THE

TEA RESEARCH INSTITUTE

OF

CEYLON

Annual Report for the Year

1967

Part II

Edited by

E. M. CHENERY, BSc, PhD (Lond), ARCS, DIC

and

R. L. DE SILVA, BSc (Cey), PhD, (Lond), DIC

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ST COOMBS, TALAWAKELE, CEYLON
1968

The Tea Research Institute of Ceylon, Talawakele.

The laboratories and headquarters of the Institute are situated at St Coombs Estate, Talawakele. Correspondence, enquiries, specimens, soil samples and other consignments should be addressed to

The Director
Tea Research Institute of Ceylon
St Coombs
Talawakele

Telegraphic Address : RESEARCH, TALAWAKELE
Railway Station : TALAWAKELE
Telephones :

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Tillicoultry	35	
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The TRI Low-Country Station, Ratnapura

Low-country estates in the Sabaragamuwa, Southern and Western Provinces should address their correspondence, enquiries, plant specimens and soil samples to

The Assistant Director
TRI Low-Country Station
St Joachim
Ratnapura

Telegraphic Address : RESEARCH, RATNAPURA
Railway Station : RATNAPURA
Telephones : Ratnapura 428 — Extension to Assistant Director's bungalow
Ratnapura 359 — Extension to Superintendent's bungalow

The TRI Uva Station, Debedde

Estates in the Uva Province should address their advisory enquiries, plant specimens and soil samples to

The Acting Chief Advisory Officer
TRI Uva Station
Gonakelle Estate
Debedde

Telegraphic Address : RESEARCH, DEBEDDE
Railway Station : BADULLA
Telephone : Passara 546

The TRI Mid-Country Station, Kandy

Mid-country estates in the Central Province should address their advisory enquiries and plant specimens to

The Mid-Country Scientific Officer
TRI Mid-Country Station
Hantane Estate
Kandy

Telegraphic Address : RESEARCH, KANDY
Railway Station : KANDY
Telephone : Kandy 7169

Until further notice, soil samples for pH determinations and eelworm counts should be addressed to the Director, Tea Research Institute of Ceylon, St Coombs, Talawakele.

Visitors—Visitors to the Institute's headquaters and laboratories at Talawakele, The Low-Country Station at Ratnapura, The Uva Station at Debedde, The Mid-Country Station at Kandy, St Coombs Estate and St Joachim Estate are welcome on any day, provided they make a prior appointment with the officer they wish to meet.

Subscriptions

The post-free subscription for *The Tea Quarterly* is Rs 24/- per annum for persons resident in Ceylon, India or Pakistan, and £ 2-5-0 for those resident elsewhere. Single numbers of *The Tea Quarterly* can be obtained for Rs 6/- or 12s. Special issues are obtainable at extra rates, which are available on application to the Director. TRI Monograph No. 6—Rs 16/- post-free.

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The Tea Research Institute of Ceylon

THE STAFF

(on 31st December 1967)†

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Deputy Director	J. A. H. Tolhurst, BSc (Reading)
Assistant Director	L. H. Fernando, BSc, PhD (Lond)

RESEARCH DIVISIONS

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Adviser	J. A. H. Tolhurst, BSc (Reading)
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Technical Assistants	V. Fernando
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Biochemist	R. L. Wickremasinghe, BSc (Cey), BSc (Lond), PhD (Sheff), FRIC
Biochemist (Flavour Research) ...	A. S. L. Tirimanna, BSc, PhD (Lond)
Research Assistants	*G. R. Roberts, BSc (Cey), ARIC
	*R. R. Selvendran, BSc (Cey)
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	K. P. W. C. Perera, BSc (Cey)
	*K. Sivapalan, BSc (Cey)

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Research Assistant	D. J. W. Ranaweera
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	A. Kathiravetpillai, BSc (Cey)
	C. Shanmugam

Plant Pathology & Nematology

Plant Pathologist	*N. Shanmuganathan, BSc (Cey), PhD (Lond)
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Nematologist	P. Sivapalan, BSc (Cey), PhD (Rutgers)
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†When more than one officer is listed under a designation, the names appear in alphabetical order.

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Technical Assistant	K. Seevaratnam

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	S. Samarasingham
	A. Thevathasan, BSc (Cey)

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St Joachim

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REPORT OF THE DIRECTOR

E. M. Chenery, BSc, PhD, ARCS, DIC

General

Nineteen sixty seven, the Centenary of the planting of commercial tea in Ceylon was celebrated at the Tea Research Institute by a Conference which was opened at the Radella Club by the Honourable Dudley S. Senanayake, Prime Minister of Ceylon. Lecture sessions were held during four mornings and field and factory inspections at St Coombs in the afternoons. Planters in the Low Country attended three field days at St Joachim a few days after the main Conference. The activities at the Institute were also publicized by a display at the Tea Centennial Exhibition held in Colombo early in August.

Advances were made on all the research fronts that are engaging the scientists in the Institute. A digest of their most important results is given under divisional headings in the summary of research.

Staff

The Director was away from the Institute between 10th May and 15th August on furlough and duty leave; Mr J. A. H. Tolhurst acted in his absence. Mr C. B. Foster-Barham, resigned his post as Chief Advisory Officer as from 8th June after about seven years service with the Institute. Dr V. P. Bhavanandan was appointed Agricultural Chemist as from 2nd November and Mr J. A. H. Tolhurst as Adviser in Agricultural Chemistry and Agronomy as from the same date.

Mr L. M. de W. Tillekeratne was appointed Uva Scientific Officer on senior staff grade as from January 1st and as acting Chief Advisory Officer from 8th June. Mr H. S. Goonewardene was appointed Accountant on senior staff grade as from 5th August.

Mr N. M. Abdul Gaffar was appointed Research Assistant in the Technology Division as from 16th April and Mr C. Kirthiratne, Administrative Officer, Low-Country Station, St Joachim as from 25th April.

Dr N. Shanmuganathan won a Commonwealth Scholarship in open competition and proceeded to British Columbia, Canada on 30th August. Messrs T. F. Saldin and P. V. Arulpragasam were awarded Colombo-Plan Scholarships; the former for work at McGill University, Montreal, Canada and the latter at Wye College, University of London, England.

Dr W. M. W. B. Manipura returned from Cambridge with his PhD on 24th May and Mr W. Joseph from various works in UK. Messrs T. C. Z. Jayman and D. Janakiram returned from Australia and India respectively.

Drs R. L. Wickremasinghe and A. S. L. Tirimanna presented papers at the 7th International Congress of Biochemistry in Tokyo, Japan during August. Dr D. Kirtisinghe attended a meeting of the International Standards Organization in Moscow from 10th to 18th June. Dr L. H. Fernando attended the 23rd Tocklai Conference in November and Dr D. Calnaido and Mr. L. M. de W. Tillekeratne attended in September the 14th Annual Scientific Conference of the United Planters' Association of South India.

The complete list of staff changes is given in *Appendix 5*.

Research

Agricultural Chemistry

A large number of fertilizer experiments have settled down into steady production. The value of generous fertilizer treatment to clearings in the earliest years seems to be well established. Differences in yield response to fertilizer, imposed by differences in site over a relatively small area, are clearly seen and emphasize the need for really detailed experimentation and soil surveys as a basis for advice.

In the up-country seedling tea, application of fertilizer twice a year has given yields as great as when the same doses were divided into four applications. Also, application in alternate rows has been as satisfactory as application in double rows. Both these results may be of particular importance when fertilizer programmes have to be based on low-bulk urea.

To-date, very little difference has been detected between the three main forms of nitrogenous fertilizer. Experiments on the storage and handling properties of mixtures of prilled urea with other fertilizers have given promising results.

Agronomy (Low Country)

Over 80 experiments were undertaken at the Low-Country Station, Ratnapura, the Substation at Kottawa and on estates in the Ratnapura, Deniyaya, Galle, Kalutara and Kelani Valley planting districts. In young tea there was a response to nitrogen, phosphate and potash, but in tea that was over four years from planting there was a response only to nitrogen. On the results of these experiments, estates were advised to reduce the level of phosphate and potash. In old seedling tea the optimum response to nitrogen was generally between 80 and 120 lb N per acre per year and in VP tea between 240 and 320 lb N per acre per year. Zinc sulphate applications increased yield and 15 to 20 lb zinc sulphate per acre per year, divided into four to five applications per year were recommended. Differences between sulphate of ammonia, urea and calcium ammonium nitrate were not significant, except on some estates such as Hunuwella where calcium ammonium nitrate was the best. At St Joachim several experiments were set down to study soil re-conditioning. Results of experimental plots indicate that tea can be successfully replanted on tea land without rehabilitation, provided that the soil is not badly eroded. In clonal tests, TRI 2023 and TRI 2026 have proved to be superior to other clones. Coombewood 21 has been found very good at St Joachim and Kottawa; TRI 2024 was the best clone at Balangoda Group. The performance of TRI 2043 was disappointing on poor soils. Clonal selections made at St Joachim are promising. Selection for drought resistance was attemped at Rye Estate, Balangoda. In experiments investigating the effect of shade trees in tea, it was found that removal of shade trees depressed yields in the first six months, but thereafter yields were increased where shade was reduced or removed. Grasses proved a problem where Gramoxone was used to control weeds. An additional application of Gramoxone, two or three weeks after the previous application was found effective, as an alternative to weeding by labour which was found necessary in conjunction with gramoxone spraying.

Plant Propagation

Observations continue to be made on the clonal testing trials laid down annually since 1961 at four different locations. Much information has been gathered and it remains now to examine the data with a view to recognizing general principles for the selection of clones likely to be appropriate for different environments. The next phase in these studies will thus be aimed more

at consolidation of the information already obtained than further expansion. Much importance is also attached to attempts being currently made to resolve inherent clonal traits that are conducive to high yield. The successful conclusion of such investigations could shorten considerably the period necessary for selection of promising clones and rejection of poor ones.

Plant Physiology

Most satisfactory progress was made during the year in nutritional studies on tea plants grown in sand culture. Deficiencies of several important nutrient elements were successfully induced and recorded in detail. Several suggest themselves as worthy of further study.

Steady progress continues to be made in investigations directed towards resolving the effects of such cultural practices as bringing-into-bearing methods, plucking, pruning, mulching and the provision of shelter from wind. Evidence of a possible association between fertilizer in the soil and unsatisfactory recovery from pruning led to tentative recommendations for reducing this risk.

Plant Pathology

Following the Institute's recommendations for the complete control of *Poria* Root Disease by soil fumigation with methyl bromide, many estates in the up-country were quick to embark on a planned programme of *Poria* control. The benefits accruing from this research are already being reaped by estates who were unable to do any satisfactory *Poria* control work because of the high cost of previously-recommended control measures, and magnitude of the problem on those estates. It has been found that methyl bromide controls *Rosellinia arcuata* just as well as it controls *P.hypolateritia*. This finding will be a great boon to estates in the Uva Districts where *R. arcuata* is a serious problem.

Studies on the epidemiology of Blister Blight were continued and much information was obtained on the fundamental aspects of the disease. The experimental programme on the determination of losses in crop caused by Blister Blight was most encouraging. Its outcome was a tentative recommendation to estates on cutting down the dose of fungicide, and thereby cutting down cost of production, and foreign exchange expenditure. The industry is likely to save well over Rs 10 million a year when the new spraying programmes are fully implemented.

More information was obtained on Collar and Branch Canker Disease of young tea. The level of soil moisture was found to be critical in disease development. The finding that there are many strains of the fungus makes the planting of resistant clones an uncertain method of controlling the disease because a clone resistant to one isloate may be susceptible to another. The Institute has, however, recommended that no clones known to be susceptible should be planted in affected districts.

Nematology

Investigations into the relationship between sampling depth and the distribution of populations of *Pratylenchus loosi*, have revealed highly significant differences in population density at varying depths. The highest population density was observed in the first six-inch zone, followed by the second and third six-inch zones respectively. Highly significant fluctuations in population levels was also observed during different times of the year, although the ratio of of vertical distribution was approximately the same throughout.

The results of the 1966/1967 tolerance test indicate that of the thirty two biclonal crosses screened for tolerance against the Root-Lesion Nematode, *P.loosi*, five were equally resistant if not better than the standard resistant clone, DT 95. Four of these crosses were the progeny of TRI 2024 x DT 1, whilst the other that of TRI 1114 x DT 95.

Experiments to compare the effect of two methods of uprooting on eelworm numbers during rehabilitation and after replanting, have not been completed. The results obtained so far indicate that the rate of build-up of eelworms within the roots of young tea, is most rapid in the hand-pulled blocks, and slow in the winched blocks; and that winching out the old tea is, by itself, not a satisfactory method for eelworm-infested areas; extensive root removal through deep forking and trenching will have to follow winching.

The results of the pre-planting soil treatment trial indicate that to control meadow eelworms on a field scale, methyl bromide is by far the most superior soil fumigant, even at the lowest rate of application (½ lb per 100 sq. ft). Though less effective when compared with methyl bromide, the new fumigant WN-12, has been found to be superior to DD, even at the rate of 10 gallons per acre (as compared with DD at 40 gallons per acre).

Fumigation of nursery soils with methyl bromide is now recommended as the standard routine measure for eelworm control. The recommended rate of application for nursery soils is still 2 lb per 100 sq. ft.

Results of the soil fumigation trial in mature tea indicate that following treatment, there is no significant increase in yield. Within a few months from treatment, the soil populations were found to have built up to the original levels. The results further show that although DD is not toxic to mature tea, the new fumigant WN-12 is slightly toxic.

An entirely new species of nematode, *Radopholus similis*, has been found in large numbers in failing young clearings in the mid-country tea districts. The symptoms of injury are very similar to those caused by *P.loosi*. An intensive survey for the distribution of this nematode is to be carried out soon. Pathogenicity trials have already been initiated at St Coombs.

Entomology

Experiments involving 26 insecticides, two fungicides and two insect pathogens showed that only heptachlor gave satisfactory control of Shot-hole Borer. Heptachlor was found to be as good as dieldrin and superior to aldrin in controlling the beetle. The duration of shot-hole borer control obtainable with heptachlor was 15 months. From a side-effect point of view, it was found that heptachlor produced the smallest build-up of Tortrix when compared with aldrin and dieldrin; although mild attacks of Tortrix were noticed, the necessity to spray DDT for tortrix control did not arise with heptachlor as in the case of dieldrin. Insecticides belonging to the organophosphorus and carbamate groups were found to be ineffective against Shot-hole Borer. Fenitrothion (Sumithion and Folithion) and fenthion (Lebaycid) gave borer control of about two months duration with a single application, but this would not be economically worthwhile. Based on the result of these experiments, provisional recommendations for controlling Shot-hole Borer with heptachlor were made in a circular which was sent out to all estates in December. It is expected that the new recommendations will give satisfactory borer control with minimal side-effects. The side-effect problems that resulted from dieldrin spraying were fully solved during the year and no outbreaks of Geometrid Caterpillars were reported to the Institute by the end of 1967.

At the Mid-Country Station, Kandy, an interesting finding was made in that nickel chloride gave a 23% control of Shot-hole Borer. Also at this station the search for clones resistant to Shot-hole Borer continued and several showed promise in field trials.

Experiments on mite control with acaricides showed that both the Scarlet and Red Spider Mites can be effectively brought under control with 10 fl. oz (formerly 15 fl. oz) of Kelthane or 10 fl. oz (formerly 30 fl. oz) of Tedion V18 per acre. It was also evident that of the two acaricides, Kelthane gave superior results. These new findings will make it possible to reduce the cost of Kelthane per acre by 33% and the cost of Tedion per acre by 200%. A large number of new acaricides were screend during the year and it was found that binapacryl (Acricid) and Morestan are likely to be of value in controlling mites in the future, after further experiments with these products are completed. Investigations on the economics of mite control showed that by controlling moderate attacks of Red Spider and Scarlet Mites it is possible to obtain a yield increase of approximately 75 lb of made tea per acre per year. Thus there is clear evidence that mite control is economically worthwhile because the cost per acre per year is estimated to be only Rs 27.

Biochemistry

The main objectives were the up-grading of the quality of low-grown tea (in collaboration with the Technology Division) and the production of a cold-water-soluble instant tea. A process for achieving the former was provisionally patented, and experiments on the latter are still in progress.

The analyses of dry, black teas were continued, and an investigation also made of the effects of storage on some of the more important chemical constituents of black tea. The properties of three enzymes (polyphenoloxidase, transaminase and phosphatase) occuring in tea were studied, and a paper dealing with the site, in the leaf, of the polyphenoloxidase was presented at the seventh International Congress of Biochemistry, held in Tokyo. Radio-active tracer techniques were used to ascertain that the amino acid, theanine was biosynthesized in the roots of tea plants, and transported therefrom to the flush. Studies of the seasonal variations of co-enzyme A and manganese in tea flush growing at St Coombs and at Uva indicated a possible relationship between the levels of these chemical entities and the development of flavour. A new spray reagent for catechins was developed. A microbiological study of the microflora present on tea flush showed that variations in climatic conditions led to quantitative and qualitative changes in the microbial population.

Tea Technology

The emphasis on work carried out in the low country has been mainly on the commercial manufacture of Rotorvane-CTC teas and in collaboration with Dr R. L. Wickremasinghe, with the quality up-grading of low-country leaf. With regard to the former, the first commercial-scale break of Rotorvane-CTC teas has now been manufactured at St Joachim, and we now await market evaluation. Trade circles in Colombo seem to differ in their opinion as to whether a granular or a more open type of leaf would be preferred particularly with regard to packing characteristics.

The use of the George Williamson (Africa) trolley-fermenting system has not significantly improved valuations of both the BOP and BOPF grades over that of table-fermented teas in the low country.

Experiments carried out at the Mid-Country Station indicate that clone MPA1 is promising with regard to liquoring character in that district. Among other matters of interest to the mid-country is that the insecticide heptachlor does not taint tea under normal conditions of use.

The Technology Division is also engaged in developing a fluid-bed tea drier in collaboration with the National Research Development Corporation in the UK. Other matters of interest include trials with the Triturator at St Coombs, which indicate that this machine produces a type of tea similar to that produced by the process of rotorvaning with regard to the liquoring character and appearance in both the BOP and BOPF grades. The machine is now being modified to simplify and improve its operation.

Statistics

Throughout the year, work was solely concerned with the design, analyses and statistical interpretations of field, factory and laboratory experiments. In all, 240 experiments were analysed. The data from extension experiments began to flow in and, owing to the large variations of the plots within the block, they were necessarily subjected to covariance analyses. Twenty such experiments have been analysed. The extents of gains in precision, the coefficients of variations of the various types of designs have been worked out and tabulated.

Advisory Work

Pests and Diseases

By the withdrawal of the recommendation of dieldrin for the control of Shot-hole Borer, the side-effects of Tortrix, Twig and Looper Caterpillars showed a sharp decline in 1967. Except for a few localized outbreaks these pests were not a problem, even during the dry months.

Provisional recommendations for the experimental use of heptachlor as a substitute for dieldrin and aldrin in the control of Shot-hole Borer were made during the year. The use of methyl bromide as a fumigant in nurseries for nematode control has come to be accepted by most estates as a routine practice. Nickel chloride as a substitute for copper in the control of Blister Blight was tried by a few estates.

Fertilizers

As an economy measure the levels of potash and phosphate were further reduced during the year, and in some instances omitted entirely from estate fertilizer programmes.

Extension Experiments

Most of the experiments conducted in the Nuwara Eliya and Uva Districts completed one year of post-treatment plucking towards the latter half of 1967. The results are being statistically analysed, and to date they indicate no responses to different levels of phosphate or potash, and no yield differences when urea, ammonium sulphate and calcium ammonium nitrate were used as the source of nitrogen.

Extension Activities

Extension activities were confined chiefly to the 14th Conference of the Institute, and the Exhibition held in Colombo in connexion with the celebrations of the centenary of the Ceylon Tea Industry.

The Agratenne Substation

Work on this substation continued and a further 20 acres of tea land was uprooted and planted with Guatemala Grass, bringing the area under grass to 40 acres. Five acres of scrub land was planted during the NE Monsoon, with 30 clones planted in six randomized blocks.

Library and Publications

Dr R. L. de Silva continued to function as joint editor of the Institute's publications and continued to be in charge of the administration of the library.

Library

The total number of journals being received by way of purchase and exchange stands at 239. The number of books added to the library was 149. The free-mailing list of recipients of the Institute's publications increased by 67 new additions during the year, bringing the total to 2884.

In June/July the library was moved to its new building near the old laboratory. The many special publications issued by the TRI to commemorate the centenary of the first commercial planting of tea in Ceylon involved the library staff in much additional work in distributing these publications. Their co-operation is gratefully acknowledged.

Publications

The volume of routine work involved in the production of the Institute's publications increased considerably because Parts I and II of the Annual Report of the TRI are published as sessional papers in Sinhalese, Tamil and English. This will be a regular practice in the future.

Dr R. L. de Silva took over the responsibility of publishing the TRI Advisory Pamphlets on field practices from Mr C. B. Foster-Barham who left the Institute's services in July. Until that time two leaflets were printed, and a further three were printed by the end of the year.

The TRI Monograph No. 6 on Tea Production in Ceylon—"*Insect and mite pests of tea in Ceylon and their control*" by Mr J. E. Cranham was released in October, The Institute gratefully acknowledges the co-operation and financial assistance of the Shell Company of Ceylon Ltd, and the Shell International Petroleum Co. Ltd, in connexion with the reproduction of the 41 excellent colour plates published in this Monograph.

Three special publications were issued by the TRI in connection with the Centenary of Ceylon Tea. Two of these were special issues of *The Tea Quarterly*. In June, a special 165-page number containing review articles by past and present members of the staff was published. We acknowledge the contributions from Dr T. Eden and Dr F. R. Tubbs, the first Agricultural Chemist and Plant Physiologist, respectively, of the Institute, and also from Mr D. M. Forrest.

The September issue of *The Tea Quarterly* was devoted to the proceedings of the Tea Centennial Conference of the TRI. Most of the papers presented in this issue were reports of research findings. A comprehensive "*Guide to the Tea Research Institute*" was written during the year and was released during the Tea Centennial Conference Week. Volume 38 of *The Tea Quarterly* remains the largest volume of the journal to be published since its inception forty years ago.

It is a pleasure to record the co-operation and effort of the TRI Photographer, Mr D. J. M. Hettiarachchi and his assistant Mr D. L. Coonghe whose contributions to the success of the Institute's publications during the year were invaluable.

The complete list of publications issued by the TRI during the year is given in *Appendix 1*, and the list of papers from the Institute published in international journals during the year is given in *Appendix 2*.

Estates

Both St Coombs and St Joachim Estates were open to visitors during the Tea Centennial Week in May. The prices fetched by teas from both estates during the year were good, those for St Joachim being among the highest for the low country. Both estates ran smoothly with no strikes or labour difficulties. This resulted in the experimental programme working satisfactorily.

Buildings

The list of buildings completed during the year and those still under construction at the end of the year are given in *Appendix 3*.

Visitors

There were many visits by planters and members of the Ceylon Tea Industry, government officials, scientists from Ceylon and overseas and other distinguished persons. *Appendix 4* gives the list of some of the official visitors to the Institute during the year.

Acknowledgements

The Institute records its grateful thanks to the Planters' Association of Ceylon, The Low-Country Products Association of Ceylon, the Agency Houses, Superintendents and Assistant Superintendents of all estates for their encouragement and unstinting co-operation in the conduct of the Institute's experimental programme.

APPENDIX I

PUBLICATIONS
ISSUED BY THE
TEA RESEARCH INSTITUTE OF CEYLON
IN 1967

1. *The Tea Quarterly*—Volume 38

   Part 1—March 1967
   Part 2—" The Centenary of Ceylon Tea "—special issue—June 1967
   Part 3—" The Centenary of Ceylon Tea "—Conference Proceedings—September 1967
   Part 4—December 1967

2. *The Tea Quarterly*—Index to Volume 37

3. Annual Report for the year 1965—Part 1

4. Annual Report for the year 1966—Part 2

5. Sessional Paper No. 9—Annual Report for the year 1964—Part 1—Published in Sinhala, Tamil and English

6. Sessional Paper No. 18—Annual Report for the year 1965—Part 2—Published in Sinhala Tamil and English

7. CRANHAM, J. E. (1967). " *Insect and mite pests of tea in Ceylon and their control* ". Monograph on tea production in Ceylon No. 6. The Tea Research Institute of Ceylon. 122 pp.+23 Col. pl.

8. CRANHAM, J. E. & DANTHANARAYANA, W. (1967). " *Tea Tortrix*, Homona coffearia *Nietner* ". *Tea. Res. Inst. Ceylon Advisory Pamphlet* 5/66. 8 pp.+6 Col. pl.

9. DE SILVA, R. L. (1967). " *A Guide to the Tea Research Institute of Ceylon* ". The Tea Research Institute of Ceylon. 72 pp.+4 maps+2 Col. pl.

10. DE SILVA, R. L. (1967). " *Blister Blight of tea*, Exobasidium vexans *Massee* ". *Tea Res. Inst. Ceylon Advisory Pamphlet* 6/66. 12 pp.+1 Col. pl. Published in Sinhala and English

11. KERR, A. (1967). " *The Meadow or Root-lesion Eelworm* Pratylenchus loosi *Loof* ". *Tea Res. Inst. Ceylon Advisory Pamphlet* 3/66. 8 pp.+3 Col. pl.

12. RICHARDS, A. V. (1967). " *Vegetative propagation of tea* ". *Tea Res. Inst. Ceylon Advisory Pamphlet* 8/66. 17 pp. Published in Sinhala and English

13. SHANMUGANATHAN, N. (1967). " Poria *Root Disease of tea* ". *Tea Res. Inst. Ceylon Advisory Pamphlet* 1/66. 13 pp.+5 Col. pl.

APPENDIX 2

PAPERS FROM THE TEA RESEARCH INSTITUTE OF CEYLON PUBLISHED IN INTERNATIONAL JOURNALS IN 1967

BHAVANANDAN, V. P. & MEYER, K. (1967). Studies on Keratosulfates. *J. biol. Chem.* **242**, 4352-4359.

DANTHANARAYANA, W. (1967). Host specificity of *Sitonia* Beetles, *Nature, Lond.* **213**, 1153-1154.

KERR, A. & RODRIGO, W. R. F. (1967). Epidemiology of tea Blister Blight (*Exobasidium vexans*). III. Spore deposition and disease prediction. *Trans. Br. mycol. Soc.* **50** (1), 49-55.

KERR, A. & RODRIGO, W. R. F. (1967). Epdemiology of Blister Blight (*Exobasidium vexans*). IV. Disease forecasting. *Trans. Br. mycol. Soc.* **50** (4) 609-614.

MEYER, K., BHAVANANDAN, V. P., YUNG, D., LEE, L. T. & HOWE, C. (1967). The keratosulfate-like muco polysaccharide of chick allantoic fluid. *Proc. N. A. S.* **58**, 1655-1659.

SELMAN, I. W. & KULASEGERAM, S. (1967). Development of the stem tuber in kohlrabi. *J. exp. Bot.* **18**, 471-490.

TIRIMANNA, A. S. L. & PERERA, K. P. W. C. (1967). A study of the tocopherols during tea manufacture. *Proc. Seventh International Congress of Biochemistry. Abstr.* 1009.

WICKREMASINGHE, R. L., ROBERTS, G. R. & PERERA, B. P. M. (1967). The localization of the polyphenolase of tea leaf. *Proc. Seventh International Congress of Biochemistry. Abstr.* 1003.

APPENDIX 3

BUILDINGS COMPLETED DURING 1967

St Coombs

1. Four standard staff houses
2. Four junior staff houses
3. Assistant Factory Officer's quarters
4. Eight minor staff quarters
5. Engineering stores
6. Sports Club Pavillion

The Low-Country Station, Ratnapura

1. Club House

The Mid-Country Station, Kandy

1. Two junior staff houses
2. Two minor staff quarters
3. Garage & workshop
4. Fertilizer stores

The Kottawa Substation

1. One junior staff house
2. Two minor staff houses
3. Two labour lines

The Agratenne Substation, Debedde

1. One junior staff house

The following were still under construction :

The Low-Country Station, Ratnapura

1. Two junior staff houses
2. Three minor staff quarters (One double unit and one single unit).

APPENDIX 4

VISITORS TO THE TEA RESEARCH INSTITUTE OF CEYLON IN 1967

Dr D. V. W. Abeygunawardene	Plant Pathologist, Department of Agriculture, Peradeniya, Ceylon
Prof. B. A. Abeywickrama	Professor of Botany, University of Ceylon, Peradeniya, Ceylon
Dr K. Akbar	Plant Pathologist & Editor of Publications, Pakistan Tea Research Station, Pakistan
Mr S. Amma	Technical Officer, Makurazaki Tea Experiment Station, Japan
Mr & Mrs Nguyen AnNhon	National Agricultural Credit Office, Saigon
Mr H. Araghi	Assistant Director, Iranian Tea Board, Iran
Sir John Arbuthnot	Chairman, Estates & Agency Co. Ltd, England
Air Commodore A. H. W. Ball	Royal Air Force, London, England
The Hon. Mr M. D. Banda	Minister of Agriculture & Food, Ceylon
Mr John Barfield	Export Manager, Bush Boake Allen Ltd, England
Mr C. Batten	Coconut Products Ltd, Tea Estates, New Guinea
Sir Frederick Bawden, FRS and Lady Bawden	Director, Rothamsted Experimental Station, Harpenden, England
Mr M. M. Betten	George Wiliamson (Africa) Ltd, Nairobi, Kenya
Mr W. J. Blackie	Food & Agricultural Organization of the United Nations, Bangkok, Thailand
Mr J. B. Blanchard	Director, Robertson Bois Dickson Anderson, England
Mr F. A. Bourke	Chairman, Dimbula Valley (Ceylon) Tea Co., Ltd, England
Mr J. Y. Boyd	Shaw Wallace & Co. Ltd, Pakistan
Mr R. C. Boylon	Union Carbide Asia Ltd, Hongkong BCC
Mr M. A. Brandt	Imperial Defence College, England
Mr R. C. Brooks	Ceylon Tea Plantations Co. Ltd, London, England
Mr H. T. Buckley	Crown Agents, 4 Millbank, London, England
Mr Julian F. Burt	Osaka, Japan
Mr R. F. Carew	Marshalls Tea Machinery Co. Ltd, England
Mr B. R. S. Carrim	Singapore
Mr R. Choudhury	Manufacturing Adviser & Tea Taster, Tocklai Experimental Station, Assam, India
Mr P. B. Clare	Australian Trade Commissioner in Ceylon
Dr D. H. Constable	Food & Agricultural Organization of the United Nations Organization in Ceylon
Mr W. H. W. Coultas	Ministry of Overseas Development, London, England
Mr A. W. Court	Commonwealth Development Corporation, England
Mr R. S. Crespi	National Research Development Corporation, London, England
Mr M. Dabir	Tea Expert, Tea Organization, Ministry of Finance, Teheran, Iran
Mr E. S. J. Davidar	Southern Indian Tea Estates Co. Ltd, India
Mr H. G. Davies	Secretary to the Parliamentary Delegation from the UK
Dr A. M. Desai	Chemicals Manager, ESSO Standard Eastern Inc., Bombay, India
Mr Ronnie de Mel, MP	House of Representatives, Colombo
Mr Vo-Ngoc-Dinh	Research Directorate, Saigon, South Vietnam
Dr M. Domros	University of Heidelberg, Germany
Mr P. C. Dore	Overseas Sales Manager, Fisons Overseas Ltd, England
His Excellency Mr J. M. Dutto	The Acting High Commissioner for the United Kindgom in Ceylon
Dr E. F. W. Dux	J. Lyons & Co. Ltd, England
Mr T. Eastwood	BDH (International) Ltd, England
Dr R. T. Ellis	Director, Tea Research Foundation of Central Africa, Malawi
Mr W. R. Ferguson	Chief Planning Architect, Commonwealth Scientific & Industrial Research Organization, Australia
Mr G. R. Ferlin	Mahaveli Ganga Project, FAO, Colombo
Mr K. Fijita	Mitsui & Co. Ltd, Tokyo, Japan
Mr Raymond Fletcher, MP	House of Commons, England
Mr R. A. Fletcher	Shell International Chemicals Co. Ltd, London, England
Prof. G. E. Fogg, FRS	Professor of Botany, Westfield College, University of London, England
Mr Lee Sin Fook	Assistant Director (Extension), Department of Agriculture, Kuala Lumpur, Malaysia

Mr & Mrs I. G. Foster	Vidyodaya University of Ceylon, Colombo, Ceylon
Mr L. J. Foster	Commonwealth Development Corporation, UK
Mr M. Fukuyama	Japan
Captain D. K. Garstien	Royal Navy, England
Mr K. P. Geethakrishnan	Deputy Secretary, Finance Department, Government of India
Mr Mohamed Ghazali	Ministry of Agriculture & Co-operatives, Malaysia
Mr P. S. Gray	George Steuart & Co. Ltd, England
Mr Eric Griffel	American Aid Officer, Embassy of the United States of America
Mr G. Guadagni	NPK Study Centre, Switzerland
Mr D. M. Hacking	Coonoor, South India
Mr W. Hadfield	Botanist, Tocklai Experimental Station, Assam, India
Mr R. S. Haines	Fisons Overseas Ltd, England
Mr E. Hainsworth	Director, Tea Research Institute of East Africa, Kenya
Mr Takashi Harada	Managing Director, Terada Seisakujo Co Ltd, Shizuka, Japan
Dr G. C. Hewitt	International Nickel Ltd, London, England
Sir John Hicks and Lady Hicks	Professor Emeritus of the University of Oxford, England
Dr R. F. Homer	National Research Development Corporation, London, England
Dr & Mrs F. Hung	University of Toronto, Guelph, Canada
Mr I. Itoh	Mitsui Norin Kaisha Ltd, Tokyo, Japan
Mr M. C. A. Jackson	Travancore Tea Estates Co. Ltd, Kerala States, South India
The Hon Mr M. G. Jawi	Minister of Agriculture & Co-operatives, Malaysia
The Hon Major Montague Jayawickrema	Minister of Pubic Works,Posts & Telecommunications, Ceylon
Mr N. C. Kankani	United Planters' Association of Southern India
Mr K. Katsui	Tea Research Station of Japan
Mr Tatsuo Kawasaki	Managing Director, Kawasaki Iron Works Ltd, Shizuoka, Japan
Mr R. W. Kettlewell	Hunting Technical Services Ltd, England
Mr Z. Khan	Shaw Wallace, Pakistan
Mr C. W. D. Knowlden	Manufacturing Adviser, Eastern Produce & Estates Co. Ltd, England
Mr Kiyoshi Komai	Chief Engineer, Kawasaki Iron Works Ltd, Shizuoka, Japan
Dr J. Kranz	University of Giessen, West Germany
Mr S. Kurimoto	Yutaka Trading Co. Ltd, Tokyo, Japan
Mr Mituo Kushida	Nagoya Air & Tourist Branch, Nippon Express Co. Ltd, Nagoa, Japan
Mr D. H. Laycock	Director, Tocklai Experimental Station, Assam, South India
Mr Bong Won Lee	The Korean Reconstruction Bank, Seoul, Korea
Mr J. Edward Maggins, JP, MP	House of Commons, London, England
Mr E. D. MaGuire	Davidson & Co. Ltd, Sirocco Works, Balfast, N. Ireland
Mr & Mrs Ronald Mann	Rood Lane, London, England
Mr Archie C. Manuel, MP	House of Commons, UK
Miss H. Marby	University of Heidelberg, West Germany
Mr Harold J. Mason	Price, Mason & Co. Ltd, Osaka, Japan
Mr R. D. Mason	Bush Boake Allen Ltd, UK
Mr McClelland	E. H. Harris & Co. Ltd, Sydney, Australia
Mr F. S. Meisenhall	Director, Speakoe Ltd, Johannesburg, South Africa
Mr H. Meyer	Sandoz Ltd, Basle, Switzerland
Mr S. K. Mitra	Planning Commission, New Delhi, India
Mr Tatsuro Miyamura	Managing Director, Miyamura Iron Works Ltd, Shizuoka, Japan
Mr K. Moores	Plant Protection Ltd, UK
Mr Y. Morishita	Kyoei Seicha Co. Ltd, Osaka, Japan
Mr E. Morris, CMG, OBE	Crown Agents Office, 4 Millbank, London, England
His Excellency H. H. Babadin	The Malaysian High Commissioner in Ceylon
Mr W. W. S. Mackay	James Finlay & Co. Ltd, Scotland
Mr Reza Najemi	Teheran, Iran
Dr S. N. Anant Narayan	International Nickel (India) Private Ltd, Bombay, India
Mr B. Natapermadi	Asian Development Bank, Manila, Philippines
Mr Shinpei Ochiai	President, Ochiai Cutlery Manufacturing Co. Ltd, Shizuoka, Japan
Mr Ichiro Oshikawa	Secretary General, Asian Productivity Organization, Tokyo, Japan
Mr Chiyoshi Owaki	Ministry of Agriculture & Forestry, Tokyo, Japan

Mr David Panter	Carrit Moran & Co. Ltd, UK
Mr C. Parker	Weed Research Organization, UK
Mr A. M. S. Perera	Secretary, Planters' Association of Ceylon
The Hon. Senator M. V. P. Peiris ...	Minister of Commerce & Trade, Ceylon
Dr G. Ponnaperuma	Director, CISIR, Colombo, Ceylon
Dr D. A. Porter	Director, US Department of Agriculture, Far Eastern Regional Office, American Embassy, New Delhi, India
Lord Popplewell, CBE	House of Lords, London, England
Mr Selwyn C. Proyer	Director of the Central Province Ceylon Tea Co. Ltd, UK
Mr T. K. Raghavan	Chemicals Marketing Assistant, ESSO Standard Eastern Inc., Bombay, India
Mr Abdul Aziz Rasic	Vice President, Ministry of Agriculture & Co-operatives, Malaysia
Dr H. G. R. Peddy	ECAFE, Regional Adviser on Oils & Fats Technology
Dr Emmanuel Rochecouste ...	Senior Research Biologist, Du Pont Far East Inc., Queensland, Australia
Mr Sojiro Sano	President, Matsushita Kojo Co. Ltd, Shizuka, Japan
Dr E. Schimdt-Kraepelin	Bonn, Western Germany
Prof. U. Schweinfurth	Professor of Geography, University of Heidelberg, Western Germany
The Hon. Mr Dudley S. Senanayake ...	Prime Minister of Ceylon
Mr K. N. Sharma	Agriculturist, Tocklai Experimental Station, Assam, India
Mr A. G. Shepherd	Farbwerke Hoechst AG, Frankfurt, Germany
Mrs Saraswati Sherestha	Ministry of Finance, H-M-G, Nepal
Mr J. Staartjes	Albatros Chemicals, Holland
Mr J. R. L. Stainton	Universal Crop Protection Ltd, London, UK
Mr J. S. Starkey	Director Agricultural Research Services, US Department of Agriculture, USA
Mr & Mrs H. R. Stewart	Wiltshire, England
Mr S. Subramaniam	Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia
Mr P. B. Suchale	Ciba of India Ltd, Bombay, India
Mr O. Takahashi	Ministry of Agriculture & Forestry, Japan
Mr A. S. M. Talimiduddin	Small Industries Corporation, Dacca, East Pakistan
Mr N. S. Teneja	Ministry of Finance, Government of India
Mr P. Taylor	J. Lyons & Co. Ltd, UK
Mr P. I. Thomas	Superintendent, Parkside Estate, South India
Mr G. R. Thurnham	Brooke Bond Ltd, London, UK
Mr J. Tommage	Mitsui & Co. Ltd, Tokyo, Japan
Mr J. Uchida	Adviser to the Government of Ceylon under the Colombo-Plan, Department of Agriculture, Peradeniya, Ceylon
His Excellency Mr G. N. Upton and Mrs Upton ...	Australian High Commissioner in Ceylon
Dr C. S. Venkata Ram	Plant Pathologist, United Planters' Association of Southern India
Dr K. S. Venkataramani and Mrs Venkataramani	Chief Scientific Officer, United Planters' Association of Southern India
Mr L. M. Venkataraman	Manager, Kodanaad Estate, Kotagiri, Nilgiris, South India
Mr Van Benten	NPK Study Centre, Switzerland
Mr VanBerkel	Albatros Chemicals, Holland
Mr C. Velupillay	Rubber Research Institute of Malaya, Kuala Lumpur, Malaysia
Mr A. J. Vernon	Rothamsted Experimental Station, Harpenden, Eng- England
Mr Vidya Sagar	Food & Agricultural Organization, Ceylon
Mr W. R. de W. Waller	Ministry of Overseas Development, London, UK
Mr T. L. Weathers	J. Lyons & Co. Ltd, UK
Col. Weelesley-Wilsey	Royal Marines, UK
The Hon. Senator A. F. Wijemanne ...	Minister of Justice, Ceylon
Mr R. H. Williams	Shell International Chemical Co. Ltd, UK
Dr Sheila Willmott	Director, Commonwealth Bureau of Helminthology, UK
Mr Geoffery Wilson, MP	House of Commons, London, England
Mr K. Yanatani	Toshoku Ltd, Kobe, Japan

and 33 Fellows of the Asian Institute of Economic Development & Planning, Bangkok, Thailand

APPENDIX 5

STAFF CHANGES — 1967

Appointments

Senior Staff

Mr L. M. de W. Tillekeratne, Uva Scientific Officer from 1.1.67.
Acting Chief Advisory Officer from 8.6.67.
Mr H. S. Goonewardene, Accountant, from 5.8.67.
Dr V. P. Bhavanandan, Agricultural Chemist, from 2.11.67.

Intermediate Staff

Mr N. M. Abdul Gaffar, Research Assistant, Technology Division, from 16.4.67.
Mr C. Kirthiratne, Administrative Officer, TRI Low-Country Station, from 25.4.67.
Dr P. Sivaprakasapillai, Research Officer, Technology Division, from 19.6.67.

Junior Staff

Mr I. Rengaraj, Internal Audit Officer, from 1.3.67.
Mr U. C. Unamboowe, Accounts Clerk, from 21.4.67.
Mr W. P. Ariyapala, Field Officer, St Coombs Estate, from 1.6.67.
Mr D. W. Wickremaratne, Accounts Clerk, from 1.6.67.
Mr M. H. Rodrigo, Junior Technical Assistant, Biochemistry Division, from 1.7.67.

Minor Staff

Mr K. B. R. Abeykoon, Motor Car/Bus/Tractor Driver, from 1.3.67
Mr J. L. Sugathadasa, Motor Mechanic, from 20.3.67.
Mr D. Galaboda, Office Attendant, from 18.4.67.
Mr B. G. D. Premadasa, Office Attendant, from 18.4.67.
Mr T. A. Gunatilake, Telephone Operator, TRI Low-Country Station from 19.4.67.
Mr L. A. D. Weerakoon, Assistant General KP, St Joachim Estate, from 1.7.67.

Resignations

Mr T. M. Muzameeir, Motor Mechanic, from 1.3.67.
Mr V. H. Perera, Junior Technical Assistant, Bochemistry Division, from 30.3.67.
Mr D. N. R. Wijewardena, Junior Technical Assistant, TRI Uva Station, from 30.3.67.
Mr C. B. Foster-Barham, Chief Advisory Officer, from 8.6.67.
Dr P. Sivaprakasapillai, Research Officer, Technology Division, from 19.10.67.
Mr M. H. Rodrigo, Junior Technical Assistant, Biochemistry Division, from 26.12.67.

Overseas Training

Departures

Mr S. Nagarajah, Research Assistant, (Plant Physiology Divison), left on an Australian National University Scholarship to Australia on 8.5.67.
Dr N. Shanmuganathan, Plant Pathologist, left on a post-doctoral Fellowship to Canada on 30.8.67.
Mr T. F. Saldin, Technical Assistant, Technology Division (Low-Country Station), left on a Colombo-Plan Scholarship to Montreal, Canada, on 19.9.67.
Mr P. V. Arulpragasam, Technical Assistant (Plant Pathology Division), left on a Colombo-Plan Scholarship to the UK on 23.9.67.

Arrivals

Dr W. M. W. B. Manipura, Research Officer, returned after his post-graduate training from the UK on 24.5.67.
Mr W. Joseph, Research Officer, returned after his overseas training from the UK on 27.5.67.
Mr T. C. Z. Jayman, Technical Assistant, returned after his overseas training from Australia on 13.6.67.
Mr D. Janakiram, Technical Assistant, returned after his post-graduate training from India on 4.11.67.

Leave

Dr E. M. Chenery, Director, was on overseas leave from 10.5.67 to 16.8.67.

Mr J. A. H. Tolhurst, Deputy Director and Adviser in Agricultural Chemistry and Agronomy was on overseas leave from 19.8.67 to 15.11.67.

Overseas Visits

Dr D. Kirtisinghe, attended the Conference of the International Standards Organization in Moscow on standards for tea from 10.6.67 to 18.6.67, and then proceeded to the UK where he remained until 29.7.67, on official duty.

Dr R. L. Wickremasinghe and Dr A. S. L. Tirimanna attended the 7th International Congress of Biochemistry in Tokyo from 29.7.67 to 27.8.67.

Dr D. Calnaido, Mid-Country Scientific Officer, Mr L. M. de W. Tillekeratne, Acting Chief Advisory Officer and Mr D. E. Hettiarachchi, Member of the TRI Board, proceeded to South India on 27th August to attend the 14th Annual Scientific Conference of the United Planters' Association of South India (UPASI) from 29.8.67 to 15.9.67.

Dr L. H. Fernando, Assistant Director, left for India to attend the 23rd Conference of the Tocklai Experimental Station on 5.11.67 and returned on 24.11.67.

REPORT OF THE AGRICULTURAL CHEMISTRY DIVISION

Adviser in Agricultural Chemistry and Agronomy — J. A. H. Tolhurst, BSc

During the year I acted for the Director for three months and also took overseas furlough for a similar period. Dr W. M. W. B. Manipura, who had returned from postgraduate training in the United Kingdom early in the year, acted for me in my absence. Dr V. P. Bhavanandan was appointed as Head of the Division and assumed duties late in the year.

Messrs S. Sandanam and M. Sikurajapathy were transferred from the Advisory Division, following staff changes there. Mr T. C. Z. Jayman returned from Australia.

The year 1967 has thus been a noteworthy year with no resignations, and with every prospect of a strong cadre fully able to develop the research programme.

Field Experiments and Trials

Details of the established experiments will be found in the earlier reports. The experiments **A3** and **A6** have been concluded. Unless otherwise stated, yields are expressed as converted to lb dry weight per acre and fertilizer doses as lb of the nutrients denoted by conventional symbols.

Acknowledgement is made to the Statistics Division for advice and assistance.

A1—*NPK at No. 3 Field—(1931)*

No report will be made on yield trends at this early stage of the 12th cycle.

A2—*NPZn, lime at No. 9 Field—(1962)*

Again, plucking in the new cycle has not progressed sufficiently to warrant a detailed tabulation of yield response. It was observed that the zinc foliar-spraying treatments began to affect yields beneficially, before nitrogen treatments showed any influence. Detailed surveys are being made to follow the change of pH in the soil profile in the limed subplots. The present pattern shows that the effect of the Limbux is still largely confined to the top one-inch layer of soil where pH values of over 6.5 have been recorded. The experiment will not be in a position to demonstrate the true effects of varying pH, until this has become more even in the upper profile. Analysis of the foliage is being done to follow changes in nutrient composition. It may be possible to use these results to obtain preliminary indications of the value of certain sections of the profile in supplying nutrients to the bush. For example, manganese uptake appears to have been reduced very quickly by the rise in pH of the surface layers.

A4—*Type of nitrogen at No. 9 Field—(1961)*

These plots were pruned in September and yield trends were similar to those reported up to November 1966. Table 1 shows the analysis of the final nine months' yields, corrected against yields obtained in the 12 months prior to November 1966. This gives the final assessment of fertilizer effects over the period when calcium ammonium nitrate (CAN) was substituted for a compound fertilizer.

TABLE 1 —*Yield trends in relation to type of nitrogen — final 9 months of 2nd cycle* — **A4** - *St Coombs*

	Yield
Sulphate of ammonia	1131
Urea	1090
Calcium ammonium nitrate	1099

Differences in yield were not significant

A5—*Frequency of application of nitrogen at No. 13 Field—(1963)*

These plots were pruned in August. Table 2 shows the yields for the three years of treatment, F1, F2 and F3 designating division of the annual dose of sulphate of ammonia into 2, 3 and 4 applications respectively.

TABLE 2 —*Yield trends in relation to frequency of application of sulphate of ammonia* — **A5** - *St Coombs — totals for 3 years*

	F 1	F 2	F 3
N 1 (120)	3,484	3,770	3,703
N 2 (240)	4,974	4,856	4,660

Differences in yield between the frequency treatments are far short of significance.

In the second cycle, urea will be substituted for sulphate of ammonia. This will bring some applications into seasons which might be considered unsuitable for urea, and will give this experiment an added value in view of the present trend towards the use of urea in estate practice.

A7—*N distribution at No. 13 Field—(1964)*

These plots were pruned in September. Table 3 shows the yields for the two years ten months under treatment. During the third year, it was decided to convert treatments to sulphate of ammonia only, omitting the original comparison between NPK mixtures. In the table, A refers to alternate-row distribution, and D to double-row distribution of fertilizer; three applications per year.

TABLE 3—*Yield trends in relation to method of distributing fertilizer* — **A7** - *St Coombs*

	A—(Alternate)	D—(Double)
N 1 (75)	3,986	3,938
N 2 (225)	5,930	5,862

The lack of appreciable difference in yields resulting from the distribution treatments, even though N up to 75 lb per application has been used, is noteworthy and has been evident throughout the 1st cycle. In the second cycle urea will be the form of nitrogen used and experiments **A4, A5** and **A7** will thus form a well-knit group on St Coombs to study the methods of use

of urea. It may be noted here that, in extension experiments up-country, doses of urea up to 90 lb N per application have been used with no apparent adverse effects. This observation may not apply to long-term effects, nor to similar experiments done at lower elevations.

A8—*NPK on Clone TRI 2024 at No. 8 Field — (1962)*

These plots were pruned in September and it appeared that the extension of the first cycle, to five years from planting, had allowed good development of main branches on even the poorer yielding plots. Yields were analysed in detail, the experiment being treated in two groups as trends were so markedly different between replicates. In studying the tables it should be borne in mind that the three replicates comprising Group 1 were only a few hundred yards from the three more scattered replicates in Group 2. The topographical and previous cultural differences between the various sites are such as are to be found in almost any medium-sized clearing in Ceylon. The results therefore have an added value in demonstrating the wide variations to be expected in yield response to fertilizer, even within a single clearing.

Table 4 shows the yield response for the full three years of plucking. The mean yield for the supernumary zero-fertilizer plots, three in each group, are also quoted.

TABLE 4—*Yield response to N, P and K* — **A8** - *St Coombs — totals for 1st cycle of 3 years*

Group 1

N1 (100)	N2 (200)	N3 (300)
5810	7286	8597
P0 (0)	P1 (50)	P2 (100)
7418	6994	7280
K0 (0)	K1 (62.5)	K2 (125)
7023	7536	7134

Mean for control plots 2926

LSD at $P=0.05$ — 431
$P=0.01$ — 554

Group 2

N1	N2	N3
3211	4953	5417
P0	P1	P2
4701	4892	3989
K0	K1	K2
3720	4809	5052

Mean for control plots 1264

LSD at $P=0.05$ — 974
$P=0.01$ — 1476

Fertilizer levels quoted are those which were adopted during the two latter years of plucking. Previously, all three nutrients had been applied from the time of planting at four-fifths of these levels. Table 5 shows the yield response for the third year of plucking.

TABLE 5—*Yield response to N, P and K for the final year of the 1st cycle — A8 - St Coombs*

Group 1

N1	N2	N3
2028	2679	3170
P0	P1	P2
2660	2579	2638
K0	K1	K2
2539	2726	2611

Mean for control plots 998

LSD at $P=0.05$ — 126
$P=0.01$ — 191
$P=0.001$ — 307

Group 2

N1	N2	N3
1100	1962	2290
P0	P1	P2
1882	1901	1570
K0	K1	K2
1512	1845	1995

Mean for control plots 198

LSD at $P=0.05$ — 346
$P=0.01$ — 524
$P=0.001$ — 844

In neither group has phosphate resulted in any significant effect on yield, although the trends suggest that the highest level may be exerting a deleterious effect in the poorer group. Potash has shown a steady, beneficial, effect only in the poorer group. In contrast, the nitrogen effects, highly significant, have been greater in the better group, where the response began to show signs of departing from linearity late in the cycle.

Clone TRI 2024 normally recovers from pruning well on St Coombs, as opposed to its behaviour at lower elevations, and observations were made on these plots to examine any relation between fertilizer and recovery. Counts of bud-break, together with main-branch number, length and mean surface area were made within certain treatments. The selected treatments, related to yield trends, included all combinations of N and K but only the middle level of P. The zero fertilizer plots were also examined.

The style of pruning imposed had reduced branch number where necessary, resulting in little structural difference between pruned frames in the various treatments. Rim lungs were left for three months. The count of growing buds and young shoots showed, three months after pruning, no relation to N or K treatments.

Further observations were made four months after pruning when shoot growth was vigorous, and before fertilizer had been applied. Visual assessment showed that in the better group, rather more vigorous growth was often associated with the higher N treatments. In the poorer group, the benefit of these same N treatments was more striking. No relation could be seen between shoot growth and extremes of either P or K. The replicates themselves differed in the rate of recovery, in a way which suggested a site effect and which had no relation to the yield performance before pruning. Quantitative evaluation of these effects will be possible at tipping.

Chlorotic and necrotic symptoms (see **A11**) have been observed in all plots. To date, no relation can be observed between their severity and any fertilizer treatment. Nor does site appear to bear any appreciable relation.

It may be suggested that this experiment has shown that over the first five years from planting, Clone TRI 2024 on St Coombs is not only able to assimilate liberal applications of N (sulphate of ammonia) but in fact requires such treatment.

A9—*Clonal spacing at Nos 2 and 7 Fields — (1964)*

Uniform fertilizer treatment was continued, to assess the residual effects of differential fertilizer (NPK) which had been applied in the first 15 months from planting. Table 6 shows the yield trends in the third year from planting, ending in July 1967.

TABLE 6 —*Residual effects of varying levels of T200 in the first 15 months from planting—totals for three clones for the third year* — **A9** - *St Coombs*

F1 (16.6)	F2 (83.3)	F3 (150.0)
1702	1844	1955
LSD at $P = 0.05$	200	

Figures in brackets refer to the N equivalent of the initial 15 months' treatment; all plots have since continued at 240 lb N per annum.

Examination of yields obtained in the first four months of the fourth year show no diminution of this trend. This long, beneficial, effect of the higher fertilizer treatments, in spite of the fact that the tea was planted in areas which had received liberal fertilizer during guatemala grass rehabilitation, is noteworthy. The finding is in accordance with those from **A8** and various of the **AYT** series of experiments. It is suggested that a fruitful line of research would be to examine in detail the long-term residual effects of a variety of cultural practices which can be imposed on tea at the start of a new clearing.

Table 7 shows the summary of the yields as effected by clonal and spacing treatments (S). Spacing is denoted in inches, rows being four feet apart.

TABLE 7—*Yield trends in relation to clonal type and spacing —totals for the 3rd year*—**A9** - *St Coombs*

TRI 2024	DT 1	TRI 777
2116	1857	1529
S 0 (14)	S 1 (28)	S 2 (42)
2003	1847	1651

LSD at $P=0.01$ — 240
$P=0.001$ — 269

Differences due to spacing were significant at the lower level of probability. It is perhaps surprising that, as the bush spread had not in all cases quite covered the ground, the effect of close spacing was not greater. There was no significant interaction between clone and spacing, showing that TRI 2024 with a more spreading habit had reacted in the same way as those of weaker (TRI 777) or more upright growth (DT 1).

A10—*N, K on Clone E 727 at Wallaha, Tangakelle Group, Lindula — (1965)*

The pre-treatment period was prolonged in order to see if an area of low-yielding plots could be brought more into line with the average. When it was evident that this could not be done, the design of the experiment was changed. The plots were pruned in June without differential treatments having been given. The Plant Physiology Division superimposed a lung-retention investigation on replicates, and details of tipping weights will be found in their report. During the first few plucking rounds it was observed that long retention of lungs had had a depressive residual effect. Lungs had been retained for periods of 0, 3, 6, 9, 12 and 15 weeks. The significance of this effect will be investigated.

A11—*Boron and molybdenum on Clone TRI 2024 — (1966)*

The only report to-date is that the symptoms observed in 1966 disappeared early in 1967. As the same symptoms were observed in the adjoining **A8** plots following the 1967 prune, **A11** should be useful for diagnostic investigation.

A12—*NPK at No. 13 Field — (1966)*

Table 8 shows the yield response to N and K treatments, quoted as annual doses, for the 20 months of recording since the experiment started.

TABLE 8—*Yield trends in relation to N and K—totals for 20 months*—**A12** - *St Coombs*

N1	N2	N3	N4	N5
(90)	(180)	(270)	(360)	(450)
1868	2512	3246	3578	3810

LSD at $P=0.05$	—	236
$P=0.01$	—	317
$P=0.001$	—	421

K1 (0)	K2 (75)	K (150)
2870	2976	3162

LSD at $P=0.05$	—	183
$P=0.01$	—	246

Response to P has not been shown in spite of the omission of P from some plots for nearly three years. N and K showed effects on yield very soon after treatments started. It must be noted that, as the bushes were then making new growth in recovering from damage suffered by the felling of grevilleas, the full effect of N and K would not be expected to be reflected in crop harvested. Prior to these treatments, the plots had had no K from pruning in July 1964 to April 1966, when the present series of records was begun.

1967 Experiments

The following experiments in the **A** series were established or prepared during the year, and no results were available for publication.

A13—*3 levels of N, with 3 levels of shade on clones at No 3 Field — (1966)*

A14—*Fertilizer experiment on Clone WY, Tangakelle Group, Lindula — (1967)*

Acknowledgement is made to the Superintendent for offering a mature clearing of Clone WY for experiment. The design will be decided upon once the uniformity assessment has been made.

A15—*Bringing-into-bearing, spacing and clonal experiment at No. 3 Field — (1967)*

A16—*Rehabilitation experiment at Nos. 11 and 13 Fields — (1967)*

Three sites were chosen, representing varied topographical features, and the first blocks of old tea were uprooted and planted in Guatemala Grass. The intention is to plant tea in 1969 within blocks which have undergone various rehabilitation treatments.

UA2—*3 levels of N, with 3 levels of shade on clones at the Agratenne Substation— (1966)*

MA1—*N, K shade on seedling tea at Hantane Estate, Kandy — (1966)*

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Young tea experiments at St Coombs

Experiments which were reported in 1966 were harvested and assessed, and a small number of new experiments and exploratory trials were started in 1967. Experiments **AYT1** to **AYT11** have been concluded, and experiments **AYT13, AYT17** and **AYT18** have been abandoned.

AYT12—*Guatemala Grass: NP, dolomite — (1965)*

The main aim was to determine if applications of sulphate of ammonia, rock phosphate, or dolomite to Guatemala Grass planted as a one-year rehabilitation crop, could influence the growth of subsequently planted tea. This investigation was designed as a single replicate, 3^3. Five clones were planted within each plot, and were harvested six months later. Only the above-ground growth was harvested.

Leaf plus stem weight, showed no relation to extreme levels of any of the above fertilizer. It must be emphasized that this does not necessarily mean that the decomposing grass residues, especially roots, would not have had an effect over a longer period of development of the tea.

Subsidiary treatments were imposed within the main plots; sulphate of ammonia and epsom salts each at two levels and in combination, were applied to the tea in one dose soon after planting. Doses of zero and 20, and zero 5g per plant were used respectively.

Table 9 shows that, with one exception, the clones responded well to sulphate of ammonia but not to epsom salts. Weights are in grams per ten plants.

TABLE 9 —*Response to post-planting application of N and Mg; leaf plus stem dry weight*—**AYT12**

Clone	N 0 Mg 0	N 0 Mg 1	N 1 Mg 0	N 1 Mg 1
TRI 2142	73.3	72.9	80.4	85.5
	Differences were not significant			
TRI 2024	152.6	153.0	224.4	237.8
	LSD at $P=0.001$		37.4	
TRI 2025	140.2	140.7	172.1	176.1
	LSD at $P=0.001$		30.0	
DT 1	115.2	112.6	145.9	133.3
	LSD at $P=0.001$		27.5	
CY 9	132.0	130.4	174.9	177.8
	LSD at $P=0.001$		27.7	

The poor growth, and erratic results, from Clone TRI 2142 are of interest. Planting was done in wet weather and the fine-textured soil, high in organic matter, was inevitably compacted. Clone TRI 2142 plants were initially among the largest, but it was soon evident that they were unable to make the rapid growth which is characteristic of this clone in the field. The remaining clones overcame the adverse planting conditions satisfactory.

These results suggest that the value of fertilizer - N to tea shortly after planting is likely to be large, in contrast to possible short-term effects of fertilizer applied to a preceding guatemala grass crop.

AYT14—*Sulphate of ammonia and hoof-and-horn meal, 2 types of placement on 5 clones —(1966)*

Response in terms of both root and leaf dry weight, was analysed in detail for sulphate of ammonia and hoof-and-horn meal. The enforced omission of data from the third fertilizer treatment (see Annual Report for 1966) inevitably entailed loss of precision in the analysis. Trends are summarized as follows:

Clones varied considerably in their reaction to N levels and to type of N. TRI 2024 showed a large response in favour of N at the lower levels, particularly in respect of root development.

Hoof-and-horn (HH) showed, with one exception, a superiority over sulphate of ammonia which was most marked at higher levels. A tendency for the highest levels of hoof-and-horn to depress root or leaf weight was seen in two clones.

Sulphate of ammonia, even at the highest levels and in spite of the aggravating effects of the drought which followed soon after planting had very little depressive effect when dibbled in to the surface layers. Clone TRI 2025 was the exception to this, showing a large decrease in dry weight production of both leaf and root at the 20 and 30 g levels. Mixing sulphate of ammonia into the planting hole caused considerably more damage than the dibbling placement at the higher levels.

AYT15—*Ammonium vs nitrate nitrogen on 2 clones — (1966)*

Molybdenum treatment had no effect on root or leaf dry matter production. Clone DT 1 showed no significant response to any of the N treatments. Significant response was shown by Clone TRI 2025, with a marked depression in yield resulting from the highest, 25 g level of sulphate of ammonia compared to 15 g. In these respects, both these clones behaved in the same way as in **AYT14.**

Table 10 shows the growth response for Clone TRI 2025, following two applications (dibbled in to the surface layers) of the N fertilizers sulphate of ammonia, sulphate of ammonia + N-Serve (NS), calcium nitrate (CN). The control plot is marked O.

TABLE 10 —*Response of Clone TRI 2025 to forms of N—g dry weight per 16 plants* — **AYT15**

	Root					
S/A 1	S/A 2	NS 1	NS 2	CN 1	CN 2	0
300	220	345	267	277	283	186
		LSD $P=0.05$ — 53				
		$P=0.01$ — 72				
		$P=0.001$ — 96				
	Leaf					
760	619	847	605	684	708	467
		LSD $P=0.05$ — 112				
		$P=0.01$ — 152				
		$P=0.001$ — 204				

Leaf and root response suggests that at the lower level ammonium nitrogen was superior to nitrate, with the effect of N-serve (reducing the rate of oxidation of ammonium to nitrate) markedly beneficial. At the higher level, calcium nitrate was apparently less damaging.

Field comparisons between ammonium and nitrate nitrogen are always subject to influence by many factors, and too much importance should not be attached to this preliminary experiment.

AYT16—*P, K. each at 2 levels and types of placement on 2 clones — (1966)*

No significant differences in leaf or root dry weight were observed for either clone; TRI 2142 and DT 1. There was a suggestion that all the treatments had been somewhat deleterious. These all involved mixing fertilizer into the planting hole; potassium metaphosphate, potassium chloride, superphosphate plus potassium chloride.

AYT17—*P, K, Mn each at 2 levels on 2 clones — (1966)*

AYT18—*P, Zn on clones — (1966)*

These experiments were abandoned, as the development of the plants was too erratic.

AYT19—*N and nematodes on 2 clones — (1966)*

Pressure of work necessitated limiting the sampling to the total above ground parts (shoot) and root; "shoot" refers to leaf plus stem.

Tables 11 and 12 show the response for the two clones to methyl bromide fumigation (F) and to levels of sulphate of ammonia (3 applications). Weights are in grams per ten plants.

TABLE 11—*Response of shoot weights (fresh) to fumigation and N*—**AYT19**

Clone TRI 2024

F0	F1		F2	F3
935	2740		3342	3821
	LSD $P=0.05$	—	475	
	$P=0.01$	—	610	
	$P=0.001$	—	719	
N0	N1		N2	N3
2179	2955		2710	2995
	LSD $P=0.05$	—	384	
	$P=0.01$	—	464	
	$P=0.001$	—	520	

Clone TRI 2142

F0	F1		F2	F3
1642	2347		2803	2560
	LSD $P=0.05$	—	350	
	$P=0.01$	—	450	
	$P=0.001$	—	531	
N0	N1		N2	N3
2221	2499		2432	2300
	$P=0.05$	...	320	

The high degree of response to methyl bromide is noteworthy, compared to the low response to sulphate of ammonia.

TABLE 12—*Response of roots (dry weight) to fumigation and N*—**AYT19**

Clone TRI 2024

F0	F1		F2	F3
41.0	92.5		113.2	102.9
	LSD $P=0.05$	—	20.1	
	$P=0.01$	—	25.9	
	$P=0.001$	—	30.5	
N0	N1		N2	N3
73.0	90.6		84.9	101.5
	LSD $P=0.05$	—	19.6	

Clone TRI 2142

F0	F1		F2	F3
87.7	113.7		123.3	114.2
	$P=0.05$	—	25.5	
N0	N1		N2	N3
109.1	111.0		113.7	105.2

Not significant

It will be seen that root weight was influenced in the same direction as shoot weight, but less markedly.

The relatively low response to sulphate of ammonia may in part be accounted for by the effect of methyl bromide in increasing the ammonium—N in the soil. These results are of particular interest in view of present work on methyl bromide as a possible rehabilitation measure.

It should be noted that the rates of methyl bromide used in this experiment were 0, ¼, ½, 1 lb per 100 sq. ft and not, as given in the 1966 Annual Report, per acre.

AYT20—*Sulphate of ammonia, urea and isobutylidene diurea (IBDU) — (1966)*

Results showed certain trends which were puzzling, and it was decided to rely on further experiments before commenting on the value of urea or isobutylidene diurea for young tea.

1967 Experiments

AYT21—*Spacing, bringing-into-bearing and clones at No 3 Field — (1967)*

This experiment was laid down late in the year, together with **AYT22** and **AYT23.**

AYT22—*Mulching on young tea at No 3 Field — (1967)*

AYT23—*Types of N and 3 clones*—split plot-Types of N split on dibbling *vs* no dibbling — *(1967)*

These plots were laid down to test sulphate of ammonia, calcium ammonium nitrate and urea as surface applications. Treatments were split on dibbling *versus* no dibbling.

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Chemical Control of Weeds

Experiments **W3, W4, W5** and **W8** have been concluded.

W1—*Simazine and Gramoxone on Clone TRI 2142 — (1964)*

These plots were continued with uniform fertilizer treatment, with no further application of weedkillers. Very little weed growth appeared in any plot as the cover was uniformly dense.

In September 1966 foliar spray treatments of epsom salts were superimposed. Mild symptoms of magnesium deficiency were uniformly present. By the end of 1967 it was clear that yield had not been affected by 20 lb of epsom salts per acre.

W2—*Simazine and diuron on grasses* (Digitaria *spp.*) *in hand-cleaned* vs *paraquat-treated blocks — (1966)*

Before applying simazine (Gesatop 50) and diuron (Karmex 80), all previous weed growth was removed by weed scrapers. This operation was done on all blocks, whether the weeds were green or had been killed by Gramoxone. Two applications of Gramoxone, at 1/4 pint in 25 gallons per acre at a two-week interval were necessary on the appropriate blocks, to kill the dense growth. In all blocks the dead weeds were left *in situ* for a few weeks to allow seeds to fall. Simazine and diuron were thus applied to a clean, loosened, soil surface in all blocks.

Digitaria seedlings, mainly *D.longiflora*, *D.marginata* and *D.stricta*, were dominant and recording was confined to this group of species. Three months after treatment the seedlings were dug up, omitting a wide buffer zone within

each plot. Table 14 shows the number and dry weight (g) per plot, 6 sq. ft. No differences were detectable between the blocks treated with Gramoxone and those which were scraped.

TABLE 13—*The effect of simazine (S) and diuron (D) on number and weight of* Digitaria *seedlings*

Seedling number

S0	S1	S2	D0	D1	D2
482	335	164	540	305	134

LSD $P = 0.05 — 243$
$P = 0.01 — 327$

Seedling dry weight

S0	S1	S2	D0	D1	D2
24.0	12.1	5.1	24.8	13.4	4.4

LSD $P = 0.05 — 12.1$
$P = 0.01 — 16.2$

It is evident that both simazine, at 1 and 2 lb per acre (ai), and diuron, at four fifths and one and three fifths pound per acre (ai), had marked repressive effects on survival and vigour of *Digitaria* seedlings. This is contrary to an opinion sometimes expressed on estates.

W6—*Simazine, diuron, linuron, DCPA, Gramoxone and hand weeding on 1-year-old plants of Clone TRI 2142 — (1966)*

Treatments continued as planned, each being repeated only as weed growth required, with the exception of DCPA. Here, weed control was so poor that this treatment was stopped and hand weeding substituted. No further symptoms were observed on the paraquat plots, as reported previously, apart from necrosis obviously due to direct contact of the spray with the foliage.

By the end of 1967 the cover of the tea was mainly dense and weed growth was generally very poor. Table 15 shows the yield trends over the 16-months period between the start of treatments and the end of 1967. The DCPA plots are omitted.

TABLE 14—*Yield trends of Clone TRI 2142 in relation to weedkiller application—lb dry weight per acre per 16 months—***W6**

	P	PE	S	D	L	Control
Level 1	1604	1746	1599	1633	1729	1590
Level 2	1471	1467	1649	1750	1575	

P	=	paraquat	:	lower stems protected
PE	=	paraquat	:	lower stems sprayed
S	=	Simazine	:	1 and 2 lb ai per acre
D	=	diuron	:	1 and 2 lb ai per acre
L	=	linuron	:	1/2 and lb ai per acre

None of the differences reached statistical significance, but it should be noted that the lower yield from the higher level of paraquat only just failed to do so. These differences persisted throughout the period, and subsequent

results may establish significance. Paraquat levels were half and one pint of Gramoxone in 40 - 50 gallons per acre, and the habit of growth of the bushes was such that spraying the lower parts of the stems did not entail any appreciable spraying of leaf or green bark.

Even though the plots are very small it was considered to be justifiable to attach approximate costs to all the weeding operations involved. Assessment of the relative costs will be a long-term matter, as it would not be wise to come to a conclusion until it was clear that the cover of tea had obviated the need for any weeding operation. At present, it seems probable that Gramoxone spraying will still be required in 1968, but doubtful if any of the three pre-emergence chemicals need be used again.

By the end of 1967, costs appeared to be in favour of hand weeding, with Gramoxone at half pint per acre (3 applications) a close second. It should be noted that the area was extremely weedy, deliberately, before treatments started, and that eventually, account will have to be taken of probable value of yield in relation to type and rate of weedkiller.

W7—*Simazine, diuron, linuron and DCPA on 3 clones — (1966)*

Analysis of the results showed no significant differences between treatments, and yields of root and shoot from treated plots were on occasion slightly greater than from the controls. It may be suggested that, over a range of clonal type, clones TRI 2025. TRI 2142 and E 727 being used, the two common pre-emergence weedkillers may be considered up-country as a means of checking weed growth in a young clearing. Application three weeks before, one day before, or three weeks after planting all appeared to be equally suitable. In practice, application after planting would be preferred, spraying right up to the stems. Rates of use were 2 and 4 lb per acre of Gesatop 50 (Simazine) and 1¼ and 2½ lb per acre of Karmex (diuron).

W9—*Diuron and linuron on Bamboo Grass in seedling tea after pruning — (1966)*

Observation of these plots showed that as bud-break of the pruned tea progressed, severe chlorosis and distortion of the developing leaves was associated with the higher levels of each compound. Further, although these levels had achieved a temporary kill of parts of the bamboo grass (*Isachne kunthiana*) mats, within several weeks the grass had largely recovered. No further experiments on chemical control of this weed are contemplated. It would seem to be preferable to look upon hand weeding after pruning, when the work can be done most efficiently, as a means of removing those weeds which intermingle with the frames (see **MW1** below).

W10—*Gramoxone on Guatemala Grass (1966)*

Gramoxone at 0, ¼, ½, 1 pint in 50 gallons of water per acre was sprayed in plots of Guatemala Grass, five months old. Sprays were directed (1) on to the soil (2) on to the lower parts of the grass culm (3) over the top of the whole plant. Harvesting the plants showed that no treatment had had any significant effects on root or shoot weight. At the time of treatment, growth was vigorous, and it is probable that drastic contamination of younger and weaker plants would have serious adverse effects. It may be suggested that Gramoxone could be safely used in well-established guatemala grass clearings, even though visible damage to the outer leaves would inevitably result. In practice, weed growth is usually plentiful by the time the grass setts have begun to grow vigorously.

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MW1—*Gramoxone in seedling tea at the Mid-Country Station — (1966)*

Treatments were started, but the final programme for Gramoxone spraying is not yet established. No special effort will be made to eliminate certain weeds by increasing either the rate or the frequency of use of Gramoxone. *Axonopus compressus* (Carpet Grass), *Paspalum* spp. and various sedges may be sufficiently checked by infrequent Gramoxone sprays, until a hand weeding can remove them at pruning. If growth of such weeds appears to be too vigorous, intermediate Gramoxone rounds may be introduced, the timing of which will be judged strictly according to the degree of recoverey shown by the weeds after the previous spray round. Other weeds, such as *Passiflora suberosa*, *Mikania scandens*, *Tylophora indica* and *Cyclea buramanni*, will be dealt with entirely by hand. Their climbing habit puts them out of reach of a contact weedkiller.

It is planned to base this experiment on a weed-control programme aimed at checking, if not eliminating, weeds and hand-weeding will be looked upon as a normal part of a gramoxone-based scheme. This approach might well be adopted by low-elevation estates in particular, where it has become evident that total reliance on Gramoxone has not been altogether satisfactory.

Application of the gramoxone spray will be by normal copper-spraying nozzles. Slight contact with the lower leaves of the tea is considered to be of little importance, once the critical period up to tipping has been passed, and in practice it appears that a fine cone delivery gives a better chance of hitting weeds than is achieved by flood jets. This applies only to mature tea.

Extension Experiments

Full responsibility for the administration of the up-country group reverted to this Division during the year. In general, estate staff have settled down well with the unfamiliar task of recording on small plots. Inevitably some difficulties arose, and in some experiments yields have appeared to be higher than expected. This is being investigated.

Covariance analysis of the results of some of the experiments is quoted. Where omitted, this means that the period of recording under treatment has not been sufficiently great to warrant analysis. All results should be taken as short-term, provisional statements of trends. The pattern may conceivably change in the next few years, especially as effects of the previous estate treatment diminish.

Fertilizer levels are given as the annual doses, except for Limbux (L) where actual rates are not quoted.

XA1—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels with shade on seedling tea at Tangakelle Group, Lindula — (1965)*

TABLE 15—*Yield response over 15½ months*

N1 (120)	2952	N2 (240)	3461	N3 (360)	3481
CAN	3250	S/A	3377	Urea	3267

LSD at $P = 0.05$ — 374

The differences are significant for the level of N but not for the type of fertilizer.

XA2—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels with shade on seedling tea at Mayfield Estate, Kotagala — (1965)*

TABLE 16—*Yield response over 12 months*

N1 (120)	1818	N2 (240)	2128	N3 (360)	2252
CAN	2004	S/A	2156	Urea	2037

LSD at $P = 0.05$ — 105

The differences are significant for the type of fertilizer as well as for the level of N.

XA3—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels with shade on seedling tea at Hauteville Estate, Agrapatana — (1965)*

TABLE 17—*Yield response over 13½ months*

N1 (120)	2707	N2 (240)	2851	N3 (360)	3232
CAN	2907	S/A	2917	Urea	2967

LSD at $P = 0.05$ — 219

The differences are significant for the level of N but not for the type of fertilizer.

XA4—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combinations with 3 levels of potash without shade on seedling tea at Diyagama East Estate, Agrapatana — (1965)*

TABLE 18—*Yield response over 13 months*

N1 (120)	3460	N2 (240)	3567	N3 (360)	3706
CAN	3644	S/A	3590	Urea	3499
K1 (0)	3640	K2 (60)	3501	K3 (120)	3592

LSD at $P = 0.05$ — 316

The differences are not significant.

XA5—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels without shade on clone TRI 2023 at Ederapolla Group, Bulathkohupitiya — (1965)*

TABLE 19—*Yield response over 7½ months*

N1 (120)	2022	N2 (240)	2137	N3 (360)	2161
CAN	2107	S/A	2111	Urea	2101

LSD at $P = 0.05$ — 171

The differences are not significant.

The following designs with the exception of **XA11** are all 3^3 unreplicated, with 3 types of N each at 3 levels. The third factor is either potash or lime. Limbux is used as the liming material in order to achieve as rapid an effect on soil pH as possible. Liming treatments will be repeated until the pH reaches desired levels. With the exception of **XA8**, all are shaded.

XA6—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combination with three levels of potash at Blairlomond Estate, Udapussellawa — (1965)*

TABLE 20 —*Yield response over 13 months*

N1 (120)	2840	N2 (240)	2949	N3 (360)	2912
CAN	2934	S/A	2830	Urea	2936
K1 (0)	2952	K2 (60)	2903	K3 (120)	2845

LSD at $P = 0.05$ — 266

The differences are not significant.

XA7—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels on soils adjusted to three levels of pH at Kirkoswald Group, Bogawantalawa (1966)*

TABLE 21—*Yield response over 12½ months*

N1 (120)	2267	N2 (240)	2556	N3 (360)	2823
CAN	2657	S/A	2554	Urea	2436
L1	2708	L2	2471	L3	2465

LSD at $P = 0.05$ — 243

The differences are significant for level of N, but for no other treatment.

XA8—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combination with three levels of potash at Brunswick Group, Maskeliya — (1966)*

TABLE 22—*Yield response over 11½ months*

N1 (120)	2523	N2 (240)	2874	N3 (360)	3145
CAN	2789	S/A	2960	Urea	2792
K1 (0)	2824	K2 (60)	2898	K3 (120)	2820

LSD at $P = 0.05$ — 85

The differences are significant for the type of fertilizer and level of N but not for the level of potash.

XA9—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels on soils adjusted to three levels of pH at Holyrood Estate, Talawakelle — (1966)*

TABLE 23—*Yield response over 11 months*

N1 (120)	2417	N2 (240)	2418	N3 (360)	2541
CAN	2409	S/A	2507	Urea	2459
L1	2473	L2	2433	L3	2470

LSD at $P = 0.05$ — 136

The differences are not significant.

In the above experiments, fertilizer is applied four times in a full cycle year. In experiments **XA10** to **XA18**, three applications are made. All are shaded.

XA10—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combination with 3 levels of potash at Clarendon Estate, Nanuoya — (1966)*

XA11—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels on Langdale Estate, Talawakele — (1966)*

XA12—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combination with 3 levels of potash at Carolina Group, Watawala— (1966)*

XA13—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combination with 3 levels of potash at Ottery Estate, Dickoya— (1966)*

TABLE 24—*Yield response over 12 months*

N1 (90)	2242	N2 (180)	2302	N3 (270)	2467
CAN	2325	S/A	2345	Urea	2341
K1 (0)	2263	K2 (45)	2369	K3 (90)	2377

LSD at $P = 0.05$ — 183

The differences are not significant.

XA14—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combination with 3 levels of potash at Dickoya Estate, Dickoya— (1966)*

TABLE 25—*Yield response over 8½ months*

N1 (90)	1277	N2 (180)	1578	N3 (270)	1612
CAN	1476	S/A	1515	Urea	1476
K1 (0)	1508	K2 (45)	1530	K3 (90)	1429

LSD at $P = 0.05$ — 135

The differences are significant for the level of N but for no other treatment.

Results from the following experiments have not been analysed.

XA15—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels in combination with 3 levels of potash at Kotiyagala Group, Bogawantalawa — (1966)*

XA16—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels on soils adjusted to 3 levels of pH at Oonoogaloya Estate, Kotmale— (1966)*

XA17—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels on soils adjusted to 3 levels of pH at Diyagama East Estate, Agrapatana — (1966)*

XA18—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels on soils adjusted to 3 levels of pH at Gonapitiya Group, Kandpola— (1966)*

S. Sandanam & M. Sikurajapathy

Publications

TOLHURST, J. A. H. (1967). Fertilizer usage: Past effects and predictions for the future. *Tea Q.* **38**, 125-127.

TOLHURST, J. A. H. (1967). Fertilizers and productivity. *Tea Q.* **38**, 239-240.

REPORT OF THE PLANT PHYSIOLOGY DIVISION

Plant Physiologist—U. Pethiyagoda, BSc, PhD, DIC

General

Mr A.V. Richards resigned from his post of Adviser in Plant Propagation in October. Mr S. Nagarajah proceeded in May to the Australian National University, Canberra, on a post-graduate fellowship. Mr A. R. Sebastiampillai and Mr S. Kandiah continued their post-graduate studies at the University of Reading and the East Malling Research Station respectively. Mr D. Janakiram returned in November, after successful completion of studies leading to the MSc degree of the Indian Agricultural Research Institute, New Delhi.

Laboratory Investigations

Growth of tea in sand culture

Satisfactory progress continued to be made in evolving methods for maintaining young plants in sand culture.

Foliar symptoms of major element deficiencies

Seven month old plants of clone CY 9 at seven months after transferring to pots, were supplied with balanced nutrient solutions completely lacking in one of each of the following major nutrient elements—nitrogen, phosphorus, potassium, magnesium and sulphur. Distinctive foliar deficiency symptoms were observed and are summarized below :

1—*Nitrogen deficiency*—Stunted growth; pale yellow leaves; defoliation beginning with the lower leaves and extending to the upper nodes; profuse flowering and fruiting; plants dead in about eight to nine months.

2—*Phosphorus deficiency*—No apparent effect on vigour and size of plant; no distinctive foliar symptoms except a darkening in colour of the mature leaves.

3—*Potassium deficiency*—No marked effect on size of plant except that the stems appear thinner and inter-nodes longer; very distinctive foliar symptoms of marginal scorch; leaves formed later show a bronzing of the undersides.

4—*Calcium deficiency*—When symptoms first appear, plants are no smaller than the controls; downward curving and deformities of the more mature leaves; youngest leaves show an 'oilspot' type of translucence on the lower surfaces; these patches gradually enlarge, coalesce and develop into brown necrotic areas; apical activity is much reduced, the later formed leaves drop and growth virtually ceases; the defoliated stem tips tend to die-back.

5—*Magnesium deficiency*—Overall growth was little affected. The distinctive chlorosis characteristic of this deficiency for some clones like TRI 2024 (Mulder & de Silva 1959) did not appear in the test clone CY 9. Instead the lower leaves dropped prematurely and the plants were soon devoid of all but an apical tuft of leaves; plants were dead in about six to eight months.

6—*Sulphur deficiency*—Overall growth apparently normal; very distinctive chlorotic symptoms; the younger leaves appear pale green to yellow; the yellowing is in localized areas, the veins standing out clearly as a green network against a pale yellow background.

Leaf analyses carried out by the Agricultural Chemistry Division, on single samples collected from the above treatment confirmed the expected very low levels of the nutrients withheld.

The unusual response of CY 9 to magnesium deficiency raises the important question whether clones could differ in the symptoms manifested when particular nutrient elements are deficient. This could have an important bearing on the use of foliar symptoms for the diagnosis of deficiencies. Four different clones (TRI 2024, TRI 2027, DT 1 and TC 9) are, therefore, being currently maintained under the above six deficiency regimes and their symptom pattern and development will be observed.

Interaction between aluminium and certain other minor elements

In three experiments, the interaction between aluminium and iron, manganese and fluorine respectively, on the growth of clone TRI 2025 is under study. The levels of each of the four elements commenced at 0, 0.5, 1.0 and 2.0 ppm. In each case there were three replicates of the sixteen possible treatment combinations. As the plants grew larger, the levels of supply were doubled. The differential nutrient treatments were applied once a week while a standard solution containing other essential elements was supplied daily.

Very striking manganese deficiency symptoms were observed at the zero level of this treatment. As the plants grew larger, symptoms progressively appeared at the 0.5 ppm level. At this stage the decision was taken to double the levels of supply of the elements under study. The earliest symptoms consisted of a marbled cholorotic pattern on the leaves that had just completed their expansion. Shortly after, the young leaves were bright yellow in colour and necrotic patches appeared within the yellow areas and extended until the leaves showed extensive dead patches. None of the other minor elements have produced symptoms of either deficiency or excess, nor have they apparently affected growth above ground. The experimental plants are now ready for assessment.

Comparison between nitrate and ammonium as forms of nitrogen for tea plants

An experiment, commenced last year, had unfortunately to be abandoned owing to certain errors in the composition of the nutrient solutions. Experimental plants of clone DT 1 are in the process of being established for use in a fresh experiment.

S. Nagarajah & S. Krishnapillai

Field Experiments & Trials

The following experiments have been concluded:

PH2, PH7, PH8, PH10, PH11, PH16, PH17, and **PH18.**

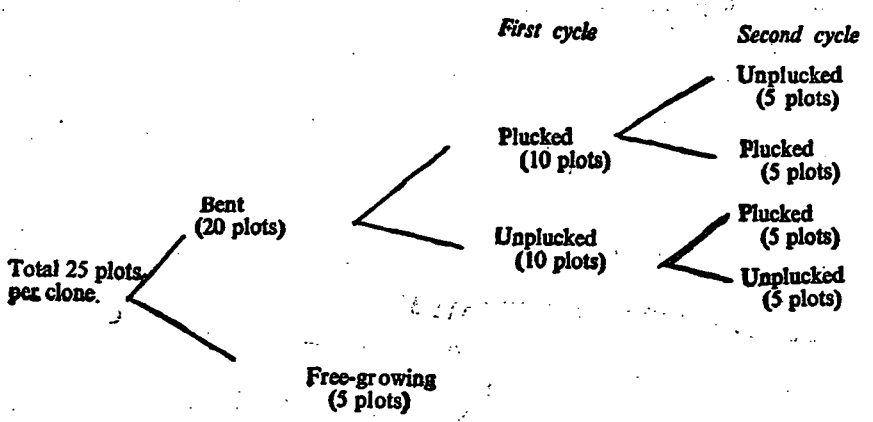
PH1—*Artificial shade—(1961)*

Plucks continued to be recorded for a little over two years after the artificial shade screens were removed in June 1965. The results this year confirmed the earlier report of the lack of an effect of previous shading on the yields obtained after its removal. This experiment has been terminated.

PH3—*Growth analysis—(1963)*

The details of this experiment are given in the Annual Report for 1964. To summarize, the main aim of this experiment is to determine the pattern of growth of tea, from planting onwards and to assess the effects of each conventional cultural operation. It consists of 25 plants of each of two clones TRI 777 and TRI 2142 selected for their contrasting growth habits. Each plot consists of 99 plants at a spacing of 3 ft x 4ft. Of the 25 plots, five have been allowed to grow freely since planting. The other 20 were bent and cut across as a conventional bringing-into-bearing practice. Of these, ten plots were plucked while ten were allowed to grow freely after cutting across. At the end of the first pruning cycle, all bushes except the free growing ones, will be pruned. The ten plots of each of the plucked and rested treatments will then be further split into groups of five. One such group in each of the first cycle treatments will be plucked in the second cylce and the other left unplucked.

The treatments may be represented diagrammatically as follows:



Samplings of plants have been done at appropriate intervals to determine the effects of the various treatments. Wherever possible, at each sampling, two standards are employed, the untouched bush allowed free growth from planting and the bush which has received normal treatment up to, but excluding the treatment in question. At each sampling, two plants selected at random from each replicate are uprooted carefully, and separated into leaves, stems and roots which are weighed separately and samples taken for determining dry matter. All figures in the tables are presented as g dry matter per plant. Total leaf areas are also estimated and basal stem girth recorded. In the columns for total dry matter, all material removed as prunings, tippings and plucked leaf have been converted to dry matter and added on to the relevant treatment.

It would be impossible to deal with this trial in detail here and such treatment is reserved for fuller publication. However, the results presented in Table I will serve to illustrate general trends. No statistical analyses of data have been attemped yet.

PH4—*Types of pruning—(1965)*

The experiment continued to be plucked for 98 rounds in the new cycle. There was no change in the general trend of results as reported last year. This experiment has therefore been terminated.

TABLE 1 — *Patterns of growth of tea in relation to various operations—Each figure represents g dry weight per plant and is the mean of either ten or twenty randomly selected plants*

(a) *After planting*

Date	TRI 2142				TRI 777			
	Root	Stem	Leaves	Total	Root	Stem	Leaves	Total
Jul. 1964	0.84	1.02	1.83	3.68	0.81	1.27	2.14	4.22
Oct. 1964	1.61	2.01	2.89	6.51	2.07	2.19	3.01	7.27

(b) *After bending in October 1964*

Date	Treatment	TRI 2142				TRI 777			
		Root	Stem	Leaves	Total	Root	Stem	Leaves	Total
Oct. 1964	at bending	1.61	2.01	2.89	6.51	2.07	2.19	3.01	7.27
Feb. 1965	free growing	2.8	4.9	6.4	14.1	3.0	5.4	9.6	18.0
	Bent	4.0	5.6	7.2	16.8	3.5	5.3	8.4	17.2
May 1965	free growing	9.1	13.9	18.5	41.5	8.3	14.5	21.3	44.1
	Bent	7.2	10.1	15.8	33.1	9.2	12.1	20.2	41.5
Aug. 1965	free growing	—	—	—	—	—	—	—	—
	Bent	14.5	33.8	45.6	93.9	18.5	29.6	41.9	90.0
Nov. 1965	free growing	50.8	114.9	121.4	287.1	50.5	105.3	130.1	285.9
	Bent	47.2	102.8	129.4	279.4	32.0	81.2	102.1	215.3

(c) *After pruning in December 1965*

Date		Treatment	TRI 2142				TRI 777			
			Root	Stem	Leaves	Total	Root	Stem	Leaves	Total
Nov. 1965	at pruning	free growing	50.8	114.9	121.4	287.1	50.5	105.3	130.1	285.9
		Bent	47.2	102.8	129.4	279.4	32.0	81.2	102.1	215.3
Apr. 1966	after pruning	free growing	204.3	433.6	352.8	990.7	169.9	355.9	305.0	830.8
		Bent	92.6	234.7	217.9	672.8	65.9	183.1	161.8	514.2

(d) *After commencement of plucking in April 1966*

Date		Treatment	TRI 2142					TRI 777				
			Root	Stem	Leaves	Total	Plucked weight	Root	Stem	Leaves	Total	Plucked weight
Apr. 1966	at plucking	free growing	204.3	433.6	352.8	990.7	—	169.9	355.9	305.0	830.8	—
		Bent	92.6	234.7	217.9	672.8	—	65.9	183.1	161.8	514.2	—
Jul. 1966		free growing	—	—	—	—	—	—	—	—	—	—
	Bent	Plucked	160	391	322	981	41	175	416	349	1032	39
		Unplucked	180	399	348	987	—	168	393	395	1006	—
Jan. 1967		free growing	668	1243	757	2668	—	463	1006	696	2165	—
	Bent	Plucked	362	737	471	1751	114	339	690	478	1664	104
		Unplucked	404	863	630	1956	—	353	752	574	1729	—
Jul. 1967		free growing	—	—	—	—	—	—	—	—	—	—
	Bent	Plucked	582	1139	684	2645	172	420	848	609	2091	161
		Unplucked	673	1387	865	2955	—	415	917	786	2198	—

PH5—*Mulching—(1965)*

The experiment has now progressed for two years since the treatments commenced. Mean yields recorded to date are presented in Table 2.

TABLE 2—*Effect of different types of mulch and levels of nitrogen on yield—Mulch applied monthly to provide 6.2 tons fresh matter per acre per annum—Nitrogen at four-monthly doses to provide 45, 135 and 225 lb per acre per annum*

(a) *Mulch effects*

Treatment	Yield (lb fresh weight per plot for 104 plucks from 31.12.65 to 31.12.67)
All leaf swept away	156.9
Mana	167.7
Grevillea robusta	186.7
Tea	194.1
Dadap	197.2
LSD at $P=0.05$	19.9
Mean yield for all mulched treatments	186.4
Yield for swept control	156.9
LSD at $P=0.001$	28.5

(b) *Nitrogen effects*

Treatment (lb N per acre per annum)	Yield (lb fresh weight per plot for 104 plucks from 31.12.65 to 31.12.67)
45	159.4
135	179.1
225	203.1
LSD at $P=0.05$	15.4 lb

The nitrogen levels as well as the mulch treatments have had significant effects on yield. There is however no significant interaction between treatments. Of the different types of mulch, the benefits from dadap and tea leaves are superior to those from *G. robusta* and Mana. It is to be noted that natural leaf droppings from the tea were removed monthly only from the control plots. In the mulch treatments, these droppings would supplement the added mulch.

The yields for 31 plucking rounds from the supplementary plots introduced later to the experiment confirm the beneficial effect of the addition of tea leaf droppings.

H. B. Wijetunge & S. Wimaladharma

PH6—*Hard pruning and methods of bringing into plucking—(1966)*

Substantial areas included in this trial have been uprooted as part of the programme for No. 3 field of St Coombs. The yield differences between the two types of pruning and the 'plucked in', 'early-tipped' and 'late-tipped' treatments have not been noteworthy. This area is being uprooted for replanting. Prior to this, representative bushes will be pruned and frame development will be assessed in relation to the treatments.

L. A. Seevaratnam

PH9—*Plucking rounds* cum *plucked unit*—*(1965)*

It was decided that this experiment be concluded at the end of its cycle (November 1965). There have, therefore, been no further results to add to last year's report. The experimental area is now being employed for an experiment on plucking frequencies (see **PH 20**).

PH12—Hakea saligna *as a shelter belt plant*—*(1965)*

The experiment continues as an observation trial.

PH13—*Rested tea bushes as shelter belts*—*(1965)*

Yields have now been recorded for five months in three blocks of long narrow plots running parallel to the rested tea hedges. The hedges have filled in well and appear to form a very effective barrier against wind. Their direction is unfortunately not across the path of prevailing wind and effects, therefore, will not be maximal. The mean yields for plots at varying distances from the hedges have been analysed but there seems to be no consistent relationship yet, between the position of a plot relative to the shelter belts and its yield of green leaf.

PH14—*Total available carbohydrate (TAC) levels and recovery from pruning*—*(1965)*

PH15—*Quantities of total available carbohydrate (TAC) and recovery from pruning*—*(1965)*

No further studies on this subject were undertaken.

PH19—*Dieback in relation to timing of fertilizer application at Beaumont Group, Pussellawa*—*(1965)*

This experiment was concluded. There were no noteworthy differences in recovery and detailed assessments were not attempted.

1967 Experiments

PH20—*Plucking frequencies and yield*—6 replicates of 9 plucking treatments—*(1967)*

This experiment was commenced on the area formerly under **PH9.** Each plot consists of approximately 200 bushes. The frequencies under test are, 3, 5, 7, 9, 10 and 14-day rounds and two combinations of alternating six and eight-day rounds and alternating four and ten-day rounds. All the above treatments are normal plucking (two leaves and a bud leaving a single expanded leaf). The ninth treatment is fish-leaf plucking on a seven-day round. The mean yields obtained so far are summarized in Table 3.

TABLE 3—*Mean yields obtained from different plucking frequencies and combinations, on seedling tea in the first year after pruning—Yields of green leaf per plot are for six months of plucking—Figures for made tea per acre per annum are approximate figures based on an assessed bush density of 3000 per acre and an out-turn of 23% made tea*

Treatment Length of plucking round (days)	*No. of plucking rounds*	*Yield* (lb green leaf per plot)	*Yield per pluck* (lb)	*Calculated made tea per acre per annum* (lb)
7 (fish leaf)	25	252.1	10.08	1588
7 (single leaf)	25	207.1	8.28	1305
5	36	199.7	5.55	1258
10	18	193.6	10.76	1220
3	60	193.4	3.22	1218
alternating 4 & 10	25	192.7	7.71	1214
9	20	182.8	9.14	1152
Alternating 6 & 8	25	180.7	7.23	1138
14	12	163.1	13.59	1028
LSD for total yields at	*P*= 0.05	18.2		
	P= 0.01	24.4		
	P= 0.001	32.0		

Of the teatments tested, seven-day rounds appear to result in the highest yields over a period of time. By plucking to a fish leaf, yields go up by about 22%.

H. B. Wijetunge & S. Wimaladharma

PH21—*Fertilizer-induced scorch during recovery from pruning*—4 replicates of 15 treatment combinations—(*1967*)

Four, eight and sixteen ounces of sulphate of ammonia, muriate of potash, saphosphosphate, calcium ammonium nitrate and T700 respectively, were applied into the soil around single bushes of TRI 2026 being pruned for the first time, at St Coombs. The treatments were replicated four times. The large doses of fertilizer were designed to induce the type of leaf crinkling and marginal scorch that are commonly seen on shoots during the early stages of recovery from pruning. Such symptoms were clearly associated with the fertilizer applications, being generally more severe with increasing dose. In extreme cases, shoots defoliated and died back after producing four to six poorly developed appendages. In some instances, exudation of a white, crusty material was observed on the dead areas of leaves. Analyses of samples showed the presence of several inorganic ions although complete quantitative analysis or identification was not possible. The symptoms were not associated with any particular fertilizer component, although saphosphosphate, presumably on account of its lower solubility, appeared to do less damage than the other fertilizers. As recovery progressed and the bulk of foliage increased, the symptoms gradually disappeared and after a few months, the bushes looked quite normal. This was an observation trial and is now concluded.

PH22—*Post-pruning growth*—(*1967*)

Ten rows, each of 25 seedling bushes at St Coombs were pruned. Two randomly selected rows were stripped of thier new growths three months later and thereafter two further rows at weekly intervals for a further four weeks. After a further three months for the growth of the second sets of sprouts in each case the bushes were again stripped of their new growths. On each occasion, the strippings from each bush were weighed and counted separately. The results are presented in Table 4.

TABLE 4 — *Post-pruning recovery — Each treatment consisted of 50 bushes and fresh weights and shoot numbers are totals for treatments — All treatments pruned on 3.9.66*

Treatment number	Date of first stripping	Interval (weeks)	Fresh weight of shoots (g)	Shoot number	Mean shoot weight (g)	Date of second stripping	Interval (weeks)	Fresh weight of shoots (g)	Shoot number	Mean shoot weight
1	2.12.66	12	4,287	3439	1.16	5.3.67	12	19,621	2667	7.87
2	9.12.66	13	8,169	3234	2.24	12.3.67	12	15,660	2389	7.47
3	16.12.66	14	11,116	3595	3.17	19.3.67	12	15,568	2369	7.04
4	23.12.66	15	20,962	4657	4.44	26.3.67	12	13,021	2662	5.20
5	30.12.66	16	21,183	3641	5.79	3.4.67	12	12,939	2103	6.12

This study was of an exploratory nature and being on seedling tea, the bushes were very variable. Nevertheless, the following general conclusions could be drawn.

1 — The total weights of new shoots produced differ greatly from bush to bush. The number of buds commencing growth largely determine this weight (coefficient of correlation = 0.820 ***) the correlation between shoot number and mean shoot weight is not significant.

2 — With progressive increase in the interval between pruning and shoot removal, total and mean shoot weights increase in a linear manner. Total shoot number however remains nearly constant. Once the new shoots have grown to a certain size, there would be a suppression of further bud break.

3 — In contrast, the total shoot weight produced in the three months regrowth after stripping shows an inverse relationship to the first growths ; *ie* the greater growth in the first recovery, the less it is after stripping of shoots. The combined first and second stripping weights fall into a typical sigmoid growth curve.

4 — The numbers of buds commencing growth after pruning and the numbers produced in regrowth show a very highly significant correlation (coefficient $r = 0.749$ ***). It will follow that stripped weights will also show the same relationship.

The main purpose of this experiment was to determine whether the amount of post-pruning growth appeared to be regulated by the availability of required materials. An unequivocal answer did not emerge from this experiment. Certain indications from the results suggest further investigations which it is hoped to be able to carry out on clonal tea. The present experiment is concluded.

PH23—*Pretreatment of cuttings with solutions of hormones*—7 compounds each at 3 levels unreplicated—(*1967*)

Single node cuttings of TRI 2024 were placed with their basal ends in solutions (10 ppm) of indole-acetic acid, indole-propionic acid, napthalene-acetic acid, indole-butyric acid, kinetin and 2-4 dichloro-phenoxyacetic acid for period of 30, 60, and 180 min followed with an overnight dip in 4% sucrose solution. The control had only the sucrose treatment. There were, therefore, 21 treatments and a control. Fifteen cuttings of each treatment were planted in randomized rows on a nursery bed. They were assessed nine months after planting. The experiment was concluded with determinations of fresh and dry weights of leaves, stems and roots. Plant height was measured and the total number of appendages counted. At the concentration and testing times that were employed, none of the compounds used resulted in any outstanding differences in any of the growth measurements carried out.

PH24—*Gibberellic acid on young nursery plants*—8 replicates of 5 treatments—(*1967*)

There have been reports of beneficial results from the use of dilute sprays of commercial preparations of gibberellic acid on nursery plants in their early stages of growth. Authentic gibberellic acid as a 20 ppm solution was used in sprays. Young plants (about six months old) of two clones TRI 777 and TRI 2025 were employed. The five treatments consisted of

1 — a single spray on intact plants,
2 — a single spray on plants in which the terminal bud and two leaves were removed,
3 — ten repeated one-monthly sprays on plants as in 1,
4 — ten repeated one-monthly sprays on plants as in 2,
5 — untreated controls.

Twenty-five plants made up each treatment and there were eight replications. Assessments of the growth of the cuttings were carried out 12 months after the experiment commenced. The data has not yet been analysed but the indications are that none of the treatments has markedly affected growth. It is hoped to test altered concentrations and treatment frequencies.

S. Krishnapillai

PH25—*Growth retardants on tea—(1967)*

Three growth retardants Cycocel (2-chloroethyltrimethyl-ammonium chloride 50%), B9 (N-dimethylaminosuccinamic acid 98% WP) and Regulox W (maleic hydrazide assumed to be 100%) are being screened for their effects on tea. In a preliminary observation trial, each of these compounds was sprayed at concentrations of 50, 200 and 800 ppm active ingredient in aqueous solution. The sprays were carried out on old seedling bushes at St Coombs, which had been tipped once after pruning. A row of tea bushes comprised a plot. One, two and three sprays (at fortnightly intervals) were compared. Ten active shoots and ten banji ones were marked in each treatment before the first spray. The only effect noticed was a transient distortion of leaves at the highest concentration of B9. Further trials are to be carried out, employing a range of concentrations, treatment frequencies and nursery plants.

PH26—*Studies on banji—(1967)*

Observations on clones TRI 2025 and TRI 2044 confirmed the earlier finding (see Annual Report for 1964) that dense shading of bushes (with coir matting) induced extensive production of banji shoots. Increasing by daily intervals the number of days of shading (from 0-7 days) combined with decreasing days of exposure (7-0 days respectively) through four such cycles, indicated that the percentage of shoots entering the banji stage increased progressively. The results are shown in Table 5.

There was a simultaneous tendency for extension growth of the shoots also to be progressively reduced by the onset of banji the conflicting tendency for an extension due to etiolation, however, presumably masked this effect.

TABLE 5—*The effect of progressively increasing days of shading on the onset of banji*

Treatment		Percentage of banji shoots	
Days shaded	Days exposed	TRI 2025	TRI 2044
0	7	10.0	0
1	6	11.1	0
2	5	30.0	36.4
3	4	55.6	33.3
4	3	60.0	37.5
5	2	70.0	100.0
6	1	100.0	100.0
7	0	100.0	100.0

Ring barking of shoots also increased the tendency towards banji production. Analyses of extracts of banji, active and banji shoots just resuming growth, for gibberellins did not yield conclusive results. Preliminary observations with gibberellic acid, indole-acetic acid and kinetin showed that some of these compounds and combinations were effective in inducing the breaking of banji buds when applied externally in dilute solution.

V. S. Kulasegaram

PH27—*Duration of lung retention and recovery from pruning at Tangakelle Estate, Lindula*—6 treatments repeated 9 times—*(1967)*

This study was carried out on an experiment being conducted by the Agricultural Chemistry Division (**A10**). The design consists of 54 plots in clonal tea (E7/27) which had just completed their pre-treatment plucks and were being pruned prior to the imposition of experimental fertilizer treatments. The plots were divided into six groups of nine contiguous plots. Lung retention times of 0 (clean prune), 3, 6, 10, 12 and 15 weeks respectively, were tested on the six groups. Each plot was divided into top and bottom halves and rim-lung and centre-lung treatments were randomly assigned to the two subplots. At pruning, efforts were made to leave two or three good-sized, comparable lungs on each bush.

All treatments were tipped at nineteen weeks from pruning and the tipping weights recorded separately for each subplot. The shoots in representative samples of known weight were counted and an estimate of the number of shoots tipped, thereby obtained. Similar assessments were made at the second tipping three weeks later. The results for the combined first and second tipping are presented in Table 6.

TABLE 6 — *The effect of duration of lung retention on recovery up to tipping — Each figure represents the total from 32 bushes and is the sum of the rim-lung and centre-lung pruned subplots — First and second tippings combined*

	Tipping Weights			Mean no. of shoots tipped per plot
Duration of lung retention (weeks)	Rim lung (lb)	Centre lung (lb)	Mean	
0	—	7.38	7.38	1084
3	5.68	6.29	5.99	1561
6	10.70	9.53	10.12	1260
10	11.53	10.52	11.03	853
12	12.28	11.43	11.86	106
15	6.76	6.12	6.44	910
Mean	9.06	8.55	8.805	
LSD at $P = 0.05$			1.20	159
$P = 0.01$			1.57	213
$P = 0.001$			2.09 lb	279

There were no worthwhile differences between rim-lung and centre lung pruning. It appears that retention of lungs for six weeks has given the most favourable combination of tipping weights and tipped shoot numbers. It is of interest to record that the estate management, on visual observation of areas surrounding the experiment, decided to remove lungs at seven to eight weeks from pruning. This is in accord with the results of this experiment, further details of which are given in the Report of the Agricultural Chemistry Division.

PH28—*Pruning of clonal tea at Welimada Group, Welimada*—*(1967)*

This is a simple unreplicated trial on mature clonal tea. Twelve plots, each with an average of 110 bushes have been demarcated in two areas of clones TRI 2023 and TRI 2026. Two levels of fertilizer, six weeks resting *vs* no resting, and three durations of lung retention (four, eight and twelve weeks) in all

combinations, comprise the twelve treatments. The treatments have been completely randomized and the fertilizer and resting treatments imposed. The plots are due to be pruned shortly. Visual observations on recovery, tipping weights and if justified, estimations of dieback are the assessments planned.

H. B. Wijetunge & S. Wimaladharma

CLONAL TESTING

General

This year there is a change in the mode of presentation of the results from the clonal-testing experiments. Commencing from 1961, these experiments have been laid down annually at St Coombs (4,500 ft amsl), at the Mid-country Station (Hantane 2,500 ft amsl), the Kottawa substation (100 ft amsl) and the Uva Station (Passara 2,500 ft amsl). They were intended primarily as performance tests for outstanding TRI and estate clonal selections. The decision to repeat them at the four locations implied a recognition of the possibility that certain clones may have particular preferences for regional climatic characteristics. It is mainly from these angles that the results to date will be considered.

In all, 93 clonal selections and three seedling populations are under test at St Coombs and similar numbers at the other locations. As in all varietal trials, a compromise had to be made between the numbers of progeny lines to be included and the size of the trial plots. Limitations of space and labour imposed limitations on the magnitude of each. In general, a plot size of 24 ft by 12 ft, containing six rows of six plants each at a spacing of 4 ft by 2 ft, and repeated four times has been selected.

As would be expected, the plot size and numbers of progenies under test has raised serious difficulties arising from the sometimes large localized variations of soil characteristics. The limited number of replications that has been possible further aggravates the problem. Clone TRI 2024 (which was the most popular clone at the time these experiments commenced), has been planted each year to serve as a standard. Unfortunately, the interplay of soil and climatic characteristics on this clone has evidently been no less than on any other. Its yield performance, therefore, varies markedly with location, site and hence, year of planting. Its validity as a standard for all trials is thus very questionable. Similarly, such wide discrepancies exist in respect of absolute yield figures for the various clones, locations and replicates that it has not been considered advisable to present yield figures. All that is being attempted, therefore, is to present the ranking order of the various clones where an experiment has progressed for one pruning cycle or longer. The experiments for 1961 and 1962 have completed at least a single cycle at all locations. The 1963 planting has completed two years of plucking at all locations and the ranking order is presented in this case too.

To give some idea of yields obtained, the cycle total for each location is given at the bottom of Tables 7 and 8. Selected levels of yield are also indicated in the body of the tables.

It must be mentioned that these calculated yields of made tea per acre are obtained by multiplying plot yields by an appropriate factor. In estate practice on large extents, a certain amount of waste for roads, paths, drains and areas that have to be excluded (*eg* rocks *etc*) has to be expected and this has not been allowed for in the figures given. A reduction by 20 to 25% of the stated figures will, therefore, give a realistic estimate of yields obtainable. Similarly, a made

tea outturn of 23% of flush weight has been assumed in the calculation. It is to be appreciated that this value probably varies with location and climatic conditions. With the available facilities it has not been possible to make corrections for the above factors, and yields may be somewhat overestimated on this account too. Where casualties have occurred in particular clones, these have not been taken into account in calculating yields. This could be considered fair, as such casualties would not support the planting of a clone, and its rank would accordingly be reduced.

It is to be noted that pruning cycles necessarily differ at different locations (three years at St Coombs and Hantane, two years at Kottawa and rather less at Passara) ; the numbers of months of plucking are indicated at the bottom of each column in the tables.

In most of the experiments, of the four replicate blocks, two are under low shade trees (*Gliricidia maculata* or dadap, the choice being dependent on climatic suitability at each location) and two are without shade trees. After careful consideration of the data obtained, it is evident that many inconsistencies exist and it is clear that no unequivocal answer has emerged on the value of such shade in young clonal tea. To avoid confusion, the results for this treatment are not presented separately. The tables are, therefore, to be considered merely as a means of assessing the relative performance of clones at locations considered to be fairly representative of the contrasting features of climate encountered in the main tea-growing areas. Kottawa with its ample and well-distributed rainfall and generally high temperatures provides conditions for vigorous growth. Likewise, St Coombs is relatively free of adverse climatic conditions. Hantane and Passara suffer from droughts of varying severity which are setbacks for cropping. Mean combined yields for all clones illustrate this trend, being higher at Kottawa and St Coombs than at Hantane and Passara.

VP1—*Clonal testing at St Coombs—(1961)*

MVP1—*Clonal testing at the Mid-Country Station—(1961)*

UVP1—*Clonal testing at the Uva Station—(1961)*

LVP1—*Clonal testing at the Kottawa Substation—(1961)*

The experiments at St Coombs and Hantane completed their first cycle of three years at the end of 1966. Those at Passara and Kottawa which are on shorter cycles have just come to the end of their second cycles. On the basis of mean yields obtained, the clones rank themselves as shown in Table 7.

TABLE 7—*Rank of clones on the basis of mean yields in experiments* **VPI, MVPI, UVPI** and **LVPI**—*Clones shown in heavy type gave a mean calculated yield per acre per annum of more than 2500 lb—Clones shown in plain type gave a mean calculated yield per acre per annum of between 1500 and 2500 lb—Clones shown in italics gave a mean calculated yield per acre per annum of less than 1500 lb*

First cycle				Second cycle	
VPI	**MVPI**	**UVPI**	**LVPI**	**UVPI**	**LVPI**
TRI 2025	**TRI 2023**	TRI 2026	**TRI 2023**	TRI 2027	TRI 2023
TRI 2023	**TRI 2026**	TRI 2027	**TRI 2026**	TRI 2023	TRI 2026
TRI 2026	TRI 2025	T 5/3	**DG 39**	TRI 2026	TRI 2024
TK 48	DG 39	N	**MT/18**	T5/3	MT/BG
TRI 2027	TRI 2151	KEN 16/3	**MT/BG**	TRI 2025	TRI 2027
DT 1	KEN 16/3	TRI 2023	**T 5/35**	N	MT 18
TRI 2024	TRI 2027	NL 4/2	**TRI 2024**	KEN 16/3	DG 39
GMT 9	T 5/35	*TRI 2151*	**UH 9/3**	GMT 9	GMT 9
CY 9	MT/BG	*TRI 2025*	**PA 22**	TRI 2151	KEN 16/3
N	MT/18	*EN 31*	**PO 26**	MT 18	TRI 2025
KEN 16/3	NL 3/1	*GMT 9*	**DT 1**	CY 9	TRI 2151
MT/BG	TRI 2024	*MT 18*	**TRI 2025**	TK 48	T 5035
CV 5 BI	DT 1	*TK 48*	GMT 9	EN 31	K 150
TRI 2151	*K 136*	*DG 39*	QT 1/5	MT/BG	PO 26
UH 9/3	*GMT 9*	*UH 9/3*	K 150	NL 4/2	PA 22
DG 39	N	*MT/BG*	TRI 2151	DG 39	QT 1/5
K 150	*QT 1/5*	*CY 9*	TK 48	DT 1	TK 48
Seed	*PA 22*	*DT 1*	TRI 2027	TRI 2024	UH 9/3
MT/18	*PO 26*	*T 5135*	NL 3/1	QT 1/5	NL 3/1
PA 22	*T 5/3*	*PA 22*	K 136	CV 4 BI	T 5/3
K 136	*EN 31*	*QT 1/5*	KEN 16/3	UH 9/3	Seed
NL 3/1	*TK 48*	*CV 4 BI*	CV 5 BI	PA 22	K 136
TRI 777	*KEN 15/7*	*TRI 2024*	Seed	PO 26	NL 4/2
T 5/3	*UH 9/3*	*K 150*	CR 4	T 5/35	DT 1
KEN 15/7	*Seed*	*TRI 777*	EN 31	CV 5 BI	EN 31
PO 26	*NL 4/2*	*PO 26*	NL 4/2	K 150	CR 4
T 5/35	*CY 9*	*NL 3/1*	T 5/3	TRI 777	CY 9
CR 4	*K 150*	*KEN 15/7*	KEN 15/7	K 136	TRI 777
QT 1/5	*TRI 777*	*CV 5 BI*	*TRI 777*	NL 3/1	CV 5 BI
NL 4/2	*CV 5 BI*	*K 136*	*CV 4 BI*	KEN 15/7	KEN 15/7
EN 31	*CR 4*	*Seed*	*CY 9*	Seed	N
CV 4 BI	*CV 4 BI*	*CR 4*	*N*	CR 4	CV 4 BI
Total Cycle Yield					
7194±85.2	4584±127.4	1757±48.2	4870±105.8	—	10232±125.9
Pruning Cycle (Months)	36	33	20	24	Incomplete	24
Mean yield/ annum (calculated)	2398	1667	1054	2435	—	5116

It will immediately be apparent that the patterns, except for a few features of general similarity, differ markedly between locations. It would be impossible to deal with any more than a few salient features. The wide ranges in mean yield per year over the first cycle, at the different locations are striking. At St Coombs 15 clones have yielded an average of over 2500 lb per acre per annum, at Kottawa 12 and at Hantane two. At Passara only five clones yielded just over 1500 lb. It seems very probable that drought conditions which are encountered at the Passara and Hantane Stations would account for the relatively lower mean yields. It should, however, be noted that the lowly position of the seedling plots confirms that this is not a disability that is exclusive to clonal tea.

In relative performance, the TRI 2020 series clones have done consistently well. It appears that TRI 2023 and TRI 2026 are particularly versatile. In contrast, TRI 2024, TRI 2027 and TRI 2151 differ in performance at the various

locations. The Balangoda Group clones DG 39, MT/BG and MT 18 have done relatively well at Kottawa and Hantane. The closely similar performance of clones MT/BG and MT 18 in all the trials lends support to the suspicion that they are one and the same clone. The performance of the different clones also suggest a regional preference of some clones for conditions similar to those of the region in which they were originally selected. At St Coombs, the clones from Talankande Estate (TK 48), Drayton (DT 1), Tangakelle (CY 9) and Diyagama (N) are among the better performers. At Passara, the performance of the Neluwa (NL 4/2) and Thotulagala (T 5/3) clones are in strong contrast to their positions at the other stations.

The standard clone TRI 2024 has fared reasonably well at Kottawa and St Coombs but relatively poorly under the dry conditions of Passara and Hantane. At St Coombs, TRI 2024 has been found to be infested with eelworm and a decline may occur. *Phomopsis theae* has affected KEN 16/3 and NL 3/1. Of the other clones in this experiment, TRI 2024, TRI 2025 and DT 1 are considered susceptible and the spread of the disease will be watched. The high yielding TK 48 is a poor fermenter while the performance of the high-quality clone DT 1 is noteworthy. This clone has generally done well at St Coombs in extensive new clearings but it seems highly attractive to Shot-hole Borer and is, therefore, a risk where this pest is prevalent. At Hantane, the clone DG 39 combines high yield with drought and shot-hole borer tolerance. TRI 2025 and TRI 2026 are considered very susceptible to damage by Shot-hole Borer and the former also appears on field observations to be highly susceptible to the recently-found parasitic nematode *Radopholus similis*.

The high-quality clones NL 4/2 and TRI 777 have generally not yielded well although the former performed exceptionally well at Passara in the first cycle and the latter has been known to yield well in estate plantings. Probably as a result of its poor response to pruning, NL 4/2 has declined in rank considerably in the second cycle at Passara. The positions of clones N (Diyagama) and CY 9 (Tangakelle) at the bottom of the table at Kottawa is unusual in view of the generally vigorous growth of the two clones, particularly at higher elevations. The figures for the second cycle at Kottawa show a remarkable increase over the first cycle, the mean figure for the two-year for all clones combined exceeding the 10,000 lb mark. Pre-eminent is the clone TRI 2023 which reached the astonishing figure of a calculated 11,400 lb to the acre in the second year of the second cycle with TRI 2026 following with a yield of 9,500 lb. Over the two years of this cycle they have averaged over 9,300 and 8,300 lb respectively. Attention is however again drawn to the inaccuracies in the extrapolation of yields and it is stressed that the above figures are calculated yields.

VP2—*Clonal testing at St Coombs*—*(1962)*
MVP2—*Clonal testing at the Mid-Country Station*—*(1962)*
UVP2—*Clonal testing at the Uva Station*—*(1962)*
LVP2—*Clonal testing at the Kottawa Substation*—*(1962)*

All the experiments have completed their first cycle. On the basis of their mean annual yields during the first cycle, the ranking order of clones at the different locations is given in Table 8. It will be noted that clone OT 5/8 replaced H 13/4 in the Hantane experiment.

TABLE 8—*Rank of clones on the basis of yields obtained in the first cycle in experiments* **VP2, MVP2, UVP2** *and* **LVP2**—*Clones shown in heavy type gave a mean yield per acre per annum of over 2500 lb—Clones shown in plain type gave a mean yield per acre per annum of between 1500 and 2500 lb—Clones shown in italics gave a mean yield per acre per annum of less than 1500 lb*

	VP2	MVP2	UVP2	LVP2
	NAY 3	KP 204	*MG*	**TRI 2043**
	MG	MPA 1	*TRI 2016*	**TRI 2024**
	TRI 2022	*TRI 2024*	*TRI 2039*	**KP 204**
	TRI 2024	*NK 4 B 29*	*KP 204*	NK 4 B 29
	TRI 2016	*TRI 2043*	*H 13/4*	TRI 2022
	TRI 2043	*TRI 2022*	*TRI 2024*	MPA 1
	TRI 2039	*TRI 2016*	*NK 4 B 29*	TRI 203
	TRI 2020	*CH 13*	*CH 13*	H 13/4
	D	*MG 3 B 1*	*MG 3 B 1*	TRI 2016
	CH 13	*TRI 2039*	*MPA 1*	NAY 3
	H 13/4	*NAY 3*	*TRI 2043*	MG
	KP 204	*D*	*TRI 2022*	*MG 3 B 1*
	MG 3 B 1	*TRI 2020*	*NAY 3*	*D*
	MPA 1	*MG*	*TRI 2020*	*CH 13*
	NK 4 B 29	*OT 5/8*	*H 6 A 1*	*TRI 2020*
	H 6 A 1	*H 6 A 1*	*D*	*H 6 A 1*
Total cycle yield	6003±349.4	2671±99.71	1285±72.4	3632±30.3
Pruning cycle (months)	36	33	20	24
Mean yield per annum (calculated)	2001	972	771	1816

Once again, mean yields at St Coombs and Kottawa exceed those obtained at the other two locations. Four clones at St Coombs and three at Kottawa have mean yields over 2500 lb per acre per annum. Only three clones at St Coombs and five at Kottawa have yields below 1500 lb average per year. At Hantane, only four clones have yielded over 1500 lb. At Passara none of the clones have given a calculated annual mean yield of even 1500 lb. Of the TRI clones included in this experiment, TRI 2020 has fared the worst. TRI 2022 and TRI 2043 have generally performed well. The estate clones which appear among the best differ markedly in their yields at the different locations (eg NAY 3, MG, KP 204, MPA 1 and NK 4 B 29). The performance of the quality clone NAY 3 at St Coombs is of interest although it is considered susceptible to *Phomopsis theae*. The clone MPA 1 at Hantane has yielded well and indications are that it possesses good quality. It may prove to be a useful clone, being also good against drought and Shot-hole Borer. The clone TRI 2043 is noted for its ' tippiness ' and is increasing in popularity in the low country, although its growth may pose problems in frame formation. The clone H 6 A 1 which was selected for outstanding tea-making qualities has fared very poorly at all locations. It is very highly susceptible to damage from Shot-hole Borer and at Hantane has actually yielded no crop at all, the bushes being almost devoid of frame and barely alive.

VP3—*Clonal testing at St Coombs—(1963)*

MVP3—*Clonal testing at the Mid-Country Station—(1963)*

UVP3—*Clonal testing at the Uva Station—(1963)*

LVP3—*Clonal testing at the Kottawa Substation—(1963)*

These experiments have completed two years plucking at St Coombs, Kottawa and Passara, while only one year's data is available for Hantane. The ranking orders of clones are given in Table 9.

TABLE 9—*Rank of clones on the basis of yields obtained in the first cycle in experiments* **VP3, MVP3, UVP3,** *and* **LVP3**

VP3	MVP3	UVP3	LVP3
B 275	TRI 2021	B 275	DG 7
W/2 145	TRI 2024	TRI 2021	TRI 2045
DG	DG 7	TRI 2024	TRI 2021
TGK 2	W 3	DG 3	DG 3
E 7/27	E 7/27	DG 7	W/2 145
TRI 2021	DG 3	TRI 2046	TRI 2024
W 3	W/2 145	E 7/27	W 3
TRI 2046	TRI 2046	W/2 145	B 275
DG 7	DG	TGK 2	E 7/27
DG 3	TRI 2045	DG 43	DG
ML 7	TGK 2	DG	DG 43
TRI 2024	ML 7	W 3	TRI 2046
		TRI 2045	ML 7
		ML 7	TGK 2

The clone (Ragala) B 275 has yielded best at Passara and St Coombs. It was not included in the Hantane planting in 1963 but has been included in the 1967 test planting. TRI 2045 is unusual in its performance at Kottawa. Similarly the position of TRI 2024 at the bottom of the list at St Coombs is abnormal. While ML 7 is consistently poor in yield, no clones have proved to be consistently high yielders at all locations. Once again locational differences in performance are marked.

VP4—*Clonal testing at St Coombs—(1964)*

MVP4—*Clonal testing at the Mid-Country Station—(1964)*

UVP4—*Clonal testing at the Uva Station—(1964)*

LVP4—*Clonal testing at the Kottawa Substation—(1964)*

Yields for the first two-year cycle at Kottawa and those for the first year's plucking at St Coombs and Passara are available. The more outstanding performers in order of yield at each location are as follows :

Kottawa—CW 21, H 1/58, TRI 2024, TRI 1526, TRI 1530 and Lansdowne biclonal (TRI 2023 × TRI 2026) seed, all of which have yielded an average of over 3000 lb made tea per acre per year of plucking. The mean yield for all clones combined together being just under 2900 lb per acre per year.

St Coombs—DW 12, MO 241, MO 146, QT 4/4, MO 208 and TRI 1114 which have yielded over 1500 lb made tea per acre for the first year of plucking. The mean yield for all clones is just over 1050 lb per acre.

Passara—PLLG 2, TRI 2024, TRI 1114, MO 208, MO 116 and DW 12 are the better yielders. The mean yield for all clones is just over 1050 lb per acre.

The yields at Kottawa are again high and those at Passara considerably lower.

The clones under test in these experiments differ between locations although several are common to all. The Mooloya clones have performed reasonably well at St Coombs and Passara, but poorly at Kottawa. In contrast, the two seedling progenies (Illuktenne and Lansdowne) have done better at Kottawa than at St Coombs and Passara in relation to the clones tested. The performance of CW 21 (Coombewood) H 1/58 (Hulandawa) at Kottawa is of interest. These two clones are unfortunately not included in the St Coombs planting and the latter is not planted in the Passara experiment.

VP5—*Clonal testing at St Coombs—(1965)*

MVP5—*Clonal testing at the Mid-Country Station—(1965)*

LVP5—*Clonal testing at the Kottawa Substation—(1965)*

LVP10—*Clonal testing at the Kottawa Substation—(1965)*

The clones included in these experiments have been listed in the Report for 1966.

VP17—*Clonal testing at St Coombs—(1966)*

MVP6—*Clonal testing at the Mid-Country Station—(1966)*

The list of clones under test appeared in the Report for 1966.

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1967 Experiments

VP21—*Clonal testing at St Coombs*—2 replicates of 20 clones—(*1967*)

MVP7—*Clonal testing at the Mid-Country Station*—4 replicates of 9 clones—(*1967*)

St Coombs—Twenty clones have been planted out in two unshaded blocks, each with 100 plants of each clone. Leaf will be used by the Technology Division for test manufactures. The clones are TRI 777, TRI 2142, TRI 1526, TRI 1114, TRI 1294, WT 26, TC 9, DT 1, DK 19, S 106, KEN 16/3, N 2, NL 4/2, W 3, W 14, BR 1, HR 11/4, HR 8/2, HR 17/4 and HR 1/3.

Hantane—The clones under test are TRI 62/5, TRI 62/9, TRI 2023, TRI 2024, TRI 2025, DG 39, BR 1, B 275 and TC 9. The clones are replicated in 4 unshaded blocks.

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Experiments **LVP6** to **LVP9** on selection and testing of clones are carried out in the low country and will be referred to in the Report on the Low-Country Station.

Factors related to yields of clones

Clonal testing that has now progressed for several years at St Coombs and other locations, amply demonstrate the difficulties of evaluating yield data obtained from such field trials. In view of these limitations and the vast expense

of time and effort that the conduct of such long term experiments entails, it would be of immense significance if some characteristics which predispose a clone towards high yield could be discovered. The obvious great dependence of yield on local conditions of soil and climate makes such a goal nearly unattainable. Nevertheless, the availability of performance data over considerable periods of time justified preliminary attempts towards a search for such factors. Attention has so far been confined to the 1961 clonal trial (**VP1**).

VP18 and **VP19** which follow, deal with attempts to relate yields of clones to growth patterns of young nursery plants and to the characteristics of flush samples, respectively.

VP18—*Nursery growth characteristics*—Randomized blocks in 4 replicates—(*1967*)

Uniform cuttings of fifteen clones, differing in their yields in **VP1** were planted for growth assessments. A plot consisted of three rows of 13 nursery bags and the clones were randomized in four replicate blocks.

Sample batches of cuttings were assessed at planting time to obtain figures for mother leaf weight and area and internode length and weight. Growth assessments were carried out at 5½, 8½ and 12 months from planting. At each sampling occasion, a randomly selected single row from each plot of the four replicates was used. For most of the estimations, a batch of 13 plants was bulked. The usual assessments of growth, *ie* fresh and dry weights of roots, stems and leaves, leaf areas, heights of plants, appendage numbers and in the earlier two samples, variation in weight of mother leaf and internode of the original cutting were made. None of the above assessments appeared to indicate a variation related to yield performance of the clone. The growth analysis terms of ' net assimilation rate ', ' leaf area ratio ' and ' relative growth rate ' for each clone were also calculated from the available data. The variations again appeared to be random and unrelated to rank based on yield. A continuation of this work with more precise and more frequent samplings on a smaller number of representative clones is planned for the future.

A. Nanayakkara

VP19—*Flush characteristics of clones*—(*1967*)

A start has been made towards studying the cropping patterns of clones in experiment **VP1**. Graphs obtained for seasonal distribution of crop suggest that the higher-yielding clones are those which appear to be capable of responding to favourable climatic and other factors during the ' rush months ' while the lower yielders show only slight increases during such times. Similar preliminary studies are in progress at the Gonakelle (Passara) and Kottawa Substations.

Representative samples of flush obtained from the clonal plots are being studied for incidence of banji and the distribution of weight in the various components of the flush shoot. The work, so far, is of a very exploratory nature and there seem to be no clear indications emerging yet.

D. Janakiram

VP20—*Reaction of clones to drought*—(*1967*)

Observations made on the clonal plantings at the various stations have indicated that wide differences occur in the reactions of clones to drought conditions. The following twelve clones which are reported as differing in their response to drought : Diyagama N, TRI 2020, Canavarella CV 5 B 1, TRI 2025 (Good), Drayton DT 1, Balangoda DG 39, TRI 2023 (Moderate), TRI 2024, Neluwa NL 4.2, Uva Highlands UH 9/3, Poronuwa PO 26 and Passara PA 22 (bad) have been selected for study.

Cuttings are being established in soil in cement pots and once the plants have grown to a reasonable size, watering will be suspended and observations made on speed of wilting, soil moisture levels associated with temporary and permanent wilting, ability to recover on resumption of watering and the moisture contents of plant organs at each of these stages. This study should shed some light on whether drought tolerance or susceptibility of tea is related to any fundamental physiological characteristics inherent in the ability of a plant to absorb or retain moisture and to tolerate periods of internal moisture deficit.

A. Nanayakkara

Plant Breeding

VP10—*Selections from open-pollinated clonal seedlings—(1962)*

The vegetatively propagated plants from selected parent bushes of open pollinated clones have been planted in observation rows. The plants have been bent and cut across and will shortly come into plucking. Yield records will not be kept but promising progeny will be propagated on a larger scale.

VP11—*Selections from hand pollinated seedlings—(1963)*

The plants in this trial are at the same stage as those of **VP10.** Yield records are to be kept.

VP12—*Selections from bi-clonal progeny—(1964)*

In this trial, biclonal progeny of the cross TRI 2023 x 2026 and open-pollinated seedlings of TRI 2024 are being compared with the parent clones for yield. The seven types of progeny are replicated in five randomized blocks. Each plot consists of 20 plants at a spacing of 4 ft x 2 ft.

Yields obtained are summarized in Table 10.

TABLE 10—*Mean yields as lb made tea per acre over 84 plucks (16.4.66—26.12.67)*

Population	*Yield*
TRI 2024	4175
TRI 2023	4098
TRI 2026	4056
Landsdowne seed (Female) 2023 x 2023 (male)	2737
Rambukkande seed (Female) 2023 x 2026 (male)	2488
Lansdowne seed (Female) 2023 x 2026 (male)	2063
TRI 2024 seed (Open pollinated)	1408

Lansdowne and Rambukkande seed were collected off the parent trees where the seed-bearer blocks consist of clone TRI 2023 and TRI 2026 planted in close proximity to one another. Thus the clone from which the seed was actually collected is the female parent while the other is presumed to be the male. Thus seed collected from both parental clones at Lansdowne have been planted while at Rambukkande, seed was obtained from clone TRI 2023 which predominates in number in the seed garden. The open-pollinated TRI 2024 seedlings are probably of mixed male parentage. The parent clones have done much better than the seedling crosses. There is very evident variability between the individual bushes of the seedling populations.

VP13—*Seedling progeny from 8 commercial seed gardens—(1965)*

The bushes are being plucked but yields are not recorded. The plots are being maintained as a source of potential breeding material.

VP14—*Hand-pollinated seedlings—(1965)*

Biclonal progenies of known parental constitution are in plucking and being maintained for studies on breeding.

A. S. B. Gomez & A. Nanayakkara

Central Nursery

The following numbers of cuttings have been planted by the Division in 1967 to meet requirements of other Divisions and the estate for 1968.

Agricultural Chemistry	20,000
Plant Pathology	12,000
St Coombs Estate	10,000
Total	42,000

All bagged soils were fumigated with methyl bromide. The removals of plants from the nursery during 1967 were as follows:

Agricultural Chemistry	14,000
Biochemistry	4,000
Plant Pathology	20,000
Plant Physiology	1,000
Technology	8,000
St Coombs Estate	16,000
Total	63,000

Arising from adjustments of the replanting programme on St Coombs, a large number of plants (about 50,000) have remained unused but they will be taken in filling seedling fields and for planting up odd areas on the estate.

Extension Experiments

Experiments on shade

The following list includes only those experiments serviced from St Coombs. For experiments in the mid country, Uva and low country, attention is drawn to the relevant reports.

XPH1—*Nitrogen at 4 levels with shade vs no shade as the main treatments at Liddesdale Group, Halgranoya—(1965)*

XPH2—*Nitrogen at 4 levels with shade vs no shade as the main treatments at Rothschild Estate, Pussellawa—(1965)*

XPH3—*Nitrogen at 4 levels with shade vs no shade as the main treatments at Mayfield Estate, Kotagala—(1965)*

XPH4—*Nitrogen at 4 levels with shade vs no shade as the main treatment at Hauteville Estate, Agrapatana—(1965)*

XPH5—*Nitrogen at 4 levels with shade* vs *no shade as the main treatments at Blairlomond Estate, Udapussellawa—(1966)*

XPH8—*Nitrogen at 4 levels with shade* vs *no shade as the main treatments at Holyrood Estate, Talawakele—(1966)*

This experiment has been abandoned.

XPH9—*Nitrogen at 4 levels with shade* vs *no shade as the main treatments at Brunswick Group, Maskeliya—(1966)*

XPH10—*Nitrogen at 4 levels with shade* vs *no shade as the main treatments at Morar Estate, Bogawantalawa—(1966)*

XPH12—*Nitrogen at 4 levels with shade* vs *no shade as the main treatments at Oonoogaloya Estate, Kotmale—(1966)*

All experimental areas included in these experiments were first plucked before the differential fertilizer treatments were imposed. The pre-treatment served to give a measure of the inherent variability between the plots which were necessarily somewhat larger than usual a bush number of around 300 per plot being aimed at wherever possible. Exact bush counts were made for the purposes of calculating quantities of fertilizer to be applied and also to facilitate the interpretation of yield data. All figures presented in the tables have been corrected for bush number and pre-treatment variations by appropriate statistical methods. During the pre-treatment plucking stage, the plots intended for the no-shade treatments had their shade trees ring-barked. The different fertilizer treatments were imposed only after the trees were dead. This took varying lengths of time, depending upon the sizes of shade trees and also on the need to accommodate pruning schedules.

The first five experiments listed above have been on their different nitrogen levels for sufficiently long to allow the results to be examined. Potassium and phosphorus were supplied at uniform levels to all plots in the basal mixture recommended. In all experiments except **XPH5**, the lowest level of nitrogen was zero. In **XPH5**, as the tea used for the experiment had previously been on relatively high levels of nitrogen, it was decided not to drop below 100 lb N per acre per annum. The other levels of nitrogen increased by steps of 100 lb per acre in **XPH5** and by steps of 120 lb in the other experiments.

The results to date are summarized in Tables 11 and 12. All figures are calculated as made tea per acre per annum. The 'shade' and 'no-shade' treatment figures are given separately.

TABLE 11—*Effects of nitrogen levels and shade trees on yield—All figures are calculated as made tea per acre per year—Correction has been made for actual bush numbers in each plot*

	Shade trees present				*Shade trees removed*			
Experiment and location	N_0	N_1	N_2	N_3	N_0	N_1	N_2	N_3
XPH1—Liddesdale ...	1311	1438	1542	1544	1490	1701	1850	1975
XPH2—Rothschild ...	1059	1326	1439	1370	1278	1470	1660	1714
XPH3—Mayfield ...	1225	1375	1605	1645	1370	1669	1904	1996
XPH4—Hauteville ...	1630	1816	1766	1861	1728	1856	2157	2141
XPH5—Blairlomond	2443	2723	2658	2711	2921	2854	2807	2971

TABLE 12 — *Effect of nitrogen and shade trees or yields in Experiments* **XPH1** *to* **XPH5**

Treatments Nitrogen levels	Mean Yields (lb green leaf per acre per pluck) XPH1 (Liddesdale)	XPH2 (Rothschild)	XPH3 (Mayfield)	XPH4 (Hauteville)	XPH5 (Blairlomond)
0	121.24	101.18	112.31	145.35	232.22
1	135.82	121.02	131.80	158.95	236.55
2	146.82	139.66	151.90	169.81	241.43
3	152.44	133.51	157.64	173.22	248.59
LSD at $P = 0.05$	10.77	9.7	8.6	11.40	
$P = 0.01$	14.75	13.32	11.8	15.62	Not significant
$P = 0.001$	20.10	18.15	16.1	21.29	
Shade trees present	126.32	112.66	126.64	153.08	229.35
Shade trees removed	151.85	135.03	150.19	170.58	250.05

Statistical analyses were carried out on the unconverted data because of the approximations necessary in the calculation of the above figures for made tea per acre. The figures for green leaf harvested were merely reduced to green leaf per pluck per acre in order to permit direct comparisons as different plot sizes and numbers of plucking rounds occur in the different experiments.

The difference between shade tree treatments is very highly significant ($P<0.001$) in favour of the removal of shade tree in all five experiments. With the exception of the experiment at Blairlomond Estate, Udapussellawa, nitrogen has had a significant effect at all locations. This may be related to the fact that the tea in this experiment was very much higher yielding than at any of the other sites at the start of the experiment—having received heavy dressings of fertilizer. As has been mentioned, it was, therefore, resolved that the lowest levels of nitrogen here (N_0) should be 100 lb N per acre per annum while in the other experiments it was zero. The differences between levels N_2 and N_3 (240 and 360 lb N per acre per annum) in the other experiments have not been significant. The suggestion in some experiments of a slight depression in yield at the highest level has not turned out to be significant.

Of particular interest are the reasonable levels of yield (see Table 11) obtained at the zero level of nitrogen. The experiment at Hauteville Estate has run for nearly one year since the nitrogen treatments were effected (*ie* including cessation of supply), while the other experiments have run for about six months longer. The results are suggestive of a high residual effect of earlier applications. The interval before yields begin to decline will be watched with interest. The percentage increases of crop obtained with increasing nitrogen levels have not been very great. They are summarized in Table 13.

TABLE 13—*Percentage increases in yield obtained with increasing levels of nitrogen, in the presence and absence of shade trees*

Experiment	*Shade trees present*				*Shade trees removed*			
	N_0	N_1	N_2	N_3	N_0	N_1	N_2	N_3
XPH1 ...	100	109.7	117.6	117.8	100	114.2	124.2	132.6
XPH2 ...	100	125.2	135.9	129.4	100	115.0	129.9	134.0
XPH3 ...	100	112.3	131.1	134.3	100	121.9	139.0	145.8
XPH4 ...	100	111.4	108.4	114.2	100	107.4	124.8	123.9
XPH5 ...	100	111.5	108.8	113.4	100	97.7	96.1	101.7

The apparent tendency for the response to nitrogen to be slightly better where the shade trees have been removed has not proved to be significant in any of the experiments. The effect of shade tree removal has been very similar in all the experiments, a very significantly higher yield being obtained from the plots that had their trees removed. It must be emphasized however, that these experiments are yet in relatively early stages of progress and the trend will have to be followed for much longer before a definite answer emerges on long-term effects of growing tea without shade trees. Generally, experience seems to be that a sharp increase does immediately follow tree removal. At least some of this benefit may arise from the leaf litter added by the ring-barked trees. If so, the gap may narrow and shade-tree litter additions will then, of course, be only in the plots with shade trees.

Pre-treatment plucks were recorded in the plots during the period between ring-barking of trees and applying differential fertilizer treatments. These data also very strongly suggested a higher yield from the tea under ring-barked trees and as mentioned, the post-fertilizer treatment yields had to be corrected (by covariance analysis) for this factor. Similarly the interactions (which have hitherto not been significant) between response to fertilizer levels and the presence or absence of shade trees will be of great interest. A curious feature in the results is that despite the very variable size and stand of trees on the experimental areas, and therefore the quantities of leaf shed by the dying trees, pre-treatment yields were consistently superior in the plots with the ring-barked trees. If the effects arise solely from the benefits of shade tree litter additions, they should prove to be transient. Results in the future should clearly be of great interest.

XPH 6—*Shade* vs *no shade at Rothschild Estate, Pussellawa—(1966)*

XPH 7—*Shade* vs *no shade at Bogawana Group, Bogawantalawa—(1966)*

XPH 11—*Shade* vs *no shade at New Peacock Group, Pussellawa—(1966)*

These simple paired-field comparisons are being conducted by the estate themselves and yield figures have not been examined.

Acknowledgements

Thanks are expressed to the Murphy Chemical Company Ltd., Cyanamid International Corporation and Burt Boulton and Haywood Ltd., for the supply of experimental samples of growth retardants and to Dr F. R. Tubbs for assistance in obtaining them.

It is a great pleasure to record my thanks to Managers, Superintendents, Assistants and other staff on estates where our trials are located, for their willing help and interest. Special thanks are due to Mr R. K. Nathaniel and Mr A. S. B. Gomez for the hard work in running the extension experiments on shade. To the Statistician and his Assistant for advise in the design of experiments and the analysis of data, and to the staff of the Plant Physiology Division, for their co-operation and meticulous management of experiments, I express my gratitude.

Visits, Lectures and Symposia

Lecture

PETHIYAGODA, U., NAGARAJAH, S., & KRISHNAPILLAI, S.—"Experimentally induced nutrient deficiencies in Tea" at the 23rd Annual Sessions of the Ceylon Association for the Advancement of Science at Colombo in December.

Publications

PETHIYAGODA, U. (1967a). Physiology as a key to rational tea husbandry. *Tea Q.* **38**, 128-136.

PETHIYAGODA, U. (1967b). Current trends in physiological inquiry. *Tea Q.* **38**, 249-252.

RICHARDS, A. V. (1967a). The development of clonal tea in Ceylon. *Tea Q.* **38**, 139-141.

RICHARDS, A. V. (1967b). Some observations on the performance of the popular TRI and estate clones. *Tea Q.* **38**, 245-248.

SELMAN, I. W. & KULASEGARAM, S. (1967). Development of the stem tuber in kohlrabi. *J. exp. Bot.* **18**, 471-490.

Reference

MULDER, D. & DE SILVA, R. L. (1959). Deficiency diseases and the symptoms of magnesium deficiency. *Tea Q.* **30**, 1-19.

REPORT OF THE PLANT PATHOLOGY AND NEMATOLOGY DIVISION

Acting Plant Pathologist — R. L. de Silva, BSc, PhD, DIC

General

Dr N. Shanmuganathan left Ceylon on the 30th August for post-doctorate research at the Canada Department of Agriculture in Vancouver, British Columbia. He was awarded a Research Fellowship by the National Research Council of Canada. Dr R. L. de Silva acted as Head of the Plant Pathology and Nematology Division from that date. Mr P. V. Arulpragasam left Ceylon on the 23rd September for post-graduate studies on virus diseases, at the Wye College, Kent, England. He was awarded a scholarship under the Colombo Plan. Dr P. Sivapalan was appointed Nematologist on the 21st March. Mr H. B. Herath was transferred to the Entomology Division on the 1st October. Dr R. L. de Silva continued to function as the Joint Editor of the publications of the Tea Research Institute, and continued to be in charge of the administration of the Institute's library during the year. Dr N. Shanmuganathan functioned as the Convener/Secretary of the Experimental and Estates Committee of the TRI until his departure from Ceylon.

Laboratory Investigations

Germination of spores of Monacrosporium ambrosium

Seven compounds were tested for their ability to prevent the germination of spores of the shot-hole borer ambrosia fungus, *M. ambrosium*. The compounds Actidione, Blastin, Gliotoxin, Griseofulvin, Kitazin, Vitavax and an organophosphorus compound were used at concentrations of 10, 20 and 40 ppm. Of these compounds, only Gliotoxin and Actidione prevented the germination of spores of *M. ambrosium*. Gliotoxin, Actidione and Griseofulvin had a marked fungistatic effect on the mycelium, but none of the compounds were able to prevent sporulation at the concentrations tested. The work is being continued.

N. Shanmuganathan & S. R. A. Fernando

Field Experiments & Trials

The following experiments have been concluded :

P1, P2, P3, P4, P5, P6, P7, P8, P9, P15, P16, P17, P22, P33, P34, P35, P36, P37, P38, P39, P40, P41, P42, P43, P44, P47, P48, P50, P51, LP1, LP2, LP4, LP5, LP6, UP3, UP4, XP1, XP3, XP4, XP5, XP6, XP7, XUP1 and XUP2.

Experiment **P49** is reported upon as experiment **N15** under the Nematology Section.

Reference is made to these experiments in the Annual Reports for 1965 and 1966, and they are now deleted.

Red Root Disease (Poria hypolateritia)

P10 — *Survival of* P. hypolateritia *in soil at different depths — (1964)*

The details of this experiment have been described in the Annual Report for 1965. Table I shows the viability of *P. hypolateritia* on roots which have been buried in the soil for two years.

TABLE 1—*Viability of* P. hypolateritia *on tea roots buried in the soil for 2 years as measured by the ability of the fungus to infect healthy tea plants*

No. of plants inoculated with infected roots buried for 2 years in fallow soil	Diameter of root segment (cm)	Number of infected plants
12	1	2
14	2	8
14	3	8
13	4	11

It is concluded that the ability of infected roots of small diameter to cause new infections is less than that for larger roots. Only 7.5% of the roots of 1 cm diameter brought about infection. In the case of roots of 2 and 3 cm in diameter, about 50% infection resulted, while 80% of the largest roots (4 cm diameter) were infective.

When root segments were retrived after three years, only 46 out of 60 were found to be viable. Young tea plants have been inoculated with these segments to assess their ability to cause infection.

P11 — *Resistance of clones to* P. hypolateritia — (*1964*)

Nineteen clones were tested for resistance to the disease. In 1966, eleven clones appeared to be free from infection but in 1967, seven of the latter succumbed leaving only four clones which have not yet been infected. These are DUN 7, MO 208, NL 3/1 and TC 9. These clones will be tested further by planting them in soil where large infected tea stumps have been buried.

P12 — *Resistance of clones to* P. hypolateritia — (*1965*)

The 20 clones in this experiment were inoculated in 1965 with *P. hypolateritia*. Sixteen of them were infected after one year, and the remaining four have succumbed during the second year from inoculation. The clones used in this experiment are listed in the Annual Report for 1965 and all of them are susceptible to the disease. This experiment is concluded.

P13 — *Selection of bushes resistant to* P. hypolateritia *at Mattakele Estate, Talawakele* — (*1964*)

Cuttings were taken from ten bushes standing in infected areas, and these cuttings have been planted in pots. The pots have been inoculated with tea root segments carrying *P. hypolateritia* and the plants are under observation. The results are not yet available.

P31 — *Control of* P. hypolateritia *in tea stumps using methyl bromide* — (*1966*)

Tephrosia vogelii was planted on the plots treated with the fumigant at ½, 1 and 2 lb per 100 sq ft in order to test the efficacy of the fumigation. *T. vogelii* proved to be difficult to establish. It was, therefore, removed and the plots were planted with tea. The experiment is continuing.

P45 — *Resistance of clones to* P. hypolateritia — (*1966*)

Nineteen clones are being tested for resistance to *P. hypolateritia*. The results are not yet available.

P46 — *Studies on inoculum potential — Determination of the effective inoculum for infection of young plants with* P. hypolateritia — (*1966*)

The amount of inoculum is varied by using infected root segments of different sizes. Fourteen different sizes of inocula were tested on potted plants of clone TRI 2024. It was found that the smallest volume of infected root which caused the death of one-year-old plants was 6 ml. This means that a root 1 cm in diameter and 8 cm long can cause infection. This experiment is concluded.

P53 — *Selection of bushes resistant to* P. hypolateritia *at Le Vallon Group, Pupuressa* — (*1966*)

The plants have now been planted in beds where large tea stumps infected with *P. hypolateritia* have been buried. Four clones were found to be susceptible to the disease. The experiment is continuing in order to see whether the remaining clones prove to be resistant.

N. Shanmuganathan & S. R. A. Fernando

1967 Experiments

P55 — *Studies on inoculum potential — Quantity of inoculum and age of host plants on the infection of tea by* P. hypolateritia — Split plot, with age of host plants as the main treatments and quantities of inocula as subtreatments replicated 10 times — (*1967*)

The experiment was laid down on plants of Clone TRI 2024, which were 1, 2, 4 and 8 years old. The root segment used for inoculation were of 3 lengths, 4, 8 and 16 cm, and 3 diameters, 1, 2 and 4 cm. The experiment is continuing.

P56 — *Soil fumigation with methyl bromide on soil nitrogen, soil microflora, and the growth of tea and Guatemala Grass* — Split plot with crops as the main treatments and fumigant dose as the subtreatments in 2 replicates — (*1967*)

Methyl bromide at 4 doses, 0, $\frac{1}{4}$, $\frac{1}{2}$ and 1 lb per 100 sq. ft was used for fumigating the experimental plots. Eight plots were planted in tea, eight others in Guatemala Grass and eight were left fallow. Soil nitrogen and microbial numbers were assessed before fumigation, and at monthly intervals thereafter. Assessments of the growth of tea and Guatemala Grass are being made every three months. The experiment is continuing.

P69 — *Resistance of clones to* P. hypolateritia — (*1967*)

Tea plants of each of twenty clones were planted in pots in November. They will be inoculated with tea roots infected with *P. hypolateritia* in 1968. The clones are TRI 37, 43, 2077 and 2138, B 95, C 103, DG 3, DK 11, KEN 13/3, KEN 15/8, KEN 15/15, MT 18, S 106, S 123, TGK 2, TK 45, UH 9/3, UR 12 and WY.

N. Shanmuganathan & S. R. A. Fernando

Root diseases of tea

P57 — *3 doses of methyl bromide for the control of* Ustulina deusta, Rosellinia arcuata, Fomes lignosus *and* Fomes noxius — 3 treatments in 3 replicates + control — (*1967*)

Methyl bromide at the doses of $\frac{1}{4}$, $\frac{1}{2}$, and 1 lb per 100 sq ft is being tested for its efficacy in controlling *U. deusta, R. arcuata, F. lignosus* and *F. noxius*. The results are not yet available.

N. Shanmuganathan & S. R. A. Fernando

Blister Blight (*Exobasidium vexans*)

P14 — *Epidemiology of Blister Blight* — (*1962*)

Routine determinations of the atmospheric density of spores was continued in the unsprayed area of No. 9 Field at St Coombs. From June, the Hirst Spore Trap which requires vaselined glass slides to be changed every 24 hr was replaced by a Burkard Spore Trap with built-in vacuum pump where adhesive coated transparent plastic tape needs to be changed only once in seven days.

An experiment designed to determine whether the spores caught in the spore trap come mainly from the unsprayed area immediately surrounding it or whether they come from further away was carried out. The spore traps were run at the centre of two, adjoining unsprayed areas. One of these was progressively pruned starting from the centre, and the spore catches were compared.

A highly resistant and a highly susceptible bush were selected in the unsprayed area of No. 9 Field, and continuously srtipped of their blistered leaves. A ring of bushes immediately circling them were pruned. The number of spores deposited on their second fully-opened leaves were counted. The number of spores deposited on the leaves of the susceptible bush was found to be significantly higher than that on the resistant bush. The investigation is continuing.

A high correlation was observed between the atmospheric density of spores and the number of spores deposited on tea leaves.

The germination of spores on the surface of the leaves of selected resistant and susceptible bushes was studied both in the laboratory and in the field. No significant difference was observed for either germ tube formation or appressorial development in resistant and susceptible bushes.

N. Shanmuganathan & T. V. Saravanapavan

P25 — *Fungicides* — (*1966*)

The treatments were applied during both monsoons of 1966 and continued until January 1967. Table 2 shows the treatments applied and their efficacy, as measured by % infection on the third leaf of each shoot. All sprays were applied at 7 to 8 day intervals.

TABLE 2 — *Efficacy of nickel chloride, nickel sulphate and a curprous oxide formulation (50% Cu) in controlling Blister Blight*

	Treatments	Dose (oz per acre)	Average % infection on 3rd leaf of shoot
1.	Nickel Sulphate hexahydrate	3	22.2
2.	Cuprous oxide formulation (50% Cu)	3	23.5
3.	Nickel chloride hexahydrate Cuprous oxide formulation in alternate rounds	3 3	24.4
4.	Nickel chloride hexahydrate Cuprous oxide formulation in alternate rounds	3 1½	24.5
5.	Nickel chloride hexahydrate	3	24.9
6.	Cuprous oxide formulation	1½	2.60
7.	Nickel sulphate hexahydrate	1½	26.9
8.	Nickel chloride hexahydrate	1½	28.0
9.	Nickel chloride hexahydrate Cuprous oxide formulation in alternate rounds	1½	29.5
10.	Control		35.1
	LSD at $P = 0.05$		0.9

Nickel sulphate compared very favourably with the cuprous oxide formulation as well as with nickel chloride in its ability to control Blister Blight.

P26 — *Loss of crop caused by Blister Blight on unshaded seedling tea — (1966)*

A preliminary report has already been published (de Silva 1967c). It was found that the loss in crop caused by Blister Blight was not significant when ½, 1, 2, 4 and 8 oz of a cuprous oxide formulation containing 50% by weight of metallic copper was sprayed. When the tea was left unsprayed, crop losses were appreciable. There was a clear dosage response in terms of blister blight infection, but the same response was not seen for loss of crop. The experiment is continuing.

R. L. de Silva & S. Murugiah

P30 — *Loss of crop caused by Blister Blight on unshaded VP tea (Clone TRI 2024)— (1966)*

Pre-treatment yield records were maintained, and the treatments have commenced. The results will be available in 1968.

R. L. de Silva, T. V. Saravanapavan & S. Murugiah

P54 — *Lanolin for the prevention of leaf scorch caused by nickel chloride — (1966)*

The effect of lanolin for preventing leaf scorch caused by nickel chloride used as a foliar spray to control Blister Blight was studied. Although there were indications of a reduction in the extent of scorch, this was not significant.

N. Shanmuganathan & R. L. de Silva

1967 Experiments

P58 — *Nickel and copper fungicide mixtures for the control of Blister Blight on VP tea* — Randomized blocks — *(1967)*

This is a preliminary experiment to compare the efficacy of mixtures of nickel chloride hexahydrate and cuprous oxide formulations, with each of the components alone, for blister blight control. The results are not yet available.

R. L. de Silva, S. Murugiah & T. V. Saravanapavan

P59 — *Blisters on tea flush — (1967)*

The extent of blister development of tea flush (the bud and the first two leaves) is being investigated in order to determine to what extent made tea can be affected by the presence of blisters. The results are not yet available.

P60 — *2 levels of nitrogen, 4 levels of infection of Blister Blight and 3 levels of shade on yield of 2 clones (TRI 2025 and TRI 2023)* — Split plot with levels of shade as the main treatments, and levels of infection of Blister Blight as the subtreatments spilt on levels of nitrogen, for each clone in 3 replicates — *(1967)*

This large field experiment was planted out on No. 3 Field at St Coombs. Treatments will commence in three years when the plants are mature.

R. L. de Silva

P61 — *Protection of tea against Blister Blight by disease forecasting — (1967)*

A device designed to forecast infection of tea by Blister Blight, based on sunshine records and atmosheric spore density is being used on data obtained on No. 14 field at St Coombs. According to this scheme, when predicted infection is high, nickel chloride is sprayed, when it is moderate, copper formulations are used, and when it is low no spraying is carried out. The experiment was begun in June 1967 and from that time until the end of the year the following sprays were applied :

Nickel chloride	—	5 rounds
Copper formulations	—	7 rounds

The experiment is continuing.

R. L. de Silva & W. R. F. Rodrigo

Collar and Branch Canker in young tea (*Phomopsis theae* Petch)

UP1 — *Bringing into bearing by 'bending' and 'cutting across' at Downside Estate, Welimada — (1963)*

This experiment was carried out on plants of a clone susceptible to *P. theae* (TRI 2024). A final assessment of canker incidence was made in July, after the tea was pruned. The results confirmed earlier observations that canker incidence was greater on plants which were brought into bearing by bending, than on those which were cut across. This was true for all four replicates. The experiment is now concluded.

UP2 — *Bringing into bearing by 'bending' and 'cutting across' at Nayabedde Estate, Bandarawela — (1963)*

This experiment was done on plants of two clones, Nayabedde 3 and 13. A final assessment of canker incidence was made in July after the tea was pruned. Canker incidence was higher on bushes of clone N 3 which were brought into bearing by bending, than on those which were cut across. On clone N 13, canker incidence was not markedly different on plants brought into bearing by either method. It is concluded that bending is not a suitable method for bringing clone N 3 into bearing. This experiment is concluded.

UP5 — *Variation in susceptibility of Clone TRI 2023 to* P. theae *at the Uva Station, Gonakelle — (1965)*

UP6 — *Seasonal variation in susceptibility of clone TRI 2024 to* P. theae *at Aislaby Estate, Bandarawela — (1965)*

Both **UP5** and **UP6** were completed during the year. There was a negative correlation between mean canker length and (a) rainfall during the month of inoculation, (b) soil moisture at the time of inoculation and (c) bark moisture at the time of inoculation. The best of these correlations was between mean canker length and soil moisture.

The largest cankers at Aislaby Estate were obtained from the inoculations done in July when both soil and bark moisture were very low. The results at Gonakelle were somewhat erratic, but the relationship between maximum canker development and low soil moisture was still discernible. These results are in agreement with those from experiments **UP3** and **UP4** (see Annual Report for 1966).

UP7 — *Resistance of clones to* P. theae *at Nayabedde Estate, Bandarawela — (1964)*

Two assessments of canker incidence were made during the year on the 20 clones being tested (see Annual Report for 1965). The experiment is continuing.

UP8 — *Resistence of clones to* P. theae *at Glen Devon Estate, Halgranoya — (1965)*

The 20 clones in this experiment (see Annual Report for 1965) were examined for cankers in October. Nine plants of a total of 50 of clone KEN 16/3 had collar cankers; of these four were dead. Apart from one collar canker on clone DT 95 and one branch canker on clone K 145, all the other clones were free from cankers. The experiment is continuing.

UP9 — *Control of Collar and Branch Canker Disease at St Leonards Estate, Halgranoya — (1966)*

The treatments, spraying fortnightly with copper fungicides; thatching with Mana Grass and a combination of both thatching and fungicide spraying, did not result in any significant differences in canker incidence between treated and untreated plots. The experiment is concluded, but is being repeated.

N. Shanmuganathan & W. R. F. Rodrigo

P18 — *Clonal resistance, pathogenicity of isolates of* P. theae *and effect of age of bushes on disease development — (1964)*

In this experiment, the details of which were given in the Annual Reports for 1965 and 1966, 50 plants of each of 20 clones were inoculated in the field at St Coombs, with five isolates of *P. theae*. The size of the resulting cankers was measured. There was a highly significant variation in the size of cankers. The most resistant clone was TRI 2023 and the least H6 A1. There was a highly significant variation in the virulence of the different isolates, and also, a highly significant interaction between isolate pathogenicity and clones. A complete report will be published shortly.

N. Shanmuganathan & W. R. F. Rodrigo

1967 Experiments

P62 — *3 fungicides for the control of* P. theae *on clone TRI 2024 at St Leonards Estate, Halgranoya* — 4 replicates of 3 treatments + control in randomized blocks — *(1967)*

P63 — *3 fungicides for the control of* P. theae *on clone TRI 2024 at Liddesdale Group, Halgranoya* — 4 replicates of 3 treatments + control in randomized blocks — *(1967)*

P64 — *3 fungicides for the control of* P. theae *on clone KP 9 at Concordia Group, Kandapola* — 4 replicates of 3 treatments + control in randomized blocks — *(1967)*

P65 — *3 fungicides for the control of* P. theae *on clones TRI 2025 and N 3 at Craig Estate, Bandarawela* — 5 replicates of 3 treatments + control in randomized blocks — *(1967)*

In experiments **P62, P63, P64** and **P65** the fungicides being tested are Santar A (yellow mercuric oxide), Fomac A (Pantachloronitrobenzene) and Bordeaux Mixture. Fomac A caused the distintegration of bark and was discontinued after first applications. The experiment is continuing.

P66 — *Soil covers on soil moisture and the incidence of Collar and Branch Disease at St Leonards Estate, Halgranoya* — 7 replicates of 2 treatments + control in randomized blocks — (*1967*)

In this experiment, black polythene and Mana Grass are being used as soil covering treatments in order to conserve soil moisture which is known to have a marked effect on disease development. Soil moisture determinations are being made at weekly intervals. Observations on disease incidence are also being made. The experiment is continuing.

N. Shanmuganathan & W. R. F. Rodrigo

Root diseases and shade trees

P19 — *Killing* Grevillea *trees with arboricides* — (*1965*)

Full details of, and results from this experiment are given in the Annual Reports for 1965 and 1966. The relatively low percentage of 11.1 of the ring-barked trees which were inoculated at complete leaf-fall with *Ustulina deusta* became infected. The mean percentage of carbohydrates present in the roots at complete leaf fall was 3.05.

It seems, therefore, that ring-barked shade trees should not be felled before complete defoliation, and it is advantageous to leave them for some time even after complete defoliation, before they are felled. If this is not done, the stumps would be potential sites of infection by root-attacking fungi like *U. deusta*.

N. Shanmuganathan, T. V. Saravanapavan & P. V. Arulpragasam

P20 — *Incidence of root diseases in tea following removal of shade trees by various methods* — (*1965*)

G. robusta trees on various fields of St Coombs Estate were felled, (a) after ring-barking and complete defoliation, (b) without ring-barking. Two of the stumps of unring-barked trees have been found to harbour *U. deusta* which has infected the surrounding tea. Records continue to be maintained.

R. L. de Silva & L. A. Seevaratnam

P32 — *Killing* Grevillea *trees by Phortox treatment and by ring-barking* — (*1966*)

Details of this experiment have been quoted in the Annual Report for 1966. The treatments were applied during the year, but the results are not yet available.

N. Shanmuganathan, P. V. Arulpragasam & T. V. Saravanapavan

Oilspot Disease

P21 — *The rate of spread of Oilspot Disease at Pedro Group, Nuwara Eliya* — (*1964*)

In the area where disease incidence is high, 1000 bushes have been marked out in order to determine the rate of spread of the disease. No new cases of the disease were recorded during the year, and disease incidence in the plot remained at 6% of the total number of bushes.

R. L. de Silva & P. V. Arulpragasam

Phloem Necrosis Virus Disease

P23 — *Search for indicator clones at Eskdale Estate, Kandapola — (1960)*

Ten low-jat clones which were planted at Eskdale Estate in 1960 are under observation for the appearance of symptoms of Phloem Necrosis Virus Disease. None of the clones showed symptoms in their seventh year from planting.

P24 — *Seed transmission — (1960)*

One seedling out of 25, from diseased bushes planted in 1958 shows symptoms of the disease.

P27 — *Tolerance of clones to Phloem Necrosis Virus Disease at Pedro Group, Nuwara Eliya — (1966)*

One hundred and forty six clones were planted in the field in November 1966 and are under observation for the appearance of symptoms of the disease. Details of the clones are given in the Annual Report for 1966. The plants are just over one year old.

R. L. de Silva

Stem Cankers on low-grown clonal tea

LP3 — *Rate of spread at Millakande Estate, Bulathsinhala — (1964)*

No further assessments of the spread of the cankers were carried out during the year. In 1966 26% of the bushes in the demarkated area showed infection. A further assessment will be carried out after the tea is pruned.

R. L. de Silva

Mechanical Harvesting of tea

P28 — *Hand, machine and shear plucking on tea yield and quality — (1966)*

This experiment was conducted on high-jat seedling tea in the 3rd and 4th years of the pruning cycle at St Coombs. The following conclusions have been drawn :

(a) A mower-type Ochiai Tea Cutter gave an unsatisfactory harvest of leaf on high jat seedling tea. Coarse leaf, stalk and cut leaves were present in abundance.

(b) When shears were used a considerably better standard of leaf was harvested, although stalk, coarse leaf, cut leaves and immature shoots were still present.

(c) Whether machines or shears were used, the time involved for picking unwanted leaf is not considered as economically possible.

(d) Made teas from machine and shear-harvested leaf were valued considerably less than hand-picked leaf.

(e) Yields from machine-harvested plots were higher than those from hand-picked plots but this was because coarse leaf and stalk were being harvested.

(f) Yields from shear harvested plots were less than those from hand-picked plots (after accounting for coarse leaf) because immature shoots were being picked before they could contribute their fair share to the yield of these plots.

This experiment is concluded. A full report will be published when the results of further experiments are available.

P29 — *Hand, machine and shear plucking on tea yield and quality—Clone TRI 2024 — (1966)*

This experiment was conducted on VP tea (clone TRI 2024). There were four treatments, *viz* — hand picking, shear harvesting, mechanical harvesting with the Ochiai Machine and mechanical harvesting with the Robin Machine. The Robin Machine has two serrated blades moving laterally over each other. This type of cutter was found to be quite unsuitable because of the preponderance of coarse leaf in the harvest. Further, it was a dangerous machine to use because of the sharp and serrated nature of the blades. The tests with the Robin machine were, therefore, abandoned.

The results obtained were substantially the same as described for experiment **P28.** With VP tea it was found that a slightly better standard of leaf was obtained than with seedling tea, possibly because of the more even growth of the VP tea. A full report will be published shortly.

P67 — *Hand, machine and shear plucking on yields and manufacturing properties of low-jat seedling tea at Pedro Estate, Nuwara Eliya* — Randomized blocks in 4 replicates — *(1967)*

This experiment is similar in lay out to **P29** and has been concluded. The results have yet to be analysed. A full report will be made in 1968.

R. L. de Silva, S. Murugiah & The Technology Division

Asphyxiation of Roots

P52 — *Depth of planting holes on growth — (1966)*

Planting holes of different sizes were dug by hand, and by the Dolmar Deeprooter Machine. Plants of clone CY 9 were used in one experiment and those of clone TRI 2025 in another . It was found that the deeper the holes, the better was the growth of the plants. This effect was more pronounced in clayey, ill-drained, poorly-aerated soil, than in good loamy soil.

R. L. de Silva & L. A. Seevaratnam

Miscellaneous

P68 — *Methyl bromide for the control of Cootch Grass — (1967)*

Methyl bromide at the dose of 2 lb per 100 sq ft of ground was used to fumigate an area of about $\frac{3}{4}$ acre which had a heavy growth of Cootch Grass. The fumigation was carried out on 30.1.67 and the area was planted up in 200 tea clones in February. At the end of 1967, no cootch had yet appeared in the fumigated area whereas it did appear in areas which were clean weeded. This experiment shows that cootch grass can be supressed by methyl bromide at 2 lb per 100 sq ft. It is possible, however, that lower doses may be effective although this has not been tested. It is also possible that on other types of soil, 2 lb per 100 sq ft may not be sufficient. This again has not been confirmed.

R. L. de Silva & L. A. Seevaratnam

Visits, Lectures & Symposia *etc*

Lectures

1. DE SILVA, R. L. — "A new look at the economics of blister blight control" at the Tea Centennial Conference of the TRI at Radella in May.
2. DE SILVA, R. L. — "Uprooting tea for replanting" to the Dimbula Planters' Association at Talawakele in September.
3. DE SILVA, R. L. — "Assessments of crop losses caused by the Blister Blight fungus of tea, *Exobasidium vexans* Massee" at the 23rd Annual Sessions of the Ceylon Association for the Advancement of Science at Colombo in December.
4. SHANMUGANATHAN, N. — "Diseases of the tea bush with special reference to current research" to the Ceylon University Botanical Society at Colombo in January.
5. SHANMUGANATHAN, N. — "The economics of *Poria* eradication" at the Tea Centennial Conference of the TRI at Radella in May.
6. SHANMUGANATHAN, N. & RODRIGO, W. R. F. — "Clonal resistance and variation in pathogenicity between isolates of *Phomopsis theae* to canker development in young tea" at the 23rd Annual Sessions of the Ceylon Association for the Advancement of Science at Colombo in December.

Field Demonstrations

Four field demonstrations were held by Dr N. Shanmuganathan and Dr R. L. de Silva at St Coombs, and three at St Joachim in May, on various aspects of research in Plant Pathology, in connexion with the Tea Centennial Conference and Field Programme of the TRI.

Tea Centennial Exhibition

Dr R. L. de Silva was responsible for the organization and administration of the Tea Research Institute's exhibits at the exhibition organized by the Ceylon Tea Propaganda Board in Colombo, in connexion with the centennial celebrations of the Ceylon Tea Industry in August. The assistance of all officers who helped in this connexion, particularly Messrs R. K. Nathaniel, D. J. Hettiarachchi, P. V. Arulpragasam and W. R. Solomon is gratefully acknowledged.

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Report of the Plant Pathology & Nematology Division

Nematologist — P. Sivapalan, BSc, PhD

General

Experiments **N3, N7** and **N8** were designed by Dr A. Kerr, organized by Mr M. K. Vythilingam and carried out by Messrs P. A. John, S. Samarajeewa, A. R. M. Hassim, T. Manivasagar and H. B. Herath. All other experiments were designed and organized by Dr P. Sivapalan and carried out by the above-named assistants.

Laboratory Investigations

Methodology

When testing the efficacy of the technique that is currently being used to extract eelworms from root samples, it was found that the number recovered per unit weight of root was inversely proportional to the weight of root sample processed. This finding has now warranted the standardization of the weight of root samples processed for eelworm recovery, a fact hither-to over looked.

Root tissue cultures

Excised tea roots have been successfully made to callus in a defined medium, under aseptic conditions. Large numbers of such tissue cultures have now been developed in this laboratory. Inoculations of nematodes are to be made on such callused tissues, to maintain aseptic eelworm colonies. Later on, it is hoped to maintain such eelworm colonies on callused tissue, developed from susceptible and resistant clones. By altering the growth medium of these tissue cultures, detailed nutritional studies are to be carried out, in respect of both susceptible and resistant tissues.

Field Experiments and Trials

The following experiments have been completed and the results published in the Annual Report for the year 1966, Part 2, pp 76-77; **N2, N4, N5, N6, N9** and **N10.**

N1 — *Resistance and tolerance of clones to* Pratylenchus loosi — *(1962)*

Thirty two biclonal crosses of known parentage were screened for tolerance to *P. loosi*, along with the clone known to be most tolerant, DT 95, and the clone known to be most susceptible, TRI 2024. At the end of the test period (one year), a marked difference in growth rates was observed among the tested crosses. Only those that performed better than TRI 2024, were selected for assessments. The results of the assessments are presented in Table 1.

TABLE 1—*Fifth test of clones* for resistance (1966-1967)*

Clone	Mean shoot wt (g)	Mean root wt (g)	Mean nematode count per g root ($\sqrt{n}$ transformed)
Cross 1	115.38	77.78	12.04
Cross 26	94.27	48.25	11.60
Cross 5	81.02	39.70	12.13
Cross 11	69.07	31.69	14.57
Cross 37	68.45	22.75	13.55
DT 95	50.27	23.82	13.01
TRI 2024	18.60	10.05	19.51
LSD ($P = 0.05$)	26.45	13.04	2.74

*Cuttings were obtained from biclonal crosses, selected by the Plant Breeding Section.

The results indicate that five biclonal crosses were found to be equally tolerant, if not slightly better than the tested superior tolerant clone, DT 95. Of these five, three have been found to be significantly superior to DT 95, in respect of both shoot and root growth. Of the selected crosses, four are the progeny of TRI 2024 x DT 1, and the other that of TRI 1114 x DT 95.

If the manufacturing characteristics and yield potentials are suitable, there is little doubt that these will in future be recommended as good eelworm tolerant clones.

N3 — *Field performance of clones tolerant to* Pratylenchus loosi — *(1964)*

The results of analysis are presented in Table 2. In general, the clones TRI 2025 and Mooloya 241, yielded well at all locations with over 1800 lb made tea per acre, in the 2nd year of the first cycle. Clones Mooloya 116 and Mooloya 208, yielded the least, less than 1300 lb made tea per acre.

TABLE 2—*Field performance of clones tolerant to* P. loosi

	Mean yield (lb green leaf)			
	Estates			
Clone	St Coombs	Derryclare	Chapelton	Mooloya
TRI 2025	121.8	156.7	73.0	106.8
M 241	111.1	129.6	90.2	74.4
DT 1	95.8	110.0	58.7	73.8
M 116	65.6	101.8	53.0	76.5
M 208	77.8	87.6	65.2	74.7
TRI 2142	86.3	84.4	74.2	104.4
LSD ($P = 0.05$)	21.1	22.2	20.2	2.9

The data on soil populations of *P. loosi* from the respective plots are presented in Table 3. These populations had increased at all four locations over and above the figures obtained for the previous year, indicating a continued build up.

TABLE 3—*Build up of soil populations of* P. loosi *among tested tolerant clones*

Clone	Mean population counts (per 100 g soil)			
	Estates			
	St Coombs	Derryclare	Chapelton (log n+1)	Mooloya (log n+1)
TRI 2025	39.5	92.7	2.287	1.432
M 241	38.2	54.2	3.812	1.046
DT 1	66.5	45.7	1.079	0.591
M 116	33.5	44.0	1.041	1.032
M 208	21.0	29.0	1.041	0.502
TRI 2142	36.0	43.7	0.301	0.921

Differences between clones are not significant at $P = 0.05$

Yield assessments and assessments of eelworm populations are still being obtained.

N7 — *Number of* Pratylenchus loosi *in infested soil during the rehablitation period and after replanting — (1964)*

Some results from this experiment have been published (Kerr & Vythilingam 1966). All eight blocks were replanted with the susceptible clone, TRI 2024. Four of these blocks were initially under potatoes for three months, followed by Guatemala Grass, whilst the other four had been under Guatemala Grass throughout. At the end of one year, ten plants were removed at random from each block, for the assessment of eelworm infestation. The results are presented in Table 4.

TABLE 4—*The effect of one crop of potatoes, prior to rehabilitation, on the subsequent build up of* P. loosi *in young tea*

Treatment before planting tea	Mean number of nematodes per g root (Log n+1 transformed)
Guatemala Grass alone ...	2.074
Potatoes followed by Guatemala Grass	1.686
LSD ($P = 0.05$)	0.372

From these results, it is evident that the build up of the population of *P. loosi* in the roots has been significantly less in the plants grown in areas that had been under potatoes previously. Potatoes being very susceptible to *P. loosi*, would have attracted a significant population from within the old tea roots left in the soil, into their own feeder roots. When the potatoes were harvested, the worms, 'trapped' within the roots would have also been removed from that area. The potato plants may, therefore, have probably served as a 'trap crop'. The potato tubers were not found to have been infested with *P. loosi*. A more detailed experiment is now being planned to test this 'mechanism'.

N8 — *The effect of two methods of uprooting on (a) survival of* Pratylenchus loosi *during the rehabilitation period and on (b) increase of* P. loosi *following replanting — (1965)*

The Guatemala Grass was uprooted at all five locations and the blocks were all planted with tea (TRI 2025). Assessments of the eelworm build-up are being made by removing, every three months, a requisite number of plants from each block.

The results obtained so far indicate that although, the soil population was nil in both the manually-uprooted and the winched blocks, at all locations the rate of build-up of eelworm within the roots of young tea had been very rapid in the manually-uprooted blocks and only gradual in the winched blocks. The presence of a larger number of old tea roots in the manually-uprooted blocks, probably accounts for the rapid build-up of eelworms. The assessments are still being made at regular intervals.

N12 — *Dosage rates of methyl bromide for fumigating nursery soil — (1966)*

The plants of clone TRI 2024 put out in soil treated with 2, 1 and ½ lb methyl bromide per 100 sq. ft respectively, were all found to be free of eelworm infestation. However, there was one important drawback in the designing of this experiment. Although the area of 200 sq. ft received only 1 lb methyl bromide, (*ie* the rate of ½ lb per 100 sq. ft) and the 100 sq. ft areas each received 1 and 2 lb respectively, in all these cases, only 100 bags of soil were placed under the sheet, in the middle of each block, and the end of the applicator was placed in the center of each group of bags. These 100 bags could easily have been well fumigated, even with the ½ lb dose. For true comparison, the entire area should have been filled up with bags containing infested soil, and when assessing, only those bags placed at the ends should have been selected, *ie* those placed away from the point of application. This experiment is to be redesigned and repeated again in 1968, with the aid of modified applicators.

N13 — *Fertilizer levels and their effects on the build-up of populations of* Pratylenchus loosi *in tea (Clone TRI 2025) — (1966)*

The results are not yet available.

N14 — *Levels of N, P and K on the pathogenecity of* Pratylenchus loosi *— (1966)*

Highly significant differences in growth rates were observed between infested and uninfested plants. However, no significant differences were observed between the different treatments, in respect of either growth rates of plants, or the build-up of the nematode population. This experiment was done in one compact block, with paired plants of each treatment distributed randomly within this block. It is possible, that this close proximity of the different treatments may have resulted in a merging of the different fertilizer treatments, and as a consequence, no proper response could have been seen among the different treatments.

This experiment is now being repeated in pots, where the different treatments are applied discretely (see **N17**).

N15 — *Fumigation with different chemicals on the survival and build-up of the population of* Pratylenchus loosi *on plants of Clone TRI 2024 — (1966)*

After the area had been replanted with Clone TRI 2024, a requisite number of plants were removed from each block every three months, to assess root growth and eelworm multiplication. The results of root assessments and the build-up of the nematodes in the roots are presented in Table 5.

TABLE 5—*Performance of clone TRI 2024 in chemically-treated eelworm infested plots*

Fumigant	Dose (gallons per acre)	No. of Applications	Mean root wt (g)	Mean No. of nematodes per g root
WN-12	5	2	91.7	90.0
WN-12	10	1	50.5	179.2
WN-12	20	1	98.9	80.2
WN-12	10	2	64.0	136.6
DD	20	1	44.0	230.0
DD	10	2	64.5	158.2
DD	15	2	65.4	122.4
DD	40	1	75.6	130.4
Control (Unfumigated)			25.2	287.4
LSD ($P = 0.05$)			*43.9*	*117.1*

It is clearly evident from Table 5, that the fumigant, WN-12 (a mixture of DD and methyl iso-thiocyanate) is superior to DD alone in controlling *P. loosi* on a field scale, and also in promoting better root growth of tea. This fumigant has been found to be very effective, even at the low rate of 10 gallons per acre.

The results of root growth assessment and the build-up of the nematode population following soil fumigation with methyl bromide (Shanmuganathan 1966), is presented in Table 6.

TABLE 6—*Performance of clone TRI 2024 in chemically-treated eelworm-infested plots*

Fumigant	Dose	Mean root wt (g)	Mean No. of Nematodes per g root (log n+1 transformed)
Methyl bromide	½ lb per 100 sq ft	125.1	0.66
Methyl bromide	1 lb per 100 sq ft	152.1	0.04
Methyl bromide	2 lb per 100 sq ft	232.6	0.75
DD	40 gallons per acre	141.9	2.42
Control		29.8	2.73
LSD ($P = 0.05$)		*64.6*	*0.54*

As seen from this table, the results indicate that methyl bromide brings about excellent control of eelworms, even at the lowest rate of application of ½ lb per 100 sq ft. Following treatment, the eelworm build-up in roots had been negligible, even after growing the most eelworm-susceptible clone, TRI 2024, for 15 months in an area where the old tea had been manually uprooted, leaving behind large numbers of infested roots.

It appears that methyl bromide has the capacity to control eelworms remaining within old storage roots, even at the lowest rate application.

N16 — *Effect of soil fumigation among standing tea, on the survival of populations of* Pratylenchus loosi *and tea yields at Derryclare Estate, Kotagala — (1966)*

Post-treatment yields were obtained over 24 plucking rounds. As there was no significant difference in the pre-treatment yields, analysis of variance was done only on the post-treatment yields. No significant difference in yields was observed between treated plots and control plots, although there was a significant difference among treated plots. The results are presented in Table 7.

TABLE 7 —*Effect of fumigation in mature tea on yields*

Fumigant	Dose (gallons per acre)	No. of Applications	Mean yield in oz green leaf
DD	80		486
DD	40		580
DD	40	2	566
DD	20	2	620
Nemagon 75% EC	10		633
Nemagon 75% EC	5		722
WN-12	20		478
WN-12	10		553
LSD ($P = 0.05$)			*152*
Treated plots			580
Control			659
LSD ($P = 0.05$)			114

Other than treatments 1 and 7, (DD at 80 gallons per acre and WN-12 at 20 gallons per acre, respectively) all other treatments appeared to have had very little effect on the tea, and no significant increase in yields was observed. Following treatments 1 and 7, there was a significant decrease in yield and it is very probable, that these fumigants, at the respective rates of application, were toxic to tea.

Within six months from treatment, the soil population had built up to almost the pre-treatment levels. It is clearly evident from this trial, that soil fumigation among standing tea, has no beneficial effects on yields. Such treatments bring about only a temporary reduction in the soil population of eelworms, and have no effect on the population within the roots. Systemic nematocidal treatment appears to be the only means of controlling eelworms within tea roots, and as a consequence, will lead to better yields.

LN2 — *Levels of N, P and K on the pathogenecity of* Pratylenchus loosi *to tea at the Low-Country Station — (1966)*

MN1 — *Levels of N, P and K on the pathogenecity of* Pratylenchus loosi *to tea at the Mid-Country Station — (1966)*

UN1 — *Levels of N, P and K on the pathogenecity of* Pratylenchus loosi *to tea at the Uva Station — (1966)*

At all three locations, more than 50% of the infested plants died within six months. The uninfested plants, however, survived, except for one or two casualties. As a consequence, no proper assessment on growth of plants or eelworm multiplication was possible with respect to the different treatments.

These experiments have, however, brought to light one important fact. It seems very probable, that at a higher soil temperature, *P. loosi* is more virulent to tea than at temperatures normally prevalent in the up-country districts. In order to ascertain the rate of build-up of the nematodes and the consequent pathogenecity to tea, a more detailed experiment is being designed to be carried out in a growth chamber, under controlled conditions of temperature and humidity.

1967 Experiments

N17 — *Fertilizer levels on the build-up of populations of* Pratylenchus loosi *in tea in pots* — 3 combinations of P and K, namely 0:0, 1:1, 2:2, combined with 5 levels of N, giving 15 treatment combinations, each being applied to infested and uninfested soils. These treatments were replicated 4 times — *(1967)*

The 15 treatments include, five levels of N, three levels of P and three levels of K. One half the number of plants in each treatment was inoculated with 2000 worms per pot, while the other half remained uninoculated. Shoot and root growth, and the rate of eelworm multiplication are to be assessed at the end of one year and a half years.

N18 — *4 levels of application of Nemagon granules (20% w/w) into infested nursery soil on the population of* P. loosi *in roots of clone TRI 2024 — (1967)*

Four different levels of application of Nemagon granules, corresponding to rates of, application of 156, 312, 468 and 624 lb granules per acre, were mixed with the basket soil and the cuttings of TRI 2024, were planted soon afterwards. The effect of these granules in controlling nematodes, is to be compared with soil fumigated with methyl bromide (at the dose of 1 lb per 100 sq. ft). Assessments will have to be made at the end of six months.

N19 — *Selective removal of old tea roots of varying sizes prior to rehabilitation, on the subsequent growth of tea plants and eelworm build-up in the roots in young tea at Ferham Estate, Talawakele — (1967)*

Old tea roots of varying sizes were removed, by trenching to a depth of 2 feet and the plots were subsequently planted with Guatemala Grass. At the end of one year, the area will be replanted with TRI 2025. Assessments of the growth of tea and the eelworm build-up in roots will be made at regular intervals.

N20 — *Selective removal of old tea roots of varying sizes, followed with soil fumigation without rehabilitation on the subsequent growth of tea plants and eelworm build-up in tea roots at Kirimetiya Estate, Galaha — (1967)*

This experiment is similar to **N19,** except that the plots were fumigated following root removal. Young tea (clone TRI 2025) was planted soon after uprooting without any rehabilitation. Assessments are to be made at regular intervals for shoot and root growth and the eelworm build-up within the roots.

N21 — *Sampling depth and sampling time, on the level of the eelworm population* — Split-plot with time of sampling split on depths, in four replicates — *(1967)*

A half-acre area in a heavily infested tea field at St Coombs was blocked out and ten random samples were taken at depths of 6, 12 and 18 in respectively, at weekly intervals, over a period of one year. Four replicates of 100 g each were processed, out of each bulked composite sample taken from the different depths. The results of the experiment are presented in Tables 8 and 9.

TABLE 8—*Assessments of the eelworm population in samples taken at different depths*

Sampling depth (inches below ground)	Mean number of nematodes per 100 g soil
0 — 6	70.2
6 — 12	38.7
12 — 18	26.4
LSD ($P = 0.05$)	*12.1*
($P = 0.01$)	*16.0*
($P = 0.001$)	*20.7*

Highly significant differences in population levels were observed between samples taken at different depths. The highest population level was observed in the first six in. of soil. Highly significant fluctuations in population levels were also observed with varying sampling time, although the ratio of the vertical distribution was approximately the same throughout.

TABLE 9—*Assessments of the eelworm population with varying times of sampling.*

Time	Mean number of nematodes per 100 g soil
January	43.8
February	21.8
March	25.9
April	23.7
May	22.4
June	54.9
July	35.6
August	88.2
September	68.6
October	65.8
November	51.0
December	41.0
LSD ($P = 0.05$)	*28.5*
($P = 0.01$)	*37.5*
($P = 0.001$)	*47.9*

The fluctuations in the eelworm population were found to have no correlation with soil temperature (taken at 14.00 hr) or to rainfall. The moisture content of the soil and temperature fluctuations (between day and night) are to be studied, to investigate possible correlation between these factors and fluctuations in population levels of nematodes.

N22 — *Levels of N, K and Ca on nematode reproduction and pathogenecity — TRI 2024 in potted sand cultures* — 4 replicates of ten treatments each in randomized blocks — (*1967*)

Ten-month-old tea plants (clone TRI 2024) were established in sand cultures by first maintaining them on ¼ Hewitt's Solution for two weeks and then on ½ Hewitt's solution for nine weeks. The different treatments, comprising of four levels of N, four levels of K and four levels of Ca, were then applied. After six weeks, about 5000 eelworms will be introduced into each pot. The experiment will be continued for six months, at the end of which assessments of the growth of the plants and the build-up of the eelworm population will be determined.

N23 — *Plant growth substances on nematode multiplication* — 5 replicates each in randomized blocks — (*1967*)

Two hundred ppm of indole acetic acid, Gibberelin, and 2-4-D respectively were applied on to the leaves of ten-month-old potted tea plants of clone TRI 2024 by painting on the solution. The pots had been inoculated with 1000 eelworms each, just before treatment. The treatments were repeated three times, at two-week intervals. Eelworm assessments within the roots were made six weeks after the last treatment. The results are presented in Table 10.

TABLE 10—*Effect of the foliar application of plant growth substances on nematode reproduction within tea roots*

Treatment	Mean nematode numbers per g root (Log n+1 transformed)
Indole acetic acid	1.0918
2-4-D	0.6715
Gibberelin	1.6113
Control	0.7424

No significant difference ($P < 0.05$) in root population was observed between the different treatments, although the highest build-up in root population, was observed in the plants treated with Gibberelin. This experiment will be repeated with more replicates and with a higher eelworm inoculum.

The Burrowing Nematode (Radopholus similis)

It became increasingly evident during the year that there may be a direct relationship between populations of a recently-found eelworm referred to as the Burrowing Nematode (*Radopholus similis*) and failures of young tea in clearings, in the mid-country districts. Light to moderate levels of infestation have been found in such clearings. Field observations made so far, indicate that TRI 2025 could be particularly susceptible to this nematode.

N24 — *Inoculum levels of* Radopholus similis *and pathogenecity in tea (TRI 2024)* 8 replicates of 4 treatments each in randomized blocks — *(1967)*

Ten month old plants of clone TRI 2024 were established in fumigated soil and suspensions of *R. similis*, were subsequently used at three different inoculum levels, to inoculate three sets of plants respectively. Pathogenecity will be assessed by comparing growth rates of the inoculated plants with that of the uninoculated controls. The treatments will be assessed one year from inoculation.

Visits, Lectures and Symposia

Lectures

SIVAPALAN, P. "Nematode problems in tea" — At the Tea Centennial Conference of the TRI at Radella, in May

SIVAPALAN, P. "The uprooting of old tea from eelworm infested areas" — to the Nuwara Eliya Planters' Association at Maturata in November.

Publications

SIVAPALAN, P. (1967a). "Recovery of *Pratylenchus loosi* from soil samples". *Tea Q.* **38**, 29-35

SIVAPALAN, P. (1967b). "Nematodes and tea". *Tea Q.* **38**, 178-185.

SIVAPALAN, P. (1967c). "Nematode problems in young tea". *Tea Q.* **38**, 260-268.

References

KERR, A. & VYTHILINGAM, M. K. (1966). "Replanting eelworm-infested areas". *Tea Q.* **37**, 67-72.

SHANMUGANATHAN, N. (1967). Report of the Plant Pathology & Nematology Division. *Rep. Tea Res. Inst. Ceylon* **2**, 72.

REPORT OF THE ENTOMOLOGY DIVISION

Entomologist — W. Danthanarayana, BSc, PhD, DIC

General

Mr E. F. W. Fernando left the service of the Institute in October. Mr Fernando served in this division for ten years and during this period he contributed to the research findings on the Shot-hole Borer, nettle grubs, white grubs and mites. From 1965 to 1967 he worked on the red spider mite problem and a thesis entitled "Studies on the Etiology and Biochemistry of *Oligonychus coffeae* Nietner (Acarina : Tetranychidae), the Red Spider Mite of Tea in Ceylon" was presented for the Master's Degree in Science of the University of Ceylon. Mr H. B. Herath assumed duties on 1st October, after being transferred from the Plant Pathology and Nematology Division. In December, Mr J. E. Cranham's book, "Insect and mite pests of tea in Ceylon and their control" was published by the Institute.

Field Experiments & Trials

The following experiments have been concluded and the results published (see Annual Report for the Year 1966, Part 2, pp. 80-92) :

E1 — E20, E22 — E24, E26, E27, E36 — E40.

Shot-hole Borer

The results of the experiments described in this section show that out of 26 insecticides, 2 fungicides and 2 insect pathogens, only heptachlor, an organochlorine insecticide, gave satisfactory control of Shot-hole Borer. Heptachlor was found to be as good as dieldrin (**E28, E33, E34**) and superior to aldrin (**E33**) in controlling the beetle. The duration of satisfactory shot-hole borer control obtainable with heptachlor was 15 months (**E35**). From a side-effect point of view, it was found that heptachlor had the least tortrix side-effect when compared with aldrin and dieldrin (**E19**) ; although mild attacks of Tea Tortrix were noticed, the necessity to spray DDT for tortrix control did not arise with heptachlor as it did in the case of dieldrin (**XE1** to **XE7**). Insecticides belonging to the organophosphorus and carbamate groups were found to be ineffective against the Shot-hole Borer. Fenitrothion and fenthion gave borer control for about two months with a single application (**E32, E41, E43, E45**) but this would not be economically worthwhile. Based on the results of these experiments, provisional recommendations for controlling Shot-hole Borer with heptachlor were made. This information was given in a circular dated 2.12.67 and was sent out to all estates. It is expected that the new recommendations will give satisfactory borer control with minimal side effects.

E28—*Heptachlor at 2 levels and dieldrin for shot-hole borer control at Goorookoya Estate, Nawalapitiya—(1966)*

The plots were approximately 1/4 acre on an even stand of old seedling tea. Four and eight pints of heptachlor 23% EC per acre were compared with six pints of dieldrin 20% EC per acre and unsprayed controls. Spraying was done soon after pruning and before bud break, using pressurized knapsack sprayers. The spray volume was 80 gallons per acre. The results to-date presented in Table I show that all treated plots harboured significantly ($P < 0.05$) lower numbers of live stages than did the untreated plots. Dieldrin at the rate of 1.5 lb per acre (six pints) and heptachlor at the rate of 2.3 lb per acre (eight pints) gave control superior to heptachlor at 1.2 lb per acre (four pints). There was no significant interaction between insecticides and the dates of sampling.

TABLE 1 — *Post-treatment counts of all live stages of Shot-hole Borer per 200 sample units*

Treatments	Rate (lb ai per acre)	No. of live stages (months after treatment)											Mean no. per 50 units as $\sqrt{n+1}$
		(1)	(2)	(3)	(6)	(7)	(10)	(13)	(16)	(19)	(22)	(24)	
Dieldrin	1.5	3	6	15	6	17	14	65	73	308	163	176	2.96**
Heptachlor ...	2.3	2	1	8	44	130	19	51	171	270	276	219	3.57**
Heptachlor ...	1.2	4	15	20	33	54	30	81	249	419	266	228	4.00**
Untreated control ...	—	7	24	14	30	121	134	130	200	578	378	208	4.80
LSD at $P = 0,05$ ...													0.78

E29—*Mid-cycle application of dieldrin, aldrin and heptachlor on shot-hole borer control and on tea yields at Kirimetiya Estate, Menikdiwela—(1966)*

This experiment was discontinued because of management difficulties in yield assessment.

E32—*Chlorfenvinphos (Birlane), arprocarb (Unden), Bidrin, fenitrothion (Sumithion), dichlorvos (Vapona) and nickel chloride for shot-hole borer control at Deltotte Group, Galaha—(1966)*

The plots were 1/20th acre on an even stand of seedling and clonal tea at an elevation of approximately 3000 ft. Blocks 1 and 3 are situated on seedling tea planted in 1963 and 1961 respectively and the blocks 2 and 4 on clones TRI 2024 and TRI 2026 planted in 1963 and 1961 respectively. The insecticides were mistblown at the dilutions given in Table 2.

TABLE 2—*Post-treatment counts of all live stages of Shot-hole Borer per 200 samples units*

Treatments	*Rate (lb ai per acre)*	*No. of live stages (months after treatment)*		*Mean no. of live stages per 50 units as* $\sqrt{n+1}$
		(2)	(4)	
Chlorfenvinphos ...	3.3	114	210	5.85
Arprocarb ...	1.6	260	184	6.65
Dichlorvos ...	3.8	163	130	5.31
Fenitrothion ...	2.7	90	125	4.25
Bidrin ...	1.1	383	138	7.12
Nickel chloride ...	3.8	108	161	5.58
Untreated control ...	—	155	149	5.35
LSD at $P=0.05$ ...				1.35

The results presented in Table 2 show that none of the treatments gave significant shot-hole borer control even at the early stages of the experiment. This experiment is concluded.

C. Shanmugam

E33—*Aldrin, dieldrin and heptachlor for shot-hole borer control in new clearings at Carolina Group, Watawala—(1966)*

The plots are approximately 1/22 acre on an even stand of clone TRI 2024. Different doses of the insecticides (see Table 3) were diluted in 100 gallons of water and sprayed with pressurized knapsack sprayers. The results to-date given in Table 3 show that all treated plots gave significantly lower numbers of live stages than the untreated plots. Heptachlor at 1.7 lb (six pints) and dieldrin at 1.5 lb (six pints) per acre gave the best result. There was, however, no significant difference in efficacy between them. Aldrin at 1.5 lb (six pints) was the next best followed by dieldrin at 0.5 lb and heptachlor at 0.6 lb. All were found to perform similarly on all dates of sampling.

TABLE 3—*Post-treatment counts of all live stages of Shot-hole Borer per 125 sample units*

Treatments	Rate (lb ai per acre)	No. of live stages (months after treatment)						Mean no. of live stages per 25 units as $\sqrt{n+1}$
		(2)	(6)	(8)	(10)	(12)	(14)	
Heptachlor ...	0.6	26	64	116	192	300	178	4.9*
Heptachlor ...	1.7	4	1	17	41	225	54	2.7***
Dieldrin ...	0.5	20	20	114	232	381	384	5.4*
Dieldrin ...	1.5	1	5	9	13	54	183	2.5***
Aldrin ...	1.5	6	30	51	104	201	251	3.9**
Untreated control	—	92	342	478	308	407	438	7.9
LSD at $P=0.05$								0.88

E34—*Aldrin, dieldrin and heptachlor for shot-hole borer control in new clearings at Balangoda Group, Bogawantalawa—(1966)*

The layout of this experiment was the same as that for **E33.** The results to-date given in Table 4 show that at the end of 13 months from spraying, the plots sprayed with the higher doses of all insecticidal treatments had less infestation than the untreated plots. There were no significant differences between the treatments themselves.

TABLE 4—*Post-treatment counts of all live stages of shot-hole borer per 125 sample units*

Treatments	Rate (lb ai per acre)	No. of live stages (months after treatment)					Mean no. per 25 units as $\sqrt{n+1}$
		(5)	(7)	(9)	(11)	(13)	
Heptachlor ...	0.6	46	55	73	273	458	5.2
Heptachlor ...	1.7	11	10	21	69	727	4.0*
Dieldrin ...	0.5	48	35	129	233	356	5.0
Dieldrin ...	1.5	2	9	32	62	404	3.3*
Aldrin ...	1.5	4	86	23	37	600	4.1*
Untreated control	—	65	134	136	351	783	6.6
LSD at $P=0.05$ ...							2.4

C. Shanmugam & S. N. Fernando

E35—*Three levels of heptachlor for shot-hole borer control at Balangoda Group, Bogawantalawa—(1966)*

The three doses of heptachlor were sprayed with knapsack sprayers using 100 gallons of water. The results to-date given in Table 5 show that at the end of 15 months after application, the plots sprayed with heptachlor at 1.7 lb (6 pints) and 1.2 lb (4 pints) active ingredient per acre showed significantly less infestation than the plots sprayed with 0.6 lb of heptachlor and the untreated plots. There was, however, no significant difference in efficacy between heptachlor at 1.2 lb and 1.7 lb per acre. There was no interaction between doses and dates of sampling.

TABLE 5—*Post-treatment counts of all live stages of Shot-hole Borer per 175 sample units*

Treatments	Rate (lb ai per acre)	No. of live stages (months after treatment) (5)	(7)	(9)	(11)	(13)	(15)	(17)	Mean no. per 25 units $\sqrt{n+1}$
Heptachlor	0.6	14	10	108	93	559	238	244	3.7
Heptachlor	1.2	17	28	23	39	403	236	202	2.8*
Heptachlor	1.7	29	20	13	52	166	169	146	2.4*
Untreated control	—	26	18	35	127	522	265	142	3.6
LSD at $P = 0.05$									0.7

S. N. Fernando & C. Shanmugam

1967 Experiments

E41—*Methiocarb, ethylene dibromide, dichlorvos, fenitrothion, heptachlor and nickel chloride for shot-hole borer control at Deltotte Group, Galaha*—4 replicates of 6 treatments + control in randomized blocks—*(1967)*

Each plot was 1/20th acre in extent on even stands of seedling and clonal tea planted in 1963 and 1961 respectively. The insecticides were mistblown at the dilutions given in Table 6. Dichlorvos was applied in combination with a new resin sticker known as 'Estab' (Velsicol International Corporation) at the rate of ten pints of 'Estab' per acre. Fenitrothion was sprayed twice with an interval of three months. Nickel chloride was sprayed at fortnightly intervals. The results presented in Table 6 show that heptachlor and fenitrothion (two applications) produced significant reductions of the beetle population when compared with the untreated control.

TABLE 6—*Post-treatment counts of all live stages of Shot-hole Borer per 200 sample units*

Treatments	*Rate (lb ai per acre)*	*No. of live stages (months after treatment)* (1)	(2)	(4)	(6)	(8)	*Mean No. per 50 units as* $\sqrt{n+1}$
Methiocarb	1.0	24	101	93	132	109	4.30
Ethylene dibromide	1.2	135	104	42	28	58	3.95
Dichlorvos	4.0	114	70	66	47	134	3.87
Fenitrothion	2.7	22	28	60	10	167	2.58*
Heptachlor	1.7	16	23	8	25	40	2.11*
Nickel chloride	3.7	104	84	65	65	69	4.21
Untreated control	—	202	149	34	67	80	4.42
LSD at $P=0.05$							1.29

C. Shanmugam & S. N. Fernando

E42—*Azinphos-methyl, Bordeaux Mixture, azinphos-methyl + Bordeaux Mixture, heptachlor, methiocarb, ethylene dibromide fenthion, endrin and DDT for shot-hole borer control at Downside Estate, Welimada*—4 replicates of 9 treatments + control in randomized blocks—*(1967)*

Each plot was 1/20th acre in extent. The spraying was done at tipping time by mist-blowers with a spray volume of 40 gallons of water per acre. Bordeaux Mixture was included as a fungicide against the Ambrosia Fungus. Although it is known that azinphos-methyl is not compatible with Bordeaux Mixture, these two were used in combination because Venkataramiah and Sekhar (1964) have shown that this mixture is somewhat effective against the coffee

shot-hole borer (*Xylosandrus compactus* Eichh.). The results presented in Table 7 have not been statistically analysed, but show a trend in favour of fenthion, endrin and heptachlor.

TABLE 7—*Post-treatment counts of all live stages of Shot-hole Borer per 200 sample units*

Treatments	*Rate (lb ai per acre)*	*No. of live stages (months after treatment)*				
		(2)	(4)	(6)	(8)	(10)
Azinphos-methyl	1.0	1	8	50	34	181
Bordeaux Mixture	7.5	12	9	126	120	176
Azinphos-methyl + Bordeaux Mixture	1.0+7.5	18	2	26	121	148
Heptachlor	1.7	0	0	16	10	33
Methiocarb	1.9	1	23	84	104	94
Ethylene dibromide	1.2	0	0	56	120	176
Fenthion	1.5	1	17	46	113	44
Endrin	1.2	0	7	1	36	48
DDT	4.2	0	1	53	9	101
Untreated control	—	1	19	44	113	128

D. J. W. Ranaweera & S. N. Fernando

E43—*Methiocarb, bromosphos-ethyl, S-6607, fenthion, fenthion + methiocarb, fenitrothion, fenitrothion + methiocarb, bromosphos-methyl and S-6538 for shot-hole borer control at Goorookoya Estate, Nawalapitiya*—4 replicates of 9 treatments + control in randomized blocks—(*1967*)

The layout of this experiment is similar to that of **E42.** The new insecticides S-6607 and S-6538 belong to the organophosphorus group. The reason for using mixtures of fenthion, fenitrothion and methiocarb was that these three insecticides gave a certain degree of control of short duration in previous experiments. The results given in Table 8 have not yet been statistically analysed, but it appears that only fenitrothion is so far effective in controlling the beetle.

TABLE 8—*Post-treatment counts of all live stages of Shot-hole Borer per 200 sample units*

Treatments	*Rate (lb ai per acre)*	*No. of live stages (months after treatment)*		
		(4)	(7)	(9)
Methiocarb	1.0	196	139	176
Bromophos-ethyl	1.5	186	155	334
S-6607	1.0	103	171	214
Fenthion	1.0	96	133	235
Fenthion + methiocarb	1.0+1.0	74	118	120
Fenitrothion	1.2	159	72	198
Fenitrothion + methiocarb	1.2+1.0	116	187	180
Bromophos-methyl	1.5	209	186	207
S-6538	0.6	72	103	167
Untreated control	—	109	133	150

A. Kathiravetpillai & C. Shanmugam

E44—*Azodrin, Gardona, Sapecron, bromophos-ethyl, bromophos-methyl, fenitrothion (Sumithion), fenitrothion (Folithion), methiocarb, fenthion, azinphos-methyl and the pathogenic fungus* Beauveria bassiana *for shot-hole borer control at Rothschild Estate, Pussellawa*—4 replicates of 11 treatments + control in randomized blocks—*(1967)*

The layout of this experiment is similar to that of **E42.** The spraying was done with mistblowers soon after tipping, with a spray volume of 40 gallons of water per acre. The fungus *Beauveria bassiana* was sprayed at weekly intervals as a spore suspension. The insecticide treatments were given in one application. The results presented in Table 9 have not yet been statistically analysed but it is clear that none of the treatments have given any indication in the reduction of the borer numbers. This is the only field experiment in which the pathogenic fungus *Beauveria bassiana* was tested, but the fungus has so far not proved to be effective under field conditions. As in the other experiments fenitrothion (Sumithion) and fenthion have given some degree of control.

TABLE 9—*Post-treatment counts of all live-stages of Shot-hole Borer per 100 sample units*

Treatments	*Rate (lb ai per acre)*	*No. of live stages (months after treatment)*		
		(1)	(3)	(6)
Azodrin	2.5	137	138	135
Gardona	1.2	38	148	270
Sapecron	2.5	12	116	82
Bromophos-ethyl	2.0	29	76	230
Bromophos-methyl	2.0	100	136	165
Fenitrothion (Sumithion) ...	2.5	32	60	55
Fenitrothion (Folithion) ...	2.5	38	151	158
Methiocarb	2.8	52	210	136
Fenthion	2.5	25	36	124
Azinphos-methyl	1.0	51	61	199
Beauveria bassiana	—	32	116	114
Untreated control	—	43	92	126

E. F. W. Fernando & S. N. Fernando

E45—*Methiocarb at 3 levels, fenitrothion at 3 levels, fenthion at 3 levels, S. 6538 and heptachlor for shot-hole borer control at Moolgama Estate, Panwilatenne* — 4 replicates of 11 treatments + control in randomized blocks—*(1967)*

The layout was similar to that of **E42.** All insecticide treatments other than heptachlor were mistblown with a spray volume of 40 gallons of water per acre. Heptachlor was sprayed with knapsack sprayers using 80 gallons of water per acre. The insecticides were applied as mid-cycle sprays. The results to-date are presented in Table 10. No conclusions can be made yet.

TABLE 10—*Post-treatment counts of all live stages of Shot-hole Borer per sample of 200 units*

Treatments	Rate (lb ai per acre)	No. of live stages (months after treatment) (4)	(6)
Methiocarb	1.0	402	428
Methiocarb	2.0	467	502
Methiocarb	4.0	573	578
Fenitrothion	0.6	263	448
Fenitrothion	1.2	379	480
Fenitrothion	2.4	262	576
Fenthion	0.6	405	448
Fenthion	1.2	491	594
Fenthion	2.4	480	537
S-6538	0.6	498	529
Heptachlor	1.7	251	184
Untreated control	—	525	418

C. Shanmugam

E46—*Phosalone, vamidothion, heptachlor, chlordane, dicrotophos, phosphamidon, dimethoate, demeton-methyl and the microbial insecticide* Bacillus thuringiensis *for shot-hole borer control at Anningkande Estate, Deniyaya* — replicates of 11 treatments + control in randomized blocks—*(1967)*

The layout of this experiment is similar to that of **E42.** All insecticides were sprayed with knapsack sprayers with 80 gallons of water per acre. The heptachlor treatment was given in three ways, *viz* as a normal spray, in combination with 'Estab' and as heptachlor treated absorbant paper. The purpose of the latter treatment was to overcome the difficulties of obtaining spray coverage during the middle of a cycle, especially in the low country. The other insecticides were applied with mistblowers. The results to-date given in Table 11 shows a trend in favour of heptachlor.

TABLE 11—*Post-treatment counts of all live stages of Shot-hole Borer per 200 sample units*

Treatments	Rate (lb ai per acre)	No. of live stages at 2 months after treatment
Phosalone	0.4	133
Vamidothion	0.4	182
Heptachlor paper	2.3	71
Dicrotophos	0.5	143
Phosphomidon	1.0	153
Dimethoate	0.9	132
Chlordane	2.8	114
Heptachlor	2.3	95
Demeton-methyl	0.6	121
Bacillus thuringiensis	—	229
Heptachlor + 'Estab'	2.3	40
Untreated control		154

S. N. Fernando

Geometrid caterpillars

These outbreaks are clearly on the decline, and during 1967, the damage has been mild or insignificant compared with the previous years.

The numbers of outbreaks in recent years are given below :

1963	*1964*	*1965*	*1966*	*1967*
2	2	19	28	5

E25—*Biology and population dynamics of the Twig Caterpillar at Goorookoya Estate, Nawalapitiya—(1966)*

These studies were conducted in a $\frac{1}{2}$-acre area, originally heavily infested with the caterpillars. The experimental area was not treated with insecticides. Rows were numbered and weekly samplings were systematically done. Information on the population density, deposition of larvae on tea and the development of the various stages and generations were collected by sampling and trapping.

The distribution of egg masses on shade trees was studied by felling *Grevillea robusta* trees which were 40 to 60 ft high. The numbers of egg masses were counted. It was found that at heights of over 16 ft there was a gradual decline in numbers. It was also found that 73% of all egg masses are laid below 16 ft, a noteworthy point when control measures are undertaken. The full data will be published in detail elsewhere. This experiment is concluded.

A. Kathiravetpillai

E30—*Biology and population dynamics of the Looper Caterpillar at Sapumalkande Estate, Dehiowita—(1966)*

The results of this experiment are discussed together with those of **E31**.

E31—*Biology and population dynamics of the Twig Caterpillar at Mohamedi Estate, Lathpandura—(1966)*

There are five generations of the Looper Caterpillar (*Buzura strigaria* Mo.) per year. The life cycle and behaviour closely resemble those of the Twig Caterpillar (see **E25**). The fecundity of the Looper Caterpillar in dissected moths was 687±205, compared with 301±50 for that of the Twig Caterpillar. There are five larval instars which can be identified by head capsule and body length measurements (see Annual Report for 1966). The Looper Caterpillar is parasitized by a braconid parasite belonging to *Apanteles* sp. (Glomeratus Group) which evidently keeps the pest under natural control. In both the Mohamedi and Sapumalkande experimental blocks, looper caterpillar outbreaks that appeared after dieldrin spraying were brought under control by *Apanteles*. At Sapumalkande the level of parasitism during certain stages of development reached 100% whereas at Mohamedi, the maximum level of parasitism was 80%. The parasite *Apanteles* generates in large numbers within a single caterpillar 80±19 grubs can be found. In contrast, *Charops* sp. (ichnemonidae) which parasitizes the Twig Caterpillar (*Ectropis bhurmitra* Wlk.) generates only a single parasite from each caterpillar. It appears, therefore, that *Apanteles* is a more efficient parasite than *Charops* and probably because of this reason, outbreaks that began with both caterpillars usually ended up with the elimination of the Looper Caterpillar and the predominance of the Twig Caterpillar. These experiments are concluded.

A. Kathiravetpillai & S. N. Fernando

Mites

Experiments on mite control with acaricides showed that both the Scarlet and Red Spider Mites can be effectively brought under control with 10 fl. oz (formerly 15 fl. oz) of Kelthane or 10 fl. oz (formerly 30 fl. oz) of Tedion V-18 per acre (**E47**). It was also evident that of the two acaricides now in use, Kelthane gave superior results. These new findings will make it possible to reduce the cost of Kelthane by 33% and the cost of Tedion by 200%. A large number of new acaricides were screened during the year (**E48**) and it was found that Morestan is likely to be of value in controlling mites in the future after further experiments with this product have been completed.

E21—*Mites, shade and fertilizer on yield at Downside Estate, Welimada—(1965)*

The main object of this experiment is to study the economics of using acaricides to control mites (Red Spider and Scarlet Mites in this instance). Each experimental block has eight plots, the plot size being 1/30th acre. Half the number of plots were sprayed with Kelthane to keep the tea almost free from mites. Two densities of shade (no shade and light shade) and four levels of nitrogenous fertilizer (0, 60, 120 and 180 lb N per acre) were incorporated. Preassessment of yield was carried out for three months. This experiment is still in progress and statistical analysis is not yet possible. The results to-date which are summarized in Table 12 may give some idea of the general trends.

TABLE 12—*Effects of mites and shade on yield*

Treatments		Total yield for 2½ years (lb made tea per acre)	No. of scarlet mites per leaf	No. of red spider mites per leaf
Sprayed	...	5506	22	6
Unsprayed	...	5321	307	102
Shaded	...	5089	170	67
Unshaded	...	5740	159	41

D. J. W. Ranaweera

1967 Experiments

E47—*Dicofol (Kelthane) at 3 levels and tetradifon (Tedion) at 3 levels for red spider and scarlet mite control at Dambawinna Division, Welimada Group, Welimada*—4 replicates of 7 treatments + control in randomized blocks — *(1967)*

The experimental plots were 1/30th acre in extent. Three applications of DDT were given in order to induce a build-up of the mite population. The acaricides dicofol (Kelthane) and tetradifon (Tedion V-18) were sprayed with knapsack sprayers with a spray volume of 60 gallons of water per acre. One pre-treatment sample and three post-treatment samples were taken at weekly intervals. The results presented in Tables 13 and 14 show that dicofol (Kelthane) gave the best results in controlling the eggs and the active stages of the Red Spider Mite. It was also clear that there was no difference in the degree of control obtainable between the three doses of Kelthane used indicating that the minimum dose of 10 fl. oz per acre would suffice. The results were almost the same in the case of the experiments on the Scarlet Mite (Tables 15 and 16). The experiment shows that Kelthane is the superior acaricide for controlling both species of mites. Tedion can be regarded as a good alternative to Kelthane.

TABLE 13—*Control of the active stages of the Red Spider Mite with dicofol (Kelthane) and tetradifon (Tedion)*

Treatments	Dose (Fl. oz per acre)	No. of mites per 100 leaves Post-treatment counts			Mean No. per 25 leaves (log transformed)
		Pre-count	1 week	2 weeks	3 weeks	
Kelthane MF	10	1779	266	133	81	4.11 **
Kelthane MF	15	1955	185	158	88	4.36 **
Kelthane MF	20	1240	190	107	58	2.36 **
Tedion V-18	10	1267	364	222	82	4.20 **
Tedion V-18	15	2016	643	286	91	4.92 *
Tedion V-18	20	2256	557	217	103	4.62 *
Tedion V-18	30	1286	406	157	32	4.07 **
Untreated control	—	1533	2781	1584	921	7.67
LSD at $P=0.05$						0.68

TABLE 14—*Ovicidal action of dicofol (Kelthane) and tetradifon (Tedion) on the Red Spider Mite*

Treatments	Dose (Fl. oz per acre)	No. of eggs per 100 leaves Post-treatment counts			Mean No. Per 25 leaves (log transformed)
		Pre-count	1 week	2 weeks	3 weeks	
Kelthane MF	10	4172	1811	1065	379	6.89 ***
Kelthane MF	15	3263	1920	1270	443	7.16 ***
Kelthane MF	20	3211	1877	1274	320	6.86 ***
Tedion V-18	10	2526	3030	3146	1130	7.95 **
Tedion V-18	15	4455	6162	3585	1333	8.52 *
Tedion V-18	20	3472	5461	2247	1479	8.17 *
Tedion V-18	30	3016	5890	4874	1516	8.68 *
Untreated Control	—	3509	6289	5559	2660	9.11
LSD at $P = 0.05$						0.45

TABLE 15—*Ovicidal action of dicofol (Kelthane) and tetradifon (Tedion) on the Scarlet Mite*

Treatments	Dose (Fl. oz per acre)	No. of eggs per 100 leaves Post-treatment counts			Mean No. per 25 leaves (log transformed)
		Pre-count	1 week	2 weeks	3 weeks	
Kelthane MF	10	37	11	13	8	0.48 **
Kelthane MF	15	51	14	10	10	0.48 **
Kelthane MF	20	28	14	20	16	0.62 **
Tedion V-18	10	37	59	31	58	0.92 *
Tedion V-18	15	25	28	27	52	0.82 *
Tedion V-18	20	101	48	41	44	0.90 *
Tedion V-18	30	66	49	54	109	1.07
Untreated control	—	42	125	117	60	1.22
LSD at $P = 0.05$						0.20

TABLE 16—*Control of Scarlet Mite active stages with dicofol (Kelthane) and tetradifon (Tedion)*

Treatments	Dose (Fl. oz per acre)	Pre-count	No. of eggs per 100 leaves Post-treatment counts 1 week	2 weeks	3 weeks	Mean No. per 25 leaves as log (n + 1)
Kelthane MF	10	36	16	22	10	0.57***
Kelthane MF	15	52	29	14	17	0.60**
Kelthane MF	20	26	9	12	7	0.40***
Tedion V-18	10	38	46	26	63	0.95*
Tedion V-18	15	26	54	21	77	0.90*
Tedion V-18	20	98	65	41	35	0.93*
Tedion V-18	30	38	45	56	135	1.10
Untreated control	—	29	112	95	89	1.20
LSD at $P = 0.05$						0.19

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E48—*Chlorphenamidine, chlorphenamidine + dichlorvos, dimethoate, demeton-methyl, amidithion, ethion, carbophenothion, phosphamidon, Morestan, binapacryl and sulphur for red spider and scarlet mite control at Dambawinna Division, Welimada Group, Welimada* — 4 replicates of 11 treatments + control in randomized blocks — (*1967*)

The layout of this experiment is similar to that of **E47.** The acaricides were sprayed with knapsack sprayers with a spray volume of 60 gallons of water per acre. One pre-treatment sample and three post-treatment samples at weekly intervals were made. Analysis of covariance was carried out on log-transformed data. The results presented in Tables 17-20 show that the acaricides Morestan, carbophenothion (Trithion), ethion and demeton-methyl (Metasystox) gave the best control of both the eggs and the active stages of the Red Spider Mite. There was, however, no significant difference between these treatments. When the results for the scarlet mites are considered, only binapacryl (Acricid) and Morestan gave the best results in controlling the eggs and the active stages. As red spider mite and scarlet mite outbreaks generally occur together or overlap, any acaricide that must be used against either of these pests must be effective against both species. This experiment shows that of the acaricides evaluated, only Morestan showed this property to a significant degree. These results suggest that Morestan must be compared with Kelthane and Tedion V-18 in further experiments.

TABLE 17—*Ovicidal action of various acaricides on the Red Spider Mite*

Treatments	Dose (lb ai per acre)	Pre-count	No. of eggs per 100 leaves Post treatment counts 1 week	2 weeks	3 weeks	Mean No. per 25 leaves as log (n + 1)
Chlorphenamidine	0.6	3206	1084	722	345	2.11*
Chlorphenamidine + dichlorvos	0.3 + 0.3	3616	1416	1218	1047	2.39*
Dimethoate	0.3	2345	835	799	600	2.26*
Demeton-methyl	0.6	4967	1600	609	234	2.04**
Amidithion	0.6	3162	761	500	298	2.00**
Ethion	0.6	2948	1508	431	267	2.05**
Carbophenothion	0.6	3656	1387	562	221	1.97**
Phosphamidon	0.3	3284	1041	1732	1464	2.49
Morestan	0.3	4279	1281	520	280	2.03**
Binapacryl	0.6	3129	1402	1539	1078	2.49
Sulphur	4.0	5491	986	810	468	2.12*
Untreated control	—	2270	2283	1892	2211	2.72
LSD at $P = 0.05$						0.17

TABLE 18—*Control of the active stages of the Red Spider Mite with acaricides*

Treatments	Dose (lb ai per acre)	No. of eggs per 100 leaves Post-treatment counts Pre-counts	1 week	2 weeks	3 weeks	Mean No. per 25 leaves (log transformed)
Chlorphenamidine	0.6	1437	149	86	72	1.17 **
Chlorphenamidine + dichlorvos	0.3 + 0.3	1272	304	174	274	1.75 *
Dimethoate	0.3	760	303	106	172	1.55 *
Demeton-methyl	0.6	1876	148	64	41	1.06 ***
Amidithion	0.6	1401	106	53	72	1.16 *
Ethion	0.6	1069	106	23	18	0.86 ***
Carbophenothion	0.6	1399	133	63	43	1.04 ***
Phosphamidon	0.3	1625	454	224	348	1.82 *
Morestan	0.3	1467	123	53	21	0.97 ***
Binapacryl	0.6	1445	437	227	214	1.72 *
Sulphur	4.0	2287	143	135	130	1.30 **
Untreated control	—	616	953	592	520	2.25
LSD at $P = 0.05$						0.23

TABLE 19—*Ovicidal action of various acaricides on the Scarlet Mite*

Treatments	Dose (lb ai per acre)	No. of eggs per 100 leaves Post-treatment counts Pre-counts	1 week	2 weeks	3 weeks	Mean No. per 25 leaves (log transformed)
Chlorphenamidine	0.6	36	51	41	138	1.08 *
Chlorphenamidine + dichlorvos	0.3 + 0.3	29	70	69	72	1.14 *
Dimethoate	0.3	27	52	40	82	1.00 *
Demeton-methyl	0.6	40	134	178	205	1.44
Amidithion	0.6	25	87	82	55	1.18 *
Ethion	0.6	49	107	99	162	1.37
Carbophenothion	0.6	29	46	46	107	1.11 *
Phosphamidon	0.3	29	73	71	121	1.26
Morestan	0.3	31	55	31	25	0.88 **
Binapacryl	0.6	39	33	14	23	0.72 **
Sulphur	4.0	46	66	115	114	1.24
Untreated control	—	26	191	114	131	1.44
LSD at $P = 0.05$						0.20

TABLE 20—*Control of the active stages of the Scarlet Mite with acaricides*

Treatments	Dose (lb ai per acre)	No. of eggs per 100 leaves Post-treatment counts Pre-counts	1 week	2 weeks	3 weeks	Mean No. per 25 leaves log (n + 1) transformation
Chlorphenamidine	0.6	27	31	34	87	0.96 **
Chlorphenamidine + dichlorvos	0.3 + 0.3	25	58	57	81	1.10 *
Dimethoate	0.3	13	55	38	59	1.02 *
Demeton-methyl	0.6	23	79	111	135	1.29
Amidithion	0.6	41	58	75	51	1.12 *
Ethion	0.6	20	77	89	98	1.23
Carbophenothion	0.6	24	45	51	86	1.08 *
Phosphamidon	0.3	17	58	90	69	1.20
Morestan	0.3	15	44	22	22	0.76 **
Binapacryl	0.6	17	34	24	36	0.85 **
Sulphur	4.0	27	78	76	109	1.22
Untreated	—	21	131	67	86	1.34
LSD at $P = 0.05$						0.20

D. J. W. Ranaweera & S. N. Fernando

E49—*Purple mite attacks on yield and the effects of shade and fertilizer applications on purple mite numbers at Liddesdale Group, Halgranoya* — Split plot, with levels of nitrogen as the main treatments split on shade and further split on mite control measures, in 6 replicates — (*1967*)

The size of each plot was 1/20 acre. Each block consisted of four plots, two unshaded and two light-shaded. Half the plots were protected against mites by spraying Kelthane. Three densities of nitrogen, 0, 100 and 200 lb N per acre were also incorporated. This experiment is in progress and the results are not yet available.

E50—*Purple mite on yield at Diyanilla Division, Liddesdale Group, Halgranoya*— 6 replicates in randomized blocks — (*1967*)

The size of each plot was 1/20 acre. Each block consisted of four plots, two of which are treated with Kelthane for mite control. This experiment is in progress and the results are not yet availabe.

E51—*Red spider mite on yield at Dambawinna Division, Welimada Group, Welimada* — 6 replicates in randomized blocks — (*1967*)

This experiment is similar to **E50.** No results are yet available.

E52—*Levels of nitrogen on the red spider and scarlet mite numbers* — (*1967*)

This experiment is carried out in the Agricultural Chemistry Division NPK experiment **A8** of 1962 at St Coombs.

Sampling for mites was done at monthly intervals. The results presented in Table 21 indicate a positive correlation between levels of nitrogen and numbers of scarlet mites. The results of this experiment have not yet been statistically analysed.

TABLE 21—*Numbers of mites per leaf in different treatments*

Nitrogen (lb per acre per annum)	No. of Scarlet Mites per leaf	No. of Red Spider Mites per leaf
0	13.99	0.63
80	19.26	0.85
160	27.11	0.84
240	32.97	0.83

D. J. W. Ranaweera, S. N. Fernando & C. Shanmugam

Termites

Reports from estates in the low country and the Maskeliya District have brought to our notice that the live wood termite problems in these areas are on the increase. Three experiments (**E54** to **E56**) were begun during the year to find a method of controlling these pests chemically.

E53—*Chlorfenvinphos, demeton-methyl, dimethoate, aldrin, dieldrin, chlordane, and heptachlor for the control of the low-country tea termites at Talangaha Estate, Nakiyadeniya* — 4 replicates of 16 treatments + control — (*1967*)

Tea bushes obviously attacked by the low-country termites (*Glyptotermes dilatates* B. & P. and *Neotermes greeni* Deoneux) were treated with each of the above insecticides as a spray on the frame and soil surrounding the collar soon after pruning. In the case of the three systemic insecticides, in addition to the above treatment, spraying of the foliage only, soil application only

TABLE 22 — *Termite control with insecticides*

Treatment	Dose (lb ai per acre)	1 Dead	1 Alive	2 Dead	2 Alive	3 Dead	3 Alive	4 Dead	4 Alive	5 Dead	5 Alive
Heptachlor (F & S)[1]	1.7	58	66	—	—	3	0	—	—	7	413
Chlordane (F & S)	1.8	33	0	—	—	7	0	0	1913	4	111
Aldrin (F & S)	1.5	29	0	—	—	—	—	—	—	36	0
Dieldrin (F & S)	1.5	40	0	23	0	23	30	60	0	13	35
Demeton-methyl (F & S)[2]	0.3	—	—	0	288	0	214	—	—	0	389
Dimethoate (F & S)	0.6	34	0	—	—	0	—	0	840	7	1
Chlorfenvinphos (F & S)	0.7	0	755	0	17	—	69	—	—	0	527
Demeton-methyl (F)[2]	0.3	—	—	—	2783	—	—	0	333	0	167
Dimethoate (F)	0.6	—	—	0	115	8	42	0	252	5	234
Chlorfenvinphos (F)	0.7	0	2	0	1	—	—	0	93	3	205
Demeton-methyl (S)[3]	0.3	0	1111	—	—	—	—	0	56	0	544
Dimethoate (S)	0.6	0	396	—	—	0	32	1	96	0	1137
Chlorfenvinphos (S)	0.7	18	38	—	—	0	149	0	397	0	19
Demeton-methyl (I)[4]	1.0	0	200	2	141	0	10	—	—	0	506
Dimethoate (I)	2.0	0	145	0	19	0	29	—	—	—	—
Chlorfenvinphos (I)	4.2	0	350	0	5	0	148	0	709	0	169
Untreated		0	947	0	106	0	469	0	64	0	152

[1]F & S — Frame and soil application
[2]F — Frame application
[3]S — Soil application
[4]I — Injection

and injection into the frame were carried out. Injection of insecticide into the frame was done by drilling a hole 0.5 cm diameter and 2.0 cm long in the lower parts of the collar and filling it up with the insecticide concentrate. Bushes had to be uprooted for proper assessment of infection. Only four bushes were, therefore, examined from each treatment for dead and live stages of the termites. As there is a great deal of variation in the size of colonies, the results are expressed in Table 22 as the numbers found in each treated bush. These results show that only the organochlorine insecticides *viz* aldrin, dieldrin, chlordane and heptachlor provided a certain degree of control of the termites. It is also clear that with these insecticides, it is possible to obtain a 100% kill in some instances, suggesting that a good control of the low-country Live Wood Termite can be obtained with any of these four insecticides provided that the spraying is thorough. None of the systemic insecticides proved to be effective except the frame and soil application of dimethoate in one instance. Further experimental results are needed before recommendations can be made.

A. Kathiravetpillai

E54—*Dieldrin, aldrin, heptachlor, chlordane, chlordane + aldrin, chlordane + heptachlor, dimethoate, phosphamidon and dichlorvos for the control of the Up-Country Live Wood Termite at Moray Group, Maskeliya* — 4 replicates of 10 treatments + control — (*1967*)

This experiment is in progress and the results are not yet available.

D. J. W. Ranaweera

E55—*Dieldrin, aldrin, heptachlor, chlordane, chlordane + aldrin, chlordane + heptachlor, dimethoate, phosphamidon and dichlorvos for the control of the Low-Country Live Wood Termite at Galbode Estate, Ratnapura* — 4 replicates of 9 treatments + control — (*1967*)

This experiment is in progress and the results are not yet available.

A. Kathiravetpillai

E56—*The biology and population dynamics of Tea Tortrix* — (*1967*)

This experiment is in progress at No. 4 Field at St Coombs and the results are not yet available.

A. Kathiravetpillai, S. N. Fernando & H. B. Herath

Extension Experiments

Experiments **XE1** to **XE8** were planned with the primary object of studying the side-effect problems, if any, of heptachlor when sprayed over a large area for shot-hole borer control. The experiments involve whole fields where sprayings have been done by the individual estates on the instructions of the TRI. The insecticide was provided by the Institute. In each experiment, the field was divided into four approximately equal areas and two of these areas were treated with heptachlor (20% EC) at the rate of six pints per acre in 80 gallons of water, soon after pruning.

XE1—*Heptachlor for shot-hole borer control at Talangaha Estate, Nakiyadeniya — (1966)*

In one of the treated blocks (total area of the block is ten acres) a mild patch of Tortrix, about ¼ acre in extent, developed in October 1966, two months after spraying. This attack was slightly more severe in November 1966 and diminished in December 1966. It was not found necessary to resort to any control measures.

XE2—*Heptachlor for shot-hole borer control at Bopitiya Group, Galaha — (1966)*

The experiment was not carried out because the spraying could not be done at the proper time.

XE3—*Heptachlor for shot-hole borer control at Kelebokka Group, Madulkele — (1966)*

A slight tortrix attack was noticed in all the blocks (including the untreated) in March 1967, five months after spraying. Sampling indicated that the treated blocks had more caterpillars than the untreated. No control measures were undertaken and the attack subsided within a few weeks.

XE4—*Heptachlor for shot-hole borer control at Dyraaba Estate, Bandarawela — (1966)*

In this experiment, the tortrix side-effect did not develop. A mild attack of Nettle Grub was noticed in January 1967, three months after spraying, but it was evident that this was a generalized attack on many fields in this estate and is unlikely that this was induced by heptachlor spraying.

XE5—*Heptachlor for shot-hole borer control at Devon Estate, Talawakele — (1966)*

A mild attack of tortrix developed in January, four months after treatment in both treated and untreated blocks. It was not necessary to resort to any control measures.

XE6—*Heptachlor for shot-hole borer control at Chrystlers Farm, Kotagala — (1966)*

A mild attack of Tortrix appeared in all blocks (treated and untreated) in April 1967, six months after spraying. The attack became somewhat severe in one of the heptachlor-sprayed blocks, but it was not found necessary to resort to control measures. This attack disappeared within a few weeks.

XE7—*Heptachlor for shot-hole borer control at Downside Estate, Welimada — (1966)*

Regular examinations for Tortrix did not show any signs of caterpillar damage.

XE8—*Heptachlor for shot-hole borer control at Deepdene Group, Rakwana — (1966)*

The experiment was not carried out because the spraying could not be done at the proper time.

Glossary of insecticides and acaricides used in experiments

Active constituent	*Trade Name*	*Owner*	*Agents*
Aldrin	Aldrex-20	Shell	Shell
Amidithion	Thiocron 30	Ciba	Baurs
Arprocarb	Unden 20% EC	Bayer	Hayleys
Azinphos-methyl	Guasthion 20% EC	Bayer	Hayleys
Binapacryl	Acricid 50% WP	Hoechst	Mackwoods
Bromophos-ethyl	Nexagan EC 80	Cela	Ceypag
Bromophos-methyl	Nexion EC 40	Cela	Ceypag
Carbophenothion	Trithion 2 E	Stauffer	Petroleum Corp
Chlordane	Intox 8 (70% EC)	Sandoz	Baurs
Chlorfenvinphos	Sapecron EC 50	Ciba	Baurs
Chlorfenvinphos	Birlane 24% EC	Shell	Shell
Chlorphenamidine	Galecron EC 50	Ciba	Baurs
Dichlorvos	Vapona 48% EC	Shell	Shell
Dichlorvos	Nogos 100% EC	Ciba	Baurs
Dicrotophos	Carbicron 50% EC	Ciba	Baurs
DDT	Arkotine D-18	Shell	Shell
DDT	Deenol EC 25	Baurs	Baurs
Demeton-methyl	Metasystox R 20% EC	Bayer	Hayleys
Dicofol	Kelthane MF 42% EC	Rhom & Hass	Mackwoods, Shell
Dieldrin	Dieldrex-20	Shell	Shell
Dimethoate	Rogor-40 (30% EC)	Fisons	Fisons
Dimethoate	Roxion EC 40	Cela	Ceypag
Ethion	Ethion 48% EC	FMC	Petroleum Corp
Ethylene dibromide	Dowfume W-85	Dow	Harrisons & Crosfield
Endrin	Endrex-20	Shell	Shell
Fenitrothion	Folithion EC 50	Bayer	Hayleys
Fenitrothion	Sumithion EC 50	Sumitomo	Shell
Fenthion	Baytex 40% WP	Bayer	Hayleys
Fenthion	Labaycid 50% EC	Bayer	Hayleys
Heptachlor	Heptachlor 2 E	Velsicol	Baurs
Methiocarb	Mesurol 75% WP	Bayer	Hayleys
Phosalone	Zolone 35% EC	Rhone-poulenc	Baurs
Phosphamidon	Dimecron 50% EC	Ciba	Baurs
Sulphur	Thiovit	Sandoz	Baurs
S-6538	S-6538 25% EC	Sandoz	Baurs
S-6607	S-6607 25% WP	Sandoz	Baurs
SD-3562	Bidrin 85%	Shell	Shell
SD-8447	Gardona 50% WP	Shell	Shell
SD-9129	Azodrin 56% EC	Shell	Shell
Tetradifon	Tedion V-18	Duphar	Mackwoods
Vamidothion	Kilval 40% EC	Rhone-poulenc	Baurs
Oxythioquinox	Morestan WP 25	Bayer	Hayleys

Visits, Lectures and Symposia

DANTHANARAYANA, W. — "Ways to economize on insect and mite pest control." at the Tea Centennial Conference at Radella in May.

DANTHANARAYANA, W. — "Shot-hole borer control with heptachlor" to the Kegalla Planters' Association at Kegalla in November.

DANTHANARAYANA, W — "The biology and control of the Twig Caterpillar (*Ectropis bhurmitra* Wlk.) on tea" at the 23rd Annual Sessions of the Ceylon Association for the Advancement of Science at Colombo in December.

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Acknowledgements

The co-operation of the Superintendents and Assistants of estates on which experiments were carried out is gratefully acknowledged. The help of the Statistician and his assistant in the design of the experiments and their analysis is acknowledged. Our thanks are also due to all firms which provided free samples of pesticides for experimental purposes.

REPORT OF THE BIOCHEMISTRY DIVISION

Biochemist — R. L. Wickremasinghe, BSc, PhD, FRIC

General

Mr V. H. Perera, Technical Assistant, resigned from the Institute on 30th April. He was replaced by Mr M. H. Rodrigo on 1st July, but this officer too resigned on 26th December. Mr R. R. Selvendran, Research Assistant, was awarded a doctorate by the University of Cambridge, and in recognition of his good work, was also awarded the Broodbank Post-doctoral Fellowship. He will be spending a further year at Cambridge as the Broodbank Fellow, and during this time he will work exclusively on biochemical problems relating to tea.

The designation of Dr A. S. L. Tirimanna was changed from Research Officer to Biochemist (Flavour Research) on 4th December.

The Biochemist, accompanied by Dr A. S. L. Tirimanna, visited Japan during August. The purposes of the visit were to meet Japanese scientists and discuss research work of mutual interest, and also to attend the sessions of the Seventh International Congress of Biochemistry in Tokyo, where the Biochemist read a paper dealing with the polyphenol-oxidase of tea.

At the end of the year, Dr Tei Yamanishi, Professor of Food Chemistry at the Ochanomizu University, Tokyo, arrived at the TRI, where she spent about six weeks working on the gas chromatographic analysis of the chemical compounds responsible for tea flavour. She is acknowledged throughout the world as an authority on the chemistry of flavour, and we are indebted to the Techinical Expert Service of the Asia Productivity Organization, which made possible her stay at the TRI.

Laboratory Investigations

Chemical analyses of tea samples

Numerous analyses were made of samples of tea flush, dhools, black and green teas for polyphenols, amino-acids, theaflavins and thearubigins.

K. P. W. C. Perera & U. L. L. de Silva

Effects of storage on the chemical constituents of tea

Tea samples stored under different conditions were analysed for moisture content, total polyphenols, vanillin-reacting polyphenols. amino-acids, epigallocatechin gallate, epicatechin gallate, theaflavins and thearubigins. The analyses were carried out at intervals of seven to fourteen days over a period of four months, and each sample was also sent to the Technology Division for report by the Tea Taster.

The results confirmed earlier findings that there was a progressive increase in quality and theaflavins during the first three weeks of storage. Exposure to light appeared to be detrimental, and it was also found that there was an inverse relationship between the levels of thearubigins on the one

hand, and amino-acid and polyphenols on the other. The levels of epigallocatechin gallate and epicatechin gallate varied markedly during storage and the cause for these variations is being investigated. The results outlined above were presented and discussed at the Annual Sessions of the Ceylon Association for the Advancement of Science (CAAS).

C. H. Wickremesinghe & K. P. W. C. Perera

Coenzyme A and manganese levels of tea flush

In view of the possible importance of Coenzyme A and manganese in the development of tea flavour, quantitative determinations were carried out at about four weekly intervals, in order to determine the effect of climatic conditions on their levels. At the same time, the amount of total sulphydryl groups was estimated. Coenzyme A was determined by the pigeon liver transacetylase method (Kaplan and Lipman 1948), which had to be modified before it could be applied to the analyses of tea flush. Manganese and total sulphydryl were estimated by chemical methods. The results indicated that in both Dimbula and Uva estates, the levels of Coenzyme A and manganese were higher during the flavoury than during the non-flavoury season. In Uva the levels of manganese were always very much higher than those in Dimbula. The results of this investigation were presented at the annual sessions of the CAAS.

B. P. M. Perera & U. L. L. de Silva

Enzymes of tea

Three different enzymes of tea were studied in some detail - polyphenoloxidase, phosphatase and transaminase. The work on the localization of the polyphenol-oxidase in the tea leaf was completed, and the results obtained by staining leaf sections with fluorescent polyphenol-oxidase antibody were confirmed in leaves which had been caused to 'brown' by treatment with chloroform vapour, and by alternate freezing and thawing. Examination of leaves of different ages showed that older leaves contained polyphenol-oxidase in the lower epidermis only, whereas the first and second leaves showed the presence of enzyme in both the upper and lower epidermis. The results of this work were accepted for presentation at the sessions of the Seventh International Congress of Biochemistry, where the Biochemist described the findings. These studies were further continued using enzyme extracts of leaves of similar age, freed of polyphenols with Polyclar as described by Sanderson (1964). The results showed firstly, that there were differences between low-grown and high-grown leaves, and secondly that the enzymic conversion of epigallocatechin gallate to theaflavin was not a straightforward reaction. Starch gel electrophoresis of the polyphenol-oxidase revealed that it consisted of five isoenzymes.

Separation of the acid phosphatases of tea leaf by starch gel electrophoresis showed the presence of six bands, possibly isoenzymes, and this work was presented at the Annual Sessions of the CAAS and is being published in The Tea Quarterly.

Tea leaf was found to contain a transaminase system, which required leucine, valine or α - alanine as amino-acids, with α - ketoglutaric acid as the amino group acceptor. Paper chromatographic methods were used in this study and the results were presented at the Annual sessions of the CAAS.

A. S. L. Tirimanna, G. R. Roberts, B. P. M. Perera & U. L. L. de Silva

Site of biosynthesis of theanine

Experiments using radioactive carbon dioxide showed that theanine, which is quantitatively the predominant amino-acid of tea, was biosynthesized in the roots of the tea plant, and transported therefrom to the flush. Autoradiographic techniques were used in this study and the results are in agreement with those of workers in Japan (Kito, Lokura, Izaki & Sasaoka 1966), who arrived at the same conclusion by using a different technique.

K. P. W. C. Perera

New chromatographic spray for the detection of catechins

Catechins were found to give a very stable red colour on spraying chromatograms with 2:4:6 trinitrophenol in alkaline conditions. This colour reaction appears to be specific for catechins and is also an extremely sensitive test for this group of compounds. The results were presented at the annual sessions of the CAAS.

A. S. L. Tirimanna & K. P. W. C. Perera

Study of the guanidino compounds of tea

Three compounds giving the characteristic reaction for guanidino compounds were detected on paper chromatograms of tea extracts. Two of these compounds occurred in very low concentration, whilst the third, (possibly a mono-substituted guanidino compound), appeard to be present in appreciable amounts.

A. S. L. Tirimanna

Changes in tocopherols during tea manufacture

Qualititative and quantitative studies of the tocopherols were carried out during the different stages of tea manufacture. Qualitatively, the picture was the same during the stages of withering, fermenting and firing, but there appeared to be a slight increase in the total tocopherol content during fermentation, possibly due to the release of free tocopherol from bound forms. The results of this investigation were submitted to the Seventh International Congress of Biochemistry.

A. S. L. Tirimanna & K. P. W. C. Perera

Microbiological studies of tea leaf flora

A study was made of the changes in the quantitative and qualititative aspects of tea leaf flora. The purpose of this study was to determine the effect of season on the microbial populations of tea leaves, and the results indicated that there were marked changes depending on the prevailing climatic conditions.

V. H. Perera & M. H. Rodrigo

Upgrading of the quality of low-grown tea

A method was devised for the upgrading of the quality of low-grown tea, and negotiations are under way with the National Research Development Corporation in London for the patenting of the method. The upgrading is based on fundamental biochemical principles, and the technological details were worked out in close collaboration with the Technologist, Dr D. Kirtisinghe.

Instant Tea

The theory of a process for the production in the laboratory of an instant tea, soluble in cold water, has been developed.

Visits, Lectures and Symposia

1. TIRIMANNA, A. S. L. — "Aroma complex with special reference to tea—at the Tea Centennial Conference at Radella in May.

2. TIRIMANNA, A. S. L. — "The separation of the acid phosphatases of the tea leaf by horizontal starch gel electrophoresis"—at the 23rd Annual Sessions of the CAAS at Colombo in December.

3. TIRIMANNA, A. S. L. & PERERA, K. P. W. C. — "A new chromatographic spray for the detection of catechins"—at the 23rd Annual Sessions of the CAAS at Colombo in December.

4. WICKREMASINGHE, R. L.—"Aspects of the biochemistry of tea manufacture"—at the Tea Centennial Conference at Radella in May.

5. WICKREMASINGHE, R. L., ROBERTS, G. R. & PERERA, B. P. M.—"The localization of the polyphenoloxidase of tea leaf"—at the Seventh International Congress of Biochemistry at Tokyo, in August.

6. WICKREMASINGHE, R. L.—"Recent advances in the chemistry of tea"—at the Symposium on "Chemistry in Food and Agriculture", organised by the Chemical Society of Ceylon and the Royal Institute of Chemistry (Ceylon Section), at Colombo in September.

7. WICKERMASINGHE, R. L.—Interviewed by the Ceylon Broadcasting Corporation on the Biochemistry of tea in the programme entitled "Science Survey", at Colombo in October.

8. WICKREMASINGHE, R. L., PERERA, B. P. M. & DE SILVA, U. L. L.—"Coenzyme A and manganese levels in tea flush"—presented by B. P. M. Perera at the 23rd Annual Sessions of the CAAS at Colombo in December.

9. WICKREMASINGHE, R. L. & PERERA, K. P. W. C.—"Studies of some of the chemical changes occurring during the storage of black tea"—presented by K. P. W. C. Perera at the 23rd Annual Sessions of the CAAS at Colombo in December.

10. WICKREMASINGHE, R. L. & DE SILVA, U. L. L.—"Studies of the transaminase and polyphenoloxidase of tea flush"—presented by U. L. L. de Silva at the 23rd Annual Sessions of the CAAS at Colombo in December.

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TIRIMANNA, A. S. L., WICKREMASINGHE, R. L. & PERERA, K. P. W. C. (1967). An anti-oxidant in tea. *Tea Q.* **38**, 36-39.

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REPORT OF THE TECHNOLOGY DIVISION

Technologist — D. Kirtisinghe, BSc, PhD, DIC, C Eng, AMIChemE

General

Mr W. Joseph returned to Ceylon from the UK in May, after successfully completing a course of training arranged by the Confederation of British Industries. Mr N. M. Abdul Gaffar was appointed Research Assistant in April. Dr P. Sivaprakasapillai joined the staff of the Technology Division as a Research Officer in June, but resigned from service in October.

Mr C. Kandappah was transferred to the TRI Low-Country Station in September to relieve Mr T. F. Saldin who left for post-graduate study in Canada under the sponsorship of a Commonwealth Scholarship.

Correspondence on problems relating to manufacture and the bulk of the factory visits were handled from Talawakele. Factory visits in the low country were, however, made from the Ratnapura Station.

In addition to the evaluation of manufacturing properties from experiments, the Technology Units at the Mid-Country and Uva Stations undertook clonal manufactures and quality evaluation of estate selections from those districts. The Unit at the Kottawa Substation was made functional in August.

Factory Experiments

Experiments **T1** to **T3, T5** to **T17, T21** and **T25** have been concluded.

High-country experiments (*St Coombs*)

T4 — *Quality assessment of new clones — (1966)*

The clones assessed for quality are classified in Table 1.

TABLE 1—*Quality assessment of new clones*

Classification Group	*Estate*	*Clones*	*Remarks*
A 1	Harrow	8/2	*
A 1/2	Gartmore	B 18, B 3, B 7	*
	Harrow	12/1, 1/3, 11/6, 17/4, 10/4	*
	Liddesdale	LD 420	Nice quality
A 2	Bambrakelly	UC 15/10, UC 17/10, LC 3/12, UC 19/10	*
	Gartmore	B 15, B 2, B 5, B 25	*
	Harrow	11/1, 16/2, 2/1, 1/2, 10/3, 14/3, 5/1	*
	Liddesdale	LD 405 SL 2/1 LD 999	Infusions are somewhat disappointing, otherwise an useful tea maker
	Liddesdale	ESK 9/5	Fair all rounder
	Liddesdale	LD 512	Fair quality, but lacking in colour
	Liddesdale	ESK 6/11	Only an average clone barely making this grade
	Ragalla	B 275	Remarkably similar to 2024 with regard to infusion, colour, strength, quality and valuation
	St Coombs	TRI 2027	Slightly better quality than 2024

* Provisional classification only

S. Samarasingham & C. H. Wickremesinghe

T18 — *Handpicking, shearing and machine harvesting of seedling tea on* yield and manufacturing properties (**P28**) — (*1966*)

Pre-treatment tests carried out in 1966 had previously confirmed (Annual Report 1966) the homogeneity of the twelve selected seedling plots as regards manufacturing properties.

The plucking treatments which consisted of handpicking, shearing and machine plucking were then applied in four replicates in the field and manufactured at weekly intervals for eight months.

Results from the first twenty of these plucks are given in Table 2.

TABLE 2—*Effect of method of harvesting on manufacturing properties*

Treatment	Rating for manufacturing properties				Valuation (cents)
	Infusion	Colour	Strength	Quality	
Handpicking	5.6	5.2	5.1	5.8	264
Shearing	5.0	5.4	4.3	4.7	143
Machine plucking	4.2	5.0	3.2	3.1	42
LSD at $P = 0.001$					19

It can, therefore, be concluded that handpicking is very much superior to shear plucking which in turn is far better than machine plucking. The differences between the treatments are so great that any reduction in the cost of plucking by the use of this machine is probably more than offset by loss of valuation.

Inspection of the results indicates that these differences between the treatments are maintained even six months after the treatments are first applied.

T19 — *Handpicking, shearing and machine harvesting of VP tea (Clone TRI 2024) on yield and manufacturing properties* (**P29**) — (*1966*)

Pre-treatment tests carried out by handpicking all sixteen selected plots indicated that there were no differences detectable by tea tasting techniques between these plots. Four plucking treatments which consisted of handpicking, shear plucking and machine plucking with the Robin and Ochiai mechanical pluckers were then applied. The results obtained are given in Table 3.

TABLE 3—*Effect of method of harvesting on manufacturing properties*

Treatment	Number of tests	Rating for manufacturing properties				Valuation (Cents)
		Infusion	Colour	Strength	Quality	
Handpicking ...	104	4.89	4.71	4.45	5.50	208
Shear plucking ...	108	4.70	5.08	4.56	4.71	169
Robin machine ...	112	4.56	5.33	3.22	3.17	61
Ochiai machine ...	112	4.42	5.23	3.20	3.20	54

It is, therefore, evident that handpicking is superior to shear plucking which in turn is much better than mechanical plucking even on VP tea where growth is more regular and that the loss of valuation by each of these treatments is larger than any savings in the cost of production that could be anticipated by imposing these treatments.

R. L. de. Silva & S. Samarasingham

T20 — *Plucking rounds* cum *plucked unit on made tea characteristics* **(PH9)** — *(1966)*

This trial has been discontinued as the field operations have been abandoned by the Plant Physiology Division. Two manufacturing replicates were carried out, however, and the results are given in Tables 4 and 5.

TABLE 4—*Effect of length of plucking round on manufacturing properties*

Length of plucking round (Days)	Infused leaf	Rating for manufacturing properties			Valuation (cents)
		Colour	Strength	Quality	
7	6.6	5.5	5.1	5.7	208
10	6.0	5.2	5.2	5.7	207
14	6.5	5.2	5.2	5.6	208

TABLE 5 —*Effect of plucked unit on manufacturing properties*

Plucked unit	Infused leaf	Rating for manufacturing properties			Valuation (cents)
		Colour	Strength	Quality	
Bud + 1 leaf ...	6.58	5.25	5.00	6.16	218
Bud + 2 leaves ...	6.25	5.50	5.25	5.33	201
Bud + 3 leaves ...	6.16	5.18	5.25	5.50	204

These results cannot be analysed statistically and definite conclusions cannot be drawn because of the paucity of replicates.

U. Pethiyagoda & S. Samarasingham

T22 — *Tat withering under controlled conditions of temperature, humidity and airflow rate — (1966)*

No progress was made on this experiment in 1967 because of a breakdown in the withering machine.

A. Thevathasan

T23 — *The use of a Rotorvane Aerator — (1966)*

This experiment was conducted in order to determine the most suitable treatment for leaf which has just passed through a Rotorvane. For the purpose of this experiment, leaf with an outturn from 43 to 45% made tea to withered leaf was given a ten-minute preconditioning roll in an orthodox roller, a single pass through a Rotorvane with one reverse-pitched vane at the centre and with an Iris end plate. The leaf going over the roll breaker was given one or two orthodox rolls in order to reduce the big bulk to approximately 10%. The treatments applied were :

1 — Aeration immediately after rotorvaning

2 — No aeration, but the leaf is stored for 15 min in trolleys after rotorvaning and before roll breaking

3 — Leaf is sent into the roll breaker directly after rotorvaning without aeration and without storage.

The BOP, BOPF and D1 grades of tea were tasted and statistical analysis of results from both panels of tasters in Colombo as well as that from the TRI Taster reveal that there are no detectable differences between these treatments for all three grades of tea.

S. Samarasingham

T25 — *Oxygen injection for rotorvane manufacture — (1966)*

This experiment was carried out to determine whether oxygen injection into the barrel of a Rotorvane would produce a change detectable by the standard tea tasting techniques in the liquoring properties of tea. The withered leaf was given a ten-minute pre-conditioning roll in an orthodox roller followed by a single pass through the Rotorvane at the rate of approximately 1500 lb per hour with oxygen injection rates of 0, 3 and 9 litres per minute into the centre of the rotorvane barrel. A 60% dhool was then extracted by roll breaking over a No. 5 and No. 6 combination mesh from which samples for tea tasting have been drawn. An outturn of approximately 45% made tea to withered leaf was aimed at for each manufacture. The results are given in Table 6.

TABLE 6—*Effect of oxygen injection into Rotorvanes on the properties of made tea*

TRI Taster

BOPF Treatments	Ratings for manufacturing properties: Infusion	Colour	Strength	Quality	Valuation (cents)
I — 3L of O_2 per min ...	6.00	6.39	5.89	5.75	273.05
II — 9L of O_2 per min ...	6.00	6.53	5.83	5.72	273.88
Untreated control ...	6.03	6.53	5.89	5.75	270.55
LSD at $P = 0.05$ ...	NS	NS	NS	NS	NS
LSD at $P = 0.01$ ...	NS	NS	NS	NS	NS
BOP					
I — 3L of O_2 per min ...	5.58	6.08	5.86	5.61	260.00
II — 9L of O_2 per min ...	5.61	6.17	5.78	5.53	256.11
Untreated control ...	5.61	5.81	5.67	5.50	253.19
LSD at $P = 0.05$ ...	NS	0.2455	NS	0.0715	NS
LSD at $P = 0.01$ ...	NS	0.3261	NS	0.0950	NS

Colombo Tasting Panel

BOPF Treatments	Ratings for manufacturing properties: Infusion	Colour	Strength	Quality	Valuation (cents)
I — 3L of O_2 per min ...	6.00	8.43	7.00	6.61	252.32
II — 9L of O_2 per min ...	5.93	8.25	6.93	6.29	247·14
Untreated control ...	6.11	8.50	7.43	6.75	255.00
LSD at $P = 0.05$ ...	NS	NS	NS	NS	NS
LSD at $P = 0.01$ ...	NS	NS	NS	NS	NS
BOP					
I — 3L of O_2 per min ...	5.71	7.14	6.25	5.89	232.14
II — 9L of O_2 per min ...	5.78	6.96	5.89	5.86	233.04
Untreated control ...	5.01	6.89	6.11	5.78	235.00
LSD at $P = 0.05$ ...	NS	NS	NS	NS	NS
LSD at $P = 0.01$ ...	NS	NS	NS	NS	NS

With regard to BOPF, the TRI Taster and the Colombo panel were in agreement that oxygen injection had no detectable effect on the infusion or the liquoring characteristics of colour, strength, quality and also in overall valuation. The TRI Taster has shown a preference for the colour of the oxygen-injected leaf at the rate of 3 and 9 litres oxygen per minute over that of the untreated control and also for the quality of the oxygen-injected leaf at 3 litres oxygen per minute over that of the untreated control as well as that of the treated control at 9 litres oxygen per minute. Neither of these treatments, however, have affected overall valuations at the 5% level of probability.

With regard to the BOP samples, the findings of the Colombo tasters were somewhat different from those of the TRI Taster. The Colombo panel showed a slight preference for the treated samples with regard to infusion. This difference was not significant at the 5% level of probability. It would appear that it was significant at the 10% level of probability. There were, however, no significant differences even at the 20% level of probability for all other characteristics including both quality and valuations between the untreated samples and both treatments.

A. Thevathasan

1967 Experiments

T26 — *Handpicking, shearing and machine harvesting of low-jat seedling tea from Pedro Estate, Nuwara Eliya, on yield and manufacturing properties* (**P67**) — 4 treatments in 4 replicates in randomized blocks plucked weekly for 8 months — (*1967*)

This experiment was carried out on lines similar to **T19,** but on low-jat seedling tea.

The experiment has been concluded but results have yet to be analysed.

R. L. de Silva & S. Samarasingham

T27 — *Time of plucking on the liquoring characteristics of made tea* — 3 treatments manufactured in duplicate and replicated 6 times — (*1967*)

This experiment was carried out to determine whether the time of plucking has any bearing on the characteristics of the resulting tea. Three times of plucking (07.00 hr, 11.00 hr and 15.00 hr) were examined and the liquoring characteristics of both clonal and seedling teas were looked into. The experiment has been concluded. Analysis of the results is yet incomplete.

N. M. Abdul Gaffar

T28 — *Different combinations of vanes on dhool and grade outturns with rotorvane manufacture* — 4 replicates of 6 treatments — (*1967*)

This experiment was carried out to determine the effect of vane combinations with an iris end plate in the fully-open position on dhool and grade outturns. The six rotorvane treatments examined are outlined below :

Rotorvane treatments	Vane combinations
1	F,F,D,F,D,F,D,F,F
2	F,F,F,F,D,F,F,F,F,
3	F,F,F,F,F,F,F,F,F
4	F,F,C,F,C,F,C,F,F
5	F,F,F,F,R,F,F,F,F
6	F,F,R,F,R,F,R,F,F

F — Forward-pitched vane
R — Reversed-pitched vane
D — Distance piece
C — Conical vane

In all these treatments, the leaf was given a ten-minute preconditioning roll in a conventional roller followed by one rotorvane pass and two 30-min orthodox rolls.

The results are summarized in Table 7.

TABLE 7—*Effect of vane combinations on dhool outturns*

Treatments	1st dhool	2nd dhool	3rd dhool
1	50.7	23.9	14.4
2	48.4	23.8	19.1
3	49.0	20.3	21.1
4	53.8	23.2	15.0
5	48.0	22.1	21.0
6	63.1	19.5	11.4
LSD at $P = 0.05$	6.0	NS	5.9
LSD at $P = 0.01$	8.1	NS	8.0

Analysis of the results indicates no significant differences in the grade outturns between any of these treatments.

T29 — *Evaluation of the merits of preconditioning in mixed orthodox-rotorvane manufacture* — 6 replicates of 3 treatments — (*1967*)

This experiment is being out to study the effect of preconditioning withered leaf in an orthodox roller before rotorvaning in a programme of mixed orthodox-rotorvane manufacture.

The treatments applied were :

I Ten minutes preconditioning roll, one rotorvane pass and two × 30 min orthodox rolls

II No preconditioning roll, one rotorvane pass and two × 30 min orthodox rolls

III No preconditioning, two rotorvane passes

This experiment is in progress and the results are not yet available.

T30 — *Triturator trial* — 9 replicates of 3 treatments — (*1967*)

A series of trials were conducted with the Triturator to determine its suitability for use in Ceylon with normal St Coombs manufacture as a standard for comparison.

The following treatments were carried out :

1 Ten minutes preconditioning in orthodox roller without pressure, one triturator pass and two × 30-min rolls in orthodox rollers.

2 Ten minutes preconditioning in orthodox roller without pressure, two triturator, passes and one × 30-min roll in orthodox rollers.

The results are given in Table 8.

TABLE 8—*The effect of the use of the Triturator in conjunction with orthodox rollers*

Treatments	Average percentage of the made tea to the withered leaf	Average percentage of dhool outturns				Average percentage of grade outturns				Average rate of feeding		Average rate of flow of water		Room temperatures (°F)		Temperature (°F)					Rise in temperature of water (°F)	
		1st dhool	2nd dhool	3rd dhool	Big bulk	BOP	BOPF	DUST	Other grades	1st pass	2nd pass	1st pass	2nd pass			After preconditioning	After 1st pass	After aeration	After 2nd pass	After aeration	1st pass	2nd pass
1	41.3	43.2	27.3	19.1	7.7	63.2	12.4	7.7	15.5	1900 lb/hr	—	17300 cc/min	—	68	64	80.1	91.8	85.7	—	—	2.5	—
2	41.4	44.2	30.0	17.1	6.5	62.0	12.8	7.5	16.5	1900 lb/hr	2200 lb/hr	16400 cc/min	16300 cc/min	68	64	79.0	91.8	86.2	93.9	86.1	2.0	F2.2
Control	42.1	46.9	24.9	19.2	7.5	62.8	12.2	7.1	16.7	2000 lb/hr	—	—	—	67	63	79.4	84.5	81.1	—	—	—	—

The liquoring properties of teas were evaluated by a panel of tasters in Colombo and also by the TRI Taster. Their reports are summarized in Tables 9 and 10.

TABLE 9—*The effect of the use of the Triturator in conjunction with orthodox rollers as assessed by the TRI Taster*

Treatments	Ratings for properties of BOP					Valuation (cents)
	Infusion	Colour	Strength	Quality	Appearance	
1	5.67	5.61	5.05	5.39	4.17	228.33
2	5.33	5.61	5.17	5.11	3.50	219.44
Control	5.39	5.72	5.05	5.61	4.28	235.28
LSD at $P = 0.05$	0.25	NS	NS	0.22	0.25	NS
LSD at $P = 0.01$	NS	NS	NS	0.30	0.34	NS

Treatments	Ratings for properties of BOPF					Valuation (cents)
	Infusion	Colour	Strength	Quality	Appearance	
1	5.22	6.22	5.22	5.11	8.61	243.33
2	5.11	6.05	5.33	5.22	8.28	245.83
Control	5.28	6.22	5.28	5.39	8.44	243.89
LSD at $P = 0.05$	NS	NS	NS	NS	0.26	NS
LSD at $P = 0.01$	NS	NS	NS	NS	NS	NS

TABLE 10—*The effect of the use of the Triturator in conjunction with orthodox rollers as assessed by the Colombo panel of tasters*

Treatments	Ratings for properties of BOP				Valuation (cents)
	Infusion	Colour	Strength	Quality	
1	4.94	4.55	4.55	4.44	222.50
2	4.61	4.78	4.17	3.94	215.00
Control	5.11	4.89	4.72	4.55	232.50
LSD at $P = 0.05$	NS	NS	NS	NS	NS
LSD at $P = 0.01$	—	—	—	—	—

Treatments	Ratings for properties of BOPF				Valuation (cents)
	Infusion	Colour	Strength	Quality	
1	5.67	6.44	5.67	4.89	250.00
2	5.22	5.89	5.33	4.61	241.39
Control	5.28	5.78	5.72	4.78	247.78
LSD at $P = 0.05$	NS	0.55	NS	NS	NS
LSD at $P = 0.01$	—	NS	—	—	—

The TRI Taster found no significant differences with regard to the colour, strength and valuations between any of these treatments in the case of BOP, but he found that the standard St Coombs tea was superior to the other two manufactures with regard to appearance and quality. In the case of BOPF, the TRI Taster found no detectable differences between any of these treatments with regard to the liquoring properties. The Colombo tasters did not report detectable differences between any of these treatments in the case of BOP and BOPF.

A. Thevathasan

T31 — *Split fermentation of dhools during the Dimbula quality season on manufacturing properties* — randomized blocks, 3 treatments, replicated 11 times and each treatment repeated 3 times — (*1967*)

The following treatments were evaluated :

1 All dhools fired immediately after roll breaking

2 Split fermentation—short period on 1st and 2nd dhools, normal fermentation on the 3rd and 4th dhools

3 Control—2hr 15 min fermentation with a range of 50 min

The object of this experiment was to find out whether there is any real advantage in attempting a split fermentation during the height of the Dimbula season, with a four x 30-min programme of orthodox manufacture.

Statistical analysis of tasting reports from Colombo reveals no significant differences between the control and each of the treatments. The analysis of the reports from the TRI Taster are given in Table 11.

TABLE 11—*Effect of the split fermentation of dhools on manufacturing properties as assessed by the TRI Taster*

Treatments	Ratings for manufacturing properties				Valuation (cents)
	Infusion	Colour	Strength	Quality	
1	5.0	4.5	4.5	5.9	224
2	5.0	4.9	4.5	5.8	228
3	5.2	5.1	4.8	5.6	233
LSD at $P = 0.05$	NS	0.2	0.2	NS	NS
LSD at $P = 0.01$	NS	—	—	0.2	NS

It appears, therefore, that the TRI Taster preferred the colour of Treatment 3 (control) to that of Treatment 2 which in turn was preferred of Treatment. 1. The strength of the control sample was preferred to that of either treatment. These preferences neither affect quality nor overall valuations which indicates that there is nothing to gain by allowing extra-short fermentation of the early dhools or by cutting down the period of fermentation of all dhools to the shortest possible interval.

S. Samarasingham

T32 — *Drier project* — (*1967*)

Work on a new type tea drier got under way at the beginning of the year. Arrangements were made through the National Research and Development Corporation for a British engineering company to assist us with the design of the drier.

An investigation of the scope of the project and a preliminary design analysis were completed in February. A small quantity of tea dhools were flown out to the UK and tests carried out on an experimental rig in March. Further tests were carried out in the presence of the TRI Development Engineer in April, and the Director and Technolgist in July.

More dhools were flown out at regular intervals and the design reached its final stages in December. It is hoped to instal a prototype machine at St Coombs by May 1968.

W. Joseph

Low-country experiments (*St Joachim*)

LT1 — *The improvement of quality of low-grown leaf — (1966)*

Experiments carried out in 1967 have been mainly modifications of the process outlined in the Annual Report for 1966 to suit factories with orthodox rolling equipment. These experiments have so far not proved to be altogether successful.

LT2 — *Rotorvane manufacture in the low country — (1966)*

These experiments were not pursued in 1967 in order to give priority for experiments on Rotorvane-CTC manufacture (See **LT4**).

LT3 — *The effect of tat withering under controlled conditions of temperature, humidity and airflow rate — (1966)*

Equipment has not yet been installed and consequently no progress has been made with this experiment in 1967. It is proposed to abandon this experiments in favour of experiments on aspects of trough withering.

T. F. Saldin

1967 Experiments

LT4 — *Rotorvane-CTC manufacture in the low country — (1967)*

Initial trials and experiments with this type of manufacture were unsatisfactory as the teas failed to have the shotty appearance characteristic of CTC manufacture. Further trials with variations in preconditioning, feed rates, leaf standards etc still failed to produce teas with the right appearance. It was then concluded that the defect lay in the tooth profile of the CTC roller cutters and the rollers were regrooved to certain specifications. The teas produced were then found to be very satisfactory and commercial production of CTC teas commenced in November.

C. Kandappah & W. Joseph

LT5 — *GWA* trolley-fermenting of orthodox-rolled low-grown leaf* — 10 replicates of 4 treatments — *(1967)*

Experiments were carried out with a GWA trolley fermenter to determine whether the use of such a system would afford any advantages over that of the standard type of fermentation carried out on concrete tables.

This experiment was carried out with third dhools because the type of rolling carried out was such, as to make flowery grades out of the first and second dhools which sold on appearance and not on liquoring properties.

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*Obtained from George Williamson Africa Ltd.

Tasting results of the BOP and BOPF samples are given in Table 12.

TABLE 12—*Comparison of trolley and table fermenting for low-country leaf*

Treatments	Ratings for manufacturing properties of BOP Infusion	Colour	Strength	Quality	Valuation (BOP) (cents)
Table fermented	4.42	6.17	4.92	4.55	160.83
Samples from Top	4.50	6.00	4.83	4.55	158.33
Centre	4.42	5.92	4.92	4.45	160.00
Bottom	4.50	6.08	4.75	4.45	157.50
LSD at $P = 0.05$	NS	NS	NS	NS	NS
LSD at $P = 0.01$	NS	NS	NS	NS	NS

Treatments	Ratings for manufacturing properties of BOPF Infusion	Colour	Strength	Quality	Valuation (BOPF) (cents)
Table fermented	4.67	5.75	4.58	4.33	167.50
Samples from Top	4.67	5.83	4.83	4.50	166.25
Centre	4.67	5.92	4.67	4.50	165.00
Bottom	4.67	5.67	4.58	4.50	165.83
LSD at $P = 0.05$	NS	NS	NS	NS	NS
LSD at $P = 0.01$	NS	NS	NS	NS	NS

It can, therefore, be concluded that this type of system does not significantly alter valuations or the liquoring properties of the low-grown leaf over that of the table-fermented control.

T. F. Saldin & C. Kandappah

LT6 — *Temperature and duration of wither on liquoring characteristics of low-grown leaf*

This experiment was carried out to determine the influence of the following factors on the valuations and liquoring characteristics of low grown leaf:

Treatment 1 — leaf withered in 1 day under ambient conditions

Treatment 2 — leaf withered in 1 day, temperature kept at 70°F

Treatment 3 — leaf withered in 1 day, temperature kept at 60°F

Treatment 4 — leaf stored for 1 day and then withered in 1day under ambient conditions

Treatment 5 — leaf stored for 1 day at 70°F and then withered in 1 day at 70°F

Treatment 6 — leaf stored for 1 day at 60°F and then withered in 1 day at 60°F

There were no detectable differences in the infused leaf, strength, quality and also in overall valuation. The colour of the liquors, however, was affected as shown in Table 13.

TABLE 13—*Effect of temperature and duration of wither on the colour of liquors*

Treatments	Mean ratings for colour
1	7.25
2	6.79
3	6.96
4	7.62
5	7.00
6	7.42
LSD at $P = 0.05$	0.33

LT7 — *Evaluation of the performance of the MKFS* unit in the low country* — 6 replicates of 3 treatments — *(1967)*

This experiment was carried out to compare the liquoring characteristics of teas fermented in the MKFS unit with a table-fermented control. The FBOPFI and FBOPF grades were extracted from first dhools fermented in this unit and the BOP and BOPF samples were taken from third dhools fermented in this machine.

The treatments were as follows:

Control	—	standard table fermentation
I	—	MKFS unit fermentation for 2½ hr
II	—	MKFS unit fermentation for 3 hr

The samples extracted were tasted by the TRI Taster who found no significant differences between any of these treatments with regard to the properties of infused leaf and the liquoring characteristics of colour, strength, quality and valuation. The results are summarized in Table 13.

TABLE 13 —*Evaluation of the use of the MKFS unit on properties of made tea*

	Ratings for manufacturing properties				Valuation (cents)
FBOPFI	Infusion	Colour	Strength	Quality	
Control	5.33	3.17	2.33	2.20	73.33
Treatment I	5.17	3.17	2.50	2.33	76.67
Treatment II	5.00	3.17	2.50	2.50	74.17
FBOPF					
Control	5.67	5.67	4.67	4.50	167.50
Treatment I ...	5.50	5.50	4.67	4.33	161.67
Treatment II ...	5.33	6.00	4.67	4.50	167.50
BOP					
Control	5.33	5.00	4.33	4.17	138.33
Treatment I	5.33	5.33	4.50	4.17	142.50
Treatment II ...	5.33	5.33	4.67	4.60	145.83
BOPF					
Control	4.83	5.33	4.50	4.00	155.00
Treatment I ...	5.17	5.67	4.83	4.33	159.17
Treatment II ...	5.00	5.67	4.83	4.33	161.67

LT8 — *Live shade on manufacturing properties of tea* — 16 replicates of 2 treatments — *(1967)*

This experiment was carried out to determine the effect of shade and no shade on the liquoring characteristics of made teas and also the appearance of flowery grades.

This experiment has been concluded, but analysis is yet incomplete.

T. F. Saldin

* This unit was obtained from Walker Sons & Co. Ltd.

Mid-country experiments

MT1 — *Quality assessment of clones — (1966)*

Forty three clones have been tested for quality in the year under review and it is very interesting to note that clone MPA 1 which appears to grow very well at the Mid-Country Station has also emerged as an exceptionally good tea maker.

MT2 — *Live shade in the field on the liquoring characteristics of tea — (1966)*

The manufacturing properties of clones TRI 2021, TRI 2024, 3 DG, KP 204, MG/3B1 and W 3 in experiments **MVP2** and **MVP3** grown under conditions of shade and without shade were evaluated by the TRI Tea Taster.

No differences detectable by the standard tea tasting techniques were found between the shaded and unshaded plots with regard to the properties of brightness of infusion, colour, strength, quality and also in overall valuations.

MT3 — *Insecticidal taint trials — (1966)*

In collaboration with the Mid-Country Scientific Officer, taint tests were carried out on the insecticides heptachlor, carbicron. and C 8949. The teas manufactured from flush which had been sprayed with these insecticides were found to be free from taint.

T. A. Munasinghe

1967 Experiments

MT4 — *Plucking rounds* cum *plucked unit*

This experiment is being carried out to determine the effect on made tea characteristics of plucking rounds of four, six and twelve days combined with three standards of plucking comprising the bud and one leaf, the bud and two leaves and the bud and three leaves.

The experiment is in progress and no results are yet available.

T. A. Munasinghe

MT5 — *Gramoxone (and hand weeding in combination with 2 levels of nitrogen) on made tea characteristics* — 2 types of weeding combined with 2 levels of N replicated 10 times — *(1967)*

This experiment investigates liquor characteristics of made tea influenced by the various treatments in **MW1.** The experiment **MW1** on weed control consists of eight treatments, *viz* two frequencies of Gramoxone spraying ($\frac{1}{2}$ pint in 50 gallon water per acre at 2-month and 4-month intervals) and two frequencies of hand weeding (normal and when grown high) at two levels of nitrogen (100 and 200 lb per acre). The experiment is in progress.

MT6 — *Calcium ammonium nitate, Sulphate of ammonia and urea each at 3 levels and 3 levels of K on made tea characteristics* — 3 forms of N with 3 levels of K factorially combined *(1967)*

This experiment, carried out in conjunction with the District Advisory Officer (Mid Country) studies the effect of calcium ammoniam nitrate, sulphate of ammonia and urea, each at 3 levels and in combination with 3 levels

of potash, on liquoring characteristics of made tea. Pre-treatment tests are being carried out for inherent variations between the plots selected for this experiment.

T. A. Munasinghe & M. K. Vythilingam

MT7 — Age *from prune on the characteristics of made tea* — 3 treatments replicated to a minimum of 15 manufactures (*1967*)

The aim of this experiment is to determine the liquoring characteristics of made tea in relation with age from pruning. This experiment is in the pre-treatment stage.

T. A. Munasinghe

Uva experiments

UT1 — *Quality assessment of clones — (1966)*

Sixty seven clones and mother bushes were tested for quality during the period under review. None of the clones tested came up to the standard of an A 1 quality clone. The clones MTBG and DG 39 have, however, been provisionally classified in the A1/2 group.

UT2 — *Live shade in the field on the liquoring characteristics of tea* (**UVP1**) — (*1966*)

This experiment was carried out on clones DT 1, TRI 2024 and CY 9 and grown under shade and without shade.

The results from this experiment are given in Table 14.

TABLE 14—*Effect of live shade in the field on manufacturing properties*

Treatments	Ratings for manufacturing properties				Valuation (cents)
	Infusion	Colour	Strength	Quality	
Shaded	5.0521	6.8645	5.0208	5.2500	223.48
Unshaded	4.9688	6.7604	4.8646	5.2083	216.66
LSD at $P = 0.05$ ...	NS	0.1379	0.0723	NS	2.79

From the averages of the various characteristics, it is seen that the teas from the shaded plots have done somewhat better than those from the unshaded plots. Although, at first sight, it would seem that this is a reversal of the findings at St Coombs (**T2**) closer examination shows that there is a shade-clone interaction for some of these characteristics.

Further tests are necessary to examine the homogeneity of the plots after the shade is lopped before definite conclusions are drawn.

UT3 — *Length of plucking rounds on made tea characteristics — (1966)*

This experiment was conducted to determine the influence on made tea characteristics of plucking rounds of six, eight, and ten days on TRI clones 2024, 2025 and 2026.

Twelve replicates have been completed so far.

1967 Experiment

UT4 — *Influence of the plucked unit on made tea characteristics* — 10 replicates of 3 types of plucked units — (*1967*)

This experiment was conducted in conjunction with the Plant Physiology division to determine the effect on made tea characteristics of three standards of plucking, *viz* — bud and one leaf, bud and two leaves as against normal plucking.

The experiment is in progress.

M. T. Subramaniam

Visits, Lectures & Symposia

Dr Kirtisinghe addressed the Tea Centennial Conference on "Quality and economy for the production of tea". Mr W. Joseph addressed two District Planters' Associations on various aspects of machinery, design and maintenance.

Dr Kirtisinghe was sent as a delegate to the sessions of the International Standards Organization held in the USSR in June as one of Ceylon's representatives on the working group committee on tea. He also visited some engineering firms in the UK in connexion with development projects on tea machinery.

Acknowledgements

The help and co-operation willingly given to us by several tea tasters in Colombo is gratefully acknowledged. Our thanks are also due to Mr P. Kanapathipillai, Statistician, for help and guidance with regard to experimental design and analysis.

Publications

KIRTISINGHE, D. (1967a). Some aspects of tea culture in Kenya and Uganda. *Tea Q.* **38**, 3-9.

KIRTISINGHE, D. (1967b). The manufacture and marketing of tea in Kenya and Uganda. *Tea Q.* **38**, 10-21.

KIRTISINGHE, D. (1967c). The yesterday, today and tomorrow of tea manufacture. *Tea Q.* **38**, 200-204.

KIRTISINGHE, D. (1967d). Quality and economy in the production of tea. *Tea Q.* **38**, 289-292.

REPORT OF THE STATISTICS DIVISION

Statistician — P. Kanapathipillai, BSc, FSS

General

The staff position continues to be the same as last year and is manned by the Statistician and one technical assistant.

Designs and analyses

Composite designs

The possibility of using composite designs at St Joachim to ascertain the optimum combination of fertilizers was mooted. For various technical reasons, the Statistician advised against the use of these designs. Subsequently, Dr S. C. Pearce of the East Malling Research Station, UK, confirmed the unsuitability of this class of designs for use on perennial crops.

Throughout the year the Division was solely concerned with the design, analyses and statistical interpretation of field, factory and laboratory experiments. In all, 240 experiments were analysed. The breakdown of these experiments into the types of design, mode of analyses, together with the ranges of their co efficients of variation is given below :

Type of design	*Number of experiments analysed*	*Mode of analysis*	*Range of coefficients of variation*
Randomized blocks (with suitable transformations where necessary)	212	analysis of covariance	13.0%—47.4%
Randomized blocks (with suitable transformations where necessary)	7	analysis of covariance	2.5%— 5.9%
Split-plot	6	analysis of covariance	10.3%—24.2%
3^3 single replicate in blocks of 9 plots	14	analysis of covariance	5.5%— 9.0%
3^4 single replicate in blocks of 9 plots	1	analysis of covariance	13.9%

Extension Experiments

The independent variate in these trials was the yield of each experimental plot prior to the treatments being imposed. In the high country, these yields were recorded for three consecutive months, *ie* about 12 plucks in all. In Uva, however, pre-treatment yields were recorded for a six-month period. The gain in precision of the experiment due to covariance analysis for some of the estates is given below :

High Country		*Uva*	
Name of estate	*Gain in precision*	*Name of estate*	*Gain in precision*
Brunswick	884%	Hugoland	717%
Mayfield	825%	Spring Valley	681%
Hauteville	276%	Cannavarella	288%
Ederapola	211%	Telbedde	173%
Holyrood	173%		

It is clear that there has been very substantial gains in precision ranging from almost twice the value (before the adjustment of yields by covariance) to about nine-fold in the case of the experiment at Brunswick.

Wherever degrees of replication varied from treatment to treatment, partitioning of sums of squares into single degree-of-freedom components was done according to methods suggested by Dr Pearce.

REPORT ON THE LOW-COUNTRY STATION AND THE KOTTAWA SUBSTATION

Assistant Director — L. H. Fernando, BSc, PhD

General

The Low-Country Station, St Joachim, Ratnapura.

Dr D. T. Wettasinghe, Research Officer, assumed duties at the Low-Country Station in March 1967 and was promoted to the senior staff grade in November 1967. In the absence of the Advisory Officer, Mr J. V. Sabanayagam, who was on study leave in Canada, Dr Wettasinghe covered the advisory work, in addition to his programme of research. Mr H. H. Samarakoon continued to assist in the advisory work. Mr T. F. Saldin left Ceylon in September 1967 on a Colombo Plan Scholarship for post-graduate training in Technology in Canada, and was replaced by Mr C. Kandappah, who was transferred from St Coombs. Mr U. P. de S. Waidyanatha was awarded the MSc Degree of the University of Ceylon in July 1967 on his thesis "The chemical control of weeds in tea in the low country of Ceylon". Mr C. Kirthiratne, assumed duties as Administrative Officer at St Joachim in April 1967.

The Kottawa Substation, Talgampola, Galle District

Mr K. H. G. Gunapala remained in charge of the Substation. Steady progress was maintained. The Substation was extended by ten acres. The results of experimental work are described in this report.

Advisory Service

The Research Officer and Assistant Director visited estates and addressed Planters at their District Associations. The Senior Staff at St Coombs collaborated with the staff at St Joachim in three consecutive Field Days at the Low-Country Station, in the week following the TRI Centennial Conference at Radella and St Coombs.

With the suspension of dieldrin spraying on estates, the incidence of pest outbreaks in low-country tea were far less than in the previous year. The Low-Country Live-Wood Termite was a problem on some estates, and the Entomologist at St Coombs was called in to investigate more effective methods of control. Diseases of tea were not serious. Rim Blight continues to occur in dry weather, following pruning or fertilizer application.

Estates using Gramoxone have reported the predominance of weeds such as *Paspalum conjugatum* and *Spermacoce latifolia*. Nevertheless, some estates have now developed effective weed control programmes by supplementing the regular rounds of half pint Gramoxone in 50 gallons of water applied six times per year, with additional applications of Gramoxone and/or alternate rounds of weeding by labour.

Advice on fertilizer applications on estates was given in accordance with the recent results of low-country experiments. An attempt was made to maintain high yields with adequate levels of nitrogen and to save on costs by reducing the quantities of phosphorus, potassium and magnesium that were sometimes used in excessive quantities when fertilizer mixtures were used for high-yielding tea.

Recent results indicate the possibility of replanting tea after tea without reconditioning of the soil in the low country. It should be emphasized, however, that severely eroded soils need reconditioning before replanting of tea.

Weather conditions were generally favourable in 1967, and it was observed that replanting programmes were successfully implemented. The clones TRI 2023 and TRI 2026 are still the best in the low country.

Experiments on estates have proved very successful and valuable results have already been obtained, with the whole-hearted co-operation of low-country estates.

Pot Experiments

Levels of N, P and K on young plants of TRI 2023 — (1967)

In a preliminary investigation, eight levels each of nitrogen (0—800 lb per acre per year), phosphoric acid (0—250 lb per acre per year) and potash (0—640 lb per acre per year) were applied to young plants of clone TRI 2023 growing in pots. It is intended to study the N, P, K contents of flush shoots and mature leaves in relation to the level of fertilizer application.

D. T. Wettasinghe & N. S. Rajendram

Nursery Experiments

Rooting and growth of cuttings in various soils, contained in polythene sleeves— (1967)

Soils :	Jungle soil	...	pH 5.2
	Rubber soil	...	pH 5.2
	Tea soil	...	pH 5.0
	Red subsoil	...	pH 5.2

Clones : TRI 2023 and TRI 2026

Red subsoil was the best rooting medium. Cuttings callused and rooted in two weeks in the red subsoil, but took three or more weeks in the other soils. In the tea soil, rooting was poor. Up to five months from planting, the shoot growth was best in the red subsoil, but thereafter growth was slow. Combinations of red subsoil in the top one third of the polythene sleeve with jungle or rubber soil below showed better shoot growth than the red subsoil alone. The performance of cuttings in tea soil alone or in combination with red subsoil above was poor.

D. D. Kroon

Field Experiments and Trials

The experiments on fertilizer and rehabilitation were done in collaboration with Mr J. A. H. Tolhurst, Agricultural Chemist; the experiments on pruning with Dr U. Pethiyagoda, Plant Physiologist; and the work on selection and testing of clones with Mr A. V. Richards, Adviser in Plant Propagation. The following experiments have been concluded : **LA6, LA15, LA30, LPH1, LW1, LW2, LW3, LW4, LW6, LW7** and **LW8.**

LA1—*NPKMg on seedling tea at Endane Estate, Kahawatte — (1955)*

The results of the two-year cycle 1965-67 are presented in Table 1.

TABLE 1—*Yield in the cycle (1965-1967) at Endane*

Treatments (lb per acre per year)		Mean yield of made tea in lb per acre per year: First year of cycle (lb)	(%)	Second year of cycle (lb)	(%)	Mean of first and second years of cycle (lb)	(%)
N	0	1539	100	1618	100	1578	100
	40	1556	101	1744	108	1650	105
	80	1558	101	1813	112	1685	107
P_2O_5	0	1545	100	1721	100	1633	100
	30	1539	100	1692	98	1615	99
	60	1569	102	1708	99	1639	100
K_2O	0	1541	100	1674	100	1607	100
	40	1556	101	1719	103	1638	102
	80	1557	101	1728	103	1643	102
MgO	0	1530	100	1694	100	1612	100
	20	1599	105	1721	102	1660	103
	40	1524	100	1706	101	1615	100
LSD ($P = 0.05$)		61	4	80	5	129	8

There was no response to fertilizers in the first year of the cycle and this confirms the results obtained in the previous cycles. It should be pointed out, however, that magnesium at 20 lb MgO per acre shows a significant increase in yield in the first year of the cycle. But there is no response at 40 lb MgO per acre. Moreover, there is no evidence of a response to magnesium in the second year of the cycle, nor is there a response when the yields of the first and second years are analysed together. Similarly, the response to nitrogen over the cycle fails to reach the 5% level of significance although there is a significant response in the second year of the cycle. Phosphate and potash have not increased yields confirming the results obtained in previous cycles.

A. A. C. Karunaratne

LA2—*NKMg and frequency of application on VP tea at Karapincha, Palmgarden Group, Ratnapura—(1961)*

The results of the third experimental cycle 1965 to 1967 are presented in Table 2.

TABLE 2—*Mean yields of made tea in lb per acre per year over the two-year cycle 1965-1967 at Karapincha, Palmgarden*

Treatments (lb per acre per year)		Yield per acre (lb)	(%)
N	75	3294	100
	150	3614	110
	225	3668	111
K_2O	50	3440	100
	100	3602	105
	150	3533	103
MgO	0	3493	100
	24	3546	102
	48	3537	101
Frequency of application per-cycle	7	3395	100
	9	3598	106
	11	3583	106
LSD ($P = 0.05$)		110	3

For the first time the response to potash is significant. Increasing potash from 50 to 100 lb per acre per year raised the yield by 5%, but increasing potash to 150 lb per acre did not increase the yield any further. As in previous years the response to nitrogen and to frequency of application are significant. Moreover, the interaction of nitrogen and frequency of application was significant, the highest yield being obtained with the highest level of nitrogen and the highest frequency of application.

At the end of the two-year cycle, 1965 to 1967, in consultation with the Manager of Palmgarden Group, it was decided to extend the cycle to three years. The plucking table at the end of two years was fairly high as no attempt had so far been made to keep it at the level required for three years of plucking. Nevertheless, because the need for the information on a three-year cycle was urgent and important, the cycle was continued into a third year. The results obtained at the end of two-and-half years indicate that yields in the third year are a little below the yields of the second year, but considerably more than the first year yields (Table 3).

TABLE 3—*Mean yield in lb per acre over successive six months periods in the 1965-1968 cycle at Karapincha*

First 6 months	Second 6 months	Third 6 months	Fourth 6 months	Fifth 6 months
530	2035	2334	2151	2127

N. Yogaratnam

LA3—*NPKMg shade on seedling tea at the Low-Country Station, Ratnapura—(1964)*

The results of the first 18 months of the second experimental cycle are presented in Table 4. The yields shown are those of 18 months and are rather low. The analysis of variance revealed significance in the response to magnesium.

TABLE 4—*Yield in lb made tea per acre in the first 18 months of the two-year cycle 1966-1968 at St Joachim*

Treatments (lb per acre per year)		Yield (lb per acre)	(%)
N	75	1321	100
	150	1326	100
	225	1336	101
P_2O_5	0	1342	100
	40	1308	97
	80	1354	101
K_2O	0	1286	100
	60	1356	105
	120	1361	106
MgO	0	1253	100
	24	1369	109
	48	1422	113
LSD ($P = 0.05$)		77	6
No Shade		1501	100
G.maculata shade at 14 ft x 14 ft		1331	89
G.maculata shade at 7 ft x 7 ft		1237	82
LSD ($P = 0.05$)		189	13

U. P. de S. Waidyanatha & H. H. Samarakoon

LA4—*NPKMg on VP tea at the Kottawa Substation—(1963)*

The yields obtained in the second year of plucking confirm the results reported last year. Yields were increased by 61% and 128% respectively when nitrogen was increased from 75 to 150 and 150 to 225 lb per acre per year. Sulphate of ammonia was far superior to urea formaldehyde and hoof and horn; for this reason sulphate of ammonia was used in all plots receiving nitrogen from the 8th July 1967. The yield was increased by 25% when 30 lb P_2O_5 per acre was applied ; increasing P_2O_5 to 60 lb per acre gave no further increase in yield. Fifty and 100 lb K_2O per acre per year increased yields by four and 10% respectively, Magnesium at 30 lb per acre did not increase yields, but 60 lb per acre raised the yields by 12%. Red Rust was severe on the plots without potash.

The experiment is being continued and the full results will be reported subsequently.

H. D. Jayasinghe

LA5—*Zn, N frequency of application on seedling tea at the Low-Country Station, Ratnapura—(1963)*

In the fourth six months of the cycle, 1965 to 1967, the yield with 125 and 200 lb N per acre per year was 19 and 26% respectively above the yield with 50 lb N per acre per year. Zinc sulphate at 10 lb per acre per year increased the yield by 26%, but there was no further increase in yield with 20 lb zinc sulphate per acre per year. When the results of the two-year cycle was analysed, however, the response to nitrogen and to zinc failed to reach the 5% level of probability. The results are shown in Table 5.

TABLE 5—*Mean yields of made tea in lb per acre over the two-year cycle 1965 to 1967*

Treatments (lb per acre per year)		Fourth 6 months (lb per acre)	(%)	Mean over 2 year cycle (lb per acre-per year)	(%)
N	50	670	100	1111	100
	125	799	119	1267	114
	200	843	126	1265	114
$ZnSO_4$	0	681	100	1135	100
	10	858	126	1295	114
	20	774	114	1212	107
Frequency of application per cycle	7	754	100	1198	100
	9	746	99	1194	100
	11	812	108	1251	104
LSD ($P = 0.05$)		108	14	240	20

E. J. B. de Silva

LA6—*Zn on seedling tea at Mahawela Estate, Ratnapura—(1963)*

In the second experimental cycle there was a 5 % increase in yield with 10 lb zinc sulphate per acre per year ; increasing zinc sulphate to 20 lb per acre per year did not effect any further increase in yield.

The experiment has now been terminated and the Institute expresses its appreciation of the help given by the Superintendent, Assistant Superintendent and Staff of Mahawela Estate.

J. I. H. Bandaranayake

LA7—*Rehabilitation : species and fertilizer at the Low-Country Station, Ratnapura—(1963)*

The tea was brought into plucking on the 21st May 1967. Any differences in the yield of tea arising from the various rehabilitation treatments will be examined statistically at the end of the first year in plucking.

LA8—*Rehabilitation with legumes at the Low-Country Station, Ratnapura—(1963)*

An assessment of the effect of the various legumes, used in rehabilitation, on the subsequent growth of tea was attempted by comparing weights of tea shoots removed at the time of tipping the tea. These results indicate the superiority of *Pueraria, Crotalaria, Tephrosia, Calapogonium* and *Desmodium* spp. over the other legumes (see Annual Report 1965). The yields of tea will be compared at the end of one year of plucking.

LA9—*Rehabilitation : species, fertilizer and duration at the Low-Country Station, Ratnapura—(1965)*

Yield records of the 27 plots that were in tea until September 1967 indicate no difference in yield between the three levels of nitrogen.

Nitrogen (lb per acre per year)	Yield of made tea (lb per acre per year)	(%)
0	806	100
40	811	101
80	818	101

These results are in agreement with those obtained last year (Annual Report 1966, p. 111).

The rehabilitation species were uprooted in October 1967 and the fresh weight of the shoots of Guatamala Grass was, of course, very much more than that of the legumes *Calapogonium, Crotalaria* and *Pueraria* spp. This material was used to determine the effect of mulching and forking by introducing another experimental factor at this stage, *viz* no mulch, mulch, mulch forked. All the experimental plots were planted in tea in November 1967 with the clones TRI 2026.

N. Yogaratnam

LA10—*6 clones at 3 levels of N and 3 levels of shade at the Low-Country Station, Ratnapura—(1965)*

All clones were cut across at 18 in. on 28th January 1967, tipped at 20 in. on 11th April and brought into plucking on 8th July. Differences in yield will be analysed at the end of one year of plucking. Clones TRI 2023, TRI 2026 and Ken 16/3 are the best so far.

LA11—*Bringing into bearing, plucking, pruning, levels of N and duration of cycle in VP tea at the Low-Country Station, Ratnapura—(1965)*

The yields of the first year of plucking indicate no significant differences between the nitrogen levels of 240, 320 and 400 lb per acre per year, nor between the three bringing-into-bearing treatments of one bending, two bendings and centering.

D. D. Kroon

LA12—*3 clones, 3 spacings and 3 levels of N at the Kottawa Substation—(1961)*

The tea was pruned in April 1967 at the end of the second experimental cycle. Clone TRI 2024 at a spacing of 4 ft × 2 ft gave the highest yield ; there was no significant difference in yield between 200 and 300 lb N per acre per year, but both these levels were better than 100 lb N.

LA13—*3 clones, 3 spacings and 3 levels of N at the Kottawa Substation—(1962)*

In the first eighteen months of the second experimental cycle there was no significant difference between the three clones TRI 2023, 18B and TRI 2026, nor between the three spacings 4 ft × 14 in., 4 ft × 28 in. and 4 ft × 42 in. Between the three levels of nitrogen, *viz* 100, 200, 300 lb per acre per year, the highest level gave the highest yield.

H. D. Jayasinghe

LA14—*Spacing and fertilizer on VP tea at the Low-Country Station, Ratnapura — (1965)*

The tea was cut across on 16th April 1967, tipped at 20 in. on 22nd September 1967 and brought into plucking on 9th November 1967.

D. D. Kroon

LA15—*Pruning of VP tea at the Low-Country Station, Ratnapura—(1964)*

This experiment was terminated.

N. S. Rajendram

LA16—*NPKMg frequency of application on VP tea at Hunuwella Group, Opanaike — (1965)*

The yields obtained in the first year of the first experimental cycle are presented in Table 6.

TABLE 6—*Mean yields in lb made tea per acre at Hunuwella over the first year (1966 to 1967) of the cycle*

Treatments (lb per acre per year)		First 6 months (lb per acre)	(%)	Second 6 months (lb per acre)	(%)	First Year (lb per acre)	(%)
N	120	1058	100	2461	100	3519	100
	240	1077	102	2743	111	3819	109
	360	1033	98	2751	112	3784	108
P_2O_5	0	1037	100	2660	100	3697	100
	30	1080	104	2660	100	3740	101
	60	1051	101	2634	99	3685	100
K_2O	0	1073	100	2674	100	3748	100
	60	1058	99	1668	100	3726	99
	120	1037	97	2612	98	3649	97
MgO	0	1102	100	2695	100	3796	100
	25	1051	95	2620	97	3671	97
	50	1016	92	2639	98	3655	96
Interval between applications (weeks)	6	1082	100	2781	100	3863	100
	8	1047	97	2692	97	3738	97
	10	1040	96	2481	89	3521	91
LSD ($P = 0.05$)		72	7	134	5	203	5

There were no significant differences between treatments in the first six months of the cycle. In the second six months the yield was increased by 11% when N was increased from 120 to 240 lb N per acre per year but not beyond this. Intervals of six and eight weeks between fertilizer applications were better than 10 weeks. There was no response to phosphate, potash or magnesium.

A. A. C. Karunaratne

LA17—*Types and levels of N, levels of dolomite on seedling tea at the Low-Country Station, Ratnapura—(1965)*

In the first six months after pruning in 1967, there was no significant difference in yield between the three forms of nitrogen, *viz* sulphate of ammonia, calcium ammonium nitrate and urea. Between the three levels of nitrogen, however, there was a significant difference in yield, 100 lb N per acre per year giving a higher yield than 200 and 300 lb N.

N. S. Rajendram & H. H. Samarakoon

LA18—*Rehabilitation with legumes at the Low-Country Station, Ratnapura—(1966)*

The legumes were uprooted and all plots were planted with Clone TRI 2026 on 20th November 1967.

N. Yogaratnam

LA19—*Bringing into bearing, plucking, pruning and duration of cycle in VP tea at the Kottawa Substation—(1966)*

The following bringing-into-bearing treatments were effected in the course of 1967 :

1 – one bending followed by cutting across at 14 in. and later at 16 in.

2 – two bendings followed by cutting across at 14 in. and later at 16 in.

3 – no bending but only cutting across at 14 in. and later at 16 in.

All plots were tipped at 19 in. in October 1967 and brought into plucking in December 1967.

H. D. Jayasinghe

LA20—*NPKMg and frequency of application on VP tea at Ratnayaka Group, Deniyaya—(1966)*

The tea was pruned on 8th January 1967. The yields obtained in the first year of the cycle, commencing January 1967, are given in Table 7.

Increasing nitrogen beyond 240 lb N per acre per year did not increase yields, nor was there any benefit from more than six applications of fertilizer per year. There was no response to the application of potash and magnesium. There was an indication of a response to phosphate.

LA21—*NPKMg and frequency of application on VP tea at Kobomella Group, Beralapantara—(1966)*

TABLE 7—*Mean yields in lb made tea per acre in the first year of the cycle (1967 to 1969) at Ratnayake Group*

Treatments (lb per acre per year)		Yield (lb per acre per year)	(%)
N	240	4936	100
	360	5010	102
	480	4908	99
P_2O_5	0	4847	100
	30	4977	103
	60	5030	104
K_2O	0	5006	100
	60	4901	98
	120	4947	99
MgO	0	4956	100
	25	4966	100
	50	4932	100
Interval in weeks between applications	8	4983	100
	6	4895	98
	4	4976	100
LSD ($P = 0.05$)		174	4

The tea was pruned on 30th March 1967. Yields obtained over the first six months of the cycle are presented in Table 8.

TABLE 8—*Mean yields in lb made tea per acre in the first six months of the cycle (1967 to 1969) at Kobomella Group*

Treatments (lb per acre per year)		Yield (lb per acre per year)	(%)
N	240	859	100
	360	963	112
	480	928	108
P_2O_5	0	913	100
	30	916	100
	60	921	101
K_2O	0	905	100
	60	922	102
	120	923	102
MgO	0	909	100
	25	917	101
	50	924	102
Interval in weeks between applications	8	891	100
	6	928	104
	4	931	104
LSD ($P = 0.05$)		36	4

There was a 12% increase in yield when nitrogen was increased from 240 to 360 lb per acre per year but not beyond this. Six weeks intervals in applications of fertilizer gave 4% more in yield, but there was no further improvement in yield with intervals of four weeks. Applications of phosphate, potash and magnesium did not increase yields.

LA22—*NPKMg and frequency of application on seedling tea at Anningkande Estate, Deniyaya—(1966)*

The yields obtained in the first year of the cycle commencing 22nd November 1966 are presented in Table 9.

TABLE 9—*Mean yields in lb made tea per acre in the first year of the cycle (1966 to 1968) at Anningkande Estate*

Treatments (lb per acre per year)		Yield (lb per acre per year)	(%)
N	100	2469	100
	200	2508	102
	300	2476	100
P_2O_5	0	2496	100
	30	2448	98
	60	2509	101
K_2O	0	2454	100
	60	2481	101
	120	2518	103
MgO	0	2516	100
	25	2506	100
	50	2431	100
Interval	10	2511	100
in weeks between	8	2470	98
applications	6	2472	98
LSD ($P = 0.05$)		73	3

There was no response to nitrogen beyond 100 lb per acre per year, nor was there any benefit from applications more frequent than ten weeks. The application of phosphate, potash and magnesium did not increase yields significantly. There was an indication of a response to potash.

LA23—*3 types of N, urea, calcium ammonium nitrate and sulphate of ammonia, 3 levels of N, 3 frequencies of application and 3 levels of dolomite on VP tea at Dankoluwa Estate, Pitabeddera—(1966)*

The yields obtained in the first year (1966 to 1967) of the cycle are presented in Table 10.

TABLE 10—*Mean yields in lb made tea per acre in the first year of the cycle (1966 to 1968) at Dankoluwa Estate*

Treatments		Yield (lb per acre per year)	(%)
N (lb per acre per year)	160	2707	100
	320	3368	124
	480	3535	130
Interval	8	3091	100
in weeks between	6	3234	105
applications	4	3285	106
Sulphate of ammonia		3204	100
Urea		3182	99
CAN		3224	101
Dolomite (tons	0	3104	100
per acre per year)	½	3256	105
	1	3250	105
LSD ($P = 0.05$)		365	11

Three hundred and twenty and 480 lb N per acre per year increased yields by 24 and 30% respectively over 160 lb N. Intervals of four and six weeks between nitrogen applications were 6 and 5% respectively better than an eight weeks interval. Between sulphate of ammonia, urea and CAN there was no significant difference in yield. Dolomitic lime at half and one ton per acre increased yields by 5%.

LA24—*3 types of N (urea, CAN and sulphate of ammonia), 3 levels of N, 3 frequencies of application and 3 levels of dolomite on VP tea at Deniyaya Estate, Deniyaya—(1966)*

The yields obtained in the first year (1966 to 1967) of the cycle are presented in Table 11.

TABLE 11—*Mean yields in lb made tea per acre in the first year of the cycle (1966 to 1968) at Deniyaya Estate*

Treatments		Yield (lb per acre per year)	(%)
N (lb per acre per year)	160	4091	100
	320	4759	116
	480	4925	120
Interval	8	4447	100
in weeks between	6	4690	105
applications	4	4638	104
Sulphate of ammonia		4607	100
Urea		4561	99
CAN		4607	100
Dolomite (tons	0	4283	100
per acre per year)	½	4751	111
	1	4741	111
LSD ($P = 0.05$)		125	3

Three hundred and twenty, and 480 lb N per acre per year increased yields by 16 and 20% respectively over 160 lb N. Intervals of four and six weeks between nitrogen applications were 4 and 5% respectively better than an eight weeks interval. Between sulphate of ammonia, urea and CAN there was no significant difference in yield. Dolomitic lime at half and one ton per acre increased yields by 11%.

LA25—*3 types of N urea, CAN and sulphate of ammonia, 3 levels of N, 3 frequencies of application and 3 levels of dolomite on VP tea at Enselwatte Group, Deniyaya—(1966)*

The yields obtained in the first year (1967) of the cycle are presented in Table 12.

TABLE 12—*Mean yields in lb made tea per acre in the first year of the cycle (1967-1969) at Enselwatte Group*

Treatments		Yield (lb per acre per year)	(%)
N (lb per acre per year)	160	4924	100
	320	5149	105
	480	5128	104
Intervals	8	5124	100
in weeks between	6	5056	99
applications	4	5021	98
Sulphate of ammonia		4997	100
Urea		5115	102
CAN		5089	102
Dolomite (tons	0	5095	100
per acre per year)	½	4960	97
	1	5146	101
LSD ($P = 0.05$)		260	5

Three hundred and twenty lb N per acre per year increased yields by 5% over 160 lb N. There was no benefit from fertilizer applications more often than once in eight weeks. Differences in yield between sulphate of ammonia, urea and CAN were not significant. Application of dolomitic lime did not increase yields.

LA26—*Methods of pruning, frequency of plucking and duration of cycle on VP tea at Handford Estate, Deniyaya—(1966)*

The first six months yields of the cycle 1967 to 1969 are presented in Table 13.

TABLE 13—*Mean yields in lb made tea per acre in the first six months of the cycle (1967 to 1969) at Handford Estate*

Treatments		Yield (lb per acre per year)	(%)
Frequency of Plucking (days)	4	696	100
	5	649	95
	6	629	92
Method of Pruning	Rim-lung	662	100
	Centre-lung	653	99
	Cut-across	659	98
LSD ($P = 0.05$)		25	4

Pruning was done in 1967 and three methods were compared *viz* rim-lung, centre-lung and cut-across. Differences in yield between these treatments were not significant over the first six months of the cycle. Plucking every four days gave a higher yield than plucking every five or six days. Provision has been made to compare two, two and a half and three year cycles in this experiment.

LA27—*Methods of pruning, frequency of plucking and duration of cycle on seedling tea at Anningkande Estate, Deniyaya—(1966)*

The first six months yields of the cycle 1967 to 1969 are presented in Table 14.

TABLE 14—*Mean yields in lb made tea per acre in the first six months of the cycle (1967 to 1969) at Anningkande Estate*

Treatments		Yield (lb per acre per year)	(%)
Frequency of Plucking (days)	5	694	100
	6	579	83
	7	609	88
Method of Pruning	Rim-lung	617	100
	Centre-lung	635	103
	Cut-across	631	102
LSD ($P = 0.05$)		29	5

Pruning was done in 1967 and three methods were compared *viz* rim-lung, centre-lung and cut-across. Differences in yield between these treatments were not significant over the first six months of the cycle. Plucking every five days gave a higher yield than plucking every six and seven days. Provision has been made to compare two, two and a half and three year cycles in this experiment.

J. I. H. Bandaranayake

LA28—*NPK, types of N and levels of lime on VP tea at Hapugastenne Group, Ratnapura—(1966)*

The results obtained in the first year 1966 to 1967 of the cycle are presented in Table 15.

TABLE 15—*Mean yields in lb made tea per acre in the first year of the cycle (1966 to 1968) at Hapugastenne Group*

Treatments		Yield (lb per acre per year)	(%)
Sulphate of ammonia		2913	100
Calcium ammonium nitrate		2908	100
Urea		2830	97
N (lb per acre—per year)	240	2747	100
	360	2847	104
	480	3057	111
P_2O_5	0	2888	100
	30	2875	100
	60	2888	100
K_2O	0	2865	100
	60	2885	101
	120	2900	101
Limbux (tons per acre per year)	0	2914	100
	½	2895	99
	1	2841	97
LSD ($P = 0.05$)		101	4

There is no significant difference in yield between sulphate of ammonia, calcium ammonium nitrate and urea. Four hundred and eighty lb nitrogen gave a higher yield than 360 lb and 240 lb. There was no response to applications of phosphate and potash, and the addition of limbux did not increase yields.

E. J. B. de Silva

LA29—*NPK and frequency of application on seedling tea at Sapumalkande Group, Dehiowita—(1966)*

The experimental cycle commenced on 25th October 1966, and the results of the first year are given in Table 16.

TABLE 16—*Mean yields in lb made tea per acre in the first year of the cycle (1966 to 1968) at Sapumalkande Group*

Treatments (lb per acre per year)		1st 6 months (lb per acre)	(%)	2nd 6 months (lb per acre)	(%)
N	120	462	100	2131	100
	240	471	102	2302	108
	360	469	101	2380	112
P_2O_5	0	478	100	2286	100
	30	462	97	2267	99
	60	461	96	2260	99
K_2O	0	489	100	2304	100
	60	465	95	2288	99
	120	448	92	2221	96
Intervals in weeks between applications	9	469	100	2231	100
	7	464	99	2289	103
	5	470	100	2292	103
LSD ($P = 0.05$)		14	3	94	4

In the first six months of the cycle there was no response to any of the fertilizer treatments. During the second six months, there was an 8% increase in yield when nitrogen was raised from 120 to 240 lb N per acre per year and a further increase in yield of 4% from 240 to 360 lb N per acre per year. The increase in yield observed with more frequent applications of fertilizer was not significant.

There was no response to applications of phosphate and potash.

N. Yogaratnam

LA30—*NPKMg and frequency of application on seedling tea at Talangaha Estate, Nakiyadeniya—(1966)*

This experiment was abandoned because of vacancies occurring in the plots after pruning as a result of termite damage.

LA31—*3 types of N (urea, calcium ammonium nitrate and sulphate of ammonia), 3 levels of N, 3 frequencies of application and 3 levels of dolomite on VP tea at Talangaha Estate, Nakiyadeniya—(1966)*

Pruning was done in 1967. The yields obtained so far have not been statistically analysed and are accordingly not presented in this report.

LA32—*3 types of N (urea, calcium ammonium nitrate and sulphate of ammonia), 3 levels of N, 3 frequencies of application and 3 levels of dolomite on VP tea at Talgaswella Estate, Talgaswela—(1966)*

Pruning was done in 1967. The yields obtained so far have not been statistically analysed and are accordingly not presented in this report.

H. D. Jayasinghe

1967 Experiments

LA33—*NPKMg and frequency of application on VP tea at Nil-Ella Estate, Morawaka* 3^5 factorial—*(1967)*

This experiment was initiated in 1967 but there are no results to report this year.

J. I. H. Bandaranayake

LA34—*NPKMg on VP tea at the Low-Country Station, Ratnapura* — 3^5 factorial — *(1967)*

Eighty one plots were planted with clone TRI 2023. The 81 treatment combinations of the following factors were assigned to the plots :

Fertilizer	Rate (lb per acre per year)
N	75
	150
	225
P_2O_5	0
	30
	60
K_2O	0
	50
	100
MgO	0
	30
	60

This experiment is similar to **LA4** and is intended to determine the effects of fertilizer levels on young VP tea from the time of planting.

N. Yogaratnam

LVP1 to **LVP5**—*Clonal testing at the Kottawa Substation—(1961-1965)*

The yields obtained in experimental plots are presented in the Report of the Plant Physiology Division and are, therefore, not repeated here.

H. D. Jayasinghe

LVP6—*Clonal testing at the Low-Country Station, Ratnapura—(1964)*

The yields obtained with clones CW 21, PCG 2, PUH 5, TRI 2021, Lansdowne bi-clonal seedlings MTBG, NK 4B 29, H 13/4, M 20 were encouraging (see Annual Report 1965, p. 41 ; Annual Report 1966, p. 115).

LVP7—*Clonal selection at the Low-Country Station, Ratnapura—(1965)*

The 220 clonal selections made at St Joachim were brought into plucking on the 23rd November 1967. Twelve clonal plants from each of 116 selected biclonal seedlings of TRI 2023 × TRI 2026 were planted in short rows in June 1967.

Of the 67 Endane seedlings only five continued to show promise and these were planted in short rows in 1967 (see Annual Report 1965, p. 41 ; Annual Report 1966, p. 115).

D. D. Kroon

LVP8—*Clonal selection at the Kottawa Substation—(1966)*

Two clones propagated from selected bi-clonal seedlings of TRI 2023 × TRI 2026 are outstanding. Some of these clonal selections were brought into plucking in 1967.

K. H. G. Gunapala

LVP9—*Clonal selection for drought resistance at Rye Estate, Balangoda—(1966)*

Of the 120 bushes that were selected for drought resistance, cuttings from only 33 were successful enough in the nursery. These were planted out in the field in short rows of ten plants each in November 1967. An attempt will be made to raise clonal plants of the other selections.

D. D. Kroon

LPH1—*Methods of pruning VP tea at the Low-Country Station, Ratnapura—(1965)*

This experiment has been terminated.

LPH2—*Methods of pruning seedling tea at the Low-Country Station, Ratnapura — (1966)*

The treatments are described fully in the Annual Report for 1966 (p. 116). The yields obtained in the first year of the cycle, 1966 to 1968, are presented in Table 17.

TABLE 17—*Mean yields in lb made tea per acre over the first year of the cycle (1966 to 1968) at St Joachim*

Treatments	Yield per acre	
	First 6 months	Second 6 months
Cut across at 24 in.	268	655
Rim-lung pruning at 18 in.	259	725
Centre-lung pruning at 18 in.	217	574
Rim-lung pruning with cleaning out of dead wood	105	444
Centre-lung pruning with cleaning out of dead wood	115	406
LSD ($P = 0.05$)	40	121

Recovery was quickest with cut-across pruning, and accordingly this gave the highest yield in the first six months after pruning, but in the second six months, rim-lung pruning resulted in a higher yield than cut-across pruning. Throughout the first year of the cycle, rim-lung pruning gave a higher yield than centre lung pruning.

LPH3—*Duration of lung retention on recovery from pruning and on yield in seedling tea at the Low-Country Station, Ratnapura—(1966)*

The treatments are described fully in the Annual Report of 1966 (p. 116). The yields obtained in the first 18 months of the cycle, 1966 to 1968, are presented in Table 18.

TABLE 18—*Mean yields in lb made tea per acre over the first 18 months of the cycle (1966 to 1968) at St Joachim*

Treatments	First 6 months	Second 6 months	Third 6 months
1 — Pruning without lungs	144	450	541
2 — Pruned and lungs removed after 4 weeks	262	635	773
3 — Pruned and lungs removed after 11 weeks at			
(a) Pruning level and tipped 4 in above this	325	695	753
(b) 4 in. above pruning level and tipped at this same level	297	710	910
(c) Pruning level and tipped 8 in. above this	267	644	812
LSD ($P = 0.05$)	54	103	106

In the first six months, the highest yield was obtained when lungs were removed at the pruning level after 11 weeks along with tipping 4 in. above pruning level. In the second and third six months, yields were highest where lungs were removed after 11 weeks, 4 in. above pruning level, with tipping also done 4 in. above the pruning level.

1967 Experiment

LPH4—*Duration of lung retention on recovery from pruning and on yield in seedling tea at the Low-Country Station, Ratnapura—6 randomized blocks—(1967)*

This experiment is similar to **LPH3.** Lungs were removed at regular intervals from four to twelve weeks. The tipping weights and yields obtained over the first six months after pruning are presented in Table 19.

TABLE 19—*Mean yields in lb made tea per acre over the first six months of the cycle (1966 to 1969) at St Joachim*

Treatments (Period of lung retention) (weeks)	Fresh weight of tippings (lb per 0.0235 acre plot)	Made tea per acre First 6 months (lb)
4	26.5	217
6	40.6	251
8	45.9	278
10	38.3	287
12	37.4	229
LSD ($P = 0.05$)	8	50

Lungs retained longer than eight weeks after pruning result in a depression of the tipping weight. This suggests that lungs should be removed by about the eighth week. It should be pointed out that where lungs were removed early, tipping was also possible earlier than was done in this experiment, and this would have resulted in higher yields with early removal of lungs.

N. S. Rajendram

LW5—*Weed effects on crop and yield of seedling tea at the Low-Country Station, Ratnapura—(1965)*

Weed removal by labour every two months gave the highest yields and this treatment was significantly superior to all others, when the means of both nitrogen levels were compared. Between the two levels of nitrogen, there was a significant difference in yield. The results are given in Table 20.

TABLE 20—*Effects and interaction of weeds and nitrogen on yield of tea in the cycle 1965 to 1967*

Treatments	Yield in lb per acre per year over the period November 1966 to May 1967			
	N levels			
	100 lb per acre	200 lb per acre	Mean	
Weeds removed every 2 months	1862	1949	1906	
Weeds removed every 4 months	1549	1879	1714	
Weeds removed every 6 months	1723	1670	1697	LSD — 139 ($P = 0.05$)
Gramoxone ½ pint per acre every 2 months	1618	1879	1749	
LSD ($P = 0.05$)	191			
Mean	1688	1844		
LSD ($P = 0.05$)	104			

U. P. de S. Waidyanatha

1967 Experiments

LW9—*Control of* Spermacoce latifolia *in tea*—3 randomized blocks—(*1967*)

Spermacoce latifolia is an annual prevalent in many low-country estates and it is a problem, particularly where the cover of tea is poor. This weed is not adequately controlled by half pint Gramoxone * in 50 gallons water per acre, applied every other month, which is the rate and frequency at which this herbicide is generally used on low-country estates. It has been observed that *S. latifolia* and *Paspalum conjugatum* are now the predominant species on many estates.

Gramoxone and a 2, 4-D WP (80% ai as Na salt) were tested. The experimental treatments are listed in Table 21. The herbicides were applied to a dense stand of the weed in tea which had been tipped.

S. latifolia was susceptible to 2, 4-D and at two lb in 100 gallons water per acre a complete kill was obtained. The higher spray volume was more effective probably on account of the better wetting of the unusually thick cover of the weed. The Gramoxone-2, 4-D mixture gave poor control ; the rapid kill by Gramoxone of the leaf tissue in contact with the spray droplets may have impeded the translocation of the 2, 4-D within the plant.

TABLE 21—*Effect of Gramoxone and 2, 4-D on* Spermacoce latifolia

Treatments	Visual assessment 30 days after treatment
2,4-D 1 lb in 50 gallons per acre	Satisfactory control
2,4-D 1 lb in 100 gallons per acre	Satisfactory control
2,4-D 2 lb in 50 gallons per acre	Satisfactory control
2,4-D 2 lb in 100 gallons per acre	Complete kill
2,4-D ½ lb in 50 gallons followed 10 days later by Gramoxone ½ pint in 50 gallons per acre	Satisfactory control
Gramoxone ½ pint in 50 gallons followed 10 days later by 2,4-D ½ lb in 50 gallons per acre	Satisfactory control
2,4-D ½ lb + Gramoxone ½ pint in 50 gallons per acre	Insufficient control

LW10—*Control of a very dense stand of* Paspalum conjugatum *in tea*—Randomized blocks with 3 replicates—(*1967*)

Plots were demarcated in abandoned tea which had not been weeded during the previous six months. The weed growth consisted almost entirely of *P. conjugatum*.

Half pint and one pint of Gramoxone, and mixtures of half pint Gramoxone and half lb or one lb of diuron WP (80% ai) were tested. All treatments were tested at two spray volumes (50 and 100 gallons per acre). The degree of weed control was assessed visually. One pint Gramoxone in 100 gallons water per acre, and half pint Gramoxone plus one lb diuron in 50 gallons water per acre were the most effective and gave satisfactory control up to 30 days after spraying.

As there was regrowth of the grass all treatments were repeated 40 days after the first spraying. Gramoxone treatments at one pint per acre gave satisfactory control upto 30 days after the repeat application. The diuron

* Gramoxone refers here and subsequently to a formulation marketed by Plant Protection Ltd. and said to contain 20% w/v paraquat and 10% w/v wetting agents.

incorporated treatments gave better control of the grass. One lb diuron plus half pint Gramoxone per acre gave good control of the grass upto 60 days after the second spraying. In the other treatments the grass began to regrow by this time. There appeared to be an advantage in using 100 gallons spray volume when applying one pint Gramoxone per acre.

LW11—*Herbicide tolerance of young tea*—Randomized blocks with 6 replicates —*(1967)*

Soil applications of simazine, diuron and Gramoxone at two times of application were tested. The treatments are listed in Table 22. The plots were maintained weed-free by frequent hand-weeding. Phytotoxicity was assessed by visual observations as well as by determining total dry weight. The Gramoxone treatments did not cause any harmful effects. The simazine treatments did not significantly reduce the total dry weight at five months after transplanting, but produced marked symptoms of interveinal chlorosis at the higher level. Diuron at one lb per acre immediately after transplanting did not affect the tea plants. The higher rate and the later applications at both levels caused much damage.

TABLE 22—*Effect of simazine, diuron and Gramoxone on the growth of 8-months old tea plants (clone TRI 2023)*

Dry weight 5 months after transplanting (in g per plot)

		Treatments applied at			
		Time of transplanting	3 weeks after transplanting	Mean	
Simazine	1 lb	142	150	146	
Simazine	2 lb	140	147	143	
Diuron	1 lb	152	122	137	
,,	2 lb	109	80	94	LSD ($P = 0.05$) 24
Gramoxone	½ pt	147	146	146	
,,	1 pt	154	143	148	
Control		143			
LSD ($P = 0.05$)		30			
Mean		140	132		
LSD ($P = 0.05$)		18			

LW12—*Effect of different levels of Gramoxone and frequencies of application on weeds and yield of tea*—3^3 factorial 6 replicates—*(1967)*

Weeds (mainly *Paspalum conjugatum*) were allowed to grow in plots for four months, and when the infestation was dense treated with Gramoxone at half, one or one and a half pints per acre at three frequencies of application, *viz* every month, every two months or every three months. With monthly applications after two to three rounds at one or one and a half pints per acre weeds were controlled effectively, and by the ninth month plots were almost devoid of weeds. At half pint, about four monthly applications were required for effective control of weeds.

At the bi-monthly frequency the two higher levels of Gramoxone gave satisfactory weed control after four rounds. When applied every three months control of weeds was not satisfactory even after nine months at all rates of Gramoxone.

Over a period of nine months, Gramoxone had no effect on the yield of tea. There is some indication that frequent applications are beneficial. This may presumably be correlated with better weed control.

TABLE 23—*Effect of 3 levels of Gramoxone and 3 frequencies of application on the yield of tea and weed growth*

Yield of green leaf per plot (0.020 acre) per 9 months and the scores for weed control

Frequency of application	Quantity of Gramoxone per acre ½ pint	1 pint	1½ pint	Mean	
Every month	77	82	75	78	
	+	+	+		LSD ($P = 0.05$)
Every 2 months	70	69	81	73	8
	+++	+	+		
Every 3 months	67	73	69	70	
	+++++	++++	++++		
LSD ($P = 0.05$)		13			
Mean	72	75	75		
LSD ($P = 0.05$)		8			

Weed control

\+ Complete Kill
++ Good control
+++ Satisfactory control
++++ Slight control
+++++ No apparent effect

LW13—*The effect of simazine, diuron, 2, 4-D and amitrole on the yield of seedling tea*—Randomized blocks with 4 replicates—(*1967*)

Commercial formulation of diuron (80% ai) and 2, 4-D (80% ai) at one and two lb per acre, and simazine (50% ai) and amitrole (50% ai) at two and four lb per acre are applied to seedling tea at two-monthly intervals. These are four promising herbicides which may be of use in the chemical control of weeds in tea, and the primary aim of this experiment is to determine the tolerance of tea to these chemicals. The experiment is in progress.

D. T. Wettasinghe & U. P. de S. Waidyanatha

LW14—*The effect of pentachlorophenol on yield of seedling tea*—4 randomized blocks—(*1967*)

This experiment is similar to **LW13.** Monthly and bi-monthly applications of 0.6, 1.2 and 2.4 lb PCP per acre are being tested.

LW15—*Primary evaluation of a number of herbicides*—unreplicated observation plots—(*1967*)

The following are being screened for their residual effect on weeds and phytotoxicity to tea when used as soil-applied herbicides :

Cotoran 1 and 3 lb per acre, Patoran 1 and 4 lb per acre, Tenoran 1 and 4 lb per acre,
Maloran 1 and 4 lb per acre, C 243 2 and 5 lb per acre, Gatnon 1 and 4 lb per acre,
Atratone 1 and 2 lb per acre, Prometryne 1 and 2 lb per acre, Desmetryne 1 and 2 lb per acre,
Alicep 2 and 4 lb per acre, Dacthal 3 and 8 lb per acre, Glenbar 3 and 8 lb per acre,
Prefix 2 and 6 lb per acre, NPH 1221 1 and 4 lb per acre, and NPH 1231 1 and 4 lb per acre.

The performance of these materials will be assessed visually.

LW16—*Competitive effect of weeds on the growth of young tea*—5 randomized blocks—(*1967*)

Plots were demarcated in a TRI 2023 new clearing. The plants were six months in the field and had been bent once. The growth of the tea in plots hand-weeded every 2, 4, 6, 8 and 10 weeks will be compared.

D. T. Wettasinghe & H. H. Samarakoon

LW17—*Seasonal pattern of weed emergence under mature seedling tea*—8 paired plots—(*1967*)

The emerging weeds, in regularly cultivated and uncultivated plots, are hand-pulled, identified and counted at fortnightly intervals.

LW18—*Gramoxone, diuron, simazine and 2, 4-D on one-year-old plants of TRI 2023* —Randomized blocks—(*1967*)

Gramoxone at half and one pint per acre, diuron at a quarter and half lb per acre with additional wetter (Shell ' N '), 2, 4-D at half lb per acre and simazine at one lb per acre are being tested. Simazine was applied after clean weeding, while the others were sprayed on to the weeds, taking care to avoid spraying the tea. Repeat applications will be given when the weed growth warrants it. The experiment is in progress. The diuron treatments appear to be promising.

D. T. Wettasinghe & U. P. de S. Waidyanatha

Extension Experiments

XLA1—*3 types and 3 levels of N (urea, calcium ammonium nitrate, sulphate of ammonia) and 3 levels of lime on VP tea at Hunuwella Group, Opanaike* —(*1965*)

The results of the first year of the cycle 1966 to 1968 are presented in Table 24.

TABLE 24—*Mean yield in lb made tea per acre during the first year of the cycle (1966 to 1968) at Hunuwella*

Types of nitrogen		First 6 months lb per acre	(%)	Second 6 months lb per acre	(%)	First year lb per acre	(%)
Sulphate of ammonia		1077	100	2717	100	3794	100
Calcium ammonium nitrate		1120	104	2821	104	3941	104
Urea		1082	100	2658	98	3740	99
(lb per acre per year)							
Levels	240	1043	100	2593	100	3636	100
of	360	1133	109	2841	110	3973	109
nitrogen	480	1104	106	2762	107	3866	106
(tons per acre per year)							
Levels	0	1120	100	2860	100	3980	100
of	½	1065	95	2652	93	3717	93
lime	1	1095	98	2683	94	3778	95
LSD ($P = 0.05$)		102	9	330	12	401	10

The differences in yield with sulphate of ammonia, calcium ammonium nitrate and urea are not significant. The response to nitrogen did not extend beyond the level of 360 lb per acre per year. Dolomitic lime did not increase yields.

XLA2—*3 levels of N and 3 frequencies of application on VP tea at Hunuwella Group, Opanaike—(1965)*

The results of the first year of the cycle 1966 to 1968 are presented in Table 25.

TABLE 25—*Mean yield in lb made tea per acre during the first year of the cycle (1966 to 1968)*

Treatments	First 6 months		Second 6 months		First year		Third 6 months	
Nitrogen (lb per acre per year)	(lb per acre)	(%)	(lb per acre)	(%)	(lb per acre)	(%)	(lb per acre)	(%)
240	1343	100	2941	100	4284	100	2867	100
360	1285	96	2754	94	4039	94	2729	95
480	1356	101	3049	104	4405	103	3029	106
Intervals in weeks between fertilizer applications								
4	1348	100	2966	100	4313	100	2913	100
6	1292	96	2777	94	4069	94	2804	96
8	1345	100	3002	101	4347	101	2908	100
LSD ($P = 0.05$)	101	8	306	10	367	9	255	8

The differences in yield between 240, 360 and 480 lb N per acre per year are not significant, nor is there a significant difference between the three frequencies of application.

XLA3—*4 levels of N × 2 levels of shade on VP tea at Hunuwella Group, Opanaike—(1965)*

The results of the first year of the cycle 1966 to 1968 are presented in Table 26.

TABLE 26—*Mean yield in lb made tea per acre during the first year of the cycle (1966 to 1968)*

Treatments	First 6 months		Second 6 months		First Year	
Nitrogen (lb per acre per year)	(lb per acre)	(%)	(lb per acre)	(%)	(lb per acre)	(%)
0	996	100	2099	100	3095	100
120	1087	109	2425	116	3512	113
240	1175	118	2865	136	4040	131
360	1198	120	2941	140	4139	134
LSD ($P = 0.05$)	88	8	326	13	399	11
No Shade	1117	101	2643	105	3760	103
Shade	1111	100	2522	100	3633	100
LSD ($P = 0.05$)	144	13	445	17	589	16

The difference in yield between shade and no shade is not significant. The response to nitrogen does not extend beyond the 240 lb N per acre level.

XLA4—*4 levels of N × 2 levels of shade on seedling tea at Hunuwella Group, Opanaike—(1965)*

The results of the first year of the cycle 1966 to 1968 are presented in Table 27.

TABLE 27—*Mean yield in lb made tea per acre during the first year of the cycle (1966 to 1968)*

Treatments Nitrogen (lb per acre per year)	First 6 months (lb per acre)	(%)	Second 6 months (lb per acre)	(%)	First Year (lb per acre)	(%)
0	857	100	2176	100	3034	100
120	864	101	2339	108	3202	106
240	876	102	2302	106	3178	105
360	888	104	2405	111	3294	109
LSD ($P = 0.05$)	167	19	338	16	282	9
No Shade	879	102	2348	104	3227	103
Shade	864	100	2262	100	3126	100
LSD ($P = 0.05$)	23	3	119	5	119	4

The difference in yield between shade and no shade is not significant. The response to nitrogen is small and does not extend beyond 120 lb N per acre.

XLA5—*3 types of N (urea, calcium ammonium nitrate and sulphate of ammonia) and 2 levels of lime on VP tea at Endane Estate, Kahawatte—(1965)*

The results of the first year of the cycle 1966 to 1968 are presented in Table 28.

TABLE 28—*Mean yield in lb made tea per acre during the first year of the cycle (1966 to 1968) at Endane*

Treatments	First 6 months (lb per acre)	(%)	Second 6 months (lb per acre)	(%)	First Year (lb per acre)	(%)
Sulphate of ammonia	948	100	2703	100	3655	100
Calcium ammonium nitrate	1016	107	2888	107	3905	107
Urea	911	96	2631	97	3537	97
LSD ($P = 0.05$)	59	6	192	7	220	6
No lime	957	100	2791	100	3745	100
Lime ($\frac{1}{2}$ ton per acre)	961	100	2686	96	3646	97
LSD ($P = 0.05$)	48	5	157	6	180	5

Calcium ammonium nitrate has given a higher yield than sulphate of ammonia and urea. Application of lime has not increased yields.

XLA6—*5 levels of N on VP tea at Endane Estate, Kahawatte (1965)*

The results of the first year of the cycle 1966 to 1968 are presented in Table 29.

TABLE 29—*Mean yield in lb made tea per acre during the first year of the cycle (1966 to 1968)*

Treatments Nitrogen (lb per acre per year)	First 6 months (lb per acre)	(%)	Second 6 months (lb per acre)	(%)	First Year (lb per acre)	(%)
0	1003	100	2347	100	3349	100
120	953	95	2507	107	3465	103
240	1030	103	2759	118	3790	113
360	1055	105	2943	125	4003	120
480	996	99	2623	112	3620	108
LSD ($P = 0.05$)	176	18	172	7	450	13

In the first six months of the cycle there is no significant response to nitrogen, but in the second six months, the response is significant up to 360 lb N per acre per year.

A. A. C. Karunaratne

XLA7—*4 levels of N × 4 levels of shade on seedling tea at Rayigam Estate, Ingiriya—(1965)*

The results of the first experimental cycle 1965 to 1967 are shown in Table 30.

TABLE 30—*Mean yields in lb made tea per acre in the cycle (1965 to 1967) at Rayigam*

Treatments	Yield of made tea (lb per acre per year)	(%)
No shade	2182	100
⅛rd shade	1720	79
⅜rd shade	1802	83
Normal shade	1769	81
LSD ($P = 0.05$)	1092	62
Nitrogen (lb per acre per year)		
80	1847	100
120	1847	100
160	1923	104
200	1855	100
LSD ($P = 0.05$)	309	17

The 19% difference in yield between shade and no shade fails to reach the 5% level of significance. Raising the nitrogen level from 80 to 200 lb per acre per year has not increased yields.

XLA8—*4 levels of N × 2 levels of shade on seedling tea at Hatherleigh Estate, Rakwana—(1965)*

The results of the first 18 months of the cycle, 1965 to 1967, are shown in Table 31.

TABLE 31—*Mean yields in lb made tea per acre in the cycle (1965 to 1967) at Hatherleigh Estate*

Treatments	First 6 months (lb per acre)	(%)	Second 6 months (lb per acre)	(%)	Third 6 months (lb per acre)	(%)
Shade	250	100	1101	100	1290	100
No shade	262	105	1153	105	1391	108
LSD ($P = 0.05$)	17	3	206	9	170	7
Nitrogen (lb per acre per year)						
0	255	100	1066	100	1091	100
80	250	98	1123	105	1208	111
160	254	100	1094	103	1185	109
240	253	99	1172	110	1182	108
LSD ($P = 0.05$)	19	7	138	13	73	7

The higher yield of the no-shade plots reaches significance in the first and third six months of the cycle. In the third six months there is a response to nitrogen at 80 lb per acre per year but not beyond this.

XLA9—*4 levels of N × 2 levels of shade on VP tea at Millakande Estate, Bulathsinhala—(1965)*

The yields of 18 months, March 1966 to September 1967, are shown in Table 32. During this period there was no plucking for three months because of a labour strike. The yields are accordingly low. The yields over the 18 months are expressed on a per year basis, after conversion.

TABLE 32—*Mean yields in lb made tea per acre per year for the period March 1966 to September 1967 at Millakande Estate*

Treatments Nitrogen (lb per acre per year)	Yields (lb per acre per year)	(%)
0	2452	100
160	2770	113
320	3209	131
480	3382	138
LSD ($P = 0.05$)	260	11
Shade	2982	100
No shade	2987	100
LSD ($P = 0.05$)	344	12

The results so far obtained indicate a response to nitrogen up to the level of 320 lb N per acre per year. Between shade and no-shade there is no difference in yield so far.

N. Yogaratnam

XLA10—*Types of N (calcium ammonium nitrate, sulphate of ammonia and urea) on VP tea at Wellandura Estate, Kahawatte—(1966)*

Ten months of plucking between the application of treatments and pruning in 1967 indicate that nitrogen at 320 lb per acre per year increased yields by 41% over the no-nitrogen plots. Sulphate of ammonia and calcium ammonium nitrate were significantly better than urea (Table 33).

TABLE 33—*Mean yield of made tea per acre at Wellandura during ten months in 1966 to 1967*

Types of nitrogen	Yield (lb per acre per year)	(%)
Sulphate of ammonia	3918	100
Calcium ammonium nitrate	3830	98
Urea	3620	92
LSD ($P = 0.05$)	173	4

XLA11—*4 levels of N × 2 frequencies of application on 6 VP clones at Balangoda Group, Bogawantalawa—(1966)*

The yields over the first 18 months of the cycle are presented in Table 34. Clone TRI 2024 gave the highest yield and the best response to nitrogen. It was also observed that at Balangoda Group, TRI 2024 was far less susceptible to Shot-hole Borer than usual, and it did in fact show a lower infestation than other clones.

TABLE 34—*Mean yields in lb made tea per acre per year in the first 18 months of the cycle (1966 to 1970) at Balangoda Group*

Clones	Levels of nitrogen 0	160	320	480	Means (clones)	(%)
MT 18	809	905	1061	1151	981	100
MT 16	962	1005	1001	992	992	101
DG 39	783	1142	1144	1199	1067	109
TRI 2025	866	930	1140	1438	1094	112
TRI 2023	1132	1221	1248	1279	1220	124
TRI 2024	1121	1265	1303	1495	1296	132
LSD ($P = 0.05$)			151		77	8
Means	945	1077	1150	1258	124	LSD between N levels
(N levels)	100%	114%	122%	133%	13%	($P = 0.05$)

E. J. B. de Silva

XLA12—*4 levels of N × 2 levels of shade on seedling tea at Sapumalkande Group, Dehiowita—(1966)*

The yields of the first year cycle, 1966 to 1968, are presented in Table 35.

TABLE 35—*Mean yields in lb made tea per acre over two successive six-months periods of the cycle (1966 to 1968) at Sapumalkande Group*

Treatments Nitrogen (lb per acre per year)	First 6 months (lb per acre)	(%)	Second 6 months (lb per acre)	(%)
0	421	100	1925	100
160	417	99	1913	99
240	450	107	2136	111
320	458	109	2151	112
LSD ($P = 0.05$)	57	12	163	8
Shade	470	112	2071	103
No shade	408	100	2013	100
LSD ($P = 0.05$)	86	21	207	10

In the first six months of the cycle, soon after shade was removed, the plots without shade yielded 12% more than shaded plots, but this difference failed to reach the 5% level of significance. In the second six months this difference was reduced to 3%. The response to nitrogen appears to extend up to 240 lb N per acre per year ; this is significant in the second six months of the cycle.

Plucking was supervised and recorded by the Assistant Superintendent of Sapumalkande and we wish to record our appreciation.

N. Yogaratnam

XLA13—*4 levels of N on TRI clones 2024, 2025 and 2026 at Berubeula Estate, Urubokka—(1966)*

During the first six months of plucking there were no significant differences in yield between the levels of nitrogen.

XLA14—*4 levels of N × 2 levels of shade on VP tea at Ratnayake Group, Deniyaya — (1966)*

The yields obtained in nine months of plucking are shown in Table 36.

TABLE 36—*Mean yields of made tea in lb per acre for a period of nine months in 1967 at Ratnayake Group*

Treatments	Yields (lb per acre)	(%)
No shade	6581	100
Gliricidia maculata	5472	83
Nitrogen (lb per acre per year)		
0	5860	100
160	5914	101
320	6098	104
480	6234	106
LSD ($P = 0.05$)	449	8

Although provision was made for three replicates in this experiment, eventually it was possible to obtain only two replicates. The shade *vs* no-shade comparison was therefore made with only one degree of freedom for error. The standard error is accordingly high and it is not possible to assess with any precision, the difference between shade and no shade, although this is 17%. The small increase in yield with increase in the nitrogen levels fails to reach significance.

XLA15—*4 levels of N × 4 levels of shade on seedling tea at Panilkande Estate, Deniyaya—(1966)*

The results obtained in the first year (*1967*) of the cycle are presented in Table 37.

TABLE 37—*Mean yields in lb made tea per acre per year in the first year of the cycle (1967 to 1969) at Panilkande Estate*

Treatments	Yield (lb per acre per year)	(%)
No shade	1914	100
Gliricidia	2053	107
Albizia	2032	106
Albizia + *Gliricidia*	2065	108
LSD ($P = 0.05$)	224	12
Nitrogen (lb per acre per year)		
80	1858	100
120	2164	116
160	1988	107
200	2055	111
LSD ($P = 0.05$)	200	11

The response to nitrogen did not extend beyond the 120 lb per acre level of nitrogen. The shaded plots gave 7% more in yield than the plots with no shade, but this difference was not significant.

XLA16—*4 levels of N × 2 levels of shade on VP tea at Mahendra Estate, Morawaka—(1966)*

The yield obtained in the first year 1967 of the cycle are presented in Table 38.

TABLE 38—*Mean yields in lb made tea per acre in the first year (1967) of the cycle at Mahendra Estate*

Treatments Nitrogen (lb per acre per year)	Yields (lb per acre per year)	(%)
0	3401	100
160	4013	118
320	4398	129
480	4837	142
LSD ($P = 0.05$)	395	12

The response to nitrogen increased up to the level of 480 lb N per acre per year. Between shade and no shade there was no difference in yield.

XLA17—*4 levels of N × 2 levels of shade on VP tea at Berubeula Estate, Urubokka —(1966)*

The mean yields in the first six months of the cycle 1967 to 1969 are shown in Table 39.

TABLE 39—*Mean yields in lb made tea per acre per year in the first six months of the cycle (1967 to 1969) at Berubeula Estate*

Treatments	Yield (lb per acre per year)	(%)
No shade	2875	100
Gliricidia maculata	2750	96
Nitrogen (lb per acre per year)		
0	2423	100
160	2831	117
320	2947	122
480	3042	126
LDS ($P = 0.05$)	232	10

The difference between shade and no shade is not significant. The response to nitrogen diminishes after the 160 lb per acre level.

J. I. H. Bandaranayake

XLPH1—*Shade vs no shade on seedling tea at the Low-Country Station, Ratnapura —(1966)*

The mean yields of made tea per acre, with and without shade, are shown in Table 40.

TABLE 40—*Yields of made tea per acre, with and without shade*

	Pre-treatment yields (4 months) before removing shade		Yields after removing shade trees on no-shade blocks					
			Before pruning		After pruning			
					First 6 months		Second 6 months	
	(lb per acre)	(%)	(lb per acre)	(%)	(lb per acre)	(%)	(lb per acre)	(%)
Shade	672	100	209	100	169	100	616	100
No shade	730	109	233	111	162	96	715	116

It will be observed that in the pretreatment yields before shade was removed from the no-shade blocks, there was a difference of 9% in favour of the no-shade blocks. This was maintained even after removal of shade. After pruning, the difference between shade and no-shade was reduced, which may be a result of any benefit that the shade had on recovery from pruning. In the second six months, however, the no-shade blocks yield 16% more than the blocks with shade.

In this experiment it was observed that the weed growth was excessive, consisting mainly of *Paspalum conjugatum* and *Spermacoce latifolia*. The bi-monthly rounds of half pint Gramoxone in 50 gallons water per acre did not provide sufficient control. The weed growth was estimated by determining the dry weight of weeds in a large number of quadrats taken at random. It was observed that the shaded blocks carried less than half the weed growth of the unshaded blocks.

The weed growth was brought under control by applying one pint Gramoxone in 100 gallons water per acre, followed a fortnight later by half pint Gramoxone in 50 gallons per acre. Then labour was used to remove grasses and creepers growing around the collar and through the plucking table of the bushes. This was followed in about a month's time with half pint Gramoxone in 50 gallons per acre to clean up any regrowth.

D. T. Wettasinghe & N. S. Rajendram

***XLE1**—*Dieldrin, aldrin and control on seedling tea at Hapugastenne Group, Ratnapura—(1965)*

This experiment has now been concluded. The results obtained are presented in Table 41.

TABLE 41—*Shot-hole borer infestation estimated by counts of infection in 100 standard units taken per plot at Hapugastenne Group*

Treatment	Percentage sample units infected (months after pruning)					Pre-treatment sampling
	(9)	(12)	(18)	(21)	(24)	
Dieldrin	4.3	6.0	13.5	29.5	35.0	
Aldrin	11.5	11.0	13.5	31.5	42.0	
Untreated control	15.1	29.5	37.3	43.5	69.0	72.0

The yield records showed considerable variation and accordingly it was not possible to determine any significant differences between treatments.

XLE2—*Dieldrin, aldrin and control on seedling tea at Alupolla Group, Ratnapura — (1965)*

This experiment has now been concluded. The results obtained are presented in Table 42.

* The **XLE** series of experiments were done in collaboration with the Division of Entomology.

TABLE 42—*Shot-hole borer infestation estimated by counts of infection in 100 standard units taken per plot at Alupolla Group*

Treatments	Percentage sample units infected (months after pruning)					Pre-treatment sampling
	(9)	(12)	(18)	(21)	(24)	
Dieldrin	2.0	0.3	5.3	11.3	33.0	
Aldrin	3.7	6.7	10.0	22.3	34.0	
Untreated control	8.0	26.7	43.3	48.3	57.0	72.3

The yield records showed considerable variation and accordingly it was not possible to determine any significant differences between treatments.

XLE3—*Dieldrin, aldrin and control on seedling tea at Hatherleigh Estate, Rakwana —(1965)*

This experiment has now been concluded. The results obtained are presented in Table 43.

TABLE 43—*Shot-hole borer infestation estimated by counts of infection in 100 standard units taken per plot at Hatherleigh Estate*

Treatments	Percentage sample units infected (months after pruning)						Pre-treatment sampling
	(9)	(12)	(15)	(18)	(21)	(24)	
Dieldrin	6.0	5.0	9.5	28.0	30.0	34.5	
Aldrin	7.5	16.5	17.5	38.0	40.5	47.0	
Untreated control	14.0	26.0	27.5	49.0	50.5	68.5	63.0

The yield records showed considerable variation and accordingly it was not possible to determine any significant differences between treatments.

XLE4—*Dieldrin, aldrin and control on seedling tea at Madampe Group, Rakwana (1965)*

This experiment has now been concluded. The results obtained are presented in Table 44.

TABLE 44—*Shot-hole borer infestation estimated by counts of infection in 100 standard units taken per plot at Madampe Group*

Treatments	Percentage sample units infected (months after pruning)					Pre-treatment sampling
	(9)	(12)	(18)	(21)	(24)	
Dieldrin	2.5	2.0	3.0	4.5	4.0	
Aldrin	1.5	3.0	11.0	11.5	9.0	
Untreated control	7.5	6.5	13.5	14.5	12.0	21.5

The yield records showed considerable variation and accordingly it was not possible to determine any significant differences between treatments.

XLE5—*Methods of dieldrin spraying on seedling tea at Hapugastenne Group, Ratnapura—(1965)*

This experiment has now been concluded. The results obtained are presented in Table 45.

TABLE 45—*Shot-hole borer infestation estimated by counts of infection in 100 standard units taken per plot at Hapugastenne Group*

Treatments	Percentage sample units infected (months after pruning)						Pre-treatment sampling
Months	(9)	(12)	(15)	(18)	(31)	(24)	
Dieldrin mistblown covering one row on either side of the sprayer	1	1	7	9	16	11	
Dieldrin mistblown covering two rows on either side of the sprayer	1	6	12	14	18	18	
Dieldrin sprayed using normal knapsack sprayer	2	5	2	7	9	6	
Untreated control	7	11	19	21	34	41	59

The results indicate that knapsack spray is more effective than mistblowing.

XLE6—*Mid-cycle application of aldrin on seedling tea at Hapugastenne Group, Ratnapura—(1965)*

This experiment has now been concluded. The results obtained are presented in Table 46.

TABLE 46—*Shot-hole borer infestation estimated by counts of infection in 100 standard units taken per plot at Hapugastenne Group*

Treatments	Percentage sample units infected (months after pruning)			Pre-treatment sampling
	(15)	(18)	(24)	(12)
Aldrin	28.5	43.0	24.0	
Untreated control	63.5	68.0	61.5	94

XLE7—*Mid-cycle application of aldrin on seedling tea at Alupolla Group, Ratnapura—(1965)*

This experiment has now been concluded. The results obtained are presented in Table 47.

TABLE 47—*Shot-hole borer infestation estimated by counts of infection in 100 standard units taken per plot at Alupolla Group*

Treatments	Percentage sample units infected (months after pruning)			Pre-treatment (sampling)
	(15)	(18)	(24)	(12)
Aldrin	46	20.5	22.5	
Untreated control	67	58.0	74.0	64

H. H. Samarakoon

Visits, Lectures & Symposia

Dr L. H. Fernando attended the 23rd Conference of the Tea Research Association, Tocklai, North East India, in November 1967. He also visited estates in Assam, Dooars and Darjeeling.

Lectures

FERNANDO, L. H.—" A reappraisal of practices in the cultivation of low-country tea," at the Tea Centennial Conference of the TRI at Radella in May.

FERNANDO, L. H.—A discussion on Tea in the series "Agricultural Surveys" conducted by Dr P. P. G. L. Siriwardene, broadcast by the Ceylon Broadcasting Corporation.

Publications

FERNANDO, L. H. (1967*a*). Progress with research on tea in the low country. *Tea Q.* **38**, 186-189.

FERNANDO, L. H. (1967*b*). A reappraisal of practices of the cultivation of low country tea. *Tea Q.* **38**, 241-244.

WAIDYANATHA, U. P. DE S. (1967). The Chemical control of weeds in tea in the low country of Ceylon.
M.Sc. Thesis, University of Ceylon. 111 pp.

REPORT ON THE MID-COUNTRY STATION

Mid-Country Scientific Officer—D. Calnaido, BSc, PhD

General

Further progress towards the development of the Mid-Country Station was achieved by the purchase of the property, and the improvement of the buildings, services, roads and layout. About fifty six acres of Field Nos 6 and 7 of Hantane Estate were surveyed and plans have been submitted to the lawyers for the drawing up of the deed of transfer, and the transaction is expected to be completed shortly.

The following buildings were completed during the year and are now in use : two standard staff bungalows ; two minor staff quarters ; garage, workshop and Entomology store rooms ; and store-rooms for the use of the Plant Physiology Division.

Mains electrical supply from the Department of Government Electrical Undertakings was obtained in July. Work on a suitable water supply system, consisting of a well, pump and storage tank, was also completed in July.

Improvements were made to the roads leading to the Station and within it. Considerable attention was devoted to the layout of the Station and improvements were effected wherever possible. An International Scout was purchased for the Station in April and this has considerably eased the transport problem.

There were no staff changes during the year.

Advisory Service

Mr M. K. Vythilingam continued to function as Advisory Officer for the mid country covering the districts of Dolosbage, Galagedera, Hantane, Kadugannawa, Kandy, Kegalle, Kelebokka, Kurunegala, Medamahanuwara, Nitre Cave and Wattegama.

The Mid-Country Scientific Officer and the District Advisory Officer attended meetings of District Planters' Associations when invited. Many planters visited the Station for discussions on agronomic problems. Several groups of school children visited the Station on study tours. We had also to attend to several tourists who were interested in tea. Eighty five visits were made to estates in connexion with advisory and extension work.

Pests and diseases

With the withdrawal of the Institute's recommendation for the use of dieldrin for shot-hole borer control for mature tea there was no incidence of twig and looper caterpillar infestations. Subsequent to the withdrawal of dieldrin, in many instances new clearings too, were not protected with the lower concentration of dieldrin, as recommended by the Institute, with the result that some clearings were heavily infested by Shot-hole Borer, to the extent that growth was severely retarded. No serious pest problems were prevalent in the district this year. Incidences of mites, brown bugs, bag worms and lymantrid caterpillars were reported, while among diseases *Poria hypolateritia*, *Fomes noxius* and *Phomopsis theae* were encountered on some estates.

Nurseries

The problems encountered in the nurseries were mainly due to over-watering and heavy shading which caused decay of the root systems and poor growth.

Fertilizer problems

Zinc deficiency was noted on seedling tea, particularly on some low-yielding estates. Many of these estates responded favourably to the application of zinc sulphate at the rate of 20 lb per acre per annum.

With the decline in the sale prices of mid-country teas, estates were naturally keen on reducing the costs of production and some of them resorted to restricted fertilizer applications by supplying N alone or fertilizer mixtures with reduced K and P.

M. K. Vythilingam

Field Experiments, Trials & Factory Experiments

The following experiments were carried out with the collaboration of the respective Heads of Divisions, except the experiments of the Entomology Research Unit at the Mid-Country Station.

MW1—*Gramoxone, hand weeding and N on seedling tea at the Mid-Country Station—(1966)*

The treatments consisted of two frequencies of hand weeding, two frequencies of gramoxone applications and two levels of nitrogen. Pre-treatment yields were recorded from 19th March 1967 to 15th September 1967. The treatments were applied on 19th September 1967. Yield figures are being maintained.

MPH1—*Mulching of young VP tea (Clone TRI 2025) at the Mid-Country Station—(1966)*

The respective plots were mulched with the appropriate rates of paddy husk and Guatemala Grass on 14th December 1966 and again on 18th July 1967, because the guatemala grass thatch had to be replaced subsequent to decay. The weed growth in the plots for five weedings are given below :

Quantities of weeds in pounds

Mulch treatment ...	20 tons	10 tons	Mean
Paddy husk ...	119	263	191
Gautemala Grass ...	366	507	437
Control	—	—	704

The paddy husk spread right up to the collar showed no ill effects to date. The growth of plants treated with 20 tons of paddy husk per acre appears to be vigorous and healthy.

MN1—*Levels of N, P and K on the pathogenicity of* Pratylenchus loosi *to tea at the Mid-Country Station—(1966)*

This experiment has been concluded, and is referred to in the report of the Plant Pathology and Nematology Division.

M. K. Vythilingam

Drought resistance of clones

Three observations were made on 9.3.65 ; 29.3.66 and 30.5.66 following drought conditions on the clones in experiment **MVP2** *(1962)*. The clones were given marks arbitrarily as for **MVP1** *(1961)* (see Report on the Mid-Country Station, TRI Annual Report, 1966), and the averages of these scores were statistically analysed. The results are given in Table 1.

TABLE 1—*The ability of the 16 clones (of* **MVP2***-1962) to withstand drought conditions*

Clones (arranged in order of merit)	*Score*
TRI 2020	6.83
OT 5/8	6.42
NK4B/29	5.67
D	4.58
TRI 2039	4.33
N 3	4.25
CH 13	4.00
TRI 2016	3.33
MPA 1	3.17
H6A 1	2.67
TRI 2043	2.25
TRI 2024	2.08
MG3B1	1.58
MG	1.25
KP 204	0.92
TRI 2022	0.67
LSD at $P=0.05$ ...	2.14
$P=0.01$ ...	2.89
$P=0.001$ ...	3.83

Vegetative propagation

These experiments are fully described in the Report of the Plant Physiology Division.[1]

MVP1—*Clonal testing at the Mid-Country Station—(1961)*

This experiment is in its second three-year pruning cycle. The first weekly plucking in this cycle commenced in March 1967 and the yields from 40 plucks have been recorded to date.

MVP2—*Clonal testing at the Mid-Country Station—(1962)*

The bushes were pruned at the end of the first cycle in July and the first pluck of the second cycle was done in November.

MVP3—*Clonal testing at the Mid-Country Station—(1963)*

One year's weekly pluckings were completed in February. The clones TRI 2021, Balangoda DG 7, TRI 2024 and Wooton W 3 yielded over 1500 lb per acre per annum in the first year of the first cycle.

MVP4—*Clonal testing at the Mid-Country Station—(1964)*

The weekly plucking in the first cycle commenced in February, 1967 and the yield from 47 plucks have been recorded up to 31st December.

MVP5—*Clonal testing at the Mid-Country Station—(1965)*

The bringing-into-bearing treatments, namely bending, cutting across and centering were done and the weekly plucking in the first cycle was started in November.

MVP6—*Clonal testing at the Mid-Country Station—(1966)*

The one-year-old plants were centred in October.

1967 Experiment

MVP7—*Clonal testing at the Mid-Country Station*—4 replicates of 9 clones, unshaded—*(1967)*

The clones under test are TRI 62/5, 62/9, 2023, 2024, 2025, DG 39, BR 1, Ragalla B 275 and TC 9.

H. B. Ratnayake

Technology

These experiments are fully described in the Report of the Technology Division.

MT1—*Quality Assessment of Clones—(1966)*

Of the 27 clones tested only MPA 1 was found to be A 1/2 quality. The following clones were not outstanding in quality—CV4B1, PO 26, BG 18, MT/BG, EN 31, DG 39, CY 9, CV5B1, T 5/3, CR 4, W 2/145, E 7/27, DG 7, DG 2043, DG 66, DK 1, DK 19, UH 9/3, QT 1/5, NK 4B/29, CH 13, N 3, 2016, 2022 and Seed.

Further tests are being carried out on 15 additional clones grown at the Mid-Country Station.

MT2—*The effect of live shade in the field on the liquoring characteristics of tea—(1966)*

Six clones, MG/3B1, KP 204, DG 3, W 3, TRI 2021 and TRI 2024 grown under shade and no shade at the Mid-Country Station, were found to have no significant differences in the manufacturing properties of brightness of infusion, colour, strength, quality and of valuation.

MT3—*Insecticidal taint trials—(1966)*

In collaboration with the Mid-Country Entomology Research Unit taint tests were done on tea sprayed with the insecticides, heptachlor, Carbicron and C 8949 and the manufactured teas were free from taint.

1967 Experiments

MT4—*Plucking rounds* cum *plucked unit*—randomized blocks—*(1967)*

The aim of this experiment is to determine the effect, if any, of plucking rounds of different durations (4, 6 and 12-day rounds) and the type of plucked units (a bud and either 1, 2 or 3 leaves) on the liquoring characteristics of made tea. This has been laid out on 0.5 acre of seedling tea and pre-treatment tests are in progress.

MT5—*Gramoxone for weed control hand-weeding and N on made tea characteristics*—(in **MW 1**) *(1967)*

This experiment aims to investigate the effect of the various treatments of Gramoxone spraying and hand-weeding, at two levels of N, on the liquoring characteristics of made tea. The experiment is in progress.

MT6—*Calcium ammonium nitrate, sulphate of ammonia and urea at 3 levels and 3 levels of K on made tea characteristics*—(in **XMA 3**) *(1967)*

This experiment studies the effect of the application of CAN, S/A and urea, each at 3 levels and in combination with 3 levels of K on the liquoring characteristics of made tea. Pre-treatment tests are being carried out and records of sunshine, rainfall and yield are being maintained.

MT7—*The characteristics of made tea in relation to the age from prune*—randomized blocks—*(1967)*

This experiment aims at determining the liquoring characteristics of made tea in relation to age from the prune. The experiment was laid out in a half acre of seedling tea and pre-treatment tests have commenced.

T. A. Munasinghe

Entomology

ME1—*Ecology of Shot-hole Borer at Hantane Estate, Kandy*—*(1962)*

In this experiment the shot-hole borer populations of a tea field are being closely studied by serial sampling so as to evaluate the population dynamics of this pest. The population trends todate follow more or less the same pattern as that of the previous cycle (Calnaido & Thirugnanasuntharan 1966), and a further analysis will have to await the completion of the entire pruning cycle.

ME2—*Clonal selection for shot-hole borer tolerance*—(**MVP1 - MVP7**)—*(1966)*

To date the investigations have been completed on 31 clones and one seedling selection of **MVP1** *(1961)* and 16 clones of **MVP2** *(1962)* and the information gathered is listed in Table 2, where the clones are arranged in order of yield and their degrees of resistance to Shot-hole Borer are indicated, along with the information on the other desirable characteristics of quality and drought resistance known todate.

TABLE 2—*Tentative list of characteristics of clones*

Yield (in order of merit)	Quality	Drought resistance	Shot-hole borer tolerance
TRI 2023	**	*	***
TRI 2026	—	—	—
TRI 2025 (> 2000 lb)	*	**	—
DG 39	**	**	**
TRI 2151	**	*	—
KEN 16/3	*	*	*
TRI 2027	*	**	—
T 5/35	*	*	**
MT/BG	*	**	**
BG 18	—	*	**
NL 3/1	**	*	—
TRI 2024 (> 1400 lb)	**	—	—
DT 1	***	**	—
K 136	**	*	*
KP 204	?	—	*
GMT 9	?	*	*
DN	*	***	**
MPA 1	?	**	**
NK 48/29	?	***	**
QT 1/5	*	*	***
PAS 22	—	—	**
POR 26	*	—	*
T 5/3	—	*	—
EN 31 (> 1000 lb)	**	**	*
TRI 2043	—	*	—
TK 48	**	**	*
KEN 15/7	**	**	*
UH 9/3	*	—	**
Seed	—	*	**
TRI 2022	*	—	—
NL 4/2	***	—	***
TRI 2016	*	**	—
CY 9	—	**	*
K 150	**	—	**
CH 13	*	**	**
MG 3B1	?	*	*
TRI 777	***	**	**
CV 5B1	—	***	*
CR 4	—	**	—
N 3	**	**	—
TRI 2039	?	**	—
MG	?	—	**
D	**	**	**
CV 4B1	**	***	**
TRI 2020	**	***	**
OT 5/8	?	***	***
H6A1	***	*	—

		Grade	Score	Galleries in prunings
Excellent	***	A1	> 85%	< 20%
Good	**	A2	> 45%	< 40%
Moderate	*	B	> 25%	< 60%
Bad	—	C	< 25%	> 60%

NB — Clones of MVP2 (1962) appear in italics

ME3—*Fertilizer response to shot-hole borer control—(1966)*

This experiment is an attempt to measure the interaction of yield response and levels of borer infestation to two levels of N, 80 N and 160 N per acre per annum, with and without shot-hole borer control. The insecticides used are dieldrin, as a post-pruning spray, and aldrin and heptachlor, as mid-cycle applications. Yield records are maintained fortnightly and infestation is measured every third month by the standard unit method. The experiment is only at the 23rd month of the pruning cycle, and it is too early to comment on the data collected so far. However, it is interesting to note that, at this stage, heptachlor as a mid-cycle spray, appears to do better than aldrin and is as good as dieldrin.

ME4—*Fertilizer response to shot-hole borer control at Bandarapola Group, Matale—(1966)*

This experiment is another attempt to measure the interaction of yield response and levels of infestation to two levels of N, 80 N and 160 N per acre per annum, with and without borer control. The plots were sprayed with dieldrin, as a post pruning spray. The yield is being recorded fortnightly and borer sampling is done once in every three months. The experiment is at the 29th month of the pruning cycle and todate observations do not show significant differences in the levels of infestation between the plots that bear the higher level of N (160 lb) and those with the lower level of N (80 lb).

ME5—*Biolgical vs Insecticidal control for Shot-hole Borer at Hantane, Kandy—(1966)*

The experiment is a comparative study of the cultural treatment of clean prune, combined with the application of a high dose of nitrogen, 180 N per acre per annum, with that of insecticidal control for Shothole Borer. The insecticidal treatments are dieldrin, as a post pruning spray, and aldrin, heptachlor, Baur's C 8949 (Chlorinated phosphorus formulation) and Carbicron as mid-cycle applications. The fungicide nickel chloride is an added treatment to test whether it will have any effect at all on the borer populations. Serial sampling of yield, fortnightly, and of borer populations, once in every three months, are being made.

The experiment is at the 27th month of the pruning cycle, and here again the mid-cycle application of heptachlor appears to do as well as dieldrin and aldrin. C 8949 at 100g per acre active ingredient and Carbicron at 200g per acre active ingredient showed bad control of the borer populations. An interesting feature is that the nickel chloride treated plots showed a 23% control of the borer populations : although this is a poor degree of control, what is important is that this fungicide shows any degree of control at all.

1967 Experiment

ME6—*Control of Shot-hole Borer with mid-cycle application of Heptachlor vs clonal resistance to borer attack at Dartry Group, Gampola*—unreplicated —*(1967)*

This experiment, laid out in May 1967, is a comparative assessment of borer infestations of three clones, TRI 2023, CH 13 and KEN 16/3, treated and untreated with heptachlor, sprayed mid-cycle (12 months from prune). Here we compare a highly tolerant clone TRI 2023, with a moderately tolerant one, CH 13 and a susceptible clone, KEN 16/3, as regards to their borer population build-up, with and without the control effected by heptachlor. Bi-monthly observations on borer infestations are being made.

K. Thirugnanasuntharan

Extension Experiments

XMPH1—*4 levels of N and 3 levels of shade on seedling tea at Kirimetiya Estate, Galaha—(1966)*

Pre-treatment yields were recorded from 16th March, 1967 to 25th September, 1967. Treatment applications of fertilizer were given on the 29th September, 1967.

XMPH2—*4 levels of N and 3 levels of shade on seedling tea at Kellebokka Group, Madulkele—(1966)*

Pre-treatment yields were recorded from 13th April 1967 to 10th July 1967, when the plots were pruned. After pruning the pretreatment yield records are once again being maintained. Treatment application will be given in January 1968.

XMPH3—*4 levels of N and 3 levels of shade on seedling tea at Mousagalla Division, Kellebokka Group, Madulkele—(1966)*

After pruning pre-treatment yields were recorded from 25th May 1967 to 24th December 1967. Treatment applications of fertilizer were given on the 27th December 1967.

XMPH4—*Shade vs no shade, Mahaousa Estate, Madulkele—(1966)*

Yield records of two years compared show no appreciable difference in yield between the shaded and unshaded blocks. The yields continue to be recorded.

XMA1—*Calcium ammonium nitrate, sulphate of ammonia and urea at 3 levels of K on seedling tea at Kellebokka Group, Madulkele—(1966)*

Pre-treatment yields were recorded from 31st March 1967 to 14th September 1967. Treatment applications of fertilizer were given on the 15th September 1967.

XMA2—*Calcium ammonium nitrate, sulphate of ammonia and urea at 3 levels and 3 levels of K on seedling tea at Wattakele Estate, Madulkele—(1966)*

Pre-treatment yields were recorded from 2nd April 1967 to 2nd July 1967. The plots were pruned on the 4th July, 1967. Treatment applications of fertilizer were given on the 14th November 1967.

XMA3—*Calcium ammonium nitrate, sulphate of ammonia and urea each at 3 levels and 3 levels of K on seedling tea at Hantane Estate, Kandy—(1966)*

This experiment had to be relaid on field No. 9 because the previously laid experiment in field No. 2 had to be abandoned, as this area is to be used for other purposes.

M. K. Vythilingam

Visits, Lectures and Symposia

Dr. D. Calnaido represented the Tea Research Institute at the 14th Annual Scientific Conference of the United Planters' Association of Southern India held at Coonoor in September and made use of this trip to study tea culture in

Southern India. Subsequently, he addressed the Hewaheta District Planters' Association on "The UPASI Conference (1967) and tea planting in South India" on the 4th October.

Dr D. Calnaido & Mr P. Kanapathipillai read a paper (see publications below) at the TRI Centennial Conference at Radella in May. Dr Calnaido also assisted at the field days at the Low-Country Station.

Mr K. Thirugnanasuntharan & Dr D. Calnaido presented paper at the 23rd Annual Sessions of the Ceylon Association for the Advancement of Science on "Further observations on the tolerance and susceptibility to tea clones to Shot-hole Borer" at Colombo in December.

Dr D. Calnaido addressed the Students of the Department of Zoology, University of Ceylon on "Agricultural Entomology, with special reference to tea" in February.

Three Scientific delegations from UPASI, Tocklai and Pakistan to the TRI Centennial Conference were received at the Mid-Country Station in May.

Publications

CALNAIDO, D. (1967). Progress with research on tea in the Mid-Country. *Tea Q.* **38**, 190-192.

CALNAIDO, D. & KANAPATHIPILLAI, P. (1967). Tolerance and susceptibility of tea clones to shot-hole borer infestations. *Tea Q.* **38**, 275-281

Reference

CALNAIDO, D. & THIRUGNANASUNTHARAN, K. (1966). Preliminary ecological studies on Shot-hole Borer and their relation to the control of the pest. *Tea Q.* **37**, 28-45.

REPORT OF THE ADVISORY DIVISION

Acting Chief Advisory Officer — L. M. de W. Tillekeratne, BSc, MEd

General

This report will cover the activities of the Advisory Division in the Up-Country and Uva Districts, and also those of the Uva Station. Advisory Activities of the Mid-Country and Low-Country Districts will be included in the reports on the Mid-Country and Low-Country Stations respectively.

The following staff changes took place during the year : Mr C. B. Foster-Barham, relinquished his post as Chief Advisory Officer after nearly 8 years of service with the Institute for an appointment in the Camaroun Republic. Mr L. M. de W. Tillekeratne was appointed Acting Chief Advisory Officer from the 8th June in addition to his duties as Scientific Officer (Uva). Mr K. L. de Alwis, filing clerk was transferred to the Administrative Division and Mr C. V. R. D. Fonseka from the Administrative section was transferred to the Advisory Division as Filing Clerk/Typist from the 1st of January. Mr J. V. Sabanayagam continued his post-graduate studies at the University of Guelph in Canada. Mr T. R. B. Sally was transferred as Accounts Clerk to the Uva Station in July.

After the withdrawal of the recommendation regarding the use of dieldrin for the control of Shot-hole-Borer, the side effects of Tortrix, Twig, and Looper Caterpillars showed a sharp decline in 1967. Except for a few localized outbreaks, these pests were not a problem even during the dry months.

In general, the climatic conditions during the year were not conducive to high crop production. Although the drought was delayed in Uva, it was strongly felt in August and September, while record crops were harvested in July. The flavoury season was confined to a very short period because of unfavourable climatic conditions.

Pests and diseases

Shot-hole-Borer

Revisions were made in the recommendations given for the control of this pest, following reports of serious outbreaks of Tortrix, Twig and Looper Caterpillars in various districts as side effects of dieldrin applications in 1966. In view of these side-effects the Institute withdrew its recommendation to use dieldrin and aldrin on mature tea, and the former is now only recommended for young clearings. Provisional recommendations were made for the use of heptachlor on an experimental basis as a substitute for dieldrin on mature tea. No adverse reports have been received as yet by using this chemical.

Mites

No serious outbreaks were reported during the year, especially from Uva during the dry weather. Reduction in the severity of infestation, may have some relationship with the reduced spraying of DDT formulations for the control of tortrix, twig and looper caterpillars.

Nematodes

The use of methyl bromide for fumigation of nurseries has come to be accepted by estates as a routine practice and queries on this subject were very few. Greater emphasis has been placed on the complete removal of roots to a depth of two ft during uprooting for replanting especially in suspected nematode-infested areas. This was necessary in view of reports that young clearings especially in the up-country districts were heavily infested with nematodes and *Poria* mainly because of poor uprooting.

Blister Blight

A fair number of queries were received from estates on the use of nickel chloride and Perezin as substitutes for straight copper for the control of Blister Blight. Estates were also interested in the economics of blister blight control as suggested by Dr R. L. de Silva in his conference address and publication in 1967.

Fertilizer Policy

Numerous queries were received from estates on economizing in phosphate and potash fertilizing. Many estates were forced to reduce or entirely omit these two nutrients, as a short-term measure for reducing costs. Every effort, however, was made to maintain nitrogen levels.

Replanting

There were a number of inquiries from estates on clones to be planted in clearings. The emphasis seem to have shifted, especially in the up-country for quality clones.

Field Experiments & Trials

Up-Country

The extension experiments on the types and levels of fertilizer continued to be managed by the Agricultural Chemistry Division. Extension experiments on shade x levels of nitrogen were managed by this Division in conjunction with the Plant Physiology Division. Treatment plucks commenced on all experiments and the progress of experiments **XPH1** to **XPH12** is described in the Report of the Plant Physiology Division.

Uva

All extension experiments in Uva were managed by the staff of the Advisory Division attached to the Uva Station.

Field experiments **UPH2, UPH3, UPH4, UPH5, UPH6, UVP4** and **UVP5** have been concluded and reported on in the Annual Report for 1966.

UPH1 — *Plucking frequency — (1965)*

This trial was concluded in April, and in addition to yield records, 12 rounds of miniature manufacture were carried out in order to observe any differences in made tea from the three plucking treatments. The area was pruned in October.

The results obtained to the end of the trial are given in Table 1. The means given are not corrected by co-variance with pre-treatment plucking means.

TABLE 1—*Effects of different plucking rounds on yield — Mean yields for the 3 clones calculated on made tea per acre*

Plucking rounds (days)	Number of rounds	Yield (lb per acre)
6	131	4095
8	99	3750
10	79	3350

A. M. Abeysinghe & N. L. C. Fernando

UPH7 — *Time of pruning, fertilizer applications before pruning and resting before pruning at Telbedde Group, Badulla* — Split - Split plot — 8 replicates for time of pruning (each month), split on 4 replicates for resting *vs* no-resting, and split again on blocks with 2 replicates for fertilizer application one month before pruning *vs* no application — (1967)

This trial was started in January to observe the effects on recovery by (a) pruning every month of the year (b) fertilizer applied one month before pruning and (c) resting three months before pruning. First plots were rested in January, and pruning commenced in April.

N. L. C. Fernando

UVP6 — *Performance of clones in soils of high acidity at Hugoland Estate, Udapussellawa — (1965)*

This trial planted in late 1965 was resuppled in 1966 and 1967. Plucking will commence in 1968.

UVP7 — *Levels of fertilizer and clones at Mahadowa Group, Madulsima — (1966)*

This trial is being continued. The nitrogen levels were increased to 240,280 and 320 lb per acre per year in keeping with a change in estate fertilizer practice.

Extension Experiments

Most of the experiments completed one year of post-treatment pluckings, and results obtained were statistically analysed.

XUA1 — *3 types of N at 3 levels at Aislaby Estate, Bandarawela — (1965)*

Results to-date are given in Table 2.

TABLE 2—*Mean yields for treatments on made tea per acre corrected by co-variance with pre-treatment plucking means — 3 forms of N x 3 levels*

				Levels of nitrogen per acre per year		
Estate	S/A	CAN	UREA	120 lb	240 lb	360 lb
Cannavarella ...	2711	2578	2564	2591	2582	2680
Telbedde ...	3262	3231	3297	3191	3315	3289
Hugoland ...	2402	2410	2427	2346	2426	2465
Aislaby ...	2425	2430	2465	2415	2443	2463
Spring Valley ...	3625	3652	3622	3523	3689	3686

There were no significant differences between the forms of nitrogen. On Hugoland and Spring Valley significant differences (at $P < 0.05$) were obtained between the lowest nitrogen level and the two higher ones.

XUA2 — *NPK each at 3 levels + control in all combinations at Aislaby Estate, Bandarawela — (1965)*

Results to-date are given in Table 3.

TABLE 3—*Mean yields for treatments of made tea per acre corrected by co-variance with pre-treatment plucking means — NPK each at 3 levels + control in all combinations*

Treatments	Aislaby	Hugoland
N_0 (120 lb N)	2467	2426
N_1 (240 lb N)	2528	2590
N_2 (360 lb N)	2548	2498
P_0 (0 lb P_2O_5)	2561	2529
P_1 (30 lb P_2O_5)	2486	2437
P_2 (60 lb P_2O_5)	2495	2552
K_0 (0 lb K_2O)	2485	2517
K_1 (60 lb K_2O)	2607	2464
K_2 (120 lb K_2O)	2450	2533

There were no significant differences in yield between treatments, except nitrogen on Hugoland, where there is a significantly quadratic ($P < 0.01$) effect. (ie there is a highly significant drop in yield at the highest level of nitrogen)

XUA3 — *3 types of N at 3 levels at Hugoland Estate, Udapussellawa — (1965)*

Results to-date are given in Table 2.

XUA4 — *NPK each at 3 levels and control in all combinations at Hugoland Estate, Udapussellawa — (1965)*

Results to-date are given in Table 3.

XUA5 — *3 types of N at 3 levels at Telbedde Estate, Badulla — (1965)*

Results to-date are given in Table 2.

XUA6 — *3 levels of N and 3 levels of Limbux at Telbedde Estate, Badulla — (1965)*

Results to-date are given in Table 4.

TABLE 4—*Mean yields for treatments on made tea per acre corrected by co-variance with pre-treatment plucking means — 3 levels N × 3 levels Limbux*

Estate	N_0	N_1	N_2	L_0	L_1	L_2
Telbedde	3364	3235	3483	3369	3391	3333
Hugoland	2752	2920	2911	2884	2848	2851
Cannavarella	2813	2942	3097	2951	2924	2973

No significant differences occurred in yields from the three levels of Limbux on all estates. On Hugoland, there were significant differences ($P < 0.05$) between the lowest level of N and higher levels, and on Cannavarella between the lower levels and the highest level.

N. L. C. Fernando

XUA7 — *Guatamala, Mana, and Napier as rehabilitation species at Telbedde Estate, Badulla — (1965)*

Experimental plots were planted with tea.

XUA8 — *3 types N at 3 levels at Nayabedde Estate, Bandarawela — (1965)*

This experiment was restarted in January, as plots were fertilized accidently during estate manuring.

XUA9 — *Guatamala, Mana and Napier as rehabilitation species at Nayabedde Estate, Bandarawela — (1965)*

Experimental plots were planted with tea.

XUA10 — *3 levels of N + 3 levels of Limbux at Cannavarella Group, Namunukula — (1965)*

Results to-date are given in Table 4.

XUA11 — *3 types N at 3 levels at Cannavarella Group, Namunukula —(1965)*

Results to-date are given in Table 2.

XUA12 — *NPK at 3 levels + control in all combinations at Spring Valley Group, Namunukula — (1965)*

Plots had to be retraced due to big differences in pre-treatment plucking records. Treatments were applied in March.

XUA13 — *3 types of N at 3 levels at Spring Valley Group, Namunukula — (1965)*

Results to-date are given in Table 2.

XUA14 — *NPK at 3 levels + control in all combinations at Kahagalla Estate, Haputale — (1966)*

The treatments were applied in April.

XUA15 — *3 types of N at 3 levels at Kahagalla Estate, Haputale — (1966)*

The treatments were applied in April.

XUA16 — *3 levels of N + 3 levels of Limbux at Hugoland Estate, Uda Pussellawa — (1965)*

Extension Activities

The extension activities of the Division centred around the Institute's contribution towards the Centenary of Ceylon Tea. To coincide with these celebrations the Institute held its 14th Conference on the 3rd, 4th, 6th and 7th of May at the Dimbula Athletic and Cricket Club, Radella, and on the 13th, 14th and 15th of May at the Low-Country Station on St Joachim Estate. The Conference at Dimbula was opened by the Honourable the Prime Minister of Ceylon, and proceedings included discussions in the mornings, followed by lunch for the delegates at the Institute Club, and in the afternoons, the visitors were conducted around the laboratories, field experiments and factory at St Coombs. Most of the arrangements were made by the staff of the

Advisory Division and in this connexion much of the success achieved is due to the efforts of Mr J. A. H. Tolhurst and Mr Foster-Barham, ably assisted by Mr Nathaniel. Overseas visitors from the Tea Research Stations in India, Pakistan and East Africa attended the Conference.

The Institute also participated in the Tea Centennial Exhibition organized by the Ceylon Tea Propaganda Board held on the old race course premises in Colombo from the 1st to 15th August. All arrangements for the Institute's exhibits were organized by Dr R. L. de Silva and Mr Nathaniel.

The following visitors spent varying periods at the Institute and district stations to study various aspects of tea cultivation.

Dr F. Hung	—	Professor of Geography, University of Guelph, Canada.
Mr Vo-Ngoc-Dinh	—	Research Directorate, Saigon, South Vietnam.
Mr Nguyen-AnNhon	—	National Agricultural Credit Office, South Vietnam.
Mr A. J. Vernon	—	Agricultural Officer, Government of Fiji.
Mr C. V. Kamalanathan	—	Department of Commerce, Colombo.

Permanent exhibits depicting the various problems associated with tea cultivation and research have been laid out in the form of a museum on the main corridor of the Institute's laboratory at St Coombs. These exhibits have been extremely useful in instructing visitors, especially batches of school children on problems associated with the cultivation of tea.

The Uva Station

Gonakelle Substation

Activities on this substation were confined to clonal testing and miniature manufacture. Results obtained during the year are reported on in the reports of the Plant Physiology and Technology Divisions.

Agratenne Substation

The transfer of the selected land area to the Institute was not completed during the year because of legal delays. With the kind permission of the Manager and Agents, Messrs George Steuart & Co Ltd, of Ury Group, work on this project continued in 1967. Unfortunately Mr D. N. R. Wijewardene who was in-charge of this project resigned his post early in the year. Approximately six acres of scrub land was brought under food production, and a variety of crops were grown. A further 20 acres of old tea land were uprooted and planted with Guatamala Grass, bringing the area under grass to 40 acres. A high-shade nursery with sprinklers was established in March to propagate 20,000 cuttings; this was a great success. Five acres of scrub land was planted with VP tea at the end of the year. The planting took the form of six experimental blocks, each consisting of 30 plots of different clones, three blocks were shaded and three without shade. The junior staff bungalow on the site is nearing completion. Two miles of road running through the substation were repaired and metalled. In this connexion our sincere thanks are due to the Manager Ury Group and his Agents for their kind co-operation in establishing this project.

Advisory Literature

The advisory pamphlets published during the year are given in Appendix I on page 17.

Visits, Lectures & Symposia

Mr L. M. de W. Tillekeratne with Mr D. E. Hettiarachi and Dr Cainaido represented the Tea Research Institute at the 74th Annual Conference of the United Planters' Association of South India held at Conoor in August-September. They visited several tea estates and factories during their short stay in South India.

Acknowledgements

Our sincere thanks are due to the President, Secretary and Members of the Committee of the Radella Club for allowing us the use of their building for the Conference; to all Managers, Superintendents and Assistants on estates that have come into the extension experiment scheme for their ready co-operation during the year. A special word of thanks to the Managers of Gonakelle and Ury Groups and their staff for their help and guidance in running the Uva Station and to all Heads of Research Divisions for their co-operation in 1967.

Publication

TILLEKERATNE, L. M. DE. W. (1967). Progress with research on tea in Uva. *Tea Q.* **38**, 193-197.

REPORT ON ST COOMBS ESTATE

Agriculturist — L. A. Seevaratnam, BSc

General

Mr S. T. Ponnusamy retired after 12 years service as Head KP of St Coombs. Mr W. G. Ariyapala was appointed Field Officer from the 1st June. Mr C. W. C. Mossop of Waltrim Group, Lindula overlooked St Coombs from 1st January to 31st December.

Delegates to the Tea Centennial Conference of the TRI were conducted around St Coombs Estate during the conference week, and were shown field experiments. Some new roads were constructed around the reservoir to facilitate access to experiments and to make their supervision more thorough.

Acreage as at 31st December 1967

	A	R	P
Seedling tea	183	3	36
Clonal tea	45	1	34
Young clonal tea	31	3	05
Land under rehabilitation	4	0	00
Area reserved for clonal cuttings and nurseries	7	0	17
Other land (Fuel clearings, buildings, roads, gardens, etc)	151	0	11
Total	423	1	23

Crop

Our estimated crop of 364,800 lb fell short this year by 8,764 lb. The yield per acre was 1,553 lb showing a decrease of 110 lb per acre in comparison to the previous year. This was because of unfavourable weather conditions, and also because a large acreage (65½ A) or nearly one-third of the estate was pruned during the year.

The yield per acre per month for St Coombs Estate from 1963 to 1967, the total rainfall, the number of wet days and the average quantity of nitrogen applied for each year is given in Table 1. Table 2 gives the yield per month for each field together with the type of nitrogen and quality of fertilizer applied.

TABLE 1—*Yield per acre per month for St Coombs Estate from 1963 to 1967; total rainfall, the number of wet days and the average quantity of N applied for each year*

Month	1967	1966	1965	1964	1963
January	116	155	136	152	106
February	109	117	88	112	92
March	106	151	97	114	124
April	140	149	183	145	138
May	187	161	177	147	171
June	134	132	129	168	149
July	105	138	108	77	111
August	120	147	87	112	124
September	118	123	106	95	105
October	120	122	125	115	98
November	152	141	137	76	117
December	146	127	137	117	110
TOTAL	1553	1663	1510	1430	1445
Total rainfall (in.)	83.96	70.94	93.21	79.76	83.50
No. of wet days	202	188	204	198	231
Average N per acre per annum (lb)	248	248	184	162	180

TABLE 2 — *Monthly yields of fields from January to December 1967*

Field No.	Type of nitrogen fertilizer *	Total N (lb) per annum	Basal† Mixture lb	Monthly yields (lb per acre) Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total per acre
1	CAN	300	448	204	164	126	144	263	196	131	125	117	119	172	156	1917
3	S/A	300	448	101	103	48	108	116	87	60	109	113	132	259	270	1506
4	CAN	200	448	126	81	101	120	136	73	8	—	1	44	51	76	817
5	S/A	160	448	105	96	92	123	157	131	81	107	93	133	139	118	1375
6	S/A	160	—	23	31	95	96	173	91	163	126	224	146	192	197	1557
7	S/A	300	—	161	88	74	138	231	125	165	291	154	182	438	370	2417
8	S/A	300	—	77	144	128	172	233	194	223	230	322	198	314	350	2585
9	CAN	240	448	110	102	121	145	157	162	64	33	—	—	34	26	954
10	S/A	240	448	134	150	138	164	228	170	126	63	—	—	—	39	1212
10 (Clonal)	CAN	200	448	155	76	176	123	324	217	231	212	276	143	324	308	2565
11	S/A	300	448	25	21	69	87	151	87	123	135	145	127	146	139	1255
12	S/A	300	448	122	154	99	171	186	126	137	200	188	207	210	186	1986
13	S/A	240	448	152	156	132	181	250	168	119	173	214	197	206	192	2140
14	CAN	300	448	24	44	69	91	117	123	83	127	123	133	141	143	1218
15	CAN	360	448	95	138	216	116	220	144	222	179	222	143	188	167	2050
16	CAN	300	—	242	220	122	207	384	190	247	306	241	228	222	208	2817
17	S/A	300	448	212	183	193	284	307	259	199	233	288	166	282	222	2828

*CAN = Calcium ammonium nitrate
S/A = Sulphate of ammonia

†This mixture is composed of :

Muriate of potash	...	150 lb
Saphosphosphate	...	70 lb
Dolomite	...	224 lb
Fertilizer borate	...	4 lb
Mixture applied per acre		448 lb

Total crop sold and prices

Year	Total crop (lb made tea)	Nett price per lb. (cents)
1967	457,727† *	203 *
1966	431,697	218
1965	419,338	224
1964	306,717	243
1963	314,204	219

Cost of Production

Year	Estimated COP (cents)	Actual COP (cents)
1967	181	183 *
1966	161	170
1965	153	148
1964	153	157
1963	147	141

Profits

Year	Gross profit	TRI contribution	Actual profit
1967	Rs 90,402 *	Nil	Rs 90,402*
1966	Rs 189,302	Nil	Rs 189,302
1965	Rs 287,862	Rs 63,763	Rs 224,009
1964	Rs 252,074	Rs 61,065	Rs 191,009
1963	Rs 222,077	Rs 63,599	Rs 158,478

Cultural Operations

All fields received applications of zinc sulphate and all fields except certain experimental areas were under fungicidal protection against Blister Blight during both monsoons.

Field No. 1

Seedling tea area ...	1A-3R-35P
VP tea area ...	18A-0R-05P
Clones planted ...	TRI 777, 2016, 2022, 2023, 2024, 2025 & 2026
Land under rehabilitation ...	2A-0R-00P
Last pruned ...	1964 and 1967 (8A)
Yield per acre 1966	2308 lb
Yield per acre 1967	1917 lb
Type of N ...	Calcium ammonium nitrate
Quantity of N—1967	300 lb in 6 applications
Shade	*Erythrina lithosperma, Grevillea robusta* & *Acacia* sp.
Experiments ...	**PH1** (0.5A), **N7** (0.25A), **N15** (0.25A), **N21** (0.25A)

About eight acres of this were pruned during the course of the year. Rim lungs were left at pruning and removed at bud-break. All the *Acacia* trees which were ring barked in 1966 were removed this year.

The *Grevillea robusta* shade trees in this field were also thinned out by ring-barking every other tree. These will be removed when the trees are quite dead. All roads through this field were metalled during the year. All ravines were cleaned out and planted with tea wherever possible.

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* Subject to verification by the auditors

† Includes 101,691 lb of crop secured on bought leaf

Methyl bromide was used to control *Poria* Root Disease wherever it was noticed.

Field No. 2

Seedling tea	Nil
VP tea area	7A-1R-23P
Clones planted	TRI 740, 777, 2016, 2023, 2024, 2025, 2026, 2039, 2142, DT 1, DT 95 & E 7/27
Planting year	1964
Last pruned	Not pruned so far
Yield per acre 1966 ...	598 lb
Yield per acre 1967 ...	1239 lb
Type of N	Sulphate of ammonia (T 200)
Shade	Nil
Experiments	**PH3** (1.78A), **PH12** (0.5A), **VP12** (0.2A)

Field No. 3

Seedling tea area	7A-1R-0P
Last pruned	1964
Yield per acre 1966 ...	1343 lb
Yield per acre 1967 ...	1506 lb
Type of N	Sulphate of ammonia (T200)
Quantity of N	300 lb in 6 applications
Shade	Nil
Area under rehabilitation ...	4A-0R-0P
VP tea area—	
1965 planting	10A-0R-15P
Clones	DT 1
Yield per acre 1966 ...	218 lb
Yield per acre 1967 ...	1021 lb
1966 planting	4A-2R-12P
Clones	TRI 740, 2024, 2025, 2142, 62/3, 62/5, E 7/27, CY 9 & KEN 16/3
1967 planting	
Clones	TRI 2023 & 2025
Shade	Nil
Experiments	**A1** (4.5A), **A9** (1A), **A13** (1.7A), **A15** (0.7A), **AYT21** (0.1A), **AYT4** (0.1A), **VP4** (1.25A), **VP5** (1A) **VP12** (0.2A), **VP13** (0.3A), **VP14** (0.5A), **VP17** (1A), **P60** (2.5A) & **N3** (0.3A)

About six acres of this field was planted this year. The major part of the planting was done for experimental purpose.

The tea planted in 1966 was bent twice, followed by a cut-across. It is now being gradually being plucked in.

No further uprooting was done in this field during the year.

About six acres under rehabilitation was planted this year. The major portion of the area was planted for of experiments.

Field No. 4

Seedling tea area	30A-2R-0P
VP tea area	Nil
Last pruned	1967
Yield per acre 1966 ...	1315 lb
Yield per acre 1967 ...	817 lb
Type of N	Calcium ammonium nitrate
Quantity of N	200 lb in 4 applications
Shade	Nil
Experiments	**PH25** (0.8A), **P20**

This field was pruned in June/July 1967. Weed control is effected completely by Gramoxone.

Towards the latter part of the year about six acres of this field was sprayed with dieldrin to induce Tea Tortrix for experimental purposes. The leaf from two consecutive plucks was discarded from this area.

Field No. 5

Seedling tea area	19A-1R-0P
VP tea area	Nil
Last pruned	1964
Yield per acre 1966 ...	1234 lb
Yield per acre 1967 ...	1375 lb
Type of N	Sulphate of ammonia
Quantity of N — 1967 ...	160 lb in 4 applications
Shade	Nil
Experiment	**P20**

Poria patches on this field were cleared this year in anticipation of this field being uprooted for replanting next year.

An area of tea (1A - 2R - 10P in extent) was uprooted in this field for laying out an experiment. Uprooting was done using a power-operated winch. Following uprooting the land was trenched and all the roots up to a depth of two feet were removed. This area is now being rehabilitated under Guatemala Grass.

Field No. 6

Seedling tea area	9A-3R-0P
VP tea area	Nil
Last pruned	1966
Yield per acre 1966 ...	1464 lb
Yield per acre 1967 ...	1557 lb
Type of N — 1967	Sulphate of ammonia
Quantity of N — 1967 ...	160 lb in 4 applications
Shade	*Grevillea robusta*
Experiments	**PH9** (3.28A), **PH20** (3.28A), **E36**, **E37** & **E56** (2A)

All dadap trees on this field were removed. The *Grevillea robusta* trees which had been ring-barked and which were quite dead were felled.

A major portion of this field is under experiments.

Field No. 7

Seedling tea area	Nil
VP tea area —	
1962 planting	6A-0R-29P
Clones	TRI 740, 777, 2023, 2024, 2025, 2026, 2043, 2142, 2151 DT 95 & TK 45
Last pruned	1966
Yield per acre — 1966 ...	2055 lb
Yield per acre — 1967 ...	2417 lb
Type of N	Sulphate of ammonia
Quantity of N — 1967 ...	300 lb in 6 applications
Shade	Nil
1964 planting	6A-0R-18P
Clones	TRI 740, 777, 2016, 1023, 2024, 2025, 2026, 2039, 2142, DT 1, DT 95 & E 7/27
Last pruned	Not pruned so far
Yield per acre 1966 ...	1067 lb
Yield per acre 1967 ...	1814 lb
Shade	Nil
Experiments	**VP2** (1.5A), **P18** (1A) & **A8** (2.4A)

Field No. 8

Seedling tea area ...	... Nil
VP tea area ...	... 8A-3R-2P
Clones	... TRI 777, 1114, 2024, DT 1 & DT 95
Yield per acre 1966	... 1735 lb
Yield per acre 1967	... 2585 lb
Type of N ...	... Sulphate of ammonia
Quantity of N — 1967	... 300 lb in 6 applications
Shade	... Nil
Experiments ...	... **A8** (2.4A), **A9** (1A), **AYT16** (0.05A), **AYT20** (0.02A) **W1** (0.8A), **W2** (0.05A), **W6** (0.5A), **VP1** (1.75A), **VP2** (1.5A), **VP3** (1A), **VP11** (0.05A) & **VP19** (1.75A)

Field No. 9

Seedling tea area ...	... 26A (Estate plucking 15¾ A)
VP tea area ...	... Nil
Last pruned ...	... 1967
Yield per acre 1966	... 1703 lb
Yield per acre 1967	... 954 lb
Type of N ...	... Calcium ammonium nitrate
Quantity of N — 1967	... 240 lb in 4 applications
Shade	... *Grevillea robusta, Erythrina lithosperma*
Experiments ...	... **A2** (2.4A), **A4** (0.4A), **AYT12** (0.2A), **AYT14** (0.2A), **AYT15** (0.05A), **PH26** (0.01A), **VP10** (0.17A) **VP14** (0.05A), **AYT19** (0.05A), **W7** (0.01A) **P14** (1A), **P19** (7A), **P31** (0.1A), **P32** (7A),. **P56** (0.3A), **P11** (0.01A) & **P57** (0.2A)

This field also was pruned and all *Grevillea robusta* trees which were ring-barked, felled before pruning.

The shade on certain parts of this field was retained for experimental work.

Field No. 10

Seedling tea area ...	... 12A-2R-0P (Estate plucking 11A)
Last pruned ...	... 1967
Yield per acre 1966	... 1977 lb
Yield per acre 1967	... 1212 lb
Type of N ...	... Sulphate of ammonia
Quantity of N — 1967	... 240 lb in 4 applications
Shade	... *Grevillea robusta & Erythrina lithosperma*
VP tea area ...	... 4A-3R-0P
Clones	... TRI 23, 740, 777, 2016, 2021, 2023, 2024, 2025, 2026 & 2027
Pruning	... Clones constantly pruned for taking cuttings
Yield per acre 1966	... 1845 lb
Yield per acre 1967	... 2565 lb
Type of N ...	... Calcium ammoniam nitrate
Quantity of N — 1967	... 200 lb in 4 applications
Shade	... Nil
Experiments ...	... **P25** (11A), **P28** (0.8A) & **P32** (10A)

Field No. 11

Seedling tea area ...	... 17A-0R-0P (Estate plucking 16¾ A)
VP tea area ...	... Nil
Last pruned ...	... 1966
Yield per acre 1966	... 1135 lb
Yield per acre 1967	... 1255 lb
Type of N ...	... Sulphate of ammonia
Quantity of N ...	... 300 lb in 4 applications
Shade	... Nil
Experiments ...	... **A16** (1.7A), **PH22** (0.17A), **VP15**

Experiments by the Entomolgy Division were carried out on this field towards the latter part of this year. Approximately 16¾ acres were sprayed with dieldrin to induce an attack of Tortrix and the green leaf from these sprayed areas over two consecutive plucks had to be discarded, these effecting the final yield of this field.

A quarter-acre area of this field was uprooted by the Agricultural Chemistry Division for an experiment on rehabilitation.

Field No. 12

Seedling tea area ...	... 29A-3R-0P (Estate plucking 26A)
VP tea area ...	... Nil
Last pruned ...	... 1965
Yield per acre 1966	... 1918 lb
Yield per acre 1967	... 1986 lb
Type of N ...	... Sulphate of ammonia
Quantity of N — 1967	... 300 lb in 4 applications
Shade	... Nil
Experiments ...	... **PH13** (1.78A), **PH21** (0.04A), **P20** (0.05A), **P20**

About 2% of the tea of the total acreage of this field was allowed to grow up as windbreaks. These windbreaks were cut down towards the latter part of the year but kept in places around experimental plots.

Field No. 13

Seedling tea area ...	... 18A-1R-0P (Estate plucking 15A)
VP tea area ...	... Nil
Last pruned ...	... 1964
Yield per acre 1966	... 2156 lb
Yield per acre 1967	... 2140 lb
Type of N ...	... Sulphate of ammonia
Quantity of N ...	... 240 lb in 4 applications
Shade	... Nil
Experiments ...	... **A5** (0.7A), **A7** (0.7A), **A12** (1.7A), **A16** (1.7A), **PH5** (1.44A), **P20** & **P26** (1A)

An area approximately a quarter acre was uprooted on this field by the Agricultural Chemistry Division for the purpose of carrying out an experiment on rehabilitation.

Just under half acre of this field had been uprooted in the past for construction of buildings. This area was planted up in clonal tea early in the year, the clone used being E7/27.

Field No. 14

Seedling tea area ...	... 12A-2R-0P
VP tea area ...	... Nil
Last pruned ...	... 1966
Yield per acre 1966	... 1143 lb
Yield per acre 1967	... 1218 lb
Type of N ...	... Calcium ammonia nitrate
Quantity of N — 1967	... 300 lb in 6 applications
Shade	... Nil
Experiments ...	... **VP15, P20**

Field No. 15

Seedling tea area ...	... 2A-1R-0P
VP tea area ...	... Nil
Last pruned ...	... 1966
Yield per acre 1966	... 878 lb
Yield per acre 1967	... 2050 lb
Type of N ...	... Calcium ammonium nitrate
Quantity of N — 1967	... 360 lb in 6 applications
Shade	... *Grevillea robusta*
Experiments ...	... Nil

Field No. 16

Seedling tea area ...	... Nil
VP tea area ...	... 4A
Clones	... TRI 2024
Last pruned ...	... 1965
Yield per acre 1966	... 3075 lb
Yield per acre 1967	... 2817 lb
Type of N ...	... Calcium ammonium nitrate
Quantity of N — 1967	... 300 lb in 6 applications
Shade	... Nil
Experiments ...	... **P29** (0.6A), **P30** (0.6A) & **P58** (0.2A)

No basal mixture was applied in this field during the course of the year. This was the 2nd year when no P or K was applied. Nitrogen was given as calcium ammonium nitrate.

An area in this field was planted in January/February of this year. It was heavily infested with Cooth Grass and was fumigated with methyl bromide at 2 lb per 100 sq ft to eradicate the grass and then planted up. This method of controlling cootch has proved to be quite successful, judging from the lack of the grass so far.

Field No. 17

Seedling tea area ...	... Nil
VP tea area ...	... 4A-3R-0P
Clones	... TRI 777, 2024, 2025
Last pruned ...	... 1965
Yield per acre 1966	... 2123 lb
Yield per acre 1967	... 2828 lb
Type of N ...	... Sulphate of ammonia
Quantity of N — 1967	... 300 lb in 6 applications
Shade	... Nil
Experiments ...	... Nil

Publication

SEEVARATNAM, L. A.(1967). A planters' battle of today. *Tea Q.* **38**, 116-121.

REPORT ON ST JOACHIM ESTATE

Superintendent—G. S. Muttettuwegama

General

Mr L. A. D. Weerakoon joined the estate in July as an Assistant General KP. Mr M. S. W. Wijeratne took charge of the estate stores from 1st July in addition to his normal duties as Head Factory Officer. All other staff appointments remained unchanged.

A major flood was experienced on the 19th October. All roads leading to the estate were inundated and impassable to vehicular traffic. The Hidellena road leading to the estate from the main Colombo-Ratnapura road was improved and a new bridge was constructed above flood level. Half the expenses of this work was met by the Institute.

Acreage as at 31st December 1967

	A	R	P
Seedling tea in bearing	224	0	14
Clonal tea in bearing	18	0	00
Clonal tea not in bearing	31	1	24
Land under rehabilitation	41	3	25
Nurseries	1	3	11
Other land (Paddy, buildings, roads, line-gardens, ravines & waste land, encroachments etc)	98	3	32
	416	0	26

Crop

A deficit of 51,798 lb made tea was recorded against the estimate of 331,000 lb for the year. The yield per acre for the year was 1,065 lb. Uprooting of old tea in Field No. 8 for replanting was commenced in June. This field was not in the programme for replanting and the shortfall in crop could be attributed to this to a certain extent.

Fine plucking was commenced in March and a very high standard was maintained thereafter. Coarse leaf and even soft banji leaf were discarded, and plucking rounds were kept at five days in seedling tea and a standard of 65-75% of two leaves and a bud was achieved.

The yield per acre per month for St Joachim Estate from 1963 to 1967, rainfall, the number of wet days and the average quantity of nitrogen applied for each year is given in Table 1. Table 2 gives the yield per acre per month for each field, together with the type and quantity of fertilizer applied.

TABLE I —*Yield per acre per month for St Joachim Estate from 1963 to 1967; total rainfall number of wet days and the average quantity of N applied each year*

Month	1967	1966	1965	1964	1963
January ...	77	92	94	117	99
February ...	96	103	57	70	91
March ...	66	104	121	115	111
April ...	82	126	88	109	114
May ...	92	108	100	113	96
June ...	70	44	101	114	92
July ...	72	16	91	94	102
August ...	82	3	102	85	90
September ...	77	97	101	87	94
October ...	107	70	116	91	92
November ...	125	83	110	89	98
December ...	119	90	110	83	95
	1,065	936	1,191	1,167	1,174
Total rainfall	147.06	132.78	166.15	185.28	174.22
No. of wet days	236	222	223	208	246
Average N per acre per annum (lb)	144.20	133.75	143.80	140.16	123.00

Total crop sold and prices

Year	Total crop sold (lb made tea)	Nett price per lb (cents)
1967	272,907 *	161 *
1966	251,457	145

Cost of production

Year	Estimated COP (cents)	Actual COP (cents)
1967	145 *	180 *
1966	155	175

High cost of production was the result of shortfalls in the estimated crop for the two previous years, the shortfall in 1966 being due to the strike, and the drought, and in 1967 to fine plucking, and more old tea being uprooted for replanting than originally estimated. However, prices realised for St Joachim teas were about the best in the low country. Taking into consideration the poor prices of low-country teas, St Joachim made a determined effort to produce quality teas fetching well over Rs. 1.50 per lb and not to exploit the Tea Export Duty Rebate Scheme granted by the Government for those teas selling between 90 cts. and Rs 1.50 per lb. Most St Joachim teas sold at prices very much above Rs 1.50 per lb for most part of the year. The high standard of teas manufactured at St Joachim was achieved by resorting to, and maintaining a good standard of leaf.

Profit

The loss suffered this year on St Joachim was due to the reduction in crop and the fall in sale prices of the low-country tea market.

Year	Gross profit	TRI contribution	Actual profit
1967	— Rs 60,869 *	—	— Rs 60,869 *
1966	— Rs 118,651	—	— Rs 118,651
1965	+ Rs 77,381	Rs 7,911	+ Rs 69,470
1964	— Rs 47,955	—	— Rs 47,955
1963	— Rs 22,798	—	Rs 22,798

Cultural Operations

It was possible to complete all cultivation work according to the programme laid out.

Field No. 1

Seedling tea area (infilled with VP tea)	—	40 A
Last pruned	...	September 1965
Yield per acre 1966	...	1,014 lb
Yield per acre 1967	...	1,205 lb
Type of N	...	Sulphate of ammonia
Quantity of N-1967	...	144 lb per acre in 4 applications
Shade	...	No shade except in 6 acres retained for experimental work
Weeding	...	Gramoxone spraying — 30 acres done bi-monthly Contract (hand weeding) 10 acres done monthly
Experiments	...	**LP1, LP2, LP3** (2.52A)

Fertilizer applied in this field in 1966 was 900 mixture and was replaced in 1967 with sulphate of ammonia.

The pruning of this field which was due in June was postponed for the next year on the advise of the research section, in order to see what effects a longer pruning cycle would have on low-country tea.

Zinc sulphate was applied as a foliar spray in April, June, October and November at the rate of 5 lb per acre per round.

*Subject to verification by the auditors

TABLE 2 — *Monthly yields of fields from January to December 1967*

Field No.	Type of nitrogen fertilizer	Total N (lb) per plant	Monthly yields (lb per acre) Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total per acre
1	S/A	144	96	114	85	99	114	113	107	89	83	107	107	91	1205
2	S/A	144	75	107	72	106	113	104	115	99	81	127	128	111	1238
3	S/A	120	75	100	60	72	39	—	15	41	39	74	95	88	698
4	S/A	144	99	125	78	107	114	23	02	18	64	83	115	112	940
5	S/A	144	84	89	51	32	26	15	15	43	49	65	100	97	666
6	S/A	144	86	116	88	98	168	119	121	136	88	107	133	131	1391
7	CAN	206	77	105	58	120	123	130	122	145	135	153	169	160	1497
8	Nil	Nil	44	48	57	33	43	32*	17	19	16	—	—	—	309
10A	T 200 900 Mixture	@ ¾ oz per plant 250	22	43	32	39	72	66	65	77	57	143	148	161	925
10B	T 200 900 Mixture	@ ½ oz & ¾ oz per plant 250	—	—	—	—	—	23	140	70	46	93	125	159	656

S/A — Sulphate of ammonia

CAN — Calcium ammonium nitrate

900 Mixture is composed of

Sulphate of ammonia	20.6%	700 lb
Saphosphosphate	27.5%	100 lb
Muriate of Potash	60%	100 lb
		900 lb

* Uprooting of tea commenced in June

Field No. 2

Seedling tea area (infilled with VP tea) ...	28A-1R-0P
Last pruned	April 1966
Yield per acre 1966	749 lb
Yield per acre 1967	1,238 lb
Type of N	Sulphate of ammonia
Quantity of N — 1967	144 lb per acre in 4 applications
Shade	Nil
Weeding	Gramoxone spraying — 26½ acres done bi-monthly Contract (hand weeding) 2 acres done monthly
Experiments	LW4 (1A); LW2 (0.8A); LW12 (1.2A); LW13 (0.8A) LPH1 (0.17A)

Fertilizer applied in this field in 1966 was 900 mixture & was replaced in 1967 with sulphate of ammonia.

Zinc sulphate was applied as a foliar spray in April, June, October and November at the rate of 5 lb per acre per round.

Field No. 3

Seedling tea area (infilled with VP tea) ...	20A-1R-0P
Last pruned	May 1967
Yield per acre 1966	1,065 lb
Yield per acre 1967	698 lb
Type of N	Sulphate of ammonia
Quantity of N — 1967	120 lb per acre in 3 applications
Shade	Nil
Weeding	Entire field is sprayed with Gramoxone bi-monthly
Experiments	LA7 (0.5A); LA8 (0.13A); LA9 (0.87A); LA18 (0.14A); LA34 (0.73A); LW11 (0.06A); LW18 (0.2A); LVP7 (0.75A)

Two cwt of dolomite per acre was applied immediately after pruning and recovery was good. Zinc sulphate was applied as a foliar spray in April, October and November at 5 lb per acre per round.

New Clearings

Both clearings were on old tea land.

A—*Planted 1966*

Seedling tea area	Nil
VP tea area	9A-1R-0P

This clearing has made very satisfactory progress and it should be possible to bring the plants into bearing in the first half of 1968. The following clones have been planted out in the clearing :

Clone	No. of plants
TRI 2023	9,102
TRI 2025	18,782
TRI 2026	18,214
St Joachim selections	2,640
Tocklai (India) selections	360
Total	49,098

Of this field half acre was planted in 1963 and another half acre in August 1966 without reconditioning. Fertilizer applied in 6¼ acres of this field was T 200 in six applications at the rate of ½ oz per plant per application and the other three at the rate of ¾ oz per plant per application.

The balance area of three acres was fertilized and maintained by the research section.

B—*Planted 1967*

Seedling tea area	2 (approximately) acres
VP tea area	18½ (approximately) acres

This clearing has made very satisfactory progress and has been planted out with the following clones. Fertilizer applied was T 200 mixture at the rate of ½ oz per plant per application, given in three applications.

Clone	No. of plants
Lansdowne seedlings	10,801
TRI 2023	55,178
TRI 2025	27,286
TRI 2026	19,603
TRI 2043	750
Total	113,618

Field No. 4

Seedling tea area (infilled with VP tea) ...	28A-1R-0P
Last pruned	June 1967
Yield per acre 1966	1,248 lb
Yield per acre 1967	940 lb
Type of N	Sulphate of ammonia
Quantity of N — 1967	144 lb per acre in 4 applications
Shade	Nil
Weeding	Entire field is sprayed with Gramoxone bi-monthly
Experiments	L 17 (0.68A); LW5 (0.92A); XLPH4 (0.6A)

Fertilizer applied in this field in 1966 was 900 mixture and was replaced in 1967 with sulphate of ammonia. Two cwt of dolomite per acre was applied immediately after pruning and recovery was good. Zinc sulphate was applied as a foliar spray in April, October and November at 5 lb per acre per round.

Field No. 5

Seedling tea area (infilled with VP tea) ...	35A-1R-0P
Last pruned	April 1967
Yield per acre — 1966	934 lb
Yield per acre — 1967	666 lb
Type of N	Sulphate of ammonia
Quantity of N — 1967	144 lb in 4 applications
Shade	Nil
Weeding	Gramoxone spraying 29¼ acres done bi-monthly Contract (hand weeding) 6 acres done monthly
Experiments	L5 (1A); LW9 (0.8A)

Fertilizer applied in this field in 1966 was 900 mixture and was replaced in 1967 with sulphate of ammonia. Recovery after pruning was good. Two cwt of dolomite per acre was applied immediately after pruning.

Zinc sulphate was applied as a foliar spray in April, June, October and November at the rate of 5 lb per acre per round.

Field No. 6

Seedling tea area (infilled with VP tea) ...	29A-3R-0P
Last pruned	May 1966
Yield per acre 1966	1,004 lb
Yield per acre 1967	1,391 lb
Type of N	Sulphate of ammonia
Quantity of N—1967	144 lb per acre in 4 applications
Shade	Nil
Weeding	Gramoxone spraying 20¾ acres done bi-monthly Contract (hand weeding) 9 acres done monthly
Experiments	**LPH2** (0.5A); **LPH3** (1.03A)

Fertilizer applied in this field in 1966 was 900 mixture, and was replaced in 1967 with sulphate of ammonia. Zinc sulphate was applied as a foliar spray in April, June, October and November at the rate of 5 lb per acre per round.

Field No. 7

Seedling tea area (infilled with VP tea) ...	42A-1R-0P
Last pruned	September 1966
Yield per acre 1966	948 lb
Yield per acre 1967	1,497 lb
Type of N	CAN
Quantity of N—1967	200 lb per acre in 5 applications
Shade	vide remarks made below
Weeding	Gramoxone spraying 27 acres done bi-monthly Contract (hand weeding) 15¼ acres done monthly
Experiments	**LW3** (1.16A); **LA15** (0.6A); **XLPH1** (42¼A)

In 1966 this field received two applications of 900 mixture and one application of calcium ammonium nitrate and in 1967 five applications of calcium ammonium nitrate and one application of basal mixture.

The research section took over the weeding of the entire field from June 1967.

For experimental work this field has been divided into six blocks. In three of these blocks the shade trees (*Gliricidia maculata*) have been retained and in the other three blocks have been uprooted.

Field No. 8

Seedling tea	42A
Last pruned	October 1966
Yield per acre 1966	811 lb
Yield per acre 1967	309 lb
Type of N	Nil
Quantity of N—1967	Nil
Shade	Nil
Weeding	Nil
Experiment	**LW10** (0.4A)

The entire acreage has been uprooted. Uprooting commenced in June and completed at the end of the year. No cultivation work or manuring was done in this field.

Field No. 9

Seedling tea area	...	...	...	Nil
VP tea area ...	...	...	...	3¼ A
Date of planting	...	...	...	1966

The tea in this clearing was planted on old rubber land. Only about 3¼ acres of the field has been planted. Fertilizer applied was T 200 mixture in 5 applications in January, March and May at the rate of ½ oz per plant per application and in September & November at the rate of ¾ oz per plant per application.

Field No. 10

Planted 1964

Seedling tea area	...	...	...	Nil
VP tea area ...	...	...	...	10A
Experiments	...	...	...	**LA14** (0.47A); **LA11** (0.7A); **LVP6** (0.8A)

Fertilizer applied in this field was T 200 & 900 mixture as follows:

January	—	4A T 200 (¾ oz per plant)
February	—	6A 900 mixture (250 lb per acre)
March	—	4A T 200 (¾ oz per plant)
April	—	6A 900 mixture (250 lb per acre)
May	—	4A T 200 (¾ oz per plant)
June	—	6A 900 mixture (250 lb per acre)
August	—	8A 900 mixture (250 lb per acre)
October	—	8A 900 mixture (250 lb per acre)
November	—	1A T 200 (¾ oz per plant)

Six acres of this clearing were in plucking since October 1966. The balance area of four acres which was planted a year later by the research section was brought into plucking at the end of 1967. The yield per acre for 1967 for the entire ten acres was 925 lb. Vacancies were supplied in 1967.

Planted 1965

Seedling tea area	...	...	...	Nil
VP tea area ...	...	...	...	6A-2R-0P

Fertilizer applied in this field was T 200 and 900 mixture as follows :

January	—	5½A T 200 mixture (½ oz per plant)
March	—	5½A T 200 mixture (¾ oz per plant)
May	—	5½A T 200 mixture (¾ oz per plant)
July	—	5½A 900 mixture (250 lb per acre)
September	—	5½A 900 mixture (250 lb per acre)
November	—	5½A 900 mixture (250 lb per acre)

One acre of this field was fertilized by the research section. The field was pruned in April and brought into plucking in June/July, the yield for the year being 656 lb per acre.

Pests & Diseases

No incidence of any major pest and disease outbreaks occurred. Very mild attacks of Blister Blight were noticed along boundaries with over-hanging trees during November and December, and no treatment was given as the infection was not serious. Also, a very mild infestation of faggot worms was seen in a few isolated patches and was treated with DDT.

Factory

CTC manufacture on a commercial scale was started at the end of the year. It was possible to sell only a few invoices. A new GWA Fermenting Unit was installed in the factory during the year. Power failures in the Government power supply were not so numerous as in the previous years.

METEOROLOGICAL OBSERVATIONS—1967

THE TEA RESEARCH INSTITUTE, ST COOMBS, TALAWAKELE

MONTH	TEMPERATURES °F					RELATIVE HUMIDITY		SUNSHINE		RAINFALL		RAINY DAYS	
	Maximum Dry	Maximum Wet	Minimum Dry	Minimum Wet	Minimum Grass	Maximum	Minimum	Mean hours per day	Diff. from Ave (25 yrs)	Inches	Diff. from Ave (25 yrs)	Days	Diff. from Ave (25 yrs)
January	79.0	75.5	46.5	44.0	42.5	97	82	6.1	0.3	2.1	— 0.9	10	0
February	78.5	75.5	47.0	42.0	40.5	100	37	7.4	0.6	2.4	0.0	7	0
March	80.0	75.5	47.2	43.5	43.0	100	48	7.0	0.4	5.8	+ 1.3	15	+ 3
April	82.5	70.5	48.0	43.5	42.0	100	32	7.9	1.5	4.5	— 2.2	12	— 4
May	78.5	70.5	56.0	56.0	54.0	100	62	5.6	0.3	3.0	— 6.4	17	0
June	74.5	70.0	53.0	53.0	52.5	100	62	3.4	0.1	9.5	— 2.8	24	+ 1
July	75.5	67.5	55.5	55.5	54.5	100	66	3.1	0.2	10.5	+ 0.2	28	+ 4
August	73.0	67.5	57.0	57.0	56.8	100	57	3.7	0.3	6.7	— 2.2	21	— 2
September	78.5	68.5	50.5	50.0	47.5	100	52	6.1	2.0	6.4	— 2.0	10	—10
October	74.5	64.0	46.0	45.0	44.0	100	64	5.4	0.9	19.3	+10.1	16	— 3
November	76.0	69.0	52.5	51.5	48.0	100	64	5.0	0.3	14.2	+ 6.8	21	+ 2
December	77.5	71.0	52.0	46.0	44.5	100	57	5.6	0.4	6.6	+ 1.0	9	— 6
	77.3	70.4	50.9	48.9	47.5	100	57	5.5	0.6	91.0	+ 2.9	190	—15
	Means									Totals			

METEOROLOGICAL OBSERVATIONS — 1967

THE TRI LOW-COUNTRY STATION, ST JOACHIM, RATNAPURA

MONTH	TEMPERATURE °F					RELATIVE HUMIDITY		SUN-SHINE	RADIATION	RAINFALL	RAINY DAYS
	Maximum Dry	Maximum Wet	Minimum Dry	Minimum Wet	Minimum Gross	From Maximum Temperature	From Minimum Temperature	Mean hours per day	Mean per day °F	Inches	
January ...	88.6	77.8	69.1	68.9	65.4	61.5	98.7	5.7	148.9	6.7	13
February ...	90.5	79.5	69.6	68.5	66.6	60.0	94.4	6.5	154.9	2.9	11
March ...	92.6	80.1	71.1	69.3	67.7	56.4	91.6	6.8	156.7	7.9	19
April ...	93.4	81.6	72.4	71.2	66.2	58.8	94.1	7.2	159.4	10.1	19
May ...	89.5	81.8	73.7	72.4	68.0	70.9	93.7	4.7	152.0	9.7	25
June ...	88.1	81.0	73.1	71.8	69.8	72.8	93.7	4.2	149.5	19.8	27
July ...	87.4	79.6	72.2	70.8	69.4	70.1	93.1	4.5	152.2	15.7	26
August ...	87.4	79.6	72.5	71.0	71.2	69.4	93.0	5.1	153.0	11.2	28
September ...	88.4	79.3	70.8	69.8	68.5	66.0	95.1	6.0	153.9	11.8	20
October ...	86.8	78.5	70.6	69.6	66.4	69.0	95.6	5.4	149.6	23.3	22
November ...	88.4	79.9	71.1	70.0	69.2	67.8	94.5	4.6	154.1	16.8	23
December ...	87.7	79.7	70.5	69.4	68.9	68.5	95.0	5.1	149.2	11.5	20
	89.1	79.9	71.4	70.2	68.1	65.9	94.4	5.5	152.8	147.2	253
	Means									Totals	

METEOROLOGICAL OBSERVATIONS — 1967

THE TRI MID-COUNTRY STATION, KANDY

MONTH	TEMPERATURE °F		SUNSHINE		RAINFALL		RAINY DAYS	
	Maximum Dry	Minimum Dry	Mean hours per day	Difference from average (4 yr)	Inches	Difference from average (19 yr)	Days	Difference from average (19 yr)
January	73.3	65.7	5.3	—1.5	2.9	— 1.9	11	0
February	75.2	66.0	7.2	0.0	6.8	+ 3.1	5	—3
March	78.4	67.8	7.9	+0.6	8.5	+ 4.1	11	+ 2
April	80.1	68.9	8.0	+0.9	3.3	— 5.6	7	—10
May	78.1	70.6	*	*	1.3	— 6.5	11	— 4
June	76.0	69.6	*	*	7.4	— 0.2	18	— 3
July	74.1	69.1	*	*	5.7	— 1.8	18	— 2
August	74.6	68.6	6.2	+0.3	2.6	— 3.0	13	— 6
September	76.3	68.3	7.0	+1.3	1.6	— 5.0	8	—10
October	75.1	67.4	6.2	+0.5	25.8	+13.5	17	— 3
November	73.6	67.6	5.5	0.0	17.9	+ 6.8	18	— 1
December	72.9	67.3	5.6	+0.7	14.5	+ 7.0	11	— 5
	75.7	68.1	*	*	98.3	+10.4	148	—45
	Means				Totals			

* Figures not available

METEOROLOGICAL OBSERVATIONS — 1967

THE TRI UVA STATION, DEBEDDE

THE GONAKELLE SUBSTATION

MONTH	TEMPERATURE °F				SUNSHINE		RAINFALL		RAINY DAYS	
	Maximum Dry	Maximum Wet	Minimum Dry	Minimum Wet	Mean hours per day	Difference from average (25 yr)	Inches	Difference from average (25 yr)	Days	Difference from average (25 yr)
January	75.1	66.7	61.5	58.5	4.1	+0.1	5.4	— 3.8	15	— 2
February	74.0	69.0	63.0	58.3	5.3	+0.7	7.6	+ 1.3	12	+ 1
March	76.9	70.4	63.1	59.5	5.9	0	4.2	— 2.9	10	— 2
April	78.8	73.1	65.0	62.5	5.3	+3.2	11.4	+ 0.6	14	— 5
May	76.3	73.1	65.6	63.4	3.8	—0.4	4.9	— 1.1	9	— 5
June	77.6	74.6	64.7	62.9	5.1	—2.5	4.7	+ 2.3	14	+ 7
July	78.1	75.1	64.9	63.1	*	*	1.1	— 3.6	4	— 7
August	77.2	74.1	63.9	61.9	*	*	5.3	— 0.7	7	— 5
September	77.5	74.0	64.6	62.5	4.7	—0.2	2.7	— 2.6	5	— 6
October	76.4	73.2	64.1	62.3	4.3	+1.8	11.2	+ 0.2	15	— 4
November	75.5	72.9	63.2	61.6	2.2	+1.2	19.2	+ 7.2	22	0
December	76.1	72.8	63.0	61.4	4.6	+3.6	7.0	— 8.4	18	— 3
	76.7	72.5	64.0	61.6	4.5	+0.4	84.7	— 8.1	145	—31
	Means						Totals			

*Figures not available

METEOROLOGICAL OBSERVATIONS—1967

THE TRI KOTTAWA SUBSTATION, TALGAMPOLA

MONTH	RAINFALL (inches)	RAINY DAYS
January	6.33	13
February	7.77	8
March	8.97	14
April	2.71	9
May	22.82	22
June	10.46	23
July	11.13	21
August	11.24	22
September	16.79	11
October	22.52	20
November	10.54	20
December	5.92	19
Total	137.20	202

FIELD EXPERIMENTS, TRIALS AND FACTORY EXPERIMENTS CONDUCTED BY THE TEA RESEARCH INSTITUTE OF CEYLON IN 1967

All field and factory experiments carried out by the TRI in 1967, at St Coombs Estate, St Joachim Estate, the TRI Stations at Debedde, Kandy and Kottawa, and on other estates are listed below. The following letters indicate the nature of the experiment :

A — Agricultural Chemistry and Agronomy

AYT — Agricultural Chemistry and Agronomy experiments on young tea

VP — Plant Propagation

PH — Plant Physiology

P — Plant Pathology

N — Nematology

E — Entomology

B — Biochemistry

T — Technology

S — Statistics

W — Experiments on Weeds and Herbicides

X — Extension experiments

Experiments on St Coombs and other estates in Dickoya, Dimbula, Nuwara Eliya and elsewhere will have no additional letters, if they are supervised by officers of the TRI at St Coombs. The centre from which each experiment is supervised is indicated by a preceding letter as follows :

L — Low Country (The Low-Country Station at St Joachim Estate the Kottawa Substation and estates in the low country)

M — Mid Country (The Mid-Country Station and mid-country estates in the Central Province)

U — Uva (The Uva Station and estates in the Uva Province)

An extenson experiment in Plant Physiology at the Uva Station for example, will have the letters **XUPH,** or an Agronomy experiment at St Joachim will carry letters **LA.** For further details of the experiments, refer Part 2 of the Annual Reports of the TRI for 1965 and 1966.

Details of the following experiments, initiated in 1965 are given in the TRI Annual Report for 1965 Part 2:

A1 to **A10**
LA1 to **LA17**
UA1
AYT1 to **AYT13**
LAYT1 to **LAYT2**
W1
LW1 to **LW5**
VP1 to **VP16**
LVP1 to **LVP7**
UVP1 to **UVP7**
MVP1 to **MVP5**
PH1 to **PH19**
LPH1
UPH1 to **UPH6**
P1 to **P24**
LP1 to **LP6**
UP1 to **UP8**
N1 to **N11**
LN1
E1 to **E24**
ME1
B1
T1 to **T17**
XA1 to **XA5**
XUA1 to **XUA13**
XPH1 to **XPH4**
XLPH1
XUPH1 to **XUPH5**
XP1 to **XP7**
XUP1 to **XUP2**
XLE1 to **XLE7.**

Details of the following experiments initiated in 1966 are given in the TRI Annual Report for 1966 Part 2:

A11 to **A13**
LA18 to **LA32**
UA2
MA1
AYT14 to **AYT20**
W2 to **W10**
LW6 to **LW8**
MW1
VP17
LVP8 to **LVP9**
MVP6
LPH2 to **LPH3**
MPH1
P25 to **P54**
UP9
N12 to **N16**
LN2
UN1
MN1
E25 to **E40**
ME2 to **ME5**
T18 to **T25**
LT1 to **LT3**
UT1 to **UT3**
MT1 to **MT3**
XA6 to **XA8**
XLA1 to **XLA17**
XUA14 to **XUA15**
XMA1 to **XMA3**
XPH5 to **XPH12**
XMPH1 to **XMPH3.**

Index to 1967 Experiments

(This list is complete up to 31-12-1967.)

Extension Experiments

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