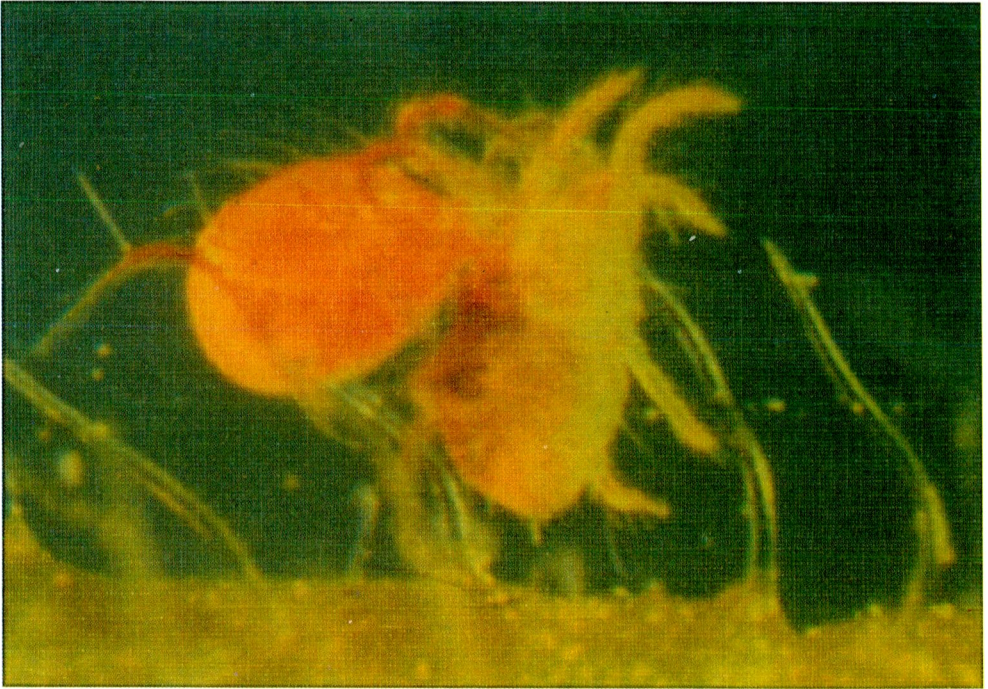
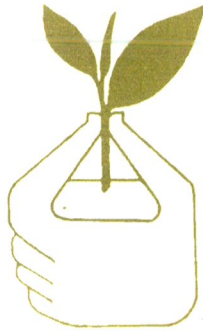


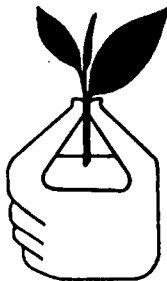
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ANNUAL REPORT - 1997
TEA RESEARCH BOARD OF SRI LANKA

**THE TEA RESEARCH INSTITUTE
OF
SRI LANKA**

**ANNUAL REPORT
FOR THE YEAR
1997**



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ST. COOMBS, TALAWAKELE, SRI LANKA
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Report of the Chairman, Tea Research Board

The action plan drawn up on restructuring of the Tea Research Institute (TRI) to meet the challenges of the 21st century was submitted to the Ministry for discussion at its Tea Sector Review meetings. A positive outcome of these discussions was the increase of the tea cess by 50 cts per Kilo of tea exported.

The CADMAR (Composite Approach to Decision Making in Agricultural Research) process of research prioritization was carried forward to near completion. A cost-benefit analysis of all identified thrusts and projects, in both applied and basic research, is now in progress. Completion of this process will lead to maximization of resources, both human and financial, in the development of technology so needed for the tea industry to carry it through the next century and beyond.

Renewed emphasis was placed in the resolution of legal matters of TRI with the assistance of the Attorney General and by obtaining his approval to retain private lawyers on a case by case basis. Matters receiving attention were in regard to defaulting of bonds by staff sent on postgraduate training abroad, defense of TRI in Labour Tribunal cases etc.

All staff were required to submit reports within specified time limits on their return from official visits abroad. They were also required to present debriefing seminars on their return for the benefit of other staff.

The post of superintendent St. Coombs Estate was filled and a visiting agent was identified for the two TRI estates. The rationale being that these TRI estates should serve as model estates for the industry. The accounts unit at TRI Talawakelle was made responsible for the financial control of both TRI estates, a practice not followed in the past. The Director TRI was given "observer" status at meetings of the Sri Lanka Tea Board and was required to report on relevant matters to the Tea Research Board (TRB)

Action was initiated to formulate a corporate plan for the TRI for the 5 year period beginning 1999. An internal committee with Director TRI as its Chairman was assigned this task. A qualified engineer was engaged to inspect and report on the vehicle fleet of TRI to facilitate replacement of those that are unserviceable. Inadequate transport facilities impede TRI's field programmes. A new generator was installed at the St. Joachim factory, replacing the old on which was beyond repair. This was done to circumvent losses in manufacture incurred due to constant power failures. Approval was given to TRI to produce video films on nursery practices, land selection and preparation and harvesting of tea and for training of its officers in this activity. These video films are for use both in estates and smallholdings in advisory and extension work. A protest was sent to the Ministry in regard to FAO supporting Sri Lankan participation

at a conference abroad on tea bypassing TRI. Low interest loans were provided to TRI estate workers at St. Coombs Estate for electrification of their houses.

A consultant was engaged to enable St Coombs Estate to obtain ISO 9000 series certification.

Schemes of recruitment were drawn up for the posts of Computer Systems Manager and Resident Engineer. Approval was obtained from the Public Enterprises Division of the Ministry of Finance to create a cadre position for a Technical Editor for TRI. Till now this function has been performed by a senior scientist at TRI, an arrangement which needs correction due to the load of work involved. Approval was sought to create 10 posts of Heads of Divisions by suppressing an equal number of posts from the senior research officers cadre.

Action was taken to extend the contractual period of Director TRI from 1 to 3 years and for revision of his emoluments. An application was made to patent the TRI plucking shear which has been adopted by a number of estates as well as small holders because of its superiority over manual plucking. TRI extension staff were permitted to work for plantation companies on payment without any deductions by TRI.

It was decided that TRI should not maintain commercial tea nurseries, except at its Hantane station and St Jochim Estate, Ratnapura. In all other stations only model nurseries are to be maintained. The TRB approved the involvement of experienced scientists who had left the TRI and also university scientists in its research projects and for them to be sponsored by plantation management companies.

Consequent to a decision to establish the Ceylon Tea Museum at Hantane Estate, Kandy the TRB approved a donation of Rs. 1 m.

The Executive Director, Council for Agricultural Research Policy, Dr D Kirtisinghe and the Secretary General, the Planters' Association of Ceylon, Mr S K Seneviratne were appointed as members of the Consultative Committees on Research and Estates & Advisory Services, respectively.

During the year the TRB held 09 meetings whilst its three consultative committees on Research, Estates & Advisory Services and Administration & Finance held 3, 3 and 8 meetings, respectively.

Dr. S D I E Gunawardene Chairman,
Tea Research Board.

THE TEA RESEARCH INSTITUTE OF SRI LANKA

ANNUAL REPORT, 1997

REVIEW OF THE DIRECTOR

Arising from its responsibility as part of the agricultural research system of the nation, and towards fulfilling its mandate for research into the planting and manufacture of tea, the Tea Research Institute of Sri Lanka sets itself four-square as a partner in the country's tea industry and specifically in the plantations and smallholder segments.

Tea is a long-term perennial crop, and any progress in tea research is mostly subtle and cumulative rather than in the form of the proverbial breakthrough. The present Annual Report sets out details of research and extension activities for 1997 under divisional headings and, as with such Reports, it is necessarily a snapshot of activity during a single year. It is perhaps difficult, therefore, to peruse it and discern progress.

For this reason, the Director's review is used to highlight achievements and advances rather than merely to abstract the details written by Divisions.

Guidelines for intercropping tea with rubber were issued, based on on-going collaborative trials with the Rubber Research Institute of Sri Lanka.

A shear harvester was developed and released for combatting the problems of low plucker-intake, labour shortage and unplucked green leaf during peak cropping seasons. It is light and manouverable and allows for leaf selectivity during harvesting. A patent was applied for together with a well-known company, Messrs P.P.P. Jinadasa, who started mass-producing the shears for sale to growers. Growers began using them with excellent results.

Soil conservation and improvement were advanced, biologically through the introduction both of an exotic species, *Arachis pintoii*, as a cover crop and of earthworms in vermicompost, and from the use of *Flemingia congesta* as hedgerow plants on sloping, marginal tea lands.

A tea tissue-culture protocol was developed and collaboration was begun with a Sri Lankan company for testing its efficacy in large scale production of tea plantlets.

Biochemical identification of tea clones was advanced through the development of an isozyme technique.

Integrated pest management (IPM) and the de-emphasis of hazardous agro-chemicals were taken further. Guidelines were issued on the integrated

management of shothole borer. The feasibility of controlling mite outbreaks using exotic predators was demonstrated, and a new, safe pesticide (a nitroguanidine) against scavenging termites, as efficacious as the chlorinated termiticides now on the banned list, was recommended.

Soil surveys and GIS technology for maximising profitability from rational land use were applied to a further six marginal mid-country estates, following on the five completed in 1996.

A rehabilitation plan for the tea industry in the mid-country was published.

A smallholder Experiments and Extension (E & E) Forum was held for the first time ever, and in the Sinhala language, in December at the TRI, Ratnapura. This was deemed a great success.

Two international meetings took place in Colombo during the year.

The International Standards (ISO) Conference was held in February, with the TRI Director as leader of the Sri Lankan delegation. Issues of tea manufacture and packaging, and evaluation methods for obtaining data on which standards could be based, were discussed. A standard (ISO 11286) was proposed that required all teas to be graded on particle size. If adopted, this would have favoured CTC and not our variably-sized orthodox teas used in blending. We therefore put forward an escape clause, fortunately accepted unanimously, that "ISO 11286 shall not apply to blended teas".

Other significant successes for Sri Lanka at the Conference included our obtaining from the Chair a clear and unambiguous statement that Sri Lankan teas were "the cleanest in the world", as far as pesticide residues were concerned. At least some of the credit for this happy state must go to the TRI.

We were also able to allay, at this Conference, West European and German anxieties that our VP or clonal teas were the result of genetic manipulation.

A Tea and Health Seminar was held in August. TRI research on establishing health benefits of tea drinking, using animal models, was presented.

Dr W.W.D. Modder
Director

TEA RESEARCH BOARD OF SRI LANKA

REPORT FOR THE YEAR 1997

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 07th 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 The 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 manufactured from tea; and to disseminate and publish at its discretion, the 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 programmes, seminars or symposia, with foreign research institutions and research institutions in Sri Lanka.

1.3 Tea Research Institute Head Office at Talawakelle

The Head Office at Talawakelle is responsible for the maintenance, administration, overall planning and execution of research and extension and advisory programmes of its main centre at Talawakelle and five sub-stations located in different tea growing districts.

1.4 Members of the Tea Research Board as at 31st December, 1997.

1.	Dr. S.D.I.E.Gunawardhena	Chairman
2.	Dr. W.W.D. Modder	Director, TRI
3.	Mr. Rohan Illangaratne	Member
4.	Mr. Clifford Ratwatte	Member
5.	Mr. Anura Ekanayake	Member
6.	Mr. E. Kanendran	Member
7.	Mr. S.K. Seneviratne	Member
8.	Mr. G.V. Tissera	Member
9.	Mr. J.P.M.Y. Ratnayake	Member
10.	Mr. Sivam Loganathan	Member
11.	Mr. V. Puthirasigamoney	Member
12.	Mr. I.L.A. Fernando	Member
13.	Mr. S. Wirasinghe	Member
14.	Prof. H.P.M. Gunasena	Member

Secretary to the Board : Mr. C.C. Mawilmada

- * M/S. G.V. Tissera and J.P.M.Y. Ratnayake served as the members of Tea Research Board until October, 1997.

1.5 Senior Management Staff as at 31st December, 1997

1. Director	- Dr. W.W.D. Modder
2. Deputy Director Research (Prod.)	- Dr. G.D. Wimaladasa
3. Deputy Director Research (Tech.)	- Dr. M.T. Z. Mohamed
4. Deputy Director (Administration)	- Mr. C. C. Mawilmada
5. Senior Accountant	- Mr. W.B. Herath

- * Dr. G.D. Wimaladasa was terminated from the TRI service with effect from 19th May, 1997 on disciplinary grounds.

1.6 Heads of Divisions, Administration, Research & Advisory Staff - Grade I - V as at 31st December, 1997.

Administration Division

01. Mr. C.C. Mawilmada	Deputy Director (Administration)
02. Mr. D.W. Bartholomeuz	Administrative Officer
03. Mrs. S.M. Jeyasinghem	Secretary to the Director
04. Mr. D.S.E. Weerasuriya	Chief Clerk
05. Mr. B. Thilakeratne	Purchasing Officer
06. Mr. M.m.P.J. Gawarammana	Transport Officer
07. Mr. G.G.E.H. Gamage	Chief Motor Mechanic

08. Mr.U.A.Wickramasinghe	Electrical Foreman
09. Mr.K.G.Piyasena	Stenographer (Sinhala)
10. Mrs.S.Shanmuganathan	Stenographer (English)
11. Mrs.P.Marapana	Stenographer (English)
12. Mrs. Devika Ratnayake	Stenographer (English)
13. Miss. D.H.Kalikutuwe	Stenographer (English)
14. Miss. A.P.V.Kalyani	Stenographer (English)
15. Miss. C.S.K.Kiribathgoda	Stenographer (English)
16. Mr.P.D.S.L.De Silva	Clerk/Typist
17. Mrs.R.Godage	Clerk/Typist
18. Mrs.I.Jayawickrama	Clerk/Typist
19. Mrs.R.Jayasinghe	Clerk/Typist
20. Miss. Ramani Wijeratne	Clerk/Typist
21. Mrs. Chandrika Jayaram	Clerk/Typist
22. Mr.Rajendrakumar	Clerk/Typist
23. Mr.D.H.Jayathilake	Clerk/Typist
24. Mr.S.H.Chandrasena	Clerk/Typist
25. Mr.P.T.Perera	Clerk/Typist
26. Mr.J.M.R.K.Bandara	Electrician
27. Mr.R.W.Rengasamy	Electrician
28. Mr.K.M.Seneviratne Banda	Telephone Operator
29. Miss. B.N.Damayanthi	Telephone Operator cum Receptionist
30. Mr.W.P.A.N.Jayasinghe	General Clerk
31. Mr.V.Shanmuganathan	Clerk/Typist
32. Mr.D.V.D.Vithanage	Work Supervisor
33. Mr.C.J.B.Abeykoon	Work Supervisor
34. Mr.W.C.K.Fernando	Chief Plumber Mechanic
35. Mr.P.D.Benadict de Silva	Plumber Mechanic
36. Mr.J.G.Gamage	Filter Plant Assistant

Finance Division

01. Mr. W.B.Herath	Senior Accountant
02. Mr.G.A.K.P de Silva	Accountant I
03. Mr.M.Bowatte	Accountant II
04. Mr.K.D.H.Pathirana	Chief Store Keeper
05. Mr.T.H.Lokuhetti	Clerk/typist
06. Mr. S.G. Punchi Banda	Accounting Assistant
07. Mr. C.B. Koswatte	Accounting Assistant
08. Miss. D.M.R.Dissanayake	Accounting Assistant
09. Mr.B.G.D. Premadasa	Clerk/ Typist
10. Mrs. N.Saparamadu	Stenographer (English)
11. Miss. V.Pahalage	Accounts Clerk
12. Mr.R.M.H.B.Ratnayake	Accounts Clerk

13. Mrs. G.A.S. Gunasekara	Accounts Clerk
14. Mrs. W.G.Piyaseeli	Accounts Clerk
15. Mr. Saman Hewasilian	Accounts Clerk
16. Mr.K.T.U. Kulathunge	Assistant Store Keeper
17. Mr.W.A.Nishantha	Data Entry Operator
18. Mr. M.W.T.P.De Silva	Assistant Store Keeper
19. Mr.H.B.W. Gunasekara	Store Assistant
20. Mr. H.B Thalghagoda	Accounts Clerk
21. Miss. A.P.Amarathunga	Accounts Clerk
22. Miss. P.V.D. Chandrakanthi	Accounts Clerk
23. Miss. H.K.Seetha	Accounts Clerk

Internal Audit

01. Mr. R.Kariyawasam	Internal Auditor
02. Mr. P.S.Wickramasinghe	Internal Audit Clerk

Library

01. Mrs. R.W.M.W.K. Illanganthilake	Librarian
02. Mrs. R.W.M.S.K.Amunugama	Library Assistant

Publication Unit

01. Mrs. F.Y.M.Maharoor	Publications/Publicity Officer
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Advisory & Extension Service Division

01. Mr.C.C.Rajasingham	Senior Advisory Officer
02. Mr.J.C.K.Rajasinghe	Advisory Officer
03. Mr.B.A.D.Samansiri	Advisory Officer
04. Mr. V. Sidhakaran	Extension Officer
05. Mr. K.R.M.Priyantha	Clerk/Typist

Agronomy Division

01. Dr. A. Kathiravetpillai	Head of Division
02. Mrs. M.S.D.L. De Silva	Research Officer
03. Mrs. J.Balasuriya	Research Assistant
04. Mr. A.R.Amarasekara	Experimental Officer
05. Mr.U.P.Abeysekara	Experimental Officer

Agricultural Economics Unit

01. Mrs. J.A.A.M.Jayakody	Senior Research Officer/OIC
02. Mr.T.P.B.Herath	Research Assistant
03. Mr.G.Ganewatte	Research Assistant

Biochemistry Division

01. Dr. I. S. B. Abeysinghe	Actg.Head/Sen. Res. Officer
02. Dr. (Mrs) A.C.Liyanage	Senior Research Officer
03. Mrs. J.Jayasundare	Research Officer
04. Mr. A.M.T.Amarakoon	Research Assistant
05. Mr. P.B.Chandradasa	Technical Assistant
06. Mr. M.W.Silva	Skilled Mechanic

Entomology Division

01. Mrs. S.I.Vitharana	Actg.Head/Sen.Res. Officer
02. Dr (Mrs) L.D.Amarasinghe	Senior Research Officer
03. Mr. K. Thirugnanasuntharan	Senior Research Officer
04. Mrs. K.M.S.M.Naghaulla	Research Office
05. Mr.M.M.Keerthi Mohotti	Research Assistant
06. Mr. D.D.Liyanage	Experimental Officer
07. Mr.N.Navaratne	Experimental Officer
08. Mrs. P.V.A.R.Abeyssekara	Experimental Officer
09. Mr.P.D.Peter De Silva	Technical Assistant
10. Mr.G.P.Udumulla	Technical Assistant

Plant Pathology Division

01. Mr.A.Balasuriya	Research Assistant/Actg. OIC
02. Mrs. R.M.D.T. Pallemulla	Research Officer
03. Mr.T.S.Gunasekara	Research Assistant
04. Mr.R.M.A.Ratnayake	Experimental Officer
05. Mrs. K.M.N.K.Ratnamalala	Experimental Officer

Plant Physiology Division

01. Dr. Ananthacoomaraswamy	Actg.Head/Sen.Res. Officer
02. Mrs.A.J.Mohotti	Research Assistant
03. Mrs. V. Sidhakaran	Technical Assistant
04. Mrs.D.M.S.Nawaratne	Technical Assistant

Plant Propagation & Breeding Division

01. Mr. V.Shanmugarajah	Actg. OIC/Research Officer
02. Mrs. M.T.K.Amarakoon	Research Assistant
03. Mr. M.Ratnayake	Experimental Officer
04. Mr.S.W. Gunadasa	Experimental Officer
05. Mr. B.A.Ratnagoda	Technical Assistant

Soil & Plant Nutrition Division

01. Dr. L.S.K.Hettiarachchi	Actg. Head/Sen.Res.Officer
02. Mrs. S.Ananthacoomaraswamy	Research Officer
03. Mr. G.P. Gunaratne	Research Officer
04. Mr. A.K.N.Zoysa	Research Assistant
05. Mr. R.G.A.Wijewardhene	Experimental Officer
06. Mr. H.A.P.Warnasiri	Technical Assistant
07. Mr.S.M.Dissanayake	Technical Assistant

Statistics Division

01. Miss. T.N.Senaratne	Data Entry Operator
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Technology Division

01. Dr. M.T. Z. Mohamed	Deputy Director Resarch (Tech.)
02. Mr.P.A.N.Punyasiri	Research Officer
03. Mr.W.S.Botheju	Research Officer
04. Mr. K.Raveendran	Chemical Engineer
05. Mrs. S.H.P.Waduge	Experimental Officer
06. Mr. L. Jayasinghe	Technical Assistant
07. Mr.A.Nandasiri	Workshop Mechanic

Research, Advisory & Extension Centres**(a) TRI Research Advisory & Extension Centre, Ratnapura (Low Country)**

01. Mrs. S.I.Vitharana	OIC/Actg.Head Entomology
02. Mr.S.Wimaladharmma	Actg. Head/Advisory & Exten. Senior Advisory Officer
03. Dr. M.A.Wijeratne	Senior Research Officer
04. Mr.N.I.Giddawage	Administrative Officer
05. Mr.S.Koneswaramoorthy	Mechanical Engineer
06. Mr.G.L.C. Galahitiyawa	Research Officer
07. Dr. K.G.Premathilaka	Research Assistant
08. Miss. S.M.Samarasinghe	Experimental Officer

09. Mr. H. S. N. Peiris	Experimental Officer
10. Mr. M. K. S. L. D. Amarathunga	Extension Officer
11. Mr. A. K. Premathunga	Experimental Officer
12. Mr. E. R. Perera	Experimental Officer
13. Mr. C. Gunasekara	Experimental Officer
14. Mr. D. W. Vithana	Experimental Officer
15. Mr. A. K. M. Jayasena	Technical Assistant
16. Mr. K. T. C. Perera	Technical Asssistant
17. Mr. K. D. Mervyn	Accounting Assistant
18. Mrs. P. V. G. Karunanayake	Clerk/Typist
20. Mr. J. S. K. De Silva	Electrician
21. Mr. K. Gunawardhene	Work Supervisor
22. Mr. J. H. N. Piyasundera	Technical Assistant
23. Mr. E. W. D. P. Premathunga	Technical Assistant
24. Mrs. B.S. N. Vithana	Technical Assistant
25. Mr. R.Nadarajah	Clerk/Typist
26. Miss. P.I. Jayawardena	Tel. Operator/Receptionist
27. Mr. M. A. B. De Silva	General Mechanic

(b) TRI Research Advisory & Extension Centre, Hantane (Mid Country)

01. Mr. P. B. Ekanayake	OIC/Senior Research Officer
02. Mr. S.T.Yatawatte	Advisory Officer
03. Dr. (Mrs) S. K. J. Liyanage	Research Officer
04. Mr. T. M. Sarathchandra	Experimental Officer
05. Mr. P. D. Uplai	Experimental Officer
06. Mr. H. J. M. De Silva	Experimental Officer
07. Mr. A. P. D. A. Jayasekara	Experimental Officer
08. Mr. U. B. Herath	Experimental Officer
09. Mrs. B. Sureshkumar	Experimental Officer
10. Mr. S. Wijethunga	Experimental Officer
11. Miss. R. M. S. Rajapakse	Experimental Officer
12. Mr. A. H. M. L. S. Abeysinghe	Experimental Officer
13. Mrs. U. Sritharan	Experimental Officer
14. Mrs. S. N. Wijesekara	Experimental Officer
15. Mr. H. Jayaweera	Experimental Officer
16. Mrs. K. Sarathchandra	Technical Assistant
17. Mrs. C. N. K. Edirisinghe	Station Assistant
18. Mrs. B. K. S. Herath	Accounts Clerk
19. Mr. L. Pahalathanthirige	Work Supervisor

Advisory & Extension Centres**(a) TRI Advisory & Extension Centre, Passara (Uva)**

- | | |
|-------------------------|-----------------------|
| 01. Mr. M. B. A. Perera | OIC/ Advisory Officer |
| 02. Mr. R. Nadasena | Station Assistant |

(b) TRI Advisory & Extension Centre, Deniyaya

- | | |
|-----------------------------------|------------------------------|
| 01. Mr. J. A. S. K. V. Jayasinghe | Actg. OIC/ Extension Officer |
| 02. Mr. O. W. Jayawardene | Station Assistant |

(c) TRI Advisory & Extension Centre, Kottawa

- | | |
|----------------------------|----------------------|
| 01. Mr. K. D. Dhanayake | OIC/Advisory Officer |
| 02. Mr. P. K. Jayawickrema | Experimental Officer |
| 03. Mr. E. K. Somapala | Station Assistant |

- 1.7 Most of the vacant positions in the Administration inclusive of St. Coombs and St. Joachim Estates were filled during the year 1997
- 1.8 Action has been initiated to fill the vacancies in the Scientific divisions
- 1.9 Action has been initiated to provide electricity to workmen's cottages of St. Coombs Estate
- 1.10 Maintenance of Divisions : Engineering, Electrical and Water Supply of TRI continued to maintain a high standard in the maintenance of buildings, electrical installations and in the supply of water to the staff quarters within the TRI Campus during the year
- 1.11 Action has been taken to expand the security within the TRI Head Office and its Sub-stations
- 1.12 Action has been taken to renovate the Guest House at Head Office to a high standard
- 1.13 Action has been initiated to draft the Manual of Disciplinary Procedure of the Tea Research Institute
- 1.14 Action has been initiated to revise the existing schemes of recruitment's, promotions etc.
- 1.15 Action has been taken to obtain five (05) Nos. direct telephone lines through the WILLS telephone system.
- 1.16 The Tea Research Board held (09) nine meetings during the year 1997. The three Consultative Committees of the Tea Research Board on Research, Estate and Advisory Services, Administration & Finance held (03) three, (03) three and (10) ten meetings respectively.

TEA RESEARCH BOARD
BALANCE SHEET AS AT 31ST DECEMBER - 1997

			Tea Research Institute 1997	St. Coombs Estate 1997	St. Joachim Estate 1997	Total 1997
1996	<u>Rs.</u>		<u>Rs. cts.</u>	<u>Rs. cts.</u>	<u>Rs. cts.</u>	<u>Rs. cts.</u>
	<u>FIXED ASSETS</u>					
240,485,117	Property, Plant, Equipment etc.		259,049,642.71	-	-	259,049,642.71
(135,108,291)	Less: Accumulated Depreciation	(Anx. I)	<u>(145,542,407.78)</u>	-	-	<u>(145,542,407.78)</u>
<u>105,376,827</u>			113,507,234.93	-	-	113,507,234.93
9,817,789	Capital Work in Progress	(Anx. II)	<u>15,497,913.79</u>	-	44,264.45	<u>15,542,178.24</u>
<u>115,194,616</u>			129,005,148.72	-	44,264.45	129,049,413.17
	<u>CURRENT ASSETS</u>					
9,487,822	Stocks	(Anx. III)	8,188,402.65	1,930,021.91	1,250,617.60	11,369,042.16
64,197,010	Debtors and Other Debit Balances	(Anx. IV)	86,887,766.01	3,064,661.05	335,582.47	90,288,009.53
11,892,067	Deposits, Pre-Payments & Purchase Advances	(Anx. V)	12,753,162.33	231,871.33	239,559.12	13,224,592.78
8,531,632	Loans and Advances to Staff & employees	(Anx. VI)	9,014,344.14	1,198,184.81	649,844.12	10,862,373.07
5,300	Other Current Assets-Patents		10,300.00	-	-	10,300.00
43,000,000	Short Term Investments-7 day Call Deposits		34,000,000.00	-	-	34,000,000.00
<u>1,434,130</u>	Cash and Bank Balances	(Anx. VII)	<u>10,237,544.92</u>	<u>1,559,479.87</u>	<u>44,708.93</u>	<u>11,841,733.72</u>
138,547,961			161,091,520.05	7,984,218.97	2,520,312.24	171,596,051.26
337,400	Suspense	(Anx. VIII)	169,285.48	178,791.62	-	348,077.10
344,051	Identified Losses	(Anx. VIII)	500,557.87	-	-	500,557.87
<u>18,713</u>	Excess & Shortages	(Anx. VIII)	<u>14,319.21</u>	-	-	<u>14,319.21</u>
<u>139,248,125</u>			161,775,682.61	8,163,010.59	2,520,312.24	172,459,005.44
	<u>CURRENT LIABILITIES</u>					
<u>(24,615,889)</u>	Creditors and Provisions	(Anx. IX)	<u>(8,720,237.36)</u>	<u>(5,572,412.11)</u>	<u>(14,530,167.51)</u>	<u>(28,822,816.98)</u>
<u>114,632,236</u>	Net Current Assets		<u>153,055,445.25</u>	<u>2,590,598.48</u>	<u>(12,009,855.27)</u>	<u>143,636,188.46</u>
<u>229,826,852</u>	Total Assets Less Current Liabilities		<u>282,060,593.97</u>	<u>2,590,598.48</u>	<u>(11,965,590.82)</u>	<u>272,685,601.63</u>
	<u>REPRESENTED BY</u>					
39,499,941	Grants and Reserves	(Anx. X)	41,371,431.89	-	-	41,371,431.89
178,244,600	Tea Research Fund	(Anx. XII)	213,441,709.80	-	-	213,441,709.80
-	A/C Current St. Coombs Estate		721,887.13	(721,887.13)	-	-
-	A/C Current St. Joachim Estate		13,514,155.15	-	(13,514,155.15)	-
754,670	Long Term Liabilities - Land Reform Commission		754,670.00	-	-	754,670.00
<u>11,327,641</u>	Provision for Gratuity		<u>12,256,740.00</u>	<u>3,312,485.61</u>	<u>1,548,564.33</u>	<u>17,117,789.94</u>
<u>229,826,852</u>			<u>282,060,593.97</u>	<u>2,590,598.48</u>	<u>(11,965,590.82)</u>	<u>272,685,601.63</u>

Note: - Negative figures are shown within brackets

TEA RESEARCH BOARD
TEA RESEARCH INSTITUTE
OPERATING ACCOUNT FOR THE PERIOD 1ST JANUARY 1997 TO 31ST DECEMBER 1997

14

1996				
<u>Rs.</u>	<u>INCOME</u>		<u>Rs. cts</u>	
86,027,473	3.1 Cess		94,433,902.31	
27,118,483	3.2 Income from Estates and other commercial Activities (Anx XI)		33,910,939.53	
3,603,803	3.3 Interst on Investments		3,226,181.53	
<u>2,612,752</u>	3.4 Miscellaneous (Anx XI)		<u>4,279,303.85</u>	
119,362,511	TOTAL INCOME		135,850,327.22	
<u>EXPENDITURE</u>				
25,654,070	4.1 Personnel Emoluments	12,117,232.40	5,743,082.00	13,260,524.79
2,902,200	4.2 Travelling	2,134,248.35	1,107,862.00	1,043,393.83
8,924,263	4.3 Supplies and Requisites	1,520,491.50	2,473,927.00	5,481,648.84
8,805,953	4.4 Repairs and Maintenance of Capital Assets	9,250,027.17	2,371,841.87	1,390,186.68
8,896,949	4.4 Depreciation of Fixed Assets	3,120,430.76	2,184,611.44	2,995,255.21
13,159,130	4.5 Transportation, Communication, Utility and Other Services	11,367,986.35	1,967,218.00	2,410,912.43
4,976	4.5 Losses and Write-offs	29,237.67	-	-
1,191,516	4.7 Contributions, Grants and Subsidies	1,186,006.40	136,750.00	108,263.50
2,673,829	4.8 Pensions and Retirement Benefits	1,149,450.21	686,150.00	1,477,159.07
1,018,949	4.8 Gratuity Provision	4,827,853.75	-	-
437,180	4.10 Media, Advertising, Publicity and Gifts	76,398.00	387,254.00	10,477.68
4,050,270	4.11 Cultivation and Field Trials		4,328,304.61	-
<u>5,250,791</u>	4.12 Miscellaneous	<u>498,518.59</u>	<u>323,442.00</u>	<u>3,374,577.63</u>
82,970,076	TOTAL EXPENDITURE	<u>47,277,881.15</u>	<u>21,710,442.92</u>	<u>31,552,399.66</u>
36,392,435	Operating Srplus			35,309,603.49
<u>(1,311,017)</u>	Prior year adjustments			<u>(112,493.29)</u>
<u>35,081,418</u>	Excess of income over expenditure transferred to Tea Research Fund			<u>35,197,110.20</u>

Note: Tea cess receivable - Rs. 58,427,836.69

ANNUAL REPORT FOR 1997

RESEARCH PROJECTS

The progress made in the multi-disciplinary and mono-disciplinary projects are reported below.

MULTI-DISCIPLINARY PROJECTS

1. **Project A/INCR** - Intercropping tea lands to maximize income and conserve soil through optimal land utilization

Project Leader - P.B. Ekanayake

1.1. Effect of intercropping tea and rubber on productivity

1.1.1 RRI-Kuruwita (1990)

This experiment is conducted in collaboration with the Rubber Research Institute of Sri Lanka.

Yields are presented in Table 1.1. Yield records were analysed separately for tea planted after rehabilitation and planted without rehabilitation. The latter was pruned for the second time in June 1997 and tipped in October, 1997.

Results showed that the yield of monocropped tea was greater than intercropped tea, under rubber at spacings of 27'x8' or 40'x8', but there was no significant difference in yield of tea between the two rubber spacings. The annual yield of tea in the mixed stand (tea +Rubber 40'x8') was 1086 kg ha/yr compared to the monocropped tea yield of 3852 kg ha/yr.

Results on the pruning and tipping assessments were in agreement with the yield differences, i.e. although there were no significant differences, a slight reduction of the weight of prunings (15%) and tippings (4%) of tea was recorded under closer spacing of rubber compared with those under wider spacings.

TABLE 1.1 *Yield of tea under different spacing of rubber*

	<i>Green leaf Yield (kg bush⁻¹)</i>	
	<i>Nov'96-Jun'97</i>	<i>Jul'97-Nov'97</i>
With Rehabilitation		
Tea (monocropping)	0.654	0.894
Tea+Rubber (8'x27')	0.318	0.270
Tea+Rubber (8'x40')	0.323	0.300
LSD (p=0,05)	0.251	0.450
Without Rehabilitation		
Tea+Rubber (8'x27')	0.378	-
Tea+Rubber (8'x40')	0.430	-
LSD (p=0.05)	NS	-

1.1.2 St. Joachim Estate, TRI-Ratnapura (1990)

The yield is presented in Table 1.2. Although there was no significant yield difference (on a per bush basis) between monocropped tea and tea under rubber (40'x8') during the first half of the year, a significant reduction in tea yield was recorded under rubber during the second part of the year. The annual yield reduction of tea (per bush basis) amounted to be about 40%. Assuming a 70% stand of tea under rubber (at 40'x8'), made tea yield in the intercropped area (mixed stand) was estimated to be 1119 kg/ha/yr compared to the monocropped yield of 2635 kg/ha/yr.

TABLE 1.2. *Yield of tea under different spacing of rubber*

	<i>Green leaf Yield (kg bush⁻¹)</i>	
	<i>Jan-June</i>	<i>Jul-Dec</i>
Tea (monocropping)	0.352	0.627
Tea+Rubber (8'x40')	0.281	0.312
LSD (p=0.05)	NS	0.303

1.1.3. Demonstration plot, St. Joachim Estate, TRI-Ratnapura, (1989)

Harvesting of rubber and tea continued together with other cultural practices.

1.1.4. Observation Block (1995)

A second cut (45 cm) was given to tea plants and other cultural practices continued in this observation block. The same planting system was continued in another 2 ha block of the remaining area of this field. Tea and rubber clones planted were TRI 2027, RRI 100 and RRI 102.

P.B. Ekanayake, M.A. Wijeratne and C. Gunasekara

1.2 Effect of intercropping in seedling tea

1.2.1 Effect of intercropping fruit species in seedling tea at Hantane Sub Station

Except for mango all species had been damaged by wild boar. Therefore it was not possible to continue this observation trial and this experiment was abandoned.

1.3. Mid Country Station, Hantane - SALT Demonstration Hedgerows

Four loppings were done during the year. *Calliandra calothyrsus*, *Cassia spectabilis* and *Flemingia congesta* had given higher biomass production than other species. The biomass produced by *Calliandra calothyrsus* was superior

while the biomass production of *Desmodium rensonii*, *Adathoda visca* and *Teckoma stans* was very poor. However, the low biomass production of *Desmodium rensonii* was attributable to the high casualty rate of this species with each lopping. The biomass production is presented in Table.1.3

TABLE 1.3. Biomass production of different hedgerow species.

<i>Species</i>	<i>Bio mass production (Kg ha⁻¹)</i>
<i>Calliandra calothyrsus</i>	6350
<i>Flemingia congesta</i>	3874
<i>Cassia spectabilis</i>	3532
<i>Adathoda vasica</i>	812
<i>Teckoma stans</i>	786
<i>Desmodium rensonii</i>	74

This demonstration trial is continuing.

A.P.D.A.Jayasekera

AGRONOMY DIVISION

Acting Head - A. Anandacoomaraswamy

1. General

Dr A. Kathiravetpillai retired from the services of the institute on July 9th after 35 years of service. Dr K.G. Prematillake completed the Ph.D program at University of Reading and returned to the institute in June. Dr Kathiravetpillai attended a workshop on 'Organic Farming' held in Calcutta in March. Mr H.S.N. Peiris spent 3 months at the Plantation Management Institute, Coonoor, South India. Mr.P.B. Ekanayake attended a workshop on 'Sustainable Farming systems' held in Japan. Ms Vanathy Yathavarajan and Anchana Balasingham, final year students of Faculty of Agriculture, University of Jaffna, Mr.T.D.P. Aratchige and Ms Dhammika Jayawardena from the Agricultural Faculty, University of Peradeniya carried out their final year projects.

Patent right was obtained for the TRI shears and arrangements were made for its mass scale production by Messrs. P.P.P. Jinadasa. A first draft of a Monograph on Pruning was written by Dr. A.Kathiravetpillai and Dr. M.A. Wijeratne. A script for the video film on plucking was written by Dr.M.A. Wijeratne and Mr. Janaka Rajasinghe. Video filming on shear harvesting at Craig Estate was completed.

2. Project B/PLUK - *Harvesting Practices*

Project Leader - M.A. Wijeratne

2.1 Effect of different methods of plucking (machine, shear and hand plucking) on yield of tea - Hapugastenna Estate, Ratnapura - (1992)

Different combinations of machine, shear and hand plucking continued until the bushes were pruned in May 1997. Over the four months before pruning, yield of machine and shear harvested plots fell by about 48% and 34% respectively, compared to manual harvesting. The majority of the other plucking systems (combinations of mechanical and manual plucking) have given a yield loss of less than 10% compared to continuous manual plucking (Table 2.1).

TABLE 2.1. - *Yield of tea 4 months before pruning*

	<i>Yield MT (kg/ha)</i>
Manual Plucking	1088
Machine plucking	565
Shear plucking	717
Manual + Machine (Cropping season)	1054
Manual + Shear (Cropping season)	1016
Manual + Machine (Alternate rounds)	995
Manual + Shear (Alternate rounds)	902
LSD (P=0.01)	186

Plucking table heights of shear harvested bushes and manually harvested bushes were comparable while those of machine harvested bushes were 7-10 cm less than the manually harvested bushes.

Pruning and tipping assessments showed no significant difference in weight of pruning and tipping between the plucking systems. However, there was a slight reduction of the pruning weight under machine harvesting.

M.A. Wijeratne, D.W. Vithana and K.T.C. Perera

2.2 Mechanical harvesting at Rassagala Estate - (1996)

Two plots of tea of about 0.5 ac (0.2 ha) each (TRI 2023) were harvested, one manually and the other by machine, to test the performance of the Kawasaki NV60H machine. In the field selected, manual plucking rounds of about 10-12 days or more are usually adopted due to shortage of pluckers. Yields of both plots were comparable i.e. 2664 and 2617 kg/ha/year for the manual and machine harvesting. Output of the machine was estimated to be 250 kg/day (green leaf) and the labour output was 83 kg/man day. The machine can harvest about 0.53 ha/day. The selected field is on undulating land with an average slope. Further comparisons showed that the labour requirement for machine harvesting has been about 50% less than that for manual harvesting.

M.A. Wijeratne, D.W. Vithana and K.T.C. Perera

2.3. Use of different kind of shears for plucking of tea.

Field No. 3, St Coombs Estate (1996). Observation trial

Five different shears viz. TRI shear, Malaysian shear, Shear with a bag, Shear with a box, Shear with a tray were used in comparison with manual plucking on six plots of tea as a demonstration.

A.R. Amarasekara

2.4 Effect of Shear plucking on growth and yield of tea.

Observation trial, Hantane Sub Station, Kandy (1997)

Two blocks of approximately 0.1 ha are being continuously plucked by hand and TRI shear; the crop is recorded and a sample is separated into different units to ascertain dry weight. There was no significant difference between shear and hand plucking on yield recorded during the year, nor between other assessments made on dry weight of different units.

S.N. Wijesekera

3. Project A/PRUN - *Pruning practices in tea*

Project Leader - M.A. Wijeratne

3.1. Study on different methods and time of pruning on the shot-hole borer damage (SHB Task Force) at Kiriwanaganga Estate, Deniyaya (1996).

Plots pruned in October were tipped and brought into plucking. The majority of recovering shoots were infested by shot-hole borer. The second set of plots (12 plots) were pruned in April, tipped and brought into plucking in October. The degree of shot-hole borer infestation of recovering shoots was less than the previous attack. (Complete assessments on the shot-hole borer infestation were done by the Entomology Division).

M.A. Wijeratne, D.W.Vithana, K.T.C.Perera, and
Staff of Entomology Division.

3.2. Study on different methods and time of pruning on the shot-hole borer damage (SHB Task Force) at Attampitya Estate, Attampitiya (1996).

An experiment was initiated to study the effect of different methods and time of pruning on the shot hole borer infestation.

The operations carried out for different methods and time of pruning is given in Table 3.1.

TABLE 3.1 - *Methods and Time of Pruning and other operations*

Treatments	Pruning	Tipping	Plucking
1. 10" Rejuvenation	Oct. '96	Sept '97	Nov '97
2. 10" Rejuvenation	Jan. '97	Sept '97	Nov '97
3. 10" Rejuvenation	Apr. '97	-	-
4. 18" Normal	Oct. '96	Jan. '97	May '97
5. 18" Normal	Jan. '96	Apr. '97	Aug '97
6. 18" Normal	Apr. '96	Sep. '97	Nov '97
7. 24" Cut across	Oct. '96	-	May '97
8. 24" Cut across	Jan. '97	-	May '97
9. 24" Cut across	Apr. '97	-	Aug '97

Assessment of shot hole bore infestation was carried out by Entomology staff.

A.R. Amarasekara

3.3 Effect of height of pruning, Type of pruning on yield and infestation of Shot Hole Borer, New Peacock Estate, Pussellawa (1997)

This experiment was initiated to study the effect of different times and heights of pruning on the degree of shot-hole borer infestation and yield of tea. The Agronomy Division carried out pruning and will keep yield records while the Entomology Division will carry out other assessments on pest infestation. The treatments, method, height and time of pruning are given in Table 3.2.

Table.3.2 - Type, height and time of pruning

Treatments	Type of pruning	Height of pruning	Time of pruning
T1	Rejuvenation	25 cm	April 1996
T2	-do-	25 cm	October 1996
T3	-do-	25 cm	January 1997
T4	Normal	45 cm	April 1996
T5	-do-	45 cm	October 1996
T6	-do-	45 cm	January 1997
T7	Cut across	60 cm	April 1996
T8	-do-	60 cm	October 1996
T9	-do-	60 cm	January 1997

Yield is being recorded in all the plots pruned in April 1996 and October pruning was also completed. The experiment is in progress.

A.P.D.A. Jayasekera

3.3. Different styles of pruning and bringing into plucking on recovery after pruning and yield of tea at Noragalla Estate (1996).

Analysis of results showed that there were no significant differences in the annual yield between the different methods of pruning (Rim-lung and cut-across) and bringing into plucking (tipping and plucking-in) tested.

M.A. Wijeratne, D.W. Vithana and K.T.C. Perera

3.4. Seasonal variation of root starch reserves of tea with and without resting, St. Joachim estate - Ratnapura (1996).

The yield for the three clones and starch content are presented in Tables 3.3. and 3.4.

TABLE 3.3. *Yield of made tea (kg ha⁻¹yr⁻¹)*

	<i>Yield of made tea (kg ha⁻¹ yr⁻¹)</i>
TRI 2027	4515
TRI 2025	3317
S 106	5249
LSD (p=0.05)	784

TABLE 3.4. *Starch content of tea roots (%)*

<i>Sample Number</i>	8	10	12	14	16	18
Clone						
TRI 2027	2.1	4.0	9.1	10.6	8.7	7.9
TRI 2025	3.6	3.8	6.7	5.8	8.7	7.7
S 106	2.8	4.6	8.5	7.6	8.3	7.2
LSD (p=0.05)	NS	NS	NS	NS	NS	NS

Although there was a significant difference in yield between clones, root starch content was not significantly different between clones. However, comparisons of monthly results revealed that starch reserves steadily increased with the expansion of the canopy foliage after tipping in October '96 and that it reached maximum about 6 months after tipping. Starch content appears to be constant during the following 6 months. Yield also varied in a pattern similar to that of starch content over the year.

M.A. Wijeratne and P. Premathunga

3.5 Effect of height of pruning, retention of lungs and method of tipping on yield, St. Coombs Estate, Talawakelle (1995)

The yields during the 2nd year of the current cycle are given in Table 3.5

TABLE 3.5 - *Effect of height of pruning, retention of lungs and method of tipping on yield*

Treatments	Yield (kg made tea ha ⁻¹)
Pruning at 45cm + with lungs + plucking in	3414
Pruning at 45cm + with lungs + tipping	2853
Pruning at 45cm + without lungs + plucking in	3016
Pruning at 45cm + without lungs + tipping	3298
Cut across at 55cm + with lungs + plucking in	3278
Cut across at 55cm + with lungs + tipping	3089

Cut across at 55cm + without lungs + plucking in	3208
Cut across at 55cm + without lungs + tipping	3414
Cut across at 65 cm + with lungs + plucking in	3176
Cut across at 65 cm + with lungs + tipping	2840
Cut across at 65 cm + without lungs + plucking in	2843
Cut across at 65 cm + without lungs + tipping	3332
LSD (P=0.05)	NS
CV%	9.4

Pruning heights, retention of lungs and method of bringing into bearing did not influence the yield.

A.R. Amarasekera

4. Project B/ENGY II - Management of shade and fuelwood trees

Project Leader : A. Anandacoomaraswamy

4.1 To evaluate the effect of Dadap shade on yield of tea - Field No. 7, Stonycliff Estate, Kotagala

The yields for the second year (December 1996 - November '97) are given in Table 4.1.

TABLE 4.1 - *Effect of shade and no shade on yield*

	Treatments Yield (kg MT ha ⁻¹)
Without Dadaps	4562a
With Dadaps	4400a
SE	177.6
CV(%)	4.9

The treatment difference is not significant.

A.R. Amarasekera

4.2.1 Evaluation of suitable Calliandra provenances

Trials on Calliandra provenances at St. Coombs Estate, Talawakelle, Dessford Estate, Nanu Oya, and Park Estate, Kandapola are in progress. The total biomass (dry weight) obtained by the second lopping of branches in July at St Coombs trial is presented in Table 4.2.

TABLE 4.2 - *Total biomass (kg.ha⁻¹)*

Code	Biomass (kg ha ⁻¹)
10/91/5	1655
10/91/19	1429
9/91/7	1339
10/91/16	1238
33/93/4	1153
33/93	1142
33/93/8	1112
9/91/6	1109
33/93/15	1087
10/91/20	1016
10/91/4	998
9/91/11	914
9/91/20	890
9/91/1	879
10/91/6	859
10/91	767
9/91/19	700
10/91/9	664
33/93/22	647
9/91/2	635
10/91/7	625
33/93/20	595
10/91/15	534
10/91/17	496
10/91/1	476
10/91/2	457
33/93/3	449
33/93/21	415
9/91/13	61
9/91/18	20

The biomass obtained by the first lopping at Park Estate, Kandapola is presented in Table 4.3.

TABLE 4.3 - *Total biomass (kg.ha⁻¹)*

Code	Biomass (kg.ha ⁻¹)
10/91/1	4417
9/91/13	3075
9/91/20	2872
10/91/7	2776

33/93	2294
10/91/5	2039
9/91/6	1873
33/93/15	1803
33/93/6	1748
33/93/10	1730
10/91/17	1540
33/93/22	1020
33/93/1	860

A.R. Amarasekara

4.2.2 Performance of different provenances of *Calliandra*, Mid Country Station, Hantane (1994)

Calliandra plants were lopped in December. The percentage of surviving plants and the mean dry weight of lopping is given in Table.4.4

TABLE 4.4 - *No. of plants and mean biomass production of different provenances of Calliandra*

Provenance	Initial No. of plants	% plants (Dec.1997)	Mean dry wt. of lopping (g/plant)
10/91	288	24.0	4968
34/93	515	39.5	4654
33/93	74	44.0	4611
9/91	543	20.0	4481

This trial is in progress

A.P.D.A.Jayasekera

4.3 Evaluation of *Grevillea robusta* provenances

About 30 provenances performing well in the nursery were transplanted in the following estates in October/November for field testing:

1. New Peacock Estate(Pusellawa)
2. Pedro Estate(Nuwara Elliya)
3. St Joachim Estate (Ratnapura)
4. Galphele Estate(Panwila)

A. Anadacoomaraswamy. K.G. Prematillaka, K.D. Dahanayake,
A.R. Amarasekara and A.P.D.A. Jayasekera

5. Project B/WATU *Water use in tea plantations*

Project Leader: A. Anandacoomaraswamy

5.1 Soil reconditioning, soil fertility improvement and soil moisture conservation studies

5.1.1. *Effect of soil rehabilitation with sugar cane varieties and grasses on the growth of tea.*

5.1.1.1. *St. Joachim Estate, Ratnapura - (1991)*

Yield records over the year showed that soil rehabilitation with different grass spp. and sugar cane cultivars before planting had no significant effect on the yield of tea. Different species tested were Sugar cane (CO 775, M 292/71, LF), Mana, Eragrostis and Vetiver.

C. Gunasekara

5.1.2 *Effect of rehabilitation after pruning on recovery and yield (K145). Observation trial, Mattakelle Estate, Talawakelle - (1991)*

The yield for the first year (November '96 - October '97) of the current cycle is given in Table 5.1

TABLE 5.1 - *Yield of tea*

	Yield (kg MT ha ⁻¹)
With rehabilitation	2236
No rehabilitation	2476

The plots were brought into plucking in November. Non-rehabilitated plots gave higher yield, probably due to their bottom slope position in the topography.

A.R. Amerasekera

5.1.3. *Effect of burying prunings on yield. St Coombs Estate (1991)*

This experiment is in the second year of the current cycle. The yields are given in Table 5.2.

TABLE 5.2 *Effect of burying and retention of prunings on yield*

Treatments	Yield (kg MT ha ⁻¹)
T1. Control (with normal fertilizer)	4669
T3. Burying prunings + half of normal fertilizer	4167
T4. Burying prunings only	3226
T5. Burying brush wood + normal fertilizer	4242
T6. Burying brush wood + half of normal fertilizer	3684
T7. Retention of prunings + normal fertilizer	4510
LSD (P=0.05)	567
CV%	9.1

There were no significant yield differences among treatments T1, T2, T3, T5 and T7, but treatments T4 and T6 depressed the yield.

5.1.4. *Effect of direct planting vs. planting after soil reconditioning on yield. Concordia Estate (1991)*

This experiment is in the fourth year of the first cycle. Yields are given in Table 5.3.

TABLE 5.3 - *Effect on yield of planting tea with and without rehabilitation*

Treatments	Yield (kg MT ha ⁻¹)		
	Rehabilitated	Direct planted	Mean
Clone			
TRI 2025	1924	1739	1832
TRI 2024	2498	1835	2166
NAY 3	2850	2533	2692
DT 1	2798	2186	2492
PK 2	3170	2746	2958
Mean	2648	2208	2428
LSD (P=0.05) for planting		144	
LSD (P=0.05) for clones		228	
CV%		10.2	9.0
SE		246.8	208.5

All clones gave significantly higher yield in rehabilitated soil.

A.R. Amerasekera

5.1.5 *Effect of alternate methods of rehabilitation compared with rehabilitation under grass. New Peacock Estate, Pussellawa - (1996)*

The plants were tipped at a height of 65cm in October 1997.

The tipping weight and girth at ground level are presented in Table 5.4

TABLE 5.4 - *Tipping weight(kg ha⁻¹) and girth(cm)*

	Tipping weight	Girth
Control (2 years rehabilitation with grass)	216.0a	4.76a
Direct planting with coir dust (3.0 kg/planting hole at bottom)	152.9ab	4.36ab
Direct planting with compost (1.5 kg/planting hole + 20g T200 fertilizer mixture)	163.5ab	4.40ab
Direct planting with coir dust (1.5 kg/planting hole at bottom + 1.5 kg compost on top)	135.2ac	3.96 ab
Direct planting with coir dust (3.0 kg/planting hole at bottom + 20g T200 fertilizer mixture)	108.9abc	4.43ab
Direct planting with 20g T200 fertilizer mixture + 1.5 kg compost on top	84.7bc	4.26ab
Direct planting with compost (3 kg/planting hole)	84.4bc	3.83ab
Interplanting <i>Flemingia congesta</i> as cover crop in tea interrows	28.3c	3.1b
LSD(P=0.05)	120	0.48
CV%	56.3	20.4

Tipping weights obtained from direct planting with compost and T200, direct planting with coir dust and compost and direct planting with coir dust and T200 were not significantly different from the control.

A.R. Amerasekera

5.2 Cover crops

Cover crops are maintained as a source of plant materials to be distributed among the plantations on request.

M.A.Wijeratne, D.W.Vithana

5.3 Mulching materials

5.3.1. Effect of different mulching materials on growth and yield of tea, Galphele Estate, Panwila - (1993)

Yields for the third year (January-December) are presented in Table 5.5.

TABLE 5.5 - *Effect of mulching materials on yield of young tea*

	Treatments Yield(kg made tea ha ⁻¹)
Tea refuse	3069 a
Mana grass	3031 ab
Paddy husk	2776 b
Coir dust	2772 b
Sawdust	2770 b
Control	2571 b
SE	125.1
5%LSD	376.9
CV%	8.8

The plots mulched with tea refuse and mana grass gave higher yields than the control. This experiment is continuing.

A.P.D.A. Jayasekera

6. Project B/WEED - Weed Management Practices in tea

Project Leader K.G. Prematilaka

6.1 Studies on Passeli weeds in Bandarawela region.

a) Preliminary investigations on the pattern of growth and reproduction of Passeli weeds in Neluwa, St. James and UvaHighlands estates. Table 6.1 gives morphological information on Passeli weeds.

TABLE 6.1. *Morphology of Passeli weeds in Uva*

	Weed	
	<u>Talinum paniculatum</u>	<u>Andredera basseloides</u>
	Bush type weed	Vine type
Plant density	80/m ²	2-3/m ²
Plant height	0.50 m	1.4-2.0 m
No. of shoots/plant	3-10	6-7
Length of a branch	15-30 cm	75-90 cm

No. of inflorescences/plant	3-10	-
No. of fruits/inflo.	25-100	-
No. of seeds/fruit	16-20	-
Total no. of seeds/plant	1200-15000	-
No. of bulbils/1m branch	-	14-15
No. of bulbils/plant root	-	150-200

b) Demonstration trials at Uva Highlands estate, Bandarawela.

i) Testing of 'Bimaster' herbicide on the control of Passeli weeds. Herbicide was sprayed @ 4 l/ha in Sep.97, but no effective control of either weed was observed 2 and 4 weeks after spraying (WAS).

ii) Use of lown-mower to slash Talinum weed.

The weed could easily be crushed with the machine but it was difficult to move the machine on uneven land and the cutter blades were easily blocked by boulders. Continuous slashing was also hampered by the need to remove cut weeds which encircled both ends of the axle. These weeds have to be regularly removed from the axle for smooth running of the cutter. Some modifications will clearly be necessary for the machine.

iii) Establishment of Arachis pintoii (a cover crop).

This new cover crop was planted on vacant patches infested with Talinum weed in early October 1997. The cover crop failed 6 weeks after planting; replanting is to be done soon.

c) Pot Experiments:

i. Impact of the size of bulbils and shade on the germination of Passeli kodi (A. basselloides). Three sizes of bulbil were compared -

Size 1 (0-1 g fresh weight)

Size 2 (1-2 g fresh weight)

Size 3 (2-3 g fresh weight)

There were 3 reps arranged in a CRD under shade, and another 3 reps without shade.

Treatments were applied in the open. 4 bulbils of each size were dibbled in the soil of each pot. Shade was provided by coir mats.

Assessments:

a) Date of emergence of first leaf.

b) Rate of growth of seedlings.

The experiment is in progress.

- ii. Competitiveness of Passeli weeds (A. basseloides and T. paniculatum) on young tea under two light regimes.

30 cement pots of size 30x30x30 cm were filled with tea soils and planted with clone TRI 4042 in August 1997. Weed treatments were

W₀ Control - no weeds planted

W₁ T. paniculatum

W₂ A. basseloides

Half the experiment (15 pots as a CRD) was shaded (coir matting) and the other half unshaded.

Two opposite corners of each weed pot (21.2 cm from the base of the tea plant) were planted with two plants of Talinum or Anredera weed according to the weed treatment.

Assessments to be made:

- 1 Growth rate of tea - at two month intervals.
 - a) Plant height
 - b) Collar thickness
 - c) No. of leaves
 - d) No. of shoots
- 2) Growth rate of both weeds:
 - a) Plant height
 - b) No. of leaves
 - c) No. of shoots plus, additionally, for Andredera
 - d) No. of bulbils and
 - e) Yam weight
- 3) Soil analyses prior to and 6 and 12 months after imposition of treatments
- 4) Plant analyses for N, P, and K, 6 and 12 months after imposition of treatments.
- 5) Ambient temperature under shade and no shade.

K. G. Prematilaka and P. Prematunge.

6.2. Investigations on new "Control Droplet Applicator(CDA) sprayer" (supplied by Monsanto Co. Ltd).

- a) Spray Swath:

I) Distribution pattern of the spray droplets within the swath. While spraying with the CDA placing the hood at 20 cm height spray droplets were collected for a minute in small petri dishes. Dishes were placed 10 cm apart along a straight line from left to right and the spinning disc and hood were placed at the centre so that spray solution is collected in dishes. The details are given in Table 6.2.

Table 6.2. Amount of spray solutions

Distance from centre(cm)	Shield level to the ground	Shield parallel to the lance
Left		
40	1.5	0.2
30	2.2	1.2
20	2.9	3.5
10	3.6	4.8
Centre		
10	1.95	1.75
20	0.4	0.1
30	0.1	0
40	0.0	0
Right		

The left side receives more droplets since the spinning disc rotates anti-clockwise and thus spray droplets are released predominantly to the left direction. Positioning the hood and cup more towards the right makes an even distribution on both sides of the hood.

ii) Spray swath as affected by the height of spinning disc from ground level.

TABLE 6.3. Spray swath(cm)

	Height(cm)		
	15	22.5	30
Hood level to the ground	50	85	92
Hood raised upward by 30°	70	90	95
Hood bent downward by 30°	56	58	82

Holding the spinning disc at height between 22-30 cm while spraying is more appropriate to wet a wider area between tea rows with spray solution without harming tea bushes.

b) Effect of walking speed while spraying with CDA and Knapsack sprayers on weed control one week after spraying(WAS).

TABLE 6.4. % Weed control

Sprayer	Speed	% Weed control	
		grasses	Broad leaf
1) CDA	same as for Knapsack (Normal)	90	45
2) CDA	Slower than above	95	60
3) Knapsack	Normal	50	10

Thus, maintaining the speed for CDA similar to that for the Knapsack sprayer provides a satisfactory control of weeds.

- c) Investigation of the rainfastness of "Round up" sprayed once using a CDA sprayer.

"Round up" was sprayed @ 1.65 l/ha using a CDA (the concentration was 66 ml/l i.e. 1.65 l/25 l of water/ha) and Knapsack sprayers (1.65 l/550 l of water/ha) to the plots demarcated in open land infested with weeds. Following application, plots were sprayed with the same volume of water to wash away the chemical at given intervals according to the treatments.

Treatments:

T1	CDA	-	Watering 1 hr. after spray
T2	do	-	Watering 2 hrs. after spray
T3	do	-	Watering 3 2 hrs. after spray
T4	do	-	Watering 4 2 hrs. after spray
T5	Knapsack	-	Watering 4 2 hrs. after spray
T6	CDA	-	Watering 5 2 hrs. after spray
T7	Knapsack	-	Watering 5 2 hrs. after spray
T8	CDA	-	Watering 6 2 hrs. after spray
T9	Knapsack	-	Watering 6 2 hrs. after spray
T10	Control	-	

Visual observations were made 1, 2 and 4 weeks after application of "Round up".

TABLE 6.5 - *Fresh weight of damaged weeds and visual observations.*

	Fresh weight of damaged weeds			Visual(% damage)			
	1 WAS(g/0.18 m ²)			1WAS	2WAS	4WAS	
T1	111 (1.96)	ab	7.5 (2.80)	40 (6.36)	abc	66 (8.16)	ab
T2	123 (2.05)	a	10.0 (3.24)	58 (7.60)	abc	75 (8.50)	ab
T3	55 (1.72)	abc	10.0 (3.15)	40 (6.40)	abc	68 (8.24)	ab
T4	123 (2.06)	a	12.5 (3.59)	30 (5.45)	abc	59 (7.56)	b
T5	38 (1.58)	c	2.5 (1.53)	25 (3.91)	cde	12 (3.25)	d
T6	95 (1.91)	abc	20.0 (4.15)	60 (7.76)	ab	81 (9.00)	ab
T7	48 (1.66)	bc	5.0 (1.98)	3 (1.53)	ed	4 (1.75)	e
T8	100 (1.99)	ab	32.5 (5.53)	73 (8.48)	a	90 (8.49)	a
T9	74 (1.81)	abc	7.5 (2.80)	20 (4.53)	bcd	30 (5.51)	c
T10	59 (1.57)	c	0.0 (0.71)	0 (0.71)	e	0 (0.71)	e
LSD (P=0.05)			NS				

WAS- Weeks after spraying

Terms in parentheses

= Log transformed values (weights)

= Square root transformed values (%s)

The greatest damage to weeds was observed throughout in plots watered 6 hour after spraying using the CDA sprayer. However, greater damage was caused to weeds with CDA even one hour after application of water than with the Knapsack sprayer. This might be due to the efficient use of glyphosate (1.65 l/25 l water) with CDA compared to the Knapsack sprayer where 1.65 l is mixed with 550 l of water. With the Knapsack, four to five hours rainfastness resulted in lower weed damage, similar to that of the control. However, a six hour rain free situation showed a more weed damage with the Knapsack than with the control treatment.

K.G. Prematilaka

6.3: Performance of Lawn Mower as a mechanical weeder.

TABLE 6.6. Time taken to weed a 50 m interrow of tea.

Lawn mower		Knife	
	Minutes		Minutes
Time - Worker A	34.0	Worker B -	23.0
	28.6		23.0
Worker B	29.6	Worker A -	32.0
	31.4		30.0
Average	30.7		27.0

Almost 90% of the weeds could be slashed with a knife but the lawn mower was able to chop only a 60 % of the total weeds. Some modifications will clearly be necessary before operating the latter as a weeder.

K.G. Prematilaka

6.4: Control of Borreria latifolia at the low country Station, TRI, Ratnapura.

Treatments:

- T1 MCPA @ 1.9 l/ha (3.5 ml/l)
- T2 MCPA @ 2.5 l/ha (4.5 ml/l)
- T3 MCPA @ 3.0 l/ha (5.5 ml/l)

- T4 MCPA @ 1.9 l/ha (3.5 ml/l) + Paraquat @ 1.1 l/ha (2 ml/l)
- T5 MCPA @ 2.5 l/ha (4.5 ml/l) + Paraquat @ 1.1 l/ha (2 ml/l)
- T6 MCPA @ 3.0 l/ha (5.5 ml/l) + Paraquat @ 1.1 l/ha (2 ml/l)
- T7 Hedonal-D @ 1.4 l/ha (2.5 ml/l) + Paraquat @ 1.1 l/ha (2 ml/l)
- T8 Hedonal-D @ 1.9 l/ha (3.5 ml/l) + Paraquat @ 1.1 l/ha (2 ml/l)
- T9 Hedonal-D @ 2.5 l/ha (4.5 ml/l) + Paraquat @ 1.1 l/ha (2 ml/l)
- T10 Control - no herbicide

The above herbicide combinations were applied to the tender patches of *Borreria* in early October, 97, with three replicates. Observations were made 7, 14 and 21 days after spraying.

TABLE 6.7. Mean visual score(%) for casualties 1, 2 and 3 weeks after spray (WAS):

	1 WAS	2 WAS	3 WAS
T1	50	50	85
T2	75	100	100
T3	82	100	100
T4	50	98	100
T5	65	85	92
T6	85	83	98
T7	82	90	92
T8	98	100	100
T9	10	100	100
T10	0	0	0

It appeared that 2.5 l/ha of MCPA alone or 1.9 l/ha + paraquat 1.1 l/ha and 1.9 l/ha Hedonal-D + 1.1 l/ha paraquat were more promising on the control of *Borreria latifolia* weed at its immature stage of growth. However, MCPA @ 1.9 l/ha alone and Hedonal-D @ 1.4 l/ha also killed the weed satisfactorily 3 WAS.

K. G. Prematilaka

6.5 Studies on the efficacy of glyphosate with incorporation of kaolin in the control of *Axonopus* grass at, St. Joachim Estate.

36 blocks of size 2 m², which were highly infested with *Axonopus compressus* grass, were used for three replicates of the following twelve herbicide treatments.

- T1 2% glyphosate alone
- T2 1% glyphosate + 3.85 kg/ha kaolin
- T3 1% glyphosate + 1.93 kg/ha kaolin
- T4 1% glyphosate alone
- T5 0.5% glyphosate + 3.85 kg/ha kaolin
- T6 0.5% glyphosate + 1.93 kg/ha kaolin
- T7 0.5% glyphosate alone
- T8 0.3% glyphosate + 3.85 kg/ha kaolin
- T9 0.3% glyphosate + 1.93 kg/ha kaolin
- T10 0.3% glyphosate + 0.97 kg/ha kaolin
- T11 0.3% glyphosate alone
- T12 Control - nil

Visual observations as well as weed fresh weight differences did not indicate any effect of kaolin on weed damage.

K.G. Prematilaka

6.6 Effect of different methods of weed management on yield of young VP tea, Galphele Estate, Panwila (1994)

The yields during the 3rd year of the first cycle are presented in Table 6.8

Table.6.8 - *Effect of method of weed management on yield of young VP tea*

Treatments	No. of weeding rounds in 1 yr.	Yield (kg ha ⁻¹)
Manual weeding every month	12	4456
Manual weeding every 2 months	6	4056
Manual weeding every 3 months	4	4196
Chemical weeding with Paraquat	4	3896
Chemical weeding with Glyphosate	3	4123
Chemical weeding with Sulphosate	3	3834
Chemical weeding with Paraquat + 24D	2	4159
Chemical weeding with Paraquat+24D + Diuron	2	4184
Slash weeding	3	4506
SE (16 df)		262.0
CV%		6.9

The results indicate that slash weeding and monthly manual weeding gave significantly higher yield than other treatments, while Paraquat and Sulphosate led to lower yields.

This experiment is to continue.

A.P.D.A. Jayasekera

6.7 Effect of different frequencies of paraquat application on yield of tea compared to manual weeding, St Coombs Estate, Field No. 8 (1995)

Treatments continued during the year. The plots were in the third year of the current cycle and the yield data is presented in Table 6.9

TABLE 6.9. Yield of tea

<u>Treatment</u>	<u>Yield (kg made tea ha⁻¹)</u>
T1 - Manual weeding (monthly interval)	1695
T2 - Paraquat at 1.1 l ha ⁻¹ (monthly)	1614
T3 - Paraquat at 1.1 l ha ⁻¹ (every 2 months)	1667
T4 - Paraquat at 1.1 l ha ⁻¹ (every 3 months)	1901
LSD (at P=0.05)	NS
CV%	5.6

No significant differences in yield were observed. This experiment continues.

M.S.D.L. de Silva

6.8 Effect of different weed populations on yield of mature tea, St. Coombs Estate, Field No. 7

Different levels of weed populations (obtained by removal of weeds) such as 15%, 30%, 45% and 60% were compared with control plots (no weeding) and the yield of tea is presented in Table.6.10

TABLE 6.10. Yield under different weed populations

<u>Treatment</u>	<u>Yield (Made Tea kg ha⁻¹)</u>
15% weed population	1679
30% weed population	1652
45% weed population	1547
60% weed population	1636
Control (80-90%) weed population	1592
CV%	10
LSD (at P=0.05)	NS

There was no significant yield reduction in the 2nd year of the 3rd cycle, probably due to lack of competition between the crop and the weeds. This experiment is continuing.

M.S.D.L. de Silva

6.9 Control of problem weeds

6.9.1 Effect of Anredera basseloides on yield of tea. St Coombs Estate, Fields 5 and 9.

An experiment was initiated to study the effect of Anredera basseloides on yield of tea. The plots were pruned in September 1996, and treatments

were imposed in April 1997. The yield for the following 8 months is presented in Table 6.11

TABLE 6.11 *Yield of Tea under various control measures*

Treatments	Yield (kg ha ⁻¹)	
	Field 5	Field 9
1. Uprooting of weeds with yams every fortnight	3468	2509
2. Slashing of weed to ground level every fortnight	3233	2261
3. Tipping the weeds at the canopy height of tea at weekly intervals	3242	2467
LSD(P=0.05)	NS	NS
CV%	11	17

M.S.D.L. de Silva

6.10. Weed survey on Anredera basseloides conducted by a questionnaire.

In the Up-country, 58 out of 143 estates responded to the questionnaire. In Uva only 21 out of 67 estates responded.

In the Up-country, 34 estates were infested with Anredera basseloides. The degree of infestation ranged from 1-30%.

In Uva, 17 estates were infested, with infestation from 1-40%.

M.S.D.L. de Silva.

6.11. Study on the development of resistance in Erigeron sumatrensis (retz) to 'Paraquat' in Up-country.

Paraquat was applied at 4 different rates (0, 0.165, 0.26, 0.325 and 0.39 a.i kg ha⁻¹) to naturally grown Erigeron populations at 4 growth stages (2-4, 5-6, and 7-8 leaf stages, and flowering stage). The impact of herbicide was estimated by the efficiency of Photosystem II (Fv/Fm) and leaf cell membrane permeability. The results indicated that Erigeron has developed resistance to all the levels of paraquat tested and at all growth stages. However, it has not developed cross-resistance. Erigeron could be controlled by Glufosinate ammonium which has a similar mode of action to paraquat.

The other herbicides - Glyphosate, Metribuzine and Hedonol (2,4 D + MCPA) also killed the weed successfully.

M.G.D.L.Priyantha, M.S.D.L.de Silva,
A.Anandacoomaraswamy and B.Marambe

6.12 The following weed specimens were added to the herbarium at St. Coombs:

- Eragrostis nigra* (*Graminae*)
- Cyperus melansperus* (nees) Suringer (*Cypereceae*)
- Eragrostis tennifolia* (*Graminae*)
- Cyperus compressus* L (*Cypereceae*)
- Cyperus distans* L.F (*Cypereceae*)
- Elusine indica* (L) Gaerta (*Graminae*)
- Cynodon arcuatus* J.S.Prest (*Graminae*)
- Hewittia sublobata* (*Convolvulaceae*)
- Salvia tiliifolia* (*Labiata*)
- Clidemia hirta* (*Melastomataceae*)
- Stachytarpheta urticaefolia* (*Verbemaceae*)
- Aster amellus* (*Compositae*)
- Wikstroemia indica* (*Thymelaeaceae*)
- Ceropegia candilabrum* (*Acletiadaceae*)

M.S.D.L. de Silva, S.N. Wijesekara and R.S.S. Rajapakse

7. D/AGRY - Divisional Activities

7.1. Growth Regulators

7.1.1 Foliar Application of Vegemax on tea (Observation Trial).

Mature tea was first sprayed with Vegemax @ 5 ml/20l of water on 30th July '97, this being repeated on 12th August and 25th August. Yield was then recorded over a 3-month period. Prior to the application of treatment pre-harvest yield was recorded for three rounds of plucking. The yield is presented in Table 7.1

TABLE 7.1 - *Effect of Vegemax on yield of tea*

Date of spray	Mean tea flush yield(g/plot/round)	
	Vegemax	Control
Pre-treatment(July)	367.5	391.0
Post-treatment		
Aug.	246.5	214.0
Sep.	285.8	257.5
Oct.	230.5	237.3

Foliar application of Vegemax gave no significant improvement in yield.

K.G.Premathilaka

7.1.2. Effect of spraying Cytozyme (growth regulator) on yield of mature tea, Clone TRI 2023 - Galphele Estate, Panwila (1997)

A study was initiated to test the effect of spraying a growth regulator (Cytozyme) on the yield of mature tea (TRI 2023). Seven applications were given and the yield obtained is presented in Table 7.2.

TABLE 7.2 - *Effect of spraying Cytozyme on Yield*

Treatments	Yield(kgMT/ha)
Control	4460
Cytozyme at 0.5l ha ⁻¹	5002
Cytozyme at 1.0l ha ⁻¹	5448
SE	247.1
LSD(P=0.05)	855
CV(10%)	9.9

A.P.D.A. Jayasekara

7.2. Effect of different size of polythene bags on growth of cuttings in tea nurseries (1996)

Measurements of growth on clones TRI 2025, TRI 2027, TRI 3055 and TRI 4061 over a period of 10 months showed that number of leaves, shoot weight and root weight all increased with larger polythene bags (Table 7.3). The largest size polythene bag (6"x9") produced the biggest nursery plant. However, the weight gain of the 6" bag over the 5" bag was less than that between 5" and 3". Of the clones tested, growth of TRI 3055 plants was faster than all other clones and TRI 2027 recorded the slowest rate of growth in the nursery. Owing to the higher percentage of casualties after a dry spell, this experiment was repeated in the St. Joachim estate nursery.

TABLE 7.3 - *Growth of nursery plants*

Clone	10 month			8 month		
	Leaf no.	shoot wt.	Root wt.	Leaf no.	shoot wt.	Root wt.
TRI2025	12.4	3.0	0.68	14.4	4.8	1.5
TRI2027	12.1	1.3	0.29	16.8	3.6	0.7
TRI3055	12.4	3.3	0.87	25.0	7.6	2.2
TRI4061	17.2	2.4	0.42	21.4	5.7	1.4
LSD (p=0.01)	4.21	0.82	0.23	3.85	1.63	0.46

Bag diameter

3"	10.3	1.4	0.32	11.3	2.2	0.9
5"	14.6	2.6	0.59	20.6	5.9	1.4
6"	15.6	3.5	0.79	26.3	8.2	2.1
LSD	2.73	0.52	0.15	3.34	1.41	0.40

(p=0.01)

M.A. Wijeratne and P. Premathunga

7.3. Studies on the drought tolerant properties of tea clones.

Studies were conducted in collaboration with the Faculty of Agriculture, University of Peradeniya. Results of the glasshouse experiments showed that moisture stress increased diffusive resistance, thereby reducing water potential and relative water content of tea leaves. Wider osmotic adjustments and lower water potential at zero turgor were recorded in most TRI 4000 series clones than in the control (TRI 2025) and TRI 3000 series clones. The variations of these water relation characteristics of the latter two clones were roughly similar. Wider osmotic adjustments and lower water potential at turgor loss point of TRI 4000 series clones suggest that they are more drought-tolerant than the other clones tested.

M. A. Wijeratne, Asha Karunaratne

7.4. Effect of bud breaking agent Dormex on yield of tea. The details of the series of trial were reported in the annual report 1996.

These trials were continued into the 2nd year in order to determine whether there is any depression of yield following the boost in yield obtained in the first year.

St Coombs Estate, Field no 7

The yield obtained for the period November 1996 - June 1997 is given in Table 7.4. This trial has now been terminated, after 8 months.

TABLE 7.4 - *Effect of Dormex on yield of tea*

Treatments	Yield (kg ha ⁻¹)	
	TRI 2025	DT1
Control for DOP	1618	1769
Sprayed on DOP @ 1%	1731	1801
Sprayed on DOP @ 2%	1680	1833
Control for 3DAP	1705	1829
Sprayed 3 DAP @ 1%	1767	1936
Sprayed 3 DAP @ 2%	1711	1893
LSD (P=0.05)	NS	NS

(Note: DOP = Day of Pruning, DAP = Days after Pruning)

Treatment differences were not significant.

1. Hantane Estate, Mid-country, Kandy Field no 7. Factory division seedling tea
2. Galphele Estate, Panwila, Field No 9A TRI 2023
The yields obtained for the period October 1996 - August 1997 are given in Table 7.5.

TABLE 7.5 - *Effect of Dormex on yield of tea*

Treatments	Yield (kg ha ⁻¹)	
	Hantane Estate	Galphele Estate
Control for DOP	698(b?)	1627a
Sprayed on DOP @ 1%	793a	1827a
Sprayed on DOP @ 2%	780a	1870a
Control for 7DAP	643a	1717a
Sprayed 7 DAP @ 1%	756a	2025a
Sprayed 7 DAP @ 2%	677ab	1728a

A.Kathiravetpillai, A.P.D.A. Jayasekera and S.N. Wijesekera

Low Country, Galle- TRI Substation, Talgampolla, Field No 7.

The yield obtained during the eight months of the second year from November 1996 to June 1997 is given in Table 7.6

TABLE 7.6 - *Effect of Dormex on yield of tea*

Treatments	Yield (kg ha ⁻¹)
Control for DOP	2897
Sprayed on DOP @ 1%	2933
Sprayed on DOP @ 2%	2981
Control for 7DAP	3005
Sprayed 7 DAP @ 1%	3100
Sprayed 7 DAP @ 2%	3235
LSD(P=0.05)	NS

There were no significant differences in yield between any of the treatments. The trial has been terminated.

A.Kathiravetpillai and P.K.Jayawickrama

Other trials conducted to study the effect of Dormex on yield of tea.

Gonakele Estate, Passara, Passara division, Field No VP9.

This study was conducted with clone TRI 2027 to investigate the effect of spraying Dormex using a Knapsack sprayer and a Mist Blower. The design was of the split-plot type with 3 replicates of main treatments (0, 1% and 2% Dormex) x (times of application), split for sprayer used, 36 plots in all with 60 bushes per plot. The tea was pruned on 27th October 1995 and spraying was carried out on (1) day of pruning (DOP) and (2) 7 days after pruning (DAP). There were no significant differences between the treatments over a period of one year from March 1996 to February 1997. The yields obtained are presented in Table 7.7.

TABLE 7.7 - *Effect of Dormex sprayed by knapsack sprayer and Mist blower on yield of tea*

Treatments	Yield (kg Fwt plot ⁻¹)	
	Knapsack sprayer	Mist Blower
Control for DOP	376.4	322.8
Sprayed on DOP @ 1%	371.9	355.9
Sprayed on DOP @ 2%	424.3	347.3
Control for 7 DAP	340.5	366.5
Sprayed 7 DAP @ 1%	325.8	373.1
Sprayed 7 DAP @ 2%	350.8	380.6
LSD(P=0.05)	NS	NS

There were no significant differences in yield between the treatments

Norogolla Estate, Ratnapura

Clone TRI 2023.

Spraying was carried out using a knapsack sprayer and a mist blower on blocks of 0.5 acre (0.2 ha) each. Pruning was done on 2nd July 1996 and spraying was carried out on (1) day of pruning and (2) 7 days after pruning at 1% concentration. The yield of tea (kg fresh weight per plot) obtained from October 1996 to June 1997 is given in Table 7.8

TABLE 7.8 - *Yield of tea*

Treatments	Yield (kg Fwt plot ⁻¹)	
	Knapsack sprayer	Mist Blower
Control for DOP	1993	1456
Sprayed on DOP @ 1%	1662	1181
Sprayed on DOP @ 2%	2242	1653

Spraying 7 days after pruning improved the yields by 12-13%.

D.W.Withana and M.W.Wijeratne

Observation trial at Dessford Estate, Nanuoya

The trial was carried out on clonal tea in 2 blocks of 100 bushes each. The tea was pruned in June 1995 and Dormex was sprayed on one block 1%, 7 days after pruning. The yield kg fresh weight for the period November 1995 to October 1996 is given in Table Table 7.9.

TABLE 7.9 - *Yield of tea with and without Dormex*

Treatments	Yield(kg MT ha ⁻¹)
Control	1861
Sprayed	2187

A.Kathiravetpillai

7.5 Earthworm culture

7.5.1 Effect of inoculation of earthworms on yield of tea. Galphele Estate, Panwila (1995)

The yield recorded in the 3rd year after the treatment application is presented in Table 7.10

TABLE 7.10 - *Effect of inoculation of earthworms on yield of tea*

Treatments	Mean yield (kgMT ha ⁻ⁱ)
T.750 + 600 earthworms	1929
T.750 alone	1683

The results indicated that inoculation with earthworms enhanced the yield significantly ($t=2.3152^*$). The experiment continues.

7.5.2 Effect of earthworms casts on growth of young tea plants, Hantane Sub Station (1996)

The growth measurements made 18 months after planting are presented in Tables.7.11 and 7.12

TABLE 7.11 - *Effect of earthworm casts on growth of tea*

Treatments	Shoots		Leaves		Roots	
	No.	DW (g)	No.	DW (g)	No.	DW (g)
75g casts	15b	8.7b	119b	35.5b	13b	15.5b
150g casts	15b	21.3b	144b	45.0b	14b	29.7ab
250g casts	24a	40.8a	243a	82.3a	34a	56.8a
T.200	16b	19.2b	152b	34.4b	15b	47.1ab
SE	?	?	?	?	?	?
% CV	18.8	51.5	34.1	42.3	16.3	55.4

TABLE 7.12 - *Effect of earthworm casts on growth of tea*

Treatment	Dry wt. of main stem	Total dry wt.
Casts 75 g	29.17b	138.35b
Casts 150 g	46.30ab	206.19ab
Casts 250 g	79.70a	297.44a
T.200	30.91b	180.70ab
% CV	34.20	25.15

The results indicate that plants treated with 250 g earthworm casts had exhibited enhanced growth compared to other treatments.

This experiment has been terminated.

7.5.3 Effect of inoculation of earthworms on growth of tea plants, Hantane Sub Station, Kandy

This experiment was carried out in 1m x 1m x 3 m cement tanks.

Treatments:

T1 - Inoculation of 100 earthworms per tank + tea fertilizer at recommended rate

T2 - Tea fertilizer at the recommended rate

Design: Paired comparison with 5 replicates

The results of the second destructive sampling is presented in Table.7.13

TABLE 7.13 - *Effect of inoculation of earthworms on growth of tea*

Measurement	Earthworm + Fertilizer	Fertilizer only	t calc
1.No.of roots	17.8	17.8	0.50
2.No.of leaves	117.0	158.0	0.74
3.No.of branches	13.4	14.8	0.50
4.Dry wt of roots(g)	24.5	31.93	0.55
5.Dry wt of leaves (g)	35.1	53.92	1.00
6.Dry wt of side shoots(g)	18.3	27.27	0.80
7.Dry wt of main stem(g)	37.5	53.92	0.81
8.Total dry wt(g)	163.9	244.88	0.87

There were no significant differences between any of the treatments. The experiment continues.

7.1.4 Effect of inoculation of earthworms with and without compost on yield of tea; Aningkanda Estate,Deniyaya.

The yields recorded during the first year after treatment application are presented in Table.7.14

TABLE 7.14 - *Effect of earthworm with and without compost on yield of tea*

Treatments	Yield(kg ha ⁻¹)
T1 Earthworm+Mana+Compost+Tea fertilizer	2849a
T2 Earthworm+Compost+Tea fertilizer	1838b
T3 Earthworm+Mana+Compost	1783b
T4 Earthworm+Mana+Tea fertilizer	2425ab
T5 Earthworm+Mana	1882b
T6 Mana+Compost+Tea fertilizer	2146ab
T7 Compost+Tea fertilizer	1593b
T8 Mana+Compost	2282ab
T9 Mana+Tea fertilizer	2341ab
T10 Tea fertilizer alone	2403ab
CV	25.8

Compost - 8000 kg ha⁻¹. yr⁻¹ and tea fertilizer at recommended rates.

The results indicate that there was a higher yield in treatment T1 and the increase in yield was significant compared to the treatments T2, T3, T5 and T7. The experiment is in progress.

7.5.4 Effect of earthworm casts on growth and yield of tea, Galphele Estate, Panwila

Treatments:

- T1-250 g casts per plant + fertilizer at recommended rate
- T2-250 g casts per plant + fertilizer at 2 recommended rate
- T3-250 g casts per plant
- T4-T 200 fertilizer at recommended rate

The experiment was initiated in June on plants given the first cut at 15 cm by the estate. After the treatment application plants were given second and third cuts at 30 and 40 cm and tipped at 50 cm before plucking commenced in December. The tipping weight is presented Table 7.15.

TABLE 7.15 - *Effect of earthworm casts on growth of tea*

Treatments	Tipping weight(kg ha-1)
250g casts + T 200 at recommended rate	150.26ab
250g casts + T 200 at half recommended rate	182.99a
250g casts only	131.03b
T 200 at recommended rate	124.68b
% CV	19.2

The results indicate that there was a significant increase in yield with earthworm casts + T 200 (either rate) when compared to either alone.

7.5.5 Effect of Vermi compost on growth and yield of tea, Doragal, Kotmale (Observation trial)

This observation trial was initiated to investigate the effect of Vermi compost on soil fertility improvement and growth and yield of tea in a tea small holding located in Upper Mahaweli catchment area. The Small holder was trained to culture the earthworms and produce Vermi compost using cow dung, kitchen waste and mana grass. The land was divided into 2 parts.

Treatments:

- T1 250g Vermi compost per plant
- T2 T 200 fertilizer at recommended rate

Six applications were given after April, and visual assessment indicated enhanced growth on plants treated with Vermi compost. The experiment is in progress.

R.M.S.S. Rajapakse

7.6 Determination of optimum plot size for experimentation and effect of plucking table variables on yield

An investigation was carried out to determine the optimum plot size for experimentation in tea and to identify the possible relationship between plucking table variables (area of plucking table and active:banji ratio) and yield. TRI 2025 planted at a spacing of 120cm x 60cm was used at low (Ratnapura), mid (Hantana) and high (Talawakele) elevations for this study. Fairfield Smith's (1938) procedure and analysis of variance were used. It was found that the optimum number of bushes per plot should be between 10-12, at all three sites. This also confirmed the earlier results obtained by Fairfield Smith. A multiple regression using the standardised values (z values) of plucking table variables showed that only plucking table area was weakly correlated with yield at all locations. There was no correlation between active:banji ratio and yield.

T.D.P. Aratchige, R.O. Thatill, P.B. Ekanayake,
M.A. Wijeratne and A. Anandacoomaraswamy

9. Particulars regarding seminars/conferences attended/participated and publications published/submitted

a) **P.B.Ekanayake**

- 1) Served as a member of the committee on "Rehabilitation of the Tea industry in Mid Country"
- 2) Participated in Group discussion held at Talawakelle on "SALT and Covercrops" in March organized by RSC 1
- 3) Participated and presented a paper on "Soil management in tea plantations" at the Workshop on Watershed Management held at Nuwara Eliya from 24th to 25th April
- 4) Addressed the Superintendents of Kahawatte Plantations Ltd., on "Covercrops in tea lands" on 30th April
- 5) Participated at the Workshop on Social forestry held at Kalutara from 2nd to 4th May
- 7) Participated the RSC seminar held at Bandarawela on 13th June and presented a paper on "Soil improvement in tea lands"
- 9) Participated in the discussion with executives of Kotagala Plantations at Talawakelle on 6th August
- 10) Participated in the training programme on "Participatory Forestry" held at Kandy on 12th August at Ratnapura on 28th August at Galle on 9th September and presented a paper on "Soil Conservation measures adopted in tea plantations"

- 11) Attended the Workshop on Forestry Master Plan held at Colombo on 4th September
- 12) Attended the annual sessions of the Soil Science Society of Sri Lanka held at Colombo on 10th October
- 13) Attended and presented the country paper at the study meeting on "Sustainable Farming systems in Upland areas" held in Japan from 27th October to 2nd November
- 14) Attended the PGIA Annual Congress held on 20th and 21st of November
- 15) Addressed the Field Officers on "Drought management" at the RSC Field day held at Hantane on 17th December

b) M.A.Wijeratne

- 1). Dr.M.A.Wijeratne supervised research projects/dissertations of two NIPM trainees (Mr.A.M.A.S.Dhanasekara, Superintendent, Keeragala Estate, Kuruwita and Mr. M.S.D.Pinto, Superintendent, Houpe Estate, Kahawatte) and Miss Dammika Jayawardena, undergraduate from the Faculty of Agriculture, University of Peradeniya.
- 2). Reviewed papers for the TRI journals.
- 3). Dr.M.A. Wijeratne and Dr.A. Anandacoomaraswamy presented a paper on Impact assessments on tea production of Sri Lanka as affected by climate change at the National Symposium on Climate Change, held in Colombo on March 7, 1997.
- 4). Addressed the Superintendents/Asst. Superintendents, Field officers and Smallholders on pruning and plucking at 9 Regional Scientific Meetings (RSC) and field days. He also participated in the RSC seminars at various regions as a resource personal.
- 5). Dr. M.A. Wijeratne was appointed as a visiting lecturer at the University of Ruhuna and he conducted lectures to the undergraduates of the Faculty of Agriculture on harvesting practices of tea.
- 6). Seminars/field days were conducted for trainee students from Agriculture Schools and routine training of NAB students was also undertaken.
- 7). Delivered a speech on the "Impact of climate change on tea Plantations in Sri Lanka" at the Planters' Association meeting at Ratnapura.

c). K.G.Premathilaka

- 1). Dr. K. G. Premathilaka presented seminars in the following fields:
 - i). Tea pruning - for small holders at Ratnapura region in Apr.'97.
 - ii) Tea pruning- for the students of School of Agriculture, Karapinche, Ratnapura in October 1997

- iii) Weed Management - for Asst. Superintendents and Field Officers at Kottawa Sub Station in November 1997.
 - iv) Tea Pruning - For the students of School of Agriculture, Angunakolapelessa in December 1997.
- 2). He attended the AGM of the Soil Science Society of Sri Lanka.
- 3). He attended the following meetings/courses:
- i) Regional Forest Conservation meeting held at DFO, Ratnapura in August 1997.
 - ii) "Master Trainers Course" on "Safe and Effective use of Pesticides" held at Pannala, Wayamba University, organized by CIC and conducted by Zeneca Agrochemicals, UK from 13th-17th, October 1997.
- d) R.M.S.S.Rajapakse**
- 1) Presented a paper on "Review of Earthworms" at a staff seminar held at Talawakelle on 9th April 1997
 - 2) Participated in a workshop on "Remote sensing for coastal and forestry resource management" held from 4th-11th June at NARESA Colombo
 - 3) Participated in a Forestry Symposium organized by the University of Sri Jayawardenapura from 12th-13th December and presented a paper as a co-author on "Land Use planning for agroforestry in tea estates of Sri Lanka"
- e) M.S.D.L.De Silva**
- 1) M.S.D.L.de Siva and P.B.Ekanayake participated in a group discussion held at Talawakelle on "Weed Management in tea plantations" on 11th June and 18th July organized by the RSC 1

Publications

- 1. Premathilaka, K.G. (1997). Studies on weed management during early establishment of tea in Low-country of Sri Lanka. Ph.D Thesis, University of Reading, London.
- 2. Amarasekera, A.R., Abesekera, U.P. and Anandacoomaraswamy, A. (1997). The Effect of post-prune operations on soil physical properties and yield of tea. *Sri Lanka Journal of Tea Science*, 65: 76-82.
- 3. Janakie Balasuriya and Gail Smith, B (1997). Effect of saturation vapour pressure deficit of air on shoot growth of clonal tea (*Camellia sinensis* L.) under controlled environmental conditions. *Sri Lanka Journal of Tea Science*, 65: 46-57.
- 4. Modder, W.W.D., Kathiravetpillai, A and Sivaram, B. (1997). Organic Farming in Sri Lanka. In: *proceedings of Organic Farming Conference held in Calcutta*.

BIOCHEMISTRY DIVISION

Acting Head - I.S.B.Abeysinghe

1. General

Mr M. W. Silva, Skilled Mechanic, was promoted to Grade V of the Institute's service w.e.f. 14th March 1996.

Mr H. Jayaweera, Technical Assistant, was transferred to Tissue Culture unit at Hantana sub station w.e.f. 2nd May.

Mr P.B. Chandradasa, Experimental Officer, was transferred back to Biochemistry division w.e.f. 22nd September .

Mr A. M. T. Amarakoon, Research Assistant, returned to the Division on the 23rd December after successfully completing his PhD programme in "Therapeutic properties of Black tea" at the Department of Human Nutrition, University of Southampton, UK.

Dr I.S.B.Abeysinghe continued to serve as a member of the committee appointed by the Ministry of Plantation Industries on Quality, Standards and Grades of tea produced and exported by Sri Lanka. He served as a member of the Board of Study in Chemical Sciences at the Post Graduate Institute of Science, University of Peradeniya and the Technical Committee on Tea appointed by the Sri Lanka Standards Institution. Dr. Abeysinghe was a member of the Sri Lanka delegation for the 17th Technical committee meeting on tea of International Organization for Standards (ISO/TC34/SC8) held in Colombo in February.

Miss Anoma Abeykoon, undergraduate student from Faculty of Agriculture, University of Peradeniya completed her undergraduate project titled "Development and Application of Isozymes Technique for the Identification of Tea Clones" in February. Mr. B.D.S.Kumara, undergraduate student from University of Colombo completed a project titled "Antimicrobial Activities of Ceylon Black Tea" in March. Miss S.C.M.Fernando undergraduate student from Uva Campus completed her undergraduate research project titled "Improvement of quality in the instant tea manufacture" in August.

2. Project B/PDEV

Project Leaders - I.S.B.Abeysinghe and A.C.Liyanage

2.1. Attempts to improve the tea character of the TRI formulated hot water soluble instant tea

In an attempt to increase the tea character of instant tea, the inclusion of withered leaf and fermented dhool to black teas in the manufacturing process were studied.

Effect of different withering periods and various combinations of withered leaf and fermented dhool were also studied. Table 1 gives details of combinations used in this experiment.

Period of Withering (Hrs.)	Withered Leaf (WL)%	Fermented Dhool (FD)%	Black Tea (BT)%
6	10	-	90
12	10	-	90
12	-	16.66	83.34
15	10	16.66	73.34
15	10	-	90
15	-	10	90
15	10	10	80

Table 1

Combination	Withering Period	TF%	TR%	TC	B%	Tasters Comments
10%WL+90%BT	6	1.80	14.95	1.49	25.99	Brownish powder, Coloury, Useful Liquor
10%WL+90%BT	12	1.84	14.09	1.52	28.60	Brownish Powder, Soft Liquor
10%WL+90%BT	15	1.82	13.84	1.43	27.48	Brownish Powder, Light in Cup
10%FD+90%BT	15	1.76	11.82	1.11	24.40	Brownish Powder, Light in Cup
10%WL+16.66%FD + 73.34%BT	12	1.91	14.72	1.63	34.39	Dark Powder, Light, Raw and Unusual Taste
16.66%FD+83.34%BT	15	1.96	13.88	1.65	34.58	Brownish powder, Bright, Fair colour, Lack Strength
10%WL+10%FD +80%BT	15	1.82	13.88	1.31	27.22	Light Brown Powder, Very Light in cup

TF=Theaflavins, TR=Thearubigins, TC=Total Colour, B=Brightness

Table 2

Instant tea was manufactured using these combinations and analysed for various chemical quality parameters. Professional tea tasters evaluation was compared with chemical quality parameters. Results of the experiment are given in Table 2.

Results indicate that the withering period has an effect on the quality of instant tea. The inclusion of leaves withered for 6hrs. gave a better product compared to inclusion of leaf withered for 12 hours. Inclusion of withered leaf with longer withering periods resulted in tea liquor becoming softer in character. The inclusion of fermented dhools resulted in brighter teas and fermented dhool with 15 hrs withering was preferred when compared to a 12hrs. withering period. The inclusion of 16.66% fermented dhool gave a better product than the inclusion of 10% fermented dhool.

A combination of 10% withered leaf and 10% fermented dhool did not produce better instant tea when compared with only 10% withered leaf or 10% fermented dhool.

I.S.B.Abeysinghe, A C Liyanage,
H. Jayaweera and M.W.Silva

3. Project D/BIOC - Divisional Activities

Project Leaders - I.S.B.Abeysinghe and A.C.Liyanage

3.1 Chemical/ biochemical method in the control of the Shot-hole Borer (*Xyleborous fornicatus*) in the tea plant

Results from experiments carried out in the indicated that caffeine may be involved in the resistant mechanism of some tea clones attack by the SHB, although there may be multiple mechanism of resistance and that synthesis, accumulation and translocation of caffeine to infested tissues may be a plant defense response.

Since the caffeine content of both susceptible and resistant clones were much higher than the concentration which inhibit growth of the ambrosia fungus, a search was made for the factor which could reduce caffeine activity. It was observed that polyphenols lowered the antifungal activity of caffeine. A collaborative project with the University of Peradeniya and funded by SAREC was started to study the relationship of caffeine content and individual catechin concentrations in the infested and non infested pencil thick stems from clones TRI 2025 and TRI 2023. For this study samples of SHB susceptible clone TRI 2025 and resistant clone TRI 2023 were collected from Attampitiya Estate , Bandarawela. Node and internode portions of these stems were separated. Bark and stem of these sections were analysed separately for Caffeine, Theobromine, Gallic acid, Epicatechin and Epigallocatechin. Results of the analysis are given in Table 3.

Clone - TRI 2023 Clone - TRI2025

Status	Node Bark	Caffeine mg/g			Caffeine mg/g			Inter Node Stem
		Inter Node Bank	Node Stem	Inter Node Stem	Node Bank	Inter Node Bank	Node Stem	
Healthy	5.17	4.86	0.35	0.32	5.9	6.19	0.44	0.34
Infested	9.09	8.15	0.70	0.49	14.64	14.20	1.14	0.97
LSD	NS	NS	NS	NS	4.01	4.39	0.37	0.50
		Theobromine mg/g			Theobromine mg/g			
Healthy	1.02	1.16	0.22	0.09	1.80	1.98	0.16	0.16
Infested	1.23	1.47	0.11	0.10	1.90	2.04	0.17	0.15
LSD	NS	NS	NS	NS		NS	NS	NS
NS								
		Epicatechin mg/g			Epicatechin mg/g			
Healthy	1.54	1.49	0.63	0.54	2.3	2.53	0.41	0.38
Infested	1.59	1.47	0.34	0.35	3.25	3.06	0.19	0.10
LSD	NS	NS	0.21	NS	NS	NS	NS	0.11
		Epicatechin gallate mg/g			Epicatechin gallate mg/g			
Healthy	1.3	0.88	0.26	0.24	1.98	1.97	0.18	0.18
Infested	1.52	1.19	0.16	0.18	3.38	3.13	0.10	0.11
LSD	NS	NS	0.07	NS	NS	NS	NS	0.05
		Gallic Acid mg/g			Gallic Acid mg/g			
Healthy	0.26	0.29	0.02	0.02	0.03	0.36	0.01	0.01
Infested	0.23	0.27	0.01	0.01	0.30	0.36	0.01	0.02
LSD	NS	NS	NS	NS	NS	NS	NS	NS

Table 3

In clone 2025, significant differences were observed for caffeine content in the bark and stem portions of the infested and non infested samples where the infested portions contained higher amount of caffeine.

In both clones, significant differences in epicatechin content in the bark were not observed, in infested and non infested portions. However significant difference was observed in stem portions of the internodes. Similar observations were made for epigallocatechin.

Experiments are being carried out in order to study the role of caffeine, epicatechin and epigallocatechin in the SHB resistance mechanism

Three unknown compounds were detected and experiments are in progress to identify these compounds.

I S B Abeysinghe, S Ratnayake, S Kumar and V Kumar (University of Peradeniya)

3.2 Evaluation of 3000 and 4000 series clones for quality

Several clones from TRI 3000 and 4000 series were evaluated for their quality potential during quality season. Initially clones TRI 4063, 4053, 4052, 3018, 3016, 3072 and 3073 from Venture estate, Norwood, clones TRI 4052, 4071, 4078 and 4079 from Sheen group, Pundaluoya, clones TRI 3015, 3020, 3019, 3016, 3018 and 3048 from Stockholm Estate, Upcot were selected by Plant Breeding division for this purpose. Flush samples were collected during quality season and manufactured at the Technology division using miniature manufacturing facility. Made tea samples were analysed for quality parameters and special emphasis was given to flavour characteristics. Made tea samples were sent for tasters evaluation. Results of the experiment are given in Table 4.

Clone	TF%	TR%	TC	B%	TR/TF	QI	TE
3015	0.69	11.91	1.82	30.52	17.63	0.28	10.5
3016	-	-	-	-	-	0.29	12.0
3018	-	-	-	-	-	0.53	11.5
3019	-	-	-	-	-	0.15	9.5
3020	-	-	-	-	-	0.36	9.5
3048	-	-	-	-	-	0.54	7.0
3072	0.90	11.06	2.37	32.26	12.32	0.43	14.0
3073	0.89	11.95	2.53	30.22	16.09	0.37	11.6
4052	1.25	13.91	2.76	41.75	11.32	0.30	15.0
4054	-	-	-	-	-	0.30	-
4063	0.91	11.61	2.21	32.84	13.34	0.28	14.25
4067	-	-	-	-	-	-	28.0
4071	0.77	12.94	1.87	37.15	16.76	0.39	14.0
4075	0.98	13.40	2.11	35.91	13.72	0.24	12.0
4078	1.28	13.15	2.63	44.40	10.31	0.38	15.6
4079	0.93	13.69	2.62	31.74	14.74	0.45	21.8
4083	0.60	12.00	1.74	29.14	19.90	-	13.0
4085	0.33	13.67	1.61	12.79	41.34	-	12.0

TF=Theaflavins, TR=Thearubigins, TC=Total Colour, B=Brightness, QI=Quality Index, TE=Tasters Evaluation

Table 4

Results indicated that clones TRI 4067 and 4079 have the potential to produce flavoury teas.

I S B Abeysinghe and J Jayasundara

3.3 Development and Application of Isozymes Technique For the Identification of Tea Clones

At present taxonomic characterization of clones of *Camellia sinensis* has been restricted to morphological and reproductive traits. But in a clone grown

under different environmental conditions the mode of expression of some of the characters could be altered depending on the environmental conditions. Therefore, one cannot conclude with confidence that the classified clones reflect true differences at the molecular level. Isozymes which are proteins are the direct products of structural genes and they exhibit the potential of reflecting DNA sequence changes and polymorphic individuals can be detected as genetically different. Isozyme analysis of tea clones was carried out as a preliminary attempt to identify tea clones.

Active buds were found to be the most suitable tissue for the enzyme extraction. The best combination of tissue to extraction buffer and PVP was found to be in the proportion of 1.0g of tissue to 2.5ml of extraction buffer and 0.3g of PVP. Thirteen enzyme systems were tested, namely esterase, acid phosphatase (Acph), aspartate amino transferase (AAT), leucine amino peptidase (LAP), alcohol dehydrogenase (ADH), malate dehydrogenase (MDH), glutamate dehydrogenase (GDH), 6-phosphogluco dehydrogenase (6-PGDH), glucose phosphate isomerase (GPI), alkaline phosphatase, phosphoglucomutase (PGM), peroxidase and polyphenol oxidase (PPO). Except for PPO, rest of the systems were all resolved. Out of the twelve enzyme systems which gave positive results, only GPI was found to be polymorphic. The rest of the enzymes appeared to be monomorphic.

Apart from tris citrate/lithium borate buffer pH 8.0, electrophoresis was carried out using different buffer systems; tris histidine pH 7 and histidine citrate pH 5.7 on esterase, AAT, PGM, GDH; and peroxidase, Acph, LAP; respectively to check if polymorphism could be detected with different buffer systems having a pH similar to the relevant enzymes. It was observed that esterase, AAT and peroxidase produced a monomorphic banding pattern while bands did not appear with PGM, Acph and LAP.

Embryonic tissues of the clones TRI 2043, 2025, 2024, 777 and ASM4/10 at three different stages of germination were analysed using several enzyme systems which included AAT, esterase LAP, Acph, ADH and GDH to check for polymorphism. During the first stage of germination, ie. emerging stage, only AAT produced bands which were monomorphic and the rest of the systems did not give any positive result. During the second stage of germination ie. prior to greening, esterase and AAT produced monomorphic banding pattern. During the third stage ie. greening stage, only AAT produced bands and they appeared to be polymorphic. On repeating with a different batch of seedlings it was found that the banding pattern obtained for AAT although polymorphic was not consistent for some of the clones. Therefore, for further discussion on genetic nature, polymorphic enzyme system GPI was used.

Around eighty five clones which included clones recommended by TRI from 2000, 3000 and 4000 series, estate selections, Chinese and Japanese varieties were used for analysis. TRI 3069 was used as a standard to categorize the clones. Representative banding patterns for GPI system are diagrammatically illustrated in Figure 1. In all, seven different banding patterns were observed and the clones were grouped accordingly.

Majority of clones showed a similar banding pattern like that of group 2. These were a mixture of clones which included TRI series and most of the estate clones. Out of eleven popular estate clones that were tested for variation in the banding pattern, 9 clones showed a similar pattern while 2 clones appeared to be different. Clone S106 showed a unique banding pattern indicating that these patterns could be used to identify the respective clones. These results indicate that although the estate selections are based on outstanding seedling bushes selected from all tea growing regions in Sri Lanka (low, mid and high) they are genetically similar for this particular locus.

Parents of most of the clones were traced in order to confirm the parental genotype which was based on the comparison of banding pattern of both progeny and parental genotype. Based on the results it could be confirmed that most of the crosses tally with the results obtained. For some clones the banding pattern does not approve the parentage as non parental bands appear in the individuals. For certain clones parentage cannot be confirmed since they are open pollinated (Figure 1).

Four clones common to high, mid, low elevations and Uva were analysed for their isozymic banding pattern to check the GxE interaction (genotype x environmental). From the results it was evident that there was no difference in the banding pattern with elevation indicating that isozymes are environmentally stable.

TRI 2025 has been treated with colchicine to produce TRI 3069 and it was expected to be a tetraploid. However, isozyme analysis showed a similar banding pattern for both clones. Analysis of clones for preferred characters ie. drought tolerance, yield, resistance to shot hole borer, eel worm and blister blight in order to detect possible linkages of isozyme loci did not reveal a strict relationship

TRI selected clones originated from ASM 4/10 and it is possible that the estate clones also could have been derived from the same clone. The clonal selection criteria is mainly based on high yield, quality, drought tolerance, resistance to pest and disease etc. Therefore, the diversity of commercially cultivated tea clones are minute. This could be the reason for monomorphic zymogrammes obtained for tested protocols. These results indicate that the genetic base of commercially cultivated tea clones have narrowed down.

The project was proposed by the Tea Research Board and was carried out in collaboration with the Coconut Research Institute, Lunuwila. This was funded by the Council for Agricultural Research Policy.

A C Liyanage, U Fernando (CRI), K P S K Pathirana and A Abeykoon

3.4 Effect of fertiliser on made tea quality

3.4.1. Effect of Sulphate of Ammonia and Urea on made tea quality

The quality of tea is determined in the field by a combination of factors namely, genotype, environmental and agronomic. A plant receiving a correctly

balanced fertiliser mixture should give a reasonable yield and a product acceptable to the customer, provided proper cultural practices and correct manufacturing procedures are followed. There can be many forms of fertiliser to supply a particular nutrient. For example, in Sri Lanka there are two major forms of nitrogen available, that is Sulphate of Ammonia (SA) and Urea. Eventhough SA is expensive than urea the use of SA has been consistent over the past years. A study was initiated to find out the effect of SA and Urea on made tea quality.

This trial was carried out at St. Coombs estate using clone TRI 2025. Effect of two different levels of nitrogen 240Kg/ha/year, 360Kg/ha/year and various combinations of urea and SA, 100%SA, 75%SA & 25%Urea, 50%SA & 50%Urea, 25%SA & 75%Urea and 100%Urea were studied.

Flush samples were collected from these plots every other week and the yield was recorded. The flush was analysed for leaf nitrogen levels.

The flush was manufactured at the Technology division using a miniature manufacturing facility. Made tea samples were graded and BOP fraction was analysed for quality parameters for made tea. This experiment was repeated 8 times and the results are given in Tables 7 and 8.

Combinations	TF%	TR%	TC	B%	TR/TF
100% SA	0.87	11.97	3.01	27.30	13.88
75% SA+25%U	0.90	12.11	3.02	27.27	13.53
50% SA+50%U	0.88	12.03	2.94	27.30	14.04
25% SA+75%U	0.90	11.86	3.06	26.49	13.33
100%U	0.89	12.15	3.12	27.04	13.76
LSD	NS	NS	NS	NS	NS

TF=Theaflavins, TR=Thearubigins, TC=Total Colour, B=Brightness,
Table 7 - Quality Parameters - SA Vs Urea - N Level - 240Kg/ha/y

Combinations	TF%	TR%	TC	B%	TR/TF
100% SA	0.80 a	11.47	2.83 a	26.45	14.40 a
75% SA+25%U	0.91 b	12.03	3.07 b	26.45	13.21 b
50% SA+50%U	0.86	11.64	3.05 b	27.82	13.61
25% SA+75%U	0.85	12.20	3.06 b	26.93	14.16
100%U	0.889 b	11.97	2.97 b	27.18	13.35 b
LSD		NS		NS	

TF=Theaflavins, TR=Thearubigins, TC=Total Colour, B=Brightness,
Table 8 - Quality Parameters - SA Vs Urea - N Level - 360Kg/ha/y

At 240N level, significant differences in quality parameters were not observed with both forms of fertiliser. But at 340N level, quality parameters Theaflavins Total Colour and TR/TF ratio showed a significant increase with

100% Urea when compared with 100%SA. This is a Collaborative project with the Soils and Plants Nutrition division.

I S B Abeysinghe, L S K Hettiarachchi J Jayasundara
and H Jayaweera

3.5.1: Effect of Phosphorous on made tea quality

Experiments to study the effect of foliar application of phosphorous on quality of made tea were continued in 1997. The clones used were CY9 and DT1. Di Ammonium Phosphate (DAP) and Triple Super Phosphate (TSP) were used for this study. There were four treatments (2% and 4% DAP, 2% and 4% TSP) and a water spray was used as the control.

Flush was collected from these plots in the 1st week and 2nd week after foliar application and flush was analysed for leaf P levels.

The flush was manufactured at the Technology division using a miniature manufacturing facility. Made tea samples were graded and BOP fraction was analysed for quality parameters for made tea. The quality of the made tea was assessed by analysing its liquor characters, desirable flavors and organoleptic properties after the 1st, 2nd and 3rd week of application. Tables 9 and 10 give the quality parameters for clones DT1 and CY9 clones after 1 and 2 weeks of foliar applications.

	TF	TR	TC	B	TR/TF	QI
Control	0.67	11.00	2.47	32.29	20.25	0.52 ba
2% DAP	1.00	13.20	2.64	32.42	13.30	0.41 c
4% DAP	0.95	12.93	2.79	28.53	13.61	0.43 c
2%TSP	0.98	12.46	2.64	31.55	12.61	0.55 a
4%TSP	0.83	12.02	2.29	30.76	14.50	0.47 bc
LSD NS	NS	NS	NS	NS	0.06	

TF=Theaflavins, TR=Thearubigins, TC=Total Colour, B=Brightness, QI=Quality Index,

Table 9 - Clone CY9 - Quality Parameters after the 2nd week of foliar application

	TF	TR	TC	B	TR/TF	QI
Control	1.00	11.21	2.77	31.97	16.09	0.40
2%DAP	0.99	12.11	2.61	33.76	12.08	0.30
4%DAP	1.32	15.47	3.70	32.04	11.72	0.41
2%TSP	1.06	12.41	3.48	31.72	11.61	0.35
4% TSP	0.94	10.43	3.16	33.13	11.09	0.41
LSD	NS	NS	NS	NS	NS	NS

TF=Theaflavins, TR=Thearubigins, TC=Total Colour, B=Brightness, QI=Quality Index,

Table 10 - Clone DT1 - Quality Parameters after the 2nd week of foliar application

Results indicated that the foliar application of DAP or TSP did not improve the quality parameters when compared with the control after one week of foliar application. However at the end of the 2nd week, application of 2% and 4% of DAP has reduced the quality index significantly in clone CY9. This is a collaborative project with the Soils and Plants Nutrition division.

I S B Abeysinghe, L S K Hettiarachchi, J Jayasundara
and H Jayaweera

4. Meetings/Seminars

Dr. I S B. Abeysinghe attended the 17th International Standards Organization Meeting which was held from 17-19 February in Colombo.

Mrs. Jayanthi Jayasundara attended a workshop on NMR at the University of Colombo in February.

Dr. I S B Abeysinghe addressed a seminar organized by John Keels Ltd on Flavour Profiles in January and RSC11 seminar in February on the same subject at TRI.

Dr. I S B Abeysinghe and Dr.(Mrs) A C Liyanage attended 1997 China International Symposium on Tea Technology and Tea Culture in Beijing China from May 28-30th and presented papers on "Aroma profiles of teas from various tea growing regions in Sri Lanka" and "A Study on the changes of PPO and peroxidase activity during drying and storage of tea" respectively.

Mrs. Jayanthi Jayasundara attended the annual session of the Institute of Chemistry in June.

Dr. I S B Abeysinghe presented a paper on "Some recent findings on black tea antioxidants in preventing inflammatory or autoimmune diseases" at the International Seminar on Tea and Health held in Colombo from 13-16th August .

Dr I S B Abeysinghe attended a workshop on development of a resource pool of assessors for accreditation activities organised by Sri Lanka Standards Institute and conducted by Swedish Accreditation Board (SWEDAC) in October

Miss A Abeykoon, final year B Sc student from University of Peradeniya presented a paper on "Development and Application of Isozyme Technique for the Identification of Tea Clones" at the 53rd annual sessions of SLAAS at the University of Ruhuna in December . This paper was based on results obtained from a project carried out in the division

5. Overseas Visits

Dr. I S B Abeysinghe and Dr.(Mrs.) A C Liyanage attended the 1997 China International Symposium on Tea Technology and Tea Culture in Beijing, China from 28-30th May .

ENTOMOLOGY DIVISION

Actg. Head - Sushila I. Vitarana

General

A proposal by the Director to consolidate the services at the TRI Low Country Station was supported by the Board and as a consequence, it was decided to shift the Division of Entomology to the Low Country Station at Ratnapura. Mrs.S.I.Vitarana was transferred to Ratnapura with effect from 20 th January in order to take up additional responsibilities in the capacity of Officer-in-Charge of the Low Country Station.

Mrs.S.B.Vithana, Technical Assistant was transferred to Low Country Station with effect from 1 st March. Transfer of other staff was suspended for lack of housing and other facilities at the station.

Mr.K. Thirugnasuntharan served as the Convenor/Secretary to the Task Force on Management of the Shot-hole Borer. The Task Force held two meetings to review progress of work; experiments under this programme are reported by the individual principal investigators in relevant sections in this report.

Mrs. I.Aladeniya, Experimental Officer, continued at her temporary posting as Promotion Assistant, Ceylon Tea Bureau, London, on secondment basis for the fourth year in succession.

Mrs. Vitarana continued to function as the Convenor/ Secretary of the Consultative Committee on Estates and Advisory & Extension Services' a sub-committee of the Tea Research Board.

Mrs. Vitarana continued to serve as a member, representing the Director on the Pesticides Technical and Advisory Committee appointed by the Minister of Agriculture and also, on the National Plant Quarantine Committee of the Council of Agricultural Policy.

Mr K. M.Mohotti Research Assistant, returned to UK to continue with the foreign component of his split-program of postgraduate training leading to a PhD.

Ms. S. M. Nagahaulla Research Assistant and Ms. S. M. Samarasinghe, Experimentenl Officer continued on their practical projects of the programmes leading to PhD and M. Phil respectively .

Mr. L S. Abeysinghe, Experimental Officer was transferred to TRI Mid Country Station, with effect from 1st September.

Mrs. Viratarana participated at meetings of the Coordinating Committee on the Implementation of Montreal Protocol, of the Ministry of Forestry and Environment.

A project proposal submitted to the Ministry of Transport, Environment and Women's Affairs in 1995 was accepted for funding through the NORAD and a sum of Rs.4,622,000.00 was made available with effect from January 1997, for a study on substitutes for Methyl Bromide as a nematocidal agent in tea plantations. The research activities of this project are being reported under "Project : MeBr".

Research Activities

1.0. Project B/NEMA - Development of Integrated Management Strategies for the control of Plant Parasitic Nematodes causing economic damage to tea.

Project Leader - Sushila I Vitarana

1.1 Screening of Promising clones for natural resistance/ tolerance / susceptibility to parasitic nematodes attacking tea.

The objective of this programme is to screen new release clones against the different species of nematodes that cause damage, to tea. 'This is a continuous programme with different batches of clones being tested each year.

1.1.1 N 1 A (1996) Screening TRI 4000 series clones against the root-lesion nematode, *Pratylenchus loosi* with reference to build up of nematode population in root and soil and growth of tea plant (16 treatments x 4 replicates in Randomized Complete Block design Nematology Experimental Area, TRI, Talawakele)

Thirteen test clones and three standards namely TRI 2024 (susceptible), TRI 2025 (tolerant) and DT 1 (resistant) planted in infested soil. The test clones included

TRI4002,4003,4004,4005,4014,4015,4019,4024,4042,4047, 4053,4085,and 4089.

I S. I. Vitharana D. D. Liyanage, G. P. Udumulla, and N . Navaratne

1.1.2. N 1 B. Screening TRI 4000 series clones against the root-lesion Nematode, *Radopholus similis* with reference to build up of nematode population in root and soil and growth of the tea plant (1994)

(16 treatments x 6 replicates in RCBD, TRI Mid Country Station, Hantana)

The experimental beds planted with anthurium in 1996 were reinnoculated with pure lab cultures of *R. similis* in build up the population before planting the test clones. However, the population levels in the test beds did not reach required levels and it was arranged to shift the experiment to a naturally infested old nursery site on Galaha Estate where the site was prepared in December and planting of cuttings was scheduled for 1998. Test clones included TRI 4002, 4014, 4020, 4047,4048, 4049, 4051, 4052, 4054, 4059 and TRI 2025 as the standard.

S.I.Vitarana, U.B.Herath, B.Suresh Kumar and G.P.Udumulla

1.2. Studies on Biological Control Agents

Field studies of a PhD project based on biological control of tea nematodes using *Pasteuria penetrans*,, commenced in February. Six experiments have been laid down up to November and the work is in progress.

K. M.Mohottie. D. D. Liyanage, N. Navaratne, P. K. Jayawickrema
and G. P. Udumulla

1 3. Cultural Control

1 3.1. Studies on Botanicals

The plant species which were earlier proved to be immune to *Pratylenchus loosi*, *Radopholus similis* and *Rotylenchulus reniformis* were being screened to check for the presence of any nematicidal properties. It was arranged with Dr.Ingo Kohler of Bayer AG Germany to isolate and concentrate the active ingredient of Marigold *Tagetes* sp.

S.I.Vitarana. I.Kohler and D.D.Liyanage.

2.0 Project : MeBr

To find substitutes for methyl bromide for eradication of plant parasitic nematodes with environmentally acceptable fumigants and Biological Control Agents and other means

Project Leader - Sushila I.Vitarana

Studies under this Project commenced in mid 1896 pending approval by the external funding agency.

2.1 Biological Control agents

N 315 -Isolation of endemic biological control agents of tea nematodes and formulating methods of augmenting their activity.

The study was undertaken with a view to isolating endemic biological control agents of tea nematodes such as fungi, bacteria and soil micro-organisms. Cultures of *P. Loosi* at Talawakelle and *H. Simil lis* at Hantane laboratories were maintained for bioassay purposes. Laboratory cultures of prospective nemato-pathogenic agents collected from field soil in December. The study is in progress.

S. I. Vitarana, D. D. Liyanage, N. Navaratne and U.B. Herath

2.2. Direct Planting of Infested Lands

2.2.1. Direct Planting using Alternatives to Rehabilitation of land under grass to eradicate soil borne parasitic nematodes

N. 316 - (MeBr No. 1)) -1996 N. C. Blook., Agarakanda Estate, Agarapatne

The trial initiated in 1996 in a nematode infested and abandoned land with the following treatments in a split- plot factorial design was in progress :

2C x 2N x 4IC where.

S = the main treatments of Soil amendments at planting

Si = Bottom 3/4 of hole filled with equal volumes of soil + decomposed spent-tea

So = No soil amendment.

N = Nematicidal treatment in sub plots,

No = No nematicide

Ni = Nemacur (7 g) in Planting hole

I = Insecticidal treatment to control white grubs that are attracted to the organic matter in the planting hole, as well as for its nematicidal activity.

I₁ = Suscon Fore (2 g)

I₂ = Suscon Fore (3 g)

I₃ = Suscon Fore (4 g)

I₄ = Suscon Fore (5 g)

One assessment on the population of nematodes in the soil and roots carried out in September has shown the following results :

- nematode population is still being retained in the plants, though to different degrees in different plots
- there were more nematodes in the roots in the case of Plots receiving no soil amendment nor nematicide;
- However, there was no statistically significant difference between treatment levels or in the interacions between treatments at this stage.

The experiment was in progress.

S. I. Vitarana, D. D. Liyanage, N. Navaratne,
Y. Konaratne (casual worker), G. P. Udumulla, and
Gaminie Jayawardena, Director for Agarakanda Estate.

2.2.2 Direct planting with new Nematicides

Four experiments in different agroclimatic areas, were initiated in the current year as given below, to study the feasibility of treating the planting holes with chemical and field as an alternative to 2-year rehabilitation under grasses. In the case of organic nematicidal agents, the material that is easily available in a given area was used in the experiment:

N. 319 - (MeBr 13) - Field No. 6, New Forest Division, Cocagala Estate, Madulsima - commenced August '97
(4 Treatments x 3 Replicates)

The experimental blocks were planted with the clone TRI 2025, in November, in replicated Randomized Block Design with the nematicidal agent incorporated in to planting holes with an untreated control plot (T4) for comparison :

- T1 - Tobacco dust 50 g per plant (mixed into the soil in the planting hole 2 days prior to planting)
- T2 - firprinol ("Rugby") @ 7g per plant
- T3 - fenamiphos ("Nemacur" @ 7g per plant (standard)

A basal treatment with T200 fertilizer mixture @ 20g per planting hole was given to all plants at the time of planting. The experiment was in progress.

S. I. Vitarana, D. D. Liyange, N. Navaratne and Subash Jegatheesan, Superintendent, Cocogala Estate

N 324 (MeBr 2) - 1997 NC., Nayapane Estate (June 1997),
(4Treatments x 3 Replicates)

The experimental blocks were planted in Randomized Block Design with the chemical nematicides incorporated in to planting holes; Treatments :

- T1 - firprinol ("Rugby") @ 7g per plant
- T2 - fenamiphos ("Nemacur") @ 7g per plant (standard - chemical)
- T3 - carbosulfan CR ("Suscon Fore") @ 5g per plant
- T4 - "Veriver" grass planted in the inter-row (standard - organic)

Visual observations were made regularly :

Best initial growth was exhibited by the plants in T4, shade provided by the grass is of added advantage to the young plants; plants in T1 exhibited phytotoxicity during the first 3 weeks after planting but, they recovered thereafter, indicating that a pre-planting period of 3-weeks is

necessary in the case of fiprinol; treatments T2 and T3 were similar in terms of general growth, however, the least number of casualties by the end of the year, in T2. Maintenance operations were carried out. The experiment was in progress.

S. I. Vitarana, D. D. Liyanage, N. Navaratne,
U. B. Herath, G. P. Udumulla and Y. Konaratne

N 325 (MeBr 3) - 1996 NC Block, Courtlodge Estate, Kandapola
(4 Treatments x 3 Replicates)

The experimental blocks were planted with the clone PK 2, in three replicates, in September and in Randomized Block Design with the chemical nematicides incorporated in to planting holes. All plots received a basal mixture of 250-300 g tea waste and 3 g "Sscon Fore" (as insurance against white grubs that are attracted to organic matter). Treatments were as follows :

T1 - fipronil ("Rugby") @ 7g per plant
T2 - fenamiphos ("Nemacur") @ 7g per plant (standard)
T3 - compost (cowdung + weeds) @ 800g per plant
The untreated control (T4) received only the basal mixture

Unlike at experimental sites of N 824 and in N 330. fiprinol did not elicit any phytotoxicity symptoms; the difference could be explained as due to the lower ambient temperature and higher organic content in the soil at Courtlodge as against the other two sites. The experiment was in progress. Since PK 2 is a tolerant. Clone, the future assessments would be based on the nematode populations.

S. I. Vitarana, D. D. Liyanage, N. Navaratne, G. P. Udumulla, Y. Konaratne
and D. Gankanda Gankansa (Superintendent, Courtlodge Estate)

N 330 - (MeBr 8) - F. No. 10. Yelverton Division, Queenstown Estate,
Hali Ela (4 Treatments x 3 Replicates)

The experimental blocks were direct Planted in Randomized Complete Block design in October '97. The treatments applied at planting were being compared with untreated control :

T1 - fipronil ("Rugby") @ 7 g Per plant
T2 - fenamiphos ("Nemacur") C 7 g per plant
T3 - "Neemazal 1%" @ 850 ml per ha, sprayapplication at planting

Phytotoxicity was observed in the form of wilting and arrested growth in the case of T1. "Neemazal" treated plants exhibited the best growth. The experiment is in progress.

S. I. Vitarana, D. D. Liyanage, N. Navaratne, G. P. Udumulla
and Y. Konaratne

2 2.3. Use of Organic Amendments in Direct Planting

N 326 (MeBr 4) - Field No. 9, Old Factory Division, Hopton Estate, Lunagala,
(4 Treatments x 3 Replicates)

The experiment plots were planted in December '97 with following in Randomized Complete Block design:

- T1 - fenamiphos ("Nemacur") C 7 g per plant (standard)
- T2 - neem formulation ("Nemacur 1%") 850 ml/ha
- T3 - fresh neem (Margosa) leaf thatch
- T4 - untreated control

Only the treatments T1 & T2 were applied by the TRI staff at the time of Planting. In the case of T3, the Superintendent (who is a collaborator in this study) was to carry out thatching with neem leaf.

S. I. Vitarana, D. D. Liyanage, N. Navaratne, G. P. Udumulla,
Y. Konaratne and M. Kariapperuma, (Superintendent and S. Godage,
(Asst. Superintendent. Hopton Estate)

N 328 - (MeBr 6) Field No. 3 (NC 97), Hanford Estate, Deniyaya.
(4 Treatments x 3 Replicates)

Direct planting of the experimental plots were carried out on Randomized Complete Block design, in October with untreated control (T4) for comparison

- T1 - All plants Per plant, thatching with *Tithonia diversifolia* (wild Sun flower)
- T2 - "Vetiver" grass planted in the inter-row
- T3 - "Nemacur" 7 g per plant at planting were given a basal treatment of 3 g of "Suscon Fore" The experiment was in progress.

S. I. Vitarana, A. K. Prematunga, D. D. Liyanage, P. K. Jayawickrema,
and R. Dharmabandu, (Superintendent of Hanford Estate).

2 2.4. Eradication of nematodes in infested Young Clearings

N 327 (MeBr 5) - Kelliewatta Estate

A study on block-infilling of infested tea with organic and inorganic nematicidal treatment in place of rehabilitation commenced in March; treatment and planting of the experimental blocks (in Randomized Complete Block design) were carried out in December. The experiment design is of Replicated Completely Radomized Blocks :

- T1 - Thatching with "Vetiver" grass
 - T2 - fenamiphos ("Nemacur") @ 7 g per Plant
 - T3 - Thatching with tobacco waste (Tobacco dust-TD))
 - T4 - Untreated control.
- The experiment was in progress.

S. I. Vitarana. D. D. Liyanage, N. Navaratne, G. P. Udumulla
and Y. Konaratne

N 332 (MeBr 15) - 1990 NC F. No. 1A. Galaha Estate,, Galaha Commenced in October.

In this trial. treatments are being carried out in an infested immature clearing under mixture of clones namely DN, TRI '2025 and '2026. a Randomized Complete Block design, with 3 replicates :

- T1 - fenamiphos ("("Nemacur") @ 7 g per Plant (standard)
- T2 - thatching with fresh, green neem (Margosa) leaf, @ 1 kg per plant, repeated at regular intervals, depending on the rate of decomposition.
- T3 - furrow application of sugar cane molasses pretreated with weeds removed from the tea land and decomposed for one month @ 500g Per plant.
- T5 - untreated control

One round of treatment application, where applicable was carried out in November.

Best recovery plants were exhibiting symptoms of nematode infestation at commencement of trial was seen in the T1 plots, by end of the Year.

S. I. Vitarana, U. B. Herath, P. Udumulla and B.SureshKumar

N 332 (MeBr 20) - F. No.. 1A,, Galaha Division, Galaha Estate, Commenced in October.

One trial similar to MeBr 15 was started to test higher dose of fresh neem leaf in an infested immature clearing under one clone. TRI 2025, in a Randomized Complete Block design, with 3 replicates . Treatments are scheduled for January :

- T1 - fenamiphos ("Nemacur") @ 7 g per plant (standard)
- T2 - thatching with fresh, green neem (Margosa) leaf. 1 kg per plant repeated at regular intervals, depending on the rate of decomposition.
- T3 - furrow application of sugar cane molasses Pretreated with weeds removed from the tea land and decomposed for one month @ 500g Per plant.
- T5 - one month control

S. I. Vitarana, U. B. Herath, P. Udumulla and B. SureshKumar

2.3. Nematicidal agents for nurserv soil sterilization (alternatives to Methyl Bromide)

2.3.1. Chemical sterilants :

N 334 (MeBr 17) - St. Coombs - Basamid Expt.Sep '97 Nematology Nursery

Nursery experiment was carried out to check the Period of toxicity due to "Basamid" fumigation' because, there was the need to shorten the period of nursery work : Fumigated soil was bagged and the cuttings were planted after one, two, three and four weeks from fumigation in T1, T2, T3, and T4 respectively. Dates of treatment were staggered in such a way that the assessments could be carried out on the same day in all plots.

The observations are summerized below :

Treatment (Period alter fumigation)	% Plants affected (dead + scorched)
One week	11 %
Two weeks	8 %
Three weeks	5 %
Four weeks	1 %

It was concluded that, soil treated with "Basamid" can be planted with tea cuttings after four weeks for with the chemical.

S. I. Vitarana and P. Udumulla

2.3.2. Soil Solarization as a means of soil sterilization

N 320 (MeBr 11) -Tea Nursery, Ova Highland Estate. Bandarawela,,

Solarization under clear-polythene, by itself and in combination with nitrogen fertilizers to impart synergistic effect are being tested in Replicate trial, using 150-plant area per plot :

- T1 - Untreated control (the current estate Practice)
- T2 - treated with 'Basamid' as per current TRI recommendation
- T3 - bagged infested soil under 3-week solarization
- T4 - bagged infested soil under 6-week solarization
- T5 - bagged infested soil under 9-week solarization
- T6 - infested soil treated with urea @ 5 kg per cube soil, bagged and solarized for 3 weeks
- T7 - infested soil treated with $(\text{NH}_4)_2\text{SO}_4$ @ 5 kg per cube soil, bagged and solarized for 3 weeks
- T8 - infested soil solarized for 6 weeks in bulk
- T9 - infested soil solarized for 9 weeks in bulk

Treatments commenced in August. Cuttings were planted in September, October and November in the 3-week, 6-week and 9-week solarized plots respectively. The experiment is in progress.

S. I. Vitarana, D. D. Liyanage and N. Navaratne

N 321 (MeBr 12) - Tea Nursery, Ury Group , Passara.

Solarization under clear-polythene, by itself and in combination with nitrogen fertilizers to impart synergistic effect are being tested in a 3-Replicate trial. using 1000-plant area per plot and 6" x 3" size bags :

- T1 - infested soil solarized for 10 weeks in bulk
- T2 - bagged infested soil under 10-week solarization
- T3 - infested soil treated with urea @ 5 kg Per cube soil, bagged and solarized for 10 weeks
- T4 - infested soil treated with $(\text{NH}_4)_2\text{SO}_4$ @ 5 kg Per cube soil, bagged and solarized for 10 weeks
- T5 - bagged infested soil fumigated with Methyl Bromide @ one 500g can per 1000 plants (standard)
- T6 - untreated bagged soil covered with Mana up to the time of' planting cuttings
- T7 - infested soil in bags, planted with cuttings and immediately covered with plythene for long term solarization (moisture is recycled under polythene))

The experiment was in Progress.

S. I. Vitarana., D. .D Liyanage and N. Navaratne

N 323 (MeBr 10) - Tea Nursery, Moray Estate, Maskeliya

Preparatory work at this nursery commenced in November for a solarization experiment similar to N 320. Treatments were sheduled for the period after dry weather sets in, in January '98.

S. I. Vitarana., N. Navaratne and P. Udumulla

N 336 (MeBr 14) - Tea Nursery, Galaha Division, Galaha Estate, Jan-98 ;

Nematode infested nursery which had been abandoned due to nematodes was prepared in November to conduct an experiment to test the efficacy of soil solarization by it self and in combination with other agents,, as given below :

- T1 - soil mixed with urea @ 900 g/450 bags, bagged and kept under 6-week solarization
- T2 - soil mixed with urea @ 900 g/450 bags,
- T3 - soil mixed with (NH₄)₂SO₄ urea @ 900g bagged and kept under 6-week solarization
- T4 - soil mixed with (NH₄)₂SO₄ urea @ 900 g/450 bags, bagged and kept under 8-week solarization
- T5 - soil mixed with "Basamid" @ 125 g/460 bags, bagged and kept under 6-week solarization
- T6 - soil mixed with "Basamid" @ 126 g/450 bags, bagged and kept under 8-week solarization
- T7 - bagged infested soil-under 6-week solarization only
- T8 - bagged infested soil under 8-week solarization only
- T9 - Untreated control (the current estate practice)
- T10 - treated with MeBr according to current recommendation

Preliminary work was carried out and treatments were scheduled for early 1998.

S. I. Vitarana,, U. B. Herath,, P. Udumulla and B. SureshKumar

2.4. Purification of nematode contaminated water for nursery use ;**LN 1 - (MeBr 19)** - Tea Nursery TRI Centre,, Deniyaya.

A study commenced to test the sedimentation efficacy of an arrangement of three "Plastishell" tanks which are easily available in any area to clean contaminated water that is the only source available to the nursery at present.

The study is in progress.

S. I. Vitarana,, A. K. Prematunga and P. K. Jayawickrema

2.5. Miscellaneous Studies under MeBr Project :**N 329 (MeBr 7)** - Survey on the usage of Methyl Bromide and other nematicidal agents in the nursery and in fields on tea estates. '97

A questionnaire was prepared to collect data from the estates where nematode infestation has been recorded. A separate vehicle was being awaited

to start the survey proper by the end of the Year.

S. I. Vitarana,, D. D. Liyanage, N. Navaratne, U. B. Herath, G. P. Udumulla, A. K. Prematunga and Y. Konaratne

1.3.0 Cultural Control

1.3.1. Studies on Botanicals

The plant species which were earlier proved to be immune to *Pratylenchus loosi*, *Radopholus simi* lis and *Rotylenchulus reniformis* were being screened to check for the presence of any nematicidal properties.

S. I. Vitarana, D. D. Liyanage, N. Navaratne, U. B. Herath
and G. P. Udumulla

4.0 Project B / PECO : Pest Ecology and Management of pests with special reference to Shot- hole Borer and Up-country live wood termite.

Studies carried out under the project B/SHBO in relation to the management of the Shot-hole borer (*Project Leader* - K. Thirugnanasuntharan are being incorporated under B/PECO as both these Projects include activities that come under those of the "Task Force on Shot-hole Borer.

Project Leader - L. D. Amarasinghe

3.1. Resistance of tea clones to the Borer (in collaboration with Plant/Breeding Division)

3.2. Effect of systemic fungicides on Borer buildup (B/SHBO)

The effect of systemic fungicides on the growth of the ambrosia fungus which is the food of the brood of the borer, is being studied in order to assess their indirect effect on the development of the borer. This study is in collaboration with the Plant Pathology Division.

E 292 - TRI Uva Station, Passara.(in collaboration with Plant Pathology Division)

In this trial, initiated in November 1996, overgrown nursery plants of the susceptible clone TRI 2025 were being treated with two systemic fungicides in two methods of application, at three concentrations, at three weekly intervals. It was planned to artificially introduce the Borer beetles to the plants in 1997.

The results did not show any significant difference between treatments.

K. Thirugnanasuntharan, A. Balasuriya, A. Abeysekera,
and P. D. P. de Silva

3.3. Effect of high potash fertilizer

E 289 - Attampettia Estate, Ettampitiya (1996)

A study on the effect of high potash on nursery stage of growth was initiated in collaboration with Soils and Plant Nutrition Division in 1996 on factorial design :

Treatments : 3C x 4K x 3R where,
 3C = 3 clones : TRI 2025 (Susceptible)
 DN (moderately susceptible)
 TRI 3041 / 4070 (resistant)
 4K = 4 Potash levels : @ 0 g, 2.3 g, 5.6 g, 8.4 g.
 3R = 3 replicates

Treatments commenced at the time of bagging of soil in the nursery and continued at fortnightly intervals after 2 months from planting of cutting. Post infestation was not observed while the plants were in the nursery. Nursery stage of the trial was terminated in September and the plants were transplanted in October in F. No. 02, First Division of the same estate. They were planted on Randomized Block Design (15 plants of one treatment combination going in to one plot in a given replicate). The following treatments were superimposed on the field planted blocks.

T1 - T 200 (@ 25 g) + 0.0 g MOP per plant per application
 T2 - T 200 (@ 25 g) + 1.5 g MOP - do -
 T3 - T 200 (@ 25 g) + 3.0 g MOP - do -
 T4 - T 200 (@ 25 g) + 4.5 g MOP was carried out in one application of fertilizer treatments December.

E290 - Tea Nursaury TRI Mid Country Station, Hantane.

This is a replicate of the experiment E289. Nursery stage of the trial was terminated in September and tyhe plants were transplanted in October in Field No. 4, Factory Division of Hantane Estate, Kandy. They were planted on Randomized Block Design using 12 plants of one treatment combination going in to one plot in a given replicate.

L. S. K. Hettiarachchi, L. D. Amarasinghe, K. Thirugnanasuntharan,
 L. S. Abeysinghe, A. R. Abeysekera, B. SureshKumar and U. B. Herath

4.2.1. E 266- Screening of Insecticides against SHB F. No. 17, First Division, Attampettiya Estate (1994)

Post-treatment assessments of branch sampling for shot-hole borer infestation were carried out; mean number of galleries and mean population

per 30 cm of primary branch were assessed commencing from 15 & 19 months after prune in October 95 (P1) and March 96 (P2) respectively. The chemical treatments included the following:

- T1 - Admire SL200 at 500 ml ha⁻¹
- T2 - Admire SL200 at 500 ml ha⁻¹
- T3 - Ekalux 25EC at 1000 ml ha⁻¹
- T4 - Ekalux 25EC at 2000 ml ha⁻¹
- T5 - Chlorpyrifos 25EC at 4500 ml ha⁻¹
- T6 - Chlorpyrifos 20EC at 1500 ml ha⁻¹
- T7 - Untreated control

Table 1: Mean number of galleries per 30cm of Primary Branch
(number of samples =30)

Insecticide Treatment	Months after pruning						
	19 Oct.	21 Dec.	15 Jan.	18 Apr.	20 Jun.	22 Aug.	25 Nov.
T1	3.3	3.6	2.8	3.0	3.7	4.4	4.4
T2	3.2	3.8	2.5	3.2	3.5	4.5	4.0
T3	4.3	4.4	2.2	3.5	4.1	4.8	4.3
T4	3.2	3.6	1.8	1.9	3.1	3.3	3.3
T5	3.0	4.0	1.6	2.8	3.1	3.6	3.4
T6	3.3	3.3	1.7	2.6	3.5	3.6	4.3
T7	3.5	4.0	1.8	2.4	3.0	4.1	3.6
T8	4.3	3.3	2.6	3.4	4.0	5.2	4.2

Table 2: Mean population per 30cm of a primary Branch
(number of samples =30)

Insecticide Treatment	Months after pruning						
	19 Oct.	21 Dec.	15 Jan.	18 Apr.	20 Jun.	22 Aug.	25 Nov.
T1	8.0	7.5	2.9	6.1	4.1	2.5	4.4
T2	12.6	7.2	5.3	4.2	5.1	1.6	5.3
T3	5.5	6.3	3.2	3.8	5.9	2.1	5.3
T4	6.8	7.2	2.8	3.0	2.9	1.8	4.0
T5	5.0	8.6	3.6	4.4	3.0	3.2	4.0
T6	4.7	8.6	3.7	3.5	5.2	2.2	3.5
T7	6.5	8.4	5.0	2.1	3.7	2.8	4.2
T8	15.0	10.1	5.1	3.7	4.8	3.9	3.7

P1 = Plots pruned in October 1995

P2 = Plots pruned in March 1996

The data indicated that the treatments were not significantly different from the untreated control.

L. D. Amarsinghe, L.S. Abeyasinghe, A. Abeysekara, and P.D.P. de Silva

4.2.2. E 275 Screening of insecticides against SHB in Young tea
(Field No. 3, NP Division, New Peacock Estate, Pussellawa 1995)

Chemical treatments are the same as in E266

Branch-breakage was used as a measure of the infestation in each plot, at one assessment carried out in November. The experiment is in progress.

L. D. Amarasinghe, L. S. Abeysinghe, U. B. Herath and P.D.P. de Silva

Table 3: Total branch breakage (4 plot each consisting average 40 plants).

Treatment	Block planted in 1995 (2 years)	Block planted in 1994 (3 years)
T1	23	6
T2	21	5
T3	24	14
T4	27	13
T5	12	12
T6	18	13
T7	16	9
T8	26	6

Results will be analysed at the first formative pruning.

4.2.3. E 294 - Use of bio-control agents in reducing shot- hole borer

This study was initiated during the latter part of the year.

Three isolates of the entomopathogenic fungus *Beauveria bassiana* namely. I-92-76A. I-94-477, were imported from Commonwealth institute of Biological Control, UK. Pure cultures were raised on Molisches Agar plates and blastospores were obtained by growing the isolates in liquid cultures of the same medium.

The preliminary bioassays were carried out by application of the test material in the form of spores, with a brush on borer infested branches (each 30cm long) held in polythene bags and replicated 4 times. Mortality/survival of Shot-hole borer was assessed after 8 days. The results showed that only the adult beetles were killed by the pathogen and the immature stages wer unaffected. The study is in progress.

L.D. Amarasinghe, L.S. Abeysinghe, A. Abeysekara

4.3. Host volatile for mass trapping

a. Identification of Kairomones :

Bark volatiles of the host and non host type of plants and of the infested and uninfested stems on such plants were studied and the progress of the study was presented at the bi-annual meeting of the SAREC project held at Institute of Fundamental Studies, Kandy, in July. The study was repeated with samples from Attampettiya Estate to confirm the first findings. The experiment is in progress.

L.D. Amarasinghe, Y. Konaratne and I.S.B. Abeysinghe

- b. Effect of presently recommended shade trees as diversionary hosts to the Borer
(in collaboration with Agronomy Division)

E 286 - Field No. 14, 2nd Division, Attampettiya Estate, Attampettiya;
Shade combination is *Grevillea robusta* and *Erythrina lithosperma*

Pre treatment assessment on shot-hole borer infestation was carried out in June. Mean number of galleries per 30cm of a primary branch was found to be the same (6.7) in all plots indicating uniform and heavy infestation. Plots were pruned in October and assessments were scheduled/commenced in December 1998.

E 287 - Field No. 1, Sirimedura Division, Kiruwanagaga Estate, Deniyaya.
Shade combination is *Albizia moluccana* and *Giricidia sepium*

Plots were pruned in June. Post treatment assessments were scheduled to commence in June 1998.

E 288 - Field No. 6, NP Division, New Peacock Estate, Pussellwa.
Shade combination is *Grevillea robusta* and *Erythrina lithosperma*

Pre-treatment assessment was carried out in June. Mean number of galleries per 30cm of a primary branch was found to be 6.2 for Plots with shade and 7.6 for plots with no shade. All plots were pruned in July. Post-treatment assessments were scheduled to commence in September 1998.

A. Kathirvetpillai, L.D. Amarasinghe, K. Thirugnasuntharan,
L.S. Abeysinghe, A.R. Abeysekera and U.B. Herath

- C. Effect of times and methods of pruning in reducing shot-hole borer
(in collaboration with Agronomy Division)

E 283 - Field No. 7, First Division, Attampitiya Estate, Ettampitiya :

Treatment in the form of pruning in January and pruning in April were carried out. (October pruning had carried out in 1996). Based on visual observations made in June and December, post treatment assessments were scheduled to begin in February 1998 (16 months from prune).

A. Kathirvetpillai, L.D. Amarasinghe, K. Thirugnasuntharan,
L.S. Abeysinghe and A.R. Abeysekera & P.D.P. de Silva

**E 284 - Field No. 1, Kiruwanagnaga Estate, Deniyaya
(pruned in October in 1996)**

Treatment in the form of pruning in April was carried out. (October pruning had been carried out in 1996). Visual observations made in August, October and December indicated that even green stems measuring about 0.5cm in diameter also, were infested in plots pruned in October '96. Data collected by the end of the year is given in Table.

Table - 4 Total branch breakage

Prune time	Type of Prune	Total Branch Breakage			
			Months after Prune		
October '96	Cut-across	4	6	10	12
	Normal	-	0	202	65
	Rejuvenation	-	95	320	80
April '97	Cut-across	-	142	160	44
	Normal	25	29	-	-
	Rejuvenation	37	19	-	-
January '98	Cut-across	4	18	-	-
	Normal	-	-	-	-
	Rejuvenation	-	-	-	-

Future assessments are scheduled for a period up to 36 months.

A. Kathirvetpillai, L.D. Amarasinghe, K. Thirugnasuntharan,
L.S. Abeysinghe and A.R. Abeysekera

E 285 - Field No. 6, N.P. Division, New Peacock Estate, Pussellawa.

Pruning scheduled for April and October were carried out. Assessments commenced in September. The experiment is in progress.

A. Kathirvetpillai, L.D. Amarasinghe, K. Thirugnasuntharan,
L.S. Abeysinghe and A.R. Abeysekera & P. D. P. de Silva

4.4 Clonal Selection for resistance to the UCLWT & SHB

E 271 - Field No. 5, of Lower Division, Mocha Estate, Maskeliya (B/PECO).

During the year, 20 more seedling bushes were selected from this field in June. Root samples were bioassayed by the methods adopted in 1996. However, none of the 20 selections proved to be promising as resistant to the up country Live wood Termite.

This experiment will be continued to complete 200 selections in the above location.

L.D. Amarasinghe, L.S. Abeyasinghe and P.D.P. de Silva

LE 83 - Clonal Selection for pest resistance inclusive of Shot-hole Borer (B/SHBO)

Field No. 5B, Maratenna Division, Balangoda Group, 100 bushes were selected from old seedling bushes in November and 72 of the best were selected out for propagation in December. Clonal cuttings were established in the estate nursery of Maratenna Division. Generation of cuttings per mother bush varied from 10 to 270. However, according to census taken after establishment, it was observed that they had 100% success.

S.I. Vitarana, A.K. Prematunga, E.St.E.R.Perera, Ramaiya Kanganie (retired Kanganie, Maratenna Division), Mr. K.C. Munaweerahettie, (The Superintendent) and K. Thirugnasuntharan

4.7 Early Detection of Up-country Live wood Termite

Further development of the equipment, High Gain Instrumentation amplifier (HGIA) is in progress.

K. Thirugnanasuntharan

5. PROJECT B/TERM : Pest ecology and productivity of tea lands in relation to the containment and management of the live-wood termites in the Low-country.

Project Leader - Sushila I Vitarana

5.1 Clonal Screening

Clonal resistance to the live wood termites is being studied on replicated plot trails designed in collaboration with the Plant Breeder as well as in mother bush blocks established in the low-country.

5.1.1 Field Screening ;**LE 22 (ix) - 1 Talangaha Estate**

The clones that were being studied included NIL211, NIL12, NIL262, NIL53, TRI3029, NIL274, TRI3052. There were no experimental operations scheduled for this year. The experiment is in progress.

S.I. Vitarana, S.M. Samarasinghe, and P.K. Jayawickrema

LE 50 - Hapugastenna Estate, LAT Division

Experimental blocks were being maintained with casualties being infilled.

S. I. Vitarana, E.St.E.R. Perera and A. K. Premathunga

**LE 78 - Hapugastenna Division, Ratnapura
F. No. 4, Hathdaraganga Division**

50 new selections made in march 1996 were being raised in the nursery. The selections turned out to be very slow growing in the nursery, perhaps because they were the most hardy and selected for total immunity for termite attack. These are meant to enter future breeding programmes.

S.I. Vitarana, S.M. Samarasinghe, E.St.E.R. Perera and A.K. Premathunga

5.2 Laboratory Screening of plants against the low country live wood termite

LE 80(a) - Bioassay of test clones with TRI 2023 as the standard, using dry power of stem material was carried out adopting the "4-channel perspex olfactometer" testing 4 clones at a time. Six replicates were run simultaneously. The following clones were being tested : 4048, 4059, 4002, 4003, 4054, 4088, 4089, 4087, 4004, 4005, 4015, 4019, 4024, 24048, 4059, 4002, 40034054, 4088, 4089, 4087, 4004, 4005, 4015, 4019, 4024, 4031 & PGI (Pambegama selection), with TRI 2023 as control. Data was being prepared for analysis. The study is in progress.

S.I. Vitarana, A.K. Premathunga and E.St.E.R. Perera

LE 80 (b) - Bioassaying of plant extracts for their kairomonal and allomonal properties (using olfactometers)

Two different models of olfactometers were used to test chemical extracts. Extractions were done both as cold extraction and by solvent distillation extraction (SDE), using hexane, methanol & dichloromethane. Extraction was replicated at TRI laboratories and at chemistry Department, University of Peradeniya. Both types of extracts elicited similar response from the test in-

sects (alates) even though the two extracts had dissimilar gas chromatograms. The test material included the clones of the series TRI 2000, 3000 and 4000.

The same extracts were used for feeding behaviour studies using two methods namely, filter paper incorporated with extracts in petri dish ensemble, secondly incorporating the extract in artificial diet medium. The observations corroborated the findings of the study of LE 80 (a). This study is in progress.

S.M. Samarasinghe, I.S.B. Abeysinghe and Vijaya Kumar
(University of Peradeniya)

LE 81 - Hapugastenne Estate, UWK Division

Land preparation, planting, thatching, infilling, weeding, fertilizer application and infilling of the experimental site were carried out. The experiment is of Randomized Block design with two replicates. The test clones include : TRI 4036, 4004, 4089, 4003, 4019, 4046, 4088, 4053, 4052, 4020, 4015, 4024 with TRI 2026 as the standard for comparison. The experiment is in progress.

S.I. Vitarana, E.St.E.R. Perera and A.K. Premathunga

5.0 Project : C/NEMA

Project Leader : Susila I Vitarana

5.1 Analytical services

47 estate samples were analysed during the period under review. 5 letters and 45 reports were sent out.

D.D. Liyanage, N. Navaratne, B. Sureshkumar, U.B. Herath and
G.P. Udumulla

5.2 *In-vitro* culturing of nematodes - N288, N289 and N290

Pure cultures of different species of tea nematodes are maintained in the laboratory for detailed experimental work. Callus tissue of carrot tuber, callus tissue developed from excised root tips of corn and callus tissue developed from excised root tips of tomato are the media for *R. Similis*, *P. loosi* and *R. reniformis* respectively. The method adopted for *P. brachyurus* is the same as for *P. loosi*.

N. Navaratne and U.B. Herath and Y. Konaratne

7. Project : D/ENTO - Divisional Activities

Project Leader : Sushila I Vitarana

7.1.2 Biological Control of Tea Mites

Properly designed trials in relation to dosages, times of release, radius of activity and their residual activity were carried out as follows

- E 272 -** Lauderdale Estate, Rakwana
To study the radius of efficacy of Phytoseiulus persimilis and Amblysius californicus on oligonychus coffeae.

Monthly assessments were carried out and the data showed that there is no statistically significant difference between the different radii. It could be inferred that the migratory habits of the two predators are such that they could move to great distances so long as there are no physical barriers such as, ravines, large foot paths, roads and streams. The experiment was terminated.

S.I. Vitarana, A.K. Premathunga, E.St.E.R. Perera and H.D. Kumarasena,
 Superintendent, (Lauderdale - Deveronside Estates, Rakwana)

- E 273b** Lauderdale - Deveronside Estate, Rakwana.
To study the effect of Biological Control of Oligonychus coffeae using the predators phytoseiulus persimilis and Amblysius californicus, on productivity of tea fields during mite outbreak periods.

Monthly field yield recorded by the Superintendent in the fields treated with the predators as well as the untreated fields over the period from 1981, were analysed. It was observed that there was a steady upward trend in the yield recorded since the present management took over in 1981. The yield increment was found to be even more after the predatory mites were introduced and since the other agricultural factors remained constant during the period after their release and since there were heavy outbreaks of mites even in 1996 in areas outside the experimental area the additional yield increment could be attributed to the activity of the introduced predators. The data was been referred to the Agricultural Economist for economic analysis.

S.I. Vitarana, E.St.E.R. Perera, A.K. Premathunga, S.B. Vitana and
 H.D. Kumarasena, (Superintendent,
 Lauderdale - Deveronside Estates, Rakwana)

7.2 Chemical Control of Scavenging Termites

ME 07 - Duckwari Estate, Rangala

Repeat experimentation to confirm the results of the experiment E268 (where "Admire 200" at 0.50% dilution proved to be the best and effective upto 18 months from treatment) was carried out at the same site using the same plots but, identified under different number, "ME 04". "Admire", is compared as against chlorpyrifos and common salt which are known termiticides. One application of chemical treatments and monthly assessments were carried out. The experiment is in progress.

S.I. Vitarana, S.T. Yatawatte, U.B. Herath, B. Sureshkumar and H.J.M. de Silva

ME 08 - F. No. - 05C Hagalla Estate, Madulkelle
Chemical Control of Scavenging Termites

The following treatments with an untreated control were applied in August : T1 - "Admire" 03% solution, T2 - "Admire" 05% solution, T3 - Chlorpyrifos 0.1% solution, T4 - common salt of 0.125% solution. All treatments applied as soaking spray at the bottom of the bush covering 1ft up the trunk and a radius of 1ft from the base of the bush.

The experiment is in progress.

S.I. Vitarana, S.T. Yatawatte, S.B. Abeysinghe, U.B. Herath and
 H.J.M. de Silva

8.0 Unusual Pest Outbreaks, etc

a. There were unusual outbreaks of the Fringed Nettle Grub in several fields of EI Tebb Estate. Chemical spraying had been carried out from May to end December. Investigations carried out showed that the activity of the parasite population was at a very low ebb. The reasons could not be elucidated. It was decided to monitor the parasite population next and undertake chemical control if and when natural control factor is assessed to be undependable, so that loss in crop could be minimized.

b. Outbreaks of Tea Totrix and tea mites was generally less than the previous years. One of the contributory factors is the intermittent rains experienced in the pest prone areas during the usual dry seasons.

c. Several nurseries were found to have been infested with nematodes. In almost all such cases the source of infestation could be traced back to the water supply. Contaminated water was being used either without sedimentation or with ineffective sedimentation mechanisms. *In-situ* experimentation resulted in a method of eradication of such infestation adopting individual plant application of "Nemacur" granules. The dosages varied according to the degree of infestation. This method would be recommended for eradication of nematodes in infested nurseries in due course.

8.0 Miscellaneous work

8.1 Directory of Tea pests :

Comprehensive lists of all tea pests including those of animal origin, plant origin (pathogens) and also, weed plants, their distribution in the tea producing countries in the world, and their bio-control agents occurring in Sri Lanka were compiled into one document for the use of the Steering Committee on National Plant Quarantine, Council of Agricultural Research Policy of Sri Lanka, (CARP). Copies of this document are deposited in the institute libraries at Talawakelle and Ratnapura and in the office of CARP.

S.I. Vitarana, Lakshmi de Silva, A. Balasuriya and G. Prematilake

8.2 Seminars, symposia, Field days and Lectures :

Mrs. S.I. Vitarana participated as a member of the Sri Lanka team, at the Technical Committee meeting of the International Standards organization (ISO) Sub Committee on Tea, held in February, in Colombo.

Mrs. Vitarana addressed the RSC seminar in Kandy on the topic "Pruning in relation to pest Management", in March.

Dr. L.D. Amarasinghe and Mr. K. Thirugnanasuntharan attendd the two day symposium of Entmology working Greoup of the Department of Agriculture held at HORDI, Gannoruwa, in August.

Mrs. Vitarana participated at a training programme conducted by the Bureau of Standards on "5S Programme" and delivered a seminar on "Total Quality Management" for the benefit of the institute staff on world standards Day, 14th October.

Mrs. S.M. Nagahaulla and Mrs. S.B. Vitana were nominated into a entomological taxonomy group which will function as a national service. They participated at two residential training programmes in Kandy during the course of the year.

Dr. L.D. Amarasinghe, Miss. S.M. Samarasinghe, Mrs. S.I. Vitarana and Mr. K. Thirugnasuntharan participated at the biannual meeting of the participants of the SAREC Biochemical Pest Control Project, at the Institute of Fundamental Studies, Kandy, in July.

Entomologist

PLANT PATHOLOGY DIVISION

Acting Head - A. Balasuriya

1. General

A. Balasuriya continued his Ph.D studies at Peradeniya University. Mr T.S. Gunasekara did not return after completing post graduate studies in the U.K. Staffing was at only 50% of the establishment throughout the year.

An undergraduate trainee, Ms V. Krishnapillai from the Faculty of Agriculture, University of Jaffna, completed a project entitled, "Two wood-rot causing fungi in Tea (*Camellia sinensis*) and some of their biological aspects", spending a little over six months, starting in January.

NDT trainees, Ms C.R. Nakandala (NDT, Kuliyaipitiya), Mr D. Weeraturunge, Ms S. Priyalakshie, Ms K.H.A.D. Kumari and Ms R. Krishnawathany (NDT, Ampara) each completed a four-month training period in the division during the year. Ms H.W. Prabha Kumari and Ms D.G.G. Janakie (NDT, Kuliyaipitiya), commenced their training in December.

2. Project: D/PLPA - Divisional Activities

Project Leader - A. Balasuriya

2.1. Leaf Diseases

2.1.1. Blister Blight

2.1.1.1. P/BB1/97 - Collaborative studies with advisory staff on the control of the disease.

Hantana, Passara and Deniyaya sub-stations were earmarked for this study. In Hantana, the plots were marked and waited for the blister to set in. Since the blisters were not found until early December, this study had to be postponed.

2.1.1.2. P/BB2/97 - Fungicide screening trial, Field No.7, St. Coombs.

Altogether, 9 rounds of spraying and 18 Blister Blight assessments were undertaken in this trial, from end July to end November, 1997. The assessments were based on infected third leaf counts of 100 shoots (three leaves and a bud) in each plot. The first four counts did not produce consistent results due to erratic weather patterns. This behavior was continued upto 12th August, one week after spraying the first round. The results of subsequent 15 rounds are presented in Table 1. In this, 14 assessments gave 50% or more control of blisters with all the treatments. All the products compared well with standard Baycor. Both Bumper and RH 7592 at double the concentration gave better control. But during the season since the aim was to maintain blisters below

35% infection level, the lower rates should be sufficient. This will also ensure minimum residue levels in the made tea which is of prime importance.

Treatments;

1. Baycor (BC) 5 ml/10 l of water / 85 ml/170 l of water ha⁻¹
2. Calixin (CX) 7 ml/10 l of water / 120 ml/170 l of water ha⁻¹
3. Bumper (BM) 6 ml/10 l of water / 100 ml/170 l of water ha⁻¹
4. Bumper (BM) 12 ml/10 l of water / 200 ml/170 l of water ha⁻¹
5. RH 7592 6 ml/10 l of water / 100 ml/170 l of water ha⁻¹
6. RH 7592 12 ml/10 l of water / 200 ml/170 l of water ha⁻¹

In addition, unsprayed plants from the adjoining area were assessed and appear as the control below.

TABLE 1. Percent shoots with infected third leaf, after treatment with different systemic fungicides in comparison with unsprayed control

Date	12/8	22/8	27/8	03/9	10/9	17/9	24/9	01/10
Week a.s.	1	2	1	2	3*	1	2	1
Baycor 5ml	89.5	48.3	36.7	53.5	33.5	29.5	8.3	18.5
Calixin 7ml	92.2	39.8	49.0	23.8	32.5	31.3	7.3	10.8
Bumper 6ml	85.5	40.0	28.5	33.0	30.8	28.8	9.5	16.3
Bumper 12ml	70.1	18.3	24.0	14.8	31.1	27.5	6.0	5.5
RH 7592 6ml	88.7	24.5	46.8	33.3	24.5	29.5	8.5	17.9
RH 7592 12ml	88.2	18.3	42.1	32.3	18.2	16.5	4.8	11.9
Control	97.0	87.0	94.0	89.0	83.5	69.5	40.0	34.0

Date	08/10	15/10	22/10	29/10	05/11	12/11	19/11
Week a.s.	2	1	2	1	2	1	2
Baycor 5ml	14.5	18.2	12.2	19.0	14.0	18.8	18.8
Calixin 7ml	29.0	31.5	21.3	25.8	15.5	24.8	27.0
Bumper 6ml	22.0	14.8	22.5	16.3	17.7	12.0	11.3
Bumper 12ml	24.3	11.2	7.8	7.8	13.3	11.8	10.5
RH 7592 6ml	18.5	15.0	8.8	34.0	13.8	11.5	13.5
RH 7592 12ml	11.8	16.0	8.5	27.8	10.5	13.0	13.3
Control	59.5	66.8	87.5	50.0	57.0	57.5	75.0

3* weeks after spraying, extended to the 3rd week due to sun-shine

Angular Transformed data of the values in Table 1 were used to find the statistical significance of the results of individual treatments (Table 2). Considering Baycor at (85ml/170l) as the standard, both Bumper and RH 7592 at 12 ml/10 l of water performed significantly better. By successful control of the disease i.e. maintaining the infections below 35%, it should be possible to achieve a similar level of control by using Calixin at 7 ml, Bumper at 6 ml and RH 7592 at 6 ml per 10 l of water, because, these were not significantly different from the standard Baycor.

TABLE 2. *Comparison of two new systemic fungicides with Baycor and Calixin in the control of Blister Blight (Angular Transformed data) (selected dates only)*

Date	12/8	20/8	10/9	22/10	19/11
Weeks a.s.	1	2	3*	2	2
Baycor 5ml	75.1	43.6	32.8	20.5	25.2
Calixin 7ml	75.0	38.7	33.8	27.0	33.5
Bumper 6ml	68.0	38.9	31.6	28.2	18.9
Bumper 12ml	53.8	25.0	31.6	16.0	18.8
RH 7592 6ml	71.5	29.4	32.7	17.0	21.3
RH 7592 12ml	70.6	25.1	23.7	16.7	20.5
SE(mean) (15)	13.2	26.6	13.3	16.8	23.6
LSD, P<0.05	11.2	11.0	5.1	4.3	6.7

* - 3 weeks after spraying, extended to the 3rd week due to sun-shine

A. Balasuriya, D. Pallemulla, N. Karunatilake, and A. Ratnayake

2.1.1.2. P/BB3/97 - Re-evaluation of Cu fungicide dosage rates for the control of Blisters in tea nursery (St.Coombs).

This study was undertaken from September to November in order to re-evaluate the dosage rates of Cu fungicides, used in the control of blisters in the nursery.

Three groups of the fungicide were used, namely; Oxide, Oxychloride and Hydroxide. The rates were based on current recommendations and the expected solubility of the chemical group. Each group was tested at three appropriate concentrations (Tables 3), on two different clones; TRI 3025 and TRI 4050.

This study revealed that all the treatments provided excellent control of the disease when sprayed at weekly intervals. When the infection level in the controls (non-sprayed) was 69%, the maximum recorded in any of the treatments was 8% while the minimum control achieved was 2% (Table 3).

Along the three products, CuO (oxide) ranked the best closely followed by Cu(OH)₂ (hydroxide) and CuOCl₂ (oxychloride). Considering different concentrations, CuO at 140g, CuOCl₂ at 90g and Cu(OH)₂ at 80g performed best within each group.

TABLE 3 - *Percent infection of plants with blister treated with different concentrations of three copper fungicides, diluted in 45 l of water*

<i>Treatment</i>	<i>level of infection</i>	<i>% plants infected (transformed date)*</i>
Control	0.69	0.66 g
CuO 100g	0.08	0.62 b
CuO 120g	0.06	0.60 b
CuO 140g	0.02	0.55 cd
CuOCl 90g	0.04	0.67 a
CuOCl 110g	0.05	0.54 a
CuOCl 130g	0.05	0.40 f
Cu(OH) ₂ 80g	0.03	0.51 e
Cu(OH) ₂ 100g	0.03	0.56 c
Cu(OH) ₂ 120g	0.05	0.004

In the second column, data followed by same letter are not significantly different at $P < 0.01$, by DMRT.

A. Balasuriya and N.K.Karunatilake

P/BB4 - Control of Blister Blight using house-hold salt, NaCl
(St. Coombs - Field 9);

Objective: There is speculation that the ordinary salt (NaCl) can be used to control Blister Blight with some success. This is being already practiced by some growers. Our aim was to establish this, and quantify same.

NaCl, at three concentrations (1.0, 2.5 and 5.0%) were tested along with the standard copper (Perenox). This trial was concluded in 1996 and the percent infection levels with different treatments were discussed in the 1996 Annual Report. It was observed that, NaCl at 5% level, resulted in comparable control of Blister Blight infections similar to Perenox (CuO).

The analysis of leaf and soil for residual Na indicated that up to seven rounds of weekly spraying with NaCl (not shown in the Table 4), there was no significant difference among any of the treatments. However, from the 8th round onwards, significant differences were found specially at 2.5 and 5% concentrations of NaCl applications. What is of most significance is the higher levels of Na recorded on mature leaf and soil. Though there are no critical levels of Na established for these parameters, one has to be cautious in resorting to continuous use of NaCl. Since this would allow one to use NaCl up to about seven rounds per season there seem to be some promise in this, as an option to the standard fungicide sprays.

TABLE 4 - *Levels of Na in leaf (%) and in soil (ppm) after 8, 9 and 10 rounds of spraying (% transformed data)*

Treatment	14th October		21st October		28th October		
	Flush	M.leaf	Flush	M.leaf	Flush	M.leaf	Soil
Perenox	0.262	0.275	0.314	0.254	0.255	0.249	76.3
NaCl 1.0%	0.298	0.310	0.281	0.273	0.281	0.293	82.3
NaCl 2.5%	0.315	0.338	0.299	0.303	0.308	0.365	81.7
NaCl 5.0%	0.352	0.445	0.309	0.315	0.252	0.394	91.0
Mean	0.307	0.342	0.301	0.286	0.274	0.325	82.8
Signific.	*	NS	NS	*	*	**	*
LSD P=0.05	0.048			0.038	0.039	0.032	7.0
CV%	7.9			6.7	7.1	5.0	4.2

A. Balasuriya, N.K. Karunatillake and G.P. Gunarathne

Efficacy of NaCl (household salt) in the control of Blister spore germination, in-vitro.

For a more detailed examination of the mechanism of control by NaCl as treatments, same concentrations of NaCl treatments were used on PDA agar plates to germinate Blister Blight spores. The same four treatments as above were mixed with PDA agar prior to pouring them. Freshly formed blisters were suspended above these plates under a bell-jar. The spore count and the number of spores germinated were recorded respectively 24 and 48 hours after setting up of the experiment.

Compared with the control (plain PDA medium), there was only a marginal decrease in the percentage germination of blister spores at 1% NaCl, concentration. NaCl at 2.5 and 5% and Perenox equivalent to standard rates, completely inhibited spore germination (Table 5). This further supports the potential of NaCl to control Blister Blight disease.

Table 5 - Spore count and the percent germination of blister spores on the culture plates in response to NaCl and Perenox

Treatment	Spore count	No. germinated	Germination %
Control	168 (76-308)	161 (75-308)	96.7 (92.6-100)
NaCl @ 1.0%	496 (235-833)	453 (219-789)	91.1 (88.1-96.3)
NaCl @ 2.5%	338 (204-581)	0	-
NaCl @ 5.0%	335 (182-510)	0	-
Perenox (Cu) @ 0.3%	300 (106-519)	0	-

A. Balasuriya and N.K. Karunatillake

Stem Diseases - Wood Rot

Hypoxylon Wood Rot :

P/WRH4 (Nuwara Eliya Estate - Oliphant Division) - Observational experiment on training of the bush frame;

Objective: To discourage any shoots arising at or near ground level of the bush, by periodic removal of same, when they are still tender. The aim is to maintain a clearance from ground to the branching off point (neck effect), so that in the event of future infection by *Hypoxylon*, the total infection could be removed from the bush through what is known as rejuvenation pruning.

This is on-going. Several visits were made during the year in order to remove any new basal shoots emerging at the collar region.

Connected activities;

Ms V. Krishnapillai studied the growth characteristics of *Nemania diffusa* and *Tunstallia aculeata* with different C source in the growing medium, with different C:N, C:P, C:K, C:Ca and C:Mg ratios of the medium, at different pH of the medium, at different T⁰ of the environment. Biochemical tests were undertaken to assay the kind of enzymes produced by these two fungi.

Several samples of live specimens were sent to Washington State University (on personal basis) for the confirmation of the causal organism. This was identified to be *Nemania diffusa* (Synonym - *Hypoxylon vestitum*)

Some fungal cultures isolated from wood-rot association were identified at the IMI of UK. They were; *Fusarium oxysporium*, *F. solani*, *Gliocladium roseum*, *Pestalotiopsis guepinii*, *Myrothecium roridum*, *Hymenomyces* sp.

Dissemination of disease in the field;

This study was undertaken in Diyagama West and Nuwara Eliya Estates with a view to establishing the possibility of spreading the disease through pruning knives in the form of contaminants. The fungus was isolated on PDA medium by using smears (cotton swabs) from the blade of pruning knife. The number of colonies were counted in the Diyagama West estate are presented in Table 6. This showed that the fungus can actually be transmitted through the blade of pruning knives. There were 17 *Hypoxylon* positive isolates from a total of 18 colonies obtained.

Table 6 - Results of pruning knife contamination experiment, with Hypoxylon

Treatment	Total no. of Colonies	No. of positive Hypoxylon colonies
Control	3	1
Plate 1	3	3
Plate 2	3	2
Plate 3	3	3
Plate 4	3	3
Plate 5	3	4
Plate 6	3	2

Effect of wood extractives on the growth of *N. diffusa* and *T. aculeata*;

Repeated the experiment with extractives using four different clones; HS 10, Walaha Yellow (resistant) and PK 2, K 145 (susceptible). They were incorporated to the PDA medium at 50, 100 and 150 ppm for testing growth response of Hypoxylon. The fungus responded with significant differences in response to different treatment combinations. However, no particular trend was seen on account of resistant and susceptible clones. Therefore, it is likely that the biochemical extractives of respective clones are not influencing the susceptibility/resistance of them to Hypoxylon wood rot disease.

A. Balasuriya and A. Ratnayake

Biological control of *Nemania diffusa*;

Aspergillus niger and a bacterium (contaminant) found to effectively suppress the growth of this fungus very strongly.

Presented an abstract paper and a poster at the annual research sessions of the Faculty of Science, University of Peradeniya and at the annual research sessions of the University of Peradeniya respectively on the latest findings about Hypoxylon wood rot.

General Wood rot

P/WRG2 (UH) - Chemical control of Wood Rot using Systemic Fungicides and Protective Paints, at two levels of 'K' fertilizer.

Objective; 'K' is known to help in tissue build up of woody plants. This phenomenon is tested here to control the General Wood Rot condition, in combination with systemic fungicides and protective paints.

This trial was discontinued after the final assessment of wood rot in January 1997. The following treatments were imposed in this study;

Main Plots

M1 - Standard rate of 'K'

M2 - Double the standard rate of 'K'

Sub Plots

S1 - Tebuconazole (Folicur) spray

S2 - Cyproconazole (Atemi) spray

S3 - RRI protective paint

S4 - Baycor 3PA protective paint

S5 - Control (no spraying, no protective painting)

Table - 7 Area of wood rot (cm²) patches and their increase (decrease) from 1994 to 1996, under different treatments

M1 M2	1994	1996	% Diff.	1994	1996	% Diff.	s.e.*
S1	347	363	16	463	536	73	22.6
S2	377	330	(47)	359	369	9	
S3	333	342	9	349	382	33	
S4	291	377	86	384	439	56	
S5	372	472	100	339	401	62	
s.e.*			35.3				50.1

* the standard errors indicated are only those of the changes in rotted areas from 1994 to 1996.

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The data of this experiment were analysed by covariance analysis procedure, using 1994 (initial) values as the covariate. Individual treatments or their interactions did not show any significant effect (Table 7). Since, we had taken extra precaution in cleaning up all the rotted material from all individual bushes, one could argue that the through cleaning alone could help in containing general-wood-rot situations when they are in an advanced stage. This field had been planted with seedlings in the year 1922 and therefore, approximately 75 years old. As a result we had to depend on highly variable wood rotted patches as they occurred naturally. This invariably resulted in high CV values (44.0 - 51.1%). This may have obscured some treatment effects. However, according to the third column (Table 7) the highest percent increase (46.5%) in the area due to wood rot was with M1xS4 and the least (1.6%) with M1xS3. When the individual treatments were considered the best performance (an actual reduction) was seen with S2 (Cyproconazole spray) closely followed by S3 (RRI protective paint.)

A protective paint such as Baycor 3PA, has better lasting properties. Therefore, when partially cleaned wounds are painted with a similar paint there is a possibility that some of the microorganisms responsible too get protected within the infected woody material. Well-protected from outside agencies such organisms may be able to do more damage. Therefore the highest amount of damage was observed with Baycor 3Pa treatment. On the other hand a paint like RRI-bitumen mixture which does not last equally well, must be only protecting the wound initially from the elements of environment. With passage of time they develop cracks which would not help in securing a profitable ecological niche for the proliferation of the microbial activity. While this is happening the individual bushes too support the healing process with their inherent capacities to callus over and repair (as seen in this experiment) some of the damage. Arguably, Cyproconazole spraying could be effective in containing general wood rot to some extent.

Low Country Stem Canker

P/CANK1/97 (St. Joachim) - Screening line for resistance in lowcountry stem canker in the plant breeding trials.

This series of evaluations were done on 584 lines in 1113 replicates. The number of plants in each replicate was variable being 5, 7 and 10. The following key was used in assessing the degree of severity of canker in each individual clone;

- 0 - No sign of cankers
- 1 - One or two small cankers
- 2 - Several small cankers
- 3 - Few large cankers
- 4 - Cankers spreading to the base of plant
- 5 - Dead due to canker

The values obtained, were adjusted for the following considerations.

- a. For the healing capability of canker wounds;
(Scores of 1, 2, 3 & 4 multiply by 0.6, 0.7, 0.8 & 0.9 respectively)
- b. For the number of plants per plot;
(Score multiply by 5 (minimum plot size/actual no. of plants per plot)
- c. For the number of replicates per line/clone;
(For replicate number 1, 2, 3, & 4 multiply by 1.0, 0.9, 0.8 & 0.7 respectively)

Table 8 - Ranking and their respective numbers of lines / clones for the resistance / susceptibility to low country stem canker.

Series Identification	No. of plots	No. of lines	No. of lines in each rank				
			1	2	3	4	5
LVP-61							
Parambe, I1-12	21	12	-	-	2	3	7
Parambe, J1-J2	20	12	-	5	7	-	-
LVP - 62							
St. Joachim, F1-F2	34	17	-	-	3	9	5
St. Joachim, H1-H2	14	7	-	1	-	2	4
St. Joachim, X1-X2	14	7	-	-	3	3	1
Non-replicated	7	7	-	-	1	-	6
Balance	29	29	2	2	17	6	2
LVP - 63							
Pettigala, A3-A4	110	55	1	6	14	19	15
Pettigala, B1-B2	26	13	-	4	6	1	2
Pettigala, E1-E2	106	53	-	-	1	11	41
LVP - 66	161	83	-	-	20	39	24
LVP - 67	209	105	-	4	28	32	41
LVP - 68	149	76	-	-	19	32	26
LVP - 71	89	45	3	17	23	2	-
LVP - 72	124	62	5	16	28	6	7
Total	1113	584	11	55	172	165	181
Percentage			2%	9%	30%	28%	31%

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Based on above adjusted averages (final disease scores) individual lines/clones were ranked for their resistance/susceptibility to canker disease as follows,

Disease score of:	0 - 0.99	- Extremely resistant
	1 - 1.99	- Resistant.
	2 - 2.99	- Moderately susceptible
	3 - 3.99	- Susceptible
	4 and above	- Extremely susceptible

Accordingly, out of 584 lines examined (in 1113 plots), there were 11 (2%) of them showing very good resistance and 55 (9%) showing moderate susceptibility to low country stem canker disease (Table 8).

P/CANK2/97 (St.Joachim) - Use of systemic fungicide sprays for the control of low-country-stem-canker.

This trial was started in St. Joachim estate. using a clonal multiplication area. Two TRI clones. 4047 and 4049 and two systemic fungicides, Baycor and Calixin at the rate of 0. .1% solution were used as treatments. After an initial assessment on the intensity of canker, two applications of fungicides were effected at two monthly intervals. Final assessment is due after two more applications of same fungicides..

SHB - Ambrosia control studies

P/AMB3 (Passara sub station) - Efficacy of systemic fungicides as an indirect measure of controlling SHB damage

Treatment& consisted of three rounds of spraying/drenching, followed by population counts through destructive sampling. The treatments were all combinations of :

- fungicide : Folicur vs Contaf
- Rates : 0. .05% , 0. .5% vs 5. 0%
- Method of application : foliar spray vs root drenching plus a control

Design: Randomized Complete Block (RCBD),. two replicates, five plants per plot.

This trial was completed in the first quarter and the results are given in Table 9. Similar to previous assessments there were significant effects on the recoverey of Ambrosia fungus on culture plate. Contaf (Hexaconazole) at 5.0% as a root drench being superior to the rest of the treatments. However this was not followed by any of the SHB counts.. A similar experiment with more number of fungicide applications was repeated at Hantana sub station on the request of IPM task force for the control of SHB.

TABLE 9 - *Response of the Ambrosia fungus on the culture medium and the SHB beetles to different systemic fungicide*

Treatments No.	Ambrosia score		SHB beetle counts			Total galleries
	Original	sqrt	young	new	live	
1	9	3.01	11	12	18	12
2	14	3.74	14	14	22	41
3	6	2.41	6	7	12	10
4	3	1.87	27	27	39	13
5	14	3.81	14	13	23	12
6	7	2.64	1	1	4	8
7	5	2.21	10	9	15	12
8	11	3.27	13	17	26	10
9	9	2.90	11	10	17	8
10	5	2.23	17	16	22	10
11	10	3.16	19	13	27	3
12	4	2.07	11	9	18	9
13	0	0.71	19	11	26	13
Mean	7	2.62	14	12	20	13
Signif..		*	ns	ns	ns	ns
LSD (P=.05)		1.38				
CV%		24.3				

* transformed data square root (x+.5)

Die-back in K 145

A repeat study to confirm previous findings was initiated towards the end of the Year

Biological control of cooch grass

Identified a fungus causing a smut disease in. *Panicum repens*, to be *Ustilago digitalariae*. Steps were taken to investigate the possibility of using this phenomenon to control this problem weed in future..

Mycorrhiza

Written two articles for the Sri Lanka Journal of Tea Science with the data collected from recently concluded two trials. They are. EFFECT OF APPLICATION OF NPK FERTILIZERS ON THE NATURAL INCIDENCE OF VESICULAR ARBUSCULAR MYCORRHIZA IN THE RHIZIOSHEREE SOILS AND FEEDER ROOTS OF TEA (CAMELLIA SINENSIS)' and INFLUENCE OF MYCORRHIZA, SYSTEMIC FUNGICIDE (TEBUCONAZOLE) AND ADDED E' ON PHOSPOROUS UTILIZATION BY TEA (CAMELLIA SINENSIS)'.

High Forest Problem

Dr. Mike Deadman of Reading University, during his visit shared our view of an involvement of a bacterium as a possible cause for the problem. A confirmation on this is awaited.

This same problem was observed for the first time on Frotoft estate, Pussellawa on clone TRI 2025, about the same age.

New Problems

In Pedro Estate, a new problem of stem galling was found to be associated with the debilitated old seedling bushes. Sample were sent to UK, through courtesy, Dr Milk Deadman who was shown this problem. Preliminary investigations revealed it to be an ascomy fungus. Further identification is awaited.

Leaf variegations on young, old and recovering bushes were reported from various parts of Up Country and Uva Estates. In Pedro estate it was possible to monitor this situation for period of time, and was found to disappear with the rains. This condition is normally associated with dry weather and therefore suspected to be influenced by high (UV) radiation.

TRI Update

Published two communications in the TRI Update. First of this was 'WOOD ROTS - THORNY STEM BLIGHT OR HYPOXYLON ?,' drawing attention of the estates concerned to the latest findings of this division and the second on 'WHY, RING-BARK SHADE TREES?' highlighting the salient features of this very useful operation..

Collaborative Research

Corresponded with several estates on proposed collaborative research activities to be undertaken shortly. A selection experiment for the formation of callus was already started in Hapugastemme Estate, Maskeliya. With Frotoft Estate,, preliminary discussions were held and a proposal prepared for the Superintendent's comments.

Discussions

Had a useful discussion on Blister Blight disease of tea with Dr E. Hamaya of Japan. when he visited Hantana. Mr Balasuriya also took part in a discussion with the CEO's of the Plantation Management Companies in Colombo by invitation.

Seminars / Lectures

Mr Balasuriya addressed the RSC-IV,, Kandy, seminar on 'Pruning in relation to Wood Rot and Blister Blight, and RSC-I., on the 'Control and Management of Blister Blight Disease', at the TRI auditorium. Mr Balasuriya also participated in RSC-I seminar on tea manufacture..

Participated in a seminar , conducted by Messrs Hiran Weerasekara (Harrisons), Upali Gangoda ((Heychem)) and Keerthi Liyanage (Finchem) on the safe handling of pesticides.

Mr Balasuriya addressed the 6th Plant pathologists work group meeting of the Department of' Agriculture, held at Mahailuplamma

All the staff of the division attended a series of lectures organised by the TRI. on ISO 9000

Visitors

Dr Mike Deadman of Reading University, UK, visited the division followed by a visit to the fields in High Forest and Pedro estates.

The second year students of the Faculty of Agriculture (Peradeniya) visited the division on two days in four batches A group of 38, B. Sc Agriculture undergraduates from the Sabaragamuwa University and also a group of students from Agriculture school in Pelwehera visited the division.

Capt. Migara Zoysa of Agalawatte Plantations spent a day to refresh his knowledge on tea disease control. Dr Kohler of Bayer, accompanied by Mr. Upali Gangoda of Heychem visited the division.

Five trainee Assistant Superintendents underwent training on the diagnosis and the controlling of important tea diseases

The following advisory visits were undertaken on the request of respective advisory officers in those regions:

Dickwella and St. James estates in Hali Ela. on death of pruned bushes Several small holders in Kottawa, on Horse hair blight disease. Loinorn estate, on death of OST bushes due to Thorny Stem Blight Pedro estate on stem galls and leaf variegation problems. Wattegod estate on a fairly heavy Phomopsis canker incidence. Small holder in Passara on Phomopsis canker disease. Champion estate on Hypoxylon wood rot incidence. Mountjean estate on a bad attack of Poria-root disease. Hapugastenne in Maskellya to start selecting from OST for Blister Blight resistance. Wewessa, Rookwood and Gonakelle estates, on non recovery of bushes and bush debilitation. Frotoft estate on a

large area of non recovering tea bushes after pruning which was apparently a physiological problem, Two small holder properties in Sooriyagoda, on poor performance of certain clones (TRI 2023) and on Phomopsis canker .

Acknowledgements

The co-operation and the ready assistance extended to us by all estates during our numerous visits to their properties and particularly where the divisional experiments and detailed studies were undertaken, is gratefully acknowledged.

PLANT PHYSIOLOGY DIVISION

Acting Head - A.Anandacoomaraswamy

1. General

Ms.D.M.S.Navaratne completed the B.Sc examination conducted by the University of Peradeniya. Ms J.Mohotti returned to Rothamstead Experimental Station (UK) in July to complete the Ph.D.program.The following students from Faculty of Agriculture, of the University of Peradeniya completed their final year projects in the division: Ms Shammalie Hewasinghe, Mr.D.K.C.Perera, Ms. P.Tennakoon, Ms L.Priyantha and Ms. Anjalika Balasingham.

2. Studies on Photosynthesis and Dry Matter Partitioning

2.1. Partitioning of assimilates in relation to aging of clonal tea in a pruning cycle, St Coombs Estate - (1992)

The annual yield of clones TRI 2025 and DT1 with age is presented in Table 1.

TABLE 1 - *Effect of age on yield(kg ha⁻¹)*

<i>Clone</i>	<i>TRI 2025</i>	<i>DT1</i>
<i>Year from Prune</i>		
2	2435	2488
3	2823	2367
4	2722	2175
7	542	382
LSD(P=0.05)	440	201
CV %	15	8

The seventh year yield was from January to April. There were no 1st year plants in the current year. Yield difference from the 2nd to the 4th year was not significant in both clones.

V.Sithakaran

2.2. Effect of resting before pruning on root starch, TRI 2023 New Peacock Estate - (1995)

The yield for the different treatments are presented in Table 2.

TABLE 2 - *Yield(kg ha⁻¹)*

<i>Treatments</i>	<i>Yield(kg ha⁻¹)</i>
One month resting	2006
Two month resting	2061

There was no substantial difference in yield between the treatments probably due to the adequate root starch levels at the time of pruning.

A. Anandacoomaraswamy and D.M.S. Navaratne

2.4. Resting before pruning and root starch accumulation in tea (K145), Mattakelle Estate (Observation Trial)

The plots were brought into plucking in October 96. The yield data for the first year is presented in Table 3.

TABLE 3 - Yield (kg ha⁻¹)

<i>Treatments</i>	<i>Yield (kg ha⁻¹)</i>
One month resting	2364
Two month resting	2348

Yield marginally improved due to resting

A. Anandacoomaraswamy and D.M.S. Navaratne

2.5. Effect of levels of nitrogen on partitioning of assimilates in nursery plants (TRI 2025).

Three levels of nitrogen (0, 52.5 and 105ppm) in Hewitt solution were tried. The P_{max}, light use efficiency and assimilates partitioning were determined. The critical level of leaf nitrogen was 2.9%.

P. Tennekoon

2.6. C¹⁴ Studies

Scintillation counter was repaired only in August. However, there were no studies conducted under this project.

V. Shanmugarajah

3. Tea Physiology and Potassium Nutrition

3.1. Effect of potassium on recovery from pruning, St Coombs Estate - (1993)

This experiment is in the final year of the current cycle. The yield is given in table 4.

TABLE 4 - Yield(kg ha⁻¹)

Main Treatments	Sub treatments	Yield
(a) Pre - prune	2:1	2404
	1:1	2460
	1:2	2598
	1:3	2911
(b) Post - prune	2:1	2592
	1:1	2746
	1:2	2461
	1:3	2590
(c) Pre and Post-prune	2:1	2448
	1:1	2472
	1:2	2612
	1:3	2729
LSD(P=0.05)		NS
CV %		9

There was no significant difference in yield between the time of fertilizer application and different N:K ratios.

V.Sithakaran

3.2. Potassium nutrition on physiology of young tea (TRI 2025, DT1)

Both clones had completed 12 months in the nursery. Photosynthesis and growth measurements were taken. Growth measurements are presented in Table 5.

TABLE 5 - Growth measurements

Treatments	Height (cm)	No of side shoots	Leaf Area (cm)
Clone TRI 2025			
1. Control(No potassium)	41.2	5	486
2. Recommended level of K	42.0	4	587
3. 1/4th of recommended level of K	31.6	3	610
4. 1/2 the recommended level of K	41.3	5	628
5. Double the recommended level of K	44.8	5	507
6. Treble the recommended level of K	46.8	6	769
Treatments	Height (cm)	No of side shoots	Leaf Area (cm)
Clone DT1			
1. Control(No potassium)	38.6	4	343
2. Recommended level of K	46.1	3	495
3. 1/4th of recommended level of K	43.9	5	385
4. 1/2 the recommended level of K	50.2	5	431
5. Double the recommended level of K	43.4	5	434
6. Treble the recommended level of K	48.2	6	508

Clone TRI 2025

Clone TRI 2025 showed better growth with respect to height, number of leaves produced, total leaf area and number of shoots produced at the highest level of potassium.

Clone DT1

Except for the height, plants of clone DT1 also showed better growth at the highest level of potassium.

V. Shanmugarajah

4. Drought Mitigation

4.1. Drought mitigation in mature tea, (TRI 2025)- St Coombs Estate, (1995).

The effect of spraying 'Green Miracle' - an antitranspirant on yield was evaluated in the mature tea plants. The yield is presented in Table 6.

TABLE 6 - Yield(kg ha⁻¹)

Treatments	Yield
1. Control(Water spray)	5417
2. Green Miracle(1%)	5555
3. Green Miracle(1%) + Potassium chloride (1%) + Urea (1%)	5063
4. Potassium chloride (1%) + Urea (1%)	4986
LSD(P=0.05)	463
CV%	5

The effect of 'Green miracle' on yield was not pronounced probably due to the mild drought experienced during the early part of the year. The results also indicate that incorporation of potassium chloride in the spray solution reduced the yield.

A. Anandacoomaraswamy and V. Sithakaran

5. Effect of Retention of Crow's Feet (Mudichchis) on Yield of Tea (TRI 2025)- St Coombs Estate

This experiment was repeated during the current year and the yield for the period from July - December is given in Table 7.

TABLE 7 - Yield(kg ha⁻¹)

<i>Treatments</i>	<i>Yield</i>
1. Retention of Crow's feet	1158
2. Removal of Crow's feet	1168
LSD(P=0.05)	NS
CV(%)	16

There was no significant difference in yield between the treatments indicating the removal of crow's feet does not improve the yield.

A. Anandacoomaraswamy, A. Kathiravetpillai and V. Sithakaran

6. Modeling Tea yield from Weather Data

Intensive weather measurements using automatic weather sensors continued at St Coombs Estate, Court Lodge Estate and Uva High lands Estate. A tea model was built using MACROS at the Institute for Meteorology and Physics, University of Agricultural Sciences BOKU, Austria.

A. Anandacoomarasamy, Josef EITZINGER and D.M.S. Navaratne

7. Effect of Canopy Height on yield of Tea TRI 2025 - St Coombs Estate

An experiment was initiated to investigate the effect of increasing canopy height on the yield of tea in mature plants. These plants were in the fourth year of the current cycle. An average height difference of 18 cm was maintained between the two canopies.

The yield is presented in Table 8.

TABLE 8. Yield (kg/ha)

<i>Treatments</i>	<i>Yield</i>
1. Canopy height of 135 cm	2606
2. Canopy height of 153 cm	2247
LSD (P= 0.05)	303
CV%	12

A. Anandacoomaraswamy and V. Sithakaran

8. Physiological and Morphological parameters associated with yield improvement in clonal tea in Up-country

A study was undertaken to identify the important physiological and morphological parameters related to the yield improvement of up-country tea

clones originated at different times. Clones used in this study were DT1, B 275 (1950's), TRI 2025 (1960's), TRI3013 (1970's) and TRI4052 (1980's).

Physiological parameters- Pmax (Maximum net assimilation rate), Efficiency of Photosystem II (Fv/Fm) and water use efficiency showed positive correlation with the yield. Morphological parameters - specific leaf weight and internode length also showed similar correlation with the yield. The results suggest that these traits could be used in the nursery stage to screen the clones for yield improvement.

A. Anandacoomaraswamy, S.P. Nissanka and D.K.C. Perera

9. Seminars/Lectures

1. A. Anandacoomaraswamy presented a paper on the 'Spacing of wind belts in tea plantations' at the E & E forum held on 23rd January 1997
2. A. Anandacoomaraswamy presented a review paper on 'Water use in Tea Plantations' at a workshop organised by Atomic Energy Authority held on September 5th in Colombo.

10. Publications

Eitzinger J and A. Anandacoomaraswamy (1997). Modelling the growth and Yield of Tea In the proceedings of the Second International Symposium on Mathematical modelling and Simulation in Agricultural and Bio-Industries (Edited by Prof. I. Farkas) organised by Department of Physics and Process Control Godollo University of Agricultural Science, Budapest, Hungary.

PLANT PROPAGATION AND PLANT BREEDING DIVISION

Officer-in-charge - V.Shanmugarajah

1. General

Mr P.D. Upali was transferred back to Hantane with effect from February 1.

Ms S.K. Sathyapala resumed duties after successfully completing her Ph.D. programme at the Miyazaki University, Japan on March 31.

Mr M. Ratnayake was awarded a Netherlands fellowship and followed the 27th International Course on Applied Plant Breeding from March 10 to June 21.

Mr H. Jayaweera, Experimental Officer of the Biochemistry Division was transferred to the Tissue Culture Unit of this Division and he assumed duties at the Tissue Culture Unit at Hantane with effect from May 2.

Mrs M.T.K. Gunasekara resumed duties after successfully completing her Ph.D. programme at Southampton University, UK on December 22.

Miss T. Kathiresampillai, a postgraduate student from the Botany Department of the University of Colombo carried out her project work on anther culture. Mr R. Paskarathevan, a graduate trainee continued his work on micropropagation. Miss S. Dhason, an undergraduate student from the Botany Department, had her vacation training. Three NDT students from the Kuliapitiya Technical College completed their training and one from Hardy Senior Technical Institute commenced his training in this Division.

2. Project A/CLON - The Development of New Clones

Project leader - V.Shanmugarajah

2.1. Polyclonal/Biclonal seed

2.1.1. VP 52 - Evaluation of polyclonal seed from the seed gardens at Karandupona and Urumiwella - Field No.9 St. Coombs Estate, Talawakele - (1990)

and

VP 58 - Evaluation of polyclonal seed - Field No. 9, St.Coombs Estate, Talawakele - (1991)

Refer 4.2.13 and 4.2.14 under Phase I.

2.1.2. VP 64 - Evaluation of polyclonal seed - Venture Estate Norwood (1992)

Bushes are plucked by the estate, and due for selection in 1998.

2.1.3. VP 65 - Evaluation of polyclonal seed - Carolina Estate, Watawala - (1992)

Cuttings from 117 selected bushes have been propagated in the TRI nursery for further evaluation.

2.1.4. VP 66 - Evaluation of polyclonal seed. Luckyland Estate, Udapussellawa - (1992)

Bushes have been pruned.

2.1.5. VP 78 - Evaluation of Biclinal and polyclonal seed from El-Teb, Halpe and St.Coombs Estates in Field No.12, St. Coombs Estate, Talawakele (1996)

Most of the seedlings planted died during the drought and the vacancies have been filled with clone TRI 3072.

V. Shanmugarajah, M. Ratnayake, S.W. Gunadasa and
B.A. Rathnaoda

2.1.6. LVP 49 - Evaluation of polyclonal seed from Karandupona and Urumiwella seed gardens. St. Joachim Estate, Ratnapura - (1991)

Refer 4.1.15 and 4.2.15 under Phase I.

2.1.7. LVP 53 - Evaluation of polyclonal seed on Hapugastenne estate - (1991)

Bushes are plucked by the estate.

2.1.8 LVP 69 - Evaluation of polyclonal seed from Karandupona and Urumiwella seed gardens in field No. 2A, St. Joachim Estate, Ratnapura - (1994)

and

Biclinal (DN x 2025) seeds from Hugoland seed garden in field No. 2A, St. Joachim Estate, Ratnapura - (1994)

Yields of the seedling progenies of different sources, planted separately in blocks, are given in Table 1.

TABLE 1 - Yields of the seedling progenies (kg ha⁻¹ an⁻¹)

Parentage	Yield
K 2023 (polyclonal)	2701
K DG 39 (polyclonal)	1706
K 2016 (polyclonal)	1590
2025 x DN	1517
K 2021 (polyclonal)	1470
2025 x DN	1412
K DN (polyclonal)	1376
K 2025 (polyclonal)	1253

A.K.M. Jayasena, J.H.N. Piyasundara, M. Ratnayake,
S.W. Gunadasa and V. Shanmugarajah

2.1.9. VP 74 - Evaluation of bicultural seed from El-teb seed garden in Uva (DN x 2025) and polyclonal seed from Sapumalkande seed garden in Field No. 14, St. Coombs Estate, Talawakele - (1995)

Plants have been allowed to grow freely.

M. Ratnayake, S.W. Gunadasa, B.A. Rathnagoda, S. Umah
and V. Shanmugarajah

3. Controlled Hybridisation Experiments

1. Crosses of 1980/1981 (see VP 39)
2. Crosses of 1982/1983 (see VP 43)
3. Crosses of 1984 (see VP 44)
4. Crosses of 1985/1986 (see VP 45)

3.1. VP 39 - Evaluation of seedlings obtained from the crosses of 1980/1981

See VP 67, VP 70, VP 71, LVP 66 and LVP 72 (4.2.6, 4.2.8, 4.2.9, 4.1.10 and 4.1.14 respectively under Phase I)

3.2. VP 43 - Evaluation of seedlings obtained from the crosses of 1982/1983

See VP 72 and LVP 67 (4.2.10 and 4.1.11 respectively under Phase I)

3.3. VP 44 - Evaluation of seedlings obtained from the crosses of 1984

See VP 73 and LVP 68 (4.2.11 and 4.1.12 respectively under Phase I)

3.4. VP 45 - Evaluation of seedlings from the crosses of 1985

See VP 75 (4.2.12 under Phase I)

General

Interspecific crosses between *Camellia sasanqua* (seedlings) and diploids and triploids of *Camellia sinensis* were carried out. The number of flowers of *C. sasanqua* crossed with pollen from clones of *C. sinensis* and the percent fruit set are given below:

	<i>C.Sasanqua</i>	fruit set per cent
TRI 777	48	0.0
DT 1	29	10.3
HS 10A (triploid)	160	7.5
TRI 2025	32	15.6

When *Camellia sasanqua* was used as the male parent and crossed with 230 flowers of clone HS 10A (triploid), the fruit set was only 0.86 %.

Self Pollination

To obtain pure lines of some popular clones the flowers were bagged and allowed to self-pollinate naturally, but no fruits were obtained. The clones and the number of flowers allowed to self are given below:

Clone	No. of flowers
TRI 2024	103
TRI 2025	10
TRI 777	50
TRI 2043	50
DT 95	75
TRI 2142	10
ASM 4/10	20

S. Umah, B.A. Rathnagoda and V. Shanmugarajah

4. Testing of clonal progenies (Phase 1)

4.1. Low country

4.1.1. LVP 55 (LVP 30/LC/I) - Evaluation of clones from Aislaby and Hugoland seed (LVP 30, Deniyaya - 1983) on Handford Estate, Deniyaya - (1991)

Refer 5.2.3.under Phase II.

4.1.2. LVP 56 (VP 37/LC/1)- Evaluation of clones from VP 37 (St. Coombs) in Field No. 5, St. Joachim Estate, Ratnapura (1992)

4.1.3. LVP 57 (LVP 42/LC/1) - Evaluation of clones from polyclonal seed established on Parambe (LVP 42), in Field No. 5 St. Joachim Estate, Ratnapura (1992)

4.1.4. LVP 58 (LVP 28/LC/I)- Evaluation of clones from Aislaby seed (LVP 28, 1983 St.Joachim Estate) in Field No. 5, St. Joachim Estate, Ratnapura (1992)

4.1.5. LVP 59 -Evaluation of clones developed from biclonal seed (2026 x DN) established on Pettigala Estate in Field No. 5, St. Joachim Estate, Ratnapura (1992)

Promising clones of LVP 56, 57, 58 and 59 were propagated and a Phase II trial established (Refer 5.2.4. under Phase II).

A.K.M. Jayasena, J.H.N. Piyasundara, S.W. Gunadasa,
M. Ratnayake and V. Shanmugarajah

4.1.6. LVP 61 (LVP42/LC/I)- Evaluation of clones from polyclonal seed established on Parambe (LVP 42), in Fields No. 2A & 5N St. Joachim Estate, Ratnapura (1993)

The yields of the 20 highest yielding clones along with control clone TRI 2023 are given in Table 2. The number of clones tested were 50.

TABLE 2 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
186	7514
160	6624
243	5951
253	5883
281	5864
285	5585
375	5464
342	5320
171	5226
168	5213
289	5080
298	5003
109	4996
119	4858
322	4786
10	4752
173	4614
169	4556

107	4481
66	4446
2023 (control)	4437
SE (1 mean)	1202
LSD (P=0.05)	3330
CV %	29.7

4.1.7. LVP 62 (LVP 45 & LVP46/LC/I)- Evaluation of clones from polyclonal seed established on St.Joachim Estate (LVP 45, 1989 & LVP 46, 1990), in Field No. 2A and 5N St. Joachim Estate, Ratnapura (1993)

Of the 72 clones tested, seventeen clones yielded more than the control clone TRI 2023 and the yields are given in Table 3.

TABLE 3 - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
63	5516
11	4426
59	4349
47	4090
12	3855
2025 (control)	3715
13	3692
64	3629
23	3624
49	3607
52	3565
54	3416
51	3294
55	3153
72	3037
36	2945
2027 (control)	2715
58	2703
10	2668
2023 (control)	2330
67	2169
70	2147
53	1934
30	1386
SE(mean)	1102
LSD (P=0.05)	3053
CV %	40.3

4.1.8 LVP 63 - Evaluation of clones developed from bicultural seed (2026 x DN) established on Pettigala Estate in Field No. 2A & 5N, St. Joachim Estate, Ratnapura (1993)

The highest yielding clones along with the controls are given in Table 4. The number of clones tested were 52.

TABLE 4 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
19/12	10397
4/2	9106
21/23	8744
2023 (control)	6836
8/9	6293
30/7	6012
19/1	5926
1/2	5756
8/8	5654
2025 (control)	5545
14/17	5477
29/22	5409
31/1	5409
11/11	5387
25/36	5193
23/16	5174
23/22	5173
15/18	5131
14/19	5097
2027 (control)	4883
SE (mean)	1213
LSD (P=0.05)	3556
CV %	32.4

4.1.9. LVP 64 (ASM.INT.88/LC/I) - Evaluation of clones from ASM 1988 Introduction seed in Field No. 2A, St. Joachim Estate, Ratnapura (1993)

The yields of the 8 clones tested, along with control clones over 33 plucks are given in Table 5.

TABLE 5 - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
11	5074
5	4521
2023 (control)	4313
10	4200
12	4193
2025 (control)	3899
6	3228
19	2877
18	2533
16	2344
2027 (control)	1336
SE (mean)	333
LSD (P=0.05)	1049
CV %	9.82

4.1.10. LVP 66 (VP 39/LC/I)- Evaluation of clones from VP 39 in Field No.2A, St.Joachim Estate - (1994)

Yields of the seven highest yielding clones out of 78 tested, along with those of the controls are given in Table 6.

TABLE 6 - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
2026 (control)	6478
2023 (control)	6016
113	5665
267	5115
95	4847
129	4665
33	4431
38	4292
222	4123
2027 (control)	4100
SE (mean)	1005
LSD (P=0.05)	2786
CV %	33.0

4.1.11. LVP 67 (VP 43/LC/I)- Evaluation of clones from VP 43 in Field No. 2A, St.Joachim Estate, Ratnapura (1994)

Of the 106 clones tested, yields of thirty one high yielding clones along with the control clones are given in Table 7.

TABLE 7 - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
814	7301
2023 (control)	6003
710 710	5032
571	4539
759	4480
655	4440
708	4399
2025 (control)	4367
679	4363
626	4254
757	4095
709	3996
554	3959
628	3943
840	3935
769	3932
685	3896
627	3828
621	3787
661	3749
612	3728
657	3706
624	3683
588	3624
770	3588
768	3520
504	3463
763	3434
557	3368
745	3348
702	3339
735	3262
744	3255
2027 (control)	3239
SE (mean)	1447
LSD (P=0.05)	4009
CV %	46.3

4.1.12. LVP 68 (LVP 44/LC/I)- Evaluation of clones from VP 44 in Field No.2A, St.Joachim Estate (1994)

Yields of the eleven highest yielding clones along with the control clones are given in Table 8. The number of clones tested were 74.

TABLE 8 - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
1021	5323
917	4639
2026 (control)	4331
930	4213
1034	3959
970	3958
959	3919
950	3878
935	3753
2023 (control)	3660
2025 (control)	3599
1037	3516
912	3331
952	3236
2027 (control)	3082
SE (mean)	499
LSD (P=0.05)	1381
CV %	18.8

4.1.13. LVP 71 (LVP 45 and LVP 46/LC/I) - Evaluation of clones from polyclonal seed LVP 45 and LVP 46, in Fields Nos. 2A & 5N, St. Joachim Estate, Ratnapura (1994)

Yields of the fifteen highest yielding clones out of 45 tested, along with those of control clones, are given in Table 9.

TABLE 9 - Yield of clones (Kg ha-1 an-1)

Clone	Yield
3/12	6011
6/28	5619
11/46	5605
4/40	5518
15/40	5379
4/16	5270
14/52	5181
5/38	5025
1/9	4964
6/38	4962
14/51	4790
5/35	4651
6/2	4610
7/33	4593

2/13	4549
2026 (control)	4514
6/23	4486
13/30	4423
4/4	4371
15/51	4354
4/21	4334
6/24	4281
5/34	4270
3/38	4196
6/13	4092
3/11	4018
6/14	3932
3/15	3774
5/21	3731
6/36	3721
15/48	3706
6/29	3666
8/75	3567
3/2	3556
2/4	3375
6/32	3172
2027 (control)	3053
SE (mean)	746
LSD (P=0.05)	2066
CV %	20.1

4.1.14. LVP 72 (VP 39/LC/I)- Evaluation of clones from VP 39 in Field No.2A, St.Joachim Estate, Ratnapura - (1994)

Yields of fourteen high yielding clones along with the controls are given in Table 10. The number of clones tested were 62.

TABLE 10 - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
232	3712
122	3448
34	3321
52	3285
44	3244
2023 (control)	3076
76	2900
20	2843
112	2814
57	2776
181	2517

2025 (control)	2403
261	2387
273	2306
113	2283
188	2217
2027 (control)	2172

V. Shanmugarajah, A.K.M. Jayasena, J.N. Piyasundara,
M. Ratnayake, S. Umah and S.W. Gunadasa

4.1.15. LVP 73 (LVP 49/LC/I) - Evaluation of clonal selections from Urumiwela and Karandupona (LVP 49) in Field No. 1, St Joachim Estate, Ratnapura (1996)

The plants were centred twice at 30 and 40 cm (12 and 16 inches) in June and August and the fresh weight of the shoots removed were recorded.

A.K.M. Jayasena and J.H.N. Piyasundara

4.2. Upcountry

4.2.1. VP 49 (VP 37/UC/I)- Evaluation of clones from VP 37 (St. Coombs) in Lamiliere Division, St.Coombs (1990)

Refer 5.1.3 under Phase II.

4.2.2. VP 55 and VP 56 (VP 38/UC/I) - Evaluation of clonal selections from Aislaby, Hugoland and Hantane seed (VP38) in Field No.9, St. Coombs Estate, Talawakele (1991)

Cuttings of 30 promising selections have been propagated in the nursery for a Phase II trial.

4.2.3. VP 60 (VP 37/UC/I) - Evaluation of clones from VP 37 in Field No. 10 St. Coombs (1992)

Bushes have been pruned for propagation.

4.2.4. VP 61 (ASM.INT.88/UC.1/I) - Evaluation of clones from ASM 1988 Introduced Seed. Field No. 10. St. Coombs Estate, Talawakele (1992)

Bushes have been pruned for propagation.

4.2.5. VP 63 (VP 37/UC-2.NOR/I) - Evaluation of clones developed from VP 37 and from Aislaby seed. Venture estate, Norwood (1992)

The bushes were pruned, weight of prunings recorded and cuttings have been propagated in the TRI and Norwood estate nurseries.

4.2.6. VP 67 (VP 39/UC.1/I) - Evaluation of clones from VP 39 in Field No. 10, St.Coombs Estate, Talawakele (1993)

Of the 149 clones tested, the yields of the forty-two clones which yielded more than the control clone TRI 2025 are given in Table 11.

TABLE 11 - Yield of clones (Kg ha⁻¹ an⁻¹)

Clone	Yield
245	3892
295	3631
258	3487
265	3473
97	3456
254	3337
238	3302
332	3271
159	3192
267	3165
286	3088
322	3061
268	3045
48	2993
281	2986
273	2964
224	2950
325	2902
178	2887
252	2878
197	2857
271	2840
316	2819
128	2815
261	2809
121	2778
130	2749
292	2743
39	2716
233	2703
288	2679
275	2653
338	2648
278	2648
28	2634
219	2628
263	2608
20	2606

250	2601
165	2587
318	2569
277	2558
2025 (control)	2528

4.2.7. VP 69 (ASM.INT.88/UC.2/I) - Evaluation of clones developed from ASM 1988 introduction seed in Field No.10, St.Coombs Estate, Talawakele (1993)

The yields of the clones along with the controls are given in Table 12.

TABLE 12 - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
23	3111
24	3035
Control 1	2723
Control 2	2608
5	2475
34	2449
14	2377
Control 3	2335
SE	395
LSD (P=0.05)	1183
CV %	29.6

4.2.8. VP 70 (VP 39/UC.NOR/I)- Evaluation of clones from VP 39 in Venture Estate, Norwood - (1993)

The yields of the seven highest yielding clones out of the 50 tested, along with the controls, are given in Table 13.

TABLE 13. - Yield of clones (Kg MT ha-1 an-1)

Clone	Yield
299	3121
295	2805
2025 (control)	2604
278	2547
46	2506
38	2492
303	2407
49	2348
N2 (control)	2365

- 4.2.9. VP 71 (VP 39/UC/1)** - Evaluation of clones from VP 39 in Field No.14, St.Coombs Estate, Talawakele (1994)

Bushes have been brought into plucking.

- 4.2.10. VP 72 (VP 43/UC/1)** - Evaluation of clones from VP 43 in Field No. 14, St.Coombs Estate, Talawakele (1994)

Bushes have been brought into plucking.

- 4.2.11. VP 73 (VP 44/UC/1)** - Evaluation of clones from VP 44 in Field No.14, St.Coombs Estate, Talawakele (1994)

Bushes have been brought into plucking.

- 4.2.12. VP 75 (VP 45/UC/1)** - Evaluation of clones from VP 45 in Field No. 14, St. Coombs Estate, Talawakele (1995)

The plants were given a cut at 35 cm (14 inches).

- 4.2.13. VP 76 (VP 52/UC/1)** - Evaluation of clonal selections from polyclonal seed from the seed gardens at Karandupona and Urumiwella (VP 52) in Field No. 14, St. Coombs Estate, Talawakele (1995)

The plants were centred in October and infilling was done.

- 4.2.14. VP 77 (VP 58/UC/1)** - Evaluation of clones from polyclonal seed from the seed gardens at Karandupona and Urumiwella (VP 58) in Field No. 12, St. Coombs Estate, Talawakele (1996)

The plants were centred in October and infilling carried out.

- 4.2.15. VP 79 (LVP 49/UC/1)** - Evaluation of clones from polyclonal seed from the seed gardens at Karandupona and Urumiwella (LVP 49) in Field No. 12, St. Coombs Estate, Talawakele (1996)

The plants were centred in October and infilling carried out.

4.3. Uva

- 4.3.1. UVP 8** - Evaluation of clones from ASM 1988 Introduction seed from St. Coombs Estate, at TRI Uva station, Passara (1993)

5. Clonal Trials (Phase II)

5.1. Up country

5.1.1. VP 41 and VP 42 - Testing 60 clones at St. Coombs Estate, Talawakele (1984)

Shoots harvested from these plots were issued to Estates and Smallholders for establishing '4000' series multiplication plots.

5.1.2. VP 62 - Testing ten 4000 series clones at St. Coombs Estate, Talawakele

Plucking was discontinued and the bushes were pruned.

5.1.3. VP 80 (VP 37/UC/II) - Evaluation of clones from VP 37 (St. Coombs) in Lamiliere Division, St. Coombs Estate, Estate, Talawakele (1996)

The plants were centred in October and infilling was done.

V. Shanmugarajah, M. Ratnayake, S.W. Gunadasa,
B.A. Rathnagoda and S. Umah

5.2. Low country

5.2.1. LVP 43 - Testing 42 clones on Diyadawa Estate, Deniyaya (1990)

5.2.2. LVP 60 - Testing eight clones at Golinda estate, Kegalle

Yields of the clones along with the controls are given in Table 14.

TABLE 14 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
2023 (control)	9433
4042	9074
4083	8096
4014	7756
2025 (control)	7088
4075	7056
4080	6862
4046	6834
4076	6669
4015	5703
SE (mean)	1011
LSD (P=0.05)	3235
CV %	21.9

5.2.3. LVP 74 (LVP 30/LC/II) - Evaluation of clones from LVP 55 in Handford Estate, Deniyaya at TRI Deniyaya station (1997)

Promising clones from LVP 55 trial were propagated and planted in August.

Number of clones	-	35
Number of plants	-	24 (per replicate)
Number of replicates	-	02
Control clone	-	TRI 2026

M. Ratnayake, S.W. Gunadasa, V. Shanmugarajah, B.A. Rathnagoda, S.L.D. Amarathunga and J.A.S.K.V. Jayasinghe

5.2.4. LVP 75 (LVP 56, 57, 58, 59/LC/II) - Evaluation of clones from LVP 56, 57, 58 and 59 of Field No.5, St. Joachim Estate in Field No. 1 of St Joachim Estate, Ratnapura (1997)

Promising clones from LVP 56, 57, 58 and 59 were propagated and planted in the field in July for further evaluation.

Number of clones	-	40
Number of plants	-	25 (per replicate)
Number of replicates	-	2
Control clones	-	TRI 2023, 2026, 2027

A.K.M. Jayasena, J.H.N. Piyasundara, M. Ratnayake, S.W. Gunadasa and V. Shanmugarajah

5.3. Uva

5.3.1. UVP 7 - Testing 38 clones at TRI Uva station, Passara (Pelagahatenne)

Shoots harvested from these plots were issued to Estates and smallholders for establishing '4000' series multiplication plots.

M.B.A. Perera and V. Shanmugarajah

6. Evaluation of '3000' and '4000' series clones (Phase III trial)

6.1. Up country

6.1.1. VP 50 - St. Coombs Estate, Lamiliere Division (1990)

Shoots harvested from these plots were issued to estates and small holders.

S.W. Gunadasa and V. Shanmugarajah

6.1.2. Stockholm Estate, Nissanka Uyana (1991)

The yields of the clones along with control clones are given in Table 15.

TABLE 15 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
3020	5711
3048	5360
3016	5184
3069	4607
2025 (control)	4414
DN (control)	3980
3019	3826
3017	3211
3015	3098
3013	3079
3018	3024
K145 (control)	3010
3014	2907
SE (1 mean)	1195
LSD (P=0.05)	3683
CV %	34.9

6.1.3. Gordon Estate, Udapussellawa - (1991)

The yields of the clones along with controls are given in Table 16.

TABLE 16 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
3015	4061
2025 (control)	3760
PK2 (control)	3628
3017	2865
DT 1 (control)	2694
3018	2613
3016	2448

6.1.4. VP 59 - St. Coombs Estate, Field No. 10 - (1992)

Bushes were pruned to be used as mother bushes.

6.1.5. Venture Estate, Norwood. Field No. 6A - (1993)

Yields of the clones along with the control are given in Table 17.

TABLE 17 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
4071	3662
2025 (control)	3285
3069	3197
3016	3139
3073	2981
4052	2551
3019	2509
4063	2459
3072	2266
4053	2032
3020	1775
3015	1753
3018	1312
3017	719

6.1.7. Sheen Group, Pundaluoya. Field No.3 NC 5A - (1992)

The yields of the clones along with the control are given in Table 18.

TABLE 18 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
4078	6223
4053	5676
4083	5538
4075	4940
2025 (control)	4730
3069	4606
4079	4016
4076	3477
4071	3247
4053	2682

S.W. Gunadasa, M. Ratnayake, B.A. Rathnagoda, S. Umah
and V. Shanmugarajah

6.2. Uva

6.2.1. Verellapatana Estate - Doomo Division - 1988

The bushes are being plucked by the estate.

6.2.2. Small Holdings in Bandarawela, Haliela and Boralanda (1992)

Plucking was discontinued, the bushes were pruned and weight of prunings recorded.

6.2.3. TSHDA - Hali-Ela (1992)

Bushes were brought into plucking and plucking was continued by the TSHDA.

M. Ratnayake, S.W. Gunadasa and B.A. Rathnaagoda

6.3. Mid country wet zone**6.3.1. Hantane Estate - (1991)****6.3.2. Small-holdings in Ukuwela, Danture, Teldeniya, Dodanwela and TSHDA nursery Muruthalawa.**

The yield of the clones at the TSHDA, Muruthalawa are given in Table 19.

TABLE 19 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
4046	7366
3018	6343
4006	6468
2025 (control)	5731
3015	5615
4042	5276
3013	5147
3020	4952
3014	4742
4053	4404
3019	4159
4047	3029
SE	672
LSD (P=0.05)	1890
CV %	25.5

V. Shanmugarajah, M. Ratnayake, S.W.Gunadasa, S. Umah,
B.A. Rathnagoda and H.M.S.S.K. Herath

6.4. Low country

6.4.1. LVP 38 - Watapotha Estate (1988)

The yields of the clones along with controls are given in Table 20.

TABLE 20 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
4056	5315
3020	4425
4059	5278
4054	5974
DG 39 (control)	6602
4055	6958
4047	6453
KEN 16/3 (control)	5935
SE (mean)	418
LSD (P=0.05)	1338
CV %	17.5

The bushes were pruned, weight of prunings recorded and the plots were handed over to the estate.

V. Shanmugarajah, A.K.M. Jayasena, J.H.N. Piyasundara,
M. Ratnayake, S.W. Gunadasa, B.A. Rathnagoda and S. Umah

6.4.2. Smallholding at Dehiowita

Yields of the eleven clones along with the controls are given in Table 21.

TABLE 21 - Yield of clones (Kg MT ha⁻¹ an⁻¹)

Clone	Yield
4006	7864
4053	7530
2023 (control)	7493
4061	7234
4033	6857
2027 (control)	6845
4055	6720
2025 (control)	6581
4059	6218
4004	6082
4049	5960
4054	5676
4048	4319
4024	3748

6.4.3. LVP 65 - St.Joachim Estate, Ratnapura - Multiplication rows of 4000 series and estate clones.

Cuttings from these plots were issued to estates and smallholders.

A.K.M. Jayasena, J.H.N. Piyasundara and V. Shanmugarajah

7. Supply of clonal cuttings

Cuttings of 3000 and 4000 series clones were supplied to estates and small holdings in the up-country, Uva, mid-country wet zone, and low-country for the purpose of establishing mother bushes and evaluation trials. The estates to which the cuttings were issued, the clones, and approximate numbers of cuttings issued are given below.

7.1. Up country

Estate	Clones	Shoots
Attampitiya Ettampitiya	3013, 3014, 3016,	
	3019, 3020, 3035,	
	4043, 4044, 4052	50 each
	4006, 4070, 4079	100 each
	4047	125
	4042, 4046, 4053, 4071	150 each 200
TSHDA Bandarawela	3020, 3047,	300 each
	4006	200
	3049, 3052	150 each
	4071	800
	3072, 3073, 4052 4053, 4079	500 each
Frotoft Ramboda	3046, 3048, 4006	75 each
	3020, 3047, 3049,	
	3072, 3073, 4067,	
	4071, 4078, 4079	100 each
Liddesdale Nanuoya	3031, 3039, 3041,	
	4045	50 each
	3014, 3025, 4042,	
	4046, 4070	150 each
	4040, 4047	100 each
4006	200	

Radella Nanuoya	3013, 3014, 3015,	
	3016, 3017, 3018,	
	3019, 3048, 3052,	
	3069, 3072, 3073	50 each
	3020	100
	4052, 4053	200 each
Mountjean Watawala	3013, 3014, 3020,	
	3069, 3072, 3073	50 each
	4006, 4052, 4053,	
	4063, 4071, 4078	75 each
Rappahannock Udapussellawa	3015, 3016, 3017,	
	3018, 3019, 3020,	
	3025, 3069, 4042,	
	4043, 4046, 4070	50 each
	3072, 3073	100 each
	4063	150
	3013, 3047, 3069,	
	3073, 4052, 4067,	
	4079	200 each
	3014, 4053, 4071,	300 each
Hope Hewaheta	4006, 4042	50 each
	4046, 4047, 4052,	
	4070	100 each
	4071, 4078	150 each
	4053	200
Mooloya Hewaheta	4024	50
	3049, 3072, 3073	100 each
	4006, 4063, 4067	200 each
	3046	250
	3013, 3069, 4053	300 each
	4052, 4071	550 each
	3014,	400
	4078, 4079	650 each
Robgill Bogawantalawa	3014, 3019, 3020,	
	3046, 3047, 3048,	
	4052, 4071, 4078	50 each
	4079	25
	3072, 3073	350 each

Binoya 'B' Rozella Watawala	3013, 3014, 3015,	
	3016, 3017, 3018,	
	3019, 3020, 4006,	
	4083	50 each
	3069, 3072, 3073,	
	4052, 4078, 4079	175 each
	3047, 3049	75 each
	4053, 4071	125 each
4063	225	
Norwood Norwood	3048	400
	3046, 3069,	200 each
	3047, 3072, 3073,	
	4006, 4063	300 each
	4052, 4053,	500 each
4079	800	
Rockwood Norwood	3046, 3048, 3069	100 each
	3047, 4006	200 each
	4079	500
New valley	3049, 4079	200 each
	3052, 4052	300 each
Kelliewatta Patana	4006, 4052, 4053,	
	4067, 4071	100 each
	4083, 4085	25 each
	4063	50
	4078, 4079	200 each
Delta Pupuressa	3025	50
	4006, 4043, 4046,	
	4047, 4052, 4053,	
	4071, 4078	250 each
	3013, 3014, 3016,	
	3017, 3018, 3019,	
	3020, 3072, 3073	300 each
Troup Talawakele	4006, 4052, 4053,	
	4063, 4067, 4071,	
	4078, 4079, 4083,	
	4085	100 each
Helbodde Katukitula	3013, 3014, 3015,	
	3016, 3018, 3019,	
	3020	200 each

	4006, 4042, 4046, 4047, 4053, 4071, 250 each	
Downside Welimada	3013, 3016, 3017, 3018, 3019, 3031, 3039, 4042, 4043	50 each
	4046, 4052, 4053, 4079	100 each
	4071, 4078	225 each
TSHDA	3020, 4071	300 each
Gampola	4006	200
	3049	150
	3052	100
Ireby Norwood	3072, 3073	500 each
Diyaniakelle Lindula	4052	150
	3072, 3073, 4053, 4071, 4078, 4079	100 each
	3016, 3017, 3019, 4083, 4085	50 each
Morawakka Ella	4052	200
	4049, 4054	50 each
Prof. Sam Casie Chetty Hatton	3014, 3016, 3017, 3025, 3049, 3069, 4006, 4042, 4046, 4052, 4053, 4071, 4078, 4079	50 each

7.2. Low country

Estates

Aigburth Bulutota	3014, 3041, 3052, 3055, 3060, 4014, 4046, 4047, 4053, 4055, 4059, 4061	50 each
Kelani Yatiantota	3041, 3046, 3047, 3055, 3058, 4014, 4042, 4046, 4047, 4053, 4055, 4061	50 each

Geekiyanakanda Neboda	3014, 3055	200 25
Pelawatta Pelawatta	3041, 3046, 3047, 3055, 3058, 4002, 4014, 4047, 4059, 4061	50 each
Yataderiya Undugoda	4004, 4043, 4052, 4053, 4054, 4055, 4061 4042, 4044, 4046	50 each 75 each
Keeragala Kuruwita	2027	500
Mohamadi Agalawatta	3046, 3055, 4047, 4053, 4059 2025, 3014, 3041, 4049, 4061 2027	50 each 100 each 200
Vogan Mattugama	3055, 3060, 4047, 4049, 4055, 4059 4048, 4061, 4062	50 each 100 each
Pambegama Godagampola	4014, 4042, 4044, 4046, 4047, 4048, 4056, 4059, 4061 4062	50 each
Hemingford Parakaduwa	3014, 3025, 3041, 3046, 3055, 4047, 4049, 4059, 4061, 4062	50 each
Katandola Elpitiya	3041, 4044, 4046, 4047, 4053, 4059, 4061	50 each
Hopton	2027 3025	600 100
Sapumalkanda Deraniyagala	3047, 3055, 4059, 4061 3025, 4042, 4043	50 each 100 each

Smallholders

TSHDA	3041, 3046, 3055,	
Kegalle	4061	200 each
	3014, 4055	300 each
	3047, 4049	50 each
	2025	1000
	2027, 3046	100 each
	3014, 4061	100 each
	3025, 3052, 3058,	
	4002, 4042, 4046	50 each
Samitha Attigala	3014, 3046	100 each
	3055	400
Hewawitharana	2025, 2027	200 each
Pelmadulla	3047, 3055, 3060	50 each
	3014	100
K.Suriyarachchi	2025	500
Nugegoda, Ratnapura		
TSHDA, Matugama	3041, 3055, 4061	100 each
	3025, 3046, 3047	
	4047, 4049, 4053	50 each
L.J.Liyanage	2025	200
Batuhena	3046	50
W.Somasiru	3046, 3047, 3055	
Pelmadulla	4061	50 each
	3014, 3025, 3041	100 each
Greenrock	2027, 4059, 4061	50 each
Dehiowita		
D.Perera	2027	200
Matugama	3014, 3025	100 each
K.B.Premathilaka	2025, 2027	100 each
Kuruwita		
Chaminda		
Kumaranayake	2025	500
Hidellana		

Rajapaksha	2027	500
Ratnapura	4042, 4049	50 each
Mahinda Liyanage	2027	400
	2025	100

7.3. Mid - country**7.4. Uva****8. Seed Gardens**

Seed gardens in St Coombs and at Hantane station were used for controlled hybridisation.

9. Divisional Activities**Observation trial**

An observation trial was carried out to see the effect of different sizes of bags on the growth of the plants in the nursery. Along with standard size (9" x 5" lay flat) bags of 4 1/2" x 5" (lay flat) were used. Better plant growth with respect to plant height, number of leaves produced and dry weight was observed with plants grown in smaller bags. Use of smaller bags helped save on soil and labour.

Germplasm Bank

Action was initiated to establish germplasm banks at the TRI stations at Ratnapura, Hantane, Passara and Talgampola. Bushes in the germplasm bank at the Head Office were pruned to supply cuttings to the above stations.

At the low country station Ratnapura a germplasm bank was commenced by planting 50 clones (of the 2000, 3000 and 4000 series) initially.

Canker Assessment

With the help of Pathology Division staff canker assessment was carried out in all Phase I trials at the low country station, Ratnapura.

Quality Assessment

Flush was collected from some of the 3000 and 4000 series clones and supplied to the Biochemistry and Technology Divisions for assessment of quality of the made tea. The following are the estates and the clones used for the above assessment:

Sheen Group, Pundaluoya -	TRI 4052, 4071, 4078, 4079
Venture Estate, Norwood -	TRI 3016, 3018, 3072, 3073, 4052, 4053, 4063
Stockholm Estate, Upcot -	TRI 3015, 3016, 3018, 3019, 3020, 3048

Large scale planting

At Norwood estate 3900 and 2800 plants of clones TRI 3073 and 4006 respectively were planted in August for evaluation.

9. Project B/TC Tissue Culture

Project Leader S.K. Sathyapala

9.1. Development of homozygous plants through anther and pollen culture of tea.

A project was initiated in collaboration with the IFS to investigate the crucial factors for production of haploid plants from anther and pollen cultures in tea and other *Camellia* species.

Under this project the following aspects are being investigated:

- 9.1.1. Effect of pre-treatments of anthers such as pre-treatment with colchicine 1mg-10mg, sugar starvation by dipping anthers in 0.3M - 0.1M manitol solution, and exposure of anthers to 32-35°C heat for 3-5 days.
- 9.1.2. Studies on the effect of different culture media (MS, B5 and N6) and plant growth regulators (2,4-D, IAA, Zeatin and BAP) on embryogenesis and callus induction in pollens.
- 9.1.3. Effect of the genotype variations on induction of embryogenesis in anther cultures. Anthers of clones TRI 2025 and DG 7 and that of *C. japonica* are being used.

These experiments are in progress.

S.K. Sathyapala, H. Jayaweera, K. Sarathchandra,
and M. Iqbal

9.2. Induction of callus in different organs of tea, *C. sasanqua* and *C. japonica* and development of cell suspension systems for *in vitro* selection, isolation of protoplasts and somatic hybridization.

It is well known that cell suspensions are ideal for isolation of protoplasts, *in vitro* mutant selection and genetic transformations. Further embryogenic

callus and cell suspensions could be used for selection of stress-tolerant cell lines and subsequent production of drought and salt tolerant tea plants. To initiate embryogenic cell suspension the following experiments were commenced:

9.2.1. Effect of the origin of callus on growth of the cell suspensions.

Treatments:

1. Stem callus
2. Leaf callus
3. Cotyledon callus
4. Hypocotyl callus

From each callus 0.5g was cultured in the liquid medium supplemented with 2,4-D and Kinetin. Every 10 days the cell suspensions are being subcultured and the following records were collected:

Packed cell volume

Mitotic index

A similar experiment is being carried out with the *C. sasanqua* and *C. japonica* explants.

9.2.2. Effect of different growth regulators on growth of the suspension cultures of TRI 2025 and *C.sasanqua*

Treatments:

1. 2,4-D 1mg/l and 10% coconut water
2. 2,4-D 2mg/l and 10% coconut water
3. 2,4-D 1mg/l and 0.5 kinetin
4. 2,4-D 2mg/l and 1mg/l kinetin
5. 2,4-D 1mg/l and 0.5 mg/l IAA
6. Kinetin 1mg/l and 0.5 mg/l IAA

The cell growth was measured by -

1. Packed cell volume
2. Mitotic index

These experiments are in progress.

S.K. Sathyapala, T.M. Sarathchandra, P.D. Upali
and H. Jayaweera

9.3. Identification of contaminants in *in vitro* cultures of tea.

A systematic study on the bacterial contaminants of tea tissue cultures may facilitate identification of the major systemic contaminants and their subsequent elimination. With this in mind, the following experiment has been initiated:

9.3.1. Isolation and identification of major contaminants present in the initial stage of the different *in vitro* cultures of tea.

The rate of bacterial contamination in different explants of tea grown under *in vitro* conditions is given in Table 1.

TABLE 1 - Percent bacterial contamination

Treatment	No. of explants	percent B.contamination
Anthers	152	9.21
Nodal explants	205	60.48
Cotyledon	75	12.00
Embryo	75	4.00

Among four different *in vitro* cultures- anther, nodal explant, cotyledon callus and embryo, the highest rate of contamination was found in nodal explants. The other three cultures had significantly low rate of contamination. The isolation and identification of the contaminants and antibiotic sensitivity tests are in progress.

S.K. Sathyapala and T.M. Sarathchandra

9.4. Improvement of direct and indirect embryogenesis in different explants of tea and *C. sasanqua*

Somatic embryogenesis is considered to be the most efficient means for clonal multiplication, somaclonal variation, artificial seed production and cryopreservation for the establishment of gene banks. A study was commenced to improve the rate of somatic embryo formation in different organs of tea and their development in to plantlets.

9.4.1. Somatic embryogenesis in cotyledon and hypocotyl explants of tea and *C. sasanqua*

The somatic embryos developed from cotyledon and hypocotyl explants of tea and *C. sasanqua* in MS medium supplemented with BAP and IAA have been transferred to the hormone-free MS half strength medium for further growth. Morphological characteristics of the somatic embryos in the germination medium are being investigated.

9.4.2. Somatic embryogenesis in leaf explants of tea

Leaf callus has been cultured in solid and in agitated liquid medium to induce the embryogenesis. The callus fragments in the liquid medium showed

high potential for embryogenesis. The effect of plant growth regulators on direct embryogenesis is being investigated.

Treatments:

1. BAP 1mg/l
2. BAP 1mg/l, IBA 0.1 mg/l and Zeatin 0.2mg/l
3. BAP 3mg/l, IBA 0.1mg/l and Zeatin 0.4 mg/l
4. Zeatin 1mg/l and IBA0.1 mg/l

Observations on embryo formation and organogenesis are in progress.

9.4.3. Somatic embryo formation in stem explants

Pre-embryo formation was found in stem callus of clones TRI 2025 and TRI 4006 cultured in MS solid medium supplemented with BAP and NAA. However, most of the stem callus has shown a tendency to organogenesis. Further investigations to improve the embryo formation using different growth regulators are in progress.

S.K. Sathyapala, P.D. Upali and T.M. Sarathchandra.

9.5. A study on die-back of TRI 2025 at High forest Estate

This study was initiated in collaboration with IFS to ascertain the cause for die-back of TRI 2025 plants in High forest Estate.

9.5.1. About 300 plantlets of TRI 2025 were grown under *in vitro* conditions to be used in bioassay experiments on xylem sap of the affected plants.

Treatments:

1. Control - Inoculation of distilled water to *in vitro* grown TRI 2025
2. Inoculation of xylem sap of the affected plants to *in vitro* plantlets
3. Inoculation of xylem sap of healthy TRI 2025 to *in vitro* plantlets

This experiment is in progress.

N. Iddagoda, P.D. Upali and S.K. Sathyapala

9.6. Implementation of embryo culture and micro propagation in the conventional breeding program.

The selection and production of new clones by conventional breeding method takes about 15-20 years. From seed to mother bushes in the observation plots takes 6-7 years, but this may be reduced to 3-5 years by using methods of embryo culture and micro propagation. However, absence of selection criteria for *in vitro* cultures has hindered the application of this technique.

9.6.1. Development of selection criteria for in vitro growing plants

A new study has been initiated to investigate the growth and performance of in vitro grown seedlings and their micropropagated plants to determine the selection criteria potential for use in the breeding program.

Seeds of Poonagala estate seed bearers were planted in vitro and in sand beds to obtain seedlings. The following growth assessments were monitored for embryo cultures:

- Length of the shoot
- Length of roots
- Plant height
- Number of leaves per plant
- Number and length of internodes
- Plant vigour

Except for the length of the roots, the other growth assessments will be monitored for the seedlings raised in sand beds.

9.6.2. Application of embryo culture to wide hybridization of tea and other *Camellia* species for selection.

To obtain seeds for embryo cultures, controlled hybridization was carried out between china jat plants and TRI 2025. Embryos of seeds from crosses of *C. sasanqua* and *C. sinensis* were cultured *in vitro* and morphological attributes of these embryos are being investigated.

These experiments are in progress.

S.K. Sathyapala and P.D. Upali

9.7. Studies on the field performance of tissue cultured plants.

9.7.1. Micropropagation of clones for field evaluation

Clones TRI 2025, 4006, 4053 and DG7, are being micropropagated for comparison of their performance with the vegetatively propagated plants of the same clones in the field.

This study is in progress.

T.M. Sarathchandra, P.D. Upali, H. Jayaweera
and K. Sarathchandra

9.7.2. Somaclonal variation among the field planted tissue cultured tea plants at Hantana and St.Coombs Estate

Periodic growth assessments of in vitro grown clone TRI 3031 are being carried out to determine somaclonal variation among tissue cultured plants. The growth parameters such as yield, shoot growth, fresh and dry weight are being monitored.

This experiment is in progress.

S.K. Sathyapala and P.D. Upali

9.7.3. Micropropagation of other trees found in tea plantations

After acclimatization in the green house, 15 in vitro grown Eucalyptus plants were planted in the field at Hantana substation. This experiment was terminated with effect from November 20 after perfecting a method for micro propagation of Eucalyptus. The original Eucalyptus plants were a gift from Australia in 1993.

S. K. Sathyapala and P.D. Upali

11. Visitors

Dr P. Huxley, Director, ICRAF, Nairobi visited the lab, seed bearer area, original bushes of the 2000 series clones and the nursery 28th May.

Capt. Migara de Zoysa, Director, Chilaw Plantations Ltd. visited the Division and had discussions on various aspects of development of clones and on the clones suited for different regions on 4th June.

Prof Dennis A. Baker, Head, Dept. of Biological Sciences, Wye College, University of London visited the lab November 24.

Students from Peradeniya, Eastern and Sabragamuwa Universities visited the Division and the nursery.

Six Assistant Superintendents from various estates were in this division on a familiarisation programme.

12. Seminars/ Training Programmes/ Meetings

Mr V. Shanmugarajah was a member of the team that participated in discussions with the following:

CEO's of the Plantation Management Companies held at the CFC auditorium, Colombo (March 8th).

Members of the RSC I, Nuwra Eliya on "Clones for Nuwara Eliya" (May 5th).

TSHDA Officials (July 7th).

Executives of Agrapatna and Kotagala Plantations (August 8th)

Dr. S.K. Sathyapala attended a seminar on "Application of Molecular biology in Sri Lanka" organized by SLAAS at SLAAS Auditorium on September 15th.

Dr. S. K. Sathyapala attended a seminar on "Genetic conservation of traditional plants" organized by ARTI, at the National library on December 5th.

Mr S.W. Gunadasa was a member of the team that had discussions with the members of the RSC I, Nuwara Eliya on "Clones for Nuwara Eliya" (May 5th).

Messrs T.M. Sarathchandra and P.D. Upali participated in Plant Biotechnology Working Group meetings held at the Institute of Fundamental Studies (March 27th) and at the Rubber Research Institute (June 6th).

Attendance at International Conference

Along with the Director, Mr V. Shanmugarajah attended the Second Asia International Tea Conference held at the Hilton International, Singapore from September 24th to 26th and presented a paper on "Clonal developments in Sri Lankan tea and their potential for the trade".

14. Publications

Modder, W.W.D, Shanmugarajah, V. and Sivaram, B. "Clonal developments in Sri Lankan tea and their potential for the trade." Proceedings of the Second Asia International Tea conference, September 24-26.

Sathyapala, S.K. and Adachi, T. "Plant Regeneration from embryogenic cell suspensions of tea" SABRAO Journal 28(2) 57-65.

Acknowledgement

We are grateful to the following for their cooperation in carrying out our trials in their fields:

Plantation Management Companies
Superintendents and Assistant Superintendents of

Golinda Estate, Kegalle
Gordon Estate, Udupussellawa
Sheen Estate, Pundaluoya
Stockholm Estate, Nissanka Uyana (Upcot)
Venture Estate, Norwood
Watapotha Estate, Watapotha

Mr A.Somaratne, Deputy General Manager, TSHDA and
Mr H.M.S.S.K.Herath of the TSHDA Muruthalawa

Smallholders in different areas.

SOILS AND PLANT NUTRITION DIVISION

Acting Head - L.S.K.Hettiarachchi

1. General

Mr A.K.N.Zoysa, Research Assistant continued his post graduate studies at Massey University, New Zealand.

Mr H.A.P.Warnasiri, Technical Assistant, was awarded the B.Sc degree by the University of Peradeniya with effect from 26th October, 1996.

Mr W.M.S.Wijethunge, Experimental Officer, commenced his Masters degree in Analytical Chemistry at the Post Graduate Institute of Science, Peradeniya with effect from 04th July 1997.

Dr L.S.K.Hettiarachchi continued to serve as a member of the Working Group on Fertilizer to the Sri Lanka Standards Institution. He served as a member of the Executive Committee of the Soil Science Society of Sri Lanka.

The overall research objective of this division is to improve soil fertility of tea lands in Sri Lanka by efficient use and/or control of both organic and inorganic fertilizers to maximize the productivity.

Field experiments have been carried out and reported under B/FERT whereas the laboratory and glasshouse experiments carried out have been under D/AGCH. Developments in relation to soil and plant chemical aspects, and soil, plant and fertilizer analyses carried out have been reported under C/ANAL.

2. *Project B/FERT - Improvement and maintenance of fertility and productivity of tea soils.*

Project Leader - L.S.K.Hettiarachchi

2.1. Soil and Fertilizer Nitrogen Studies

2.1.1. Application of different proportions of sulphate of ammonia and urea on soil/plant sulphur status and yield of tea, St.Coombs Estate, Talawakele - Clone TRI 2025 (1980).

The yield obtained in the 1st year of the 5th cycle is given in Table 1.

In the 1st year, no significant differences in yield were found between 240 and 360 kg of N ha⁻¹ yr⁻¹ applications. However, application of N at 360 kg ha⁻¹ yr⁻¹ yielded more than the 240 kg ha⁻¹ yr⁻¹. Also, no significant differences in yield were observed between any of the treatment combinations.

TABLE 1 - *Effect of different proportions of SA/urea on yield (made tea kg ha⁻¹ yr⁻¹) of mature tea*

Levels of N (kg ha ⁻¹ yr ⁻¹)	Proportions (%) of Yield		
	SA (N)	Urea (N)	(made tea kg ha ⁻¹ yr ⁻¹)
240	100	0	1047
	75	25	1090
	50	50	1105
	25	75	1098
	0	100	1078
360	100	0	1255
	75	25	1159
	50	50	1178
	25	75	1133
	0	100	1113
LSD (P = 0.05)			NS
CV%			10

The effect of application of SA/urea on soil pH and sulphate sulphur levels (0-15 & 15-30 cm) are given in Table 2 and 3 respectively.

TABLE 2 - *Effect of application of different proportions of SA/urea on soil pH levels at 0-15 and 15-30 cm depths*

Proportions(%) of SA (N)	Urea (N)	Soil pH	
		0-15 cm	15-30 cm
100	0	4.60	4.30
75	25	4.28	4.30
50	50	4.37	4.40
25	75	4.60	4.63
0	100	4.70	4.72
LSD (P = 0.05)		0.298	0.305
CV %	5	5	
Sub Level of N (kg ha ⁻¹ yr ⁻¹)			
240		4.54	4.61
360		4.48	4.33
LSD (P = 0.05)		NS	0.193

In general, soil pH levels at both depths decreased with increased proportions of SA in SA/urea combinations, except at 0-15cm depth with 100:0 SA:urea combination, even after application of dolomitic limestone at 1000 kg ha⁻¹ after pruning. However, no significant differences in pH were found between 25:75 and 0:100 SA:urea applications. Although, no significant difference in soil pH levels between 240 and 360 kg of N ha⁻¹ yr⁻¹ was observed at 0-15cm

depth, at 15-30cm depth significant difference exist. This is probably due to dolomitic limestone application.

TABLE 3 - *Effect of application of different proportions of SA/urea on soil sulphate sulphur levels at 0-15 and 15-30 cm depths*

Proportions(%) of		SO_4^{2-} -S (mg kg ⁻¹)	
SA (N)	Urea (N)	0-15 cm	15-30 cm
100	0	133	179
75	25	137	163
50	50	143	164
25	75	112	128
0	100	80	93
LSD (P = 0.05)		51.0	47.6
CV %		32	25
Sub Level of N (kg ha ⁻¹ yr ⁻¹)			
240		123	159
360		119	132
LSD (P = 0.05)		NS	NS

No significant differences in soil sulphate sulphur levels were found between two N levels, at both depths. However, significant increases in sulphate sulphur levels were found between 100:0, 75:25 and 50:50 SA:urea applications and 0:100 SA:urea application, at both depths.

S.Ananthacumaraswamy and L.S.K.Hettiarachchi

2.1.2. Application of very high levels of urea and sulphate of ammonia on soil/plant nutrient status and yield of tea, St.Coombs Estate, Talawakele - Clone TRI 2025 (1980).

This is an observation trial established in 1990 to study the ill effects of high levels of nitrogen. The yield obtained for the period July 1996 to June 1997 i.e. 1st year of the 2nd cycle is given in Table 4.

TABLE 4 - *Effect of application of very high levels of SA and urea on yield of tea*

Nitrogen (kg ha ⁻¹ yr ⁻¹)	Yield (made tea kg ha ⁻¹ yr ⁻¹)	
	Urea	SA
0	772	773
300	819	775
600	766	812
900	1001	923
1200	906	894
1500	860	1052

During the 1st year after pruning, in general, consistent trends in yield were not observed with the increasing rates of N and two different forms. This experiment is in progress.

G.P.Gunaratne and L.S.K.Hettiarachchi

2.1.3. Improvement of soil organic matter status and efficiency of uptake of inorganic fertilizer nutrients by incorporation of different sources of organic-manure, Bearwell Estate, Talawakele - Clone TRI 2025 (1990).

The yield obtained in the 2nd year of the 2nd cycle and soil pH levels at 0-15cm depth are presented in Table 5 and 6 respectively.

TABLE 5 - Effect of levels and sources of organic manure at 0 and 240 kg N $ha^{-1} yr^{-1}$ on the yield (made tea kg $ha^{-1} yr^{-1}$) of tea

Level of organic manure (*Mt $ha^{-1} yr^{-1}$)		5		10	
Level of N (kg $ha^{-1} yr^{-1}$)		0		240	
Compost		2281	2622	2235	2463
Cow dung		2344	2340	2277	2496
Mana		2342	2570	2269	2459
Gautemala		2320	2248	2316	2478
LSD(P=0.05)			281		
CV %			7		
Type of Organic manure		Compost 2400	Cow dung 2364	Mana 2410	Gautemala 2341
LSD(P=0.05)			NS		
Level of organic manure (*Mt $ha^{-1} yr^{-1}$)		5		10	
		2383		2374	
LSD(P=0.05)			NS		
Level of N (kg $ha^{-1} yr^{-1}$)		0		240	
		2298		2460	
LSD(P=0.05)			99.5		

* Mt-Metric tons

TABLE 6 - *Effect of levels and sources of organic manure at 0 and 240 kg N ha⁻¹ yr⁻¹ on the soil pH levels at 0-15 cm depth,*

Level of organic manure (*Mt ha ⁻¹ yr ⁻¹)		5		10	
Level of N (kg ha ⁻¹ yr ⁻¹)		0	240	0	240
Compost		4.69	4.52	4.48	4.41
Cow dung		4.53	4.30	4.64	4.12
Mana		4.60	4.26	4.49	4.24
Gautemala		4.66	4.18	4.74	4.33
LSD(P=0.05)				0.359	
CV %				5	
Type of Organic manure		Compost	Cow dung	Mana	Gautemala
		4.52	4.40	4.40	4.48
LSD(P=0.05)			NS		
Level of organic manure (*Mt ha ⁻¹ yr ⁻¹)		5		10	
		4.47		4.43	
LSD(P=0.05)			NS		
Level of N (kg ha ⁻¹ yr ⁻¹)		0		240	
		4.60		4.29	
LSD(P=0.05)			0.127		

* Mt-Metric tons

Significant differences in yield were not found either between source and level of organic manure both at 0 and 240 kg of N ha⁻¹ yr⁻¹ levels, or due to sources and levels of organic manure alone. However, yields were significantly increased due to application of N at 240 kg ha⁻¹ yr⁻¹ when compared to zero. Also, as far as soil pH levels are concerned, no significant effects were found due to sources and levels of organic manure. However, pH levels dropped significantly due to application of N at 240 kg ha⁻¹ yr⁻¹. This experiment is in progress.

S.M.Dissanayake, A.K.N.Zoysa and L.S.K.Hettiarachchi

2.1.4. Effect of different levels of nitrogen (0-720 kg ha⁻¹ yr⁻¹ N at 120 kg N increment) with and without (0 and 5 t ha⁻¹ yr⁻¹) compost manure on soil/plant - N status and yield of tea, St.Coombs Estate, Talawakele - Clone DT1 (1992).

The yield obtained in the 5th year of the 1st cycle is given in Table 7.

TABLE 7 - Effect of different levels of nitrogen with and without compost on yield

<i>Treatments N level</i>	<i>Yield (made tea kg ha⁻¹ yr⁻¹)</i>
0	1909
120	2391
240	2335
360	2395
480	2537
600	2350
720	2385
LSD (P=0.05)	NS
CV %	6
Sub	
No compost	2372
5 t ha ⁻¹ yr ⁻¹ compost	2289
LSD (P=0.05)	NS

Significant differences in yield were not observed due to incorporation of compost. Although no consistent significant increases in yield were observed with the increasing rates of N, trend exist up to 480 kg ha⁻¹ yr⁻¹ N, and thereafter drop. This experiment is in progress.

R.G.A.Wijayawardhana and L.S.K.Hettiarachchi

2.2. Soil and Fertilizer Potassium Studies

2.2.1. Split application of nitrogen and potassium fertilizer in mature tea in relation to N/K antagonism, St.Coombs Estate, Talawakele - Clone TRI 2025 (1990).

The yield obtained in the 1st year of the 2nd cycle i.e. July 1996 to June 1997 is presented in Table 8.

TABLE 8 - *Effect of split application of potassium on yield (made tea kg ha⁻¹ yr⁻¹) of tea*

K fertilizer applied (%)		Yield	
Initially	6 weeks after	K - Fertilizer (kg K ₂ O ha ⁻¹ yr ⁻¹)	
		120	240
100	0	864	839
80	20	905	913
60	40	849	925
40	60	875	840
20	80	936	824
0	100	874	838
LSD (P=0.05)	78		
CV %	6		

Significant differences in yield were not observed either due to split applications or due to different K fertilizer rates, although differences between some mean yields were greater than the LSD value. This experiment is in progress.

G.P.Gunaratne and L.S.K.Hettiarachchi

2.2.2. Effect of application of increasing levels of potash (60-360 kg ha⁻¹ yr⁻¹) at 60 increments with N (240 and 360 kg ha⁻¹ yr⁻¹) on soil/plant K and Mg status and yield of tea, Halgolla Estate, Yatiyantota - Clone TRI 2025 (1984).

After the completion of 3rd pruning cycle and assessments of data, investigations have been concluded. A part of data was presented to the 195th E & E forum, and the overall results will be published as scientific findings from a paper.

G.P.Gunaratne and L.S.K.Hettiarachchi

2.2.3. The effect of application of potash (48 to 480 kg ha⁻¹ yr⁻¹ K₂O) with and without Mg (0 and 60 kg ha⁻¹ yr⁻¹ MgO) fertilizer, on soil/plant K/Mg status and yield of tea, Glenanore Estate, Haputale - TRI 2025 (1991).

The yield obtained in the 2nd year of the 2nd cycle is given in Table 9.

TABLE 9 - Effect of different N:K₂O ratios and MgO on yield of tea

Level (kg ha ⁻¹ yr ⁻¹)		MgO	N:K ₂ O	Yield (made tea kg ha ⁻¹ yr ⁻¹)
N	K ₂ O			
240	48	0	5:1	2672
240	48	60	5:1	2609
240	60	0	4:1	2718
240	60	60	4:1	2655
240	80	0	3:1	2711
240	80	60	3:1	2659
240	120	0	2:1	2636
240	120	60	2:1	2655
240	240	0	1:1	2735
240	240	60	1:1	2628
240	360	0	2:3	2675
240	360	60	2:3	2703
240	480	0	1:2	2626
240	480	60	1:2	2701

LSD (P=0.05)

NS

CV %

4

*Sub treatments*MgO (kg ha⁻¹ yr⁻¹)

0

2682

60

2659

LSD(P=0.05)

NS

Significant differences in yield were not observed due to different N:K₂O ratios, or increased potash rates or due to application of MgO at 60 kg ha⁻¹ yr⁻¹.

The effect of N:K₂O ratios and of MgO on soil K and Mg status are given in Tables 10 and 11 respectively.

TABLE 10 - Effect of different N:K₂O ratios and MgO on soil K status at two soil depths

Level (kg ha ⁻¹ yr ⁻¹)		MgO	N:K ₂ O	Soil K (mg kg ⁻¹)	
N	K ₂ O			0-15 cm	15-30 cm
240	48	0	5:1	130	122
240	48	60	5:1	120	110
240	60	0	4:1	150	154
240	60	60	4:1	125	117
240	80	0	3:1	157	142
240	80	60	3:1	222	162
240	120	0	2:1	207	175
240	120	60	2:1	140	132
240	240	0	1:1	212	195
240	240	60	1:1	162	150
240	360	0	2:3	220	230
240	360	60	2:3	207	190
240	480	0	1:2	232	207
240	480	60	1:2	240	212
LSD (P=0.05)				84	70
CV %				37	34
<i>Sub treatments</i>					
<i>MgO (kg ha⁻¹ yr⁻¹)</i>					
0				187	175
60				174	153
LSD(P=0.05)				NS	NS

Generally, soil K levels increased with increasing rates of ground K fertilizer application at both depths. In this year, significant effect in soil K level was not found due to Mg fertilizer application at 60 MgO ha⁻¹ yr⁻¹, at both depths.

TABLE 11 - Effect of different N:K₂O ratios and MgO on soil Mg status at two soil depths

Level (kg ha ⁻¹ yr ⁻¹)			Soil Mg (mg kg ⁻¹)		
N	K ₂ O	MgO	N:K ₂ O	0-15 cm	15-30 cm
240	48	0	5:1	165	120
240	48	60	5:1	210	160
240	60	0	4:1	182	187
240	60	60	4:1	202	183
240	80	0	3:1	254	172
240	80	60	3:1	220	214
240	120	0	2:1	185	171
240	120	60	2:1	217	171
240	240	0	1:1	213	160
240	240	60	1:1	193	199
240	360	0	2:3	198	141
240	360	60	2:3	218	213
240	480	0	1:2	196	199
240	480	60	1:2	190	212
LSD (P=0.05)				NS	NS
CV %				39	40
<i>Sub treatments</i>					
<i>MgO (kg ha⁻¹ yr⁻¹)</i>					
0				199	164
60				207	193
LSD(P=0.05)				NS	NS

Significant differences in soil Mg levels were not observed either due to ground Mg fertilizer application at 60 kg ha⁻¹ yr⁻¹ or due to increased potash rates, at both depths, although differences exist with and without Mg application.

The effect of N:K₂O ratios and MgO on leaf Mg and K is given in Table 12.

TABLE 12 - Effect of different N:K₂O ratios and MgO on leaf Mg and K

Level (kg ha ⁻¹ yr ⁻¹)			Leaf nutrient (%)		
N	K ₂ O	(MgO)	N:K ₂ O	K	Mg
240	48	0	5:1	1.39	0.28
240	48	60	5:1	1.43	0.28
240	60	0	4:1	1.23	0.30
240	60	60	4:1	1.28	0.31
240	80	0	3:1	1.24	0.32
240	80	60	3:1	1.20	0.30
240	120	0	2:1	1.21	0.30
240	120	60	2:1	1.14	0.34
240	240	0	1:1	1.28	0.28
240	240	60	1:1	1.33	0.30
240	360	0	2:3	1.42	0.27
240	360	60	2:3	1.47	0.31
240	480	0	1:2	1.44	0.27
240	480	60	1:2	1.28	0.32
LSD (P=0.05)				0.202	0.036
CV %				12	10
<i>Sub treatments</i>					
<i>MgO (kg ha⁻¹ yr⁻¹)</i>					
0				1.32	0.29
60				1.31	0.31
LSD(P=0.05)				NS	0.012

Magnesium concentration in the foliage significantly increased with the ground Mg fertilizer application at the rate of 60 kg ha⁻¹ yr⁻¹. However, significant increases in leaf K concentrations were not observed with the increasing rates of potash. This experiment is in progress.

R.G.A.Wijayawardhana, G.P.Gunaratne and L.S.K.Hettiarachchi

2.2.5. The effect of increasing levels of potash (in 100 increments) with N (in 100 increments) fertilizer, on soil/plant N/K status and yield of tea, St.James Estate, Hali ela. - Clone TRI 2025 (1990).

The yield obtained in the 2nd year of the 2nd cycle is given in Table 13.

TABLE 13 - *Effect of increasing levels of potash with N on yield of tea*

<i>Level (kg ha⁻¹ yr⁻¹)</i>		<i>N:K₂O ratio</i>	<i>Yield (made tea kg ha⁻¹ yr⁻¹)</i>
<i>N</i>	<i>K₂O</i>		
100	100	1:1	2178
200	100	2:1	2165
300	100	3:1	2289
400	100	4:1	2299
500	100	5:1	2363
100	300	1:3	2319
200	300	2:3	2265
300	300	3:3	2363
400	300	4:3	2347
500	300	5:3	2344
100	500	1:5	2284
200	500	2:5	2363
300	500	3:5	2220
400	500	4:5	2385
500	500	5:5	2216
LSD (P=0.05)			NS
CV %			11
<i>Level of N (kg ha⁻¹ yr⁻¹)</i>			
100			2261
200			2264
300			2291
400			2344
500			2308
LSD (P=0.05)			NS
<i>Level of K₂O (kg ha⁻¹ yr⁻¹)</i>			
100			2259
300			2328
500			2294
LSD (P=0.05)			NS

Significant differences in yield were not observed between ground-application of N and K fertilizers with different N:K₂O ratios. Further, there were no significant yield increases with the increasing rates of either N or K fertilizer, although the trends exist.

The effects of N and potash ground applications on soil K status, and leaf N and K are given in Tables 14, and 15 respectively.

TABLE 14 - *Effect of increasing levels of potash with N on soil K status at two depths*

Level of N (kg ha ⁻¹ yr ⁻¹)	Soil K (mg kg ⁻¹)	
	0-15 cm	15-30 cm
100	214	210
200	213	193
300	173	163
400	167	162
500	163	148
LSD (P=0.05)	34	31
CV %	27	27
Level of K ₂ O (kg ha ⁻¹ yr ⁻¹)		
100	124	113
300	181	173
500	254	240
LSD (P=0.05)	26	24
CV %	27	27

TABLE 15 - *Effect of increasing levels of potash with N on leaf N and K status*

Level of N (kg ha ⁻¹ yr ⁻¹)	Leaf nutrient (%)	
	N	K
100	3.27	1.58
200	3.26	1.49
300	3.48	1.50
400	3.45	1.49
500	3.52	1.46
LSD (P=0.05)	0.175	0.094
CV %	8	9
Level of K ₂ O (kg ha ⁻¹ yr ⁻¹)		
100	3.38	1.41
300	3.40	1.53
500	3.41	1.57
LSD (P=0.05)	NS	0.073

In general, soil K levels decreased with the increasing rates of N at both depths, and increased with the increasing rates of potash. Leaf N concentration gradually increased with the increasing rates of N while leaf K concentration decreased. Leaf N concentration remained unaffected with the increasing rates of potash, while leaf K concentration increased. This experiment is in progress.

R.G.A.Wijayawardhana, G.P.Gunaratne and L.S.K.Hettiarachchi

2.3. Soil and Fertilizer Phosphorus Studies.

2.3.1. Application of increasing levels of phosphate (0-120 kg P_2O_5 ha⁻¹ yr⁻¹ at 20 kg increments) fertilizer on soil/plant P status and yield of tea, St.Coombs Estate, Talawakele - Clone TRI 2025 (1989).

The yield obtained in the 3rd year of the 2nd cycle and soil P levels are given in Tables 16 and 17 respectively.

TABLE 16 - *Effect of increasing levels of phosphate fertilizer on yield*

<i>Level of P fertilizer (kg ha⁻¹ yr⁻¹ P₂O₅)</i>	<i>Yield (made tea kg ha⁻¹ yr⁻¹)</i>
0	2388
20	2384
40	2448
60	2432
80	2430
100	2387
120	2431
LSD(P=0.05)	NS
CV %	7

Significant increases in yield were not observed with the increasing rates of Eppawala rock phosphate(ERP).

TABLE 17 - *Effect of increasing levels of phosphate fertilizer on soil P*

<i>Level of P fertilizer (kg ha⁻¹ yr⁻¹ P₂O₅)</i>	<i>Soil P (mg kg⁻¹)</i>	
	<i>0-15 cm</i>	<i>15-30 cm</i>
0	23.3	24.7
20	15.2	9.2
40	26.7	33.4
60	34.3	20.8
80	55.0	44.4
100	43.2	28.5
120	51.6	38.4
LSD (P=0.05)	27.86	25.06
CV %	60	68

In general, soil P levels at 0-15 cm depth, extracted using borax solution (pH=1.5) increased with the increasing rates of ERP. However, no overall pattern of increase was observed at 15-30 cm depth. This experiment is in progress.

H.A.P.Warnasiri, A.K.N.Zoysa and L.S.K.Hettiarachchi

2.3.2. Application of increasing levels of phosphate fertilizer with two methods of application (Broadcast and Incorporated) on soil/plant P status and yield of tea, Walahanduwa Estate, Galle - Clone TRI 2025 (1994).

The yield obtained in the 3rd year of the 1st cycle is given in Table 18.

TABLE 18 - Effect of increasing levels of surface applied and soil incorporated ERP on yield

<i>Levels of P fertilizer (kg ha⁻¹ yr⁻¹ P₂O₅)</i>	<i>Yield (made tea kg ha⁻¹ yr⁻¹)</i>	
	<i>Surface</i>	<i>Incorporated</i>
0	5414	5510
20	5231	5101
40	6112	5128
60	5424	5374
80	5642	5050
100	4834	5408
120	5953	5443
LSD(P=0.05)	NS	
CV %	12	

Significant differences in yield were not observed due to either the rates of P or mode of application i.e. surface applied or incorporated. This experiment is in progress.

H.A.P.Warnasiri, A.K.N.Zoysa and L.S.K.Hettiarachchi

2.3.3. Effect of foliar application of phosphorus (0, 1, 2, 3 and 4% DAP and TSP) on plant P status, quality and yield of tea, St.Coombs Estate, Talawakele - Clones DT 1 and CY9 (1992).

The yield obtained in the 4th year of the 1st cycle (i.e. from December 1996 to November 1997) is presented in Table 19.

TABLE 19 - *Effect of foliar application of phosphate on yield*

Treatments	Yield (made tea kg ha ⁻¹ yr ⁻¹)	
	Clone	
	CY9	DT1
Control	2602	2310
1 % TSP	2678	2466
2 % "	2937	2373
3 % "	2681	2341
4 % "	2805	2358
1 % DAP	2586	2304
2 % "	2780	2572
3 % "	2581	2338
4 % "	2538	2328
LSD (P=0.05)	NS	NS
CV %	7	3

Significant differences in yield were not observed due to foliar application of P in either form (i.e. TSP or DAP), compared to control. After modifying, foliar phosphorus concentrations in September 1995, at different times, flush samples were subjected to miniature manufacture and assessed for P concentrations and biochemical parameters of made teas, and as well as for P concentrations of leaves. Data interpretation and the other day-to-day operations are in progress.

R.G.A.Wijayawardhana and L.S.K.Hettiarachchi

2.4. Soil and Fertilizer Magnesium Studies

2.4.1. Application of increasing levels of kieserite on soil/plant nutrient status and yield of tea, St.Coombs Estate, Talawakele - Clone TRI 2025 (1990).

The yield obtained in the 1st year of the 2nd cycle is given in Table 20.

TABLE 20 - *Effect of increasing levels of kieserite application on yield*

Level of kieserite (kg ha ⁻¹ yr ⁻¹ MgO)	Yield (made tea kg ha ⁻¹ yr ⁻¹)
0	2485
15	2455
30	2440
45	2434
60	2315
75	2263
LSD (P=0.05)	NS
CV %	9

Significant differences in yield were not observed due to application of different rates of kieserite.

The effect of kieserite on soil pH levels is given in Table 21.

TABLE 21 - *Effect of increasing levels of kieserite on soil pH at two soil depths*

Level of kieserite (kg ha ⁻¹ yr ⁻¹ MgO)	Soil pH	
	0-15 cm	15-30 cm
0	4.83	4.75
15	4.53	4.61
30	4.66	4.78
45	4.57	4.62
60	4.61	4.54
75	4.51	4.56
LSD (P=0.05)	0.284	NS
CV %	4	5

Significant differences were not observed in soil pH levels at both depths, due to different rates of kieserite. This experiment is in progress.

H.A.P.Warnasiri and L.S.K.Hettiarachchi

2.4.2. Application of increasing levels of dolomite fertilizer at three frequencies (Cycle, Mid & yearly basis) on soil/plant nutrient status and yield of tea, Field No.4, St.Coombs Estate, Talawakele - Clone TC 9 (1989).

The yield obtained in the 2nd year of the 2nd cycle is given in Table 22.

TABLE 22 - *Effect of increasing levels of dolomite application on yield*

Level of dolomite (kg ha ⁻¹)	Yield (made tea kg ha ⁻¹ yr ⁻¹)		
	Frequency of dolomite application		
	Cycle	Mid-cycle	Yearly
Control	3102	3102	3102
1250	3087	3057	3193
2500	3000	3149	3214
5000	2889	2936	2950
10000	2743	2897	-
LSD (P=0.05)		304	
CV %		8	

Lower yield was recorded from plots that received dolomite at the rate of 10,000 kg ha⁻¹ pruning-cycle⁻¹, at cycle frequency when compared to control. This experiment is in progress.

H.A.P.Warnasiri and L.S.K.Hettiarachchi

2.4.3. Application of increasing levels of dolomite fertilizer at three frequencies (Cycle, Mid & Yearly basis) on soil/plant nutrient status and yield of tea, Field No.2, Morogolla Estate, Imaduwa - Clone TRI 2025 (1990).

The yield obtained in the 1st year of the 3rd cycle is shown in Table 23.

TABLE 23 - Effect of increasing levels of dolomite application on yield

Level of dolomite (kg ha ⁻¹)	Yield (made tea kg ha ⁻¹ yr ⁻¹)		
	Frequency of dolomite application		
	Cycle	Mid-cycle	Yearly
Control	1965	1965	1965
1000	2484	2388	2304
3000	2379	2153	2306
5000	2164	2075	2392
LSD (P=0.05)		NS	
CV %		11	

Significant differences in yield were not observed either due to level or frequency of dolomitic limestone application. However, lower yield was observed from the control plots where no dolomite was applied over a period of 7 years. This experiment is in progress.

H.A.P.Warnasiri and L.S.K.Hettiarachchi

2.4.4. Effect of different particle sizes of applied dolomite fertilizer on soil pH, soil/plant Mg status and yield of tea, Mattakelle Estate, Talawakele - Clone TRI 2023 (1991).

The plants in these plots were pruned in April 1996, and have recovered after a long period of time due to blister blight attacks. Hence, plants were harvested only for a period of 2 months in the 1st year of the 2nd cycle. Therefore, computation of statistics in relation to yield data was not carried out. The soil Mg levels are presented in Table 24.

TABLE 24 - *Effect of different sizes of dolomite particle on soil Mg levels*

		<i>Particle size combinations of dolomite</i>				
Passing through:	30 BS	100	100	100*	100	100
Passing through:	100 BS	100	75	50	25	0
<i>Depth (cm)</i>		<i>Soil Mg (mg kg⁻¹)</i>				
0-15		44.5	42.8	43.5	37.0	35.5
15-30		50.8	48.3	47.5	38.3	50.3
LSD (P=0.05) 0-15 cm				NS		
CV %				32		
LSD (P=0.05) 15-30 cm				NS		
CV %				32		

* Presently recommended particle size of dolomite fertilizer

In general, significant differences in soil Mg levels were not found due to application of dolomitic limestone with different particle size combinations tested, at both depths. This experiment is in progress.

H.A.P.Warnasiri and L.S.K.Hettiarachchi

2.4.5. Effect of different particle sizes of applied dolomite fertilizer on soil pH, soil/plant Mg status and yield of tea, Talangaha Estate, Nakiyadeniya - Clone TRI 2025 (1991).

The yield obtained in the 3rd year of the 2nd cycle and the soil Mg levels are presented in Tables 25 and 26 respectively.

TABLE 25 - *Effect of different sizes of dolomite particles on yield*

		<i>Particle size combinations of dolomite</i>				
Passing through:	30 BS	100	100	100*	100	100
Passing through:	100 BS	100	75	50	25	0
		<i>Yield (made tea, kg ha⁻¹ yr⁻¹)</i>				
		3092	3183	3216	3212	3234
LSD (P=0.05)				NS		
CV %				9		

* Presently recommended particle size of dolomite fertilizer

At this site, significant differences in yield were not observed due to application of dolomitic limestone with different particle size combinations.

TABLE 26 - *Effect of different sizes of dolomite particle on soil Mg levels*

<i>Particle size combinations of dolomite</i>					
Passing through: 30 BS	100	100	100*	100	100
Passing through: 100 BS	100	75	50	25	0
<i>Soil Mg (mg kg⁻¹)</i>					
0-15	104.3	67.3	93.8	92.8	104.3
15-30	81.8	52.5	81.8	50.8	61.5
LSD (P=0.05) 0-15 cm				NS	
CV %				32	
LSD (P=0.05) 15-30 cm				25.8	
CV %				30	

* Presently recommended particle size of dolomite fertilizer

In general, significant differences in soil Mg levels at 0-15 cm depth were not found due to application of dolomitic limestone with different particle size combinations, although at 15-30 cm depth, some differences were greater than the LSD value. This experiment is in progress.

H.A.P.Warnasiri and L.S.K.Hettiarachchi

2.4.6. Effects of application of potassium and/or magnesium from Sul-Po-Mag and kieserite at 2 levels of N on soil/plant nutrient status and yield of tea, Kiruwanaganga Estate, Galle - Clone TRI 2025 (1993).

The yield obtained in the 1st year of the 2nd cycle and the soil Mg levels are presented in Tables 27 and 28 respectively.

TABLE 27 - *Effect of application of K and/or Mg from kieserite and Sul-Po-Mag on yield*

<i>Treatments</i>	<i>Yield (made tea kg ha⁻¹ yr⁻¹)</i>	
	<i>Level of Nitrogen (kg ha⁻¹ yr⁻¹)</i>	
	240	360
U 709 (Urea)	2457	2558
U 709 + Kieserite	2576	2458
U 750 Sul-Po-Mag	2471	2362
UT Mix. (Urea & SA)	2613	2340
T 1130 (SA)	2693	2737
LSD (P=0.05)	NS	
CV %	10	

Significant yield differences were not found either due to application of different fertilizer mixtures or between 2 N levels.

TABLE 28 - *Effect of application of potassium and/or magnesium from kieserite and Sul-Po-Mag on soil Mg at 0-15 and 15-30cm depths*

Treatments	Soil Mg (mg kg ⁻¹)	
	N level (kg ha ⁻¹ yr ⁻¹)	0-15 cm 15-30 cm
U 709 (Urea)	240	54.3 39.2
U 709 + Kieserite	240	65.1 61.4
U 750 Sul-Po-Mag	240	58.6 36.1
UT Mix.(Urea & SA)	240	44.6 23.9
T 1130 (SA)	240	23.7 16.3
U 709 (Urea)	360	50.2 43.0
U 709 + Kieserite	360	81.8 58.5
U 750 Sul-Po-Mag	360	52.6 58.7
UT Mix. (Urea & SA)	360	34.4 19.0
T 1130 (SA)	360	28.5 23.7
LSD (P=0.05)		34.8 52.69
CV %		49 96

In this year, although significant differences in soil Mg levels at both depths were not observed due to addition of Mg enriched NPK fertilizer mixtures at both levels of N, considerably lower levels were found particularly from the plots that received T1130 mixture, which is probably due to lower soil pH values, even after dolomitic limestone application at the time of pruning. This experiment is in progress.

S.M.Dissanayake and L.S.K.Hettiarachchi

2.4.7. Effects of application of potassium and/or magnesium from Sul-Po-Mag and kieserite with and without dolomite on soil/plant nutrient status and yield of tea, Hopton Estate, Passara - Clone TRI 2025 (1993).

The yield obtained in the 4th year of the 1st cycle is presented in Table 29.

TABLE 29 - *Effect of application of potassium and/or magnesium from kieserite and Sul-Po-Mag on yield*

Treatments	Yield (made tea kg ha ⁻¹ yr ⁻¹)	
	Without dolomite	With dolomite
U 709 (Urea)	1698	1637
U 709 + Kieserite	1691	1667
U 750 Sul-Po-Mag	1780	1630
UT Mix. (Urea & SA)	1725	1657
T 1130 (SA)	1665	1730
LSD (P=0.05)		NS
CV %		6

Significant differences in yield were not observed either due to any of these fertilizer-treatments or to with and without dolomite applications. This experiment is in progress.

S.M.Dissanayake and L.S.K.Hettiarachchi

2.4.8. Effect of application of potassium and/or magnesium (U 709, U 709+Kie, U 750, UT Mix & T1130 & 2 levels of N - 240 & 360 kg ha⁻¹ yr⁻¹) from Sul-Po-Mag and kieserite on soil/plant nutrient status and yield of tea, Waltrim Estate, Lindula - Clone TRI 2025 (1994).

The yield obtained in the 3rd year of the 1st cycle and the soil Mg levels are presented in Tables 30 and 31 respectively.

TABLE 30 - Effect of application of potassium and/or magnesium from kieserite and Sul-Po-Mag on yield

Treatments	Yield (made tea kg ha ⁻¹ yr ⁻¹)	
	Levels of Nitrogen (kg ha ⁻¹ yr ⁻¹)	
	240	360
U 709 (Urea)	3249	3265
U 709 + Kieserite	2925	3438
U 750 Sul-Po-Mag	3090	3522
UT Mix. (Urea & SA)	3168	3199
T 1130 (SA)	3303	3438
LSD (P=0.05)	NS	
CV %	6	
	Yield (made tea kg ha ⁻¹ yr ⁻¹)	
Levels of N (kg ha ⁻¹ yr ⁻¹)		
240	3147	
360	3372	
LSD (P=0.05)	149	

So far, significant effect in yield was not found between these fertilizer-treatment and N levels. Also, significant yield differences were not found due to application of different fertilizer mixtures alone. However in this year, yield significantly increased due to application of N at 360 kg ha⁻¹ yr⁻¹ when compared to application of N at 240 kg ha⁻¹ yr⁻¹.

TABLE 31 - *Effect of application of potassium and/or magnesium from kieserite and Sul-Po-Mag on soil Mg at 0-15cm depth*

Treatments	N Level (kg ha ⁻¹ yr ⁻¹)	Soil Mg (mg kg ⁻¹)	
		0-15 cm	15-30 cm
U 709 (Urea)	240	15.7	21.5
U 709 + Kieserite	240	24.6	27.9
U 750 Sul-Po-Mag	240	32.2	37.2
UT Mix. (Urea & SA)	240	15.4	23.1
T 1130 (SA)	240	10.7	12.5
U 709 (Urea)	360	14.5	17.5
U 709 + Kieserite	360	29.6	30.6
U 750 Sul-Po-Mag	360	36.3	41.3
UT Mix. (Urea & SA)	360	11.6	10.0
T 1130 (SA)	360	14.7	16.9
LSD (P=0.05)		NS	NS
CV %		35	42
		Soil Mg (mg kg ⁻¹)	
		0-15 cm	15-30 cm
U 709 (Urea)		15.1	19.5
U 709 + Kieserite		27.1	29.3
U 750 Sul-Po-Mag		34.2	39.3
UT Mix. (Urea & SA)		13.5	16.6
T 1130 (SA)		12.7	14.7
LSD (P=0.05)		8.68	12.15

So far, significant effect in soil Mg levels was not found between these fertilizer mixtures and N levels. Also, no significant differences in soil Mg levels were found between 2 levels of N. In this year, soil Mg levels significantly increased due to application of Mg enriched NPK mixtures such as U709 + kieserite and U750(Sul-Po-Mag) compared to NPK mixtures, yet the levels in general, are marginal. This experiment is in progress.

S.M.Dissanayake and L.S.K.Hettiarachchi

3. Project D/AGCH - Divisional activities

3.1. Characterization of soils in tea growing areas in Sri Lanka

This project commenced in early July 1995 in collaboration with the Land Use Division of the Irrigation Department. Altogether, 12 soil pits were cut from the Ratnapura district from the identified soil types in different regions. A draft memorandum of understanding (MOU) is prepared and yet to be finalized, in order to carry out the work program.

Another project was initiated in 1996 to study the land use planing options for development of marginal tea lands in mid country. Soil survey commenced in November 1996 in order to prepare detailed soil distribution maps through GIS software from 5 selected Estates, to incorporate soil information. The soils of West Hall, Hantane, Craighead, Galphelle and Ratwatte Estates were surveyed and samples are being analyzed for physico chemical parameters. Preparation of maps are in progress. The operations in this project have been carried out in collaboration with a soil surveyor from the Environment and Forest Conservation Division of the Mahaweli Authority in Kandy, Agricultural Economics unit of the TRI and with a trained assistant cartographer. This project is partially funded by the Council for Agricultural Research Policy (CARP).

W.M.S.Wijethunge, G.P.Gunaratne, L.S.K.Hettiarachchi
and J.A.A.M.Jayakody

3.2. Adaptive fertilizer trials - TRI & TSHDA collaboration

The objectives of this study, are to evaluate the performance of U709 and T1130 fertiliser mixtures under tea small holders' situation with a view to disseminating technologies and convincing the small holder the advantages of U709 mixture.

Soil pH levels prior to commencement of trials and after dolomitic limestone applications along with rates, obtained from 17 sites at tea small holders' lands, are presented in Table 32.

TABLE 32 - Soil pH levels prior to commencement of trials, after dolomitic limestone applications along with rates from 17 tea small holders' lands

Location	Soil pH at 0-15 cm depth				Dolomite rate (kg ha ⁻¹)
	Prior to commencement		After dolomite application		
	Block T1130	U709	Block T1130	U709	
Boralanda	4.20	4.90	4.70	5.00	1500
Pitamaruwa	4.70	4.70	4.90	5.10	1000
Kandagolla	4.70	4.80	4.80	4.90	1000
Balangoda	3.50	3.50	3.70	3.80	2000
Kalawana	3.70	3.65	4.20	4.30	2000
Deraniyagala	3.80	3.90	4.50	4.30	2000
Ingiriya	4.55	4.50	4.50	5.20	2000
Badureliya	3.40	4.00	3.80	4.00	2000
Kadugannawa	4.10	4.10	4.30	4.40	1500
Rangama	4.20	4.30	4.50	4.50	1500
Hiniduma	3.70	3.60	4.40	4.40	2000
Elpitiya	4.10	4.40	4.70	5.00	2000
Akuressa	3.80	3.80	4.10	4.00	2000
Urubokka	4.10	4.20	4.50	5.10	2000
Deniyaya	3.60	3.80	4.80	5.50	2000
Tispane	4.30	4.30	4.30	4.30	1500
Nortonbridge	4.50	4.60	4.50	4.50	1000

In general, pH levels were found to be below 4.5 and in some plots it was below 4.0, prior to commencement. The levels were determined after 4 to 6 months period. After dolomite applications, pH levels improved except at few sites. This is probably due to site specific characters such as slope, type of soil etc.

The trial established at Rikillagaskada was abandoned due to unavoidable circumstances and instead another trial was established in the same area recently. The field operations such as fertilizer applications etc. are in progress. These trials are carried out in collaboration with the staff members of both the TRI's Advisory and Extension stations and Tea Small Holdings Development Authority, in those respective regions.

H.A.P.Warnasiri, S.M.Dissanayake, W.M.S.Wijethunge, G.P.Gunaratne, L.S.K.Hettiarachchi, and M.B.A.Perera, S.L.D.Amarathunge, P.B.Ekanayake, S.T.Yatawatte, K.D.Dahanayake, J.A.S.K.V.Jayasinghe, S.Sithakaran and C.C.Rajasingham

3.3. High Forest Estate Problem Clone TRI 2025 - Die back of shoots

The details of the problem were given in the *Annual Report for 1994*.

As per the proposals made at High Forest Task Force meetings, two micro plots (each consisting of 20 plants) were demarcated from the affected patch, in order to apply both ground and foliar fertilizers. Previously marked plot (consisting of 20 plants) from the unaffected patch was used as the control.

During 1997, 06 applications of both ground (N, P, K, Mg & S) and foliar (N, P, K, Mg, S, B, Mo, Cu & Fe) fertilizer were given together. Henceforth, improvement in relation to general growth was observed. Experiments are in progress as per proposals.

S.Ananthacumaraswamy and L.S.K.Hettiarachchi

3.4. Soil and Plant Sulphur Survey

The work in relation to this study was completed, and will be published.

S.Ananthacumaraswamy and L.S.K.Hettiarachchi

3.5. Dolomite cum fertilizer applicator

The objective of this study is to see whether presently available motorized and/or hand-operated fertilizer/granule applicators can be modified in order to broadcast dolomite and/other fertilizer mixtures for tea plantations.

A motorized applicator available in the market was tested at St.Coombs with dolomite and fertilizer mixtures for its suitability, and found that this type of applicators, were not suitable to broadcast either dolomite or fertilizer mixtures.

The particle size distributions of a range of fertilizer mixtures that are used in the tea sector were obtained, in order to prepare specifications and requirements to purchase a power-operated applicator for testing. The specifications were prepared and forwarded to local agricultural machinery agencies for the submission of suitable applicators from the manufacturers. This is in progress.

S.M.Hulangamuwa and L.S.K.Hettiarachchi

3.6 IPM/SHB Experiments

As per the proposals made by SHB Task Force, two nursery experiments commenced at Hantane station and Attampitiya Estate, to test the effects of

high potash (K_2O) levels on SHB infestation. The plants raised were removed at different time intervals, and soil and leaf samples are being analyzed for possible growth, and soil and plant nutrient parameters. Thereafter, treated plants that remained on nurseries after the completion of respective periods, were transplanted in the field, in order to investigate the effects on immature plants, as per designed trials. These experiments are in progress.

H.A.P.Warnasiri, S.M. Dissanayake, W.M.S.Wijethunge,
G.P.Gunaratne and L.S.K.Hettiarachchi

4. Project C/ANAL - Central Analytical Services

The number of fertilizer, soil and leaf samples analyzed for advisory purposes during 1997 are given below:

<i>Element</i>	<i>Fertilizer</i>	<i>Soil</i>	<i>Leaf</i>	<i>Total</i>
Nitrogen	860	472	22	1354
Phosphorus	753	913	327	1993
Potassium	825	1228	327	2380
Magnesium	560	1108	327	1995
Calcium	02	08	04	14
Sodium	-	08	-	08
Zinc	42	44	411	497
Copper	-	08	23	31
Iron	-	08	04	12
Manganese	-	08	04	12
Biuret	03	-	-	03
E.C	-	02	-	02
pH	-	2504	-	2504
O.C%	-	2524	-	2524
Mesh size	370	-	-	370
Total	3415	8835	1449	13,699

G.P.Gunaratne, S.Ananthacumaraswamy, R.G.A.Wijayawardhana,
W.M.S.Wijethunge, H.A.P.Warnasiri, S.M.Dissanayake
and L.S.K.Hettiarachchi

5. Meetings and Seminars

Dr L.S.K. Hettiarachchi, Mrs S. Ananthacumaraswamy, Mr R. G. A. Wijayawardhana attended a workshop on "Safe Handling of Pesticides" organized by Sri Lanka Crop Protection Association, held at TRI Auditorium on 22nd January.

Dr L.S.K.Hettiarachchi and Mrs S.Ananthacumaraswamy attended the 194th meeting of the Experiments and Extension forum held at TRI Auditorium on 24th January.

Dr L.S.K.Hettiarachchi attended a Technical Committee on Tea meeting at Sri Lanka Standards Institution, in order to discuss matters in relation to forthcoming 17th ISO Technical Committee on Tea meeting to be held in Colombo, during 17th - 19th February, on 31st January.

Dr L.S.K.Hettiarachchi attended a seminar on Land Degradation in Sri Lanka, organized by MPI/ACAIR held at TRI Hantane station on 11th February.

Dr L.S.K.Hettiarachchi attended the 17th ISO Technical Committee on Tea meeting held at Trans Asia Hotel in Colombo from 17th to 19th February.

Dr L.S.K.Hettiarachchi attended the RSC (Nuwara Eliya) meeting held at TRI Auditorium on 27th February.

Dr L.S.K.Hettiarachchi participated at the seminar organized by Lanka Phosphate Ltd, in the promotion of ERP in tea small holding sector, held at the HARTI in Colombo on 31st March and addressed on the "Present recommendations on the use of ERP in tea and their significance" as well.

Dr L.S.K.Hettiarachchi addressed the members of the Planters Association Sub district meeting on "Management of Tea Soil Fertility in Nuwara Eliya sub-district" at Planters Club, Talawakele on 6th May.

Mrs S.Ananthacumaraswamy addressed the members of RSC III in Uva on "Use of Fertilizer to Increase the Land Productivity in Uva Region" at Bandarawela Tennis Club, Bandarawela on 13th June.

Dr L.S.K. Hettiarachchi joined the Director, TRI in a discussion with Messrs. M.J. Albrecht and A. Munasinghe from IMC Global Operations Inc, U.S.A. and Aristons Pvt. Ltd., Colombo respectively, to discuss the progress in relation to Sul-Po-Mag trials on 24th June.

Dr L.S.K.Hettiarachchi addressed the members of the 195th E & E forum on "Experimental Evidence: Towards Revised Fertilizer Recommendations" at TRI Auditorium, Talawakele on 27th June. The Executive staff members of the division also attended the forum.

Dr L.S.K.Hettiarachchi attended a symposium on "Upper Mahaweli Catchment Conservation - Status & Trends", jointly organized by the Environment & Forest Conservation Division of the Mahaweli Authority and Section B of SLAAS, held at SLAAS auditorium, Colombo on 04th July.

Dr L.S.K.Hettiarachchi participated at the International Seminar, organized by the Sri Lanka Tea Board on "Tea and Health", held at BMICH in Colombo from 14th to 15th August.

Dr L.S.K.Hettiarachchi participated at the discussion, held between TRI Scientists and Executives of Kotagala, and Agrapatana Plantations Company Ltd, at TRI Auditorium, Talawakele on 29th August.

Dr L.S.K.Hettiarachchi addressed the members of the RSC-I in up-country region on "General nutrient management in tea" on 04th September at TRI Auditorium, Talawakele.

Dr L.S.K. Hettiarachchi participated in a panel discussion of a RSC seminar in Kandy on 18th September.

Dr L.S.K.Hettiarachchi participated at a meeting organized by Dr. A.N.Jayakody, Senior Supervisor of Mr G.P.Gunaratne's postgraduate studies, attached to Soil Science Department, University of Peradeniya in order to discuss the progress so far made by the candidate, with a view towards the completion, on 18th September.

Dr L.S.K.Hettiarachchi along with DGM (Extension), TSHDA attended the 1st set of progress meetings arranged between TRI and TSHDA officials, in order to discuss problems and constraints in relation to monitoring 18 collaborative fertilizer trials established at tea small holders' lands and thereby to improve monitoring.

Dr L.S.K.Hettiarachchi attended the Annual General Meeting of the Soil Science Society of Sri Lanka at SLAAS Auditorium on 10th October and joined the field visit to Horton plains on 11th October.

Dr L.S.K.Hettiarachchi along with Dr S.M.Hulangamuwa visited Farm Machinery Research Centre at Maha-Illupallama and Farm Machinery Training Centre at Anuradhapura, in order to see some applicators available at these centers; discuss the possibilities of fabricating a hand-operated applicator; explain the requirements under tea crop situation and to meet the Agricultural Engineers and thereby to familiarize him self with calibration procedures etc. from 16th to 19th October

Dr L.S.K. Hettiarachchi participated at a discussion organized by the senior officials of the Pussellawa Plantations Ltd, at the Hellbodde Estate, in order to prepare it's fertilizer policy for 1998, on 11th November.

Dr L.S.K.Hettiarachchi attended the 9th Annual Congress of the Post Graduate Institute of Agriculture at PGRC Auditorium in Peradeniya from 21st to 22nd November.

Dr L.S.K.Hettiarachchi participated at the panel discussion of a RSC seminar in Kandy on 11 December.

6. Workshops and Training programs

Mr K.A.E.P.Fernando, NCA trainee from Technical College, Kuliapitiya, completed his 04 months training program on soil, plant and fertilizer analyses, by January 1997.

Mr J.M.A.R.Hemachandana, NCA trainee from Technical College, Kuliapitiya, completed his 06 months training program on soil, plant and fertilizer analyses, from January to July 1997.

Mr N.S.Athapattu and Mr W.C.Wickramarachchi, NDT trainees from Hardy Advanced Technical Institute, Ampara completed their 04 months training program on soil, plant and fertilizer analyses, from April to July 1997.

Miss D.Liyanage NDT trainee from Hardy Advanced Technical Institute, Ampara and Mr C.Wickramasinghe NDT trainee from Technical Collage, Kuliapitiya completed their 04 months training program on soil, plant and fertilizer analyses from August to November 1997.

7. Visitors

Dr P.Owour, Senior Principal Research Officer/Head Chemist, Tea Research Foundation, Kenya, visited SPND in order to discuss tea soils and plant nutrient aspects in Sri Lanka, with Dr L.S.K. Hettiarachchi on 24th February.

The managers from Glasgow and Balmoral Estates visited SPND in order to discuss general fertilizer related aspects, on 24th March.

Three Group Managers from Agrapatana Plantations Limited visited SPND in order to discuss fertilizer related aspects with Dr L.S.K. Hettiarachchi on 23rd April.

A group of students from Eastern University visited SPND in order to discuss and familiarize soil, plant and fertilizer related aspects, on 7th May.

Mr M.C.Bostock, Executive Chairman, Rajawela Holdings Pvt. Ltd., visited SPND in order to discuss fertilizer related aspects with Dr L.S.K. Hettiarachchi, on 7th May.

Four Assistant Superintendents from Plantations Management Companies visited SPND in order to discuss fertilizer related aspects and to familiarize soil, plant and fertilizer analytical work, on 16th and 19th May.

Mr M.de Zoysa from Chilaw Plantations Ltd., visited SPND in order to discuss fertilizer related aspects with Dr L.S.K. Hettiarachchi on 4th June.

A group of agricultural students from Sabaragamuwa University visited SPND in order to discuss and familiarize soil, plant and fertilizer related aspects, on 16th July.

Dr S.M.Hulangamuwa, Consultant Engineer, Department of Agriculture, Peradeniya visited SPND in order to discuss about dolomite and/or fertilizer applicator work and as well as to test one of the applicators available in the market on 7th August.

Two Assistant Superintendents from Agalawatte Plantations Ltd, visited SPND in order to discuss fertilizer related aspects and to familiarize soil, plant and fertilizer analytical work, on 01st and 02nd September.

Two groups of agricultural students from University of Peradeniya visited SPND in order to discuss and familiarize soil, plant and fertilizer related aspects, on 10th and 17th September.

Messrs F.R.Amarasinghe and T.T.Christy from Maskeliya Plantations Ltd visited SPND to discuss modalities to lay down a collaborative fertilizer-related trial at Brunswick Estate, on 06th October.

Dr A.N.Jayakody, a senior lecturer at the Soil Science dept: of the Faculty of Agriculture, University of Peradeniya visited SPND with a view to discuss a research component for a post graduate student with Dr L.S.K. Hettiarachchi and lay down necessary collaborative experiments, on 07th November.

8. Publications

HETTIARACHCHI, L.S.K. AND GUNARATNE, G.P.(1997). Identification of magnesium deficiency symptoms : Leaf analysis as a guide in tea crop nutrition. *TRI Up Date* 2(1), 4.

ZOYSA, A.K.N., LOGANATHAN, P. AND HEDLEY, M.J. (1997). A technique for studying rhizosphere processes in tree crops: soil phosphorus depletion around camellia (*Camellia japonica L.*) roots. *Plant and Soil*, 190: 253-265.

HETTIARACHCHI, L.S.K., (1997). Thea Vagave Sadhaha Pohora In *Phohara Veladunta Athvelak*, published by National Fertilizer Secretariat, Ministry of Agriculture and Lands, Colombo, Sri Lanka, 19-30.

HETTIARACHCHI, L.S.K., BALASINGHAM, A., ANANTHA CUMRASWAMY, S., GUNARATNE, G.P. AND WARNASIRI, H.A.P. (1997). Mineral composition in relation to leaf maturity from 2000, 3000 and 4000 clonal series: Leaf analysis as a guide in tea crop nutrition. *S.L.J. Tea Sci*, 65 (1/2). In press.

TECHNOLOGY DIVISION

Head - M.T. Ziyad Mohamed

1. General

Mr. Robin Fundinger an engineer from IMKO, MICRO MODULTECHNIK, Germany spent one week from 1st April and tested a modified moisture meter to measure the moisture content in the withered leaf.

Mr W.S. Botheju visited India from 22nd July to 31st December to attend a training program on Tea Tasting and Quality Control at Kothari Agriculture Management Center in India. This visit was funded by the Technical Co-operation Scheme of Colombo Plan.

Mr. P.B. Chandrasa Experimental Officer, was transferred to Biochemistry Division with effect from 22nd September.

Dr. M. T. Ziyad Mohamed served as a member of the Technical Committee appointed by Chairman Sri Lanka Tea Board to advice on Tea Factory Development Subsidy Scheme for orthodox factories.

Dr. M. T. Ziyad Mohamed continued to serve as a member of the panel of Professional Examination in Tea Manufacture and Factory Practices by the Chairman, National Institute of Plantation Management (NIPM).

Dr. M. T. Ziyad Mohamed was appointed to panel of Teachers/Examiners of the Post Graduate Institute of Science (PGIS) University of Peradeniya with effect from 4th July.

Dr. M. T. Ziyad Mohamed was appointed to serve as the Chairman of the Technical Committee on Tea by the Sri Lanka Standard Institute.

Dr. M. T. Ziyad Mohamed was appointed as a member of the Academic Committee of NIPM.

Dr. M. T. Ziyad Mohamed was a member of the Sri Lankan delegation for the 17th Technical Committee on Tea Meeting of International Organization for Standards (ISO/TC34/SC8) held in Colombo in February.

Dr. M. T. Ziyad Mohamed served as a member of the committee appointed by the Ministry of Plantation Industries on "Quality, Standards and Grades of tea produced and exported by Sri Lanka."

Dr. M. T. Ziyad Mohamed continued to function as convenor/secretary of the Consultative Committee on Research, a Sub Committee of the Tea Research Board.

2. **Project B/CPCO - Continuous process**

A continuous preconditioning system was designed by a University trainee in consultation with the divisional staff at Talawakele. The samples of material to fabricate the unit/system have been ordered.

3. **Project B/EDRY - Reduction of the cost of tea drying**

3.1 **Performance of stepwise FBD 3 compared with FBD 4**

Few trials were carried out from early May to compare the performance of FBD3. The objective is to optimize weir heights in three sections to increase the efficiency of the drier. This drier was designed in such a way that the weir heights in each section could be changed individually. Trials were restarted with presetting of weir heights at 4" as suggested earlier.

TABLE 1 - *Moisture content of tea in different sections and output of drier*

W/dhool % Moisture	Sections % Moisture			Temperature(C)		Average Output (Kg)
	1st	2nd	3rd	Inlet	Weir end	
(1) 53.5	31.5	6.0	2.4	129	112	194
52.8	31.0	7.7	2.2	129	112	
52.9	33.1	10.1	3.1	117	107	
52.5	36.0	9.2	3.2	116	104	
(2) 55.5	31.0	8.2	2.8	112	104	197
54.9	38.6	18.2	4.0	115	91	
55.8	44.9	25.2	4.6	123	94	

The results revealed that the average output was about 195 kg on both occasions. The moisture contents of the samples drawn from each section were analyzed. The moisture content of dhool in each section is dependent on the initial moisture content of the fermented dhool, feeding rate as well as the inlet and exhaust temperatures of the dryer. This work is in progress.

M. T. Ziyad Mohamed, W. S. Botheju, L. Jayasinghe

3.2 **Trials with 'Economizers'**

Although the economizer was installed with necessary ducting, the amount of air sucked through economizer was not sufficient. Further modifications will be carried out and trials will continue.

3.3 Solar Tea Drying Project

The objective of this project is to test the feasibility of using solar energy for withering and drying. As an initial step two prototype solar flat plate collectors were designed and fabricated, and their performance tested at St Joachim Estate. The initial results showed that the air could be heated from about 32°C to 92°C using solar energy. To produce 1kg of tea, as much as 22 MJ of thermal energy is spent, according to energy audits carried out.

The approach was to preheat the air which enters the heat exchanger to around 50 - 60°C using solar energy and to raise the temperatures to operational conditions (95°C) using firewood or oil. The technology using solar energy for thermal energy applications is well established. However, the importance of working out the economics would be looked into.

Current Status:

Fabrication of all 200 solar collectors was completed. The fabrication of ductings was also completed. The structure to fix the solar collectors has been decided and construction started with prestressed concrete columns and beams, in consultation with Dr. Kulasinghe, consultant for the project appointed by NARESA.

S. Koneswaramoorthy, and M. T. Ziyad Mohamed

3.4 Dehumidified air technique for withering

The objective is to check the effect of dehumidifying the air used for drying with a view to

1. Reduce the cost of drying by reducing the temperature of the drying air.
2. Check the improvement in tea character (if any).

The miniature drier at the Technology Division was tested to find the initial condition for drying teas.

Silica was packed in wire mesh and fixed to the drier to dehumidify the air used for drying. However the dehumidifying capacity of the silica packing was not satisfactory. The design of the silica packing was modified and this packing will be used in future tests.

K. Raveendran, and M. T. Ziyad Mohamed

In the meantime a cost effective prototype dehumidifying unit is being developed by Dr. Attalage of University of Moratuwa, for the specific purpose of using it for withering tea leaves. Once the unit is developed the Technology staff will get involved in testing the same, studying the effect of such a system

on quality of made tea. This is a collaborative project with TRI, University of Moratuwa and Energy Conservation Fund (ECF). The project is funded by ECF.

K. Raveendran, G. L. C. Galahitiyawa, M. T. Ziyad Mohamed

3.5 Generation of thermal energy using a local gasifier (NERD) for drying tea.

The NERD gasifier was dismantled and a new one was fabricated with a thicker gauge B. I. sheet with modification to the burner unit at NERD workshop and installed during 4th quarter of 1996. The new unit was funded/paid by the Energy Conservation Fund.

Trials were carried out for several days. Difficulties were encountered in raising the inlet temperature up to 200°F. On certain days it was possible to maintain an inlet temperature of around 200° F. This temperature although adequate but not the ideal for Low Country type of manufacture. Since the firewood has to be cut into small pieces to feed this gasifier, data on cost of splitting were also recorded.

However, field trials would continue at least for another 6 months or so to make any recommendations.

Wood-fuel losses and labour/power costs in splitting and chopping of firewood

Trials were carried out during the period under review and data collected indicate the following.

Wood losses in sawing / splitting	5 - 6%
Labour for sawing (man-hrs/ cu.yd)	1.5 - 2
Labour for chopping (man-hrs/ cu.yd)	6 - 10
Power consumption in sawing (Kwh/ cu.yd)	4 - 5.6

P.B.Chandradasa, G. L. C. Galahitiyawa, M. T. Ziyad Mohamed

4. Project B/ENGY - Reduction of Cost of Energy

4.1 Modifications to the trough with a view to reduce the cost of electrical energy

This is a collaborative project between TRI and Energy Conservation Fund (a statutory body under Ministry of Power and Energy) and it is funded by Energy Conservation Fund (ECF).

Electrical energy is required for the unit operations of Withering, Rolling, Roll breaking and Drying. Electrical Energy consumption in sorting and packing

operation is rather small. The actual energy consumption in typical High/ Mid and Low country factories observed by analysis of historical data and by actual measurements during energy audits is given in Table 2.

TABLE 2 - Electrical Energy Consumption in Tea Processing Unit Operation wise.

	Mid/High Country		Low Country	
	kWh/kg MT	%	kWh/Kg MT	%
Withering	0.46	48.9	0.46	61.3
Rolling	0.20	21.3	0.10	13.3
Drying	0.07	7.4	0.07	9.3
Sorting & Packing	0.09	9.6	0.07	9.3
Ancillaries (including domestic use)	0.12	12.8	0.05	6.7
Total	0.94	100	0.75	100

(Ref W. C. A. De Silva, Planters Energy Network 1993)

Bulk of electricity consumption takes place in the unit operation of withering and as the following analysis shows considerable energy savings could be effected by R + D relating to withering operations.

In withering, electricity is consumed entirely by the fan motors operating continuously for about 12 hours in the case of Up/Mid country factories and about 18 hours in the case of Low country factories.

For trough withering units the following design features are considered appropriate.

Rate of spreading	30 Kg/m ²
Air flow requirement	0.6 m ³ /min/kg GL
Required pressure head trough	15mm wg
Estimated pressure loss in fan housing	5mm wg
Fan head	20mm wg
Assumed fan motor efficiency	80%
Safety factor for motor capacity	25%
Assumed fan efficiency	80%

Based on the above, electrical energy requirements of a trough of 1,000 kg (GL) capacity is 4 kW and the corresponding specific electrical energy consumption (based on an outturn of 22.2% MT/GL is only 0.22 kWh/kg MT for withers lasting 12 hrs and 0.32 kWh/kg MT for withers lasting 18 hrs, as against observed specific consumption of 0.46 kWh/kg MT.

This clearly illustrates that the electricity consumption of trough fans is too high in relation to design figures.

Contributory factors often are incorrect fan duct design, lack of airflow distribution measures, use of oversize fans (capacity being adjusted by fan blade angle), air leaks and the use of oversize motors.

The extent of using oversize motors could be assessed by comparing the usually installed motor capacities (Samaraweera 1986) with those calculated to confirm to the design features given above. The details are given in Table 3.

Usually installed motor capacities compared with design calculations based on an air requirement of 0.6m³/min/kg GL for troughs of varying capacities

TABLE 3 - Motor ratings for various trough sizes

Trough	(ft)	60	72	84	100	120
	(m)	<u>18.3</u>	<u>21.9</u>	<u>25.6</u>	<u>30.5</u>	<u>36.6</u>
Capacity (kg)		988	1183	1382	1647	1976
Air flow required (m ³ /min)		593	710	829	988	1186
Air power @ 20mm total						
Pressure (kW)		1.93	2.31	2.70	3.22	3.86
Calculated fan motor						
Capacity (kW)		3.0	3.6	4.2	5.0	5.9
Calculated motor rating (kW)*		3.7	4.4	5.2	6.2	7.4
Usual motor rating		3.7	5.5	7.4	11	11
Oversize (%)		0	25	42	77	49

*(at an assumed motor efficiency of 65%, providing for a safety factor of 25%)

By improving designs of troughs it should be possible to reduce electricity consumption in withering by 30% to 50% i.e. from 0.46 kWh to 0.32 kWh per kg of made tea. At a national level this represents a saving of about 28 GWh per annum.

Methodology

- (1) To access the present energy consumption pattern and to identify the energy saving potential, the following study methodology has been adopted.
- (2) Measure all the critical parameters to estimate the specific energy consumption of existing withering operation without making any operational changes.
- (3) Measure all the critical parameters while maintaining these parameters at desired range of withering in order to estimate the specific energy consumption.
- (4) Identify operational changes required for improvement of energy efficiency.
- (5) Carry out trials in the prototype withering trough to establish desired parameters to achieve optimum energy efficiency.

Test Procedure

Fresh green tea leaf was spread evenly on the trough at (2.5-3.2 kg/ft²). Spreading was done as quickly as possible and the trough fan started. Temperature measurements were taken at the following points.

- Air outlet over the leaf bed,
- Air inlet temperature,
- Ambient air position for hot air inlet duct and,
- Plenum chamber

Temperature

Wet bulb & Dry bulb temperature were monitored at four points using thermocouple wires of K type and a data logger and were continuously recorded at 15 minute intervals for the entire withering process.

Weight

Weight losses of green leaves during withering were measured by taking samples of 3.5kg green tea leaves contained in basket made out of wire mesh and placed on the same trough. The weights of these samples were recorded at one hour time intervals. Two samples of leaves were collected at the beginning and end of the withering process for measurement of moisture content. The total green leaf weight and the withered leaf weight (once the wither is ready) were also recorded.

Static pressure

Static pressure in the plenum chamber was also measured at 5 points along the length of the trough.

Air flow

Air velocity at inlet position was measured. In order to reduce the air flow rate through the bed the small door at the rear side of the trough (gable end door) was kept open from 4.00 a.m and air velocity through this back door was also measured. The leaf bed was turned twice during the process (11.30 p.m & 4.00 a.m).

Observations and recommendations:-

Table 4 gives the summary of the results of the field trials carried out at St Joachim Estate, Ratnapura.

TABLE - 4 Electrical Energy consumption during withering

	case1	case2	case3	case4	case5*	design condition
Weight Distribution (kg/ft ²)	2.5	2.5	3.14	2.5	3.2	2.8
Withering Time (h.min)	16.30	13.10	15.15	11.35	12.15	12
Specific Energy Consumption (kWh/ Tonne of MT)	0.316	0.316	0.256	0.241	0.201	0.222
Initial Moisture Content %		74.01	77.7	80	75.7	80
Final Moisture Content %		65.00	65.0	65	61.2	60

* Controlled operation

Moisture Loss

Fig 1 shows the weight loss of leaves during the process. It was observed that more than 50% of the moisture removal has taken place during the first four hours of the withering process.

Wet bulb/ Dry bulb Temperature Difference

The withering process of the green leaves is ruled by the difference in wet and dry bulb temperature of the ambient air. The difference should be 2.2°C as an absolute minimum and the average around 3-4°C.

During the wet days and in the evening the difference may be too small for withering to take place and in this case hot air from the drier is mixed with ambient air to achieve the required 'wet bulb depressions'. This is normally checked with dry and wet bulb thermometer in the trough. There is no meter to measure the moisture content in the leaf within a short period. It is common practice that the wither percentage is checked by squeezing the leaf by hand with the experience of the factory officer. During the measurements a continuous temperature recording unit was used with thermocouple wiring indicating the wet/dry bulb temperature of air entering and leaving air of the trough. Fig 2 shows the variation of wet & dry bulb temperature difference under normal operation and Fig 3 shows the wet/dry bulb temperature difference under controlled conditions.

The specific energy consumption at the present operational mode is about 0.316 kWh/ Kg of MT. This value was reduced to 0.241 at moderately controlled conditions.

Based on the above findings it could be concluded that energy consumption for withering could be reduced at least by 20% with proper control of Wet/Dry bulb temperatures.

To carry out further trials a prototype trough (20'X6') with all the necessary ducting, was constructed at the Mechanical Workshop and the fan and motor were coupled/ installed to the same unit. Based on the above findings a speed controller will be installed to control the airflow with time of withering

M.T. Ziyad Mohamed, G. L. C. Galahitiyawa and ECF Officials

6. Project D/TECH - Divisional activities

6.1 Testing new moisture meter to measure the moisture content in withered leaf

TRIME-GM (Time domain Reflectometry with Intelligent microelements for Gravimetric Water content measuring) based on the TDR- technique was tested during the year 1996.

A modified instrument brought by an Engineer from IMKO, MICROMODULTECHNIK, Germany was tested with withered leaf samples with varying moisture content during the year 1997.

Graph A, TRIME Mass% (instrument reading) vs Reference value in Mass% (result from standard laboratory test) was obtained by the Engineer from the test results.

The test was done using withered leaves consisting of,

- 1) Mixed leaves (tender leaves + coarse leaves)
- 2) Tender leaves

In the graph it can be seen that the points are scattered. Further to this the meter was tested by the officers attached to Technology division on several occasions and similar graphs were obtained.

Based on these test results the following conclusions were made.

- a) The results are encouraging for samples with moisture levels below 60%
- b) The results are not reliable when,
 - (i) The moisture content in the sample is above 60%
 - (ii) There is more moisture in the stem compared to leaves during rainy days. It is difficult to remove the excess moisture and the moisture content of the withered leaf varies.
 - (iii) The leaf standard is poor
 - (iv) There is presence of sand

This is a collaborative project with Post Harvest Technology Department, University of Hohenheim, Germany.

M. T. Ziyad Mohamed, K. Raveendran, S. H. Priyanthi, L. Jayasinghe

6.2 Optimization of grade mix – No3 mesh for the Roll Breaker

The objective of this study is to check the merits and demerits of using No 3 mesh instead of No 4 mesh in the roll breaker for low country type of manufacture. Since the perforation is larger in No 3 mesh higher dhool percentages were expected.

550 kg of withered leaf was charged initially to two rollers with 4x20 minutes rolling. The dhool percentages are presented below.

	Mesh No. 4 (%) (single roll breaking)
1st dhool	2.20
2nd dhool	5.00
3rd dhool	22.30 (double roll breaking)
4th dhool	24.20 (No. 2 mesh single roll breaking)
Big Bulk	46.20

Grades	(%)
BOP1(33)	8.8
BOP(40)	5.8
OP1	5.2
OP	13.1
FBOP	7.3
FBOPF 1	4.3
FBOPF	3.1
F PEKOE	1.8
OPA(25)	12.6
OPA(30)	5.0
FFsp	1.2
OFF GRADES	24.1

Labour requirement for roll breaking : 5 nos

From the above it could be seen that the dhool percentages with No. 4 mesh were less and big bulk percentage was high. As such it was decided to do double roll breaking in the case of No. 4 roll breaker. This is a common practice in most of the Low Country factories.

The 1st 2nd and 3rd dhools were extracted by roll breaking the bulk twice (double roll breaking) in the case of control using No 4 mesh. In the case of treatment using No 3 mesh, the 1st 2nd and 3rd dhools were extracted by roll breaking the rolled leaf once.

The 4th dhool was extracted using a No 2 roll breaker mesh in each case. Three replicates were completed during the period under review and the results are summarized below

TABLE 5 - Dhool percentages using No. 3 mesh verses No. 4 mesh in the roll breaker

	mesh no.3 (single roll breaking) %	mesh no.4 (double roll breaking) %
1 st dhool	8.48	7.50
2 nd dhool	13.84	16.53
3 rd dhool	21.60	21.21
4 th dhool	32.11	26.24
Big Bulk	23.91	28.50
Grades	(%)	(%)
BOP1(33)	9.0	9.8
BOP1(40)	7.1	7.0
OP1	12.3	11.0
OP	11.6	11.4
FBOP	8.2	8.6
FBOPF1	3.5	4.3
FBOPF	4.2	3.1
F PEKOE	2.9	2.5
PEKOE	12.0	10.0
OPA(25)	8.0	7.8
OPA(30)	4.1	6.0
FFsp	1.8	1.9
OFF GRADES	15.6	16.6

Labour requirement for roll breaking:

5 no.s'

10 no.s'

Preliminary results indicate that the dhool percentages and grade percentages are comparable, in spite of employing single roll breaking with No. 3 mesh against double roll breaking with No. 4 mesh. However, the samples were also sent to professional tasters for their evaluation. If the valuation is comparable or better in the case of treatment using No. 3 mesh, this would result in substantial reduction in deployment of labour in the rolling room as mentioned above i.e. 5 labourers against 10. This is in progress.

G.L.C. Galahitiyawa, P.B. Chandradasa, N. Vidanapathirana,
M.T. Ziyad Mohamed

6.3 Net Outturn – made tea to green leaf.

Net outturn achievable under low country conditions had been the subject of debate for some time. This is an important factor for the leaf suppliers, mainly small holders as well as factory owners since the price paid for the green leaf is based on this outturn.

Trials were carried out under commercial conditions at St Joachim Factory, Ratnapura, where more than 90% of the production is from bought leaf. Several batches of green leaf were selected, and manufacturing was carried out under normal (commercial) conditions. The teas were graded and the net outturn determined for each batch.

The results from 18 replicates are summarized in Table 6.

TABLE 6 - Gross and net outturn percentages in made tea when the good leaf percentage is over 60

Rep. No.	Moisture content(%)	Good leaf (%)	Gross outturn(%)	Refuse tea (%)	Net outturn(%)
1	79.06	83.00	22.18	2.22	19.65
2	79.11	80.50	21.31	2.68	20.25
3	76.19	73.50	23.82	3.09	22.80
4	77.83	86.70	21.39	1.98	20.41
5	80.84	84.60	19.75	0.57	19.47
6	79.42	77.50	19.67	1.18	19.08
7	74.73	85.27	24.86	1.60	24.55
8	77.00	73.60	22.60	3.68	22.21
9	78.00	62.00	21.65	5.73	20.99
10	77.18	66.20	22.30	3.96	22.46
11	76.23	72.80	23.65	1.80	23.22
12	74.50	70.00	24.88	2.72	23.97
13	77.56	70.27	22.75	4.28	22.17
14	79.90	71.65	20.27	4.13	18.30
15	76.80	71.83	23.28	5.13	22.48
16	77.80	72.55	22.38	5.24	21.08
17	74.60	71.40	24.80	4.84	22.69
18	79.00	49.00	21.47	4.98	19.41

1) The regression for Net Outturn X Moisture Content of green leaf

Predictor	coef	St dev	t-ratio	Probability
Constant	91.833	7.135	12.87	0.000
MC	-0.90833	0.09199	-9.87	0.000 ***

$S = 0.6979$ $R^2 = 85.9\%$ R^2 (adjusted) = 85.0%

*** Highly significant – 85% of the variation of Net outturn is explained by Moisture content of green leaf.

The regression equation is $NO = 91.8 - 0.908MC$ (1)

NO – Net outturn, MC – Moisture content of green leaf.

- 2) The regression for Net outturn X Good leaf% gave

$$NO = 21.2 + 0.0024 GL \dots\dots\dots(2)$$

Predictor	Coef	St dev	t-ratio	Probability
Constant	21.227	3.660	5.80	0.000
goodleaf	0.00235	0.04947	0.05	0.963 ****

$$s = 1.859 \quad R - SQ = 0.0\% \quad R - SQ(ADJ) = 0.0\%$$

**** Not significant – Net outturn has no relationship with Good Leaf%
This implies that the nett outturn does not depend on good leaf percentage

- 3) The regression for Net outturn, moisture content & good leaf (GL)

$$NO = 91.2 - 0.0912 MC + 0.0128 GL \dots\dots\dots(3)$$

Predictor	Coef	St dev	t-ratio	Probability
Constant	91.172	7.325	12.45	0.000
mc	-0.91191	0.09375	-9.73	0.000 ***
gl	0.01278	0.01893	0.68	0.510 NS

$$s = 0.7101 \quad R - sq = 86.3\% \quad R - sq (adj) = 84.5\%$$

This again confirms that the nett outturn doesnot depend on good leaf percentage

- 4) The regression for refuse tea% X on Good leaf%

$$RT = 12.4 - 0.124 GL \dots\dots\dots(4)$$

RT – refuse tea% GL – good leaf%

Predictor	coef	st dev	t-ratio	Probability
Constant	12.401	2.182	5.68	0.000
Goodleaf	-0.12357	0.02949	-4.19	0.001 ***

$$s = 1.108 \quad R - SQ = 52.3\% \quad R - SQ(ADJ) = 49.3\%$$

*** Highly significant – 49.3% of the variation of refuse tea% is explained by Good leaf%

The results indicate that the Net outturn mainly depends on the moisture content of the green leaf, rather than the leaf standard. Using the above correlation (equation 1) if the moisture content in green leaf is known, the nett outturn could be predicted.

It was also decided to collect samples of green leaf received at St. Joachim factory almost everyday for about one year and determine the moisture content to work out the net outturn achievable using the above equation and predict a possible average figure for the whole year.

TABLE - 07 *Moisture Determination of green leaf samples received at St Joachim Factory*

Date	Estate leaf		Bought leaf	
	MC%	Surface moisture	MC%	Surface moisture
97/07/09	81.0	yes	79.9	yes
10	81.9	yes	82.5	yes
11	80.4	yes	81.4	yes
14	80.6	yes	78.7	yes
15	79.7	yes	79.1	yes
29	75.6	no	77.5	yes
30	75.6	no	79.6	yes
31	74.6	no	78.3	no
97/08/01	76.3	no	79.2	yes
04	75.8	no	77.8	yes
05	76.1	no	76.9	no
97/10/13	-	-	78.9	yes
97/11/04	79.5	yes	79.3	yes
05	80.2	yes	81.4	yes
06	80.4	yes	80.9	yes
07	79.6	yes	79.2	yes
18	79.8	yes	80.1	yes
19	77.7	no	77.0	no
97/12/03	78.5	yes	80.6	yes
04	79.1	yes	80.6	yes
05	76.0	no	78.6	no
06	77.1	no	77.3	no
08	76.2	no	76.8	no
09	78.8	yes	79.6	yes
10	77.6	yes	77.3	yes
11	79.5	yes	80.3	yes
12	78.2	yes	77.6	yes
15	79.2	yes	80.3	yes
16	80.3	yes	80.1	yes
17	77.6	yes	77.5	yes
18	77.7	no	79.1	yes
19	78.9	yes	79.0	yes

G.L.C. Galahitiyawa, and N. Vidanapathirana

6.5 Monitoring the standard of leaf at St. Coombs Factory

Monitoring of the standard of leaf coming to St. Coombs factory was continued at least two days a week. The bought leaf coming from St. Coombs estate, Lamilliere and Diyanillakelle estates (bought leaf) were taken to monitor the standard of leaf brought to St. Coombs factory.

Standard leaf	Sub Standard leaf
Bud itself	Bud + three or more leaves
Bud + one leaf	and leaf with hard stem
Bud + two leaves	Coarse banji
Bud + three leaves (if 3rd is tender)	Coarse single leaves
Tender single leaf	Any damaged leaves
Tender banji	

Several samples of leaf were taken after spreading on the troughs for each division separately. The respective samples were bulked and about 250 gm from each sample was taken to monitor the leaf standard. They were then divided into Standard leaf and Sub Standard, the percentages being shown below.

The acceptable standard of leaf should be about 65% good leaf (minimum) for good manufacture.

TABLE 8 - Standard of leaf brought to St. Coombs factory in three different places

Months	St. Coombs		Lamillier		Diyaniilakele	
	Count%	Weight%	Count %	Weight%	Count%	Weight%
January	53	48	55	49	58	54
February	62	55	63	58	57	54
March	57	49	58	55	60	53
April	63	53	55	45	57	48
may	49	42	58	48	51	40
June	53	54	61	51	65	55
July	59	45	62	51	64	46
August	58	43	63	51	59	50
September	65	52	61	51	70	59
October	61	63	68	55	69	59
November	59	42	61	48	69	46
December	58	46	57	46	65	52

S. H. Priyanthi, L. Jayasinghe

6.6 ISO 9000

ISO 9000 series certification has become an international standard for quality management. Many companies across the globe had obtained this certification and many more are in the process of obtaining the same.

Although at present, the tea importing countries are not demanding ISO 9000 certification for the tea processed at a particular factory, by the turn of the century there is the possibility, it might become a prerequisite to have this certification for selling tea produced from each factory.

To achieve certification, a company must demonstrate its commitment to quality. To make it a success the total involvement of everyone in the company in the operation of the quality system is utmost important. There are three standards under this series.

ISO 9001	design/development, production, Installation and customer service
ISO 9002	production, Installation and customer service
ISO 9003	final inspection and test

What is relevant/appropriate to the industry at present is ISO 9002. The system requires documentation and demonstration. In other words, one must say what he does & do what he says.

There are three manuals to be prepared,

1. Quality manual
2. Quality procedures manual
3. Work instructions

With the intention of leading the way for other factories to follow, action was initiated first to obtain ISO 9002 certification for processing at St. Coombs factory. In this regard the assistance received from M/S Gihan Talgodapitiya Associates (Pvt) Ltd, Colombo 07, in preparing all three manuals is appreciated.

The institute has appointed M/S Technoconsult (Pvt) Ltd., Colombo 06 as consultants to implement the system and obtain certification. As an initial step the consultants conducted several training programs on ISO 9000 for the benefit of the staff (Executive grade & Intermediate grade). It is anticipated to obtain ISO 9002 certification by mid 1998.

M. T. Ziyad Mohamed, K. Raveendran

6.7 Packing Trials with New Type of Paper Sacks

When the tea is packed in tea chest the cost of packing is the largest component in tea processing. As a result new packing materials are tested from time to time for their suitability for packing tea.

In this study two types of tea bags (sacks), one with the inner ply having two joints of Aluminum/LDPE/Kraft paper and the other with matallized polyester/LDPE/Kraft paper were tested. The normal paper sack with the same dimension, but with inner ply having one joint was used as the control.

The following information were recorded from each type of bag.

1. Sack dimensions
2. Grammage/ thickness
3. Tensile strength measured by the "drop test"

52 kgs of BOP grade tea was packed in each sack (6 numbers from each type) and stored in the Division and the humidity in the room was also recorded. Initial moisture content of the tea was also recorded. At the the end of each month duplicate samples of teas were drawn from each bag and the moisture content and the chemical parameters such as TF, TR, total colour etc were analyzed.

The samples were also evaluated by tasting (sensory evaluation) and also sent to three professional tasters for their evaluation. The results after 2 months of the trial are summarized below.

Dimensions of Tea Sacks

Empty sacks (lay flat) dimensions

	Control Safe tea sack	New tea bag Metalized	New tea bag Al Kraft Papeer
Sack length(mm)	1078-1080	1055-65	1060
Sack width (mm)	700	703-705	705
Width of bottom(mm)	212-215	200-204	205-207

Grammage (gsm)

	New tea bag Metalized	New tea bag Al Kraft paper
LDPF	20	20
Aluminium	20	21
Kraft Paper	65	65

Filled sack dimension

	Control Safe tea sack	New Tea bag Metalized	New tea bag Al Kraft Paper	
Sack length(mm)	1110	1100	1080	
Sack width (mm)	535	540	520	
Width of bottom (mm)	270	272	315	
	TF%	TR%	Colour	Moisture
Initial bulk Tea	0.8308	14.04	3.40	3.7

After one month,

Sacks	TF%	TR%	Colour	Moisture
STS 1	0.9281	14.36	3.83	3.95
STS 2	0.8359	14.58	3.77	3.7
NTB(M) 1	0.8313	14.43	3.73	3.85
NTB(M) 2	0.7639	14.35	3.83	3.75
NTB(AL) 1	0.8224	15.17	3.94	3.6
NTB(AL) 2	0.8314	14.76	3.99	3.8

After Two Months

Sacks	TF%	TR%	Colour	Moisture
STS 1	0.8392	14.35	4.00	3.0
STS 2	0.8100	15.45	3.89	3.7
STS 3	0.8932	13.78	4.00	3.8
STS 4	0.9070	14.10	3.74	3.7
NTB(M) 1	0.8452	14.36	3.90	3.9
NTB(M) 2	0.8674	14.77	4.02	3.8
NTB(M) 3	0.7800	14.85	3.97	3.9
NTB(M) 4	0.8320	14.87	3.88	3.7
NTB(AL)1	0.8336	12.88	3.81	3.7
NTB(AL)2	0.8885	14.14	4.12	3.9
NTB(AL)3	0.8460	14.59	3.39	3.9
NTB(AL)4	0.8430	15.40	3.93	3.8

These trials are expected to continue till end of February next year.

M. T. Ziyad Mohamed, K. Raveendran, S. H. Priyanthi, L. Jayasinghe

7. Seminars/ Lectures

Dr. M. T. Ziyad Mohamed

Presented a paper titled "Keeping quality of Teas" at a seminar organized by John Keels Ltd at TRI, Auditorium, Talawakelle on 3rd January.

Presented a seminar titled "CTC Manufacture in Kenya" based on the information gathered during his visit to Kenya in October/November 1996, at TRI, Auditorium on 22nd January.

Addressed RSC I seminar for Superintendents/ Asst. Superintendents at TRI, Auditorium on 27th February.

Addressed RSC I seminar for Factory Officers at TRI, Auditorium on 10th March.

Addressed RSC VII seminar at Hotel Reef Comber, Hikkaduwa on 14th March.

Addressed a seminar organized by District Planters' Association at Talawakelle Club on 21st July.

Attended a seminar and exhibition titled 'Tea and Health' in Colombo on 14th and 15th August.

Delivered a lecture on 'Tea Manufacture' for the students following Plantations Evaluation Course at Faculty of Agriculture at University of Peradeniya on 06th September.

Addressed the staff of Watawala Plantation Ltd on 'Finer points in tea Manufacture' at Waltrim Factory on 29th September.

Addressed a seminar on 'Tea Manufacture' for Superintendents and Factory Officers at Maskeliya Club on 1st October.

Addressed the participants on 'Finer points in tea manufacture' at Mid Country RSC IV seminar held at Hantana on 11th December.

8. Training Programs/Paper presentation

Dr. M. T. Ziyad Mohamed served as a resource person for the following factory officer training programme (skill development in tea manufacture), at NIPM Bogawantalawa on the following dates;

27 th and 28th April

04 th 06th May

06 - 09th July

14 - 17th September

11th - 12th November

12 - 14th December

Dr. M.T. Ziyad Mohamed conducted Factory Officer training programe on 'Tea Manufacture' for Factory officers attached to Kahawatte Plantations Ltd on 2nd May.

Factory Officer training programe on 'Tea Manufacture' for Agrapathana Plantation Ltd on 19th May, at Agras Club.

Training programe on 'Tea Manufacture' for Superintendents and Assistant Superintendents on 20th May at Agras Club.

Dr. M.T. Ziyad Mohamed served as a resource person for National Certificate Examination in Tea Manufacture for factory officers on 12th June, 17th July and 25th September.

Dr. M.T. Ziyad Mohamed presented a paper on Solar Energy Project at a seminar held at NARESA on 29th October.

Mr. G. C. Galahitiyawa served as a resource person for factory officer training programmes on “Tea Manufacture” on the following dates at NIPM Bogawantalawa.

17th, 19th and 20th July

28th, 30th and 31st August

15th September

25th, 27th and 28th September

10th November

Training programmes on “Tea Manufacture” for Assistant Superintendents at NIPM on 12th June.

9. Visitors

The number of visitors during the above period to the Technology Division was 12.

10. Advisory Reports

During the period under review, 29 advisory visits to factories were made by the members of the Technology Division, including low country, on various aspects of tea manufacture and factory development. This excludes seminars and NIPM factory officer training programmes.

The number of samples received from estates for determination of moisture content percentage was 1009. These were reported with advice for correction of defects wherever necessary.

STATISTICS

T.S.N. Senaratne

General

Ms. N Senaratne continued to assist various research disciplines of the Institute in statistical analyses of their experimental data. She served as Assistant Coordinator for Information for Agricultural Research Managers (INFORM). She also completed Part I & Part II of the ACS (Australian Computer Society) examination.

In 1997 the following standard analyses of experimental data were carried out, mainly using the SAS statistical program:

Completely Randomised design	10
Randomized Complete Blocks	195
Split-Plot	64
Split-split-Plot	7
Incomplete Blocks	27

Of these, 21 had factorial treatment structure and 6 involved covariance analysis.

Correlation/Regression analysis 15

On the administrative side, a program was developed in Visual Basic for presentation of St Coombs workers' salaries.

AGRICULTURAL ECONOMICS UNIT

Officer -in -Charge J.A.A.M. Jayakody

1. General

Mr. B. Sivaram left the TRI in October after completing a three and a half years consultancy period in the unit.

Mr Dilkalum Pallihakkara, NDT trainee from the NAB, completed his 4-month training programme in March. Miss H.W. Shyamali started working as a temporary Research Officer w.e.f April, for the CADMAR research prioritization programme under the financial assistance of the GTZ- CARP research management project. Miss.M.H. Attanayake joined the unit in June as a graduate trainee of the Ministry of Youth Affairs. Mr R. Ravishankar, final year student from the Department of Extension, Faculty of Agriculture, Peradeniya completed a 3-month research programme in October on "Ergonomics of Tea Plucking".

2. Divisional Activities:

2.1. Research Prioritization.

The Composite Approach to Decision Making in Agricultural Research (CADMAR) approach is continued and co-ordinated by the AEU with the technical assistance of the GTZ-CARP research Management project. In this approach 25 applied research thrusts with 82 projects covering most aspects of the problems/constraints of the tea sector were identified for prioritization.

There are 8 steps in the process of implementation of CADMAR, namely (i) Identification of the problems and constraints limiting productivity and/or the profitability of the industry, (ii) Classification of them according to researchability, (iii) Formulation of research thrusts, (iv) Assesment of the profitability of success of and the time needed for completion of the Research Thrusts, (v) Estimation of the costs of the research Thrusts, (vi) Estimation of the Aditonal Benefits of the Innovations resulting from the Thrusts, (vii) Tabulation and presentation of the data which permits the comparision of Research Thrusts, and the setting of Research Priority and finally (viii) Prioritization of the Research Thrusts.

Step (vi) is now almost complete and the next two steps could be completed within the first quarter of the next year. In order to balance the current and future research information requirements of the Institute a basic research programme has also been identified including fifty two basic research projects.

J.A.A.M. Jayakody and H.W. Shyamali

2.2. Economic Studies

The following studies were completed during the year 1997.

2.2.1. Financial Viability of Replanting in Estates and Smallholdings

An analysis of financial returns of replanting was undertaken, separately for the estate and smallholder sectors based on the position prevailing at the end of year 1996. The results obtained are given in the table below. It shows the improved financial viability of replanting in all segments of the tea industry following recent market changes.

Elevation	Average NSA for year 1996 (Rs/kg)	NPV @ 15% interest rate	
		Estates	Smallholdings
Low	114.35	17608	211477
Medium	89.70	-4560	35796
Up	93.38	138151	54706

B. Sivaram and G. Ganewatte

2.2.2. Economics of Shade Management

A cost-benefit analysis of shade establishment and management was done using replacement cost approach with the view of highlighting the importance of shade in tea. The following table summarises the overall annualised cost and benefits of shade management for one hectare of tea land.

TABLE - Overall Cost and Benefits of Shade Management in Up and Mid Elevation(Rs/ha/year)

Cost	Rs	Benefit	Rs
Quantifiable			
Establishment cost	338.87	Addition of Organic Matter	7688.00
Shade Management	996.50	Fuel Wood Value	3600.00
Fertilizer Uptake	950.00		
Gain	9002.63		
Total	11288.00		11288.00

Non - Quantifiable

Blister - Blight Occurance

Pest and Disease Control
Quality Improvement
Less Soil Erosion
Build Up of Soil Organic Matter
Increased Water Holding Capacity

B. Sivaram and G. Ganewatte

2.2.3. Domestic Resource Cost of Tea Production

An analysis was done to examine the comparative advantage of tea production using the Domestic Resource Cost approach.

B. Sivaram

2.2.4. Economic Evaluation of Bag Plants vis-a-vis Bed Plants

An analysis was done to examine the economic significance of bag plants compared to bed plants using all quantifiable costs and benefits of the practices. Results showed a very small financial advantage in using bag plants compared to the bed plants. It is now important to convince tea producers of the non quantifiable benefits that can be obtained by using bag plants compared to bed plants through the TRI extension programmes.

G. Ganewatte and J.C.K. Rajasinghe

2.2.5. Financial Analysis of Replanting with and without Rehabilitation

A preliminary analysis was done using data obtained from a tea field of the Waltrim Estate to compare the financial viability of two approaches to replanting old seedling tea fields. Direct replanting with SALT shows very high financial attractiveness compared to the conventional method. The result obtained is location specific and therefore it is not possible to reach a general conclusion at this stage. Since the long term impact of the SALT system is not properly assessed and the agronomic feasibility of the technique is not fully explored, the applicability of this result is very limited.

G. Ganewatte

2.2.6 Optimum Pruning Cycle Length

Preliminary results obtained from an analysis of field data from several estates in different locations indicated that more estates would need to be sampled, as results were very location specific. The object of this work was to determine the optimum pruning cycle length for tea fields in different locations. Data analysis is in progress for Concordia Estate, Nuwara Eliya. Further analysis is required to confirm the results.

J.A.A.M. Jayakody , G. Ganewatte and M.H. Attanayake

2.2.7 Cost of Tea cultivation

An analysis on the annual cost of tea cultivation in different locations was initiated with the objective of developing financial guidelines for decision making in tea cultivation. Cost estimation of establishing and maintaining a tea nursery, replanting and maintaining young and mature VP fields, maintenance of high and low yielding seedling fields in four different elevation categories were initiated.

J.A.A.M. Jayakody and M.H. Attanayake

2.3. Development Planning

2.3.1. Nuwara Eliya District Development Plan

A complete report covering various aspects of estates and smallholdings of the district was prepared.

B. Sivaram

2.4 Geographic Information System studies in Tea Sector

2.4.1. Development of a Tea Information System

A collaborative project to study the potential use of GIS for Land Use Planning in tea estates continued between the Tea Research Institute and the Environment and Forest Conservation Division of the Mahaweli Development Authority. As it was decided to build up the GIS capabilities within the Institute by having basic software and hardware, PC Arc/Info and Arc View 3 software programs were purchased. An order has been placed to purchase a computer with the necessary technical specifications, in order to develop an Information System for the Plantation sector. A questionnaire was developed and is ready to be distributed to tea estates to collect estate information.

J.A.A.M. Jayakody

2.4.2. GIS application for Tea Estate Planning

Results of the GIS study carried out in five tea estates in Nuwara Eliya District managed by the Kelani Valley Plantation Ltd, for the purpose of selecting suitable lands for forestry programmes were presented at the 3rd Annual Forestry Symposium held on 12th and 13th December 1997 organised by Department of Forestry and Environmental Science, University of Sri Jayawardenapura.

J.A.A.M. Jayakody and R.M.S.S. Rajapakse

2.4.3 Land Use Planning for Development of Marginal Tea Lands

A contract research project funded by CARP No 12/302/235 - "Land use planning for development of marginal tea land with multiple objectives in the mid-country" was completed. At the review of the project it was decided to include the soil information also in digital form. Therefore soil surveys were initiated in November 1996 in five out of the six estates where the land use study was carried out. The soil survey was completed in Westhall, Craig head, Galphelle and Hantane Estates, and is still in progress at Rattwatte estate. The soil surveys were carried out in collaboration with the SPND of TRI and

the ENDEV project of the Mahaweli Authority, Polgolla. Work at Westhall estate was carried out as a case study to train TRI staff in Aerial Photo Interpretation for identification of land forms for soil sampling and to describe soil profiles.

J.A.A.M. Jayakody , R.M.S.S. Rajapakse and Manoj Jayawardena

2.4.4. GIS application for the smallholder sector

A GIS application on the tea smallholder sector, to study the desirability of this technology being used in the sector, continued. The report presenting the final outcome is to be written jointly by the TRI, TSHDA and the EFCD of the Mahaweli Authority.

J.A.A.M. Jayakody

2.5 Socio-economics Studies

A survey was initiated to study the labour scarcity problem prevailing in the Low Country tea estates due to labour migration away from tea sector. The first questionnaire of a set of three was prepared and pre-tested in the Deniyaya area to collect information from the management point of view. Development of the other two questionnaires to collect data from the workers' point of view is in progress.

J.A.A.M. Jayakody, G. Ganewatte , J.C.K. Rajasinghe and
J.A.S.K.V. Jayasinghe

2.6 Miscellaneous Activities

Mrs. J.A.A.M. Jayakody and Gaminda Ganewatte continued to participate in the monthly group meeting of Socio-economist and Policy Analyst in the National Agricultural System, organised by the CARP from 21 August 1997.

3. Publications and Presentations

3.1. Nuwara Eliya District Development Plan

A Monograph covering almost all aspects of development of estate and smallholdings in Nuwara Eliya District was published.

3.2. "Tea Bulletin"

Two articles titled "Replanting Reassessed" and "Economics of Shade Management in Tea Estate" were submitted for publications in the next "Tea Bulletin".

3.3. TRI Update

AEU contributed during the year by providing an article on "Bag Plants vis-a-vis Bed Plant - an Economics Overview".

3.4 "Ranpath"

AEU contributed to the "Ranpath" Sinhala magazine published by TSHDA, providing an article on financial gains from replanting.

3.5 Other

"Land Use Planning for Agro-Forestry Programmes in Tea Estates" was submitted to the proceedings of the third annual forestry symposium of the University of Sri Jayawardenapura.

3.6. Seminars and Meetings

The following meetings and seminars were attended by the divisional staff:

- i) Presentation on "Economics Aspects of Nitrogen Fertiliser" by Mrs. J.A.A.M. Jayakody at 194th E & E meeting on Revised Fertiliser Recommendation in June.
- ii) Presentation on "Worker motivation" at the seminar by Mr. Sivaram organised by PHSWT in Ratnapura in July.
- iii) Presentation on "Productivity and Quality Improvement in Tea" by Mr. Sivaram at a PMC seminar.
- iv) Presentation on "Land Use Planning for Agro-Forestry Programmes in Tea Estates" by Mrs. J.A.A.M. Jayakody at the 3rd Annual Forestry Symposium held on 12th and 13th December 1997 organised by Department of Forestry and Environmental Science, University of Sri Jayawardenapura.

4. Overseas Visit

Mrs. J.A.A.M. Jayakody participated the Second Indian Annual ESRI/ERDAS User Conference held in New Delhi on 2nd and 3rd December 1997.

St. Coombs / Lamiliere Estate

1. General

Mr. M. W. Newman Superintendent of Ouvakelle Estate was over looking this property upto 10th May

Mr. Hiran Dunuwille was appointed as Superintendent on St. Coombs/St. Joachim Estates with effect from 10th May

Mr. D. H. Wickremasooriya was appointed as Visiting Agent to St. Coombs and St. Joachim Estate from July 1997.

Mr. P. Periyannen - Chief Clerk was transferred to St. Joachim Estate with effect from 01st June and Mr. A. R. William the Senior Assistant Clerk is acting for the Chief Clerk.

Mrs. K. Asalinona who was appointed as Medical Assistant on casual basis retired in June.

Mr. H. M. R. Kuladasa was appointed as Junior Assistant Factory Officer with effect from 1st June.

Mr. S. Fernando was appointed as Estate Medical Assistant with effect from 23rd June.

Mr. K. Selvaraj was appointed as driver with effect from 01st September.

Mrs. K. G. S. Sriyani was appointed as Midwife with effect from 1st August.

Mr. S. M. Sunil Shantha was transferred to St. Coombs Estate from St. Joachim Estate with effect from 01st December.

2. Weather and Rainfall :

A rainfall of 2395.9 mm has been recorded over 199 wet days as against 2199.2 mm over 199 days in 1996.

3. Hectarage Statement

The revenue extent of St. Coombs and Lamiliere were 98 Ha. and 48 Ha. respectively, totalling 146 Ha.

4. Crop and Yield

	1997		1996	
	Crop	Yield	Crop	Yield
St. Coombs	188,515	1,923	183,395	1,877
Lamiliere	91,203	1,898	78,767	1,624
Total	279,718	1,915	262,162	1,793
Bought Leaf	104,319		113,432	
Grand Total	384,037	1,915	375,594	1,793

5. Tea Prices

Apart from topping the Western market on several occasion, St. Coombs recorded an all time highest price of Rs. 204/- per kilo for B.O.P. grade in March 97 and Rs. 176/- for Dust No. 1 in June.

6. Working Results

Made a profit of Rs. 7,922,124.19

7. Nursery

A total of 38,900 plants of clone TRI 2025 and from TRI 3000 and 4000 series were raised in the Nursery for planting and infilling.

8. Labour

Labour on St. Coombs and Lamiliere has been quiet and the health of labour was satisfactory. Wiring (electricity) of labour cottages is in progress, A loan from TRI was granted for this purpose, and to be recovered from labour on installment basis.

TABLE 1 Working account of St. Coombs/Lamilere for the year 1997 compared to previous years.

Year	Total crop kg(MT)	Bought leaf (Kg)	Yield (kg MT/ Ha)	Nett sale Average Rs. cts	Cost of Production Rs/kg		Gross Profit + Loss - Rs	Actual Profit + Loss - Rs
					Estimated	Actual		
1993	246,267	102,211	1696	87.02	74.36	88.43	-463,497.40	-463,497.40
1994	467,687	91,434	1,845	89.60	84.36	85.01	1,828,191.13	1,828,191.13
1995	292,530	107,765	2,001	93.52	83.03	82.56	2,965,830.76	2,965,830.76
1996	262,162	113,432	1,793	106.52	83.09	92.69	5,194,465.00	5,194,465.00
1997	279,718	104,319	1,915	120.30	85.79	99.49	7,922,124.19	7,922,124.19

MT - Made Tea

Table 2 Monthly Yield (kg/ha), Rain fall and average 'N' applied from 1993 to 1997 - St. Coombs Estate

Months	1993	1994	1995	1996	1997
January	109	172	206	148	161
February	57	153	168	102	86
March	90	140	136	74	58
April	178	199	184	93	69
May	125	199	276	424	413
June	236	146	172	105	140
July	119	112	119	150	203
August	92	105	190	140	115
September	155	163	132	93	109
October	146	173	205	164	190
November	192	164	184	198	196
December	<u>196</u>	<u>170</u>	<u>178</u>	<u>186</u>	<u>193</u>
Total	1695	1896	2150	1877	1923
Rain fall (mm)	2918.7	2356.1	2291.9	2199.2	2395.9
No. of wet days	220	220	188	210	199
Average N (kg ha ⁻¹ yr ⁻¹)	222	220	234	258	226

Table 3 Monthly yield (kg/ha) of fields with amounts of "N" applied - St. Coombs (1997)

Field No.	Ext-ent Ha	Total "N"	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1	7.1	200	149	64	75	85	471	181	189	166	126	172	200	181	2059
2	2.6	165	66	119	80	83	480	211	232	146	120	254	305	180	2276
3A	7	230	292	119	65	63	566	171	247	197	86	255	232	280	2573
3B	6.7	230	274	87	88	81	544	195	304	128	180	308	299	350	2838
4	9.1	200	178	118	66	83	481	212	298	155	140	239	231	186	2387
5	7.4	195	120	123	80	138	377	266	247	190	165	342	291	323	2662
6A	3	95	101	24	23	14	246	P				14	69	184	676
6B	2.9	95	112	42	31	37	113	P					53	16	404
7	4.7	230	149	142	44	68	520	136	203	125	158	183	203	130	2061
8	5.2	200	98	77	49	66	402	93	345	137	119	220	213	181	2000
9A	3	150	268	123	68	82	292	235	170	210	238	326	377	291	2680
9B	4.8	150	213	91	47	85	574	144	260	120	158	235	222	238	2387
10	0.5	165	594	246	176	88	334	324	346	108	206	138	192	272	3024
10B	2	165	159	73	77	49	320	176	274	122	145	249	297	198	2139
11A	2	230	266	125	73	179	428	110	157	80	188	442	221	343	2612
11B	4	190	128	98	56	48	264	129	156	76	63	99	136	223	1476
12A	1.2	230	272	144	84	71	564	186	222	128	130	115	163	261	2340
12B	7.1	90	94	57	50	29	301	71	173	75	48	108	112	93	1211
13	10.4	40	68	25	24	16	234	9	4	5	4	3	28	32	452
14	7.3	200	129	49	43	72	466	103	259	90	101	177	186	168	1843
	98		161	86	58	69	413	140	203	115	109	190	196	193	1923

P - Pruned

8. Cultural Operation

Field No.1	Seeding Tea (Ha)	V.P Tea (Ha)	Clones	Last Pruned	Planting Year	Yield per Hect 1996	Yield per Hect 1997	Shade
1	Nil	7.1	TRI 777 2016-2023 2025 & DN	Aug 1994	1953-1959 1993	2791	2059	Dadaps & Grevillea
2	Nil	2.6	TRI 2143 2142-2025 DT 1 & DT95	Aug 1996	1964	1091	2276	- Do -
3	0.4	13.3	TRI 2027 2043, 2025 WT 26	July 1993	1965-1966 1967-1968	2878	2705	Dadaps Grevilliea & Calliandra
4	Nil	9.1	TRI 62/9 2025, 3016 DN,N2 CY9	Oct 1995		1862	2387	Dadaps & Grevillea
5	Nil	7.4	TRI 2142 2023, 2025 TC9,DT95 & N2	May 1996	1970	999	2662	- Do -
6	Nil	5.9	TRI 2025 DN & N2	June 1997	1985-1986	1619	542	Grevillea
7	Nil	4.7	TRI 2024 2025, 62/9 DT 1 & DT 95	April 1996	1962-1964	2213	2061	Dadaps & Grevillea
8	Nil	5.2	TRI 2024, 2025 & DT 1	June 1994	1962-1964	1932	2000	Grevillea

Field No.1	Seeding Tea (Ha)	V.P Tea (Ha)	Clones	Last Pruned	Planting Year	Yield/Ha 1996	Yield/Ha 1997	Shade
9	4.8	3	TRI 3000 TRI 2025	Decem 1995	S 1935 VP 1986	1472	2500	Grevillea/ Dadaps
10	0.5	2	SALT area	July 1992	S 1935 VP 1991 1993	2730	2320	Grevillea/ Calliandra
11	4	2	TRI 2025 62/9, N2	July 1993	S 1935 VP 1988	1676	1857	Gravillea/ Dadaps
12	7.1	1.2	TRI 2025 K 145	June 1994	S 1935 VP 1985	1128	1376	Gravillea/ Calliandra
13	9.1	1.3	TRI 2025 7/27 & DN	July 1997	S 1935 VP 1986	1379	452	Do
14	1	6.3	TRI 777, 2024 & N2	June 1994	1961	2247	1843	Do

**Table 4 Monthly Yield (kg ha⁻¹), and average N applied from 1993 to 1997
- Lamiliere Devision**

Months	1993	1994	1995	1996	1997
January	105	167	184	120	149
February	86	129	161	98	76
March	111	149	114	63	58
April	202	143	171	153	76
May	174	172	196	287	311
June	189	134	146	113	186
July	108	107	60	118	196
August	79	112	134	123	111
September	158	192	93	82	142
October	125	115	161	133	191
November	185	158	141	176	209
December	176	161	144	158	193
	<u>1698</u>	<u>1737</u>	<u>1705</u>	<u>1624</u>	<u>1898</u>
Average N kg ha⁻¹ yr⁻¹	222	220	217	215	213

**Table 5 Monthly yield (kg ha⁻¹) of fields and amounts of "N" applied -
Lamiliere Division (1997)**

Field No.	Ext-ent	Total Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec												Total	
		"N"													
4	5.1	150	138	90	55	151	184	226	224	130	175	215	262	208	2058
4B	1.9	200	258	89	57	51	508	194	285	131	211	197	247	151	2379
5	1.5	80	52	61	41	27	168	87	81	43	55	72	59	51	797
6	2	40	55	24	18	13	201	76	101	51	77	63	89	62	830
6B	3	110	68	20	22	15	167	79	115	75	18	P		3	582
7	4.5	165	223	104	110	80	386	261	258	96	161	252	243	216	2390
8A	5	230	195	118	85	123	386	248	252	186	201	263	237	330	2624
8B	4	110	121	48	40	70	225	195	147	123	159	186	257	138	1709
9A	4	250	11	P	39	50	267	147	258	120	221	202	256	217	1788
9B	4	100	168	79	58	56	298	P			28	93	179	236	1195
10	6.6	200	194	97	56	69	388	240	213	126	134	224	239	197	2177
11	6.4	200	172	94	60	86	389	239	254	135	155	255	207	223	2269
	<u>48</u>	<u>213</u>	<u>142</u>	<u>76</u>	<u>58</u>	<u>76</u>	<u>311</u>	<u>186</u>	<u>196</u>	<u>111</u>	<u>142</u>	<u>191</u>	<u>209</u>	<u>193</u>	<u>1898</u>

10. Report on Lamiliere Division

11. Cultural Operation

Field No.	Seeding Tea	VP Tea	Clones	Last Pruned	Planting Year	Yield/Ha 1996	Yield/Ha 1997	Shade
4A		5.1	TRI 2025	June 1996	1984	988	2058	Dadaps & Gravillea
4B		1.9	TRI 2025	May 1993	1986	2241	2379	- Do -
5	1.5			June 1993	1935	689	797	- Do -
6A	2			June 1993	1935	767	830	- Do -
6B		3	DT 1-WT26 and TRI clones	August 1997	1990 and 1991	697	582	-
7			TRI 2025	July 1993	1983	2118	2390	- Do -
8A		5	TRI 2025	May 1995	1987/1983	2055	2624	- Do -
8B		4	TRI 2025 DN N2 CY9 WT 26 &	June 1996	1989/1990	691	1709	- Do -
9A		4	TRI 2025	August 1996	1979	1584	1788	- Do -
9B		4	TRI 2025 DN & CY 9	May 1997	1980	1861	1195	- DO -
10		6.6	DN and TRI 2025	May 1994	1967/1969	2248	2177	Dadaps
11		6.4	DN and TRI 2025	July 1995	1970/1971	2013	2269	Dadaps

ST. JOACHIM ESTATE

1. General

Mr.S. G. Ekanayake functioned as Assistant Superintendent of St.Joachim Estate and Mr.H. L.Dunuwila, Superintendent of St.Coombs Estate was appointed to overlook St.Joachim. Mr.D.Hemant Wickramasooriya of Kelani Valley Plantations Limited was appointed as Visiting Agent for St.Joachim and he made his first visit to the property on the 6th September 1997.Estate Affairs Committee Meetings were conducted regularly with the Chairman,Director and other officials and matters pertaining to St.Joachim were fully discussed and remedial actions were taken.Messrs.Bartleet and Co., Ltd.,and Messrs.De Silva, Abeywardena & Peiris continued as Brokers for St.Joachim during 1997.The brokers requested us to desist from using the word "Clonal" as concern was expressed by consuming countries since of late as the word "Clone" has become synonymous with genetically manipulated material.As such the selling mark "St.Joachim Clonal" was changed as "New St.Joachim" with effect from November,1997.

This year too the factory functioned without the Head Factory Officer and a case is pending before the Labour Tribunal at Ratnapura.The Junior Assistant Factory Officer Mr.S.M. Sunil Shantha was transferred to St.Coombs Estate with effect from 1st December,1997.The Field Officer Mr.D.J.W.Ranawake did not work on the estate during this year too as he was mobilised for Army Voluntary Service.

2. Hectarage as at 31st December,1997.

	<i>ha</i>	
Mature V.P. tea	54.07	
Land under rehabilitation	27.75	
Estate Nursery	1.50	
Timber Clearing	3.34	
Abandoned tea	0.65	
Crop Diversification-Coconut	0.93	
Land under Rubber	12.30	
Land under Paddy	8.74	
Intercropping -Tea/Rubber	7.59	116.87

Other lands		
Acquisition by Government, buildings,roads,ravines and jungle	25.11	

Total extent	141.98	

3. Crop (made tea kg)

The production on St.Joachim Estate in 1997 compared to the previous year was as follows:-

<i>Year</i>	<i>Estate crop</i>	<i>Bought crop</i>
1996	63,330	1,094,941
1997	66,847	996,106

The production on the estate showed an increase of 3,517 in comparison to the previous year. This represents an increase of 5.55%.

3.1 Bought Leaf

The bought leaf manufactured at St.Joachim Factory showed a decrease of 98,835kg in comparison to last year. This represents a decrease of 9%. This decrease is mainly attributed to few more private factories being opened in the district and very wet weather prevailed through out the year.

4. Prices

All teas produced at St.Joachim Factory were sold at the Colombo Auctions in the Main Low Grown catalogue. Messrs. Bartleet and Co. Ltd. and Messrs. De Silva, Abeywardena & Peiris sold our teas in equal proportions.

The tea produced during the year was sold at a Nett Sale Average price of Rs.125/71. The Nett Low Grown Average for the year was Rs.129/47, thus the factory Nett Sale Average was Rs.3/76 below Low Grown Average. The average price paid for bought leaf during the year under review was Rs.19/29.5 per kg as against an average of Rs.17/31.9 paid in the previous year. The working of St.Joachim Estate resulted in a profit of Rs. 22,302,584/-. (Table 1)

5. Nursery

The supply of planting materials to Small Holders in the district continued this year too. Sale of planting materials as compared to the previous year was as follows. (The distribution of plants was done through the Tea Small Holding Develop. Authority.)

<i>Year</i>	<i>Shoots supplied</i>	<i>Income (Rs.)</i>	<i>Plants supplied</i>	<i>Income (Rs.)</i>
1996	-	-	8,750	26,250
1997	-	-	182,948	548,844

TABLE 1

**WORKING ACCOUNT OF ST. JOACHIM ESTATE FOR THE YEAR 1997
IN COMPARISON WITH PREVIOUS YEARS**

Year	Total crop sold(Made tea kg)	Yield/ha (Made tea kg)	Nett Sale Average (Rs/Kg)	Estimated cost of Production Rs.	Actual	+Profit -Loss Rs.
1991	*726,162 75,190	1,162	55/96	65/17.16	60/09.21	-2,653,503/=
1992	*338,205 31,463	693	70/00	64/10.00	72/60.08	-2,999,959/=
1993	*690,355 55,775	1,014	74/70	71/65.59	72/37.69	+1,734,553/=
1994	*865,691 57,487	1,045	69/49	66/13.84	69/53.08	-35,914/=
1995	*887,732 55,643	1,097	78/89	68/80.25	75/88.38	+2,827,076/=
1996	*1,094,941 63,330	1,248	113/81	87/06.38	102/30.88	+17,978,620/=
1997	*996,106 66,847	1,236	129/90	98/24.30	114/03	+22,302,584/=

* Bought crop

1997 Production - 137,186 kg of made tea unsold as at 31/12/97

6. Cultural Operations

Field No.1

V.P.Tea	... 5.85 ha
Clones	... T.R.I. 2023,2025,2026,2027 & S106
Last pruned	... July,1996
Yield per hectare 1996	... 372 kg
Yield per hectare 1997	... 497 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Plucking experiment has been carried out by TRI in machine plucking and as well as manual plucking.

Routine upkeep of the tea was done during the year.1600 V.P. plants of TRI 2025,2027 clones were used for infilling vacancies.

Field No.1A

V. P. tea	... 1.20 ha
Clones	... T.R.I. 2025,2027,S/106 & KEN
Last Pruned	... May, 1995
Yield per hectare 1996	... 2,124 kg
Yield per hectare 1997	... 2,555 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... nil

Upkeep of mana grass was undertaken during the year. Routine upkeep of the tea was done

Field No.2

V.P tea	... 4.12 ha
Clones	... T.R.I. 2025,2026,2027 & S106
Yield per hectare 1996	... 562 kg
Yield per hectare 1997	... 790 kg
Shade	... <i>Albizia and Gliricidia</i>

This field is under the supervision of the T.R.I. and is used for clonal proving trials.

Field No.2A

V.P.tea 0.93 ha
Clones	... T.R.I.2025,S106
Yield per hectare 1996	... 2,988 kg
Yield per hectare 1997	... 3,649 kg
Last pruned	... June 1995
Shade	... <i>Albizia and Gliricidia</i>

Intercropping area.Planted coconut in tea.Routine upkeep of tea and coconut was done during the year.

Field No.2F

V.P. tea	... 6.78 ha
Clones	... T.R.I. 2025,2026,2027 & S106
Last pruned	... May 1996
Yield per hectare 1996	... 788 kg
Yield per hectare 1997	... 1,641 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Machine plucking has been carried out by TRI Low Country Staff.

Routine upkeep of the tea was done during the year

Field No.3

V.P. tea	... 8.40 ha
Clones	... T.R.I. 2023,2025
Last pruned	... July, 1997
Yield per hectare 1996	... 1,452 kg
Yield per hectare 1997	... 788 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Nil

Routine upkeep of tea was undertaken during the year.

Field No.3 Rubber Area

The rubber in this area was tapped and the latex was given to Rubber Manufacturing and Exporting Corporation of Sri Lanka Ltd., at Kuruwita. Routine maintenance was carried out during the year.

Field No.10 Rubber Area

This field too was tapped and the latex was given to Rubber Manufacturing and Exporting Corporation of Sri Lanka Limited Kuruwita. Routine maintenance was carried out during the year.

Field No.10 Rubber Area (Part)

This was planted in 1990. The extent is 3.60 ha. Tapping was undertaken during this year. Latex was given to the Rubber Manufacturing and Exporting Corporation of Sri Lanka Ltd., Kuruwita.

Field No. 4

V.P. tea	... 5.85 ha
Clones	... T.R.I. 2023,2025,2026,2027,H50/1,S106
Last pruned	... June 1994
Yield per hectare 1996	... 1,030 kg
Yield per hectare 1997	... 1,180 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Machine plucking has been carried out by TRI Low Country Staff.

Routine upkeep was done during the year.

Field No.5

V.P.tea	... 8.20 ha
Clones	... T.R.I. 2023,2025,2027,H50/1
Last pruned	... May 1995
Yield per hectare 1996	... 771 kg
Yield per hectare 1997	... 1,996 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Weedicide and cover crop experiments were carried out

Routine upkeep was done during the year.6475 v.p.plants of TRI 2025, 2027 were used for infilling vacancies.

Field No.6

V.P. tea	... 1.50 ha
Clones	... T.R.I.2025,2026 & 2027
Last pruned	... June 1995
Yield per hectare 1996	... 2,943 kg
Yield per hectare 1997	... 3,121 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Nil

Routine maintenance was undertaken during the year in tea area as well as the area under mana grass.

Field No.8B

V.P.tea	... 4.30 ha
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This area which was excluded from tea-in-bearing hectarage in 1996 and was shown under abandoned tea.Now it is under mana grass.

Field No.8A

V.P.tea	... 6.00 ha
Clones	... T.R.I.2025,2026,2027, KEN,S106 and 3063
Last pruned	... July 1997
Yield per hectare 1996	... 2,396 kg
Yield per hectare 1997	... 1,782 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Nil

Routine upkeep was done during the year

Field No.8C

V.P. tea	... 1.90 ha
Clones	... T.R.I.2025,2027,KEN,S106 & 3063
Last pruned	... July,1997
Yield per hectare 1996	... 2,540 kg
Yield per hectare 1997	... 1,538 kg
Shade	... <i>Albizia and Gliricidia</i>
Experiments	... Nil

Routine upkeep of tea was undertaken during the year.
The following New Clearing work was undertaken during the year.

Field No.8D - 2.83 ha - Area under rehabilitation

Upkeep of Mana, lopping and weeding were done during the year.

Field No.1 - 4.80 ha - Area under rehabilitation

Upkeep of Mana, lopping and weeding were done during the year.

Field No.6 - 6.08 ha - Area under rehabilitation

Upkeep of Mana, lopping and weeding were done during the year.

Field No.5 - 5.60 ha - Area under rehabilitation

Upkeep of Mana, lopping, and weeding were done during the year.

Field No.4 - 4.14 ha - Area under rehabilitation

Upkeep of Mana, lopping and weeding were done during the year

Field No.8C - 4.30 ha - Area under rehabilitation

Upkeep of Mana, lopping and weeding were done during the year

Field No.8B - 2.02 ha

Replanting was undertaken in this field using Clones TRI 2025 2027 and 3061, 31150. The routine upkeep after the planting was done during the year V.P. plants were used.

7. Factory

Routine upkeep of factory building and machinery was done during the year. Painting the factory roof and doors and windows was done. A 300 KVA new generator was installed in the factory since the existing 200 KVA generator was inadequate to supply electricity to the factory as well as to all the bungalows. Re-siting of machinery has to be undertaken because of the installation of a new drier. Tarring the factory road was undertaken.

8. Buildings

All buildings on the estate were well maintained during the year. Renovation of 1 set of cottage type building near V.P. nursery to provide accommodation to 2 Jnr.Asst.Factory officers was undertaken

9. Labour

Health condition of the population was satisfactory. There were no strikes or major disputes. The estate was unaffected by any form of violence or disturbances during the year.

The monthly yield of St.Joachim Estate for 1997 in comparison with the yields obtained from 1992 to 1996 is given in Table 2 while the monthly yield of each field is given in Table 3.

TABLE 2

**Monthly yield (kg ha⁻¹), rainfall and average of N Applied
from 1992 to 1997 - St.Joachim Estate.**

Month	1992	1993	1994	1995	1996	1997
January	89	71	102	94	82	112
February	24	34	94	68	86	42
March	05	52	99	77	83	61
April	12	90	109	96	90	118
May	60	82	66	97	96	111
June	44	96	88	99	75	147
July	61	108	66	102	119	113
August	82	79	79	101	112	95
September	68	88	75	101	108	99
October	70	98	87	89	125	90
November	85	106	89	104	126	122
December	93	110	91	69	146	126
	-----	-----	-----	-----	-----	-----
	693	1014	1045	1097	1248	1236
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Total rainfall (mm)	3993.7	4589.3	3679.0	4216.2	3655.0	4552.3
No.of wet days	185	226	217	208	188	199
Average N (kg-1 ha-1 yr-1)	160	154	133	165	119	143

**Monthly yield(Kg ha-1) of fields with fertilizer mixture used and
amounts of N applied of St. Joachim Estate**

M O N T H S

Fld No	Exte. (ha)	Total	Fertilizer Mixture used	M O N T H S												Total
				J	F	M	A	M	J	J	A	S	O	N	D	
1	5.85	160	U/235	24	07	24	37	31	44	39	51	61	45	64	70	497
1A	1.20	160	U/235	219	104	175	309	178	222	215	188	238	222	233	252	2555
2	4.12	TRI	EXP.BLOCK.	48	17	33	64	78	82	83	63	81	77	83	81	790
2A	0.93	160	U/235	125	52	79	228	254	371	459	348	351	468	435	478	3648
2F	6.78	160	U/235	128	76	63	144	139	144	133	138	178	156	166	176	1641
3	8.40	140	U/235,U/300	105	27	42	106	118	127	53	06	26	11	84	83	788
4	5.85	140	U/235,U/300	96	23	46	84	95	120	107	118	127	112	134	118	1180
5	6.80	160	U/235	75	35	44	66	93	94	103	104	110	97	117	84	1022
5J	1.40	160	U/235	63	11	32	25	89	144	79	96	75	130	102	128	974
6	1.50	160	U/235	248	147	210	210	154	338	290	226	310	265	379	344	3121
8A	6.00	160	U/235,U/300	231	60	105	266	201	296	171	170	21	36	88	137	1782
8C	1.90	160	U/235	221	65	99	160	130	277	202	-	35	22	144	183	1538
3A	3.34	160	T/750	73	41	68	73	38	106	67	51	101	90	88	97	893
<hr/>				112	42	61	118	111	147	113	95	99	90	122	126	1236

Advisory and Extension Services Division

Actg. Head S. Wimaladharm

General:

Mr. S. Wimaladharm was appointed as Actg. Head of the Advisory & Extension Services Division with effect from 20th January 1997.

Mr. B.A.D. Samansiri, Advisory officer returned to the island on 8th December 1997 to begin the local research component of his M.Sc. programme.

Mr. J.C.K. Rajasinghe, Advisory officer was transferred to the Mid Country Station to cover up the functions of Mid Country Advisory Officer who was on a study tour in India

Mr. M.K.S.L.D.Amarathunga Extension Officer has completed his post graduate M.Sc. programme part 1 on 21 November and commenced his research project on "Impact of variation of the weather parameters on crop environment and productivity of tea land in Sri Lanka."

Mr. M.K.S.L.D.Amarathunga was transferred back to Ratnapura after covering up the duties of OIC Deniyaya who was on study leave for a period of nine months

Mr. H.J.M. De Silva was transferred back to Hantana in July from Low Country Station after covering up the duties of Mr. M.K.S.L.D.Amarathunga .

Mr. J. A. S. K.V. Jayasinghe returned to Deniyaya Station on 1st July after completing his post graduate Dioploa Course at Kothari, India.

Mr. S.T. Yatawatte followed a Course on Plantation Management at Kothari Agriculture Management Centre, Coonoor, Tamilnadu State, India from 10th July to 31st September.

The activities of Advisory and Extension service centres of Ratnapura, Passara, Talawakelle, Hantana, Kottawa, Deniyaya are as follows.

Special Events

1. Tea Research Board has already identified low country as the area that contributes most to the total production of tea in the country. Consequently it has decided to establish a Central Advisory Service at TRI Ratnapura to enhance the Advisory and Extension service in the area with effect from 20th January.

2. Experiment and Extension Forum for the Small Holding Sector.

An E & E Forum for the Small Holding Sector was held for the first time in Sinhala medium at TRI Low Country Station, Ratnapura on 5th December 1997.

Activities conducted by the Advisory and Extension Division, Low Country Station Ratnapura

S. Wimaladharmasena Senior Advisory Officer / Actg. Head

1. Advisory Correspondences

626 Advisory correspondences have been sent on routine advisory matters, preparation of development plans and on statistical information.

250 on call requests pertaining to the advisory matters were received over the phone and necessary advices given.

2. Advisory & Extension Visits

a. Advisory Visits

45 Advisory Visits to the Company Estates and 39 visits to the smallholding / private sector were made by the Advisory Staff on the following subject areas.

1. Yield declining studies and productivity assessment.
2. Preparation of pruning programmes.
3. Monitoring of shade trees and wind belts.
4. Preparation of manuring programmes.
5. Problems related to the nursery failures.

b. Extension Visits

Extension visits were made to estate and small holding sector to; evaluate and monitor the TRI 3000 & 4000 series colonial blocks; carry out a preliminary survey on bag plants Vs bed plants; and inspect and monitor the fertilizer trials.

3. Visitors to the Station

432 visitors of whom 103 Estate Management Personnel, 120 small and 60 private estate holders and 79 others visited the station seeking advise in relation to the problems such as nursery failure, Canker and wood rot drought casualties, termite and shot hole damage, labour shortage, productivity decline of the lands etc. 70 Universitys Diploma students and 70 others also visited the station for educational purposes.

4. Advisory & Extension programmes conducted

The following Advisory and Extension programmes were conducted by the Advisory Staff in collaboration with research staff.

a. Advisory Officers Meeting

Advisory Officers Forum meeting was held on October 03, at the Center, which was presided by the Director TRI Advisory and Extension Officers and Officers in charge of TRI stations attended.

b. E & E and RSC Meetings

1. An E & E Forum was held for the first time in Sinhala medium at TRI Low Country Station, Ratnapura on 5th December 1997 for the Small Holding Sector.

2. Senior Advisory Officer attended three RSC meetings conducted in Galle, Talawakelle and Kandy and addressed the executive staff of Plantation companies on Nursery Management and Pruning Practices.

3. Five Field days/seminar and four NIPM programmes for estate sector and three programmes for Small holder sector were held on pruning practices, fertilizer recommendation, harvesting and shear plucking pest and disease management, weed management and mitigation of drought hazards.

4. Eleven group/panel discussions for estate sector and twelve for small holding sector were held to exchange knowledge and experience on cultural practices and to draw up manuring and pruning programmes and development plans for their tea lands.

5. Ten skill development training programmes for the field staff of the estate sector and three for the small holding sector were held to develop practical know-how on nursery management and pruning techniques.(see plate -1)

Plate -1. Skill development nursery training programme conducted for small holders at Waralla Estate.

Plate-2.Field demonstration on correct mixing of straight fertilizer at a small holding site in Balangoda.

6. Eight field demonstrations were conducted at the adaptive fertilizer trials sites at Deraniyagala, Kalawana, Balangoda, Palawatta, Horana and Ingiriya, to disseminate knowledge on correct mixing and application of straight fertilizers, and on the precautionary measures to be adopted to mitigate drought effect (see plate No. 2).

A new adaptive fertilizer trial was established in Horana to conduct the community participatory agriculture demonstration for small holders in collaboration with Soil and Plant Nutrition Division / TRI and TSHDA - Regional centre - Kalutara.

7. Twenty three training programmes were conducted for University Students, Diploma students and G.C.E(O/L &A/L) Students in tea growing areas on “ Advantages of the adaptation of eco-friendly economically viable agriculture practices for sustainable productivity of tea land”

8. A meeting was held with TSHDA officials to discuss the programme of work of TRI/TSHDA adaptive trial in Kegalle, Kalutara and Ratnapura areas.

9. “Mass Media” approaches to disseminate knowledge.

a. Lak - handa Radio programme

Senior Advisory Officer attended the radio programme conducted live by Lak - handa Radio unit on the industry and its beneficial effects.

b. Video Programme

Preliminary work on production of a documentary video programme titled “Tea Industry in Sabaragamuwa Province” commenced in December to telecast at the 50th Anniversary Independence Exhibition to be held at the BMICH in 1998 (S.L.D.Amarathunga).

c. Documentary Report

The documentary report titled “Significance of the TRI Low Country Station on the tea industry in Sabaragamuwa province” was prepared by the Advisory Division and submitted to the Sabaragamuwa Province Exhibition Committee to be included in the documentary report “50 years progress in Sabaragamuwa Province,” for the 50th Anniversary Independence Exhibition to be held at the BMICH in 1998 (S.L.D.Amarathunga).

d. Participation at exhibitions

1. Sri Lanka Tea Exhibition and International seminar - at BMICH, 13-16th August, 1997.
2. Mahapola Exhibition at Baddegama.
3. 53rd Annual session - of SLAAS at University of Ruhuna from 8 to 12 December, 1997.
4. Preparation for the 50th Anniversary Exhibition at BMICH commenced.

9. Research and Development

a. A detailed survey commenced to collect information on the regionale profile on the extent, owner-ship pattern & distribution, productivity, weather pattern, soil status, manuring & pruning programme, factory information to prepare computer data base on Low Country Tea Planting District. (SW/SLD)

b. A nursery survey commenced to collect information on the performance of the bag plant vis-a-vis bed plant (SW)

c. Socio economic information was collected from the Community Participatory Training Programme and the demonstrations conducted at six sites where fertilizer adaptive trials are carried out. (SLD)

d. Updated the display panel at the Museum of Low Country Advisory Division. (SLD)

e. Preliminary arrangements have been made to prepare the model of a tea garden to display the cultural practices to be adapted to mitigate adverse effect of El - Nino at 50th Anniversary Exhibition at BMICH. (SW/SLD)

10. Soil pH analysis

569 Soil Samples were tested for soil pH and nursery suitability.

11. Advisory Publications Distributed

1. Advisory Leaflets (issued free)	1020
2. Publications Sold	32

12. Special Problems

Tea growers were advised on the precautionary measures to be implemented to mitigate adverse effect of the consequences of El - Nino which is expected in early part of 1998 by conducting informal discussions, field visits, demonstrations and distribution of leaflets and other publications.

Activities conducted by the Advisory and Extension Division, TRI, Talawakelle.

Officer in Charge C.C.Rajasingham

1. Advisory Correspondences

515 Advisory correspondences were sent on routine Advisory matters.

2. Advisory & Extension Visits

a. Advisory Visits

105 Advisory visits to the Company Estates and 21 visits to the small holding sector were made by the Advisory Staff.

3. Visitors to the Station

950 visitors including Estate Management Personnel, small and private estate holders and 2249 University Students / Diploma students and other students visited the station.

4. Advisory and Extension Programmes

The following Advisory and Extension programmes were conducted by the Advisory Staff in collaboration with research staff.

1 RSC Seminar

The following four RSC seminars were organized by the Nuwara Eliya District Planters Association (NEDPA) at TRI Talawakelle.

a. Seminar on “Tea Manufacture” for Superintendents and Asst. Superintendents.

b. Seminar on “Quality Tea Manufacture for Western Quality season” for the Factory Officers on 10th March.

c. Seminar for Superintendents and Asst. Superintendents on 29th The following subject matters were discussed and “Management of Blister Blight” “Tea Nursery Technology”, and “Harvesting practices to obtain better prices” 85 planters and 25 TRI officers participated.

d. Seminar for Superintendents and Asst. Superintendents was held on 4th September on the subject of “Integrated Soil Management”, and “Proposal for Development Plan for Nuwara Eliya District” 87 Superintendents, 19 Asst. Superintendents and TRI officers participated.

e. Four group discussions were conducted for Asst. Managers and Field Officers of estates managed by Maskeliya, Bogawantalawa and Madulsima Plantation Companies at the TRI. The subjects covered were “Dry weather pests”, “SALT and cover crops in tea” and “Effects of drought in tea field”. 13 participants attended the discussion. Short lectures were conducted by senior scientists on relevant subjects which were followed by open discussions.

2. Workshops on plucking and interrelated activities were conducted for field staff and workers attached to 13 estates managed by 4 plantation companies and some private estates. A total of 520 field staff and workers participated in these workshops which were held at TRI Talawakelle. In addition, another workshop was conducted on “Nursery Techniques” to ensure success in the nursery and identify common error in the nursery.

3. Seven nursery training programmes were conducted for the following estates: Concordia, Annfield, Ferham, Edinburgh, Ingestre, Pedro, Glassaugh and Diyagama.

4. Seventy one plucking seminars were conducted for estate field staff, Kanganies and pluckers.

5. Extension programme for small holder sector

Three workshops on nursery practices, two seminars on plucking and replanting were held for small holders in the Nuwara Eliya District.

6. Six lectures and demonstrations were conducted for under graduate students of Affiliated Universities and diploma students of Aquinas, Gampaha Polytechnic College, Puliyankulama and Kundasale Technical Colleges.

5. Preparation of Extension Teaching Materials

a. Video Programme

Video filming of earthworm project at Kotmale and on shear plucking Craig Estate Bandarawela (J.C.K.Rajasinghe) at completed Preparation of video film on "Replanting" is nearing completion (J.C.K.Rajasinghe and Bandula Perera)

b. Advisory booklet on "Chemical control of tea peste" has been prepared (V.S.Sidhakran).

c. Preparation of 150 slides in various field operations has been completed (V.S.Sidhakaran).

d. Preparation of an advisory leaflet on "Field planting of tea" is in progress (J.C.K.Rajasinghe with staff from Agronomy Division).

6. Research and Development

Information on general profile of upcountry tea lands was collected and processed to formulate a development plan for tea in the Nuwara Eliya District. This information includes the general distribution of tea lands and their productivity and resilient agricultural problems faced by the estate and small holders and the recommendations to improve the agricultural aspects in the district. This has since been published by TRI in December 1997 (C.C.Rajasingham and V.S.Sidhakran).

A preliminary study on possibility of extending length of pruning cycle was initiated by gathering information from estates in Upcot area (J.C.K.Rajasinghe and V.S.Sidhakran).

Publication on "Tea nursery survey" conducted in the up country estates in 1995 has been updated and forwarded for publication.

(V.S. Sidhakaran, C.C. Rajasingham)

Exhibitions participated :

Staff attended the following exhibitions

Agricultural, Animal husbandary and Environmental exhibition at Nuwara Eliya.

Mahapola Exhibition at Baddegama (with TRI Kottawa) and Kuliypitiya (with TRI-Kandy) and Tea & Health Exhibition at BMICH-(with TRI- Ratnapura).

Industrial exhibition at Ruhunu University in collaboration with TRI Ratnapura.

**Activities conducted by the Advisory And Extension Division,
Mid Country, Station Kandy.**

Advisory Officer : S.T. Yatawatta.

1. Advisory Correspondences

295 Advisory correspondences were sent on routine Advisory matters.

2. Advisory & Extension Visits

a. Advisory Visits

101 Advisory visits to the Company Estates and the small holding sector were made by the Advisory Staff.

3. Visitors to the Station

557 visitors including Estate Management Personnel, small and private estate holders and 111 University Students, Diploma students and other students have visited the station seeking advise on tea cultivation and related problems.

4. Advisory and Extension Programmes conducted

1. RSC Seminar

Five RSC seminars were held for the Superintendents and Asst. Superintendents. Subjects covered were pruning, nursery management and drought management

2. Ten Field day sand seminars were conducted for field staff of estate to impart practical know-how on areas such as drought management, nursery management and other cultural practices.

3. A tea manufacturing seminar was held for the Factory Officers.

4. A seminar was held to disseminate recent research findings to the Tea Inspectors and Extension Officers.

5. Ten Field days/Seminars were conducted for the tea small holding sector.

6. Four practical training programmes were conducted for the Diploma holders of Anuradapura, Akmeemana, Kundasale and Vavunia Technical Colleges.

7. Senior Advisory Officer conducted lectures and demonstrations for field officers at NIPM, Bogawanthalawa on 23 November.

8. A meeting was held with TSHDA officials to discuss the co-ordination of TRI/TSHDA adaptive trial in Kandy.

9. Exhibition participated

Staff participated at Mahapola Exhibition held at Kuliypitiya from 5th Jan. to 04th Feb. and at Sri Sumangala Vidyalaya, Kandy.

10. Soil sample analysis
1629- Soil samples were analysed for pH value.
11. Research and Development activities.
 - a. Advisory Officer attended to the Sinhala translation of the TRI Field Guide book
 - b. Updated the regional statistical information on the tea growing areas in Kandy.

**Activities conducted by the Uva Advisory And
Extension Centre, Passara**

Officer in Charge : M.B.A.Perera

1. **Advisory Correspondences**
294 Advisory correspondences were sent on routine Advisory matters and other problems.
2. **Advisory & Extension Visits**
74 Advisory visits to the Company Estates and the small holding sector were made by the Advisory Officer.
3. **Visitors to the Station**
304 visitors including Estate Management Personnel small and private estate holdings, University students, Diploma students and other students visited the station.
4. **Advisory and Extension programmes conducted**
 1. **Advisory Officers Forum**

Advisory Officers Forum meeting was held on February 24th at the Center. Dr. G.D. Wimaladasa Deputy Director Research (Production) also participated with the Advisory and Extension Officers and Officers in charge of TRI regional centres.
 2. **RSC Meetings**
 - a. Two Regional Scientific Committee meetings were held at TRI Uva Centre on 9th January and 17th March.
 - b. Advisory Officer in charge attended the RSC Kandy seminar held at Gannoruwa, on 5th March and Southern RSC seminar held at Hikkaduwa on 14th March.
 - c. RSC- seminar was held at Bandarawela on 13th June on the subject "Productivity improvement in Uva tea lands".
 - d. RSC group discussion was held at Uva Centre on 24th June for planters from Passara, Lunugala, Madulsima and Namunukula sub regions.

e. Three Group discussions were held at Hali Ela and Bandarawela for Asst. Superintendent of Agarapatana Plantation Ltd.

3. A field day was held on "Shear Plucking" at St. James Estate, Hali Ela for the staff of Malwatta Valley Plantation Ltd. on 10th January.

4. Special field day was held at Malwatta Valley to study extent affected by the weed Pasali by a team of scientists from TRI and University of Peradeniya on 25th January.

5. Advisory Officer in charge participated at a seminar on "Pesticide Safety" at TRI Talawakelle on 22 January.

6. Ten Seminars for small holders were held at Medawelagama, Attampitiya, Welgolla, Welimada, Lunugala, Kandahena, Bandarawela, Agratenna and Boralanda.

7. Two field days were held at Verellapatana and Conogolla estate on dry weather pests.

8. Advisory Officer in charge served as a resource person for two training programme conducted by NIPM, for field officers.

9. Advisory Officer in charge participated as a resource person for training programme conducted by TRI Kandy, for field officers.

10. A meeting was held with TSHDA officials to discuss the co-ordination of TRI/ TSHDA adaptive trial in Uva.

11. Exhibition participated

a. Sri Lanka Tea Exhibition and international seminar at BMICH, 13 - 16th August.

b. Mahapola Exhibition at Baddegama in September.

c. 50th Anniversary Exhibition at BMICH.

5. Research and Development

a. Out door filming to produce a video film on "Land selection and preparation of land for Replanting tea" is nearing completion (J.K.C.Rajasinghe and M.B.A.Perera).

b. Advisory Officer attended to the Sinhala translation of the TRI Field Guide book.

c. Preparation of a leaflet on "Tea Industry in Sri Lanka" for the 50th Anniversary of Independence Exhibition(M.B.A.Perera).

6. Soil analysis

1629- Soil samples were analysed for pH value.

400- Soil samples were tested for Organic Carbon %.

7. Special Problem encountered

Terminal die back on Clone TRI 2023 and poor recovery after pruning was observed in some estates in Uva region. Variegated foliage and toxicity symptoms were also observed in young tea fields and field recovering from pruning.

**Activities conducted by the Advisory and
Extension Centre, Kottawa**

Advisory Officer / OIC: K. D. Dahanayake

1. Advisory Correspondences

114 Advisory correspondences were sent on routine Advisory matters and other problems.

2. Advisory & Extension Visits

81 Advisory visits to the Company Estates and the small holding sector were made by the Advisory Officer.

3. Visitors to the Station

171 visitors including Estate Management Personnel, small and private estate holdings University and Diploma students and other students visited the station.

4. Advisory and Extension programmes conducted**1. Advisory Officers Forum**

Advisory Officers Forum meeting was held on 26 May at the Center. DDR(T) participated with the Advisory and Extension Officers and Officers in charge of TRI regional centres.

2. RSC - Seminars

Organised two seminars for estate executives and officers from TSHDA and Tea Commissioner's Division. The Director, Actg. Head Advisory and Extension Services, Chairman, Vice Chairman and General Secretary of Planter's Association also participated. The subjects discussed were Plucking, Pruning, Fertilizer, Weed management, Nursery and Pest and Diseases.

3. Seminars for the estate executive staff

20 seminars were held to estate executive staff attached to Watawala, Namunukula, Elpitiya and Hayleys plantations Ltd. and John Keels on Plucking, Pruning, Fertilizer, Weed management, Nursery, Shear plucking, Shade management and Pest and Diseases.

4. Training Programme for Small Holding Sector

59 Groups of small holders were trained at Kottawa Centre and also at Galle, Matara, Baddegama, Elpitiya, Hiniduma and Udugama areas. The topics covered were on Plucking, Pruning, Fertilizer use, Chemical weeding, Nursery and Shade. The usual problems encountered by them were raised and satisfactory solutions given.

5. Fifteen small holder group discussions were conducted at the Centre on the following topics: Cultural operations, shear harvesting, Fertilizer application, Dolomite application and pH testing.

6. Four other training programmes for officials of Government Department, Fertilizer companies, Teachers and School children on all cultural operations and effects of El - Nino were conducted.

7. Four "Sramabimana" Training Programmes were conducted for rural youth pluckers including small holders of the area with the assistance of TSHDA officials at Kottawa Centre.

8. Officer in Charge participated at District Co- ordination Committee meeting held at Town Hall, which was presided by the Hon. Minister of Education and Higher Education.

9. Advisory officer assisted the monitoring of adaptive research trials (TRI/ TSHDA) at Akuressa, Hiniduma & Elpitiya.

10. Exhibition attended

Staff participated at Mahapola Exhibition at Wanduramba Central College in September.

11. "Tea Shakthi" programme

Officer in Charge participated at the "Tea Shakthi" programme conducted by TSHDA at Deniyaya, Kananke and Wandumraba.

**Activities conducted by the Deniyaya Advisory and
Extension Centre, Diyadawa**

Extension Officer/Actg. OIC: J. A. S. K. V.Jayasinghe

1. Advisory Correspondences

310 Advisory correspondences were sent on routine Advisory matters and other problems.

2. Advisory & Extension Visits**Advisory Visits**

34 Advisory Visits to the Company Estates and the small holding sector were made by the Advisory staff.

Extension Visits

51 inspection visits were made to experimental plots & sites where adaptive fertilizer trials are on.

3. Visitors to the Station

578 visitors including Estate Management Personnel from small and private estate holdings University and Diploma students and other students visited the station.

4. Advisory and Extension Programmes Conducted

Advisory Officers forum

Officer in charge attended the Advisory Officers' forum meetings held at Passara, Kottawa and Ratnapura.

1. RSC - Seminar

Regional Scientific Committee (VII) organised two seminars in collaboration with TRI Kottawa for estate executives and officers of TSHDA and Tea Commissioner's Division. The Director, Actg. Head Advisory and Extension Services, Chairman, Vice Chairman and General Secretary of PA attended. The subjects discussed were Plucking, Pruning, Fertilizer, Weed management, Nursery and Pest and Diseases.

2. Two field days were held for small holders on Nursery management, Pruning, & Infilling.

3. Five programmes were conducted for estate executive staff, one on Nursery management and four on all agricultural practices.

Two student programmes on all agricultural practices.

One worker programme on plucking.

Two programmes for University students on all agricultural practices.

4. Seminars

Ten seminars were held for small holders covering all agricultural practices

Two seminars were held on nursery practices.

One panel discussion was held on pruning.

5. Demonstration

2 field demonstrations were held for small holders and estate staff on pruning.

6. Informal discussions

Seven programmes were conducted for estate staff on agricultural practices, pruning and machine harvesting.

Three programmes were conducted on Plucking, Nusery management, Soil sampling and Agricultural practices.

Three programmes were conducted for Tea Inspectors on agricultural practices and adaptive extension trials.

7. Video programmes
35 Video films were shown to planters, small holders and students on Plucking, Nursery management, Soil fertility and Mites.

8. Field Trials

a). Shear plucking Vs manual harvesting

A trial commenced at this station to study the effect of different methods of plucking (TRI shear, Indian shear & hand plucking) on yield of tea, in collaboration with Agronomy division.

b). The staff attached to the station also helped the research division on the following projects carried out in the region:

1. Effect of earth worm on yield of tea (Anninkanda Estate)

2. The effect of application of Potassium and / or Magnesium from Sul Po-Mag and Kieserite at 2 levels of N on Soil / Plant nutrient status and yield of tea (Kiruwanganga Estate). This experiment is in progress.

3. Me Br- 06 To test alternatives to MeBr to eradicate Eelworm in tea fields (Handford Estate). This experiment is in progress.

4. Experiments to investigate effective time and type of pruning (Kiruwanganga Estate). This experiment is in progress.

5. Effective combination of shade / fuel wood tress for diversification (Kiruwanganga Estate). This experiment is in progress.

6. Adaptive fertilizer trials at Pasgoda & Deniyaya were conducted by the TRI in collaboration with TSHDA Matara region.

7. LVP - 43 Siduwa Estate plucking continued from January 1997 and yield records were maintained.

The summary of activities carried out by the Advisory & Extension Service of TRI

Subject	Ratnapura	Deniyaya	Talawakelle	Passara	Hantana	Talgampola
Adv.						
Correspondence	626	310	515	294	295	114
Adv. Visit	137	34	105	74	101	81
pH Tests	569	87	-	939	1629	171
Visitors	432	578	3199	304	-	742
Training Prog	28	33	7	19	10	104
RSC Meetings	4	2	-	-	5	6
NIPM Prog	4	-	-	-	2	-
Group Discussion	38	17	10	-	15	71
TRI/TDHDA	4	3	-	-	1	-
Video Prog.	2	35	-	-	-	-
Exhibition	4	-	5	-	2	-
Org. C % Tesrts	-	-	-	400	-	-
Free Leaflets	1020	-	-	-	-	-
Priced Pub.	32	-	-	-	-	-

LOW COUNTRY STATION, RATNAPURA.

Officer-in-Charge - Sushila I. Vitarana

1.0 General

S. I. Vitarana assumed duties as the Officer'-in-Charge of the station with effect from 20th February in addition to her normal duties in the capacity of Head of Entomology Division, with S. Wimaladharma relinquishing his services as the OIC.

As per recommendation by the Director, the Tea Research Board decided to station the Head of Advisory and Extension Division at this station from this year in view of the fact that the tea lands in the low country contribute the most towards production and earnings from tea.

The Tea Research Board accepted a recommendation by the Director to expand the services rendered by the station to the low country tea sector and accommodate the higher demand for research, extension and other services by the sector in keeping with the contribution it makes towards the total production and earnings from tea in the country. Plans were underway for this expansion.

1.1 Appointments, Transfers and Retirements

D. A. Lional, driver, was transferred from Head Office with effect from 20th January.

K. Gunawardana was appointed as work Supervisor of the station with effect from 03rd February.

D. V. Jemis, Plumber Mechanic retired from the services of the institute with effect from 07th June, after continuous service of 35 years at the station.

S. L. D. Amarathunga, Extension Officer who acted for J. A. S. K. V. Jayasinghe in the capacity of officer-in charge at the TRI Advisory and Extension Centre at Deniyaya was transferred back to the Station in July and Mr. H. J. M. De Silva, Extension officer who acted for Mr. Amaratunga at the station returned to TRI Mid Country Station simultaneously.

Ms. B. S. Vithana, Technical Assistant was transferred from Head office with effect from 1st March.

T. S. Lokuhetti, Clerk/Typist was transferred from Head Office with effect from 26th December, to work in place of Mr. R. Nadarajah who was transferred back to Head office.

P. B. Chandradasa, Technical Assistant was transferred to Biochemistry Division, TRI Talawakelle with effect from 27th November.

1.2 Human Resources Development - Local and Overseas :

Local

S. L. D. Amarathunga completed the academic part of an MSc programme in November and commenced the project component which is an agro-ecological survey : "Impact of Variation of the Weather parameters on Crop Environment and Productivity of tea lands in Sri Lanka".

S. Koneshwaramoorthy, Mechanical Engineer, continued on the practical project on utilization of Solar Energy in tea factories as part fulfillment of requirements for a PhD.

H. S. N. Pieris, Experimental Officer continued his research work as part fulfillment of the requirements for MPhil degree.

S. M. Samarasinghe, Experimental officer continued with her research work on allomones (kairomones and allelomones) of tea and other plants with reference to Low Country Live Wood termites of tea, as part fulfillment of the requirements for MPhil degree.

Overseas

G. Galahitiyawa, Research Officer participated at an international workshop on "Renewable Energy Application to Plantation and other Industries" in India, in April.

H. S. N. Peiris, Experimental officer followed a training course on "Tea Plantation Management" from July to October, in India.

2.0 Advisory and Extension Services

Staff combination of one advisory officer and one extension officer in the Advisory and Extension Division continued in this year too. The Regional Scientific Committee of the region (RSC IV) remained inactive for want of reappointment of the committee and thereby, the scheduled programme of extension services could not be completed. The work output is summarized as follows :

Advisory correspondence	626*
Advisory visits made by the staff	139* + 16**
a. Estates	45
b. Small holders	39
c. Others (Extension works)	53
Testing of soil samples for pH	569

Extension Programs :

Type of Programme	Estate Sector	Small Holder Sector	Diploma/ Student	Other
a. RSC 3	1	-	-	-
b. Seminars/Field Days	5	3	-	-
c. NIPM Programs	4+6**	-	-	-
d. Skill-training in nursery management	10	3	-	-
e. Other training Programs	-	-20	-	-
f. Group discussions	11	12	-	-
g. Informal discussions	4	11	-	3
h. Demonstrations using Community Participatory Adaptive Research trials (Plucking/manufacturing weeding, etc)	-	8	-	-
i. TRI/TSHDA interaction meetings	-	4	-	-
j. Educational Programs	-	-	3	-
k. Meetings attended by the staff on advisory matters	-	15	-	-

Total number of extension programs conducted = 112

1. Publications distributed in the low country :

a. Advisory leaflets	560
b. Advisory Circulars	460
c. Handbook on Tea	06
d. Field Guide Book	20
e. TRI Monographs	06

m. Visitors to the station :

a. Estate management personnel	103
b. Small holders	180
c. Students	70
d. Others	79

* - The number of activities conducted by staff of Advisory and Extension Division

** - The number conducted by staff of Technology Division

S. Wimaladharm, S. Koneshwaramoorthy, G. Galahitiyawa, S. L. D. Amarathunga and research staff of other divisions.

3.0 Research Activities

Research activities of the following projects were on-going in the low country and were serviced by the staff resident at the station except in the case of pathology studies :

Agronomy Division	-	Projects B/INCR and D/AGRY
Entomology Division	-	Projects B/TERM, D/ENTO and MeBr
Plant Breeding Division	-	Project B/CLON
Technology Division	-	Project D/TECH, ENGY
Pathology Division	-	Project D/PLPA

Progress of work under the above research projects are being recorded in this report elsewhere.

4.0 Issue of Clonal Material for Establishment of Mother-bushes

A total of 6500 clonal shoots were supplied to the estates for establishment of their mother bush blocks. The clones included :

4002, 4004, 4014, 4042, 4043, 4044, 4046, 4047, 4049, 4052, 4054, 4053, 4059, 4061, 4062;, 3041, 3046, 3047, (immune to low-country live-wood termites but, highly prone to stem canker caused by *Macrophoma theicola*) 3052, 3055, 3058, 3060, 2025 and 2027.

The above issues varied from one clone to twelve clones per recipient, supplying material for nursery plants varying from 125 to 3000 plants per clone, the higher number being of old clones. It is useful to record the identity of the recipients of the above clonal material for future reference. They are :

Estate Sector : Aigburth Estate, Bulutota; Kelani Estate, Yatiyantota; Gekiyanakanda Estate, Neboda; Pelawatta Estate, Pelawatte; Yatideriya Estate, Undugoda; Vogan Estate, Matugama; Pambegama Estate, Dehiowita;

Small Holder Sector : D. Perera, Mathugama; K. B. Prematilaka, Kuruwita; Chaminda Kumaranayake, Hidellana; Rajapakse, Ratnapura and Mahinda Liyanage, Ratnapua.

A. K. M. Jayasena and N. Piyasundera

5.0 Meteorological Station :

Recording of meteorological data and despatch of monthly data to the Meteorological Department continued. The summary of weather records for the current year is being reported elsewhere in this report,

6.0 Station Administration

A proposal to expand research, advisory and extension services capacity at the Low Country Station and engagement of Sri Lanka State Engineering Corporation (SEC) for consultation purposes were approved by the Tea Research Board. Planning commenced in April. It has been proposed to increase the Staff Cadre from 38 to 74 with a staff structure as given below :

Grade I	-	09 (research staff only)
Grade II	-	12
Grade III	-	01
Grade IV	-	23
Grade V	-	16
Grade VI	-	13

Surveying and preparation of the preliminary architectural drawings of the Entomology lab, Library, Plant Breeding lab, Stores and the Auditorium were completed in October. A total of Rs. 161,791,500/= has been estimated for the whole project inclusive of staff residential facilities.

A project proposal was submitted to Asian Development Bank (ADB) to request for funding for construction work and procurement of facilities. The proposal was accepted in principle by the bank for funding under the Second Small Holder Development Project scheduled to be undertaken in 1998.

7.0 Special Events :

The first ever Experiments and Extension (E & E) Forum to be conducted in Sinhalese for the benefit of sinhalese speaking majority particularly of the small holder sector, was held at the TRI Low Country Station on 5th December. Mr. Rohana Illangaratne, the Chairman of the TSHDA was the Guest-of-Honour.

Sushila I. Vitarana

MID COUNTRY RESEARCH, ADVISORY & EXTENSION CENTRE KANDY

1. General:

Mr.A.W.M.L.S.Abeysinghe, Experimental Officer, was transferred from Talawakele to the Entomology Unit in September.

Ms.U.Sritharan, Experimental Officer, was transferred from Talawakele to the Tissue Culture Unit in December.

Mr.S.T. Yatawatte, Advisory Officer had undergone 3 month training in Tea Plantation Management in the Kothari Agricultural Management Centre, India from July to September.

Mr.P.B.Ekanayake, Officer-in-Charge & Agronomist participated and read the Country paper at the Study Meeting on "Sustainable Farming Systems in Upland Areas" held in Japan from 27th October to 2nd November

2. Advisory & Extension Service:

- 305 Letters were written to estates and small holders
- 119 Advisory visits were made during the year
- 233 local and foreign visitors and 324 small holders visited the Station.
- 1629 Soil samples were tested for pH
- 04 RSC Seminars were held for Superintendents & Assistant Superintendents in the region.
- 09 Field days were held for Estate Field staff at the Station and in several estates in the Mid Country.
- 07 Seminars/demonstrations were held for small holders in the region

3. Hectarage as at 31st December, 1997

Type of land use	ha
Seedling tea	3.60
VP tea (mature)	7.00
VP (young)	0.40
Mother bush	3.00
Nursery (tea)	0.20
Fruit trees	0.40
Coconut	0.81
Forestry	1.21
Marshy land	0.62
Buildings, gardens, paths & roads	5.77
Total	23.00

4. CROP**Green leaf harvested (kg)**

Month	Crop harvested	Crop sold	Rate paid/kg Rs.cts	Total Rs.cts
January	3855	3854	11.40	43,935.60
February	2608	2604	12.92	33,643.68
March	1492	1486	12.81	18,099.48
April	4583	4496	12.63	56,784.48
May	4017	3992	16.29	62,504.73
June	2580	2715	16.80	45,612.00
July	2548	2540	14.70	37,338.00
August	3576	3565	15.43	55,007.95
September	3271	3241	16.08	52,115.28
October	4535	4461	17.30	77,175.30
November	4429	4418	18.70	82,616.60
December	3759	3746	18.50	69,301.00
Total		41,118		634,134.41

5. Income

No:of cuttings sold	6,86,125
Income from sale of cuttings	Rs. 1,37,225.00
No:of VP plants sold	96,121
Income from sale of plants	Rs.3,26,811.40
Total crop harvested (kg)	41,118
Income from sale of green leaf	Rs.6,34,134.41
Guest House occupation charges	Rs. 21,275.00
Electricity charges	Rs. 2,940.10
Soil testing (pH) charges	Rs. 48,870.00
Miscellaneous	Rs. 39,492.50
Total income	Rs.1,210,748.41

6. Special Scientific Visitors

1. Mr. James Tupper, NIPM, Colombo in January
2. Mr. D.M.K.Bandara NIPM, Colombo in January
3. Mr. Athauda Jayawardena, CIC (Colombo) Ltd.in April
4. Dr. K.P.Premaratna, Faculty of Agriculture University of Peradeniya in April
5. Ms. R.D.Chitranyana, NRMCC, Department of Agriculture, Peradeniya in May

6. Mr. Saman Premalal, Monsanto in June
7. Mr. Gordon Tissera, Kahawatte Plantations Ltd. in June
8. Dr. Palitha Randeniya, University of Peradeniya in August
9. Dr. S.Kodomari, Shizuoka, Japan in August
10. Dr. M.Omori, Otsuma Wou University, Tokyo, Japan in August
11. Mr. Sarath Wimalaratna, Visiting Agent, SPC/JEDB in October
12. Mr. M.B.Ratnayake, Director, JEDB in October
13. Dr. L.Maniwel, Plant Physiologist, India in November
14. Dr. G.P.Shetty, Multiplex Fertilizer Ltd. India in November
15. Dr. (Mrs) Rohini Ekanayake, Entomologist, ORDI, Gannoruwa in December

DENIYAYA ADVISORY AND EXTENSION CENTRE DIYADAWA

Actg: Officer-in-Charge: J.A.S.K.V. Jayasinghe

General

Mr. J.A.S.K.V. Jayasinghe returned to the Deniyaya Station on 01st July 1997 after completing his Post Graduate Diploma Course in India.

Mr. H.K.S.L.D. Amarathunga was transferred back to Ratnapura Station with effect from 05 th July 1997.

Staff Position as at 31st December 1997

Mr. J.A.S.K.V. Jayasingha Extension Officer/Actg:OIC Grade IV BSc(Agri)

Mr. C.W. Jayawardana Station Assistant V

Mr. R.W. Suwaris Field Supervisor VI

Mr. P. Ranaweera Driver VI

Mr. A. Sinnathamby GH Keeper VI

Adviory & Extension Services

- 310 letters were written on Advisory matters
- 34 Advisory visits were made
- 51 Inspection visite (Experimental & Demonstration trials)
- Nil Commercial nursery inspections
- 578 Visitors including small holders visited the station
- 2 Field days (Small holders)
- 18 Training programmes (15-Planters, 8-Small holders, 2-Students, 1-Labourers & 2-Campus students)
- 13 Seminars (10-Small holders, 3-RSC)
- 2 Field demonstrations (1-Small holders, 1-Planters)
- 17 Informal discussionss (7-Planters, 7-Small holders, 3-Tea inspectors)
- 35 Vedio programmes
- Nil Exhibitions etc. participatted
- 87 Soil samples tested for pH

Hectarage

Area under tea	6.41 Ha.
Area under Coconut	0.13
Area under Pepper	0.05
Building	1.44
Nursery	0.70
Encroachment	1.12
-----	1.45
Jungle (Rock area)	<u>1.92</u>
Total	13.22 Ha

Crop Green leaf harvested

Month	Harvested (Kgs) (With A/CLON)	Rate paid/kg	Total payment
		Rs. Cts.	Rs. Cts.
January	1617	17/773	27,121.94
February	980	16/398	16,070.04
March	1643	17/14	28,161.02
April	1876	18/20	34,143.20
May	2194	19/148	42,010.71
June	1774	20/554	36,462.80
July	2368	19/788	46,857.95
August	2016	20/84	42,013.44
September	2390	21/178	50,615.42
October	1951	21/218	
	757	21/00	56,873.32
November	2901	20/107	58,330.41
December	2826	20/81	58,800.06
Total	25273		497,469.34

Income

No of cuttings sold		131,100
Income from sale of cuttings	Rs.	26,220
No of VP plants sold		22,450
Income from sale of plants (with loading plants)	Rs.	77,332.50
Amount of crop harvested (Kgs)		25,273
Income from sale of crop	Rs.	497,469.34
Average price fetched per kg	Rs.	19,684
Miscellaneous income	Rs.	27,022.09
Total income	Rs.	628,043.93

Experiments which are being conducted at the station**LVP-74 (30) LC - Phase II**

This trial commenced at the station in August '97.

Project MeBr - MeBR - 18

The experiment to determine the efficacy of soil solarization as a means of eradicating nematodes in nursery soil, at the TRI-Deniyaya station commenced in December '97.

Project MeBR - MeBR - 19

Sedimentation process for nematodes infected water. This experiment was started during December 1997 at Deniyaya station.

Shear plucking Vs Hand plucking

A trial was commenced to study the effect of different methods of plucking (TRI shear, Indian shear & hand plucking) on yield of tea.

This experiment is in progress.

The experiments which are in progress outside the station under different projects with the assistance of TRI-Deniyaya station

1. Effect of Earthworm on yield of tea (Anningkanda Estate)
2. The effect of application of Potassium and/or Magnesium from Sul-Po-Mag and Kieserite at 2 levels of N on Soil/Plant nutrient status and yield of tea (Kiruwananga Estate). This experiment is in progress.
3. MeBR-06 - To test alternatives to eradication of nematodes in tea fields. (Handford Estate). This experiment is in progress.
4. Effective time and types of pruning in reducing SHB (E-284). (Kiruwanaganga Estate). This experiment is in progress.
5. Effective combination of shade trees for diversification purposes (E-287) (Kiruwanaganga Estate). This experiment is in progress.
6. Demonstrative Fertilizer Trials - Pasgoda & Deniyaya
This experiment has been carried out by TRI in collaboration with TSHDA (Matara region). This experiment is in progress.
7. LVP - 43 Diyadawa Estate
Plucking continued from January 1997 and the yield records are maintained.

UVA ADVISORY AND EXTENSION CENTRE - PASSARA

Officer in Charge: M.B.A. Perera

1. Advisory and Extension Services.

- 294 Advisory letters were written
- 74 Advisory visits were made to Estates
- 19 Seminars/Field Days were held for Estates/Smallholders
- 6 Regional Seminars were held in collaboration with Uva RSC
- 304 Visitors including Planters/Smallholders visited the Centre
- 936 Soil samples were tested for pH.
- 400 Soil samples were analyzed for their organic carbon content

2. Hectarage as at 31st December 1997 (approximate)

Mature tea in plucking	-	5.30
Mother Bushes	-	1.15
Under Rehabilitation	-	0.50
Buildings /Roads	-	0.50
Forest /Scrub/Grass /area	-	6.85
Total		14.30

3. Crop

Green leaf harvested and sold (kg) - 1997

Month	Harvested	Sold	Price/Kg	Income
January	3068	3074	11.50	35,351.00
February	2579	2578	12.22	31,503.16
March	2458	2455	12.45	30,564.75
April	3898	3898	12.65	49,309.70
May	5302	5303	14.34	76,045.02
June	2864	2862	14.57	41,699.34
July	3362	3363	13.83	46,510.29
August	1922	1920	15.06	28,915.20
September	2278	2277	16.74	38,116.98
October	3674	3676	18.66	68,594.16
November	3912	3930	19.06	74,905.80
December	2597	2598	18.95	49,232.10
Total	37914	37934		570,747.50

The average yield obtained, including the seeding area, was 1575 kg MT ha⁻¹. The Estimated Yield for the year was 1413 kg MT ha⁻¹. The average price obtained for green leaf during the year was Rs.15.05 per Kg. Green leaf prices rose markedly during the last quarter of the year.

4. Income

No. of VP Cuttings sold	75,850
Income from sale of VP Cuttings	Rs. 18,962.50
No. of VP plants sold	60
Income from sale of VP plants	Rs. 225.00
Amount Kg of crop harvested	37,934
Income from green leaf sold	Rs.570,747.50
Average price fetched per Kg green leaf	Rs. 15.04
Soil analytical charges	Rs. 72,080.00

Other Income

Guest House occupation,	
Sale of publications etc.	Rs. 31,381.00
Total	Rs.693,171.00

The nursery was maintained only to raise a limited number of TRI 3000/4000 series clonal plants. These plants were issued for clonal trials in plantations and selected smallholdings. A batch of seedlings are maintained in the nursery raised from selected seeds obtained from Poonagala seed garden. These seedlings will be planted at the Centre for selection by Plant Breeding/Propagation Division.

5. Labour Force

No of permanent check-roll labour	26
Outturn (Women)	74%
Outturn (Men)	48%

The very poor outturn of men labour hindered scheduled field operations.

6. Field Trials

6.1 Clonal observation trials UVP 8 and UVP 9 are in progress at the Centre. These trials are carried out and monitored by the Plant Breeding/Propagation Division.

6.2 An observation trial on the use of shears for harvesting tea is carried out at the Centre.

6.3 Demonstration trials on the use of fertilizer mixtures T-1130 and U-709 for mature tea under small holder cultivation conditions are carried out in three different locations in the region in selected smallholder properties. These trials are conducted by the Soils/Plant Nutrient Division in collaboration with TSHDA.

7. Special Uva problems

7.1 Terminal die-back of VP bushes of about 25 years old (especially clone TRI 2023) is becoming a common problem in Uva.

7.2 Poor recovery after pruning was also reported by many plantations. This condition was mainly due to inadequate starch reserves at the time of pruning. Resting of fields due for pruning is not a standard practice in many Uva plantations.

7.3 Formation of variegated foliage on young tea bushes and on bushes recovering from pruning was a "New Problem" reported by many plantations, and some small holders as well. Investigations are in train to establish the reasons for this condition.

7.4 Weeds known as "Passali" (*Talinum paniculatum*) and "Passali kodi" (*Andredera basseloides*) are becoming serious problems in Uva. Special investigations by our Agronomy Division in collaboration with the University of Peradeniya are in progress regarding this problem.

ADVISORY AND EXTENSION CENTRE

KOTTAWA, TALGAMPOLA

1. General

Mr. K.D. Dahanayake continued as Officer-in-Charge.

2. Improvements to the centre

2nd coat of tarring for the old approach road to the centre was carried out.

3. Labour force

Number on check roll - 60
Outturn - 50 average

4. Crop

Green leaf harvesting - 1997

Month	Harvested kg	Sold kg	Rate paid/kg Rs. cts.	Total Income Rs. cts.
January	7340	7340	17/88.6	131283.24
February	4772	4772	18/30.9	87370.55
March	4779	4779	18/10.4	86519.02
April	5042	5042	19/37.7	97698.83
May	6731	6731	20/83	140206.73
June	4722	4722	21/84.5	103152.09
July	6548	6548	20/73.5	135772.78
August	6583	6583	21/87.2	143983.38
September	8009	8009	22/00	176198.00
October	7783	7783	22/53.4	175382.12
November	6649	6649	22/00	146278.00
December	7060	7060	22/50 approx.	158850.00 approx.
	<u>76018</u>	<u>76018</u>		<u>1,582,694.74</u>

Total rainfall - 2805.1 mm

No. of wet days - 165

5. Commercial nursery

Income from supply of VP plants - Rs. 125982.50
Income from supply of VP shoots - Rs. 12350.00

6. Miscellaneous income - Rs. 18060.00

7. Total Income

Income from sale of green leaf	-	Rs. 1582694.74
Income from sale of VP plants	-	Rs. 125982.50
Income from sale of VP shoots	-	Rs. 12350.00
Miscellaneous income	-	Rs. 18060.00
	-	<u>1,739,087.24</u>

8. Extension services

- (I) Small holders - Number who visited the station personally seeking advice and collecting VP plants and VP shoots 742
The number who requested for visits, small holdings visited - 81
Correspondence - 114
- (II) Training programme - Superintendents, Assistant Superintendents, Field Staff and small holders - 59
- Seminars/Field days - Objective - Advice on all aspects including demonstration relating to nursery work, plucking, pruning, pests & diseases as applicable to Low Country - 45

9. No. of soil samples tested for pH - 171

10. No. of VP plants issued - 35995

11. No. of VP cuttings sold - 61750

12. Experiments & Observations

01. Chopping prunings
02. Shear plucking observations
03. Hedge planting observation block
04. 4000 Series clones observation block
05. Bud grafting experiment
06. Caliandra plants block
07. Intercropping coffee, pepper planted in existing tea
08. 200 Plants Cinnamon in boundaries (intercropping)
09. Biclinal experiment
10. Multi Vs single cutting planting observations
11. Gravilia robusta provanances shade trees
12. Adaptive Research Trials at Hiniduma, Akuressa & Elpitiya

METEOROLOGICAL OBSERVATIONS - 1997

TRI - St Coombs, Talawakele (Lat. 6° 55' N, Long. 80° 40'E, 1382 m amsl)

Month	Mean Temperature (°C)		Soil at 20 cm under grass depth		Relative Humidity (%)		Wind Travelled (miles)	Mean Sunshine (h. day ⁻¹)	Total Rainfall (mm)	Wet Days	Total Evaporation (mm)
	Min	Max	8.30h	15.30h	8.30h	15.30h					
January	9.3	25.7	21.4	22.5	90.5	80.9	2401.13	8.6	0.0	0	104.04
February	9.6	26.5	22.0	23.3	91.7	92.2	1984.20	8.1	8.5	3	85.70
March	10.2	27.4	22.6	23.8	90.5	92.9	2473.00	7.4	42.1	6	100.90
April	13.8	26.3	22.0	22.7	91.9	94.2	1761.00	6.1	337.0	18	47.63
May	15.1	25.4	22.1	22.7	94.0	94.5	1856.00	6.1	218.0	21	75.90
June	14.2	24.4	22.4	23.0	93.4	93.2	1943.00	6.6	154.5	14	73.70
July	16.4	22.9	21.8	22.2	96.7	94.7	2364.00	2.7	203.3	23	56.00
August	15.0	23.1	21.7	22.2	95.6	93.4	2787.00	5.6	137.4	19	68.70
September	14.8	23.6	21.8	22.3	92.9	95.1	6420.00	5.4	298.0	20	69.30
October	14.6	25.1	21.9	22.3	92.1	95.1	1759.00	5.8	425.5	24	88.40
November	14.6	24.8	22.1	22.5	93.3	94.4	1807.00	5.4	298.0	22	61.50
December	14.6	24.5	21.7	21.7	22.2	93.8	2319.00	5.2	164.4	13	59.50

**MID-COUNTRY, RESEARCH, ADVISORY AND
EXTENSION STATION, KANDY**

(Elevation 762 m amsl)

Month	Mean temp. (°C)		Relative Humidity (%)		Mean sunshine (h. day ⁻¹)	Rainfall (mm)	No. of wet days	Cum. Evaporation (mm)
	Min.	Max.	08.30 h	15.30 h				
January	18.06	26.79	86.73	78.06	8.76	0	0	111.70
February	18.59	29.52	78.55	64.28	7.25	16.80	3	119.80
March	19.61	30.34	82.72	58.79	9.02	85.10	4	121.70
April	20.02	29.85	85.91	82.27	6.76	326.00	19	108.30
May	21.00	28.83	87.24	85.51	6.77	173.40	16	74.90
June	20.67	29.26	85.30	79.06	6.73	72.91	11	105.90
July	20.98	26.65	88.41	84.47	4.29	112.55	16	65.80
August	20.66	26.45	88.83	81.86	6.62	86.00	11	108.70
September	19.85	27.74	86.35	84.44	5.43	317.90	21	74.50
October	19.66	27.76	92.71	92.03	5.05	503.00	19	85.90
November	19.88	27.83	95.41	90.52	4.65	391.10	23	47.60
December	19.44	27.60	95.93	91.11	5.43	211.70	14	9.50 (8 days only)

LOW COUNTRY STATION, RESEARCH, ADVISORY & EXTENTION CENTRE, RATNAPURA - 1997
 (Lat 6° 41'N Long 80°E - 40°E, 29m amsl)

Month	Mean Temperature		Relative Humidity (%)		Mean Sunshine (h day ⁻¹)	Total Rainfall (mm)	Difference from 30 yrs	Wet days	Difference from 30yrs	Evaporation (mm/day)
	Max. Dry.	Min. Dry.	9.00h	16.00h						
January	23.4	34.4	84	59	7.5	9.0	- 102.9	02	- 07	4.39
February	24.3	35.1	82	53	6.9	47.2	- 89.8	04	- 05	4.65
March	24.6	35.2	84	57	6.5	164.0	- 48.2	09	- 05	5.00
April	24.4	34.8	84	68	6.0	401.8	+ 62.9	19	- 01	3.47
May	24.8	33.4	84	79	4.6	574.2	+ 98.3	20	No difference	2.44
June	25.2	33.1	82	72	5.8	331.8	- 80.4	12	- 09	3.50
July	24.3	31.4	87	73	3.2	601.2	+ 308.4	24	+ 04	2.39
August	24.9	31.8	84	71	5.4	182.0	- 122.1	17	- 03	3.39
September	23.6	32.1	86	75	3.4	721.3	+ 299.9	19	- 01	2.34
October	23.7	33.2	86	82	3.7	569.1	+ 132.3	27	+ 06	2.68
November	23.7	32.7	86	79	4.1	591.4	+ 220.0	21	+ 03	2.27
December	23.2	32.9	87	77	4.0	384.6	+ 149.3	20	+ 06	2.43
Total	-	-	-	-	-	4577.6	-	-	-	-
Mean	24.2	33.3	85	70	5.1	-	-	-	-	3.24

DENIYAYA ADVISORY AND EXTENSION CENTRE
(Elevation 250 m amsl)

Month	Mean Temperature (°C)		Soil at 30 cm		Relative Humidity %		Total	Total	Sun shine*	Total
	Mini Dry	Max Dry	0830 h	1530 h	0830 h	1530 h	Rainfall (mm)	wind (km)		
January	17.7	27.7	27.7	27.8	66.22	53.23	29.9	783	-	-
February	20.4	32.5	27.5	28.0	77.48	60.71	200.8	700	-	-
March	26.5	33.9	28.9	29.4	79.23	62.70	89.7	838	-	-
April	22.0	32.6	28.5	29.2	79.23	72.46	498.0	695	-	-
May	23.3	31.1	28.0	29.1	82.0	60.64	528.5	1043	-	-
June	23.0	31.6	29.0	29.2	79.74	67.81	155.1	1274	-	-
July	23.8	30.1	27.9	28.2	79.82	73.29	392.0	2087	-	-
August	24.4	30.0	27.8	28.7	78.77	70.19	193.6	2519	-	-
September	23.1	30.3	27.6	27.2	83.0	77.82	567.0	1226	-	-
October	22.0	31.5	28.2	28.5	82.9	84.00	403.4	751	-	-
November	20.7	31.7	27.0	27.6	81.7	80.1	723.9	491	-	-
December	20.8	30.8	27.4	28.3	80.7	69.5	563.7	961	-	-
Total	-	-	-	-	-	-	3907.4	13168	-	-
Mean	22.31	31.15	27.96	28.40	80.69	70.21	-	-	-	-

* Sunshine recorder had been stolen

UVA ADVISORY AND EXTENSION CENTRE - PASSARA - 1997
(Lat. 6°56' N, Long 18°07'E, 1120 m amsl)

Month	Mean Temperature (°C)		Relative Humidity (%) 0830 hrs	Humidity 1530 hrs	Mean Sunshine h. day ⁻¹	Total Wind (km)	Total Rainfall (mm)	Total Evaporation (mm)
	Min. Dry	Max Dry						
January	15.0	24.5	83	78	6.90	1630	222.5	42.6
February	15.0	25.9	78	75	6.70	1192	58.32	73.8
March	16.6	23.4	78	68	7.20	540	29.5	91.7
April	18.1	27.4	92	82	5.70	295	245.8	136.7
May	20.3	27.0	87	79	5.10	273	328.1	35.15
June	19.0	26.5	84	85	5.00	425	108.9	33.3
July	17.0	27.0	80	80	5.20	700	74.5	39.08
August	19.0	29.0	82	82	7.10	810	40.0	58.92
September	18.2	26.0	82	80	3.90	448	309.6	30.4
October	17.0	25.0	83	86	3.52	470	574.2	40.62
November	17.8	24.6	89	87	4.30	577	499.36	10.7
December	16.8	23.1	85	82	3.54	1268	374.5	40.02
Total						8628	2865.2	632.95
Mean	17.48	25.78	83	80	5.34			

Rainfall (mm) Total for Month
 Max. Dry (C°) Average for Month

Evaporation (mm) Total for Month
 Wind (Km) Total for Month

Min. Dry (C°) Average for Month

SOUTHERN PROVINCE EXTENSION CENTRE, TALGAMPOLA - KOTTAWA
(Elevation 30 m amsl)

Month	Mean Temperature (°C)		Relative Humidity (%) 0830 hrs	Mean Sunshine (h day ⁻¹)	Total Rainfall (mm)	Rainfall Difference (from 20 years)	Wet Days	Difference from 20 years
	Max. Dry	Min. Dry						
January	32.0	20.3	85	8.8	4.0	- 108.8	02	-
February	32.4	20.5	90	7.6	88.1	- 10.7	03	-
March	33.3	21.3	85	8.5	74.0	- 63.5	05	-
April	32.0	22.4	87	6.8	309.2	+ 46.0	11	-
May	31.1	23.9	90	4.6	260.1	- 112.4	15	-
June	31.2	23.4	91	5.8	183.3	- 117.5	15	-
July	30.2	23.4	87	2.7	299.6	+ 115.8	23	-
August	30.4	23.6	92	6.6	172.7	- 35.8	18	-
September	30.3	23.2	91	4.7	434.1	+ 158.0	20	-
October	31.4	22.8	90	4.7	426.0	+ 72.7	20	-
November	30.6	22.7	90	3.5	408.3	+ 90.1	20	-
December	32.2	22.4	86	5.0	145.7	- 25.8	13	-
Total					2805.1		165	
Mean	31.4	22.5	89	5.8				

දුරකථනය :
දුරකථන අංකය
Telephone } 691151

ෆැක්ස් අංකය
පැක්ස් අංකය
Fax No. } 697451

මගේ අංකය
எனது இல.
My No. } PI/H/TRB/97/171

ඔබේ අංකය
உமது இல.
Your No. }



විගණකාධිපති දෙපාර්තමේන්තුව
නිදහස් වතුරඳය, කොළඹ 7, ශ්‍රී ලංකාව

கணக்காய்வாளர் தலைமை அலுவலர் திணைக்களம்
சுதந்திர சதுரங்கம், கொழும்பு 7, சிறீலங்கை

AUDITOR-GENERAL'S DEPARTMENT
INDEPENDENCE SQUARE, COLOMBO 7, SRI LANKA

දිනය / திகதி / Date : 17 November 1998

The Chairman,
Tea Research Board.

Report of the Auditor General in terms of Section 13 (7) (a) of the Finance Act No. 38 of 1971 on the accounts of the Tea Research Board for the year ended 31 December 1997

The above mentioned report is sent herewith.

2. In this connection your attention is drawn to Section 13 (8) of the Finance Act reproduced in the note below.

(J.D.R. Jayalath)
Assistant Auditor General
for Auditor General.

- Copies : 1. Secretary - Ministry of Public Administration, Home Affairs and Plantation Industries.
2. Secretary - Ministry of Finance and Planning.

Note :

Section 13 (8) of the Finance Act

“The reports referred to in paragraphs (a) and (b) of Sub-section (7) shall be considered by the governing body of a Public Corporation and after such consideration that body shall inform the Auditor General of the steps that they propose to take with regard to the matters pointed out in the audit reports within three months of the submission of the reports to the Corporation.”

The Chairman,
Tea Research Board.

**Report of the Auditor General in terms of Section
13 (7) (a) of the Finance Act No. 38 of 1971 on the accounts of the
Tea Research Board for the year ended 31 December 1997**

The audit of accounts of the Tea Research Board for the year ended 31 December 1997 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 report in terms of Section 13 (7) (a) of the Finance Act appears below.

1.2. Scope of the Audit

Audit 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 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 planned and carried out in accordance with generally accepted 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. Subsections (3) and (4) of Section 13 of the Finance Act No. 38 of 1971 give discretionary powers to the Auditor General to determine scope and extent of the Audit.

2. Accounts

2.1. Financial Results

According to the accounts presented, the working of the Tea Research Board for the year ended 31 December 1997 had resulted in a surplus of Rs. 35,309,603 compared with the surplus of Rs. 36,392,435 in the previous year. The following statement gives a summary of the financial results for the year under review and the preceding year

Year ended 31 December

	1997		1996	
	Rs.	Rs.	Rs.	Rs.
Income				
Cess and grants	94,433,902		86,027,473	
Income from plantation and other commercial activities	33,910,940		27,118,483	
Miscellaneous income	4,279,304		2,612,752	
Interest on investments	3,226,181	135,850,327	3,603,803	119,362,511
Less : Expenditure				
Personnel emoluments	31,120,839		25,654,070	
Travelling expenses	4,285,504		2,902,200	
Supplies and requisites	9,476,067		8,924,263	
Repairs and maintenance of capital assets	13,012,056		8,805,953	
Depreciation	8,300,297		8,896,950	
Transportation, communication, utility and other services	15,746,117		13,159,130	
Losses and write-offs	29,238		4,976	
Media, advertising, publicity symposia and gifts	474,130		437,180	
Contributions, grants and subsidies	1,431,020		1,191,515	
Pensions and retirement benefits	3,312,759		2,673,829	
Provision for Gratuity	4,827,854		1,018,949	
Cultivation and experiments	4,328,305		4,050,270	
Miscellaneous	4,196,538	100,540,724	5,250,791	82,970,076
Surplus for the year		35,309,603		36,392,435
Prior Period Items		(112,493)		(1,311,017)
Transferred to Tea Research Fund		<u>35,197,110</u>		<u>35,081,418</u>

2.2. Financial Structure

According to the accounts presented, the financial structure of the Board as at 31 December 1997 compared with that as at end of the preceding year is given below.

As at 31 December

	1997	1996
	Rs.	Rs.
Resources		
Government Grant	1,175,000	1,175,000
Capital Reserve	40,196,431	38,324,941
Long Term Liabilities		
- Land Reform Commission	754,670	754,670
- Provision for Gratuity	17,117,790	11,327,641
Tea Research Fund	213,441,710	178,244,600
	<u>272,685,601</u>	<u>229,826,852</u>
Utilization		
Fixed Assets at written down value	113,507,235	105,376,827
Capital work-in-progress	6,747,175	1,022,786
Development Projects	8,795,003	8,795,003
Net Current Assets	143,636,188	114,632,236
	<u>272,685,601</u>	<u>229,826,852</u>
 <i>Less</i> : Gratuity paid	 -	 695,393
Cash generated from Operating activities	19,496,512	21,485,343
Cash flows from investing activities		
Interest on Investments	3,226,181	3,603,803
Purchase of fixed assets	(19,488,631)	(12,573,600)
Proceeds from sale of fixed assets	2,026,440	-
(Increase)/Decrease in capital work-in-progress	(5,724,389)	691,205
Cash used in investing activities	(19,960,399)	(8,278,592)
Cash flows from financing activities		
Grants received from ARP	561,491	2,733,084
NORAD	1,310,000	-
NARESA	-	7,200
ACITR	-	175,000
IWEM	-	6,150
Purchase consideration of Lamilier Estate	-	1,504,670
Cash generated from finance activities	1,871,491	4,426,104
Net increase in cash and cash equivalents	<u>1,407,604</u>	<u>17,632,855</u>
Cash and cash equivalents at beginning of the year	44,434,130	26,801,275
Cash and Cash equivalents at end of the year	<u>45,841,734</u>	<u>44,434,130</u>
	<u>1,407,604</u>	<u>17,632,855</u>

2.3 Cash Flow

According to the accounts presented, the cash flow of the Board during the year under review and the preceding year is given below.

	Year ended 31 December			
	1997		1996	
	Rs.	Rs.	Rs.	Rs.
Cash flows from operating activities				
Surplus for the year excluding interest on investments		32,083,421		32,788,632
Adjustments for items not involving movement of cash				
Depreciation	10,434,117		12,131,932	
Provision for gratuity	5,790,149		1,018,949	
	<u>16,224,266</u>		<u>13,150,881</u>	
<i>Less</i> : Income from sale of fixed assets	<u>1,102,334</u>	<u>15,121,932</u>	-	<u>13,150,881</u>
		47,205,353		45,939,513
<i>Less</i> : Prior period items		<u>112,493</u>		<u>1,311,017</u>
Operating surplus before changes in items of working capital		47,092,860		44,628,496
Changes in items of working capital				
Stocks - (Increase)/Decrease	(1,881,220)		180,291	
Debtors and other balances - crease)	(26,090,999)		(23,080,795)	
Deposits, prepayments and purchase advances - (Increase)	(1,332,526)		(4,146,320)	
Loans and Advances to staff & employees - (Increase)/Decrease	(2,330,741)		104,031	
Other current assets - (Increase)	(5,000)		-	
Identified losses - (Increase)	(156,507)		(109,331)	
Suspense - (Increase)	(10,677)		(135,410)	
Excesses and shortages - Decrease	4,394		438	
Creditors and provisions - Increase	<u>4,206,928</u>	<u>(27,596,348)</u>	<u>4,739,338</u>	<u>(22,447,758)</u>
		19,496,512		22,180,738

Format - 1**Methods and Formulae used in Estimating Physical Quantities of Materials**

<i>Description of Materials</i>	<i>Whether receipts/issues of inventory</i>	<i>Description of formulae or method</i>	<i>Whether the basis is realistic</i>	<i>Whether there was a change in the basis</i>
Green leaf	Receipts	Factory weight of green leaf is ascertained after deducting 3% of the field weight for moisture	Realistic	No.

Format - 2**Items in accounts based on Estimates and Provisional Valuation**

<i>Description of item in the accounts</i>	<i>Value Rs.</i>	<i>Basis of estimating or provisional valuation</i>
(a) Provision for payments	119,774	Actual payment made in subsequent year
(b) Provision for Audit Fees	215,000	- do -
(c) Provision for bad debts	98,953	- do -
(d) Provision for Goods in transit	156,124	- do -
(e) Provision for Uniforms & Protective Clothings	250,000	- do -
(f) Provision for Holiday pay & Incentive Bonus	233,378	Total earnings for the Year x Entitled days Total days worked for the year (per employee)
(g) Provision for Gratuity	17,117,790	Half month salary x No. of years of services.

Format - 3**Basis of costing Receipts and Issues of Materials**

<i>Type of material</i>	<i>Whether receipts/issues</i>	<i>Basis adopted</i>
(i) Stocks	Receipts/Issues	First in First out
(ii) Green (Tea) Leaf	- do -	- do -
(iii) Tea Chests	- do -	- do -
(iv) Fire wood	- do -	- do -

Fixed Assets - Depreciation Rates

Type of Asset	Method of depreciation	Rate per annum	
		1997	1996
(i) Buildings	Straight line method	2%	2%
(ii) Motor vehicles	- do -	20%	20%
(iii) Laboratory equipment	- do -	20%	20%
(iv) Library books	- do -	10%	10%
(v) Water Supply	- do -	10%	10%
(vi) Furniture	- do -	10%	10%
(vii) Office equipment & computer	- do -	10%	10%
(viii) Electrical installations	- do -	10%	10%
(ix) Work Shop Equipment	- do -	10%	10%
(x) Telephones	- do -	10%	10%
(xi) Capital replanting	- do -	3%	3%

Note : Depreciation is provided for the year of purchase and no depreciation is provided in the year of disposed

Accounting Deficiencies

Description of item in the accounts affected	Type of deficiency	Description of deficiency
(a) Work in progress	Inappropriate Disclosure	The work had to be carried out under several research projects which had been abandoned subsequently are continuously shown under the work-in-progress account for over 7 years. The details of the projects are given below

	Rs.
NERD L/C Technology	190,369
Instant tea Project	4,652,830
LTP Project	4,142,173
Water Tank H/O	192,855
Water storage St. Joachim	104,014
	<u>9,282,241</u>

(b) Fixed Assets

Errors in Capital and revenue recognition

Following fixed assets purchased by the Board had been written off without considering their capital nature.

Description of the asset

Name of the account charged

Value

Rs.

(a) Supplying & Installation of Auto Air Condition System to the Pajero No. 32 - 5991

“Repairs and maintenance of capital assets account”

35,000

(b) Supply of 03 Nos. Termite Detectors

“Supplies & Requisites account”. 45,000

(c) Stock of fuel in vehicles

Overstatement

Fuel stock valued at Rs. 18,950 as at 01.01.97 of the vehicle fleet of TRB had not been deducted to reach the balance stock as at the end of the year. Balance stock, therefore, shown as Rs. 41,773 as at 31.12.97 had been overstated by Rs. 18,950 as well.

(d) Fixed Assets Depreciation

Understatements/ Overstatement

Following understatement/ overstatement of depreciation of fixed assets had been revealed in the accounts due to calculation errors.

Nature of Assets

Division

Overstatement/ Understatement

Machinery

St. Joachim estate

Rs. 246,786 (Overstatement)

Machinery

- do -

Rs. 154,786 (Understatement)

(e) Fixed Assets Errors in Capital and revenue allocation

Following expenditure had been capitalised under various fixed assets items without considering their recurrent nature.

<i>description</i>	<i>Amount</i>	<i>Account debited</i>
	<i>Rs.</i>	
Cost of binding of journals	19,650	Library books
Annual subscription fees of "Economics"	6,240	Other fixed assets

(f) 7 day call deposits Omission

Accrued interest for 1997 valued at Rs. 172,623 on 7 day call deposits had not been accounted for.

(g) Rental Omission

A sum of Rs. 90,000, being rent receivable from the Electricity Board, had not been shown in the accounts and no provision had also been made thereon.

(h) Bonds Outstanding Omission

Eventhough following officers had not resumed for duties at the Board after completion of their post graduate degrees at foreign countries, the value of bonds aggregating Rs. 4,132,501 had not been brought to account.

<i>Name of officers</i>	<i>Value of bonds outstanding</i>
	<i>Rs.</i>
T. S. Gunasekara	2,382,496
Nalin L. Herath	260,157
W. A. D. P. Wanigasundara	891,000
D. K. Nawarathna	598,848
	<u>4,132,501</u>

- | | | | |
|-----|---|--------------------------|---|
| (n) | Provision for gratuity | Inappropriate disclosure | Provision for holiday pay amounted to Rs. 332,885 and Rs. 1,103,268 in respect of St. Joachim and St. Coombs Estates respectively, had been shown together with provision for gratuity under long term liability instead of being shown as current liability. |
| (o) | Tea Sales | Overstatement | Sales invoice No. 330 dated 30,12,1997 valued Rs. 123,624 had been accounted twice and thereby sales have been overstated by the same account. |
| (p) | Work-in-progress | Inappropriate disclosure | <p>Advances amounting to Rs. 100,000 paid for the purpose of carrying out of a research Project had been shown under work in progress account the heading called "Collaboration Project".</p> <p>An estimated sum of Rs. 295,000 had been provided in the accounts and debited to the work in progress account for construction of labour lines at St. Joachim estate, without ascertaining the quantity of work completed at the end of the year under review.</p> |
| (q) | Electrification Labour Lines -
St. Coombs Estate | Classification error | Deposit amounting to Rs. 145,600 made for the electrification of labour lines at St. Coomb's estate had been shown under the receivable from the staff in the accounts for the year under review. |

Verification of Physical Assets

<i>Class of Asset</i>	<i>Percentage verified during the year or at the end of year</i>	<i>Shortages observed</i> Rs.	<i>Excesses observed</i> Rs.	<i>Value of assets not based on physical verification</i> Rs.	<i>Whether variations have been investigated</i> Rs.	<i>Treatment of variations in account</i>
TRB - Head Office						
(i) Stationery stocks	100%	1,117	2,891	Nil	No	-
(ii) Motor spares	100%	Nil	Nil	Nil	No	-
(iii) Scientific Stocks	100%	197,540	80,241	Nil	No	-
(iv) Drugs	100%	263	768	Nil	No	-
(v) Electrical Stocks	100%	Nil	Nil	Nil	No	-
(vi) General Stocks	100%	Nil	54,400	Nil	No	-
(vii) Stocks at Ratnapura (Low Country Stations)	100%	11,064	17,448	Nil	No	-

St. Coomb's Estate

Consumable Stock Verified Schedules had not been submitted 1,640,881 - -

Verification conducted by the Govt. Audit Team

Auto - Diesel	100%	-	1,267 (lit.)	-	No	-
Fire - Wood	100%	18.4 (c.m.)	-	-	No	-
Tea						
BOP (kgs)	100%	1,339	-	-	Investigations in Progress	
PEKOE (Kgs)	100%	-	6	-		
BOPF (Kgs)	100%	-	109	-		

St. Joachim Estate

Consumable stock - Verification Schedules had not been submitted to audit 844,818 -

<i>Confirmation of Assets</i>	<i>Balance as per accounts</i>	<i>Total No. of accounts</i>	<i>No. of accounts confirmed</i>	<i>Value of balances confirmed</i> Rs.	<i>No. of accounts confirmed as a percentage</i> %	<i>Percentage of balances confirmed in value</i> Rs.
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TRB - Head Office

(i) Sundry debtors	1,535,850	109	Nil	Nil	Nil	Nil
(ii) Trade debtors	82,218,312	29	10	58,652,325	34.48	71.34
(iii) Analytical charges due	443,214	173	38	76,390	21.96	17.23
(iv) Insurance claims due - vehicles	103,085	7	Nil	Nil	Nil	Nil
(v) Pre-payments	456,032	5	Nil	Nil	Nil	Nil
(vi) Advance payments	4,762,593	95	1	25,000	1.05	0.52
(vii) Deposits	867,192	31	Nil	Nil	Nil	Nil
(viii) Bank Balances	9,908,953	3	2	4,035,079	66.67	40.72
(ix) Petty cash balances	310,089	8	Nil	Nil	Nil	Nil

St. Joachim Estate

(i) Sundry debtors	34,772	26	Nil	Nil	Nil	Nil
(ii) Cash in hand	33,857	1	Nil	Nil	Nil	Nil
(iii) Pre payment	221,256	9	Nil	Nil	Nil	Nil

Confirmation of Liabilities**Format - 12**

Type of liability	Balance as per accounts	Total No. of accounts	No. of accounts confirmed	Value of balances confirmed	No. of accounts confirmed as a percentage	Percentage of balances confirmed in value
	Rs.			Rs.	%	Rs.
TRB - Head Office						
(i) Sundry creditors	2,597,753	409	25	551,903	6.11	21.24
(ii) Tender deposits refundable	15,450	20	Nil	Nil	Nil	Nil
(iii) Security deposits refundable	179,378	3	Nil	Nil	Nil	Nil
(iv) Petrol deposits refundable	9,600	53	5	800	9.43	8.33
(v) Retention money payable	5,036	1	Nil	Nil	Nil	Nil
(vi) Other creditors	4,839,792	9	Nil	Nil	Nil	Nil
St. Joachim Estate						
Sundry creditors	794,233	27	2	84,708	7.41	10.66

Unreconciled Control Accounts

<i>Description Control Account</i>	<i>Balance as per Account</i>	<i>Description of subsidiary records</i>	<i>Balance as per subsidiary records</i>	<i>Difference</i>
			<i>Rs.</i>	<i>Rs.</i>
TRI - Head Office				
(i) Depreciation	8,300,297	Detailed schedule	9,344,148	1,043,851
(ii) Electrical stock	866,118	- do -	907,708	41,590
(iii) Stock at TRI Ratnapura	281,202	- do -	332,032	50,830
(iv) Stock at TRI Kottawa	17,702	- do -	52,675	34,973
(v) Stock at TRI Deniyaya	91,473	- do -	56,500	34,973
(vi) V. P. Plant Stock at Hantana	136,558	- do -	183,248	11,192
(vii) V. P. Plant Stock at Kottawa	136,558	- do -	145,184	8,626
(viii) Motor Spare Parts Stocks	1,348,549	- do -	1,240,227.85	110,000
(ix) Scientific stocks	887,473	- do -	839,856	47,617
(x) Labour loans - Deniyaya	7,100	- do -	3,900	3,200
St. Jochim Estate				
(i) Depreciation	1,205,898	- do -	1,165,412	40,486
(ii) Fixed Assets - Additions during the year 1997	5,011,381	Fixed Assets Register	5,040,511	29,130
(iii) Deepavali Festival Advance - 1997	166,000	Detailed Schedule	174,800	8,800
(iv) New Year Festival Advance - 1997	13,200	- do -	5,200	8,000
St. Coombs Estate				
(i) Account Current	721,887	Estate Balance Sheet	1,293,974	572,087
(ii) Cash advance	25,350	- do -	27,050	1,700
(iii) Electricity Recovery - St. Coombs Estate	1,594,938	- do -	1,580,833	14,105
(iv) Electricity Provision	Nil	- do -	242,807	242,807
(v) Lorry 26/9375	Nil	- do -	18,561	18,561
(vi) Electricity recovery - Lamilere Division	185,787	- do -	161,537	24,250
(vii) Other Income	Nil	- do -	821,050	821,050
(viii) One day Wages A/c	32,375	- do -	56,625	24,250

Suspense Accounts

<i>Title of Account</i>	<i>Nature of Transaction</i>	<i>Balance as at balance sheet date</i> Rs.	<i>Reason for not clearing</i>	<i>Age analysis</i>
(i) Suspense Account H.O	Recoverable amount from store keeper of the Board Loss of stationery items	169,285	Not explained	Over four years
(ii) Suspense Account - St. Coomb's Estate	Unidentified payments by Sundry Creditors	178,791	Not explained	Over three years

Lack of Documentary Evidence for Audit

<i>Description of items in the accounts affected</i>	<i>Value shown in the accounts</i> Rs.	<i>Documentary evidence not available</i>
(a) Stocks		
(i) Stock at Estates		
St. Coomb's Estate		
Consumable Stock	1,640,881	Detailed schedules and verification sheets
Nursery Stock	289,140	- do -
St. Joachim Estate		
Consumable Stock	844,818	Detailed schedules and verification sheets
Nursery stock	405,798	- do -
(b) Debtors		
(i) H.O.		
Sundry debtors	1,535,850	Confirmations
Insurance claims due vehicle	103,085	Confirmations
Sundry debtors	(26,308)	Age analysis
Recovery A/c	115,609	- do -
(ii) St. Coomb's Estate		
Staff salaries	158,074	Detailed schedules
Checkroll debtors	129,728	- do -
Sundry debtors	885,095	Detailed schedules, age analysis and confirmations
Ceylinco Insurance	10,530	- do -
Sub contractors	436,057	- do -
Electrification Labour Lines	1,409,151	Detailed schedules
Death donation A/c	12,487	- do -

(c) **Deposits, Pre-payment and Advances**

(i) **H.O.**

Deposits	867,192	Confirmations
Pre payments	456,032	Confirmations not called for

(ii) **St. Joachim Estate**

Pre payment	221,256	Confirmations
Gas Cylinder deposits	11,700	Detailed schedules
Drugs purchase A/c	5,646	- do -

(iii) **St. Coomb's Estate**

Purchasing advances	51,179	Detailed schedules and confirmation.
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(d) **Loans and Advances**

(i) **St. Coomb's Estate**

Festival loan	216,660	Detailed schedules
Special loan	24,950	- do -
Staff loan	898,420	- do -
Labour advance	58,155	- do -

(e) **Cash and Bank balances**

(i) **H.O.**

Bank of Ceylon - Talawakele	9,056,487	Confirmations
Petty cash imprest at sub stations	167,410	- do -

(ii) **St. Coomb's Estate**

Cash at Bank	1,555,957	- do -
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(f) **Creditors, Provisions and Other Credit balances**

(i) **H.O.**

Retention money payable	5,036	Schedule & confirmation
Provision for Payment	119,774	Schedule
Provision for Goods in transit	156,124	- do -
Tender deposits refundable	15,450	Confirmations
Security deposits refundable	179,378	- do -

(ii) **St. Coomb's Estate**

Sundry Creditors	1,660,190	Schedules, age analysis & confirmations
Check Roll	1,038,720	Schedules
Unpaid wages	7,120	- do -
Attendance bonus	595,646	- do -
Refundable deposits	13,598	Schedules & Confirmations
Provision for Payment	11,500	Schedules
Bought leaf A/c	952,416	- do -

(iii) **St. Joachim Estate**

T. S. H. D. A. Plants	60,900	Schedules
Production bonus	227,279	- do -
Provision for payments	3,954,652	- do -

(g) **Ratnapura Low Country station** 12,312 Bills, Purchasing Order, GRN etc.

Age Analysis of Debtors

<i>Class of Debtor</i>	<i>Amount as at Balance Sheet Date</i>	<i>0-3 Months</i>	<i>3-6 Months</i>	<i>6-9 Months</i>	<i>9-12 Months</i>	<i>1-2 Years</i>	<i>2-3 Years</i>	<i>3-4 Years</i>	<i>4-5 Years</i>	<i>Over 5 Years</i>
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
TRB - H.O										
Sundry Debtors	1,562,157	911,502	83,343	38,978	46,355	175,482	10,321	117,474	57,214	121,488
Sundry debtors(26,307) Age analysis had not been submitted										
Trade debtors	82,218,312	82,201,031	-	-	-	13,437	3,444	-	-	400
Analytical Charges Due	443,214	99,895	60,665	9,250	61,690	135,334	39,340	20,140	12,075	4,825
Insurance Claims Due	51,333	-	-	-	-	2,377	-	-	-	48,956
Bonds Outstanding	2,172,176	-	-	-	-	-	-	-	-	-2,172,176
	<u>86,447,193</u>	<u>83,212,428</u>	<u>144,008</u>	<u>48,228</u>	<u>108,045</u>	<u>326,631</u>	<u>53,105</u>	<u>137,614</u>	<u>69,289</u>	<u>2,347,845</u>

St. Joachim Estate

Sundry debtors	34,772	(14,876)	13,270	-	750	23,737	8,297	3,594	-	-
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Age Analysis of Creditors

<i>Class of Creditor</i>	<i>Amount as at Balance sheet date</i>	<i>0-3 Months</i>	<i>3-6 Months</i>	<i>6-9 Months</i>	<i>9-12 Months</i>	<i>1-2 Years</i>	<i>2-3 Years</i>	<i>3-4 Years</i>	<i>4-5 Years</i>	<i>Over 5 Years</i>
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>

TRB - H.O

Sundry Creditors	2,597,753	2,597,753	-	-	-	-	-	-	-	-
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St. Joachim Estate

Sundry Creditors	794,233	791,608	-	-	-	-	2,625	-	-	-
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Identified Losses

<i>Particulars of Items</i>	<i>Amount Rs.</i>	<i>Reasons for loss</i>	<i>Treatment of loss in accounts</i>
(a) Petty cash loss	76,436	Loss of petty cash at cash counter in 1992	Amounts identified had been transferred to the identified losses account and shown under the current asset.
(b) Loss of salary packets	132,238	Loss of salary packets at the cash counter in June 1992	Action had not been taken to recover the amount over 5 years and the amount recoverable had been transferred to identified losses account.
(c) Unpaid travelling claims	3,778	Advance not settled over 4 years	- do -
(d) Unpaid medical claim	2,221	- do -	- do -
(e) Unpaid cash against cheques	1,500	A personal cheque encashed at the counter	-do -
(f) Unpaid vouchers	200	Advances not settled	- do -
(g) Loss of items from electrical foreman's bungalow	109,331	Assets removed by the officer who had occupied the bungalow	Action had not been taken to recover the losses over two years.
(h) Missing items from Divisions	156,507	Loss of office and lab equipment investigated by the Internal Auditors	Action had not been taken to recover from relevant officer.
(i) Loss of VP Plant Sales-Deniyaya Investigated by the Internal Auditors	227,116	Reasons for loss had not been investigated	Adjustments had not been made in accounts.
(j) Missing inventory items of Entomology & DDR (T)'s office investigated by the Internal Auditors	8,741	- do -	- do -

Cost of Personnel

Category of Personnel	No. of Employees		Total Cost				Cost per Employee			
	As at end of 1997	As at end of 1996	Normal Pay		Overtime		Normal Pay		Overtime	
	1997	1996	1997 Rs.	1996 Rs.	1997 Rs.	1996 Rs.	1997 Rs.	1996 Rs.	1997 Rs.	1996 Rs.
Executives	52	54	5,956,224	6,166,789	-	-	114,543	114,119	-	-
Non-executives	119	112	8,649,626	7,527,482	729,048	654,413	72,686	67,209	6,126	5,843
Minor Employees	62	58	3,224,424	3,021,040	722,028	484,165	52,007	52,086	11,646	8,348

Other Slow-moving, Idle and Under-utilised Assets and Idle Labour

Description of item	Period of non-use or under-utilisation	Reason
Estate Bungalow at St. Joachim	Over three years	Factory Mangers's bungalow at St. Joachim Estate had remained idle with the furniture for over three years.
Electrical Stock, General Stock H.O	Over three years	According to the report of the Board of survey for 1995 revealed that large number of items had remained in the stores without being utilised for appropriate purposes.
Tea Factory at Lamilear Division - St. Coomb's Estate	Since 1987	A Tea Factory with the machineries installed for Production of green tea had remained idle from the time of acquisition of Lamilear Division by the Board.
Vehicles		Following unserviceable vehicles had remained in the garage premises for long period without action being taken to disposed off.
	<i>Registration No.</i>	<i>Duration at garage</i>
	23 - 7607 Tata - 1210 Bus	From 1993
	29 - 6584 Isuzu van	- do -
	35 - 1702 Mitsubishi van	- do -
	38 - 8248 Volkswagen van	- do -
	14 - 8959 Volvo car	- do -
	27 - 4862 Mitsubishi Canter Lorry	- do -
	41 - 4802 Mitsubishi Fuso Lorry	- do -
	31 - 8906 Mitsubishi Jeep	- do -
	40 - 1990 Datsun Double Cab	- do -
Generator at St. Joachime	One year	This generator had been remained idle for over one year.

Uneconomic Transactions

<i>Class of Transactions</i>	<i>Details of Transaction</i>	<i>Nature of deficiency</i>
(a) Gasifier and steam boiler/radiator system for withering and drying Project at St. Joachim Estate-Ratnapura	An Advance amounting to Rs. 2,043,750 paid to M/s Colombo Commercial Company Ltd. for supply & installation of gasifier Steam boiler at St. Joachim Estate - Ratnapura	Eventhough the advance paid, the work had not been completed yet. Action had not been taken by the Board to get complete the contract or to recover the advance paid.
(b) Foreign Scholarships	Employees of the Board who went on study leave abroad had not resume duties at the Board as per their bonds agreed. The value of the bonds to be recovered as follows.	The Board did not benefited ifed in turn eventhough it had facilitated to the employees to enhance their technical skills and competent.

The bonds outstanding valued at Rs. 5,952,477 remained unrecovered as at 31 December 1997.

<i>Name of the officer</i>	<i>Value of the bonds outstanding</i> Rs.
Athula Ekanayake	317,370
U. K. K. Wickramasinghe	422,020
Sri Ramaratnam	125,325
Asoka Basnayake	104,261
T. Thevadasan	851,000
T. S. Gunasekara	2,382,496
Nalin L. Herath	260,157
W. A. D. P. Wanigasundara	891,000
D. K. Nawaratna	598,848
	<u>5,952,477</u>

(c) Patent Rights	Patent right had been registered by the Board in connection with the two inventions called "Development in or relating to the increased stability and self life of liquid tea and concentrates and carbonated non carbonated ready to drink beverages" and "An efficient method for the commercial propagation of tea by Tissue culture technique."	Eventhough this patent rights had been obtained several years ago and being renewed yearly income on the patent right had not been generated so far, thus indicating that no one had been used these new inventions for their purposes.
(d) Insurance claims due	Insurance claims aggregating Rs. 51,333 had remained outstanding for over 8 years	Eventhough these claims outstanding over long period, action had not been taken by the Board to write off the amounts.

Major Variations against the Budget

Class of Item	Budget Rs.	Supplemen- tary Budget Rs.	Total Rs.	Actual Rs.	(A) Adverse (F) Favourable Rs.	Percentage %	Reasons given by the Management
(A) Revenue							
a) Sale of Green Leaf	2,420,000		2,420,000	3,511,159	1,091,159 (F)	45.09	Increase in price of Green Leaf
b) Miscellaneous	1,827,000		01,827,000	4,279,304	2,452,304 (F)	134.23	Increase in number of analytical samples and Disposal of Fixed Assets not budgeted.
(B) Expenditure							
1) Personnel Emoluments	30,229,000	50,000	30,279,000	31,120,839	841,839 (A)	2.78	Increase in daily rate of Labour Wages
2) Travelling Expenses Local	2,300,000	30,000	2,330,000	3,510,403	1,180,403 (A)	51.32	Increase in Subsistence & batta rates and more visits
Overseas	600,000		600,000	767,345	167,345 (A)	27.89	More foreign visits
3) Supplies and Requisites	9,163,000	181,000	9,344,000	9,476,067	132,067 (A)	1.44	Price increase of the General Goods etc.
4) Repairs and Maintenance of Capital Assets	8,458,000	57,000	8,515,000	13,012,056	4,497,056 (A)	53.17	Repairs to vehicles which are over 10 years old & due to high cost of Spare Parts.
5) Depreciation of Fixed Assets	8,500,000		8,500,000	8,300,297	(199,703) (F)	(2.35)	Over provision
6) Transportation, Communication Utility & Other Services	13,228,000		13,228,000	15,746,117	2,518,117 (A)	19.04	Due to increase in Electricity & Telephone charges
7) Pensions, Retirement benefits	3,445,000		3,445,000	3,312,759	(132,241) (F)	(3.84)	Vacancies not filled
8) Gratuity Provision	900,000		900,000	4,827,854	3,927,854 (A)	436.43	Salary increase not budgeted
9) Losses & Write-offs	25,000		25,000	29,238	4,238 (A)	16.95	Under Provision
10) Contribution, Grants and Subsidies	1,150,000		1,150,000	1,431,020	281,020 (A)	24.44	Due to increase in price of Tea supplied to staff.
11) Cultivations and filed Trials	3,715,000		3,715,000	4,328,305	613,305 (A)	16.51	Increase in daily rates of Labour Wages
12) Miscellaneous	7,220,000	12,000	7,232,000	4,196,538	(3,035,462) (F)	(42.04)	Less Overseas Training

(c) Capital Expenditure

1) Buildings	2,274,300	325,000	2,599,300	33,046	(2,566,254) (F)	(112.84)	Revoted for 1998
2) Plant Machinery & Lab Equipment	2,577,000	60,000	2,637,000	2,448,371	(188,629) (F)	(7.32)	Revoted for 1998
3) Office Equipment	1,781,100	778,000	2,559,100	2,392,672	(166,428) (A)	(9.34)	Replacement of Computers
4) Furniture Fittings and Household Equipment	755,100	130,000	885,100	879,101	(5,999) (A)	(0.79)	Increase in price of items
5) Road, Water Supply, Electricity & Telephone	595,000	125,000	720,000	536,133	(193,867) (F)	(32.58)	Works not completed
6) Motor Vehicle and bicycles	3,000,000		3,000,000	3,645,000	645,000 (A)	21.50	Under estimated
7) Workshop tools and Equipment	76,500		76,500	66,970	(9,530) (F)	(12.46)	Purchases not made
8) Other Fixed Assets	1,962,000	172,000	2,134,000	1,300,341	(833,659) (F)	(42.49)	Purchases not made

Format - 30

Rates and Percentages

Description

According to the accepted elevation averages, the refuse tea percentage on made tea should be 4% in Nuwara Eliya area.

Deficiencies

However, the refused tea percentage of St. Coomb's factory had significantly been varied with accepted norms in 1997.

The table I shows the monthly - wise refuse tea percentage in 1997 compared with 1996 figures.

Action had not been taken to improve plucking practices at St. Coomb's estate in orders to obtain lower rates of refuse tea percentages.

Table I Rates and Percentages of refuse tea in 1997 as compared with 1996
 Figures - St. Coomb's Factory

Month	Green Leaf	Refuse Tea	Made Tea	Refuse Tea 1997 %	Percentages 1996 %
January	135,517	2,119	34,960	6.35	5.43
February	68,169	995	18,677	5.62	5.54
March	52,072	814	14,261	5.98	5.50
April	80,454	906	18,425	5.10	6.13
May	344,837	5,748	77,255	7.92	11.95
June	129,450	1,358	30,891	4.39	9.56
July	176,907	2,065	39,610	5.38	7.90
August	108,480	1,220	24,164	5.20	6.80
September	115,531	1,206	25,377	4.89	4.60
October	158,941	1,880	36,796	5.30	4.90
November	165,384	2,117	39,761	5.52	6.88
December	164,582	2,008	40,002	5.18	6.43

Delays in Projects

<i>Description of the Project</i>	<i>Details of delays in completion</i>	<i>Reasons for delays</i>
Funds granted from foreign agencies for special research Projects	(a) Field trail on Sul-po-mag Out of sum of Rs. 50,000 granted in May 1991 for this Project Rs. 6,381 only had been utilised for the project.	The trial had been abandoned.
	(b) Radophol is Projects Details are given below.	Reasons for delays in completion had not been explained.
	Sums granted Details are given below.	
	<i>Sums granted</i>	<i>Rs.</i>
	April 1993	50,000
	Sep. 1994	112,568
		162,568
	Amount spent	<u>47,413</u>
	Amount un-utilised as at 31 December 1997	<u><u>115,155</u></u>
	(c) Orthodox - CTC Project A sum of Rs. 2,500,000 received in July 1995 remained unutilized upto 31 December 1997	Reasons had not been explained.

Non-compliance with Laws, Rules and Regulations

Reference to Laws, Rules, Regulations, etc.

Non-compliance

(a) SLAS - 10

Any event or transaction falling outside the time frame of the current financial year which does not satisfy are of the following three categories to be shown as current year item.

- (a) Gains or losses as a result of a decision or determination of persons other than management or owners.
- (b) Correction of fundamental error.
- (c) Change in accounting policy.

Prior period item totalling Rs. 69,672 which did not satisfy any of these categories mentioned in SLAS - 10 had not been treated as current year item.

(b) **Finance Act No. 38 of 1971**

(i) Section 13 (5) (b)

A report to be submitted along with the accounts in terms of Section 13 (5) (b) of the Finance Act No. 38 of 1971 as specified by the Auditor General.

The report in terms of Section 13 (5) (b) of the Finance Act No. 38 of 1971 as specified by the Auditor General had not been furnished to audit.

(ii) Section 8 (1)

The Board shall prepare a budget in respect of every financial year and such budget shall be approved by the Governing body of the Board not later than three months prior to the commencement of the financial year.

The budget for the year under review had been approved by the Governing body of the Board on 20 December 1996.

(iii) Section 6

The accounts of the Board should be submitted to the Auditor General for audit within four months after the close of that year along with any report on the accounts which the Auditor General may require to be submitted in the manner specified by him.

- (i) Annual accounts of the Board for 1997 had been furnished to audit on 16 July 1998.
- (ii) Annual board of survey reports on fixed assets and age analysis of debtors and creditors were not furnished for audit.

(ii) Chapter xxiv
Section 2

Salary loans should be granted only for the purposes as specified under the Section xxiv of the Establishment Code. Mrs. S. M. M. A. Jayakody had been granted an interest free special loan amounting to Rs. 94,398 in 1992, payable in 157 instalments over 13 years for her higher studies in U.K. Out standing balance as at 31 December 1997 was Rs. 57,121. Action had not been taken as yet to recover the loan eventhough this matter had been included in previous year audit report also.

(e) Ministry of Finance and
Planning Circular
No. MF/6/1/1/96 dated
on 02 April 1996

Advance amounting to Rs. 152,791 obtained by a Deputy Director on foreign visits made to Kenya in October 1996 had not been settled until 30 August 1998.

(f) Financial Regulations
No. 109 (1) and the

Action had not been taken as per the F. R. 109 (i) in connection with the write-off of losses valued at Rs. 156,507 at the TRB - Head Office. No Board approval had also been taken for the write-off as well.

(g) Employee Provident
Fund Act No. 15 in 1958

(i) E.P.F. Contributions deducted from holiday pay aggregating Rs. 141,930 of St. Coombs Estate in February 1997 had been remitted to the Central Bank on January 1998.

(ii) E. P. F. Contributions for February 1997, amounting to Rs. 3,067, deducted from the staff of Passara Sub-station, had not been remitted to the Central Bank as at the date of Audit Inspection.

Systems and Controls**Main Functional**

Areas	Detailed aspect	General comments	Detailed comments
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(a) Cheque receipts

Delay in depositing at the Bank

Poor in operation

It was observed that long delays had been experienced in banking of cheques as details given below.

Date of receipt of the Cheque and Number

Date deposited at the Bank

Value of the Cheque
Rs.

97.01.01
182229

97.1.15

20,000.00

97.01.01
101191

97.1.15

25,025.70

97.01.29
143154

97.02.11

1,250.00

96.11.25
631124

97.01.07

1,5000.00

96.11.18
631121

97.01.07

1,000.00

(b) Purchasing advances

It was observed in audit that an unacceptable practice was experienced in payment of advances at the Low-country Station at Ratnapura. Advances were paid under temporary vouchers certified by the officer in charge of the station. They prepare a fresh voucher and entered in the cash book when settlement of the advance and subsequently the temporary voucher is destroyed. Each and every advance should be entered into the cash book when the advance payment is made.

Poor in operation of system

The usual practice to enter the advance payment in the cash book when the advance payment is effected. It is entered in the cash book at the time of settlement.

- (c) Bank Reconciliation Non-presented cheque - do - Non-presented cheques for more than six month period valued at Rs. 7,581 had not been taken in to the income of St. Joachim Estate Ratnapura as details given below.

<i>Name</i>	<i>Amount</i>	<i>Year</i>
Sri Lanka Telecom	25.00	April 96
L. M. Lional	2,934.93	June 96
TRI Sports Club	980.00	March 97
T. Indrani	3,641.27	- do -
	<u>7,581.20</u>	

- (d) Festival and Other Advances Action had not been taken to recover or write off the balances of festival advance remained outstanding during last four years. Poor operation in system Actions had not been taken to recover or write off the following balance of festival advance given to the officers of St. Joachim estate and St. Coomb's estate.

St. Joachim Estate

<i>Year</i>	<i>Amount</i> <i>Rs.</i>
93/94	9,132.19
94/95	980.00
95/96	2,080.00
96/97	<u>1,025.73</u>
	<u>13,217.92</u>

St. Coombs Estate

M.P.C.S. - Nuwareliya	20,000
V. Sundar	8,445

- (e) Stocks

- (i) Auto diesel and Fire-wood-St. Coombs Estate - do - There was no proper control over the stocks of St. Coombs Estate at Talawakele. It was revealed the following shortages and excesses at the audit verifications.

	<i>Diesel</i> <i>(litre)</i>	<i>Fire wood</i> <i>(C.M.)</i>
Stock balance as at 1998.09.12	13,004	146
Physical verified balance	<u>14,271</u>	<u>127.6</u>
Excess/shortage	<u>1267</u>	<u>18.4</u>

(f) Cheque receipt	No follow up action had been taken in respect of unrealized cheques issued members.	Poor operation in system	A cheque amounting to Rs. 26,594.02 - received on 9.12.96 from Mr. W. M. Premaratna of St. Coombs Estate, on account of settlement of distress loan balance had not been realized as at September 1998. No follow up action had been taken in this connection.
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(g) Cash advance payment	Un-authorized cash advance payment	Deviation of the system	A cash advance of Rs. 9,750 had been paid to an office peon with out requisite authority and necessity.
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Amount

Rs.

1740 Muthukumar

9,750

(h) Advances	Long delay in settlement of advances	Poor operation of control	Long delays were observed in setteng advances, granted to outside parties as well as employees for the purchases of goods and obtain services. The details of advances granted and delays observed are shown in Schedule I.
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(i) Fuel stock	Non-availability of measure	- do -	The fuel stock could not be verified due to non-availability of measure (dip - stick) which is a n essential part of the Cylinder tank located at St. Joachim Estate.
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(j) Tea Stock	Non-use of bins	- do -	It was observed in audit that made tea had been heaped up on the floor of the St. Joachim factory without using tea bins before packing. This situation leads to high moisture content and contamination of the made tea.
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Schedule -

Delays in settling advance

Name	Payment		Settlement		Balance	Outstan-
	Date	Amount	Date	Amount	Refund	ding
		Rs.		Rs.		Rs. Rs.
Insurance Corp.	14.1.97	93,584	22.10.97	93,584	-	- -
G.P. Udumulla	27.1.97	800	14.2.97	-	-	- -
Kandy offset printers	10.2.97	5,100	14.7.97	-	-	- -
Associated newspapers						
Ceylon Ltd.	7.3.97	1,275	17.5.97	-	-	- -
Brown & Co. Ltd.	24.3.97	4,000	15.5.97	-	-	- -
Lake House Book Shop	7.3.97	5,616	31.12.97	-	-	- -
B. D. G. Premadasa	31.3.97	1,000	16.6.97	-	-	- -
Swedlanka Industries	11.4.97	53,493	18.11.97	-	-	- -
D. K. W. Plastic Industries	5.6.97	28,386	01.10.97	-	-	- -
Seelanatha Kuruppu & Sons Ltd.	6.5.97	37,375	17.9.97	-	-	- -
Contractor Supplies (Management) Ltd.	4.6.97	3,650	23.9.97	-	-	- -
Hayleys Engineering Ltd.	10.12.96	1,238,118				
			7.8.97	-	-	- -
- do -	10.6.97	1,000,000				
East West Information Systems Ltd.	16.7.96	181,850	8.8.97	-	-	- -
Neshanya (Pvt.) Ltd.	25.3.95	47,500	27.5.97	-	-	- -
St. Anthony's Industries Group (Pvt) Ltd.	27.6.97	21,940	25.8.97	-	-	- -
Brown & Co. Ltd.	30.12.96	3,000	12.6.97	-	-	- -
B. Tilakarathna	8.8.97	15,000	6.12.97	28.11.97	5,975	- -
Ratnayake Rubber Industries	10.9.97	79,400	11.12.97	-	-	- -
Diesel & Motor Eng. Co. Ltd.	23.9.97	132,590	18.11.97	-	-	14,280 -
		12,250				
Lake House Book Shop	22.2.96	5,616	31.12.97	-	-	- -
Time C/o Bank of Ceylon	20.6.94	1,872	31.12.97	-	-	- -
		<u>2,973,415</u>				

Vehicle Utilisation

Certain significant information relating to the performance of the Board's vehicle fleet is given below.

	<i>Petrol</i>		<i>Diesel</i>	
	<i>1997</i>	<i>1996</i>	<i>1997</i>	<i>1996</i>
Total Number of Vehicles as at 31 December				
Motor Cars (include cab vehicle)	04	-	11	-
Jeep	-	-	15	-
Buses	-	-	04	-
Vans	-	-	02	-
Lorries	01	-	07	-
Motor Cycles	23	-	-	-
Tractors	-	-	02	-
Land Vehicles : Tractors	-	-	01	-
Bulldozers	-	-	-	-
Total	<u>28</u>	<u>-</u>	<u>42</u>	<u>-</u>

<i>1997</i>				<i>1996</i>				<i>1997</i>				<i>1996</i>			
<i>Type of Vehicle</i>				<i>Type of Vehicle</i>				<i>Type of Vehicle</i>				<i>Type of Vehicle</i>			
<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>

Performance

No. of vehicles utilised during the year (excluding unserviceable)	04	01	23	-	-	-	-	28	11	-	03	-	-	-	-
Distance travelled operated Km.	29,930	1,531	74,637	-	-	-	-	1,029,220	154,110	-	4,788	-	-	-	-
Fuel consumed in litres	3,543	386	3,152	-	-	-	-	117,853	38,256	-	3,882	-	-	-	-
Total expenditure on fuel	Rs. 158,906	19,404	161,621	-	-	-	-	1,602,646	517,989	-	52,430	-	-	-	-
Cost of repairs and maintenance (including insurance licence)	Rs. 479,860	76,684	100,277	-	-	-	-	4,496,120	1,882,225	-	105,256	-	-	-	-
Drivers' salaries, Bata and overtime Rs.															
Total cost (excluding drivers' remuneration)	Rs. 638,766	96,088	261,898	-	-	-	-	6,098,766	2,400,214	-	157,686	-	-	-	-

**Vide classification below.

*Transport Fleet had not been submitted for 1996.

	1997				1996				1997				1996			
	Type of Vehicle				Type of Vehicle				Type of Vehicle				Type of Vehicle			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
Performance per Kilometre/Hour*																
Average performance per litre in Km/m hours*	8.44	3.97	23.68	-	-	-	-	8.73	4.03	-	1.23	-	-	-	-	-
Average expenditure per Km/hour* on fuel Rs.	5.31	12.67	2.16	-	-	-	-	1.56	3.36	-	10.95	-	-	-	-	-
Average expenditure per km/hour* on repairs and maintenance Rs.	16.03	50.09	1.34	-	-	-	-	4.37	12.21	-	21.98	-	-	-	-	-
Average expenditure per km/hour* on drivers' remuneration Rs.																
Average cost per Km/hour* in respect of depreciation Rs.																
Overall average expenditure per Km/hour Rs.	21.34	62.76	3.51	-	-	-	-	5.92	15.57	-	32.93	-	-	-	-	-

** Classification

Type of Vehicle	Basis of Computation
A. Passenger vehicles (Excluding buses)	Kilometre
B. Buses and Lorries	-do-
C. Motor Cycles	- do -
D. Land Vehicles *	Hour

J. D. R. Jayalath
Assistant Auditor General
for Auditor General

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இலங்கை தேயிலை ஆராய்ச்சி நிலையம்
TEA RESEARCH INSTITUTE OF SRI LANKA

විදුලි පුවත් : රීසර්ච්, තලවාකුලේ
තැන්පි : ඊසේඡ්, තලවාකුලේ
Telegrams : 'RESEARCH' Talawakelle

දුරකථනය : } Nu. E. 052-8385
 } 8386
 } Hatton 0512-601

සැදුණු අංකය : } CA/42 A
 }
 } REFERENCE No. }



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සෙණරු සුමිල්
ST. COOMBS

තලවාකුලේ, ශ්‍රී ලංකා
තලවාකුලේ, இலங்கை
TALAWAKELLE, SRI LANKA

Yr. Ref : PI/H/TRB/96/163

9th March 1998

The Auditor or General
Auditor General's Department
Independence Square,
Colombo 7.

Attention : Mr. J. D. R. Jayalath
Assistant Auditor General

Dear Sir,

**Report of the Auditor General on the accounts of the
Tea Research Board for the year ended 31 December 1996
in terms of Section 14 (2) (c) of the Finance Act No. 38 of 1971**

We refer to your letter dated 25th February 1998 on the above subject and forward herewith our comments on the draft report.

It is very much appreciated if you could review the report after taking into consideration our comments dated 05th February 1997.

Yours faithfully,

Dr. S. D. I. E. Gunawardene
Chairman
Tea Research Board
9.3.98

W. B. Herath
Senior Accountant
TRI
9.3.98

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- 289 - 299 - Comments submitted on 5th February, 1998**
- 300 - 303 - Director's and Deputy Director Research's observations**
- 304 - Additional commentsfor draft report dated 25th February, 1998**

**COMMENTS ON THE AUDIT REPORT IN TERMS OF
SECTION 13 (7) (a) OF THE FINANCE ACT
NO. 38 OF 1971 ON THE ACCOUNTS OF
TEA RESEARCH INSTITUTE FOR THE YEAR ENDED
31ST DECEMBER, 1996**

Format 9 - Accounting Deficiencies

a) **Fixed Assets** : **Errors in capital and revenue allocation**

Description of the assets

a) Nebulizer and rings purchased for Analytical Division : Auditors comment is incorrect. These spare parts were purchased for repairs.

b) Installation of monark burner for the factory at St. Joachim : This has been adjusted in 1997 accounts

c) Cost of UPS system for St. Joachim Estate : This has been adjusted in 1997 accounts

d) Jem motor for Water Pump : Auditors comment is incorrect. Jem motor for Water Pump had been correctly charged to capital account in 1996.

e) Construction of retaining wall at St. Coombs Estate : This has been adjusted in 1997 accounts

b) **Fixed Assets** : **Omission**

The goods received note for the Pressure Plate Apparatus Accessories had been sent to CARP and was not available to us at the time of preparing the final accounts.

c) **Fixed Assets Depreciation** : **Understatements/overstatements**

This has been adjusted in 1997 accounts

d) **Fixed Assets** : This has been adjusted in 1997 accounts

e) **Fixed Assets** : **Errors in capital and revenue allocation**

These are capital nature of expenditure and had been correctly charged to capital accounts.

f) **Prior year adjustments** : **Inappropriate disclosure**

We have been debiting the prior year adjustment entries as per SLAS 10 up to end of 1994. But Auditors in their report for the year ended 1994 highlighted that the expenditure of the prior year be charged to prior year adjustment account as shown in the following extracts of Auditors report 1994.

Expenditure on telephone charges for 1993 amounting to Rs. 2006.78 had been accounted for as expenditure for the year instead of being debited to prior expenses account.

Expenditure on maintenance of colour separator during 1993 amounting to Rs. 8,000 had been accounted for as Expenditure for the year instead of being debited prior period items (PI/H/TRI/94/121-07.08.95)

E. P. F. payable during 1993 amounting to Rs. 8,609.39 had been debited to labour wages instead of being debited to prior period items.

Expenditure on railway bills for 1993 amounting to Rs. 7465.50 had been debited to personnel emoluments instead of being debited to prior items.

In future the expenditure pertinent to prior year will be dealt as per SLAS 10.

g) Fixed Assets

: Inappropriate disclosure

Fixed Assets in question are still the property of the Tea Research Board although they are located at the Sri Lanka Tea Board.

h) Sales Overstatement

: This was the practice adopted by us all these years. However action will be taken to value the stock at the year end at COP or Net realizable value whichever is lower.

i) Grants Received

: Classification error

Audit comment is correct. However this has not affected the final accounts presented for the year 1996. The ledger has been corrected in 1997.

j) Foreign travelling advance

: Classification error

Amount advanced to Dr. G. D. Wimaladasa equivalent to Rs. 152,791/= was treated as a debt due from him as he has failed to submit a proper statement of expenditure. This classification error appearing in 1996 accounts was rectified in the books of accounts in the year 1997.

- k) **Insurance claim due** : **Omission**
The amount stated in the Audit Report was not available to us at the time of preparing the final accounts. This has been accounted for in 1997 accounts.
- l) **Fixed Assets** : **Omission**
Internal Auditor's report was not available to us at the time of preparing the final accounts. Adjusted in 1997 accounts.
- m) **Bonds outstanding** : **Omission**
These have been taken in to 1997 accounts. Legal action is contemplated against the officers through the Attorney General.
- n) **Sub contractors St. Coombs Estate** : **Calculation error**
There was no overpayment. The credits for work completed had not been accounted. Accounts had been adjusted in 1997 accordingly. No double payment have been made.

Format 10 - Verification of Physical Assets

Class of Assets:	Shortages	Excesses	
TRB - Head Office			
(1) Stationery Stocks	Rs. 228	Rs. 674	Action will be taken to investigate and adjust the accounts in 1997.
(3) Scientific Stocks	Rs. 37,982	Rs. 9,576	Action will be taken to investigate and adjust the accounts in 1997.
(4) Drugs Stock			Verification schedules had been submitted.
(6) General Stocks	Rs. 8,596	Rs. 15,975	Evaporation of petrol for the last 10 years.
(7) Stocks at Ratnapura	Rs. 750	Rs. 242	Action will be taken to investigate and adjust the accounts in 1997.

Format 11 - Confirmation of Assets

In the letter by which a confirmation is invited, we have explicitly stated that in the absence of response, it will be concluded that the balance indicated is correct.

In respect of pre payments and advance payments we do not invite the confirmations since the documents from the payees are available which would confirm the correctness of the amounts.

Format 12 - Confirmation of Liabilities

Same comment as in the 1st para under Format 11 above.

Format 13 - Unreconciled Control Accounts

- (1) Fixed Assets : This has been reconciled.
- (2) Total Expenditure under solar energy power : This has been reconciled.
- (3) General Stock : This has been reconciled.
- (4) Electrical Stock : This has been reconciled.
- (5) Sundry Creditors : This had been reconciled and detailed schedules had been submitted.
- (6) Labour Loans Kottawa : This has been reconciled.
- (7) Labour Loans Passara : This has been reconciled.

St. Coombs Estate

- (1) Festival Advance : This had been reconciled and the detailed schedules had been submitted.
- (2) Check Roll Debtors : This had been reconciled and the detailed schedules had been submitted.

St. Joachim Estate

- (1) Festival Advance : The difference is the omission of the festival advance balance of Mr. Kamal Perera from the detailed schedule.

Format 14 - Suspense Accounts

- (1) Suspense Accounts H/O.
Loss of Stationery Items : Officer responsible had been dismissed from the services of the Institute L. T. Case is pending.
- Missing Table : This has been adjusted in 1997 accounts
- Loss of Petty Cash : Officer responsible had been dismissed from the services of the Institute. L. T. Case is pending.
- Amount payable to Ex-officer
Mr. V. Selladurey : Action will be taken to refund the balance after recovering for the missing items.
- (2) Suspense Account Unidentified payments : Action will be taken to
St. Coombs Estate by sundry creditors clear this account in 1997.

Format 15 - Lack of Documentary evidence for audit

- a) Vehicle running expenses : Detailed schedule will be forwarded.
- b) Stocks
 - Stocks at Estates :
 - St. Coombs Estate :
 - Rice and foodstuff : This has been sent subsequently.
 - General Stock : This has been sent subsequently.
 - Nursery Stock : This has been sent subsequently.
 - St. Joachim Estate
 - Consumable Stock : This has been sent subsequently.
 - Nursery Stock : This has been sent subsequently.
- c) Debtors
 - St. Coombs Estate
 - Sundry Debtors : This has been sent subsequently.
- d) Deposit, Pre-payments,
Advance for Purchases
 - St. Coombs Estate
 - Sub contractors : The detailed schedule will be forwarded.
- e) Advances
 - St. Coombs Estate
 - Special Loan : The detailed Schedule will be forwarded.
 - Labour Advance : The detailed schedule will be forwarded.
- f) Creditors Provisions & Other Credit Balances
 - St. Coombs Estate
 - Sundry Creditors : The detailed schedule has been submitted.
 - Attendance Bonus : The detailed schedule will be forwarded.

Format 16 - Age analysis of Debtors

- a) Sundry Debtors : Mr. S. Sundaralingam former OIC, TRI Pelagahatenna has to perfect documents and forward same to REPPIA for the reimbursement of Rs. 96,840/-.
- The other amounts are dues from ex-TRI officers. In respect of these there are L.T. cases pending and once the outcome is known these will be recovered from the amounts due for payments.

- b) Recovery Account Rs. 1,100/= due from ex-TRI officers cannot be recovered seeking approval for write-off.
- c) Trade Debtors Rs. 1000/= due from Hopton Group for supplying cuttings from Passara TRI Centre. OIC Passara will follow action to recover the amount.
- (d) Insurance Claims Due : Period of claims had been lapsed. Action will be taken to investigate and seeking approval for write-off.
- e) Bonds Outstanding : Files have been handed over to Attorney General Dept. for necessary Legal action.
- h) Analytical Charges Due Attempts to recover analytical service charges from Private small holders have failed. Seeking approval for a write-off.
- St. Coombs Estate Action will be taken by the new Superintendent for the recoveries.
- St. Joachim Action will be taken by the new Superintendent for the recoveries.

Format 17 - Age Analysis of Creditors

TRB - Head Office

- b) Tender Deposit Refundable Action will be taken to credit the TRB Miscellaneous Income account if not claimed.
- Sundry Creditors
- St. Coombs Estate : Action will be taken to credit the TRB Miscellaneous Income account if not claimed.
- St. Joachim Estate Action will be taken to credit the TRB Miscellaneous Income account if not claimed.

Format 19 - Identified Losses

- a-f) Loss of Petty Cash, Salary Packets, Medical Claims Travelling Claim, etc. : The officer responsible had been dismissed from the services of the institute after a domestic inquiry. Labour Tribunal case is pending.
- g) Loss of items from Electrical Foreman's Bungalow : The cost of items lost was recovered from the former Electrical Foreman, but had to be refunded on Assistant Commissioner of Labour's directive. Seeking approval for a write-off.

- h) Ban Charges : All the expenditure of L/C and other charges had been debited to Research Units.
- i-j) Missing "Mettler" balance at Plant : This is being investigated by the Lindula
Physiology Division and loss of lab
equipments investigated by the
internal auditors : Police.

Format 25-Other Slow-,moving Idle and under-utilized Assets and Idle labour

- Estate Bungalow
St. Joachim Estate : L. T. Case is pending against the Factory officer who had been interdicted. Action will be taken to gain possession of the house and household items.
- Electrical Stock and General :
Stock - HO : These are slow moving items and will be used whenever required.
- Dismantled items at St. Joachim : Action will be taken to dispose the items by an Auction.
- Tea Factory at Lameliere Division :
St. Coombs Estate : The Green Tea Project would not be re-activated until the staff in the Technology Division is trained.
- Vehicles : Action will be taken to dispose the items by an Auction.

Format 26 - Un economic Transaction

- a) Reimbursement of Medical
Claim : Actions per Medical Fund Rules, 50% of the Medical Claim could be reimbursed for the officer and his/her family.
- b) Patent Rights : A party who is interested had already applied for a BOI project to produce this product in commercial scale and negotiations/discussions are currently underway to finalize the transfer of the patent rights.
- c) Gasifier and steam boiler/Radiator :
system for withering and during
project of Ratnapura : M/S Colombo Commercial Co. Ltd. failed to deliver the goods under the contract. This matter has been brought to the notice of the Attorney General's Department to pursue legal action.
- d) Foreign Scholarships : Legal action contemplated against the officers through the Attorney General.
- e) Workers' Housing
Electrification : Work has been completed in 1997.

- f) Goods in transit : Goods had already been cleared and the entries will be passed in 1997.
- g) Insurance claims due : Action will be taken to write-off.

Format 30 - Rates and Percentages

- a) According to the accepted estate practices the check roll weight should be below than factory weight : (1)However, at the end of the year the total factory weight is higher than the check roll weight.
- b) According to the accepted elevation averages, the refuse tea percentage on made tea should be 4% in Nuwara-Eliya area : St. Coombs Estate was running without a permanent Superintendent for the last three years. Now a permanent Superintendent has been appointed the plucking standard would be improved.

Format 33 - Delays in Projects

Description of the Project

- a) Field trial on sul-po-mag. : This is an on-going project. The expenditure of fertilizer and travelling had been inadvertently charged to B/FERT and D/AGCH.
- b) Radopholus Projects : This is an on-going project and in progress
- c) Energy Efficiency Solar Energy Project : This is an on-going project and is in the final stage.
- d) Ortho-CTC Project : Action will be taken by the Institute's Tender Board as tender limits have been enhanced as per new guideline by Government on purchasing.

Format 36 - Non compliance with Laws, Rules, Regulation and Management Decision

Reference to Laws, Rules, Regulation etc.

- a) **Finance Act**
 - (i) Section 8 (1) : The reason for delay was the resignation of the Senior Accountant in April 1996 and the new Senior Accountant was appointed on 16/12/1996. However, every attempt will be made to get the budget approved three months before the year end in future.
 - (ii) Section 13 (5) (b) : Contents noted. Action will be taken to submit the reports of the stock and stores from the year 1997 onwards.

b) Financial Regulations

F. R. 756

Assets were verified continuously from 1994 to mid 1996. Hence, an annual verification was not carried out in 1996. However, from 1997 action will be taken to verify assets at the end of the year.

c) Establishment Code

(i) Chapter XXIV Section 2

This had been inadvertently debited to loan account instead of debtors. This facility has been provided to Mrs. J.A.A.M. Jayakody to gain specialization in agriculture economics, a subject matter area a crucial importance in evaluating the new technologies developed by the Institute.

(ii) Chapter XXIV Section 7.5

Disciplinary action will be taken against the officers who had failed to produce the certificate of registration, revenue license, etc. for the vehicle loans obtained.

d) Department of Inland Revenue
Circular dated 24 August 1989

Action will be taken to remit the turnover tax collected to the Inland Revenue Department early.

e) Ministry of Finance and Planning
Circular No. MF/6/1/1/96 dated
2 April 1996

Amount advanced transferred to Debtors Account. Action will be taken to recover the dues early.

f) Tea Research Board Circular
SO/7/91 dated 13 December 1991

Ministry of Plantation Industries had called quotations for the purchase of vehicles to the Ministry and using the same quotations/tenders, with the approval of the Secretary of MPI, the Institute purchased vehicles considering the exigency/urgency of vehicles.

Format 38 - Systems and Controls

Petty Cash

TRI Sports Club Petty Cash had been taken into TRB Petty Cash.

Authorization of Journal Vouchers

These Journal entries had now been approved. General Stock and Electrical Stock issue vouchers were fed into the Computer and the sorted print outs were treated as Journal Vouchers. These vouchers were approved by an Accountant.

Encashment of Personnel cheques

Officers of the Board are entitled to encash two personal cheques upto Rs. 2,500/- per month. If the cheque is returned by the Bank with the remark "Refer to drawer" the facility enjoyed by the officer would be suspended for one year.

Fixed Assets Register	Action has been taken to computerize the Fixed Assets Register.
Advance	Interest had been charged at the rate of 30% per annum for the delay in settling the advances taken by the officers. Delay was due to non receipt of invoices and goods received notes in time.
Salaries	Salary advances are paid to officers within the permitted limits. The negative balances appearing in the Pay lists are due to recoveries made other than the statutory deductions. Action had been taken to restrict other recoveries from the pay sheets.
Fuel Pump	The underground tank is tilted and accurate balance cannot be ascertained as a result.
Surety bonds for Cashiers	The Post of Cashier is vacant and is being attended temporarily by a senior officer of the Institute.
Register of trees	Action will be taken to maintain registers at the Estates for valuable trees.
Control on Transport Section	(i) The Log Book of vehicle No. 14/8958 had been submitted subsequently. Vehicle No. 14/5011 had been lent to TSHDA temporarily. Log Book of vehicle No. 14/4675 is being maintained. (ii) These had been corrected. (iii) These vehicles had to be used even postponing repairs due to scarcity of vehicles to meet Institute's commitment.
Check roll wages	It is not possible to obtain the signature/thumb impression of the labourers when the payments are being made. The check roll cannot be released in advance to get the signature due to security reasons. The Labourers are not interested to sign after receiving the money, hence this is not practicable.
Check roll wages	Labourers mentioned in the report are working in the Estate.

Maternity Benefits

EPF Nos. of the following had been corrected.

Sooriyakumarie - 2179

Thanalectumy - 2182

Cash work

Cash workers and seasonal workers are offered work during the cropping season.

Muster chits and pocket check roll abstracts

This is being investigated.

Stores Control St. Coombs Estate

Goods received notes are issued to all purchases.

**Staff Officers overtime
St. Coombs Estate**

This is the practice in the Estate.

**Advance Salary payment for
St. Coombs Estate**

In addition to the normal monthly advance, on exceptional circumstance, advances are paid to workers on a separate register and recovered in the same month.

Sub-contractors

- (i) Action has been taken to maintain a register for contracts.
- (ii) Action has been taken to reconcile.
- (iii) Contracts forms had been signed by the Contractors.
- (iv) Delay in obtaining raw materials.
- (v) There was no overpayment.
- (vi) Mr. I. D. Gunaratne was the Actg. Superintendent.

AUDITOR GENERAL'S REPORT, 1996

(pages 16 to 18)

3:2 Research Projects

Significant Factors Identified

- (a) **Important that yield/ha be increased to levels in other tea-producing countries.**

Response : Agreed. However, yield increases depend on many factors not entirely in the control of the Tea Research Board (TRB). The Tea Research Institute (TRI) endeavours to produce higher yielding planting material, and advises constantly on soil preservation and good agricultural practices.

- (b) **Poor calibre of personnel in all segments of tea sector resulting in inefficiencies in production.**

Response : Agreed. This is sensu strictu outside the influence of the TRB. However, the TRI is collaborating actively, in Asian Development Bank (ADB) - funded programmes, with the Ministry of Plantation Industry, the Planters' Association (PA), the Tea Small Holders Development Authority (TSHDA) and the National Institute of Plantation Management in organising and mounting training programmes at all levels and in advising on recruitment procedures.

- (c) **Failure of the TRB in assisting policy formulation based on scientific grounds.**

Response : The Chairman of the TRB, and the Director and Deputy Directors Research of the TRI, are in point of fact members of the Tea Sector Review which meets every month under the chairmanship of the Secretary, Ministry of Plantation Industries. The purpose of their membership is to advise and assist in policy formulation based on scientific grounds, and this is being done as the Minutes and the decisions taken at these meetings will show.

Researches not serving the pressing needs on the end users.

Response : While arguably this was the case even in the period covered by the 1996 Report, in recent months there have been more positive statements and a growing appreciation of the new directions the TRI has embarked on, from the PA, the TSHDA, company executives and other elements and individuals in the tea industry. These new directions, initiated over the last several months, are described in the 1998-2002 Corporate Plan of the TRI. The TRI now has a modern outlook with a well-defined corporate Mission and goals.

An independent opinion on the TRI's recent record in serving one important sector of the end users, namely the smallholders, is contained in the *Progress Report on the First Phase of the Smallholder Tea Development Project* issued in December 1997 by an evaluation team from the Asian Development Bank. The Report recognises that the TRI is active both in smallholder extension and in new research and advisory programmes designed specifically for smallholders. The Report recognises also the usefulness of the recent extension, by the TRI, of the Experiments and Extension (E & E) Forum concept, hitherto restricted to the plantation sector, to participants from the smallholder sector. (The first TRI smallholder E & E was held on 5 December 1997 and was the first E & E ever to be held in Sinhala.)

(d) Lack of a long-term energy policy for the tea processing sector.

Insufficient research on hydro power, solar energy and energy conservation.

(e) Inter-/multi-cropping of tea with rubber and other crops not popularised.

Response : Popularisation depends on a complex of factors outside the influence of the TRB. However, data generated by the TRI are in fact available for inter cropping tea with rubber, coconut and export agricultural crops, in order to increase the profitability of marginal land. For instance, guidelines have been issued for intercropping tea with rubber. Similarly, guidelines have been prepared for intercropping tea with coconut, and with export crops such as coffee and pepper.

(f) Lack of a mechanical plucking system

Response : This is not true anymore. The TRI patented a manual shear in 1997. It is light and manoeuvrable and allows for faster harvesting as well as leaf selectivity which serves to ensure quality of the product. The TRI has given the manual shears to estates and smallholders, at their request, for testing. They report excellent results and performance data are now being examined. A Sri Lankan company has mass-produced these shears and they are available for sale to producers. The use of shears will greatly increase worker productivity, and reduce the worker requirement for harvesting by about one half.

(g) Lack of efficient engineering services to the plantations.

Observations on Actions proposed by the Board

(i) Development of high-yielding, elevation-specific clones.

Response : Evaluations have in fact been done on the TRI 3000 clonal series released in 1976 and the TRI 4000 series released in 1990. Depending on soil and climate, the TRI 3000 series may yield 2,500 - 3,200 kg mt/ha/year, and combine yield potential with drought, and pest and disease, tolerance. The TRI 4000 series may yield 4,000 kg mt/ha/year and is more drought-tolerant. Thirty selections of the TRI 5000 series are presently being evaluated and are giving yields of 3,000 - 5,000 kg mt/ha/year.

Overall national yields from clones are now at about 2,500 kg mt/ha/year at high elevations and considerably more at lower elevations, compared to less than 1,000 kgmt/ha/year from seedling tea.

Diagnostic survey on fertiliser application.

Response : Data from the questionnaires are presently being processed and evaluated by the appropriate scientists.

Mass production of clones to meet requests from estates and small holders.

Response : It is now generally recognised in the tea sector, and presumably also by the ADB, that the TRI cannot possibly participate in mass production of any sort because this will result in moving limited staff and facilities away from research and extension. These are TRI's primary concern. Production of planting material in the huge quantities required to satisfy the Sri Lankan requirements (40 to 95 million plants per annum) is best done on a commercial scale by

smallholder societies. Interested estates and entrepreneurs. All the TRI can do is to assist in selection of sites, registration, supply of cuttings, and periodic inspections of the commercial nurseries and mother bush areas set up.

(ii) CADMAR shortfall.

Response : The CADMAR process will be completed in April/May 1998. The research thrusts and projects were formulated at a series of multi-disciplinary in-house meetings of TRI scientists, and the scientists themselves, under the chairmanship of the Director, took the process through the required steps. This is the preferred approach. The CADMAR formulation and prioritisation do not need the direct involvement of the TRB and its Consultative Committee on Research.

(iii) Technology trials and experiments

Due to heavy crop during the period under review, the high capacity drier FBD-4 was operated.

The FBD-3 which is coupled with the Economizer (at St. Coombs Estate) is a low capacity drier and was not operated.

Therefore the trials on the Economizer could not be carried out.

Two types of Gasifiers have been installed at St. Joachim Estate.

1. BECE-KARA

This gasifier was used for electricity generation on and off especially during the days of power crisis.

2. NERD gasifer

This gasifier could not be operated due to poor design. NERD engineers could not repair it and put it in order.

(iv) Additional research projects

Response : Approximately 80 applied research projects have been formulated to date in the CADMAR process, in order to address the problems identified both at the 1995 workshops and in later interactions within and outside the TRI. In addition, a long list of basic projects are presently being prioritised for the purpose of understanding and diagnosing the applied problems.

(v) Progress in tissue culture

Response : Already the TRI has developed a protocol for the tissue culture of tea and lodged an application for a patent. A Memorandum of Understanding has been entered into with a Sri Lankan company for using the growth and rooting media detailed in the patent protocol for the mass production of plantlets.

Suspension of research on green tea

Response : Research into green tea has been suspended, mainly owing to the excellent prices being obtained for black tea for which Sri Lanka is well known. The present needs of end users do not include research on green tea. It is expected that the good market for black tea will persist into the foreseeable future.

No development of machinery for black tea manufacture owing to lack of staff.

Response : Agreed. The TRI has lost experienced and qualified staff over the last several years owing to the poor conditions of employment. Overtures are being made to the authorities by the TRI for the revision of terms and conditions, with a view to recruiting and retaining good quality staff in the TRI.

**WWDM
8 March 1998**

**Comments on the Draft Report of the Auditor General on the
accounts of the Tea Research Board for the year ended
31 December 1996 in terms of Section 14 (2) (c) of
the Finance Act No. 38 of 1971**

1.3. Provision in the Tea Research Board Act No. 52 of 1993

a) Section 15 (5) of the Act

- 1) The TRB has initiated action to get the Act amended and the Hon. Minister has given his concurrence to be forwarded to the Parliament.

2.5. Comments on Accounts

2.5.1. Accounting Policies

- b) The expenditure had been disclosed under different headings. Action will be taken to disclose the expenditure under respective categories according to SLAS No. 10.

2.5.2. Accounting Deficiencies

- h) An advance amounting to Rs. 152,791 made to an officer in connection with the foreign visit to Kenya had been treated as a debt due from him as he had failed to submit a proper statement of expenditure.

3.2. Research Projects

Report from Director, TRI is sent herewith.

3.8. Uneconomic Transactions

- a) The TRB has decided an upper limit of Rs. 250,000/- for reimbursement of Medical Claims which will be intimated to the Trustees of Medical Fund in order for implementation.

3.12. Vehicle Utilization

- a) The log book of vehicle No. 14/8958 had been handed over to the Superintendent of Government Audit subsequently.