant, retired after 37 years of service on 7/05/2002.

(d) Mr. D A Sirisena, Carpenter, retired after 22 years of service on 21/08/2002.

(e) Dr. W W D Modder, Director, contractual period expired on 09/06/ 2002.

(f) Mr. S N A Devadas, Carpenter, retired after 21 years on 05/10/ 2002

1.12 Resignations during the year

(a) Mr. D H Jayatillake, Clerk/Typist, resigned on 12/08/2002.

1.13 Staff Recruitments

Dr. S.S.B.D.G. Jayawardena, Director & Mr. S Wimaladharma, Head, Advisory & Extension Services were recruited on contractual basis during the year.

1.14 Officers Issued with vacation of post letters

Two officers were issued with vacation of post letters.

1.15 Overseas Training/Seminars/Conferences etc.

(a) Mr V Sidhakaran, Advisory Officer, Advisory & Extension Division, followed a professional training course in inter disciplinary team research in agriculture from 14.01.2002 to 25.07.2002 at International Centre for Development, Wageningen, The Netherlands.

(b) Mr G P Udumulla, Experimental Officer, Entomology Division, followed a training course on Integrated Pest Management Techniques applicable to managing nematode problems in cultivated crop from 06-02-2002 to 06-03-2002 at the Institute de Nematologia, Bari, Italy, under the Methyl Bromide Project.

(c) Dr A Anandacumaraswamy, Senior Research Officer, Agronomy Division, attended the meeting on "Assessment of Impact and Adaptation to Climate Change Project Implementation" from 11-02-2002 to 15-02-2002 at the United Nations Environment Program Headquarters in Nairobi, Kenya.

(d) Mr T M Sarathchandra, Experimental Officer, Plant Breeding Division, was awarded a fellowship for training on Techniques of Polyploidy induction Mutation from 15-04-2002 to 15-07-2002 at the National Botanical Research Institute, Lucknow, India.

(e) Dr (Ms.) M T K Gunasekara, Senior Research Officer, Plant Breeding Division followed a training course on Biotechnology, Plant Breeding and Seed Technology, from 29-04-2002 to 05-07-2002 at the International Agricultural Centre, the Netherlands under the Netherlands Fellowship Programme.

(f) Dr M A Wijeratne, Senior Research Officer, Agronomy Division and Mrs. J. A. A. M. Jayakody, Senior Research Officer, Agricultural Economics Unit participated in a workshop on Climate Change Vulnarability & Adaptation workshop from 03-06-2002 to 14-06-2002 at A.I.C.C.C. In Trieste, Italy.

(g) Mrs. W Illangantilake, Librarian, followed a short-term training in Library Science from 03-06-2002 to 15-06-2002 at the Indian Agricultural Research Institute, New Delhi, India, under the M.O.A, between ICAR & CARP.

(h) Mr N Navaratne, Experimental Officer, Nematology Division, followed a training in the field of Biological Control of Plant Parasitic Nematodes from 17.06.2002 to 14.07.2002 at the Queensland Government Science Centre, Qureensland, Australia.

1.16. Maintenance Divisions:

The Engineering Division carried out the following activities.

- Annual program for Internal colour washing of TRI quarters.
- 100 day Accelerated Programme from 1st January 2002.
- Preparation of plans, Bill of Quantities, tender documents etc. for building construction work
- Renovation of 14 line rooms and staff quarters at Kottawa Station Work being in progress.
- Completed Stage I of (240 m length) of new road construction (access road to village) at Deniyaya Station, while improvement of internal roads is in progress.
- Renovation work at the Laboratory, Hostel and Staff quarters at Walahanduwa
- Partial completion of renovation work at the filtering plant. With the replacement of the filter media, the filtering process functions properly now.
- About 274 major repairs and new jobs were undertaken.
- Purchases included 2 Centric PM/200/3 pumps and essential spares, tools including 2 Box spanner sets, one wood working machine and 13 replacement gas cookers

The Electrical Division carried out the following:

- Head Office in Talawakelle: About 372 jobs in the laboratories and bungalows.
- Deniyaya Station: Wiring repair work, streetlights and over-head line.
- Kottawa Station: Reconstruction work was completed with 3-phase over-head line and fixed the air conditioners to the office building.
- Hantane Station: Rewired the ARP - C 1 quarters, wiring and installation of Plant Breeding Unit.
- Walahanduwa: Rewired the stores of the Soils and Plant Nutrition Division laboratory.

REPORT OF THE FINANCIAL DIVISION

TEA RESEARCH BOARD

BALANCE SHEET AS AT 31ST DECEMBER - 2002

2001 Rs.			Tea Research Institute 2002 Rs. Cts.	St. Coombs Estate 2002 Rs. Cts.	St. Joachim Estate 2002 Rs. Cts.	Total 2002 Rs. Cts.
	FIXED ASSETS					
464,598,859	Property, Plant, Equipment etc.	(Anx. I)	509,766,346.20	–	–	509,766,346.20
(242,663,672)	Less: Accumulated Depreciation	(Anx. I)	(286,498,010.72)	–	–	(286,498,010.72)
221,935,187			223,268,335.48	–	–	223,268,335.48
24,826,995	Capital Work in Progress	(Anx. II)	54,534,102.27	741,647.80	–	55,275,750.07
246,762,182			277,802,437.75	741,647.80		278,544,085.55
15,550	Other Assets-Patents		15,550.00	–	–	15,550.00
246,777,732			277,817,987.75			278,559,635.55
	CURRENT ASSETS					
10,189,976	Stocks	(Anx. III)	8,588,934.64	1,249,390.22	1,937,840.98	11,776,165.84
198,401,053	Debtors and Other Debit Balances	(Anx. IV)	75,119,910.14	6,301,832.69	1,774,354.11	83,196,096.94
36,633,703	Deposits, Pre-Payments & Purchase Advances	(Anx. V)	31,348,789.22	454,425.43	1,025,062.77	32,828,277.42
23,449,094	Loans and Advances to Staff & Employees	(Anx. VI)	22,431,730.66	3,502,891.41	1,203,862.52	27,138,484.59
62,994,016	Short Term Investments - 7 day Call Deposits	(Anx. VII)	116,000,000.00			116,000,000.00
5,231,745	Cash and Bank Balances	(Anx. VIII)	40,404,903.00	233,035.24	24,050.19	40,661,988.43
336,899,586			293,894,267.66	11,741,574.99	5,965,170.57	314,601,013.22
500,558	Identified Lossess	(Anx. IX)	500,557.87	–	–	500,557.87
281,889	Excess & shortages	(Anx. X)	300,511.28	–	–	300,511.28
337,682,034			294,695,336.81	11,741,574.99	5,965,170.57	312.402,082.37
	CURRENT LIABILITIES					
(36,783,240)	Creditors and Provisions	(Anx. XI)	(28,467,530.68)	(6,725,525.55)	(11,603,388.60)	(46,796,444.83)
300,898,793	Net Current Assets		266,227,806.13	5,016,049.44	(5,638,218.03)	265,605,637.54
547,676,525	**TOTAL ASSETS LESS CURRENT LIABILITIES**		544,045,793.88	5,757,697.24	(5,638,218.03)	544,165,273.09
	REPRESENTED BY					
59,683,060	Grants and Reserves	(Anx.XII)	89,984,590.53	–	–	89,984,590.53
452,705,232	Tea Research Fund		419,092,529.15	–	–	419,092,529.15
–	A/C Current St. Coombs Estate		6,855,064.39	(6,855,064.39)	–	–
–	A/C Current St. Joachim Estate		10,626,687.31	–	(10,626,687.31)	–
754,670	Long Term Liabilities - Land Reform Commission					
34,521,763	Provision for Gratuity	(Anx. XIII)	17,473,672.50	12,612,761.63	4,988,469.28	35,074,903.41
11,800	Petrol Deposit Refundable	(Anx. XIV)	13,250.00	–	–	13,250.00
547,676,525			544,045,793.88	5,757,697.24	(5,638,218.03)	544,165,273.09

Accountant - T.R.I.

Director - T.R.I.

Chairman - T.R.B.

TEA RESEARCH BOARD
OPERATING ACCOUNT FOR THE PERIOD 1ST JANUARY TO 31ST DECEMBER - 2002

2001 Rs.				2002 Rs. Cts.
		INCOME		
256,799,008	1	Cess	(Note 1)	230,242,023.75
5,790,694	2	Income from Other Commercial Activities	(Annx. XV)	5,093,316.64
8,179,867	3	Interest on Investments		5,802,045.46
3,403,609	4	Miscellaneous	(Annx. XV)	4,085,266.59
				245,222,652.44
(970,581)	5	Estate Profits/(Loss) - St.Coombs Estate	(Annx. XVIII)	(4,362,172.05)
(1,096,536)		- St. Joachim Estate	(Annx. XIX)	(3,200,384.90)
272,106,061		Total Income		237,660,095.49

				Administration Finance and Common Service		Advisory, Extensions & Publicity		Research		Total	
		EXPENDITURE		Rs.	Cts.	Rs.	Cts.	Rs.	Cts.	Rs.	Cts.
65,314,507	01	Personnel Emoluments		23,811,483.68		12,494,994.45		27,147,615.75		63,454,093.88	
4,680,844	02	Travelling		1,606,332.73		1,233,688.90		1,752,322.42		4,582,344.05	
14,730,245	03	Supplies and Requisites		4,565,846.35		4,778,127.48		12,171,911.26		21,515,885.09	
18,257,805	04	Repairs and Maintenance of Capital Assets		16,006,484.54		7,480,916.98		2,224,249.74		25,711,651.26	
31,802,170	04	Depreciation of Fixed Assets		8,635,479.01		6,596,802.04		24,005,220.26		39,237,501.31	
33,894,020	05	Transportation, Communication, Utility and Other Service		23,633,413.76		13,464,257.78		526,442.12		37,624,113.66	
2,383,021	07	Contributions, Grants and Subsidies		2,125,299.36		202,548.38		203,039.30		2,530,887.04	
6,724,656	08	Pensions and Retirement Benefits		2,069,384.10		1,129,217.76		2,753,028.06		5,951,629.92	
2,753,396	08	Gratuity Provision		1,972,306.00		–		–		1,972,306.00	
768,273	10	Media, Advertising, Publicity and Gifts		209,759.74		841,232.54		13,435.00		1,064,427.28	
5,398,878	11	Cultivation and Field Trials		–		4,726,816.57		3,790,004.92		8,516,821.49	
5,638,168	12	Miscellaneous	(Annx. XVI)	1,050,523.31		175,396.58		4,507,246.77		5,733,166.66	
192,345,983		**Total Expenditure**		85,686,312.58		53,113,999.46		79,094,515.60		217,894,827.64	
79,760,078		**Operating Surplus for the year 2002**								**19,765,267.85**	
–		Less: Tax Payments								(931,066.55)	
79,760,078		Surplus after the Tax Payments								18,834,201.30	
–		Less: Prior years Adjustments	(Annx. XVII)							(52,446,903.96)	
79,760,078		**Operating Surplus/Defficit) transferred to Tea Research Fund**								**(33,612,702.66)**	

Note : 1. Tea Cess receivable as at 31st December 2002 - Rs. 28,368,882.89

TEA RESEARCH BOARD
CASH FLOW STATEMENT 2002

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

	Year ended 31st December			
	2002		2001	
Cash flows from Operating Activities	**Rs.**	**Rs.**	**Rs.**	**Rs.**
Surplus/(Deficit) for the year excluding interest on investments		**13,032,156**		**71,580,210**
Adjustment for items not involving movement of cash:				
Depreciation	43,835,318		35,689,452	
Provision for Gratuity	553,140		2,678,217	
	44,388,458		38,367,669	
Less: Income from sale of fixed assets	(19,274)	44,369,184	(161,600)	38,206,069
		57,401,340		109,786,279
Adjustment for items not involving movement of cash:				
Less: Prior period items - Cess Adjustment		(52,446,904)		–
Operating surplus before changes in items of working capital		**4,954,436**		**109,786,279**
Changes in items of working capital				
Stocks - (Increase)/Decrease	(1,586,190)	82,735,823	276,410	
Debtors and other balances - (increase)/Decrease	115,665,230		(72,986,479)	
Deposits, Prepayments and purchase advances - (Increase)/Decrease	3,805,426		3,301,212	
Loans and advances to Staff & Employees - (increase)/Decrease	(3,689,392)		(3,188,326)	
Other Current Assets - (Increase) / Decrease	–		(5,250)	
Excesses and shortages - (Increase)/Decrease	(18,622)		(229,552)	
Creditors and provisions - (Decrease)/Increase	9,259,985	123,436,437	(3,272,782)	(76,104,767)
Cash generated from operating activities		**128,390,873**		**33,681,512**

Cash generated from operating activities C/F		**128,390,873**		**33,681,512**
Cash Flows from Investing Activities				
Interest on investments	5,341,771		7,219,283	
Purchase of fixed assets	(45,168,471)		(47,922,165)	
Proceeds from sale of fixed assets	19,278		161,600	
(Increase)/Decrease in capital work-in-progress	(30,448,755)		(11,229,121)	
Cash used in investing activities		**(70,256,177)**		**(51,770,403)**
Cash Flows from Financing Activities				
Grants received from :				
NRC	348,784		279,731	
ADB	29,623,469		6,066,961	
Uppsala University	329,278		273,180	
Cash generated from financing activites		**30,301,531**		**6,619,872**
Net Increase/(Decrease) in cash and cash equivalents		**88,436,227**		**(11,469,019)**
Cash and cash equivalents at beginning of the year		68,225,761		79,694,780
Cash and cash equivalents at end of the year (Note)		**156,661,988**		**(68,225,761)**
Note: Head Office				
Short Term Investments - 7 Day Call Deposits		116,000,000		62,994,016
Bank of Ceylon Corporate Branch		35,266,176		2,186,044
Bank of Ceylon - Talawakelle		1,614,347		2,270,709
Bank of Ceylon - Talawakelle ADB		2,267,985		1,250
Bank of Ceylon - Deniyaya		5,642		5,960
Petty Cash Imprest		1,241,793		657,426
Stamp Imprest		8,960		26,561
St. Joachim Estate				
Cash In Hand		6,911		11,098
Cah at Bank		17,013		69,599
Stamps		126		10
St. Coombs Estate				
Cash in Hand		28,663		1,456
Cash at Bank		204,216		1,532
Stamps		156		100
		156,661,988		68,225,761

AGRONOMY DIVISION

Research activities

1. Thrust: A9-A11 Development of an economically viable system to eliminate /reduce soil rehabilitation period prior to replanting in the up-country, mid-country and low country

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

The system tested are (1) soil organic carbon enrichment by incorporating coir dust, refuse tea and compost (2) insitu soil rehabilitation (3) growing of economic crop such as cow pea, 'tur-dhal', green gram, and citronella and sweet corn in-between rows of the replanted tea and (4) growing *Flemingia congesta*. The above systems were compared with traditional soil rehabilitation with mana for two years. There are six experiments located at up, mid and low elevations. In all the trials, none of the alternate systems matched the traditional soil rehabilitation in terms of establishment, growth and yield of tea. In some trials, benefits of soil reconditioning was seen in the second cycle as well.

2. Thrust 12 –14 Development of intercropping systems for tea lands in Estate and Small holder sectors

The objective(s) of these thrusts are (1) to evaluate the compatibility of the intercrops such as pepper and coffee at different spacing and their effect on the yield of tea in marginal tea lands in mid-country estate and small holder sector and (2) to develop an intercropping systems at low elevations with plantation crops such as rubber and coconut.

In one experiment at mid-country pepper and coffee came in to bearing during the year and the crop harvested was very small. There is no significant effect on yield of tea during the first year of the cycle. In another experiment at mid-country there was a high percentage of casualties in pepper and coffee due to the prolong drought experienced during 2001. Therefore, the location of the one experiment was changed.

In tea and rubber intercropping experiment at the low-country carried out in collaboration with the Rubber Research Institute of Sri Lanka, there are six treatments viz. monocropping of tea, monocropping of rubber (18'x12'), tea (rehabilitated) under rubber (27'x8'), tea (rehabilitated) under rubber (40'x8'),

The yield of rehabilitated tea under rubber was significantly lower than that of monocropped tea. Analysis of the results on yield of tea planted without rehabilitation showed that tea intercropped with rubber spaced at 8'x40' gave a higher yield than tea intercropped rubber spaced at 8'x27'

In another experiment, the feasibility of intercropping tea in rubber is being tested with the following treatments viz. tea, tea under rubber (40'x 8') and rubber (20'x 12'). The yield of tea was 80% higher for monocropping compared to intercropping of tea under rubber. The rubber yield in the intercropped plots about 50 ml $tree^{-1}$ $tapping^{-1}$ higher than for monocropped rubber

There are two experiments with tea and coconut intercropping at low elevations carried out in collaboration with CRI and 'Tea Shakthi'. The treatments included tea with/without soil rehabilitation and different spacing for coconut (12'x30', 12'x30', 20'x30', 20'x40' and 20'x60')

3. Thrust A19 - Development of water management techniques for young tea in drought prone areas to minimize causalities

The objective of the above thrust is to (1) determine quantity of water and frequency of application for drought susceptible clones and (2) to evaluating existing technologies for water application in tea. Under this project, three studies were undertaken at low-country, up-country and Uva.

In the Low-country growth of young tea was tested with and without irrigation (drip irrigation with liquid fertilizers) under two systems of planting viz. on raised bed and flat beds (control) with two clones viz. TRI 2023 and TRI 3025. Clone TRI 2023 gave a higher yield than TRI 3025. In another trial, fertigation was tested at three frequencies of water application with 100% water soluble fertilzer. The response for fertigation was more than 75%

In the up-country, fertilizer was given with the irrigation water at the rate of 180, 225 and 300 kg N ha^{-1} as urea for 300 days. There was an additional treatment of water application only with surface broadcasting of fertilizer at the rate of 360 N kg ha^{-1} in four splits. The results indicated that fertigation increased the yield by more than 100%.

In the Uva, four treatments of varying frequencies of water application were tested in large blocks of land (0.25 ha). Fertilizer was given with the irrigation water at the rate of 180 kg N ha^{-1} as urea for 300 days. The yield improvement was about 50% over the control.

4. Thrust A20: Development of harvesting devices to overcome labour shortage.

The objective of the above thrust is (1) to evaluate harvesting devices (2) to modify harvesting intervals and (3) to modify bush management practices for mechanical harvesting

There were two trials with Kawasaki NV 60H Motorized machine on two clones (TRI2027, H1/58) and two harvesting intervals (14 and 21 days) and different levels of potassium. Results showed that there was a significant decline in yield (33-40%) with the use of machine on both clones. Also potassium levels (Normal and 1.5 times the normal) on VP tea (TRI 2027) showed that there was no significant difference in yield between the two rates in relation to mechanical and manual harvesting. However, harvesting of tea using the motorized machine has reduced the yield by 36% in comparison with manual harvesting.

There were two experiments with varying planting densities to modify the bush architecture. Single hedgerows (1.2m x0.6m) were compared with double hedgerows (0.6m x 0.9m x1.5m, 0.6 x 0.9m x1.5m, and 0.45m x 0.9 x1.5m) in two clones (TRI 2026 and DG39). The results had shown that double hedge rows with a spacing of 0.6 x 0.6 x 1.5m and 0.9 x 0.45 x 1.5m gave a significantly higher yield than the 0.6x1.2m spacing and 0.6x0.9x1.5m spacing.

5. Thrust A21: Development of devices for improving pruning efficiency

The objective of the above thrust is to develop a mechanical pruning device to minimise the worker requirement for pruning. Field testing was carried out on the new hand pruner which was designed, fabricated and patented. This study revealed that it can prune about 750 bushes per manday. The labour requirement for pruning with this new machine is estimated to be 16 workers/ha thus registering about 68% saving on labour. Considering the cost of a portable generator, fuel, depreciation, maintenance and labour, mechanical pruning with this hand pruner reduces the cost over manual pruning by about 35%.

6. A 24. Development of Weed Management Strategies in tea

The objective of the above thrust is to develop an integrated strategy to control weeds in tea plantations. The approaches were to (1) screen new herbicides (2) test different combinations of weed management strategies and (3) control problem weeds in each agro-ecological regions

Screening of Deverinol (Napropamide 45% sc) - a pre-emergent herbicide and Amiphosate (50%) (granular formulation of Glyphosate) were continued.

Control of Passali Kodi (*Anredera cordifolia)* was investigated in field trials. A cocktail mixture of Diuron (80% wp) @ 1.2 kg ha^{-1} + Round-up 3.0 l ha^{-1} controlled getakola at tender phase.

7. Divisional Activities:

7.1. 100 day program: Use of TSTH and plucking baskets

The main objective of the field program was to enlighten and train tea pluckers, field staff and management staff of estates on the use of TRI Selective Tea Harvester (TSTH) and the innovated plucking baskets. The program consisted of a lecture, video film and a field demonstration cum training on the use of the basket and TSTH. The lecture was aimed at changing the attitude of workers, field staff and the management staff of estates regarding mechanization of field practices on estates. The video film was on the proper use of TSTH in association with the new baskets. The whole program emphasized the importance of using new innovations in the light of improving worker productivity, reducing cost of production, minimizing drudgery of field work (plucking) and absenteeism, attracting the younger generation for field work and improving income and the standard of life of workers. During the period of the 100 day program (from January 12-April 10), it has been possible to conduct 73 programs covering 106 company estates and some private estates in the Low and Mid country as well as in Uva. About 1800 estate workers including 'kanganies', 620 staff members (Superintendents/Assistant Superintendents and field officers) and more than 300 small holders were educated and trained on the use of TRI selective tea harvester and improved baskets.

7.2 Impact of global climate change on the productivity of tea plantations

A new research project was initiated in collaboration with SLASS, CRI and Met Department and administrated by International START Secretariat, Washington D.C., USA and funded by United Nation Environmental Program. Collection of productivity and socio-economic data was completed and results are being analyzed. Further, a Sri Lanka Climate Change model **(SRILAKACLIM)** was built with the assistance of University of Waikato, New Zealand. This model could forecast the possible future climate for Sri Lanka based on Global Circulation model down scaled to regional scale.

8. **Publications:** There were eleven publications including scientific and news paper articles.

BIOCHEMISTRY DIVISION

1. Project B17 – Development of Chemical/Biochemical methods in the control of Shot-hole Borer (*Xyloborus fornicatus*) in tea.

Shot-hole Borer (SHB) is a major insect pest of tea, which affect 30% of tea lands in Sri Lanka. This project was initiated to study the chemical ecology of the insect with the ultimate objective of finding semiochemicals to manage the pest in an environmentally friendly manner.

Twenty five volatile compounds in the stem and leaves of tea plant, which could act as semiochemicals, were identified using GC-MS. Further analysis of these compounds have shown that concentration of S-isomers of Linalool Oxides were several folds higher than R-isomers in susceptible tea varieties indicating an involvement of these compounds in attracting SHB.

2. Project B18 - Use of DNA markers for molecular characterisation of tea

Germplasm characterisation is an important link between conservation and utilization of plant genetic resources as a source of variance for useful traits in plant breeding programmes. DNA technology offers novel methods of observing the genome directly. In this connection a CARP-funded project on molecular characterisation of tea was conducted in 1999/2000. This project was further extended in 2001 and is being currently funded by SAREC.

A tea genomic library has been constructed to screen for SSRPs (Simple Sequence Repeat Polymorphisms). The library is being screened at present. 36 clones resistant, susceptible and moderately susceptible to Blister Blight are being screened with RAPD primers to look for putative markers for Blister Blight resistance.

3. Project B19 – (a) Effect of black tea on oral microorganisms

Studies were carried out to determine the effect of black tea on harmful oral microorganisms in collaboration with the Faculty of Dental Science, University of Peradeniya. In 2001 it was shown that tea extracts, and its polyphenol fraction, could inhibit the growth of *Candida* species which cause Candidasis (oral thrush).

In 2002, studies were carried out to determine the effect of black tea on *Staphylococcus* species which cause dental root canal infections. It was found that black tea extracts could inhibit the growth of *Staphylococcus* species. The

study was extended to find the effect of tea extracts on methicillin (a semi-synthetic penicillin, active against penicillin resistant *staphylococci*) resistant *staphylococcus aureus* variants. It was found that black tea extracts could inhibit the growth of methicillin resistant *staphylococcus aureus* variants isolated from oral cavity and other body sites. The study will be continued.

(b) Polyphenol content and antioxidant activity of teas produced in different regions of Sri Lanka

Teas produced in different regions of Sri Lanka such as Nuwara Eliya, Udapussellewa, Dimbulla, Bogo Valley, Malwatte Valley etc. are marketed as specialty teas in the world market. A study was carried out to find the chemical composition of teas produced in different regions of Sri Lanka.

Teas were collected from fifty three estates on a monthly basis and analysis is being carried out to determine total polyphenols (TP), theaflavin (TF) and thearubigin (TR) content. TR to TF ratio, total colour (TC) and antioxidant activity are also being measured. Preliminary results indicate higher antioxidant activities in teas produced in Nuwara Eliya and low country regions.

4. Project B22 – Establishment/Monitoring of flavour profiles of made tea for various agro climatic regions

The changes of flavour profiles in made tea due to the seasonal variation in the Uva region were studied during this year. Made tea samples (22) from the Uva region were collected during the season and subjected to gas chromatographic analysis for volatile chemical compounds. This is an on going project and will continue during the year 2003.

In addition, gas chromatographic analysis was carried out to find the differences in volatile optical isomers of linalool and their oxides in teas produced in Sri Lanka, Kenya, India, Ruwanda and Indonesia. A total number of 66 samples were analysed.

5. Project B26 – Biochemical and chemical methods in the control of Blister Blight leaf disease of tea caused by *Exobasidium vexans*

The project was started with the objective of studying the chemical and biochemical parameters relevant to the resistance to the disease with the ultimate objective of controlling it in an environmentally friendly manner.

Work carried out in the past revealed that higher concentrations of anthocyanins and epicatechin in the flush increased the resistance to the disease.

In 2002, flavonoid biosynthetic pathways in tea leaf were studied using ^{14}C labelled precursors to find the changes that occur on these compounds upon infection. Involvement of five enzymes in the pathway was demonstrated for the first time. These investigations suggest the formation of proanthocyanidins, which is important in resistance mechanism, from leucoanthocyanidins via epicatechin in the tea leaf.

6. Project D28 - Establishment of factors responsible for Bogo Valley character

Some teas produced in Bogo and Maskeliya Valley regions show an extra redness in their liquors. In order to understand the factors responsible for this extra redness, tea samples were collected from Bogo and Maskeliya Valley regions (teas from Dimbula region were used as controls) and analysed for TP, TF, TR, B, TC and fluoride content in 2001. Further samples were collected from these regions and analysis was continued.

Polyphenols often forms coloured complexes with trivalent cations, which may contribute to the redness of the liquor. Therefore, in addition to the above parameters, Fe, Al, Cu, Mn, were also included in the analysis. It was found that made tea samples from Bogo valley region contain more aluminium (882 ppm) than in Dimbulla (793ppm) teas.

7. Project D30 – Development of multi-residue methods for the analysis of pesticide residues in made tea.

Pesticide residue analysis in made tea is very important in the marketing of tea. Therefore, twenty one pesticides were selected for development of multi residue methods. Initially two solvent systems and two clean up methods were tested for five pesticides to develop multi residue methods. Extraction with ethyl acetate and GPC clean up was suitable for Chloropyrifos-ethyl, Dimethoate and Diazinon.

8. Project - New 3 - Comparison studies on organic non organic teas

Quality of organically grown tea and conventionally grown tea could be different due to the differences in inputs. Therefore, a study was initiated to find the chemical and organoleptic differences between organic teas and conventional teas.

Flush samples were obtained from experimental plots in field No.13, St Coombs estate. There were four treatments in the experiment where different organic and non organic fertilisers were used.

Flush samples were manufactured using the miniature manufacturing facilities in the Technology Division, TRI. Made tea samples were sent to professional tasters for organoleptic evaluation. Chemical analysis was carried out for total polyphenols, EGCG, ECG, EGC, EC, C, Gallic acid, theaflavin, thearubigin, caffeine and flavour profile. Results are being statistical analysed.

9. Project A 29.2 - Improvement of technology for producing a liquid tea concentrate

Use of various additives in food commodities has been a major concern of the consumers. In this regard trials are being conducted to minimise or eliminate the use of various additives in the preparation of liquid tea concentrate. Experiments for the future are focused on minimising the use of citric acid and sodium benzoate used as a preservative, and aluminium sulphate and bentonite used as clarifying agents.

Outcome of the trials, on the effect of reduced levels of citric acid on taste, indicate that samples with 75% of the normal level of citric acid has been ranked the best in terms of taste, while the samples with 50% of the normal level of citric acid has been ranked the best in terms of colour, tea character and general acceptability. All samples showed stability over storage.

Preliminary trials to replace aluminium sulphate and bentonite with microfiltration have been initiated.

10. Project A 30.3 - Development of a Tea Sherry/Wine

The problems associated with wine/sherry were, poor clarity, after bitter taste, coating of the tongue with polyphenols and lack of tea character. These were addressed during 2001 using different tea blends, different tea concentrations and maturation of the ferment using Halmilla casks. This led to a development of a product with good clarity and colour. Samples of the product were sent to the interested commercial parties and their comments indicated that fine tuning of the product was necessary.

Experiments were carried out to fine tune the product and as a result optimum maturation period in the Halmilla (Berraya cordifolia) casks was established.

ENTOMOLOGY DIVISION

1. Research Activities

A 1.2: Screening lines for resistance to SHB, ULWT

i. Phase II Trials - Field No.12, St.Coombs Estate
Out of a total of 59 test clones 9 were found to be resistant to the borer, 50 were borer attacked and 3 of them (Code no. 272, 101 and 210) were extremely susceptible and not suitable for Shot hole borer active areas.

ii. *Camellia sasanqua* seed garden, Field No.9, St.Coombs Estate. Out of a total of 79 lines, only 04 lines were observed to be infested.

A 1.6: Continued screening of new clones for their resistance and tolerance to the plant parasitic nematodes attacking tea in the Up- country

Expt. **N1 A (2001-2002) –TRI, Talawakelle.**

Five of the TRI 4000 series, one Nilagama series and K145 were included with DT 95 and TRI 2024, 2043, & 2025 as the standards, in the study.
The clones that can be used in nematode areas, but following all good agricultural practices, are TRI 4052, NIL 53 and K 145.

A 2.2: Screening lines for resistance to Shot-hole borer in Mid – country

ME 16- Clonal screening for Shot-Hole Borer (Bio assay)

The results indicated that TRI 3022 was the highest damaged, 3014, 3019 & 3063 were next most damaged ; 3014, 3018, 3015 & 4006 were lightly damaged whereas 2023 was the only clone not damaged within the one month period of testing.

ME 17- Clonal screening for Shot-hole Borer

(a) Rangala Estate. Field No:NC 99 –Branch Assessment of the clones TRI 3019, 3063, 3025, 4006, 3020, 3014 were carried out.

(b) Greenwood Estate, Field No. 01 - Branch assessment of 07 TRI 4000 clones was carried out . The clones TRI 4078 & 4061, were found to be resistant, clone 4053 susceptible and the others, TRI 4052, 4072, 4079 & 4071 were moderately susceptible when compared with TRI 2025.

(c) Mid-country station, Hantane Field No. 04 – In the assessment done in October, TRI 4046 was found to be resistant to the borer.

A 2.5: Continued screening of new clones for resistance and tolerance to the plant parasitic nematodes attacking tea in the Mid- country

N1B 1(2000/2): Nematology Nursery, TRI Station, Hantane - The final destructive assessments were carried out. Data is being analyzed.

N1B 2 (2001/3) : Hantane Estate, Hantane-
Soil and Root sampling were being carried out at the end of the year. The assessments are in progress.

A 3.2: Screening lines for resistance to SHB in Uva

Phase III trial at Mahadowa Estate. – The clones were being reassessed in order to revise the Advisory Circular No.6/02 : Three out of 29 clones, TRI 4043, 4042 & 4045 were certified as tolerant and suitable for borer active areas in Uva.

A 3.5 – Screening lines for resistance to Tea Nematodes, *P.loosi* and *R.simiies* In Uva
N1C(2002/3)- TRI Station, Passara –
Nematode population was being built up in the testing tanks, for the new series of test clones.

A 4.2: Screening lines for resistance to Low country Live Wood Termite

LE 50 Hapugastenne Estates, L. A. Division (Planted 1990)-

26 lines of the 132 selections, and 03 of the older selections were still free of Livewood termites and canker (after 12 -20yrs) and they also, had good branching. These are : H27, H41, H71, H101,

H102, H108, H117, H119, H122, H134, H153, H188, H211, H310, H314, H354, H374, H402, H424, H427, H467, H472, H482 and PET 142 (Pettigala), TV 09(Tocklai) and Y2.

The above 26 selections and the standard clones were pruned in October, for further studies.

LE 78 : HapugastenneEstate, Hadaraganga Division (Planted 1998)-
Screening of 37 clonal lines selected for termite resistance was in progress. Two growth assessments were carried out. 33 of the lines had good growth. 15 lines recorded yield exceeding 100 kg/ ha/anum, HG 19 recording the highest yield (1694 kg/ha/anum).

LE 81 Hapugastenne Estate, Upper Wewelketiya Division (Planted 1997)-
Screening of TRI 4000 series clones for resistance to LCLWT :One post-prune assessment was carried out and observations have been recorded. None of the clones exhibited live wood termite damage.

LE 83- Balangoda Estate, Maratenne Division– Screening of 72 selections for pest resistance inclusive of SHB, live wood termites,etc.: Three growth assessments were carried out. The 15 best grown lines (MT 131, 105, 101, 150, 114, 133, 121, 104, 119, 127, 122, 142, 128, 153, and 165) were bio-assayed but only 06 lines were found to be resistant to Live Wood Termites.

A 22.1: Screening of synthetic pesticides for reducing Shot hole borer in tea
Four experiments are ongoing

E 303 - Rangala Estate. Field No:NC 99.
ME 15 -Rangala Estate –Kalduria Division-Field No.13a
LE 87- Hapugastenne Estate ,Dehenakande Division, Field No. 27 (Planted 1999)
E 307 – Mahanilu Estate, Field No.5

Spraying of 03 new chemicals (fiprinol at 2 doses, Beta-cyfluthrin & Imadichlorprid) were carried out in February, June & October. Monthly assessments indicated no significant difference between the chemical treatment in relation to borer damage or the yield when compared to the control.

A 22.2: Screening of biological control agents for reducing SHB damage in tea with *Beauvaria bassiana.*

E 309 – Rangala Estate, Rangala Field No.NC 99
E 310 – Field No.H-I, Templestowe Estate, Rossalla (2nd year after prune)
ME 20- Location – Morahena (Mr. Dodanthenna's private property.)

It was observed that all the adult beetles were killed by the fungus and the fungal suspension could be seen to be effective for two months after application.

A 22.3: Identifying shade trees species as diversionary hosts for reducing SHB damage

Stems of 12" length and 1 cm diameter from the following plant species were tested in the fields for their trapping effienciency:

1. *Montanoa bipinnatifida*
2. *Grevellia robusta*
3. *Calliandra calothyrsus*
4. *Flemingia congesta*

Montanoa bipinnatifida did not attract *X.fornicatus*, instead it attracted another species of *Xyleborus* that does not attack tea. The other three species were attractive to the tea borer.

A 22.5: Modifying potassium fertilizer to reduce SHB damage
E 289- Attampttia Estate, 1st Division, Field No.2
E 290 – Hantane Estate, Factory Division, Field No. 9A

There was no difference seen between potassium levels, but the differences between the clones, DN, TRI 4070, TRI 2025, & TRI 2023, was seen to continue.

A 22.7- Computarized data base and modeling of yield damage relationship for Shot – hole Borer

Formulation of population model to describe dynamics of shot-hole borer for forecasting purposes has been investigated. The model is built using DYMEX®, a modular modeling package developed by the Corporate Research Center for Tropical Pest Management

(CRCTPM) in Australia. Supplementary data needed to complete the model has been identified and experiments have been initiated to fill in the gaps of the knowledge in bionomics of the pest.

A 23.4 Refining cultural practices for managing nematode pests in mature tea including the incorporation of various soil amendments using plant raps/cover crops to help reduce nematode population.

Project A 23.4 and A 32

The following were strengthened for scientific validation of organic farming, biodynamic agriculture, nature farming and traditional practices in agriculture in relation to establishment, growth, restoration of biodiversity components, incidence of pest and diseases in tea.

Nature Farming Demonstration and Research Area was established in the Nematology experimental area at TRI.

'TRI-ORCON' trial: was on going

'BIDORCON' trial: was initiated in May 2002 at Nematology Experimental area.

N 369: Mass propagation of nematode bio control agents

Laboratory and pot cultures of different isolates of *Pastueria penetrans* and nematode trapping fungi, *Arthrobotrys musiformis*, *A. oligospora*, *A.* spp., *Dactylella* spp. and *Monacrosporium* spp. were maintained, for future studies.

Exploitation of these materials as indigenous biological materials for agricultural purpose and field dissemination on experimental basis will be done in the future.

N 370: Management of tea nematodes under organic tea culture

Soils collected from organically and conventionally maintained experimental plots were evaluated for various soil fauna in order to understand their relationship and development.

N371: Monitoring naturally occurring nematode antagonists of tea nematodes

Periodic monitoring of densities of nematode bio control agents and population of *P. loosi* in Needwood estate and *Radopholus similis* in TRI station, Kottawa was done in order to elucidate the mechanism of nematode antagonism under tropical conditions.

The effect of organic tea cultivation on soil biomass with special reference to population densities of micro arthropods was studied. Conventionally treated, and neem oil cake amended soils, showed a significant reduction in the micro arthropod density ($p = 0.05$).

The microbial activity measured as CO_2 evolution rate, showed significant improvement ($p = 0.05$) in the range of 3.82 and 4.20 µg per g soil per hour in organic tea soils; while it was 3.01 in conventionally managed tea soils. Among the organically managed tea soils, compost amended soils showed the highest percentage increase in CO_2 evolution rate, which was 37.47 % with respect to the conventionally managed tea soils.

The results of bioassay indicated a significant improvement ($p = 0.05$) in root biomass, shoot biomass and rooting depth of plants grown in organic tea soils as compared with conventional tea soils. Compost amended tea soil showed the highest performances with respect to these parameters. Thus, organic tea cultivation could help improve the soil biodiversity and ecological restoration while maintaining the sustainability of the system with respect to crop yield.

Analyses for Humic acid and E4:E6 ratio of soils collected from organically and conventionally maintained experimental plots were also performed.

N 375: Soil-less medium for tea propagation as alternatives to chemical treatments in tea nurseries

The tea plants raised on different soil-less media and planted on micro plots with heavy infestation of *P. loosi* were assessed for nematode infestation. Data did not show significant results and the experiment will be repeated.

N 419: Evaluation of different wormy tech methods in growth, nematode incidence and productivity of tea

The experiments are in progress.

A 23.5: Effect of soil pesticides on soil biomass and productivity of tea

Six pesticides (Paraquat, Diuran, Round Up, Carbofuran, Nemacur and Basamid) were screened on six different soils from Hantane, Passara, Kottawa, Deniyaya, St. Coombs and Ratnapura for soil biomass, *Rhizobium* activity and productivity of tea under glass house conditions. The experiments are in progress.

N 417: Health assessment of estate workers occupationally exposed to different cultural practices

Health status of a selected group of workers of a conventional (St. Coombs) and organic (Haldummulla) tea estates were compared. Data on clinical information collected and the specimen samples drawn from individuals are being analyzed.

Project A 23.6

N 398: Effect of biotic materials on soil biomass and productivity of tea

Four biotic materials (Bio pack, China, Humat 2000 and EM) were screened to evaluate the soil biomass and productivity of tea under glass house conditions. Data is being analysed.

B 29: Refining the techniques of screening tea clones for natural resistance to the major pests of tea

ME16 – Clonal Screening for Shot-hole borer (Bioassay)

The results indicated that TRI 3022 was the highest damaged, 3014,3019 and 3063 were next most damaged; TRI 3014, 3018, 3015 and 4006 were lightly damaged whereas TRI 2023 was the only clone not damaged within the one month period of testing.

Bio assay I - Screening of Maratenna Selections for Low Country Live-wood Termite (LCLWT) resistance - was carried out on 15 selections which showed good growth in the field. Only 06 clones showed resistance to LCLWT while the balance 09 clones were susceptible to the termite. The 06 resistant clones, namely, MT 131, 105, 101, 142, 128 & 165, have been earmarked for multiplication.

Clones were found to be significantly different in relation to the number of termite individuals sitting on stems or on the tissue, and the number dead.

Data was analyzed using CATMOD procedure, and the results are given below:

In relation to Gallery count, numbers alive and dead , the treatment effects were significant but CV% was too high for a reliable conclusion . The study is in progress

Project B 30: N 386 Biochemical resistance of tea clones towards major pests such as nematodes and Low country live wood termite

Nematodes (stage II studies) Cuttings of tea clones resistant and susceptible to *P. loosi* were put out for use in experimentation to study the biochemical basis of resistance in tea.

N 386: Biochemical basis of resistance of tea clones to nematodes

Thirteen tolerant and susceptible clones in St. Coombs and Loolcondera estate were selected for the study.

Root extracts of tea clones were analyzed for the content of total polyphenols and leucoanthocyanidins using colorimetric and HPLC methods.

Total polyphenol content was significantly different between the two locations, but, was not significantly different between susceptible and resistant clones. The total polyphenol content of resistant clones was higher than the susceptible clones at Loolecondera.

Poor correlations for polyphenol content and the population of *P.loosi* were observed for both locations. The study has been modified.

Cyanidin and Delphinidin represent the condensed tannins in root. Condensed tannins could be a one factor that contributes to nematode resistance in tea plant. Cyanidin content is higher in resistant clones than the susceptible clones.

N 384: Studies on nematicidal action of planting *Arachis pintoi* in tea soils

Soil populations of *P. loosi*, *R. similis* and *Meloidogyne* spp were maintained in the cement-lined tanks planted to *A. pintoi* at TRI, Hantane. The experiment is in progress for chemical extractions .

Low country live wood termite

Different bio assay methods were used to observe the activity of these fractions but no positive results were obtained. It was suspected that the activity was due to either the collective compounds or the single compounds.

Electro Antennogram Studies (EAG)

Wood material was absorbed in a solvent. These were fractioned using MPLC. Identification work is in progress.

C 2: Eelworm analysis

1146 samples were processed and examined and 36 reports have been sent

D 17: Management of Nematode pests in tea lands

MeBr 9 – Development of Steam Chamber for sterilization of infested soil.

The steam generator, the water reservoir and the chamber were constructed and tested. Arrangements were made to patent the equipment.

MeBr 48 – Evaluation of nursery Tunnel- Diyagama East Estate, Diyagama.

Final growth and nematode assessments were carried out. The experiment was completed. Data is being analyzed.

MeBr 49 – Evaluation of combined effect of Soil Solarization and Soil Substitutes on tea nematodes- Nayabedda Estate, Bandarawela

Final growth and nematode assessments were carried out. Data is being analyzed.

MeBr 52 – Effect of Poly tunnel on Soil Solarization- Rangala Estate, Rangala

Final assessment was carried out. Data was submitted for analysis.

MeBr 53 – Screening of Nematicides-TRI Station, Hantana

Experiment was being maintained. Final assessment was scheduled for January 03.

MeBr 54 – Effect of Nursery Tunnel on soil substitutes - Queenstown Estate, Hali–Ella.

Final growth and nematode assessments were carried out. The experiment was completed. Data is being analyzed.

MeBr 54A – Effect of nursery tunnel on nematodes-Queenstown Estate, Hali–Ella.

This is a follow up study of nursery experiment and is on-going.

MeBr 56 – Soil Roasting as a means of Nematode eradication. Hauteville Etate,Agarapatna.

Construction of roasting plate and gas hearth were completed and tested at the nursery. The experiment is on going

FUNDAMENTAL STUDIES- To determine the physical state of paddy husk for soil substitution in the nurseries

MeBr 58 -Testing of different grades of Paddy Husk from different places for its feasibility at use in Tea Nurseries. Queenstown Esate, Hali-Ella. Undamaged paddy husk from the Japanese huller produced better shoot growth compared to the product from the local huller. There was no difference between the two mixing ratios of paddy husk and soil. The effect on root growth was variable. The effect on nematodes was the same with all the different combinations of paddy husk.

MeBr 67 – Soil substitutes in closed bags vs. open bags- Hauteville Estate, Agarapatana
Fertilizer application and other maintenance works were carried out. The experiment is ongoing.

MeBr 70 - Double-tent Soil Solarization, Queenstown Estate, Hali–Ella.
Nursery beds were prepared. The experiment is ongoing.

MeBr 71 -Biological control of nematodes-TRI Laboratory
Cultures have been maintained at the nematology laboratory. The experiment is ongoing.

MeBr 72 -Soil Substitutes in layers, Queenstown Estate, Hali–Ella.
Nursery beds were prepared. The experiment is ongoing.
The pH of the media containing 50% soil got adjusted with time to be within 4.1 and 5.5 whereas the pH of 100% organic media had pH value ranges from 5.82 –6.00, even though the tea cuttings were not adversely affected in the latter.

MeBr 51 – Testing of the nematicidal effect of soil solarization in combination with Soil substitutes and chemical nematicides - Nursery, Handford Estate , Deniyaya
Experiment is in progress.

MeBr 64 The experiment, with chemical treatments for "Deniyaya problem"was maintained as a demonstration plot, at Minirankanda ,Batayaya, Deniyaya.

Two treatments , Nemacur @ 10 g/bush, repeated after 6 months, and Metham sodium @ 10 ml/bush were both effective. The Nemacur (T1) treated plots had recovered well after about 1-2 months from the 1st treatment.

D 18: Management of Up country Live wood Termite

E 311 – Laxapana Estate, Valamalai Division, Field No. 03 -

Treatments:
1. Imidachlorpid ("Admire SL 200") @ 6.5 l/ha
2. Fiprinol ("Regent 50 EC" @ 3.5 l/ha
3. *Beauveria bassiana* spore solution
4. *Beauveria bassiana* sproe solution + Admire SL 200 6.5 l/ha
5. Fiprinol ("Regent) granules @ 30 kg/ha.
6. Untreated Control

Live Population/ bush

Treatment			1st Assessment	2nd Assessment
T1	–	R1	15	35
		R2	244	195
		R3	182	0
		R4	0	162
T2	–	R1	0	0
		R2	6	0
		R3	0	0
		R4	0	0
T3	–	R1	0	0
		R2	0	4009
		R3	1290	325
		R4	–	–
T4	–	R1	0	41
		R2	0	0
		R3	4843	30
		R4	–	–
T5	–	R1	–	0
		R2	–	0
		R3	–	45
		R4	–	350
T6	–	R1	516	0
		R2	152	125
		R3	200	15
		R4	467	20

Observation up to end of the year were not conclusive. This experiment is in progress

D 19: Management of Low country Live wood Termite

LE 88 – Location. Panambalana Tea Estate, Attamalahena Mawatha,Kahatapitiya, Kananvila(Horana)

The objectives of this study are:

1. To see whether coir dust and paddy husk (easily available in the costal area) can be used in low country nurseries where scavenging termites are active in the soil.
2. Where LCLWT tolerant clones (TRI 4046, 4006, 3014, 4042, 4049 and 2027)can be used with new technology for better advantage.
3. To select the best clone studied to the environmental conditions peculiar to the area, namely marginal (gravely) soils, termite and stem canker pathogen activity and high temperature conditions.
4. To see the small holder capacity for adoption of modified technology.

The cuttings were putout in June 2002 and nursery practices are been carried out. Growth assessment were done at 3 months for the plants.

D 20: Identification of safe insecticides acaricides and designing of IPM methods for Control of seasonal pests of tea

ME 6(02) - Screening of insecticides to manage scavenging termites in the Mid-Country area – Duckwari Estate. Lolgama Division, Field No: 10

Chemical application has been carried out in June 2002 after 15 months of 1st application. Monthly observations are taken.

Summery of Results for period January-December 2002

	Whole Damage			Fresh Scavenger Activity			Presence of Termites		
	R1	R2	R3	R1	R2	R3	R1	R2	R3
T1	01	21	23	01	25	22	00	02	04
T2	03	22	13	03	21	17	05	00	07
T3	01	13	21	01	12	27	02	01	07
T4	26	41	73	20	38	64	18	06	23

T1-Regent (Granular formation)-30 kg /ha
T2-Regent (Liquid suspension)-3.5 liters/ha
T3-Regent (Liquid suspension)- 2 liters/ha
T4-control

This experiment is in progress.

LE 90 :Collaborative Experiment of Entomology Division and Plant Breeding division of TRI, Low Country Station (Ratnapura)

To study the feasibility of using easily available agricultural byproducts as partial soil substitute for tea nurseries where scavenging termites are active, to reduce the usage of soil as the rooting medium. One experiment was set up with coir dust and paddy husk at TRI Low Country Station, Ratnapura.

Nine treatments in 03n replicates with 100 plants per replicate per treatment, wee established. Cuttings of the Clone TRI 4042 were put out in Dec 2002. Nursery practices are been carried out.

Miscellaneous Studies

New Pest Outbreaks – Beetle attack on immature tea bushes Minipura, Dumbara (small holding)

The plants were damaged by the adult beetle of (Fam: Scarabaedae, Sub F: Melolonthinae)

The plants were sprayed with Reagent 10 %(50 ml of reagent in 15 l of water) and the pest was brought under control.

PLANT PATHOLOGY DIVISION

PROJECT A-1.2 – Screening/Selection for Resistance, Upcountry

PP/POR1/98 - Screening of new clones for the resistance/susceptibility of *Poria* root disease, St Coombs Estate.

The plants were uprooted and the trial discontinued after a final assessment and rating of the disease. This study revealed that clones TRI 4072, 2025, 3072 and 4052 were fairly tolerant of *Poria* while TRI 3057 was the least.

PP/BB3/99 - Selection of OST bushes for the resistance of Blister Blight disease, Diyagama East Estate.

Cuttings were obtained from 17 bushes selected and screened mainly for the tolerance of blister blight and secondly for other bush characteristics. Cuttings are being evaluated in the Estate's nursery under their supervision.

PP/POR1/00 - Screening of new clones for the resistance/susceptibility of *Poria* root disease, St Coombs Estate.

In spite of the poor quality of the starting material, the data collected were analysed for a preliminary guidance. Accordingly TRI 4042, 2025, 3014, 4006, and 4046 were showing some resistance to *Poria* in that order, descending from the most to the least. The plants were uprooted and the trial discontinued aiming for a new series.

PP/POR1/02 - Screening of new clones for the resistance/susceptibility of *Poria* root disease, St Coombs Estate.

A new series of screening was started in August, using both pits afresh. In pit No1, the cultivars TRI 3014, 3047, 4059 & 4079 are being tested alongside TRI 2025. In pit No 2, the cultivars TRI 4006, 4042, 4053 & 4067 are being tested also, alongside TRI 2025.

PP/BB3/02 – Screening of clones for the resistance/susceptibility of Blister Blight, VP 80-Phase II trial, St Coombs Estate.

Completed assessing clones using total blister count of 2nd leaves in one replicate, involving 29 plots.

PROJECT A-4.2 – Screening/Selection for Resistance, Low-country

PP/MC1/00 - Selection of OST bushes for the resistance of *Macrophoma* Canker Disease (Hulandawa Estate, Akuressa);

Ten bushes were used as mother plants in obtaining about 25 cuttings each. These are now being evaluated in the Estate's nursery.

PROJECT A-23.1 – Screening and evaluation of soil-born fungi (locally isolated) with antagonistic properties to major root diseases and as bio-degrading agents

In dual culture, *Poria hypolateritia*, *Phellinus noxious* (*Rigidoporus noxious*) and *Rigidoporous microporus* (*R. lignosus*) were successfully controlled by *A.niger*, *P.aurantiogriseum* and *T.pseudokoningii* in a pre-pathogen combination. These metabolites were incorporated into PDA medium in Petri dishes at 5, 10, 15, 20, 30 and 40% to test their toxicity/antagonism. All other combinations too gave reasonable suppression of pathogens thus showing their biological potential.
In broth culture, *P. hypolateritia*, *R. microporus* and *P. noxious* were assayed against the metabolites of three saprophytes; *A. niger*, *T. pseudokoningii* and *P. aurantiogriseum*. Different degrees of control was observed on all three pathogens.

P. hypolateritia (Red root) isolate obtained from Lankaberiya Estate has proved to be a different pathotype to that of the isolate coming from Moray, Maskeliya. But this responded in a similar manner to the saprophytic fungi listed above.

A.niger (saprophyte) was controlled at the concentrations of 0.05% of Tridemorph, Propiconazole, Hexaconazole and Tebuconazole while Bitertanol did not control it at the concentrations tested.

T.pseudokoningii (sprophyte) was not controlled/suppressed even at the concentrations of 0.15% of Bitertanol, Tridemorph, Propiconazole and Hexaconazole. But Tebuconazole controlled this fungus at 0.05% concentration.

P.aurantiogriseum (saprophyte) was controlled at the concentrations of 0.05% of Tridemorph, Propiconazole, Hexaconazole and Tebuconazole while Bitertanol did not control it at the concentrations tested.

Presented an abstract paper during the 58th Annual sessions of the SLAAS (4-7 December) entitled, '*Antagonism of three naturally occurring fungi against major tea root diseases of Sri Lanka and their sensitivity to recommended systemic fungicides*'.

PP/BC1/02 (Glass House, St Coombs Estate) – Started a pot experiment, using TRI 2025 and the saprophytic fungi; *A. niger*, *T. pseudokoningii*, *P. aurantiogriseum* singly and in all combinations plus a control. The second application of treatments (approximately 10^5 spores ml^{-1}), using same organisms was completed.

The spores of *A. niger*, *T. pseudokoningii* and *P. aurantiogriseum* maintained in both sterilized soil and talc under room temperature were assessed at 3 monthly intervals for their viability. All three organisms supported very high percentages of viability in both soil and talc.

Presented an abstract paper during the 58th Annual sessions of the SLAAS (4-7 December) entitled, '*Antagonism of three naturally occurring fungi against major tea root diseases of Sri Lanka and their sensitivity to recommended systemic fungicides*'.

PROJECT A-23.2 - Screening and Multiplication of VAM

Of the five weed species assayed (one did not perform well), only three species recorded infections at 2%, 5% & **45%**. Thus one species (*Centella asiatica*) showed very good promise. Their total contribution by way of bio-mass and trapped mineral nutrition were estimated.

Thirty, non-tea plant species (including common weeds) found in St Coombs Estate were assayed for their natural VAM infections. Out of them ten were identified as potential VAM host species, based on their infection and associated (rhizosphere) spore counts. Four species recorded infection levels at 13%, 16%, **65% & 70%**, the last two being very high. Four soil samples associated with them were assayed for their spore levels.

Findings of this study was presented as a final year project report at the University of Ruhuna, entitled '*Mycorrhizal non-tea plants and their potential towards improved soil productivity in tea*', by Ms W G N Udayangani (TA).

PROJECT D-21 (D/LEAFDC) – Leaf Disease Control

Tea Leaf surface micro-organisms: A series of *in vitro* studies were initiated to see the effect of anti oxidants (in tea leaf extracts) on the germination and germ tube elongation of *E. vexans*. Citric acid inhibited germination of *E. vexans* spores.

Four culture media; water agar (WA), Czapek Dox Agar (CDA), Malt Extract agar (MEA) and Potato Dextrose Agar (PDA) were tested for the performance (germination & germ tube elongation) of *E. vexan* spores and the PDA was found to be the best. The new 'Micro-Image' software package was found to be very useful in this activity.

In vitro studies were completed using Tridemorph (Calixin), Bitertanol (Baycor), Propiconazole (Tilt), Tebuconazole (Folicur), Hexaconazole (Contaf), Oligosachcharin (OS-Sterling), Plantomycin (antibiotic) on the performance of *E.vexans* spores. Except for Bitertanol and Plantomycin all the others were able to completely inhibit the germination of *E.vexans* spores at the levels tested.

Characterized blisters, blister spores, their germinability, *etc.*, collected from different clones, locations and clone x location combinations to compare morphological characters.

A fresh series of studies were initiated by an undergraduate student from Peradeniya University, aimed at biological control of blister blight disease drawing special attention to bacterial and yeast isolates from tea leaf surface.

PP/BB/01/02 Blister blight control using fungicides, Field No 13, St Coombs Estate.

Treatments were, Oligosachcharin (OS-Sterling) at 0.1% & 0.15%; Baycor 0.05% & 0.1%; Plantomycin at 0.1% and the control. Each treatment was replicated three times. Ten rounds of spraying and 11 rounds of assessments were completed.

PP/BB/02/02 Blister blight control using fungicides, Field No 07, St Coombs Estate.

Treatments were Perenox alone, Perenox with Latron (sticker), Perenox with Leili (sticker), Contaf alone, Contaf with Latron and the Control. Each treatment was replicated three times. Five rounds of spraying and 7 rounds of assessments were completed.

Released the revised circular (DM1; Serial No. 1/02) on 'Protection of tea from blister blight'.

PROJECT D-22 (D/STEMDC) - Stem Disease Control

PP/WRG1/02 – Assessment of wood rot in SPND trial, treated with different levels of fertilizers with special reference to the levels of K, Haupe Estate, Kahawatte.

Completed the assessment of wood rot development in stem snags, since last pruning (3rd) in July 2001. There was no significant effect on the extent of wood rot (volume) on stem snags developed, since last pruning. The CV was found to be very high (225%) which demands improvement to the assessment procedure.

PROJECT D-23 (D/ROOTDC) - Root Disease Control

In vitro screening of fungicides against major root diseases i.e. Red root (*P. hypolateritia*), White root (*R. microporus*) and Brown Root (*P. noxious*) was completed, using available systemic fungicides, Bitertanol (Baycor), Tridemorph (Calixin), Propiconazole (Tilt), Hexaconazole (Conaf) and Tebuconazole (Folicur). *P. hypolateritia* was successfully controlled at 0.05% concentration of Tridemorph, Propiconazole, Hexaconazole and Tebuconazole and at 0.15% concentration of Bitertanol.

R. microporus was successfully controlled at 0.05% concentration of Tridemorph, Propiconazole, Hexaconazole and Tebuconazole while Bitertanol was not effective.

P.noxious was successfully controlled at 0.05% concentration of Tridemorph, Propiconazole, and Tebuconazole while Bitertanol and Hexaconazole were not effective.

PP/RDC1/02 – Field testing of systemic fungicides (new/revised) in the control of poria root disease, Lankaberiya Estate, Ittakanda.

Eighteen naturally infected patches were selected for six treatments, each having 3 replicates. The treatments (5 fungicides plus control) were introduced in the field (Field No. 8 of Thungala Division) in June. Four rounds of treatments were completed.

Released the revised circular (DM2; Serial No. 2/02) on 'Protection of tea from red root disease'.

PROJECT D-25 (D/MISCEL) - Miscellaneous Activities

High forest problem

Prof N K B Adikaram of University of Peradeniya was of the view that this could be a pathological situation, sometimes with affiliations to stress conditions. To retest this, a series of isolations were done using stem and root material from infected plants on culture media incorporated with Plantomycin, Captan and Oligosaccharin (a new product by Heychem). Plantomycin and Oligosccharin were able to suppress bacterial growth in all the samples.

Continued the application of treatments in the field, Plantomycin (100 ppm), Captan (0.1%) and Oligosaccharin (2500 ppm). Plantomycin seemed to have some suppressing effect on the rate of spread of the problem. Therefore continued the application of only Plantomycin (100 ppm).

Collected xylem sap using vacuum created flasks. Pot plants were inoculated using this sap. An intensive programme of activities was initiated with the involvement of a Post Graduate student from the Kelaniya University. Microbial samples were collected from xylem saps and soil solutions. Already there are 30 bacterial and 24 fungal cultures in the collection for further studies.

Deniyaya yield decline

A debilitated patch of tea was selected in Hanford Estate (Field No 4) and effected three treatments for observational purposes. The treatments are Nemacur, Captan and the control. The treatments were repeated in the patch of field in Hanford Estate (Field No 4).

Yeast and Made Tea Quality

Orange and Pink yeasts (pigmented) were separated from tea leaf surface. There were two in the pink group *i.e. Rhodosporidium* sp. and *Geotrichum candidum,* which possess some capacity to ferment sugars. However, *Bullera crocea* (orange type) does not have this ability.

Mr Jayasundara (EO) started a training programme with the Kelaniya University aimed at enumerating all microbial contaminants in made tea, representing produce from the entire country. Already 30 samples have been completed.

Horse Hair Blight problem in the low country

PP/HHB/01/02 – Horse hair blight control trial using hydrated lime and fungicides, Silvery Estate (Pvt), Nagoda.

A repeat trial using hydrated lime, Champion (Cu), Tilt, Folicur (both systemic fungicides) and hydrated lime. Having pruned the required area, two rounds of spraying were completed.

A survey, covering a good proportion of the Galle district was initiated with the involvement of an undergraduate student from the Wayamba University in order to assess the extent, intensity and the factors that have contributed to the current situation. Already 50 fields have been covered.

PLANT PHYSIOLOGY DIVISION

1.Basic Research Projects

B 11-Studies on Photosynthesis and Dry Matter Partitioning

Partitioning of assimilates in relation to age of clonal tea in a pruning cycle, St Coombs Estate – (1992)

The objective of the above study was to determine the dry matter partitioned to different parts of mature tea in a pruning cycle. Two clones, TRI 2025 and DT1 were used for this study.

The yield in the first year was significantly lower than the rest of the years in the cycle probably due to higher assimilates partitioning for frame formation than to the growing shoots. There was no significant difference in yield among the second, third and fourth years of the cycle.

Effect of source capacity on shoot growth

A short term study was undertaken to investigate the effect of source capacity on the growth of shoots of TRI 2024 and DT1 under up-country conditions during March-July. This study demonstrated the importance of full mother leaf for healthy and vigourus shoot growth. The practical significance of this study is to maintain a healthy complete mother leaf for maximum productivity. The thermal time requirement was 380-390 day degrees.

2. Experiments on shade effects and shade trees

Due to frequent drought and climate change, there is rise in ambient air temperature. Therefore a new thrust on shade trees was identified (A34). Under this new thrust the following investigations were carried out:

2.1 An experiment was initiated to study the effect of the levels of sunlight on mature tea yield and quality at St Coombs Estate. The levels of sunlight tested are (1) full sunlight (2) 70% of the full sun light and (3) 30% of the full sunlight. Nylon netting is used to vary the sunlight level. There was no significant difference in yield between the treatments

2.2 Photoinhibition of photosynthesis in tea was investigated in relation to shade

2.3 Alternate shade tree species

2.3.1 A data base on the possible 56 shade tree species including indigenous and exotic varieties that can be used as alternate shade, was compiled based on canopy, leaf and root characteristics.

2.3.2 Growth and yield of tea under some tree species grown for shade in tea estates.

2.3.2.1 Plots containing approximately 30 plants around the shade trees were marked out. Plots with *Erythrina lithosperma* as the shade tree and unshaded plots also were marked as the control. Shoot growth and yield of these plots are monitored.

3. Project New 1(A33)-Identifying factors responsible for yield decline in mature tea

A new project was formulated to identify the factors responsible for defoliation, apical die-back and yield decline in mature tea. Under this new project, investigations were carried out on (1) High Forest problem and (2) Deniyaya problem. The High Forest and Deniyaya task forces were reactivated.

Two possible causes for the problem were identified as (1) stress and (2) diseases.

3.1.1 Examination of the plant samples for possible pathogens

Experiment 1

The Plant Clinic of the CABI Bio Sciences, UK, offered to examine and test samples from High Forest Estate for possible pathogens free of charge. Different parts of the affected plants and soil were sent to CABI Bio Sciences, UK for this purpose. However, according to the final report sent on 15 November, no fruiting bodies of *Phellinus noxious* were induced.

Glass house experiments with different extracts of xylem sap of affected bushes.

The xylem sap and different parts of the bush (stem bark, stem without bark, whole stem and roots) were extracted using different solvents, namely hexane, di-chloro methane and methanol, from affected and unaffected bushes from High Forest and Nuwara Eliya Estates. These extracts were separately mixed with autoclaved soil from St Coombs estate. One-year-old plants of the susceptible clone TRI 2025 and DN as non-susceptible clone were planted in these soils. In addition, fresh xylem sap, xylem+phloem sap was also mixed with soil as treatments (Annual Report, 2000).

No symptoms were developed in any of the plants for a period of 34 months, hence the experiment was terminated.

Experiment 2:

Xylem sap was poured on the young tea plants of the above two clones of same age after scraping the leaves, the stems and roots, without wounding the plants, and by direct injection of the sap to the stems. A control was left without adding the xylem sap.

No symptoms were developed in any of the plants for a period of 26 months, hence the experiment was terminated.

Experiment 3- Modification of microclimate in the field.

Part of the affected area in the TRI 2025 block in field no 18A of third division at High Forest estate was shaded with coir matting and the ground was thatched to minimise the 'insolation'. Further, temporary shading was given to the affected plants with coir mating. To alleviate water stress, plants in the affected area were watered at two weekly intervals during the dry weather. About 75% of the affected bushes had recovered. Harvesting was commenced on the recovered bushes in December 2001 and continued till July 2002. Shade trees, both Grevillea and Dadaps, were established. Vetiver was planted in between tea rows to break down the allelochemicals produced by tea roots during the stress. While planting the grass, it was observed that forking was not done properly in this area earlier and there were boulders 15-30cm below the soil surface.

Symptoms similar to High forest problem was also observed at Tangakelle Estate, Agarapatana. Similar alleviation measures were given to the part of the affected area.

4. Tea root physiology

Experiment 1:

Approximately one year old tea plants (clone DT1) were established in rhizotrons in order to study the physiology of the tea root system. The treatments included different organic manures and bulk densities.

Experiment 2:

Periodic samples were taken from the 'TRI-ORCON' organic vs inorganic field experiment, in order to study the root physiology of field grown tea. The root measurements were related with the shoot measurements and some soil properties.

Experiment 3:

Periodic samples were taken from the 'TRI-ORCON' organic vs inorganic field experiment, in order to study possible anatomical changes in roots of field grown tea with organic and inorganic treatments.

5. Studies on organic tea

Second year after the first pruning of the 'TRI-ORCON' organic vs inorganic field experiment was completed. The yield showed no significant difference between the treatments.

6. Studies on drought mitigation

An experiment was initiated to assess the drought stress effects on nursery plants after spraying of K, at the controlled environment facility, Crop Science Department, Faculty of Agriculture, University of Peradeniya. One clone each of a drought susceptible (TRI 2026) and drought tolerant (TRI 4046) were selected. KCl and K_2SO_4 were sprayed and the physiological changes monitored.

7. Effect of change in level of carbondioxide on physiological process and growth of tea

The objective of the study was to determine the effects of elevated CO_2 and three nitrogen levels on growth and some selected physiological processes in clonal tea in the nursery stage. The results of the study indicated that there is variation in response to CO2 rise depending on the clonal material.

8. Publications:

There were two international publications of research articles.

9. Root starch analysis

Approximately 175 root samples from the estates were analysed for the starch.

PLANT PROPAGATION AND BREEDING DIVISION

Highlights

- For the development of new clones 1043 genotypes were evaluated under different phases in different regions.
- Two clonal evaluation trials (one each of Phase I and II) were established.
- Cuttings of 23 promising bushes selected at Labukelle Estate were propagated in the nursery at Talawakelle
- Commenced monitoring the yield of the different seed stocks planted in the different regions
- Three micro seed gardens were established as a measure of broadening genetic base
- Two new nursery trials were initiated at the low country station
- Initiated another trial to compare the performance of mature bushes of seed stocks already available in estates, for use as seed cultivars.
- Major portion of the cuttings were issued to the ADB project
- An Advisory Circular on "The Suitability of Tea Clones for the Different Regions" was published

1. Thrust A 1 - Development of clones for the up-country

Project 1.1 Evaluation of clones for the up-country

1.1.1 Phase I and Phase II trials

Of the 523 genotypes evaluated under Phase I trial, 56 were found promising. Of the 73 genotypes evaluated under Phase II trial, 13 were found promising.

A new Phase I trial with 22 selections from Pedro was established in Field No.10 of St Coombs.

1.1.2 Phase III trails: Regional testing of clones

1.1.2.1 Evaluation of TRI 3000 and 4000 series clones in Venture Estate, Norwood

Yield of the above series of clones under organic conditions was monitored for the second year of the second cycle.

1.1.2.2 Evaluation of TRI 3000 and 4000 series clones in Luckyland Estate, Udapussellawa

Completed monitoring the yield of the above series of clones in the second cycle and the bushes were pruned. Observations were made on the recovery after pruning and the trial was terminated thereafter.

1.1.3 Selection

Twenty-three promising bushes selected from the seedling fields of Labukelle Estate were propagated in the nursery at TRI for further evaluation.

2. Thrust A 2 - Development of clones for the mid-country wet zone

Project 2.1 - Evaluation of clones for the mid-country wet zone

Regional evaluation of TRI 3000 and 4000 series clones in phase III trial at TSHDA, Sooriyagoda

The yields of the clones in the second cycle were monitored.

Death of bushes of clone TRI 4042 was noticed and this was reported to the Pathologist who found that the death was due to brown root disease and gave advise on the control, to the Manager, TSHDA.

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

Project 3.1 - Evaluation of clones for the mid-country semi-dry zone

The sixty-four genotypes under evaluation in Phase I and Phase II trials were brought into plucking and continued monitoring the yield.

4. Thrust A 4 - Development of clones for the low-country

Project: 4.1 - Evaluation of clones for the low country

The number of genotypes under evaluation in Phase I trial are 176 and all these were planted during 2000. The bushes are due for plucking soon.

A new Phase II trial with 29 genotypes was established. With these, the number of genotypes evaluated under the Phase II trials is 207. The yields of 101 genotypes in different trials were monitored.

5. Thrusts A 5 - A 8 Development of bi-clonal and polyclonal seed cultivars

Project A 5.1 Development of seed varieties for up country

Evaluation of seed stocks

The plants of the different seed socks were brought into plucking and the yields were monitored.

Project A 6.1 Development of seed varieties for mid-country

Evaluation of seed stocks
The plants in the trial with different seed stocks were brought into plucking and commenced recording the yield.

Micro seed garden
Majority of the plants in the two micro seed gardens established in the fields of Tea Small-holdings Development Authority, Hantane died due to the prevailing drought last year. Therefore, they were re-established with the same combination of parents (TRI 4053 x N 2 and TRI 4052 x TRI 3017).

Project A 7.1 Development of seed varieties for mid-country semi-dry zone

The plants in the trial with different seed stocks were brought into plucking and commenced recording the yields.

Project A 8.1 Development of seed varieties for low-country

Evaluation of seed stocks
The plants in the trial with different seed stocks were brought into plucking and commenced recording the yields.
Micro seed garden
A micro-seed garden in the form of crossing block was established at the low country station at
Ratnapura and the clonal combination planted is TRI 4053 x TRI 4071.

Two micro seed gardens with the following combinations were established at the Regional Station at Kottawa:

TRI 2022 x KEN 16/3 and TRI 4049 x TRI 3072

6. Other Experiments

6.1 Polyploid Breeding
Seventeen colchicine treated TRI 2027 plants were planted in the field (Field No. 9) with controls, to evaluate their field performances. These plants were

obtained from single nodal cuttings of shoots developed after colchcine treatment. Some morphological changes were already observable in the newly developed leaves of those plants.

Eleven single nodal cuttings obtained from colchicine treated TRI 4006 apical buds were propagated for further evaluation .

6.2. Mutation Breeding (*In vivo*)

Measures were taken to irradiate large number of single nodal cuttings of clone TRI 2025. Gamma dosage used was 4k. Attempts were also made to raise irradiated single nodal cuttings without the mother leaf. To accelerate root initiation, those cuttings were treated with "Rootone".

6.3 Nursery Trials

6.3.1 Up country

(a) Effect of different sizes of bags on the growth of cuttings

This trial was concluded and the data is being analysed.

(b) Comparison of TRI recommendation with that of Indian practice in the nursery

This trial was abandoned due to unavoidable reasons. However, the observations made in a similar trial carried out by Court Lodge Estate indicate that the plant growth was better with the TRI practice.

6.3.2 Low country

(a) Comparison of shoot and root growth of some TRI 3000 and 4000 series clones in the nursery

This trial was completed. It was observed that plants of clones TRI 4042, 4049 and 4053 grew better.

(b) Use of refuse tea as a partial soil substitute in low country tea nurseries

A trial was initiated to study the use of refuse tea as a partial soil substitute in the low country nursery.

(c) Easily available agricultural by products as partial soil substitute in low country tea nurseries where scavenging termite is active

A trial was initiated in collaboration with the Entomology Division to study the possibility of using easily available agricultural by products as partial soil substitutes in low country nurseries where scavenging termites are active in the soil.

6.4 Evaluation of the performance of seed stocks planted by the estates

Aislaby estate

Monitoring the yield of the (Aislaby) seed stock was continued at Aislaby Estate. In this trial yield of the mature seedlings is compared with that of clones grown in the same field.

Kiruwanaganga Estate

A trial to compare the performance of Aislaby seedlings with that of clones planted in the same field was initiated at Kiruwanaganga in Deniyaya.

7. Project D 1 - Use of *in vitro* techniques

7.1 Development of Embryo Rescue Technique

(a) Monitoring of fruit development to aid embryo rescue

Using clone TRI 2016, fruit and embryo development of open pollinated fruits have been completed up to 8 months after pollination. Illustrations were made using anatomical and morphological features of fruit, seed, embryo and endosperm characteristics.

(b) Immature embryos culture

It was possible to establish a culture protocol to raise whole plants from very immature embryos isolated from open pollinated seeds. The culture medium used was B5 basal medium supplemented with 0.5mg/l ABA and 0.5mg/l BAP.

7.2 Quantification of shoot multiplication rate

(a) Shoots derived from seed material

Majority of the cotyledons when cultured on MS medium supplemented with growth regulators produced somatic embryos instead of producing whole plants or shoots. Therefore, quantification of shoot multiplication using seed material could not be assessed as the medium was not suitable to produce shoots.

(b) Shoots derived from nodal stem explant

Measures were taken to quantify the number of shoots that can be initiated from stem nodal explants and to quantify multiplication rates at each culture passage. Studies could not be performed successfully owing to high contamination rate found in initial stem nodal cultures.

7.3 Callus Culture

Studies were undertaken to monitor the optimum sub-culture passage for stem derived callus for its better proliferation. It has been found that callus need to be transferred to the fresh medium at 6 week culture passage.

As callus proliferation of stem explants was not sufficient to initiate suspension cultures, cotyledons as well as in vitro leaf materials were selected as explants to obtain profuse callus production as an alternative measure. Cotyledons were cultured on MS medium supplemented with 2mg/l BAP + 1mg/l 2,4-D.

7.4 Anther Culture

Anthers taken from immature flower buds (size 5mm diameter) of TRI 2023 were cultured on two media: (1) half MS + 1mg/l 2,4-D + 0.5mg/l Kinetin
(2) half MS + 1mg/l 2,4-D

800 anthers were cultured in above two media and half of the cultures in each medium was maintained in dark and the other half in the light. Anthers maintained in the dark showed very compact and whitish callus whereas anthers in the light formed profuse and friable callus which may show regeneration capacity. No marked difference were found with regard to callus formation in two different media.

7.5 *In vitro* induction of mutants by gamma rays

A preliminary study was undertaken to measure the effect of physical mutegens (gamma rays) on *in vitro* shoots derived from seed material of TRI 2023. The gamma dosages used were 1, 3 and 6 Kr. Irradiated *in vitro* shoots were monitored continuously for their survival/ death as well as for any morphological changes. Percentage mortality of microshoots was 20, 30 and 50 percent at 2, 3 and 5 Kr treatment respectively and none in the control. Multiple shoot formation was observed only in a single *in vitro* shoot exposed at 3Kr.

8. Issue of cuttings

Issue of cuttings was continued in the up country and in the low country. Major portion of the cuttings was issued to the ADB project and the balance was issued to some estates and small holders.

9. Other Activities

9.1 Other Divisional Activities

One officer commenced attending the Advance Certificate Programme in Laboratory Technology at the Open University of Sri Lanka.

9.2 Visitors

The Chairman, Director and Scientists from UPASI visited the Division and had discussion with the staff. Other visitors include Students and staff of various Universities and Colleges and Planter trainees from various estates.

9.3 Workshops/ Seminars/ Training Programmes/ Meetings attended

One officer was awarded a fellowship by the Netherlands Fellowships Programme of the Netherlands
Minister for Development Co-operation and attended a 10 weeks programme on 'Plant Breeding Biotechnology and Seed technology'.

One officer was awarded a fellowship for a short-term training in India on 'Mutation Breeding' and another officer was awarded a Commonwealth Fellowship for a short-term training in India on 'Tea Plantation Management'.

9.4 Publications /Posters

One Advisory Circular and two papers were published while two papers were submitted for publication.

9.5 Training Programmes conducted

One undergraduate student carried out her project work in the Division and another student commenced her research leading to Ph.D, both under the supervision of Dr M.T.K.Gunasekare.

Three NDT trainees had their practical training in the Division.

9.6 Services

The staff at Talawakelle helped in the identification of clones in 4 estates and the staf at low country station helped in the identification of clones in two estates.

SOILS AND PLANT NUTRITION DIVISION

1. GENERAL

The research activities in the Soils and Plant Nutrition Division is directed towards establishing optimum nutrient quantities necessary for enhancing yields and made-tea quality, whilst minimising environmental degradation and hazards.

2. APPLIED RESEARCH

Thrust A15 Development of regional and site specific fertilizer recommendations for improvement of productivity and made tea quality.

Project A15.1 Characterization of soils in tea growing areas in Sri Lanka, down to soil series level.

A detailed description of the objectives, work, outcomes and publications reported in the Annual Reports of 1996 to 2001.

The field activities of the second phase, covering soils of the Intermediate zone, was completed and the book is in press.

Project A15.2 Estimating crop response to macro nutrients (N, K, Mg, S and P) at regional level.

A15.2.1 Fertilization experiments.

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

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) Clone PK2, Field No 15B, Court Lodge Estate, Kandapola - (1999)

Though a significant linear yield increase was seen in the 2nd year, no such increase was observed with increasing rates of N in the 3rd and 4th year. No significant effect has been seen so far with increasing rates of K and Mg. There was also no interaction between N & K, N & Mg and K & Mg.

As in the case of 2nd and 3rd years, the 4th year too (estimated in June 2002) showed a significant decrease in soil pH, at both 0-15 cm and 15-30 cm depths, with increasing rates of N. No soil pH change due to increasing rates of K or Mg. Soil K levels, increased significantly with increasing rates of K at both depths, even in the 4th year, but was not influenced by increasing rates of N and Mg. Soil Mg levels, at both depths, did not show any significant variation with increasing rates of N, K or Mg fertilizer till the last year. However, a significant decrease in Mg was seen in the current year in 0-15 cm depth with increasing rates of N and K; and an increase with increasing rates of Mg fertilizer (the latter also being evident at the 15-30 cm depth). These effects were more pronounced with increasing rates of N fertilizer.

Leaf N, K and Mg concentrations did not vary significantly from the previous year with either rate of N, K and Mg fertilizers. Leaf N, K, Mg and Ca concentrations, estimated in the current year showed a greater variation. Leaf N showed significant linear increase with N rates but K, Mg and Ca concentrations increased only up to the 2nd rate of N fertilizer and thereafter it decreased. The Mg concentration in soil also decreased with increasing rates of N fertilizer. With K fertiliser rates, N concentration did not change but K increased significantly while Mg and Ca decreased. In 0-30 cm depth, K increased with K fertilizer rates but Mg did not vary greatly.

With increasing rates of Mg fertilizer, only leaf Mg concentration increased significantly but N, K and Ca did not vary. The experiment continues.

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

So far no significant variation has been found on yield or soil pH with increasing rates of N, K or Mg. No significant variation was also found in any of the treatments at both depths even though it is known that soil pH decreases with increasing rates of N due to acidification caused by nitrification. Like in previous year, the soil pH in this year also did not show any significant variation at both depths. This is perhaps due to continued effect neutralization of acidity to a greater extent following the application of dolomite, in July 2002, at the rate of 2500 kg ha^{-1}.

As observed previously, there was a significant increase in soil K level with increasing rates of K at both depths, but with increasing rates of N, a decreasing trend exist although not significant unlike last year at both the depths. Soil Mg did not vary significantly with any of the treatments yet, however there was a trend in increasing level with Mg fertiliser rates. No interactions were found between increasing rates of N and K, N and Mg, and K and Mg.

As observed last year, with increasing rates of N fertilizer, leaf N concentration increased although it was not quite significant this year, while Mg and Ca concentrations decreased significantly but K did not vary despite a decrease in available K in the soil. With increasing rates of K and Mg, none of the leaf nutrient concentrations varied significantly, except for leaf K which increased with K fertilizer rates. Like in previous years, soil K also increased with increasing K rates. The experiment continues

3) Clone TRI 2027, Field No.8, Talgaswela Estate, Galle - (1999)
4) Clone TRI 2025, Field No.85, Houpe Estate, Kahawatte - (1999)
5) Clone TRI 2026, Field No. 4B, Lumbini Estate, Deniyaya - (1999)

The three experiments listed above showed no significant variation on fresh weight of pruning, base stem circumference, average circumference of secondary branches and tipping weight with increasing rates of any of the treatments. Soil and leaf samples obtained in September, April and November 2002 respectively, and the yield in the 1st year are being statistically analyzed. The experiment continues.

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

No significant variation was found on fresh pruning weight and average circumference of secondary branches with increasing rates of any of the treatments. As far as base stem circumference and tipping weight are concerned, indications were such that base stem circumference appeared to widen with increasing rates of N fertilizer while tipping weight decreased with increasing rates of K fertilizer. How ever, this needs confirmation at the next prune.

Soil and leaf samples obtained in May 2002, and the yield in the 1st year are being statistically analyzed. The experiment continues.

7) Clone TRI 2025, Field No. 23, Rangala Estate, Karaliyadda - (2002)

The experiment (appeared in Annual Report 2000 as A15.2.1.15 and in 2001 as A15.2.1 (a) 7) was terminated due to age and a mature tea field planted in 1995 and last pruned in July 2002 was chosen. Thereafter 81 plots, each consisting of 30 plants, were marked and a new experiment commenced in August 2002. Soil and leaf samples were obtained from the plots in September 2002 and are being analyzed for physico-chemical parameters. Dolomite was applied at the rate of 1500 kg ha^{-1} as the grand mean of pH in soil was 4.3. Stem circumference at 5 cm height from the base and circumference of secondary branches 2.5 cm below the pruned cut were measured. Secondary branches below the pruned

cut were labelled for future measurements. Results of soil and leaf samples obtained following treatment application in May 2002, and yield recorded during the 4th year (July 2001 to June 2002) are being analysed statistically. The experiment continues.

8) Clone TRI 2025, Field No NC5, Midland Estate, Ratthota - (2000)

Soil and leaf samples obtained in May 2002, and yield of the 4th year is being statistically analyzed. Dolomite applied at the rate of 1500 kg ha^{-1} as the grand mean of pH in soil was 4.4. Stem circumference at 5 cm height from the base and circumference of secondary branches 2.5 cm below the pruned cut were measured. Secondary branches below the pruned cut were labelled for future measurements. The experiment continues.

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

1) Rates: N - 100, 200, 300, 400 and 500 kg ha^{-1} yr^{-1}
K_2O - 100, 300 and 500 kg ha^{-1} yr^{-1}
Clone TRI 2025, St.James Estate, Hali Ela - (1990)

The data collected over the period of January to December 2002 are being analysed for soil physico-chemical properties, plant nutrients and statistical significance. This experiment continues.

2) Effects of split application of N and K fertilizer in mature tea in relation to N/K antagonism.
Clone TRI 2025, St.Coombs Estate, Talawakelle - (1990)

Total nutrient analysis of the pruned branches and the soil and leaf samples collected over 10 years (June 1990 to December 2000) continue to understand the overall effects. Analytical work continues.

3) 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 & 12 weeks
Clone TC9, Field No. 4B, Brunswick Estate, Maskeliya - (1998)

All the data collected during the previous cycle (January 1998 to end 2002) have been critically analysed and was to be presented at the 206th Experiments & Extension forum, to be held on 31st January 2003. This experiment continues.

c) Effects of application of different rates of K_2O at two levels of N as urea and sulphate of ammonia on growth, soil/plant nutrient status and yield.

1) Rates: K_2O - Six levels ranging from 60 to 360 kg ha^{-1} yr^{-1}
N - 240 and 360 kg ha^{-1} yr^{-1}
Clone TRI 2025, Halgolla Estate, Yatiyantota - (1984)

Total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 12 years (October 1984 to March 1996) continue to understand the overall effects. Analytical work continues.

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

1) Rates: N - Seven levels ranging from 0 to 720 kg ha^{-1} yr^{-1}
Compost - 0 and 5 t ha^{-1} yr^{-1}.
Clone DT1, Field No. 3, St.Coombs Estate, Talawakelle - (1992)

As observed in most of the years, yield in the 4th year of the cycle also showed a significant increase with increasing rates of N. Diminishing returns for N was seen until 450 kg N. However, in the 2nd year there was a linear pattern. So far, compost had no significant overall effect, nor was there an interaction. However, unlike earlier observations, data over the last two years did not show a difference in yield between compost and no compost treatments.

Although the pH levels determined in November 2000 and July 2001 did not clearly show variation with increasing N rates, this year's estimation showed that the level clearly decreased with increasing rates of N similar to the determination made in 1999. This occurred despite application of dolomitic limestone at the rate of 1500 kg ha^{-1} in August 1998.

Soil K levels, in general, are expected to drop when excessive nitrogen is applied to soil, but at this site, so far no such trends have been observed. The quantity of potash supplied for plots was 180 kg ha^{-1} except for nil N plots. Soil K levels in the nil N plots were, therefore, considerably lower compared to other treatments. As far as leaf N and K concentrations are concerned, no significant influences have so far been found with increasing rates of N fertilizer or compost application. This experiment continues.

2) Rates: N - 200, 400 and 600 kg ha^{-1} yr^{-1})
Compost - 0, 10, 20 and 30 t ha^{-1} yr^{-1})
Clone TRI 2025, Baddegama Estate, Baddegama - (2000)

This experiment appeared in the Annual Report for year 2000 (as A15.2.1.14 and in 2001 as A15.2.1 (d) 2). Due to heavy infestation of horsehair blight and the age, treatment effects were not seen and therefore it is to be terminated soon.

3) Rates: N - 200, 400 and 600 kg ha^{-1} yr^{-1})
Compost - 0, 10, 20 and 30 t ha^{-1} yr^{-1}
Clone TRI 2026, Anningkanda Estate, Deniyaya - (2001)

Data collected before and after imposing treatments, during the period January 2001 to December 2002, have been analyzed statistically and kept as base information. The experiment continues.

e) Effects of application of different rates N as urea and sulphate of ammonia and their proportions (urea:S/A) on growth, soil/plant nutrient status and yield.

The following trials, vide 1 to 7, are being carried out as part of a post-graduate study on S nutrition with specific objectives, and detailed investigations are ongoing.

1) Rates: N as urea as well as S/A – 200 to 500 kg ha^{-1} yr^{-1}
Urea : SA ratio - 100-0, 75-25, 50-50, 25-75 and 0-100
Clone TRI 2025, Field No. 11& 13, St. Coombs Estate, Talawakelle (1979)

On an average, application of N at 360 kg ha^{-1} yr^{-1} gave 321 kg more crop than at 240 kg ha^{-1} yr^{-1}, which was in fact significantly different unlike the last year. During 1st and 2nd years of the previous cycle also, application of N at the higher rate gave more crop than the lower rate and this difference became significant only in the 3rd and 4th years. During this year as well, the effects of Urea:S/A proportions and its interaction on yield were not significant. After applying dolomite at the rate of 1500 kg ha^{-1}, at the time of pruning soil pH levels determined in the 2nd year, at both depths where N was applied at the rate of 360 kg ha^{-1} yr^{-1}, was lower compared to 240 N although not significant. This was in spite of the difference in the 1st year being significant. A trend in decreasing soil pH levels was observed even this year like in the initial phase of the previous cycle at both depths, as the proportion of S/A increased in Urea + S/A combinations although it was not statistically different. Determination made in the 1st year showed that it was significant particularly at the 0-15 cm depth. As has been observed, there was a significant linear reduction in soil sulphate as the proportion of urea increased in the combinations, at both depths. However, leaf sulphur concentrations were not yet affected either due to Urea + S/A combinations or N rates. This experiment continues as a long-term trial.

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

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

At sites 2 and 3 above, neither the fresh pruning weight nor the yield varied significantly with the increasing rates of N and application of N in different proportions of Urea:S/A. The experiment continues.

4) Clone TRI 2023 Field No.03, Mahaousa Estate, Madulkelle - (2001)

Although the yields are high it did not vary significantly even with the increasing rates of N. The experiment continues.

5) Clone TRI 2027 Field No. 7, Milakande Estate, Horana - (2001)

Yield recorded before and after imposing treatments, during the period October 2001 to end December 2002, have been analyzed statistically and kept as base information. The experiment continues.

6) Clone TRI 2026, Field No.13, Kiruwangange Estate, Deniyaya - (2001)

Yield recorded before and after imposing treatments, during the period February 2002 to end December 2002, have been analyzed statistically and kept as base information. The experiment continues.

7) Clone TRI 2025 Field No.3A, Dessford Estate, Nanu-oya - (2001)

Yields are being recorded during the immature phase and the experiment continues.

f) Effects of application of different sources of organic manure on improvement of soil organic matter, growth, soil/plant nutrient status and yield.

1) Clone TRI 2025, Bearwell Estate, Talawakelle - (1990)

Total nutrient analysis of pruned branches and, some soil and leaf samples collected over 10 years (December 1990 to April 2001) continue to understand the overall effects. Analytical work continues.

g) Effects of application of sul-po-mag and kieserite along with some of the commonly used fertilizer mixtures on growth, soil/plant nutrient status and yield.

1) Rates: Commonly used fertilizer mixtures at 240 and 360 kg ha^{-1} yr^{-1}
Clone TRI 2025, Kiruwanaganga Estate, Deniyaya - (1993)

Total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 06 years (June 1993 to August 1999) continue to understand the overall effects. Analytical work continues.

2) Rates: Commonly used fertilizer mixtures at 300 kg N ha^{-1} yr^{-1}, with and without dolomitic-limestone
Clone TRI 2025, Hopton Estate, Passara - (1993)

Total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 08 years (October 1993 to April 2001) continue to understand the overall effects. Analytical work continues.

3) Commonly used fertilizer mixtures at 2 levels of N 240 and 360 kg ha^{-1} yr^{-1}
Clone TRI 2025, Waltrim Estate, Talawakelle - (1994)

The 4th year yield in the last cycle, did not vary significantly with respect to application of N levels, despite having been significant last year. A notable difference yet exists between the two levels. In the 2nd year of this cycle also, there was a notable difference present. But in the 1st year it was marginal like in both the 1st and 2nd years of the previous cycle. In the 3rd and 4th years of the previous cycle, yields obtained at as N level of 360kg ha^{-1} yr^{-1} were significantly higher compared to 240. There were no significant differences between the other fertilizer treatments.

No significant differences were observed in pruning weights following the applications of treatments over an 8-year period. Investigations in this experiment are to be concluded with the completion of two pruning cycles following the recording of tipping weights in January 2003. The data collected over 2 pruning cycles are to be analyzed in detail for overall findings and also collectively with other investigations vide A15.2.1 (g) 1 and 2 above, where sul-po-mag, is being tested.

h) Effects of application of different rates of K and/or Mg on growth, soil/plant nutrient status and yield.

1) Rates: Kieserite - 0 to 75 kg MgO ha^{-1} yr^{-1} at 15 kg increments
Clone TRI 2025, Field No.5, St.Coombs Estate, Talawakelle - (1990)

Total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 10 years (December 1990 to November 2001) continue to understand the overall effects. Analytical work continues.

2) Rates: N at 240 kg ha^{-1} yr^{-1}
K_2O at levels from 48 to 480 kg ha^{-1} yr^{-1}
MgO at levels of 0 and 60 kg ha^{-1} yr^{-1} MgO)
Clone TRI 2025, Glenanore Estate, Haputale - (1990)

Total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 10 years (July 1990 to May 2001) continue to understand the overall effects. Analytical work continues.

i) Effects of application of different rates of P fertilizer on growth, soil/plant nutrient status and yield.

1) Rates: P as ERP at 0 to 120 kg P_2O_5 ha^{-1} yr^{-1} at 20 kg increments
Clone TRI 2025, St.Coombs Estate, Talawakelle - (1989)
2) Methods of application of P:(Broadcast and Incorporated
Clone TRI 2025, Walahanduwa Estate, Galle - (1994)

In the two experiments listed above the total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 10 years and 6 years (mid 1989 to April 1999; April 1994 to February 2001) respectively continue to understand the overall effects. Analytical work continues.

Project A15.3 Estimating crop response to micro nutrients (Zn, B, Mn etc.) at regional level

Micronutrients foliar feeds: Multiplez and Kiecite
Zinc Sulphate: Two solution combinations of 11kg Zn ha^{-1} yr^{1})

1) Clone TRI 2025 Field No.3B, St Coombs Estate, Talawakelle - (1999)
2) Clone TRI 2025 Field No.3, Baddegama Estate, Baddegama - (2000)
3) Clone TRI 2025 Madulkelle Estate, Madulkelle - (2000)
4) Clone TRI 2025 Greenwood Estate, Nawalapitiya - (2000)
5) Clone TRI 2025 Indola Estate, Deniyaya - (2000)

At site 1 basal soil fertilizations along with foliar fertilizations are being carried out. The rates of N and K_2O supplied are 300 and 150 kg ha^{-1} yr^{-1} respectively. Multiplex treated plots gave significantly higher yields when compared to the control. Both Zinc sulphate and Zinc sulphate along with commercial Epsom salt also gave significantly higher yields. Experiment will continue.

At site 2 investigation in this experiment was concluded with the completion of present cycle owing to death of plants. The data collected over March 2000 to end March 2002, following commencement, have been analyzed statistically.

At the above two sites (3&4) basal soil fertilizations along with foliar fertilizations are being carried out. The rate of N supplied is 320 kg ha^{-1} yr^{-1} from U709. So far, no significant variation in yield was found with foliar fertilisation treatments. The experiment will continue.

Basal soil fertilizations along with foliar fertilizations are being carried out. The rates of N and K_2O supplied are 320 and 100 kg ha^{-1} yr^{-1} respectively. No significant variation in yield has so far been found with foliar fertilisation of the different formulations. The experiment will continue.

Project A15.4 Evaluating effects of foliar application of macro and micronutrients on soil plant nutrient status, quality (biochemical parameters) and yield.

1) Foliar application of P at 0, 1, 2, 3 and 4% DAP and TSP
   Clones DT 1 and CY9, St.Coombs Estate, Talawakelle - (1992)
2) Foliar application of K at 2, 3 and 4% MOP and SOP
   a) Clone TRI 2025, Field No. 5, St.Coombs Estate, Talawakelle - (1999)
   b) Clone PK2, Field No. 13, Pedro Estate, Nuwara-Eliya - (2000)

In experiment 1 the optimum quantities of nutrients have been given by soil fertilisation. However, following the inclusion of TRI 2025 clone, no attempt was made during last year also for assessing made tea quality. Yield records were maintained and soil and plant nutrient status assessed with a view to undertaking quality assessments. This experiment continues.

The above two trials (2a & b) were terminated as results showed a wide variation in some measurable parameters which over-shadowed treatment effects.

Project A15.6 An islandwide survey on identifying factors affecting response to potash, K (and S).

Data have been collected from 19, 28, 4, 1, 2, 3, 2, 9, 7, 8 fields in the estates under WU1, WU2, WU3, WM1, WM3, WL1, WL4, IU1, IU2 and IM2 agro-ecological regions respectively. Collected soil and leaf samples are being analyzed for nutrient status, and other data are being organized for statistical analysis.

Thrust A16 Development of regional and site specific dolomitic limestone recommendations, for ameliorating soil acidity and enhancing soil productivity.

Project A16.4 Establishing dolomitic limestone requirements for better growth, soil/plant nutrient status and yield of mature plants different tea growing regions at soil-series levels.

1) Rates of dolomitic limestone : Increasing levels
Frequencies:Cycle, Mid cycle and yearly
Clone TC 9, Field No.4, St.Coombs Estate, Talawakelle - (1989)

The same results on yield were obtained as in the previous years, with frequencies of dolomitic limestone applications. There was no difference in yield between the control, 1,250 and 2,500 kg ha^{-1} at any frequencies. However, a significantly linear decrease in yield was seen with increasing rates of dolomitic limestone beyond 2,500 kg ha^{-1}, with considerably lower yields being recorded at the 5,000 kg ha^{-1} (at all three frequencies) and 10000 kg ha^{-1} (at cycle and mid-cycle frequencies). No interactions were found between rates and frequencies of application.

Total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 10 years continue, with a view to understand the overall effects. This experiment is in progress.

2) Clone TRI 2025, Field No.2, Moragolla Estate, Imaduwa - (1990)

Total nutrient analysis of the pruned branches and, some soil and leaf samples collected over 10 years continue, with a view to understanding the overall effects along with the St Coombs trial vide A16.4 (1) and also to draw final conclusions collectively. Analytical work continues.

3) Effects of different particle sizes of applied dolomitic-limestone fertilizer on soil pH, soil/plant Mg status and yield of tea.
   a) Clone TRI 2023, field No 4, Mattakelle Estate, Talawakelle - (1991)
   b) Clone TRI 2025, Field No 5, Talangaha Estate, Nakiyadeniya - (1991)

Two 10-year field trials testing different particle sizes of dolomitic limestone on amelioration of soil pH, showed no difference in yield, pH and the available Mg levels in soil for different particle sizes.

Thrust A17 Development of fertilizer and/or dolomite applicators for improving broadcasting efficacy and to overcome labour shortage

Project A17.1 Evaluating and improving the efficiency of fertilizer applicators

Shortcomings and inefficiencies in manual fertilizer application have been identified as uneven distribution of fertilizers and dolomite over the surface of the soil in mature tea fields and inability of giving the required amount of fertilizer (T200 and T750) per plant in immature fields.

Imported Swiss Max hand operated applicator and Kaaz motorized applicator have been tested and evaluated for its suitability of use in the tea industry of Sri Lanka. Uneven distribution of fertilizer, inability to give required amounts by hand operated applicators and high rate of fertilizer release as well as high rate of airflow in the motorized applicator have been identified as problems. Creation of typical dome and clogging specially with urea based tea fertilizer mixtures, were the common problems in both applicators. The reason for uneven release to the discharging tube is primarily due to the obstruction for fertilizer granules above the opening by forming a dome.

Friction angle (on different surfaces), repose angle and shear strength that intervened with free flowing of fresh samples have been determined for different tea fertilizer mixtures and their ingredients. As existing mechanisms in the imported applicators failed several possible mechanisms for smooth release of fertilizers have been evaluated viz. vibrating mechanism, auger mechanism, scraping mechanism. At the same time different shapes of hoppers have been evaluated. Modifications continue.

3. BASIC RESEARCH

1) Fate of long-term application of ERP fertilizer in acid tea soils

Soil samples were collected from a long-term (40 years) on-going field trail using NPK fertilizer located at St. Coombs, Talawekelle. The treatments are 3 levels of NPK in a factorial combination. Representative soil and leaf samples were analyzed to understand the fate of long term application of Eppawela Rock Phosphate (ERP) in soil.

Increasing rates of N had increased the acidification of soil. Irrespective of the level of N applied to the soil, the application of increasing levels ERP fertilizer has increased the soil pH. The consumption of soil acidity for the dissolution of phosphate rock was the reason for increase in soil pH.

The P-fractionation revealed that increasing levels of long-term ERP application had increased resin–P, NaOH-P_i and NaOH-P_o in the soil. Majority of applied

ERP was recovered as NaOH-P_i and NaOH-P_o in the soil. The concentration of resin-P and residual-P fractions were low compared to the other P fractions. The H_2SO_4-P fraction was rather undetectable. This proved that there was sufficient acidity to make the applied EPR dissolve completely in the soil.

2) Effect of mixing compost on the dissolution ERP in organic tea soils

The application of ERP and compost as natural sources of nutrients is usual practice in organic tea growing. However the work on ERP dissolution in organic tea soils in the presence of compost was not studied adequately. Therefore this study is to understand the fate of ERP in organic tea soils.

Soil were collected from Stassen Bio Tea Project at Haputale and treated with ERP at 0, 15, 30 and 45 kg P ha^{-1} and compost at 0, 10, 20 and 30 mt ha^{-1}. The treatments were replicated 4 times and arranged in complete randomized design in a glasshouse at the TRI, Talawakelle.

The study showed that the application of ERP and compost increased soil pH. The concentration of exchangeable Ca and Mg in the soil increased with time due to mineralization of organic matter in compost and release of Ca in the dissolution of ERP in the soil. The P-fractionation revealed that the applied P was recovered as resin-P, NaOH-P_i and NaOH-P_o and H_2SO_4-P.

3) Use of dolomite for amelioration of soil acidity in tea nursery soil

Soil reaction (pH) plays a dominant role on growth of plants in the nursery. Scarcity of soil with suitable pH is a problem in Sri Lanka in producing planting materials of good quality. The quantity of dolomite to be mixed with soil depends on many factors, however, no work has been reported to this effect.

An incubation study was conducted at TRI laboratory, Walahanduwa using soils collected from a tea estate at Galle. Dolomite was applied at increasing rates to the soil. A control treatment was also included and replicated 5 times. The soil pH reached a maximum when dolomite was applied at the rate of 5 g kg^{-1} of soil. Dolomite application beyond a rate of 5 g kg^{-1} of soil increased soil pH beyond the desirable range for tea plants. The increasing rates of dolomite also increased Ex. Ca and Mg in the soil. Increasing rates of dolomite decreased the borax extractable P in the soil. However the validity of the results lies with in the limits of the trial. Further investigations are needed using different types of soils.

4) Evaluating soil test methods for assessing bio-availability of sulphur.

A glasshouse experiment was commenced in June, using 6 soils representing different soil series under different agro-ecological regions viz WU1, WM3, WL1, WL2, WM1 and IU3 from locations Dessford, Mahaousa, Talgaswela, Millakande, Kiruwanaganga and Ury estates. The soils were sieved through a 6.4 riddle and 4kg of moist soil was weighed and treated with wettable S at different rates viz 0, 20, 40, 60, 80 & 100 kg S ha^{-1}. Wettable S treated soils were put into pots of 5 L volume and replicated 6 times. Thereafter, 04-month old VP tea plant (TRI 4052) was transplanted in each pot in June. Applications of basal nutrients containing NPK and Mg were made. First batch of 108 pots, were dismantled in December and fresh and dry weight of shoots and roots were recorded. Soils and leaf samples are being analysed for necessary parameters, and work continues.

B15 Environmental studies

B15.1 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.

Rainwater quality monitoring continued in collaboration with the meteorological centers of the TRI stations at Talawakelle, Ratnapura, Hantane, Passara, Kottawa and Deniyaya. Parameters such as rainfall, in situ pH, NO_3-N, SO_4-S, Mg and Ca are being monitored.

The data collected during March 1999 to April 2002 have been analysed for variance and its interpretation and work continue.

4. SUPPORTIVE PROJECTS

1) Adaptive fertilizer trials

a) TRI and TSHDA collaboration

Detailed descriptions of the trials along with the objective/s and some of important findings have been given in the Annual Reports 1996 to 1999. The results obtained from the trials collected over a period of about 4 to 6 years, are being analyzed in detail collectively in order to draw final conclusions. Operations of some of these trials still continue.

b) TRI, and Balangoda and Madulsima Plantations collaboration - 2002

High (U877) and low potash (U709) mixtures on the soil/plant nutrient status, growth and yield in seedling and clonal tea (El Teb, Mahadowa, Wewessa, Telbedde, Kew, Kirkoswald, Cecilton, Balangoda and Gonakelle Estate)

Either a single or two mature tea field/s was chosen from each estate and thereafter 4 to 24 plots, each consisting of 50 plants having a minimum of two replicate, were marked during the period of May to September 2002. Soil and leaf samples were obtained from each of these trials and analyzed for required physico-chemical parameters. Pretreatment yield was recorded for a period of 2 to 3 months except for Mahadowa estate, where a pruned field was chosen. Thereafter, fertilizer treatments, having ratio of N: K_2O of 1:1 and 2:1 have been carried out. Regularly harvested crop yields are being recorded. These experiments continue.

Thrust A18 Development of regional analytical laboratories for soil, plant and fertilizer analysis.

1) **Analytical laboratory service**
The total number of elements analysed for advisory purpose at Talawakelle, Walahanduwa and Hantane laboratories are 12503, 7265 and 100 respectively.

The maximum, minimum and mean values of soil pH carried out at Talawakelle, Walahanduwa and Hantane laboratories at the WU1, WU2, IU1, IU2, IU3, WM1, WM2,WM3,IM2, IM3, WL1, WL2 and WL4 agro-ecological zones are 6.9, 3.7,4.8; 7.4, 3.8, 4.7; 4.8, 3.5, 4.1; 6.7, 3.4, 4.7; 6.0, 4.0,4.7; 7.1, 4.1, 4.9; 5.4, 4.3, 4.9; 6.8, 3.9, 4.7; 6.6, 3.9, 4.6; 5.9, 3.8, 4.7; 5.9, 3.8, 4.6; 7.7, 3.8, 5.3 and 5.3, 3.7, 5.1 respectively. Soil organic carbon in WU1, WU2, IU1, IU2, IU3, WM1, WM2,WM3,IM2, IM3, WL1, and WL2 agro-ecological zones are 4.3, 0.92. 2.15; 10.8, 0.40, 2.45; 2.1, 0.83, 1.67; 5.7, 0.53, 2.25; 6.6, 0.40, 2.05; 1.5, 0.25, 0.91; 4.5, 0.76, 1.60; 4.9, 0.30, 1.48, 4.9, 0.91, 2.40; 3.8, 0.85, 2.15; 2.3, 0.65, 1.35; and 2.8, 1.0, 2.0 respectively.

2) Analytical laboratory accreditation

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

GENERAL

Mr R G A Wijayawardhana successfully completed his course work studies in October on Environmental Science at the PGIS, University of Peradeniya.

TECHNOLOGY DIVISION

Computer model for drawing a rolling program

The staff developed a simple computer model to select rolling programs in black tea processing during the year 2001. Application of this model in tea factories was demonstrated at the Experiments and Extension Forum held in February. The Tea Research Board granted officers involved in developing this model two merit increments in recognition of their contribution. The Tea Research Board also decided to make this model available to the end users free of charge, as it is expected to improve the quality of tea produced.

Introduction of this model to tea factories was selected as an activity under the **"Hundred day - Revolutionary Program"** proposed by the new Government for implementation in year 2002. As such the entire staff strength was deployed in installing this program in as many factories as possible, during the first four months of the year. In factories where there were no computers, information on machinery was requested through a questionnaire, and appropriate rolling programs were drawn and posted. The progress on this activity could be summarized as follows:

No. of factories visited	- 125
No. of factories where the program was installed	- 106
No of questionnaires posted	- 400
No. of replies received	- 131
No. of factories to which rolling programs were posted	- 131

Subsequently, this program was distributed in compact disks for use by the stakeholders. Adopting this program will ensure made tea quality and the efficient use of machinery.

Applied Projects

Thrust No 25:

Project A 25.1 - Reduction of cost of electrical energy in withering, using speed controllers

Monitoring the performance of the speed controllers installed to 100' troughs continued. During the trials, the relative humidity of the air supplied and the dry bulb temperature were maintained at comparable levels in both troughs, as far as possible.

Statistical analysis of data indicates a saving of about 39% on energy consumed due to speed controllers. Variation in moisture content of withered leaf was not significant in the experimental trough compared to control. Results were presented at the Experiment and Extension Forum held on 31 July. However, during the experiment harmonics in power supply was observed. Hence it is compulsory to use harmonic filters with speed controllers to prevent/minimize damage to the capacitors/capacitor banks.

In addition to this, several variable speed drives, supplied by different firms were tested in commercial bought leaf factories. Some of these units gave similar results compared to the unit tested by TRI, where as the performance of some other units was poor.

During the period under review, four units consisting of light-weight fans and lesser horse-power motors with speed controllers were fitted to four 60' length troughs at St Coombs factory, and their performances were monitored.

Thrust No: 26
Project A 26.1 - Developing and evaluating solar energy techniques for tea drying

During the year under review, data could not be collected due to breakdown of the booster fan, coupled to this system.

Thrust No: 27
Project A 27.1 - Evaluating new type of paper sacks

The aim of this project is to recommend new packing materials with good moisture barrier properties and without any foreign odour. During the period under review, paper sacks from a new manufacturer was received for testing. The experiment is in progress.

Thrust No 28:
Project A 28.1 - Optimum condition for best grade mix in Hatton District
Project A 28.2 - Optimum condition for best grade mix in Uva

Although there is no demand for ortho-CTC tea from Hatton district, there is enthusiasm from plantations in Uva district to improve the grade mix during the off-season, as the teas produced during this season do not fetch good prices. As such, some preliminary work was carried out at TRI to establish optimum conditions, such as ideal wither percentage, gap setting etc. Environmentally Controlled Miniature Manufacturing Unit procured from Tea craft (UK) Ltd.,

was used in these trials. El-Teb estate from Uva district has been identified to carry out trials in that area. Trials will commence in January 2003

Basic Projects

B 41 - Identification of TRI 3000 and 4000 series clones for better CTC manufacture

No new clones were tested during the period under review.

B 48 - Designing a Dust Collector

At tea factories, dust coming out during drying operation creates an unpleasant environment for the officers and workers inside the factory premises. In addition to that installation of electronic items such as humidity sensors was found to be difficult inside the factories. It is therefore, intended to design a dust-collecting system in order to remove dust from the factory. The systems that are already installed at factories are not promising. It has been decided to improve the system through proper design.

Through a collaborative project with the University of Moratuwa, a fair amount of data on particle size distribution in the blow out from the drier, density of such particles, velocity of the exhaust air etc was collected. Using these data, a pilot scale unit was fabricated and tested. This unit will be tested for its performance and design improved for commercialization.

Divisional Projects

D 31 - Computer Aided Tea Manufacture

A project was initiated to check the feasibility of using load cells to monitor the withering process. A specially designed metal basket with 4 ft^2 area was placed on the middle of a trough, with a view to monitoring the loss of moisture during withering, at St.Coombs factory. Another four sided cage, to prevent leaf from outside touching the basket, was installed. A load cell with digital display to indicate the instantaneous weight of the leaf inside the basket, coupled to an un-interrupted power supply (UPS), was also installed.
The basket was fixed to the load cell in such a way as to record only the weight of the leaf in the basket. The following problems were encountered with preliminary trials:

(i) Due to the up lift of the airflow from the fan, the load cell indicated a lower figure than actual.

(ii) There was a severe air leak between the basket wall and the outside cage.

Initial trials showed that the leaf inside the basket was under-withered compared to leaf outside the basket, mainly due to air pockets created as described above. Attempts to seal the air leaks between the inner basket and the cage were not very successful and as such even withers could not be achieved. Thus it was concluded that load cells could not be used to control the withers and the project was terminated.

Testing new moisture meters

A compact, new type of moisture meter working on capacitance principle, was received for testing during the latter part of the year.

In addition to this, nine out of ten moisture meters received from estates were calibrated.

Though moisture determination by Infra Red Bulb method is very popular in tea factories, their calibration is cumbersome and the readings are not reliable when there is voltage fluctuation in the power supply.

Development of a moisture meter based on capacitance principle

Moisture meters based on the capacitance principle are used in the tea industry. However, with such meters, reproducibility is very poor. Through work carried out at the TRI in the past, a theoretical model for moisture measurement by the capacitance method was established.

But designing an instrument to measure the moisture content in all grades using this model was difficult, as the bulk density varies from one tea grade to another and one factory to another. Therefore, currently experiments are carried out, to devise a mechanism to make the equation independent of bulk density, by compressing a known weight of sample in a fixed volume. Although promising results were obtained for broken (small) grades, the results with leafy grades are not very encouraging. This is in progress.

Effect of type of manufacture on quality of tea produced

It is reported that the teas produced in Up country do not have adequate flavour, compared to what was produced a decade ago. Out of many reasons for decline in such quality, certainly the type of processing carried out too plays a major role. It is known that, since of late, the tea leaf is subjected to severe maceration

in 8" diameter rotorvanes compared to gentle rolling in orthodox rollers. The objective of this study is to compare the effect of different types of rolling on made tea quality, with special emphasis on flavour.

The clone selected for the study was DT1. Field No.3 and Field No.5 of St.Coombs Estate have been reserved and the required quantity of leaf is obtained for the experiment. The leaf was plucked, transported carefully to the factory and manufactured using pure orthodox and orthodox -rotorvane types of manufacture. The made tea samples were tested for quality parameters, including flavour profile. Made tea samples were also sent to professional tea tasters for organoleptic evaluation. Six replicates were conducted during the year. More replicates will be conducted in the coming year.

Outturn Made tea to green leaf in up-country region:

Keegel, in 1955 suggested an average nett out-turn of made tea to green leaf of 22.22% throughout the year. This figure was arrived at by monitoring the nett outturn recorded daily at St.Coombs factory, over a period of one year mostly using seedling leaf. Since the 1960s,tea production in the country has increased mainly due to the proliferation of small-holdings and planting of vegetatively propagated tea.

Commercial scale experiments were carried out using estate leaf to determine the nett outturn achievable in the Up-country and a correlation between nett outturn of made tea to green leaf and moisture content in green leaf, was established as follows:

$$NOT = 111.75 - 1.17 \times MC.$$

Where: NOT – Nett outturn of made tea/green leaf, MC – Moisture content in green leaf

These results were presented at the 205th Experiments and Extension forum held in July and also at the Uva Regional Scientific Committee meeting in September. Validity of the results is being checked using actual data obtained at St.Coombs and Mattakelle tea factories.

Shear plucking Vs Hand plucking Experiment at St Clair Estate

The effect of using TRI Selective Tea Harvester on yield and made tea quality was studied. Experiments were conducted at St.Clair Estate as well as in Technology Division of the TRI. Plots were demarcated for two popular clones TRI 2025 and K145 and seedling teas. Shear and manual plucking were carried

out in randomly selected plots. Yield data from the plots were recorded. The leaf harvested was transported to TRI, manufactured and made tea samples were tested for quality parameters. Tea samples were also sent to professional tasters for organoleptic evaluation. Results from 21 replicates indicate that there is neither significant yield differences nor significant variation in quality parameters between the two treatments.

ISO 9002 certification for tea processing at St.Coombs tea factory

St.Coombs tea factory was awarded the ISO 9002 certification for tea processing by SLSI. The effective date of certification is 20th of May 2002. Under this programme several internal audit programs were carried out by the staff at St.Coombs factory. The officers from the Division and the factory followed several training programmes related to ISO 9000 Quality System, Hazard Analysis and Critical Control Points (HACCP), 5 'S' etc conducted by SLSI and assisted the factory staff in implementing the ISO 9002 certification system.

Development of a Sand Separator

As reported in last three years the cleaning of sand/grit from tea is satisfactory. However, during the year under review, frequent breakdown of this machine was observed, due to poor quality raw material (such as aluminum pulley) used. It was decided to fabricate a commercial scale unit using good quality raw materials.

ISO 11286 Tea - Classification of leafy grades by particle size analysis

Based on a recommendation adopted last year, more true to type samples from St Joachim Estate are being analyzed. The work is in progress.

Determination moisture content and weight percentages of each component of the tea leaf

Objective of this experiment is to check the impact of different parts of the shoots on made tea to green leaf outturn. Shoots from different clones were harvested and the weight percentage and the moisture content of each part of the plucked shoots were determined separately during wet and dry days. This is in progress.

Shear plucking Vs Hand plucking Experiment at St Joachim Estate

No trials were carried out under this project as the miniature/experimental rollers were sent for repairs/modifications.

Collaborative projects with National Engineering Research and Development (NERD) Center

The staff had a few discussions with officials from National Engineering and Development Centre (NERD) with a view to identifying collaborative projects. Areas for collaboration identified are as follows:

i. Micro-controller application in tea withering process
ii. Generation of Biogas and bio-fertilizer manufacture from refuse tea
iii. Design and development of efficient cost effective waste heat recovery system

1. Micro controller application in tea withering process

Withering process is the first unit operation in tea manufacture. The control of wither in leaf received at different hours every day is a difficult task in most of the factories and as a result a fair amount of energy is wasted. It was decided to incorporate control system to withering trough in order to facilitate better control of wither and to reduce the energy consumption in this process.

The details of the process and the possible control system to withering trough have been discussed with the Engineers attached to National Engineering Research and Development (NERD) center, with a view to commencing a collaborative project. NERD has made arrangements to purchase auxiliary items required for the project and develop software for the system.

2. Biogas and Bio-fertilizer manufacture from refuse tea.

The refuse tea produced in tea factories is decomposed and applied as fertilizer in the tea fields. These teas could be used to produce bio gas and converted as a fertilizer by **anaerobic digestion**. This process can be made as a cottage industry, where the estate people could be given the task of producing bio-gas for their cooking and lighting purposes in their households. Initially to demonstrate viability of such a system, preliminary trials are carried out using refuse tea from St Coombs at NERD with the digesters already prepared. On successful completion of the trials, the system could be used in estates. It is to be noted that the results from past research on biogas production conducted by TRI using **aerobic digestion** were not very successful.

3. Design and development of efficient, cost effective waste heat recovery system

Thermal energy is required to produce hot air for drying and withering processes in tea factories. In the production of hot air, considerable energy is lost in the flue gas from furnace/ heat exchangers. Some of this heat could be recovered

and thereby fuel consumption in the processes could be reduced. Although several designs of waste heat recovery units were suggested, the installation of such units did not gain momentum primarily due to high capital cost.

A gravity assisted heat pipe heat exchanger has been designed. This unit will be fabricated and developed to recover the heat.

4. Energy Audit

The staff was also involved in an energy audit (thermal and electrical) carried out by NERD officials at St Joachim factory, Ratnapura. Several areas for improvement were identified. Action has been taken to improve those areas and to repeat the audit again to work out the savings.

Monitoring the standard of leaf at St. Coombs Factory

It is a well-established fact, that to produce good quality tea, the percentage of good leaf should be above 65% good leaf (on count basis) or 80% on weight basis, as per recommendation of the Institute. The standard of green leaves coming to St. Coombs factory was monitored twice a week. Leaf was obtained from two Divisions, St. Coombs and Lamilliere, and the leaf samples were tested according to the following method:

After spreading the leaf, samples of approximately 100 g of leaves were collected at every 10 feet length along the trough randomly, after spreading the leaves on the trough separately. The respective samples were bulked and 250g samples taken to monitor the leaf standard. The leaves were divided as standard and sub-standard leaf.

The acceptable standard of leaf should be about 65% (minimum) good leaf (on count basis) or 80% on weight basis, to produce good quality tea. However, the standard of leaf from St Coombs as well as Lamiliere was very poor, on weight basis, throughout the year.

4.0 General

4.1 Achievements:

The collaborative study on "Conservation of electrical energy in trough withering" won the Sri Lanka Energy Managers Association (SLEMA) Award as the best energy related study during the year 2002. The award was received by Dr M T Ziyad Mohamed and Mr G Galahitiyawa, the two officers from TRI involved in this project, along with collaborating scientists from Energy Conservation Fund.

4.2 Brain storming session on quality of tea produced

A brain storming session on "quality of tea produced in Sri Lanka" was organized on 14 November. Based on deliberations a concept paper on quality of tea produced with a view to preparing a policy document on tea processing was prepared and circulated to all stakeholders.

4.3 Publications/ Paper presentations:

The Divisional staff published 10 articels during the period udner review

4.4 Advisory Reports

During the period under review, the members of the Technology Division at Talawakelle and Ratnapura made 60 and 53 advisory visits respectively. These exclude the seminars and the Factory Officer training programs conducted and coordinated by NIPM.

Number of samples received for moisture determination from estates/factories was 484. Divisional staff calibrated nine moisture meters received from commercial factories.

AGRICULTURAL ECONOMICS DIVISION

1. Applied Research

Thrust A 31. Identification of appropriate labour use pattern to improve profitability in plantations.

This thrust was revised to study the problem of labour scarcity in all tea growing regions and it was decided to study the situation in Uva, Mid country and Kalutara, Ratnapura & Kegalle districts of the Low country. Due to inadequacy of staff, this study was not continued and it is planned to continue this study in the year 2003.

Thrust A 35. Development of Financial Support System for soil rehabilitation and conservation in tea estates.

A research proposal has been forwarded to South Asian Network for Development and Environmental Economics (SANDEE) for their comments and consideration for funding.

Thrust A 36. Assessment of vulnerability, impact and adaptation to climate change in the Tea Industry of Sri Lanka

In the divisional research programe, it was proposed to undertake a study to assess the drought damage in tea using GIS and Remote Sensing techniques. This was integrated with climatic change impact assessment study of the Tea Research Institute, which is undertaken in collaboration with the Sri Lanka Association for Advancement of Science (SLAAS), Meteorological Department of Sri Lanka and the Coconut Research Institute.

Collection of primary data is complete in the up country. Data Analysis and data collection in the other locations will be continued.

2. Basic Research:

Project B1 - Establishment and maintenance of micro level tea information system in Geographic Information System (GIS)

Activity 1: Development of a tea area overview map in GIS

Computing estate information was continued in collaboration with the Council for Agricultural Research Policy.

Activity 2: Estate mapping for GIS:

Two undergraduate students of Surveying Department, University of Sabaragamuwa started a project to develop GIS Maps using Global Positioning System (GPS). The objective of this project is to estimate the cost and time requirement for developing an estate map in GIS. Suitable area is selected in St.Coombs estate to undertake mapping. Necessary steps have been taken to purchase a suitable GPS instrument for the Institute.

Project B 56. Estimating the variation of yield according to elevation, slope and aspects in tea fields.

Project B 57. Estimating tea canopy characteristic using spectral analysis

Both of the above projects were not undertaken due to lack of staff. The staff member who was trained on GIS technology has left the service of the Institute and all GIS related project activities were affected. Capital expenditure estimated for the above two projects were also not utilized due to the same reason.

B 5 Estimation of cost of tea cultivation

A manual on " Cost of tea cultivation; from nursery to the field " was written and published. Writing the same manual in sinhala, incorporating smallholder sector information was commenced.

3. Divisional Projects / Activities

D 35.1 Tea Information

National and International tea data collection and computation was continued. National and International statistics of tea industry was provided to be published in the diary of the Tea Research Institute, for the year 2003.

D 35.2 Project Monitoring Activities

1. In September 2002, this Division was given the responsibility of coordinating the INFORM Database for the National Agricultural System. Annual information on research projects and scientists were collected and computed. Ms. H.W.Shyamalie participated at a two-day workshop held by the CARP for this purpose.

2. A format was prepared to report to the Tea Research Board, the progress of research programs.

3. Annual reviewing system for Applied Research Thrusts was initiated and a schedule was prepared to complete the exercise within the first two months of the year 2003.

D 35.3 Tea Policy Document

A concept paper on tea cultivation aspects was compiled for "The Tea Policy Document" is to be prepared by the Ministry of Plantation Industries (MPI) and the concept paper was discussed at the Tea sector Review meeting held in the MPI in November 2002. A concept paper on tea processing and marketing aspects was also complied jointly with the Deputy Director Research (Technology). The first draft is completed and circulated among the scientists and stakeholders for comments.

ADVISORY & EXTENSION SERVICES

1. General

The activities undertaken by the Advisory & Extension Services through its centres at Talawakelle, Ratnapura, Hantane, Passara, Kottawa and Deniyaya are summarized below:

1.1 Advisory Correspondence

A total of 2,338 letters were sent out to plantations, Regional Plantation Companies, private estates, small holders and others on problem solving, preparation of development programs, land selection for replanting, general information on tea and Other matters.

1.2. Advisory Visits

A total of 558 visits were made to company managed plantations, private estates and small holdings. These visits were largely made as and when requests were made for problem solving purpose on all aspects of tea cultivation and plantation management. A certain number of Extension Visits were also made to estates and small holdings for evaluating and monitoring clonal blocks of the new-release clones and fertilizer demonstration trials, as well as for carrying out surveys on aspects such as Shear harvesting and fertilizer/dolomite use in small holdings.

1.3. Training Programs

A total of 559 training programs, seminars, group discussions, field days, demonstrations, education/familiarization programs were conducted. Field demonstrations were also conducted for small holders on cultural practices like harvesting, nursery management etc. Training programs were conducted at the request of the NIPM in their various programs. Informal discussions were also held with tea growers visiting the Extension Centers.

1.4. Dissemination of Technology

A total of 3,201 Advisory/Extension publications, pamphlets and leaflets were distributed. Four booklets on Shear Harvesting, Pruning, Plucking and Nursery Management were prepared and printed. Five Advisory Circulars were revised and released, along with a new Circular on Land Suitability Guidelines. Several leaflets/guidelines were prepared for the use of small holders in the Uva district. Specially prepared video programs were also shown to tea growers and workers towards upgrading their knowledge status. Awareness programs were also

conducted for plantations staff, workers and small holders on harvesting skills, pest/disease management etc.

1.5. Commercial Nursery Inspections

About 331 commercial nurseries were inspected in small holdings and private estates under the Tea Nursery Plant Certification Program.

1.6. Soil Analysis

A total of 2,215 soil samples were analyzed for pH, soil carbon and their suitability for nursery work.

1.7. Sale of Planting Material

A total of 385,740 cuttings were issued to the growers from the Regional Centres.

1.8. Visitors

A total of 6,505 visitors to the TRI Extension Centres were handled. These included persons seeking tea information through informal discussions, as well as students on study tours for whom appropriate educational programs were arranged.

1.9. Regional Scientific Activities

Five Regional Scientific Seminars were organized for district plantation managerial staff at Kandy, Galle, Uva and Ratnapura regions. In addition the Advisory staff attended Provincial/District development meetings and represented the TRI at the various fora.

A summary of activities of the respective Advisory and Extension Centres are given in the table below:

No.	Description	T'kelle	R'pura	Passara	Kottawa	Hantane	Deniyaya	Total
01	Visitors to the Division: Estate/Students/Foreigners/ S'holders/Others	3265	1000	451	1114	314	361	6505
02	Advisory Correspondence to Estate/Small holders	596	808	130	290	233	281	2338
03	Advisory Visits (on call and routine visits) in problem solving Development Programs, Pruning, Manuring, Programs etc. to Cooperate sector & Small holder sector	136	136	40	68	138	40	558
04	Training: Training Programs/ Seminars, NIPM Programs, Group Discussions, Field Days, Demonstration, Educational Programs, Familiarization Programs	35	209	57	77	69	112	559
05	Issue of Publications, Leaflets, Extension Pamphlets	1003	1914	58	202	24		3201
06	Soil Samples tested for pH and C%		188	1133	323	461	110	2215
07	Issue of VP cuttings		138,500	1,665	69,625		170,950	385,740
08	Commercial Nursery Inspections.	6	18	140	31	106	30	331
09	Green Leaf Harvested (kg.)			7539	20674		10358	38571
10	Area Reserved (ha.)				02			02
11	Plants Infilled/Extent (ha.)				714			714
12	Other Activities-NIPM/ Meetings/Other Visits		50					50
13	Bags Prepared/Planted cuttings				30722			30722

2. Extension Activities under the Corporate Plan

Project 1: Adaptive Demonstration Trials

Total of 14 Adaptive trials are in progress in small holder lands in different locations on different types of fertilizer mixtures. Two nursery trials have also been commenced in Ratnapura and Hantane to study the seasonal effect on the growth of plants.

Project 2: Information Desk

Preparation of ready reckoners on regional estate data and weather is in progress. A website to display TRI information is also under preparation. Leaflets containing statistical information were prepared and printed.

Project 3: Upgrading Tea Museums and A.V. Saloons

Upgrading work on the tea museums is in progress at all the Regional Centres.

Project 4: Establishment of Clonal Mother Bush Blocks

Establishment of 54 ha of clonal mother bushes under ADB funding is in progress. Planting of 34 ha is completed at 4 extension centres and two TRI estates. Planting of the total extent will be completed in 2003.

Project 5: Monitoring Agricultural performance of Tea Plantations/Small holdings

Routine visits to estates and small holdings have commenced in some regions to monitor the adoption of agricultural practices and collection of field information.

Project 6: Production of Extension Material

Wall posters on pest management is nearing completion. Production of two video films on shade and weed management has been completed. A booklet on ' Control of Stem and Branch Canker' was prepared and is ready for printing. The Sinhala version of the leaflet on 'Tea Information' was completed. Ten video programs that were produced under assistance from the Plantation Reform Project were converted to CD format.

2. Special Assignments/Problems

1. The incidence of White Root Disease was seen to be increasing in the low country small holding sector due to the direct conversion of rubber lands into tea without soil rehabilitation. This problem is being studied.

2. A joint survey has been commenced with Soils and Plant Nutrition Division to study the use of high potash fertilizer in tea, and this is in progress.

MID-COUNTRY RESEARCH, ADVISORY & EXTENSION CENTRE KANDY

1. General:

Mrs.P.Marapana, Stenographer and Mrs.W.R.D.P.de Silva, Typist/Clerk were transferred to Hantane from Talawakele in July.

2. Hectarage as at 31st December 2002

Type of land use	ha
Seedling tea	2.00
VP tea (mature)	6.00
VP (young)	1.75
Mother bush	2.00
Nursery (tea)	0.20
Under mana grass	2.25
Fruit trees	0.40
Coconut	0.81
Forestry	1.20
Marshy land	0.62
Buildings, gardens, paths & roads	5.77
Total	**23.00**

3. CROP hrvested (kg)

Month	Crop harvested	Crop sold	Rate paid/kg Rs.cts	Total Rs.cts
January	2422	2413	14.33	34578.29
February	1533	1529	17.46	26696.34
March	1247	1245	17.46	21737.70
April	2471	2456	19.26	47302.56
May	1874	1868	19.26	35977.68
June	1196	1181	17.19	20301.39
July	975	969	14.61	14157.08
August	794	786	12.66	9950.76
September	1299	1287	12.79	16460.73
October	1287	1287	14.29	18391.23
November	1436	1436	14.29	20520.44
December	2029	2029	15.41	31266.89
Total	**18563**	**18486**		**297,341.09**

4. Income

No:of cuttings sold		785,645
Income from sale of cuttings	Rs	196,411.25
No:of VP plants sold		20
Income from sale of plants	Rs.	100.00
Total crop harvested (kg)		18486 kg
Income from sale of green leaf	Rs	297,341.09.
Guest House occupation charges	Rs.	22,325.00
Soil testing (pH) charges	Rs.	15,390.00
Sale of TRI publications	Rs.	6,770.00
Miscellaneous (Sale of pepper,cloves & trees)	Rs.	13,550.00
Total income	**Rs.**	**551,887.34**

TRI RESEARCH, ADVISORY AND EXTENSION CENTRE RATNAPURA

General

There were 25 technical and 17 administration staff based at this Station. They conducted research in agronomy, entomology, plant breeding and technology. Technical staff assisted staff of the Advisory and Extension Division at transferring technology to the plantation sector. Other research activities in the low country were serviced by staff from the head office.

Detailed reports of research, advisory and extension activities conducted by the staff of the station have been reported under the individual reports of the Agronomy, Entomology, Plant Breeding, Technology and Advisory and Extension Divisions.

Appointments, transfers, retirements and resignations

Mr.S.Wimaladharma, Head Advisory and Extension Services Division, retired from the services of the TRI with effect from 16th January 2002. He was reempl;oyed on contractual basis to serve in the same capacity and was based at this station. Mr.Muditha Jayathilaka, Technical Assistant, Entomology Division, and Mrs.H.K.Seetha, Accounts Clerk were transferred from Talawakelle and assumed duties at this station with .effect.from 10th June and 12th August, respectively. Mr.R.Nandasena, Station Assistant was transferred out, to TRI Advisory and Extension Centre, Passara w.e.f. 2nd September. Mr. K.W.K.Chaminda Driver, was transferred to TRI Advisory & Extension Centre, Deniyaya w.e.f. 03rd June and Mr. P.Rnaweera, Driver from head office took his place w.e.f. 08th April.

Training and Attending Conferences, Symposia

Miss.S.M.Samarasinghe, Research Officer, was granted permission to register at the PGIA to undertake a post-graduate study programmme leading to a PhD Degree.

Mr.J.S.K.de Silva, Electrician attended a short training in electrical maintenance conducted by the ICTAD, Colombo.

Seven apprentice trainees from Hardy Technical College, Ampara and School of Agriculture, Naiwala underwent on-the-job training in extension, agronomy and entomology, as part fulfillment of the requirements for the National Diploma in Technology (Agriculture).

Four apprentices commenced training in English Stenography, Accountancy and General Clerical work and one completed the training by the end of the year.

Mrs S.I.Vitarana participated at an International conference held in Thailand, to discuss the progress of research conducted on alternatives to methyl bromide used in the agricultural sector..

Meteorological Station

Mr.A.K.Prematunga, Experimental Officer, Entomology Division, maintained the weather records and the meteorological station under the supervision of Dr. M. A. Wijetatne, Agronomist at the Station. Weather Record have been published elsewhere, in this report.

TRI Low Country Station Expansion

Construction work on improvements to the Administration Block was completed, in November.

Construction work on the new Hostel Complex was nearing completion. Soil survey was carried out and a location was identified for new deep well to supply water to hostel complex.

Designing, drawings and tender documents were completed by Sri Lanka State Engineering Corporation, (construction consultants), for the proposed D-type Quarters, Circuit-bungalow, and a building complex for Auditorium, Plant Breeding Lab, hardware stores and workshops for Electrical and to the works supervisor.

Authority was granted by the United Nations Overseas Project Services to construct one Glass House, using funds of the Methyl Bromide Project and the tender document for this purpose was being prepared by the Resident Engineer, TRI.

Maintenance of Buildings, Roads and Water Supply

Renovation of the C-16 quarters and the Mechanical Workshop of the Technology Division were completed. Repairing the roof and gutters of C-1 was completed. Complete colour washing of B-1 and C-15 and roof painting of Technology Division, D-7 and D-8 ware completed. Painting of the roof of the office and laboratory premises, replacement of gutters, down pipes and repairs of the roof of the office and lab complex were completed. Repairs of main beams and pavements of D1,D2,D3 and D4 quarters were completed.

Replacing barbed wire fence around the boundaries of the TRI and new fencing around residential quarters was in progress.

Re-tarring of all internal roads commenced in December and was in progress.

Laying down of pipe lines to supply water to the administration building was completed.

The day to day maintenance of the buildings, roads etc was satisfactorily carried out.

Transport - Major Repairs

Tinkering and re-painting of Mitsubishi Pajero (32/3468) were completed. An engine overhaul of vehicle Mitsubishi Pajero ((32/1808) was in progress. Day-to-day maintenance of vehicles was carried out satisfactorily.

Electrical

Lay down of Aerial bundle-cable and re-wiring of mechanical workshop after renovations were completed. The day-to-day maintenance of electrical work was satisfactory.

Security Service

As pointed out on several occasions in the performance reports submitted to head office, the services rendered by the security force was very unsatisfactory. This has been so, even though there were sufficient security guards to cover the security points.

Constraints

As indicated in several performance review reports the staff strength both in the Administration and technical divisions was inadequate. Therefore, some officers continued to attend to additional duties.

LIBRARY

Collecting & disseminating information on tea and allied areas were carried out throughout the year.

The total number of the new accessions during the year was 37. The TRI subscribed to 42 journals, and about 21 journals were also received on a gift/ exchange basis.

The library continued its normal routine work such as classification, cataloguing , indexing , lending materials and also maintained a news clipping collection.

Inter-library loan activities continued satisfactorily. On request 28 articles were sent to various agricultural libraries while 26 articles were received for our users.

Ten literature surveys were done using CD-ROM database & Internet facilities available at the CARP.

The Library continued to maintain its relationship with AGRINET (Agricultural Information Network) with a view to resource sharing. About 73 journals content pages were received according to our user requirements and 370 content pages were forwarded to AGRINET Libraries on SDCP services. A further 31 articles were received from other Libraries & 74 articles were sent to other libraries through AGRINET.

In addition, reference services were made available to students, outside scientists etc., on request.

ST. COOMBS / LAMILIERE ESTATE

Field Works & Cultivation

Hectare Statement as at 31st December 2002

	Total
Old Seedling Tea in Bearing	11.60
V.P.Tea in Bearing	122.82
ADB Project	14.01
Nurseries	1.30
T R I Experimental Area	5.90
Labour Housing	1.09
Ravines & Grass Land	32.00
Buildings, Roads, Workers' Gardens etc.	48.98
TOTAl	**237.70**

Weather and Rainfall

A rainfall of 1,708.3 mm was recorded over 171 wet days as against 1,949.3 mm over 181 days in 2001.

Crop and Yield

	2002		2001	
	Crop (kg)	Yield (kg/ha)	Crop (kg)	Yield (kg/ha)
St.Coombs	183,869	2,043	168,219	1,828
Lamiliere	111,331	2,369	103,841	2,308
Total	295,200	-	272,060	1,986
Bought Leaf	-	-	8,369	-
Grand Total	295,200	2,155	280,429	1,986

The yield recorded in 2002 was the highest at 2,155 kg per ha.

Cultural Operations

Regular upkeep of the work was done during the year.

Field No. 14 – 1.68 ha. uprooted for ADB mother bush project.
1,493 Gravellia plants planted in field Nos. 6A in Lamiliere and 6A, 9, 10, 11,12 & 13 in St.Coombs.

Labour / Labour Accommodation

Re roofing was undertaken in St.Coombs Upper Division Line No.51 and Lamiliere Division Line Nos. 8, 13 & 16.

Workers went on strike in July for 3 days demanding profit share bonus and wages increase.

National Housing Development Authority Housing Project started in St.Coombs Upper Division Field 4 and Lower Division Field No.12 for 36 beneficiaries.

Nursery

88,230 plants of T.R.I. 3000 & 4000 series clones were raised in the estate nursery for the ADB Project and Infilling work for St.Coombs & Lamiliere.

Factory and Manufacture

Top Prices
Silver Tips tea sold in November – Rs.5,000.00

SLS ISO 9002 : 1994 for tea processing at St.Coombs Factory
Quality System Certificate was received. (QSC – 0164)

Factory road tarring work was in progress.

Factory workers rest room was completed.

General

Computerizing estate accounts is in progress.

Working Results

The loss for the year is Rs. 1,653,120.00 .

Support Staff

Mr.D.H.Jayatillake was appointed as Chief Clerk with effect from 15th October 1999 and letter of appointment to the effect was received on 27th August 2002.

Mr.P.A.Piyadasa , Driver was transferred to St.Joachim Estate with effect from 23rd September 2002.

TABLE 1

Working Results of St.Coombs / Lamiliere Estate for 2002 compared to previous years

Year	Total Crop kg (MT)	Bought Leaf (kg)	Yield (MT kg/ha.)	Net Sale Average Actual (Rs/kg)	Cost of Production		+ Profit Loss Rs.
					Estimated Rs/kg	Actual Rs/kg	
1997	279,718	104,319	1,915	120.30	85.79	99.49	+7,922,124.19
1998	218,264	35,063	1,509	152.85	102.76	119.10	-746,355.40
1999	266,001	13,872	1,840	121.60	94.95	116.14	-14,031,161.11
2000	288,058	-	2,036	148.50	103.29	115.74	+9,431,018.92
2001	272,060	8,369	1,986	160.00	108.31	130.00	+633,769.54
2002	295,200	-	2,155	141.18	118.78	146.78	-1,653,120.00

TABLE 2

Monthly Yield (kg/ha), Rainfall and Average 'N' applied from 1997-2002 St.Coombs Estate - St.Coombs Division

Month	1997	1998	1999	2000	2001	2002
January	161	176	190	165	176	153
February	86	118	168	179	154	151
March	58	66	173	182	123	90
April	69	48	193	201	165	160
May	403	95	118	244	209	327
June	140	156	73	144	195	162
July	203	60	130	98	87	134
August	115	135	168	183	123	90
September	109	112	120	133	118	160
October	190	83	166	101	108	228
November	196	168	127	192	171	201
December	193	196	199	172	199	178
Total	1,923	1,413	1,825	1,994	1,828	2,034
Rainfall (mm)	2,395.9	2,292.0	2,032.0	1,887.6	1,949.3	1,708.3
No. of wet days	199	170	190	184	181	171
Average N ($kg\ ha^{-1}yr^{-1}$)	226	220	170	225	270	270

TABLE 3: Monthly Yield (kg/ha) of fields and amounts of "N" applied – St.Coombs Division (2002)

Field	Extent (ha.)	Total (N/ha.)	Mixture	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
1	6.5	270	VPUM	170	149	99	151	378	219	186	136	258	348	335	305	2734
1A	0.6	200	STUM	118	97	158	124	413	68	100	102	105	228	132	135	1780
2	2.6	270	VPUM	68	197	138	254	338	145	192	103	242	392	362	279	2710
3A	7.0	270	VPUM	157	230	79	159	346	175	142	111	202	243	215	185	2244
3B	6.7	270	VPUM	183	153	109	208	383	177	87	3	7	-	28	32	1370
4	9.1	270	VPUM	182	201	82	192	364	264	168	92	116	209	176	174	2220
5	7.4	270	VPUM	174	151	118	226	447	184	186	118	321	359	304	354	2942
6A	3.0	270	VPUM	124	92	42	6	12	5	3	6	20	12	99	89	510
6B	2.9	270	VPUM	108	149	57	162	23	-	-	-	-	7	15	48	569
7	4.7	270	VPUM	186	126	110	161	314	210	143	131	153	217	199	185	2135
8	5.2	270	VPUM	176	161	98	139	390	196	111	116	200	340	239	234	2400
9	7.8	270	VPUM	212	140	99	170	435	141	175	110	184	283	304	180	2433
10	2.0	270	VPUM	157	182	48	68	263	104	103	72	112	244	48	149	1550
11A	2.0	270	VPUM	149	153	96	132	378	117	131	74	176	296	138	139	1979
11B	1.0	200	STUM	142	182	59	131	279	119	175	94	149	238	111	105	1784
12A	1.2	270	VPUM	144	160	108	126	300	232	238	153	212	286	261	295	2515
12B	1.0	200	STUM	149	3	-	-	-	12	-	-	-	-	24	2	190
13	9.0	200	STUM	70	102	95	183	299	114	120	74	151	245	190	134	1777
13A	1.4	270	VPUM	106	129	59	108	94	109	102	63	149	116	155	124	1314
13NC	2.0	270	VPUM	32	6	41	37	202	91	63	58	91	82	151	86	940
14	7.3	270	VPUM	163	160	72	131	306	177	133	119	169	225	202	155	2012

Table 4 : Cultural Operations - St. Coombs Division

Field No.	Seedling Tea (ha.)	V.P. Tea (ha.)	Clones	Last Pruned	Planting Year	Yield (kg/ha) 2001	Yield (kg/ha) 2002	Shade	Experiments
1	-	6.5	TRI, 2016,2023, 2025 &DN	Sep. 1999	1953 - 1959	2404	2734	Dadaps & Grevillea	Nil
1A	0.6	-	-	Aug. 2000	Before 1935	1765	1780	Grevillea	Nil
1B	-	0.6	TRI 777	Sep. 1999	1993	-	-	Dadaps	ADB Mother Bush Area
2	-	2.6	TRI 2043, 2142 2025, DT1 & DT 95	May 2001	1964	622	2710	Dadaps, Grevillea & Calliandra	Plant Breeding
3A	-	7	TRI 2027, 2043 2025	June 1998	1965 -1968	2852	2244	Dadaps, Grevillea & Calliandra	Agronomy & Agri. Chemistry
3B	0.4	6.3	WT26,	June 2002	1965-1968	2496	1370	Dadaps, Grevillea & Calliandra	Agronomy & Agri. Chemistry
4	-	9.1	TRI 62/9,2025,3016 DN, N2 CY9	May 2000	1978-1981	2163	2220	Dadaps, Grevillea & Calliandra	Agronomy & Agri. Chemistry
5	-	7.4	TRI 2142,2025 2023,TC9,DT95 N2	May 2001	1970	904	2942	Dadaps, Grevillea & Calliandra	Agronomy & Agri. Chemistry & Plant Breeding
6A	-	3	TRI 2025,DN	June 2002	1985-1986	2003	510	Dadaps, Grevillea	Agronomy & Agri Chemistry
6B		2.5	N2 & TRI 4061	June 2002	1985-1986	1543	569	Dadaps, Grevillea	Plant Breeding
7	-	4.7	TRI, 2024,2025, 62/9 DT1, DT95 & 3019	April 2000	1962-1964	1814	2135	Dadaps, Grevillea	Nil

Table 4 : Cultural Operations - St. Coombs Division (Contd.)

Field No.	Seedling Tea (ha.)	V.P. Tea (ha.)	Clones	Last Pruned	Planting Year	Yield (kg/ha) 2001	Yield (kg/ha) 2002	Shade	Experiments
8	-	5.2	TRI, 2024,2025 4052,4072 & DT 1	June 1999	1962-1964	2380	2400	Dadaps, Grevillea & Calliandra	Agronomy
9	4.8	3	TRI 3000 & 2043	Dec. 1995	1986	1794	2433	Dadaps, Grevillea & Calliandra	Agronomy
10	-	2	SALT area	'March 1999	1993	2136	1550	Dadaps, Grevillea & Calliandra	Agronomy
11A	-	2	TRI 2025, 62/9	June 1998	1988	2231	1979	Grevellia & Caliandra	Nil
11B	1			June 1998	1935	1802	1784	Dadaps, Grevillea & Calliandra	Plant Breeding
12A	0.4	1.2	TRI 2025,KO 145	June 1999	1985	2046	2515	Dadaps, Grevillea	Plant Breeding & Pathology
12B		1.5		June 1999	1935	1115	190	Grevellia	Nil
13	8			July 2001	1935	1114	1777	Dadaps, Grevillea & Calliandra	Agri Chemistry
13A	-	1.4	TRI 2025, 2043 DT1	July 2001	1986	901	1314	Grevellia & Calindra	Nil
13NC		2	TRI 3000 Series 2025,DT1	July 2001	1996	-	940	Grevellia & Caliandra	Entomology
14	-	5.1	TRI, 777,2023 2024,3000 Series & N2	Oct. 1999	1961	2012	2022	Dadaps, Grevillea & Calliandra	Plant Breeding & Pathology

TABLE 5 : Monthly Yield (kg/ha) of fields and amounts of "N" applied - Lamiliere Division (2002)

Field No.	Extent (ha.)	Total (N/ha.)	Mixture	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
4A	5.1	270	VP/UM	363	213	187	287	376	208	-	8	-	23	59	51	1775
4A	5.1	270	VPUM	159	95	109	263	378	243	175	108	249	318	275	178	2550
4B	1.9	270	VPUM	313	117	94	189	595	183	151	127	291	285	315	341	3001
5	0.5	200	STUM	242	232	156	158	376	290	174	180	148	346	222	260	2784
5NC	0.5	270	VPUM	322	100	134	240	386	268	304	452	450	666	408	532	4262
6A	1.5	200	STUM	181	81	58	91	222	117	111	77	134	235	149	211	1667
6B	3.0	270	VPUM	253	95	119	267	276	148	150	95	188	103	-	-	1694
7	4.5	270	VPUM	181	148	112	247	284	159	154	112	232	262	348	233	2472
8A	5.0	270	VPUM	224	145	142	229	306	241	143	149	277	305	307	285	2753
8B	4.0	270	VPUM	207	142	104	281	410	229	185	148	268	366	301	234	2875
9A	4.0	270	VPUM	248	143	69	141	-	-	-	-	10	127	114	265	1117
9B	4.0	270	VPUM	242	102	77	209	235	214	102	-	-	-	54	20	1255
10	6.6	270	VPUM	218	115	105	202	500	177	159	144	221	328	307	227	2703
11	6.4	270	VPUM	227	208	93	174	536	176	151	200	227	335	242	199	2768

TABLE 6

Monthly Yield (kg/ha), Average 'N' applied from 1997-2002 St.Coombs Estate – Lamiliere Division

Month	1997	1998	1999	2000	2001	2002
January	149	197	176	175	230	220
February	76	170	178	174	206	134
March	58	65	196	203	197	103
April	76	75	174	200	185	214
May	311	185	139	261	280	355
June	186	189	84	125	244	180
July	196	122	126	93	113	141
August	111	117	134	193	128	119
September	142	114	131	133	161	199
October	191	95	172	127	137	262
November	209	153	134	218	213	236
December	193	225	227	220	214	204
Total	**1,898**	**1,707**	**1,871**	**2,122**	**2,308**	**2,367**
Average N ($kg\ ha^{-1}yr^{-1}$)	213	219	169	220	270	270

Table 7: Cultural Operations - St. Coombs Estate - Lamiliera Division

Field No.	Seedling Tea (ha.)	V.P. Tea (ha.)	Clones	Last Pruned	Planting Year	Yield (kg/ha) 2001	Yield (kg/ha) 2002	Shade	Experiments
4A	-	5.1	TRI, 2025	July 2001	1984	1775	2550	Dadaps & Grevellia	
4B		1.9	TRI 2025	Aug 1998	1986	2505	3001	Dadaps & Grevellia	
5	0.5	-			1999	2534	2784	Dadaps & Grevellia	
5NC	-	1.0	TRI 3041				4262	Dadaps & Grevellia	
6A	1.5		Mixed Clones				1667	Dadaps & Grevellia	
6B	-	2.0	DT1,WT 26 TRI 2025	Oct 2002	1990-1991	2166	1694	Dadaps & Grevellia	1.0 ha.ADB - PPPB
7	-	4.5	TRI 2025	July 1998	1983	1969	2472	Dadaps & Grevellia	
8A	-	5	TRI 2025 & CY 9	June 2000	1979	3151	2753	Dadaps & Grevellia	
8B	-	4	TRI 2025, DN, N2, WT 26 , CY 9	June 2001	1989-1990	1587	2875	Dadaps & Grevellia	
9A	-	4	TRI 2025	May 2002	1979	2258	1117	Dadaps & Grevellia	
9B	-	4	TRI, 2025, DN & CY 9	July 2002	1980	2282	1255	Dadaps & Grevellia	
10	-	6.6	DN & TRI 2025	June 1999	1967-1969	2285	2703	Dadaps	
11	-	6.4	DN & TRI 2025	May 2000	1970-1971	2418	2768	Dadaps	

ST. JOACHIM ESTATE

1. General

Mr. M.S.E . Perera functions as the Superintendent with effect from , 15/12/2001.

Mr. D.H. Wickremasooriya of Kelani Valley Plantations Ltd., visited this estate on 5/07/2002.

The A.D.B Mid -Term Review Mission , M/s. Ai Tee Loh and other members visited this estate on 09//09/2002 to inspect the progress of the Mother Bush Programme.

2. Hectarage as at 31st December 2002

	Ha	
Mature tea	47.92	
Nursery	1.58	
Land under coconut (TRI)	3.89	
ADB Project	32 .19	
Land under paddy	8.74	
Crop - Tea /Rubber	3.68	
Rubber	7.12	
Mana Grass	13.02	**118.14**
Other Lands		
Acquisition by Government		
Buildings/roads/ravines and jungle		**23.84**
Total extent		**141.98**

3. Crop (made tea kg)

The production on St.Joachim Estate in 2002, compared to previous year was as follows:-

Year	Estate Crop (Kg)	Bought Crop (Kg)
2001	66,459	609,732
2002	65,071	658,619

The production on the estate registered a decrease of 1388 kg or 2.09 % comparison to the previous year. This is due to 5.05 ha being uprooted during the year for the ADB Project.

Y.P.H Although the crop has declined by 1388 kgs due to above reason, there is an increase of 218 kgs in Y.P.H compared to last season.

3.1 Bought Leaf

The bought leaf manufactured at St.Joachim factory showed an increase of 48,887 kgs or 8.02 % in comparison to previous year.

3.2 A.D.B. Project

An extent of 12.83 ha has been planted during the season 2002 under the ADB Project with clones of 30/40 series.

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, Forbes & Walker and De Silva Abeywardena and Peiris sold the teas in an equal proportion.

The Nett sale average for the year was Rs.147/84, and compared with last year shows an increase of Rs. 10/61. The working of St.Joachim Estate resulted in a Profit of Rs.265968/- as at 31st October, 2002.

5. 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	Shoots sold Rs.	Proceeds Rs.	Profit on sale of Shoots Rs.	Plants sold	Proceeds Rs.	Profit on sale of Plants Rs.
2001	-	-	-	39063	273438/=	-
2002	432475	108119/=	7774/=	80082	585813/=	176213/=

Table 1

WORKING ACCOUNTS OF ST. JOACHIM ESTATE FOR 2002 IN COMPARISON WITH PREVIOUS YEARS

YEAR	TOTAL CROP SOLD MADE 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 RS.
*1996	* 1,094,941 # 63,330	1248	113/81	87/06.38	102/30.88	+17,978,620/=
*1997	996,106 66,847	1236	120/61	98/24.30	111/60	+19,325,357/=.
*1998	890,131	73,473	133/64 1359	94/25.00	87/43	+16,605,650/=
*1999	746,768	78,197	120/22 1446	100/30.00	117/33	+8,262,014/=
* 2000	711,325	75,336	138/70 1393	82/98.00	75/62	+ 9,360,576/=
*2001	609,732	66,459	137/23 1140	89/48	89/13	- 424,423/=
*2002	658,619 65,071	1358	147/84	96/26	87/14 * *(To end October)	+ 265,968/= *

* Bought Crop Made Tea

Estate Crop Made Tea

Table 02

Monthly Yield (kg/ha) rainfall and average N applied from 1997 to 2002 St. Joachim Estate

Month	1997	1998	1999	2000	2001	2002
January	112	146	122	117	123	102
February	42	99	94	105	115	81
March	61	81	132	139	122	109
April	118	131	133	141	113	109
May	111	104	108	143	118	127
June	147	123	113	118	87	130
July	113	103	102	95	86	116
August	95	98	101	100	88	130
September	99	120	135	101	56	104
October	90	127	121	100	88	113
November	122	107	138	110	78	105
December	126	120	147	124	90	85
Total	**1236**	**1359**	**1446**	**1393**	**1140**	**1358**
Total Rainfall (mm)	4552.3	4579.9	4526.4	3740.6	3593.5	3194.8
No.of Wet Days	199	220	224	211	189	206
Average N (kg / ha/yr -)	143	158	164	162	163	162

Monthly Yeild (Kg / Ha) of Fields with - Year 2002
Fertilzer Mixture used and amounts of "N" Applied on St. Joachim Estate

Field No.	Extent	Total N.	Fert. Next	MONTH												
				Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
1	2.68	160	VPLC/880	112	86	99	125	166	118	365	248	110	196	181	157	1963
02A	0.93	180	VPLC/880	54	73	160	128	211	259	116	344	255	288	288	359	2535
02F	6.78	140	VPLC/880	62	53	63	96	51	55	56	40	–	–	–	59	476
3	8.40	140	VPLC/880	97	82	104	109	103	150	91	104	101	92	98	62	1193
4	5.85	140	VPLC/880	55	44	71	70	61	72	80	115	84	116	94	87	949
6	1.50	270	VPLC/880	203	179	231	167	273	79	101	166	134	85	–	–	1618
08A	6.00	270	VPLC/880	188	107	179	197	220	213	145	190	131	190	188	142	2090
08B	2.02	180	VPLC/880	212	189	282	159	230	314	308	189	232	201	311	241	2668
08C	1.90	270	VPLC/880	80	87	89	123	43	86	47	101	53	68	46	88	911
6B	1.10	18.0	VPLC/880	204	198	138	244	319	199	189	310	234	160	97	–	2292
6C	2.00	180	VPLC/880	99	81	124	114	214	117	111	139	166	128	–	–	1293
1B	0.80	160	VPLC/880	–	–	–	–	250	566	277	319	381	335	305	342	2775
*1A				178	186	247	–	–	–	–	–	–	–	–	–	611
02 (TRI)	4.12			10	13	05	75	44	11	12	23	31	38	53	39	286
3 A (TRI)	3.34			54	56	67	55	47	90	81	88	98	78	72	53	839
06 A (TRI)	0.50			200	26	124	198	354	462	324	396	376	470	472	316	3718
	47.92			**102**	**81**	**109**	**109**	**127**	**130**	**116**	**130**	**104**	**113**	**105**	**85**	**1358**

* Fld. 1A. Uprooltd for ADB

METEOROLOGICAL OBSERVATION - 2002
ADVISORY AND EXTENSION CENTRE, DENIYAYA

(Elevation 250 m. amsl)

Month 2002	Mean Temperature		Soil at 30 cm		Total Rainfall (mm)	Wet Days	Total Wind (km)	Total Evaporation (mm)	Sun Shine Hours
	Min. (°C)	Max. (°C)	8.30 h	15.30 h					
January	20.93	29.90	28.66	28.72	190.0	12	752	2.61	188.2
February	20.45	32.47	28.98	29.27	29.9	08	872	3.26	207.9
March	21.20	32.70	29.12	29.66	173.1	13	859	3.12	217.8
April	22.56	31.72	29.19	29.55	582.1	26	632	3.57	178.0
May	24.00	30.20	28.95	29.27	324.9	25	861	2.86	180.9
June	23.60	29.88	28.18	28.65	192.9	12	3630	3.49	177.6
July	23.68	28.92	28.66	28.17	252.4	23	3223	3.30	164.5
August	23.20	29.34	27.56	27.71	121.5	11	2941	3.25	193.1
September	23.20	30.63	29.28	29.45	108.6	12	1928	3.33	233.3
October	21.57	30.29	27.99	28.44	420.8	26	1176	3.93	151.5
November	21.92	29.89	27.47	27.74	458.3	23	744	2.96	132.75
December	21.54	29.99	27.64	27.93	308.2	18	617	2.04	151.7
Total					3162.7	209	18235		2177.25
Mean	22.32	30.49	28.47	28.71	263.56	17	1519	3.14	181.4

METEOROLOGICAL OBSERVATIONS - 2002

MID-COUNTRY RESEARCH, ADVISORY AND EXTENSION CENTRE, KANDY

(Elevation 762 m amsl)

Month	Mean Temperature (°C)		Relative Humidity %		Mean Sunshine (hrs/day)	Cum.Rainfall (mm)	No:of Wet days	Cum. Evaporation (mm)
	Min	Max.	8.30h	15.30h				
January	20.65	25.30	90.85	92.10	5.92	20.00	00	94.20
February	20.10	27.50	93.85	80.82	6.53	41.00	03	116.60
March	20.70	25.30	94.94	76.76	8.00	137.20	06	111.50
April	20.85	29.50	95.01	85.76	6.52	498.50	18	88.70
May	22.10	27.85	97.10	97.20	6.90	125.97	05	101.36
June	20.60	26.80	97.10	97.20	5.90	180.90	10	102.75
July	20.60	25.70	97.40	97.40	5.50	86.31	07	171.50
August	20.50	26.70	98.40	98.40	5.40	140.34	08	166.50
September	20.10	29.00	98.60	98.60	7.80	24.00	01	115.13
October	20.40	27.70	99.10	99.00	5.00	280.50	13	68.43
November	19.80	27.30	99.00	99.50	4.10	450.80	15	45.35
December	19.60	25.60	99.00	98.00	3.30	142.80	08	67.27
Mean	**20.50**	**27.02**	**96.69**	**99.39**	**5.90**	–	–	–
Total	-		-		-	**2118.32**	**95**	**1219.39**

METEOROLOGICAL OBSERVATIONS - 2002

UVA ADVISORY AND EXTENSION CENTRE, PASSARA

(Latitude 6° 56'N, Longitude 81° 07'E, Elevation 1120 m amsl)

Month	Mean Temperature (°C)		Mean Relative Humidity (%)		Mean Sunshine $(hrs/day)^{-1}$	Mean Wind Speed km / h	Total Rainfall (mm)	Cum. Evaporation (mm)
	Min Dry	Max. Dry	9.00 A.M.	4.00 P.M.				
January	17	23.7	83	85	4.5	2.84	110.2	57.54
February	17.2	24.4	80	78	5.6	3.12	121.2	68
March	17.9	26.6	71	69	7.3	1.66	109.8	104.16
April	19.1	–	76	74	5.5	0.81	385.8	76.61
May	19.8	–	75	82	5	1.87	128.6	90.06
June	19	–	75	74	4.9	1.07	57.6	89.40
July	18.6	27.6	72	68	5.3	2.22	17.5	90.45
August	18.6	28.3	71	70	5.5	1.66	143.3	91.02
September	18.6	28.1	66	68	6.2	1.56	23.3	105.71
October	18	25.5	81	86	3.9	0.75	360.5	57.04
November	17.9	24.7	85	88	3.1	1.27	322.1	44.8
December	17.3	23.1	84	87	2.6	3.93	325.8	53.67
Total							2152.7	928.46
Mean	18.2	25.8	76	77	4.9	1.89		

Rainfall (mm) total for Month , Evaporation (mm) total for Month
Min Dry (°C) Average for Month
Max Dry (°C) Average for Month

METEOROLOGICAL OBSERVATIONS - 2002

TRI-LOW COUNTRY STATION RESEARCH, ADVISORY & EXTENSION CENTRE, RATNAPURA

(Lat 6°41'N, Long 80°-40°E, 29 m amsl)

Month	Temperature (°C)		Relative Humidity %		Mean Sunshine	Rainfall Total	Difference from	Wet Days	Difference from	Pan Evaporation
	Min	Max	9.00 hrs	16.00 hrs	hours	mm	30 years		30 years	mm
January	22.11	33.56	88	61	5.84	43.9	–6.72	07	–2	2.48
February	22.06	34.81	86	58	6.64	179.5	+42.5	09	–	2.96
March	22.73	35.20	87	64	6.12	146.0	–66.2	11	–3	3.41
April	23.37	34.64	87	71	4.78	306.1	–32.8	22	+2	2.95
May	24.32	33.11	86	72	3.73	440.4	–35.5	25	+5	2.74
June	24.39	30.18	82	67	4.67	380.9	–31.3	16	–5	2.91
July	23.89	31.76	86	69	4.26	186.0	–106.8	17	–3	2.48
August	23.80	31.96	84	61	5.19	176.9	–127.2	16	–4	2.86
September	23.21	33.63	83	62	6.89	178.4	243.0	11	–9	3.59
October	23.12	32.50	88	67	3.64	446.4	+9.6	27	+6	1.93
November	23.26	32.43	87	65	3.41	343.3	–28.1	22	+4	2.79
December	22.45	32.07	90	65	3.43	260.3	+25.0	15	+1	2.00
Total	—	—	—	—	—	3088.1	—	—	—	—
Mean	23.23	32.98	86	65	4.88	—	—	—	—	2.75

METEOROLOGICAL OBSERVATIONS

TRI - ST.COOMBS, TALAWAKELLE

(Lat.6"54768'n,Long.80"4239'e,1382m amsl)

Month	Mean Temperature (°C)		Soil Tem (°C) at 20 cm under grass		Rainfall Humidity (%)		Wind Travelled (miles)	Mean Sunshine (hrs/day-1)	Total Rainfall (mm)	Wet Days	Total Evaporation (mm)
	Min.	Max.	09.00hrs	16.00hrs	09.00hrs	16.00hrs					
January	11.2	25.0	20.4	21.9	91.5	90.1	2750.36	6.0	26.9	3	85.12
February	12.6	26.4	21.0	22.9	91.9	94.6	1940.06	7.1	11.6	3	66.88
March	12.2	27.4	21.5	23.4	92.6	95.0	2023.92	7.7	111.2	6	99.45
April	14.1	26.1	21.7	23.1	94.5	95.9	1422.21	5.7	269.6	21	57.55
May	15.8	24.7	22.3	23.2	96.0	94.8	1713.76	3.9	135.4	18	51.71
June	15.7	23.0	21.2	22.1	96.7	93.2	2330.14	3.9	203.7	13	49.33
July	15.9	22.1	21.1	21.6	97.1	94.8	2055.75	2.6	193.0	18	40.46
August	15.4	22.7	20.7	21.6	96.6	94.8	2791.27	3.8	207.7	18	44.14
September	13.5	24.9	21.7	23.4	94.3	95.5	1790.75	6.8	54.5	7	72.71
October	14.5	24.6	21.6	23,.0	95.2	93.9	1230.16	4.9	243.8	23	57.31
November	14.3	25.2	21.6	22.8	95.4	94.4	1476.91	4.7	149.0	12	51.17
December	13.6	24.4	19.1	21.3	94.3	91.3	1831.42	4.2	59.4	9	58.63
Average	14.1	24.7	21.2	22.5	94.7	94.0	1946.4	5.1			
Total									1665.8	151	734.46

METEOROLOGICAL OBSERVATIONS - 2002

ADVISORY AND EXTENSION CENTRE, KOTTAWA, TALGAMPOLA

(Elevation-30m amsl)

Month	Mean Temperature (°C)		Relative Humidity (%)		Mean Sunshine (h day^{-1})	Total Rainfall (mm)	Rainfall difference from 20 years	Wet Days
	Min	Max	9.00 h	16.00 h				
January	22.2	30.5	88	73	6.0	87.5	–33.4	07
February	22.0	32.8	89	82	7.8	69.6	–20.1	06
March	21.9	32.3	87	80	7.4	101.2	–11.6	07
April	23.3	31.6	90	78	5.9	145.4	–109.5	14
May	24.0	31.0	90	79	7.1	277.6	–86.8	20
June	24.3	30.6	87	79	6.1	110.5	–162.8	11
July	24.1	30.0	86	76	5.5	128.3	–65.8	13
August	24.0	30.1	86	86	7.0	78.6	–136.7	13
September	23.0	31.0	86	77	8.0	161.4	–153.7	18
October	23.1	30.2	87	75	6.1	533.6	–170.7	21
November	18.2	30.1	87	76	4.1	336.4	+44.7	19
December22.3	30.7	90	86	4.1	131	–41.9	13	
Total						2161.1		162
Mean			88	79	6.3			

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கணக்காய்வாளர் தலைமை அதிபதி திணைக்களம்
AUDITOR-GENERAL'S DEPARTMENT

මගේ අංකය
எனது இல.
My No. PI/H/TRB/2002/240

මෙම අංකය
உமது இல.
You No.

දිනය
திகதி
Date 28 April 2003

The Chairman
Tea Research Board

Report of the Auditor General on the accounts of the Tea Research Board for the year ended 31 December 2002 in terms of Section 14 (2) (c) of the finance Act No. 38 of 1971.

The audit of accounts of the Tea Research Board for the year ended 31 December 2002 was carried out under my direction in pursuance of provisions in Article 154 (1) of the Constitution of the Democratic Socialist Republic of Sri Lanka read in conjunction with Section 13 (1) of the Finance Act No. 38 of 1971. My observations which I consider should be published with the annual report of the Board in terms of Section 14 (2) (c) of the Finance Act appear in this report. A detailed report in terms of Section 13 (7) (a) of the Finance Act will be issued in due course.

1:2. Scope of Audit

Audit opinion, comments and findings in this report are based on a review of the financial statements presented to audit and substantive tests of samples of transactions. The scope and the extent of such review and tests were such as to enable as wide an audit coverage as possible within the limitations of staff, other resources and time available to me. The audit was carried out in accordance with Sri Lanka Auditing Standards, methods and practices to obtain reasonable assurance as to whether the financial statements are free of material misstatements. The audit included examination of evidence supporting the amounts and disclosures in financial statements and assessment of accounting principles and significant estimates and judgements made in the preparation of financial statements, evaluation of their overall presentation and determining whether accounting policies adopted were appropriate, consistently applied and adequately disclosed. Sub-sections (3) and (4) of Section 13 of the Finance Act

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சுதந்திர சதுக்கம்,
கொழும்பு 07, இலங்கை
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No. 38 of 1971 give discretionary powers to the Auditor General to determine the scope and extent of the audit.

1:3. Provisions in the Tea Research Board Act No. 52 of 1993

(a) Section 15 (5) of the Act states that,

"the Auditor General shall as soon as practicable after the thirty first day of December of each year prepare a report on the administration of the affairs of the Board during that year, together with a statement of the income and expenditure of the Board and of the investment of money belonging to the Board during that year".

(b) Section 16 of the Act states that,

"the Auditor General shall transmit the report prepared by him in pursuance of Section 15 to the Minister in charge of the subject of Plantation Industries who shall cause such report and statement to be placed before Parliament".

It is the responsibility of the Board to prepare and render the Income and Expenditure Account for audit and to prepare the statement of the affairs of the Board. Accordingly, the accounts rendered by the Board were audited in terms of the Constitution and the Finance Act.

However, the Act had not been amended as appropriate even as at the date of this report.

2. Accounts.

2:1. Audit Opinion

Except for the effects of the adjustments arising from the matters referred to in paragraph 2;4 of this report, I am of opinion that, the financial statements have been satisfactorily prepared to present fairly in all material respects, the financial position of the Board as at 31 December 2002 and the results of its operations for the year then ended in accordance with the Sri Lanka Accounting Standards other than the Standard referred to in this report and the stated accounting policies as set out in the Notes 1 to 2 (k) to the financial statements.

2:2. Financial Results

According to the accounts presented the working of the Board for the year ended 31 December 2002 had resulted in a surplus of Rs. 19,765,268 as compared with the corresponding surplus of Rs. 79,760,076 in the previous year

2:3. Financial Structure

According to the accounts presented, the financial structure of the Board as at 31 December 2002 compared with that as at 31 December 2001 is given below.

	As at 31 December	
	2002	2001
	Rs. '000	Rs. '000
Resources		
Government Grant	1,175	1,175
Capital Reserve	88,810	58,508
Long Term Liabilities		
– Land Reform Commission	–	755
– Provision for Gratuity	35,075	34,521
– Petrol Deposit-Refundable	13	12
– Tea Research Fund	419,092	452,705
	544,165	547,676
Utilization		
Fixed Assets at Written Down Value	223,268	221,936
Capital Work-in-Progress	55,276	24,826
Net Current Assets	265,621	300,914
	544,165	547,676

2:4. Comments on Accounts

2.:4:1. (a) Accounting Policies

Accrding to the Accounting Policies stated by the Board stock should be valued at the lower of cost of net realizable value. However, stocks as at 31 December 2002 had been stated at the book values.

(b) Depreciation of Fixed Assets

Value of land and building had not been identified separately. Therefore depreciation had been provided for land too.

(c) Unidentified Assets

Accumulated depreciation on assets valued at Rs. 752,467, had been shown under the Fixed Assets of St. Coombs, Lamiliere and St. Joachim Estates, amounted to Rs. 722.840. However, the method of depreciation applied could not be ascertained.

2:4:2. Accounting Deficiencies

The following observations are made

(a) The value of Guarantee Bonds of three officers who had gone abroad on scholarships amounting to Rs. 3,533,653 had been shown as a note to the debtors schedule and not as a note to the Balance Sheet.

(b) Work-in-progress in the Accounts to the value of Rs. 643,160 under 6 items had not been capitalized due to non-receipt of the completion report.

(c) Labour allowances relating to the period 1999 to 2002 in respect of 4 officers amounting to rs. 338,601 had been debited to the Salary Account without the approval of the Board.

(d) The value of 41 unusable items amounting to Rs. 20,482 had been brought to account without taking action for their disposal.

(e) Advances paid to suppliers during the period 1990 to 2001 amounting to Rs. 2,813,042 had not been recovered.

(f) A theft of money amounting to Rs. 234,720 occurred in 1992 had not been written off after investigation.

(g) Shortage of stocks for the year under review amounting to Rs. 265,838 had not been recovered from the responsible officers.

(h) A shortage of stocks valued at Rs. 300,511 revealed during the year under review had not been brought to account.

(i) Local and foreign training, expenses amounting to Rs. 4,617,512 had been shown under the Miscellaneous expenses without being shown separately.

(j) An advance amounting to Rs. 86,109 paid for medical purpose had not been recovered.

2:4:3. Accounts Receivable and Payable

The following observations are made.

(a) Debtors balances aggregating Rs. 994,821 and Rs. 889,581 had remained outstanding for over two years and five years respectively.

(b) Significant delays had been observed in the settlement of advances amounting to Rs. 56,300 paid to 6 officers by the Board for the supply of goods and services. Effective control procedures had not been adopted by the Board for the early settlement of advances.

2:4:4. Lack of Evidence for Audit

The following items in the accounts could not be satisfactorily vouched or accepted in audit due to the non-availability of evidence indicated against each item.

Item	Value Rs.	Evidence not made available
Debtors	83,196,096	Confirmations
Creditors	21,046,643	

2:4:5. Uneconomic Transactions

A sum of Rs. 122,101 had been spent for the repairs to the engine of the vehicle GDCP 7650, only 14 months after the purchase of the vehicle due to carelessness.

2:4:6. Non-compliance with laws Rules, Regulations and Management Decisions

Provisions in the following Laws, Rules, Regulations etc. had not been properly complied with.

(a) Establishments Code Chapter XXX Section 1.4.

(b) Financial Regulations 135-140, 315, 502 (2) and 1645.

(c) Public Administration Circular no. 2/97 of 12 November 1997 paragraph 3.1, and Management Service Circular No. 17/2001 of on 24 October 2002.

(d) Treasury Circular No. 842 of 19 December 1978 and PED 52 of 16 June 1989.

(e) Sri Lanka Accounting Standards 24 paragraph 24.

3. Financial and Operating Review

3:1. Financial Results.

The operations of the Board during the year under review had resulted in a surplus of Rs. 19.765 million as compared with the surplus of Rs. 79,760 million for the preceding year thus disclosing a decrease of Rs. 59,995 million in the surplus.

3:2. Performance

3:2:1. Research Projects

The objectives of the Board are to conduct of,

- researches to resolve problems at affecting the tea industry.
- researches into the economic viability of the tea industry and
- joint studies, programmes, seminars etc.

The Board operates 9 Research Divisions namely Agronomy. Biochemistry, Entomology, Plant Pathology, Plant Physiology, Soil and Plant Nutrition Technology, Agricultural Economics and Plant Breeding. There are 5 Advisory and Extension Centres at Hantana, Kottawa, Passara, Ratnapura and Deniyaya.

According to information furnished by the Board. Researches had been commenced under five general target heads as follows.

(i) Breeding for Crop Improvement

(ii) Improvement of Land Productivity

(iii) Crop Management

(iv) Post-harvest Technology

(v) Resource Planning

Applied project, basic projects, supporting services project and service projects had been implemented in the nine Divisions of the Board to achieve the above targets.

3:2:2. Seminars and Training Programmes

Achievements of researches are introduced to the public through workshops, seminars and publications. Mainly 2 Experiments and Extension Forums were held by the Board each year to the members who are actively involved in various aspects of the tea industry in Sri Lanka.

3:3. Slow Moving and Idle Stocks

(a) Out of the 552 items in the General stores, Electrical stores and motor spare part stores, stocks valued at Rs. 513,316 had not moved for several years.

(b) The stock of spare parts included 113 categories of spare parts valued at Rs. 168,484 identified as unserviceable and to be disposed.

3:4. Guarantee Bonds

Audit test checks revealed that a sum of Rs. 3,807,268 remained to be recovered for breach of bonds from 12 officers who had gone abroad on scholarships and failed to return. The Board had failed to take prompt legal action against the officers. Two officers who had agreed to settle the dues in installments had failed to settle the dues.

3:5. Inefficiencies in Tender Procedures Followed

(a) Same officers were in the Tender Board and in the Evaluation Committee.

(b) A sum of Rs. 195,425 had been over paid for the repairing the workers houses No. 12 to 24 and 24 to 31, as the lowest tender had not been accepted.

3:6. Working Results of Estates

The working results of the two estates, viz., St. Joachim and St. Coombs, managed by the Board for research activities, during the year under review as compared with the preceding year are given below.

	St. Coombs (including Lamilier Division) Estate		St. Joachim Estate	
	2002 Rs. '000	2001 Rs. '000	2002 Rs. '000	2001 Rs. '000
Tea Sales				
Quantity (Kg)	295	280	724	676
Value 39,779	39,550	107,709	95,026	
Other Income	78	46	711	437
	39,857	39,596	108,420	95,463
Less : Estate Expenditure Less Rubbr Plantation	39,536	36,243	105,332	91,097
	321	3,353	3,088	4,366
Less: Administration and Finance Expenses	3,793	3,523	3,434	2,443
	(3,472)	(170)	(346)	1,923
Less : Sales and Distribution Expenses	869	824	2,408	2,259
Profit/(Loss)	(4,341)	(994)	(2,754)	(336)
Cost of Production per Kilogram of made Tea (Rs.)	146.9	141.8	151.1	138.33
Yield per Hectare (Kg.)	2,200	2,200	1,358	1,391
Net Sales Average per Kg (Rs.)	141.18	144.96	147.46	137.23

3:7. Vehicles Utilisation

(a) The Board had a of 131 motor vehicles as at end of the year under review.

Total cost of fuel for the year under review amounted to Rs. 5,780,535 and total kilometres performed amounted to 1,563,501. Details of maintenance expenditure had not been furnished to audit.

(b) **Release of vehicles**

Two double cabs released for the 100 days Government programme on the request of a Private Secretary to the Ministry had not been returned to the Board until the end of the year under review.

Expenditure on fuel, dirivers' salary and subsistEnce paid during the period of release amounting to Rs. 248.891 had not been recovered by the Board.

3:8. Analytical Charges

(a) Charges for Analytical services had been recovered at the prices approved in 1992.

(b) Incentives had been paid merely on the certificate of the Head of Division regardless of the income earned.

3:9. Sale of books

(a) The value of 2262 free issue books was Rs. 213,650 and the loss on sale of 91 books below the price was Rs. 17,330.

3:10. Operating Activities of Estates

Following deficiencies were observed in the examination of the operating activities of the Estates.

(a) **St. Coonmbs Estate**

(i) Actual expenditure had exceeded the budget without approval thus indicating that the budget had not been made use of as instrument of management control.

(ii) In some instances, the green leaf paid for by check roll had not been handed over to the Factory.

(iii) There had been delays in the completion of field works.

(iv) There had been frequent delays in picking green leaf.

(v) Capacity utilisation of machinery in the Factory has been below 50%/

(v) **St. Joachim Estate**

The percentage of waste tea had been exceeded the standard.

3:11. Budgetary Control

Two budgets had been prepared for the year under review. The two budgets had estimated profits of Rs. 25 million and Rs. 15 million respectively for the Estates which incurred losses of Rs. 2 million in the preceding year. However, the Estates had incurred a loss of Rs. 7.5 million.

4. Systems and Controls

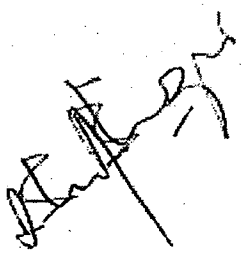
Special attention is needed in respect of the following areas of control.

(a) Accounting

(b) Fixed Assets

(c) Debtors

(d) Utilisation of Motor Vehicles



(S. C. MAYADUNNE)
AUDITOR GENERAL