THE

Tea Research Institute

OF

Ceylon

BULLETIN No. 27

Annual Report for the Year 1945

Published by
THE TEA RESEARCH INSTITUTE OF CEYLON,
ST. COOMBS, TALAWAKELLE.

The Tea Research Institute of Ceylon.

SCIENTIFIC STAFF.

Director	...	Roland V. Norris, D.Sc. (Lond.), M.Sc. (Manc.), F.R.I.C.
Department of Entomology.		
Entomologist & Deputy Director		C. H. Gadd, D.Sc. (Birm.)
Assistant Entomologist	...	G. D. Austin
Assistant	...	D. J. W. Ranaweera.
Field Assistant	...	W. T. Fonseka
Department of Mycology.		
Mycologist	...	Vacant.
Research Assistant	...	C. A. Loos
Department of Agricultural Chemistry.		
Agricultural Chemist	...	T. Eden, D.Sc. (Manc.), A.R.I.C.
Assistant	...	E. N. Perera
Field Assistants	...	M. Piyasena
		F. P. Jayawardana
Department of Biochemistry.		
Biochemist	...	J. Lamb, M.Sc. (Lond.), A.R.I.C., A.I.C.T.A. (on leave).
Research Assistant	...	H. B. Sreerangachar, M.Sc. (Bombay) B.Sc. (Mysore), A.R.I.C., A.I.I.Sc.
Assistants		E. L. Keegel
		V. Mendis
		S. M. Guneratnam
Department of Plant Physiology.		
Plant Physiologist	...	F. R. Tubbs, Ph.D. (Lond.) D.I.C., A.R.C.S., F.L.S.
Assistant	...	M .H. E. Koch
Field Assistant	...	F. H. Kehl
Small-Holdings Officers.		
		R. L. Illankoon
		F. D. Tillekeratne
		M. B. Boange
Superintendent, St. Coombs Estate	...	F. C. Daniel

NOTE.

The Laboratories of the Institute are situated at St. Coombs Estate, Talawakelle, and letters and enquiries should be addressed to the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle. Telegraphic Address :—Research, Talawakelle ; Telephone, Talawakelle 44 (Private Exchange). It is particularly requested that letters should not be addressed to officers by name.

TWENTIETH ANNUAL REPORT

OF THE

BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON

FOR 1945

Foundation.—The Tea Research Institute was established by Ordinance No. 12 of 1925, dated the 27th October, 1925. The Constitution of the Board is laid down in that Ordinance; the personnel on the 1st day of January, 1945, was:—

Ex-Officio Members

The Hon'ble the Financial Secretary (Hon'ble Mr. H. J. Huxham, C.M.G.)
The Director of Agriculture (Mr. L. J. de S. Seneviratne, C.C.S.)
The Chairman, Planters' Association of Ceylon (Mr. G. K. Newton).
The Chairman, Ceylon Estates Proprietary Association (Mr. D. F. Ewen).

Representatives of the Planters' Association of Ceylon.

Mr. R. G. Coombe.
Mr. R. C. Scott, C.B.E. (Chairman).
Mr. R. Singleton-Salmon.

Representatives of the Ceylon Estates Proprietary Association.

Major J. W. Oldfield, C.M.G., O.B.E., M.C., M.S.C.
Mr. J. C. Kelly.
Mr W. H. Gourlay.

Representative of the Low-Country Products' Association.

Mr. F. Amarasuriya.

Representative of the Small-Holders. (Vacant).

Chairman.—Mr. R. C. Scott, C.B.E.

Secretary.—Dr. Roland V. Norris.

Solicitors.—Messrs. Julius & Creasy.

Auditors.—Messrs. Ford, Rhodes, Thornton & Co.

Registered Office.—Office of the Planters' Association of Ceylon, Kandy.

The following changes in the composition of the Board took place during the year:—

The Hon'ble Sir Oliver Goonetilleke, K.B.E., C.M.G., succeeded Mr. H. J. Huxham, C.M.G., as Financial Secretary and thus became an *ex-officio* member of the Board.

Mr. R. C. Kannangara, M.S.C., was nominated by H. E. the Governor as the Representative on the Board of the Small-Holders, with effect from the 8th April, *vice* Sir Tikiri Banda Panabokke who had resigned in December, 1944.

Mr. G. K. Newton proceeded on leave on the 1st July and Mr. R. Singleton-Salmon then became an *ex-officio* member as Acting Chairman of the Planters' Association of Ceylon. Mr. H. S. Hurst was nominated by the Planters' Association to act in the vacancy thus created, with effect from the same date.

Mr. E. E. Spencer became an *ex-officio* member of the Board on assuming the Chair of the Ceylon Estates Proprietary Association on the 1st July, *vice* Mr. R. Mann vacated.

Mr. R. Gorton Coombe was nominated to the Board by the Planters' Association of Ceylon with effect from the 16th November, *vice* Mr. R. G. Coombe resigned.

Grateful thanks are due to the retiring members for their services to the Institute.

Special reference must be made to the severance of Mr. R. G. Coombe's long association with the Board. Mr. Coombe was intimately associated with the setting up of the Tea Research Institute and, up to the date of his resignation, had been continuously on the Board since this was formed. Early in 1927 he became the Second Chairman in succession to Major Oldfield and he held this office for seven years. During all these years he gave ungrudgingly of his time to the Institute's affairs and the Board on receiving his resignation on the 17th August recorded a very appreciative vote of thanks to Mr. Coombe for his valuable assistance and guidance.

The Board noted with great satisfaction the award, in the Birthday Honours List, by His Majesty the King, of the honour of Commander of the Order of the British Empire to the Chairman of the Board, Mr. R.C. Scott.

COMMITTEES.

Finance Sub-Committee.—The Chairman, T. R. I.; the Chairman, Planters' Association of Ceylon; the Chairman, Ceylon Estates Proprietary Association; Major J. W. Oldfield, C.M.G., O.B.E., M.C., M.S.C. Mr. J. C. Kelly, Mr. R. Singleton-Salmon and the Director, T. R. I.

The Committee held two meetings during the year.

Estate and Experimental Sub-Committee.—The Director, T. R. I. (Chairman), the Visiting Agent, the Superintendent, St. Coombs, Messrs. R. G. Coombe, D. T. Richards, R. H. Horne, J. W. Craig, E. de la Mare, G. K. Newton and Dr. T. Eden (Convener),

Mr. H. S. Hurst was appointed to act on this Committee during Mr. Newton's absence on leave.

The Committee held three meetings.

Medical Scheme Sub-Committee.—The Chairman, T. R. I.; the Director, T. R. I.; and Mr. G. D. Austin (representing the Junior Staff).

Trustees of the Junior Staff Provident Fund.—The Chairman, T. R. I., the Director, T. R. I.; Mr. R. G. Coombe and Mr. E. N. Perera (representing the Junior Staff).

Mr J. C. Kelly was appointed a Trustee with effect from the 20th December, *vice* Mr. R. G. Coombe resigned.

Visiting Agent.—Mr. A. H. Hall was on the 17th August appointed Visiting Agent of St. Coombs following the resignation of Mr. H. Tonks. The severance of Mr. H. Tonks' connection with the Institute will be very much regretted and a cordial vote of thanks to him for his valuable services was recorded by the Board.

FINANCE.

The total receipts amounted to Rs. 381,748 made up as follows:—Cess Rs. 325,129. Profit on St. Coombs Estate Rs. 46,015, and Miscellaneous Receipts Rs. 10,604. Receipts were thus Rs. 60,579 lower than in 1944. This was entirely due to reduced exports of tea during 1945, the proceeds from the cess being Rs. 60,992 below the figure for the previous year. The profit from St. Coombs Estate was almost identical with that for 1944.

Expenditure on Revenue Account, comprising Research Revenue Expenditure at Rs. 315,486, Interest charges on the Government Loan Rs. 28,159 and Depreciation at Rs. 30,150, amounted to Rs. 373,795 against Rs. 361,450 in 1944. There was thus a surplus on Revenue Account of Rs. 7,953, the corresponding figure for 1944 being Rs. 80,877. The lower surplus was of course mainly due, as indicated above, to the much smaller proceeds from the cess.

Capital expenditure was incurred to the extent of Rs. 61,454, this comprising expenditure on assets of Rs. 14,937 and Rs. 46,517 paid off against the Government Loan.

Nett liquid assets as at 31st December, 1945, after allowing for specific liabilities such as the accrued interest on the Government Loan and Furlough and Passages Reserve, amounted to Rs. 520,158. The liability under the Depreciation Reserve at the same date was Rs. 572,931, while the balance due to Government on Loan account was Rs. 477,093.

The depreciation reserve was thus covered to the extent of 90 per cent.

ST. COOMBS ESTATE

Fertilisers, on the rationed scale, were regularly received during 1945. Weather conditions in the first half of the year were, however, most unfavourable, Dimbula suffering from one of the worst droughts on record. In these circumstances the crop of 201,813 pounds, as against 214,817 pounds in 1944, may be considered as satisfactory. The yield for the old tea was 710 pounds per acre and for the 20-acre clearing (1937) 724 The two acres of the latter clearing, planted 5 feet×1½ feet on the contour, gave a yield of 1,237 pounds per acre.

The entire crop, with the exception of 2,448 pounds used for local consumption, was sold to the Ministry of Food realising 118.89 cents per pound nett as against 112.04 cents in 1944.

The cost of production at 94.79 cents per pound (including Dearness Allowance at 24.44 cents) was 5.05 cents above the figure for 1944.

The profit on Estate Working Account was therefore Rs. 46,015 against Rs. 46,160 in the previous year.

PUBLICATIONS.

As the result of shortage of staff and other difficultes, no issues of the *Tea Quarterly* were made in 1945, the only publication being Bulletin No. 26, the Annual Report for 1944.

Normal publication of the *Tea Quarterly* will be resumed in 1946.

ACKNOWLEDGMENTS.

The thanks of the Board are, as usual, due to the Ceylon Association in London, the Planters' Association of Ceylon and the Ceylon Estates Proprietary Association for continued co-operation and assistance.

The Board is also indebted to the Ceylon Tea Propaganda Board for the use of their Committee Room for Meetings of the Board.

The Audited Statement of Accounts and the Balance Sheet for 1945 are attached, together with the report of the Visiting Agent and of the Director and Scientific Staff dealing with the research activities of the Institute.

ROLAND V. NORRIS,

Secretary.

THE TEA RESEARCH INSTITUTE OF CEYLON

BALANCE SHEET AS AT 31st DECEMBER, 1945

LIABILITIES	Rs. Cts.	Rs. Cts.
CREDITORS & CREDIT BALANCES :—		
Accrued Interest on Loan	6,560·00	
Sundry Creditors—Estate	10,156·66	
Sundry Creditors—Research	20,032·48	
Subscriptions for Publications received in advance	693·80	
Contribution for Upkeep of Kowlahena Cart Road	301·00	37,743·94
FURLOUGH RESERVE :—		
At 31st December, 1944	31,216·09	
Additions during 1945	10,826·66	
	42,042·75	
Less: Payments in 1945	16,316·99	25,725·76
DEPRECIATION RESERVE :—		
At 31st December, 1944	556,144·13	
Added at 31st December, 1945	30,150·28	
	586,294·41	
Less: Items scrapped in 1945	13,363·50	572,930·91
Carried over		Rs. 636,400·61

ASSETS	Rs. Cts.	Rs. Cts.
DEBTORS & DEBIT BALANCES :—		
Principal Collector of Customs	28,921·97	
Fertiliser Control Bureau	978·01	29,899·98
SUNDRIES—RESEARCH :—		
Ceylon Association in London £363-5-11	4,843·94	
Research Staff	1,053·58	
Suspense Account	71·63	
Accrued Interest on Fixed Deposits	2,800·72	
	8,769·87	
SUNDRIES—ESTATE	4,186·66	12,956·53
STOCKS-IN-HAND :—		
Tea 51,479 lbs.	65,775·34	
Stocks on Estate	28,430·78	94,206·12
INVESTMENTS—(At Cost) :—		
£2,300·0·0 3½% War Loan Bearer Bonds	32,434·76	
£2,063·18·1 4% Funding Loan 1960/90	29,928·06	
£6,750·0·0 2½% National War Bonds 1952/54	90,000·00	
Rs. 30,000/- 3½% Ceylon Govt. Loan 1957/62	29,512·50	
Rs. 15,000/- 3% Defence Bonds 1952	15,000·00	
Rs. 20,000/- 3% do 1949	20,000·00	
Rs. 40,000/- 3½% Ceylon Government National Loan 1956	40,000·00	
Rs. 50,000/- 2½% Ceylon Government War Loan 1954	50,000·00	306,875·32
Carried over		Rs. 443,937.95

THE TEA RESEARCH INSTITUTE OF CEYLON

BALANCE SHEET AS AT 31st DECEMBER, 1945—*(contd.)*

LIABILITIES	Rs. Cts.	ASSETS	Rs. Cts.	Rs. Cts.
		Brought forward		443,937·95
Brought forward	Rs. 636,400·61	CASH :—		
		On Current Account	13,062·19	
		On Fixed Deposit	112,000·00	
		Petty Cash Account	1,435·98	126,498·17
		Estate—N.B.I. Ltd., Colombo	13,363·44	
		,, In hand	894·36	14,257·80 140,755·97
		FUNDS OVERSPENT :—		
		To 31st December, 1944		11,568·59
		Capital Expenditure 1945		1,573·50
		Government of Ceylon Loan Account		46,517·16
				59,659·25
		Less: Revenue Account Surplus 1945		7,952·56 51,706·69
	Rs. 636,400·61			Rs. 636,400·61

We have audited the books of the Tea Research Institute of Ceylon and have obtained all the information and explanations required by us. The allocations of Capital Expenditure and of Research Revenue Expenditure as made by the Director have been accepted by us. We are not in a position to say whether the Reserves made for Depreciation are adequate. Subject to the foregoing reservations, the above Balance Sheet, in our opinion, is properly drawn up so as to exhibit a true and correct view of the financial affairs of the Institute at 31st December, 1945, according to the best of our information and the explanations given to us, and as shown by the books.

(Sgd.) FORD, RHODES, THORNTON & CO.,
Chartered Accountants.

Colombo, 14th June, 1946.

THE TEA RESEARCH INSTITUTE OF CEYLON

ESTATE WORKING ACCOUNT AS AT 31st DECEMBER, 1945

EXPENDITURE		Rs. Cts.	Rs. Cts.	INCOME			Rs. Cts.
To Estate Expenditure—Revenue				By Tea Sales—Tea Commissioner	198,671 lbs.		238,208·66
	Previously	171,651·38		,, Do —Local	264	,,	264·00
,, do do	December	19,547·71	191,199·09	,, Do —Broken Mixed	106	,,	42·40
,, Charges to Invoice No. 38			1,809·98	,, Do —Biochemical Dept.	324	,,	324·00
,, Balance Carried Forward			46,015·49	,, Motor Road Roller Account			185·50
		Rs.	239,024·56			Rs.	239,024·56

REVENUE ACCOUNT AS AT 31st DECEMBER, 1945

	Rs. Cts.	Rs. Cts.		Rs. Cts
To Administration of the Board:—			By Balance from Estate Working Account	46,015·49
Planters' Association of Ceylon	240·00			
Travelling of the Board	1,503·70		,, Tea Cess ...	325,129·21
Clerical Staff	8,700·00			
Telephone Operators	999·77		,, Rent of Caddy ...	15·00
Office Peon	672·00			
Postages	417·03		,, Miscellaneous Receipts ...	55·35
Stationery	1,330·22			
Advertising	99·48		,, Interest Account ...	10,533·41
Telegrams, Trunk Calls, etc.	182·17			
Printing	Credit 136·00			
Legal Expenses	31·50			
Auditors' Fee	714·17			
Contingencies	143·84			
Dearness Allowance	4,047·90	18,945·78		
Carried over	Rs.	18,945·78	Carried over	Rs. 381,748·46

THE TEA RESEARCH INSTITUTE OF CEYLON

REVENUE ACCOUNT AS AT 31st DECEMBER, 1945—(*contd.*)

		Rs. Cts.	Rs. Cts.
	Brought forward		18,945.78
To Personal Emoluments of Scientific Staff:—			
Director	...	22,500·00	
Mycologist	...	20,400·00	
Agricultural Chemist	...	21,275·71	
Entomologist	... Credit	4,836·14	
Plant Physiologist	...	2,026·05	
Biochemist	...	15,530·43	
Asst. Mycologist	...	11,937·59	
Dearness Allowance	...	12,200·00	101,033·64
,, Emoluments—Junior and Sub-Scientific Staff:—			
Junior Scientific Staff		42,716·74	
Lab. Attendants and Fieldman		4,920·86	
Dearness Allowance		12,619·17	60,256·77
,, Laboratory:—			
Equipment and General Working Expenses		4,998·25	
Furniture and Office Equipment		100·00	5,098·25
,, Library:—			
Library		2,138·58	
Publications		1,229·68	3,638.26
,, Small-Holdings:—			
Salaries and House Allowances		8,051·87	
Travelling and General Expenditure		5,737·43	
Dearness Allowance		2,087·70	15,877·00
	Carried over	Rs.	204,579.70

	Rs. Cts.
Brought forward	Rs. 381,748·46
...	
...	
...	
...	
...	
...	
...	
Carried over	Rs. 381,748·46

THE TEA RESEARCH INSTITUTE OF CEYLON

REVENUE ACCOUNT AS AT 31st DECEMBER, 1945—(*contd.*)

	Rs. Cts.	Rs. Cts.
Brought forward		204,579.70
To Field and Factory Experiments:—		
Agricultural Chemist	5,545·57	
Plant Physiologist	224·78	
Miscellaneous Field Experiments	189·18	
Factory Experiments	3,741·20	9,700·73
,, Travelling of Staff:—		
Officer's Expenses	1,587·36	
,, Insurance of Car and License	148·67	
Driver's Wages	792·00	
Driver's Batta	170·65	
,, Running Expenses and Repairs	2,650·36	
Dearness Allowance	558·50	5,907·54
,, Maintenance of Buildings:—		
Laboratory	250·00	
Six Senior Staff Bungalows	2,500·00	
Junior Staff Bungalows (13)	1,500·00	
Clerk's Bungalows (3)	322·49	
Miscellaneous Lines and Buildings	1,500·00	
Passara Buildings	100·00	
Guest House	63·34	
Replacement and Renewals Junior Staff and Clerical Staff Furniture	414·17	6,650·00
,, General Services:—		
Electric Power	7,874·78	
Mechanic	787·50	
Telephones, Rent and Maintenance of	543·50	
Roads	600·00	
Sanitation	1,674·98	
Water Snpply	3,581·45	
Tappal, Lorry and Book Fees	292·83	
Nettikans and Drains	138·75	
Upkeep of Grounds	1,296·85	
Guest House	203·16	
Dearness Allowance	1,150·51	18,144·51
Carried over	Rs.	244,982.28

	Rs. Cts.
Brought forward	381,748·46
Carried over	Rs. 381,748·46

THE TEA RESEARCH INSTITUTE OF CEYLON

REVENUE ACCOUNT AS AT 31st DECEMBER, 1945—(*contd.*)

		Rs. Cts.	Rs. Cts.
	Brought forward		244,982.28
To Miscellaneous:—			
Incidentals	...	199.08	
Provident Fund, Senior Sc. Staff		39,826·73	
Do Junior Scientific Staff		11,338·87	
Do Sub-Staff	...	3,072·73	
Passages	...	6,000·00	
Ceylon Nursing Association and Fraser Nursing Home	...	200·00	
Medical Fees, Sub-Staff	...	396·74	
Medical Scheme, Junior Staff	...	3,083·00	
Insurances	...	4,590·40	
Watchmen and Caretakers	...	1,052·13	
Observatory Allowance	...	240·00	
Dearness Allowance	...	504·80	70,504·48
„ Government of Ceylon Loan Interest Account	...		28,158·86
„ Depreciation	...		30,150·28
„ Balance	...		7,952·56
		Rs.	381,748·46

	Rs. Cts.
Brought forward	Rs. 381,748·46
	Rs. 381,748·46

ROLAND V. NORRIS,
Director.

THE TEA RESEARCH INSTITUTE OF CEYLON

Dr. **CAPITAL ACCOUNT AS AT 31st DECEMBER, 1945** **Cr.**

EXPENDITURE	To 31-12-44	Additions in 1945	Items Scrapped or sold in 1945	Total
	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.
To Land—Including Development	893,721·70	7,250·37	—	900,972·07
,, Buildings & Lines	947,280·78	4,283·52	13,240·25	938,324·05
,, Furniture and Equipment	82,671·48	—	123·25	82,548·23
,, Laboratory Equipment	43,216·29	193·39	—	43 409·68
,, Machinery—Estate	145,667·76	3,209·72	—	148,877·48
,, Machinery Experimental	29,705·38	—	—	29,705·38
,, Motor Road Roller	7,386·03	—	—	7,386·03
,, Motor Car	4,025·00	—	—	4,025·00
	Rs. 2,153,674·42	14,937 00	13,363·50	2,155,247·92

RECEIPTS			
		Rs. Cts.	Rs. Cts.
By Government of Ceylon :— Loan on Mortgage @ 5½% per anuum		1,000,000·00	
Less : Repayments to 1945		522,906·95	477,093·05
,, Revenue Applied to Capital Purposes to 31-12-44		1,618,495·62	
do do 1945		7,952·56	1,626,448·18
,, Funds Overspent as at 31-12-44		11,568 59	
do do 1945		40,138·10	51,706.69
			Rs. 2,155,247·92

(Sgd.) ROLAND V. NORRIS,
Director.

THE TEA RESEARCH INSTITUTE OF CEYLON

LOAN ACCOUNT

	Rs. Cts.			Rs. Cts.
To Government of Ceylon	Rs. 1,000,000·00	By Repayments Principal :—		
		To 31st December, 1944	...	476,389·79
		„ To 31st December, 1945	...	46,517·16
		„ Balance	...	477,093·05
	Rs. 1,000,000·00			Rs. 1,000,000·00

(Sgd.) ROLAND V. NORRIS,
Director

REPORT

ON

ST. COOMBS ESTATE

FOR 1945

Superintendent.—Mr. J. A. Rogers proceeded on leave in October and Dr. Eden was appointed to act for him.

Acreage :—

	A.	R.	P.
Tea in full bearing	264	1	06
Tea in partial bearing (1937) ...	20	—	—
Tea in partial bearing (1938) ...	16	—	—
Tea nurseries	1	1	08
Fuel clearings	36	—	—
Reserve land available for planting	27	1	09
Building Sites, etc.	26	2	22
Waste land and swamps ...	23	1	14
Total ...	414	3	19

The Tea in Partial Bearing (1937), 20 acres will be included in the full-bearing acreage as from 1st January, 1946.

Weather.—(Estate Gauge).

	Rainfall	Wet days
Registered in 1945 ...	70.04 ins.	177
Registered in 1944 ...	87.16 ins.	244

Climatic conditions were not favourable for crop this year. Rainfall was abnormally low. An early drought was followed by a dry May and again rainfall was very low in September.

Crop :—

	1945	1944
Estimate	220,000 lbs.	200,000 lbs.
Total crop (including Broken Mixed) ...	201,813 lbs.	214,817 lbs.

Yield per acre :—

	1945	1944
Old Tea (264 acres) ...	710 lbs.	781 lbs.
Clearing (1937) 20 acres ...	724 lbs.	425 lbs.
Total on 284 acres ...	711 lbs.	756 lbs.

1937 Clearing only :—

18 acres 4 ft.×3 ft. ...	667 lbs.	384 lbs.
2 acres 5 ft.×1½ ft. Contour planted	1,237 lbs.	794 lbs.

Prices and Total Crop Sold :—

Year	Total Crop Sold	Gross Average	Nett Average
1945 ...	199,365 lbs.	119.79 cts.	118.89 cts.
1944 ...	213,063 lbs.	113.18 cts.	112.04 cts.

Cost of Production :—

	1945	1944
Estimate ...	90.33 cts.	100.47 cts. per lb.
Actual cost ...	94.73 cts.	89.68 cts. per lb.

Dearness Allowance included in the above figures was :—

	1945	1944
Senior and Subordinate Staff	2.33 cts.	2.14 cts.
Factory Staff ...	3.02 cts.	1.01 cts.
Labourers ...	19.09 cts.	16.61 cts.
Total ...	24.44 cts.	19.76 cts.

Profit on Estate Working :—

1945 ...	Rs. 46,015
1944 ...	Rs. 46,160

Capital Expenditure :—

1945 ...	Rs. 14,743—7.32 cents per lb.
1944 ...	Rs. 15,817—7.37 cents per lb.

Manuring.—It was impossible to carry out the programme as originally intended. The pruned fields Nos. 1, 2, 3 and 10 were not manured, but all other fields received manure, doses varying from 30 lbs. to 68 lbs. nitrogen per acre.

Pruning.—93 acres were pruned at a cost of approximately Rs. 19 per acre, exclusive of Dearness Allowance. There was some good new wood to prune on.

Green Manuring.—Leaf-fall from prunings was forked in in Nos. 3 and 10, 61 acres. In the old fields Green manure is not plentiful, but in the new clearings a good quantity is available.

Weeding.—The whole estate is weeded on estate account. Weeds were less troublesome in 1945 than in 1944 and it was possible to maintain closer rounds. In consequence the estate is in good order in this respect.

The Polygonum ground cover is still rather thin at present. Weeding cost Rs. 2-95 per acre, without Dearness Allowance.

Supplying.—No supplying was done during 1945

Labour.—Number of working labourers 371.

This force should be sufficient for the Tea Research Institute's requirements and the estate working, but estate account weeding absorbs a lot of labour and the force is reported to be rather inefficient.

Lines.—148 line rooms, 60 of which are not up to Government Standard in respect of windows. Repairs to drains, ramps and latrines are being carried out as materials become available.

Factory and Machinery.—All maintained in very good order. The Water Tank for the Sprinkler System has been completed and some pipes have arrived on the estate; there has been delay however in the arrival of other materials.

Fire Fighting Squads have been trained and regular practices are carried out.

General.—I inspected the estate for the first time in October, 1945 and was well satisfied with the appearance of the tea and the good order maintained.

A. H. HALL,
Visiting Agent.

METEOROLOGICAL OBSERVATIONS, 1945.

ST. COOMBS.

(Laboratory Gauges)

MONTH	TEMPERATURES							RAINFALL		RAIN DAYS		SUNSHINE	
	Mean Maximum	Difference from average 1931-1940	Mean Minimum	Difference from average 1931-1940	Adopted Mean	Mean on grass	Mean Relative Humidity	Inches	Difference from average 1931-1940	Days	Difference from average 1931-1940	Hours	Difference from average 1931-1940
January	76·2	+ 2·5	50·5	- 5·3	63·4	42·9	61	0·08	- 4·04	2	- 9	283·93	+88·93
February	78·7	+ 2·6	53·2	- 1·2	66·0	48·7	58	0·43	- 2·47	1	- 7	215·02	- 15·50
March	78·3	+ 1·1	54·9	- 0·4	66·6	50·7	67	3·18	- 1·06	11	- 1	229·22	- 5·24
April	77·7	+ 0·4	57·8	0·0	67·8	55·5	77	7·40	+ 1·10	14	- 2	220·23	+ 15·99
May	78·8	+ 4·0	58·5	- 1·4	68·6	53·1	77	2·13	- 10·25	10	- 9	241·30	+ 82·70
June	72·8	+ 2.0	59·5	- 0·9	66·2	56·8	84	11·17	- 1·24	23	- 4	151·38	+ 57·10
July	70·3	+ 0·5	59·6	+ 0·1	65·0	56·6	87	8·02	- 4·65	27	+ 1	130·30	+ 22·16
August	70·9	- 0·1	59·1	+ 0·1	65·0	57·4	86	9·91	+ 0·22	24	- 1	106·13	- 14·03
September	72·5	+ 0·3	58·0	- 0·1	65·2	55·1	84	3·87	- 4·61	17	- 4	163·05	+ 16·13
October	74·0	+ 0·8	57·2	- 0·5	65·6	54·7	80	10·28	+ 1·05	17	- 5	169·18	+ 10·85
November	74·2	+ 1·0	57·2	- 0·2	65·7	54·4	80	10·28	+ 2·11	28	+ 3	156·32	+ 2·05
December	74·6	+ 0·9	53·6	- 2·6	64·1	51·2	74	3·29	- 1·64	8	- 7	220·80	+ 35·04
Annual	74·9	+ 1·3	56·6	- 1·0	65·8	53·1	76	70·04	- 25·48	177	- 45	2286·86	+ 296·18
	Means							Totals					

REPORT

OF

THE DIRECTOR

TEA RESEARCH INSTITUTE OF CEYLON

FOR 1945

Finance.—Receipts for 1945, at Rs. 381,748, were Rs. 60,579 lower than in the previous year. This shortfall was almost entirely accounted for by the reduced yield from the cess due to lower exports of tea. Expenditure on Revenue Account was Rs. 373,795 as against Rs. 361,450 in 1944. The surplus on Revenue Account was, therefore, Rs. 7,953 only. Capital expenditure was incurred to the extent of Rs. 61,454. This included Rs. 46,517 paid off against the Government Loan and Rs. 14,937 spent on assets.

Full details of receipts and expenditure will be found in the Report of the Board and the Audited Accounts given earlier in this report.

St. Coombs Estate.—Fertilisers, on the rationed scale, were received regularly during the year. Unfortunately, this fact was offset by the serious drought, one of the worst experienced in Dimbula, which occurred in the early months of the year. Conditions improved later and the final crop figure of 201,813 lb. was in the circumstances, better than might have been expected. The profit for the year on working account, at Rs. 46,015, was almost identical with the figure for 1944. Further details will be found in the Report of the Visiting Agent.

Staff.—Major C. B. Redman King, Lieut.-Colonel F. R. Tubbs and Major R. L. Illankoon remained on military service for practically the whole of the year. The two former were released in December when we were glad to welcome back Dr. Tubbs to his normal work. Mr. King, unfortunately, owing to reasons of health, was unable to resume his duties and has resigned his appointment.

Dr. T. E. T. Bond proceeded on home leave in August and information has since been received that he will not be returning to Ceylon owing to his having been offered an appointment in the University of Sheffield.

Mr. Rogers, the Superintendent of St. Coombs, also left on leave out of Ceylon in August. Dr. T. Eden was away earlier in the year but returned from leave at the end of July.

In these circumstances, those officers left at St. Coombs had naturally to take on additional duties. Dr. Gadd remained in charge of the Entomological Division as well as that of the Plant Physiologist and Dr. Eden had from the 1st September to assume charge of St. Coombs Estate in addition to his normal duties.

The situation is not likely to be materially better in the present year. Delay in filling the vacant appointments is inevitable under present conditions and the writer and Dr. Gadd are long overdue for home leave.

The staff is also below strength in the junior cadres as during the war years it has not been possible to take on and train new men.

It is well that these conditions should be appreciated as, with the termination of the war, the Institute will doubtless be called on to extend its activities, not only at St. Coombs but also perhaps in the Low-country. No active steps can be taken in this direction until the position at St. Coombs is once again stabilised and the continuity of the existing programme of work once more assured.

Fertiliser Rationing and Distribution.—The Director remained in charge of the Fertiliser Rationing Scheme throughout the year. Shipments of fertilisers though inconveniently irregular at times, were on a higher level than in the previous year. In consequence, distribution was uninterrupted and with effect from 1st July it was found possible to increase the nitrogen quota for tea estates by fifty per cent. In view of the widespread demand for nitrogen in the devastated countries for food crops, and the fact that production is at a considerably lower level than normal owing to the destruction of producing plants, nitrogen shipments are likely to be restricted for a considerable period further and rationing must, therefore, remain also.

Advisory Work.—Towards the end of the year, as men began to trickle back from service enquiries from estates increased considerably in number. Such men have naturally been out of touch with developments in planting methods and it will be necessary to give them, and men coming out to the Tea Industry for the first time, every opportunity of becoming familiar with the work of the Institute. Transport conditions remained difficult with petrol and tyres in short supply and new cars still not available. In these circumstances visits to estates at a distance from St. Coombs had necessarily to be restricted.

Advisory work to small-holders continued in the Kadugannawa and Baddegama areas and at the end of the year arrangements were made for an extension of such work to the Morawak Korale, a third Advisory Officer being appointed for this purpose. This work presents difficulties at the present time as it has not proved easy to convince those concerned that without a reasonable quota of tyres and petrol, the advisory officers are for all practical purposes immobilised. Occasional visits to small holdings serve but little purpose, as the holders are liable to lose interest if such visits are not repeated at relatively frequent intervals.

Technical.—In previous reports it has been usual at this stage to provide a short summary of the results obtained in the different sections during the past year. As, however, these are set out in detail in the attached reports by the technical staff, a more general review of the work of the Institute is given below. This seems appropriate at the present moment which marks a transitional stage between the war period and a new period of development. During the war the senior staff was for most of the time reduced to about fifty per cent of the full cadre. In these circumstances, and with additional *ad hoc* problems to be met it was inevitable that attention had to be focussed in the first place on

maintaining the continuity of the Institute's permanent or long range experiments. It is satisfactory to note that, with a few minor exceptions, such continuity has been preserved, and the data, now under fuller examination than was always possible during the war, will give a valuable guide for the future development of these major lines of work. It should not, however, be understood from the above that work during the war years has been restricted to routine matters. On the contrary, in several directions new ground has been opened up and these developments promise to yield results of very considerable interest and practical value.

Diseases and Pests.—Under this head comes the advisory work of the Institute in regard to diseases and pests and the research arising from such problems. It has been fortunate that during the war years in spite of a reduced level of cultivation due to the shortage of fertilisers and difficulties of labour and supervision, there has been no undue incidence of the more common diseases and pests. The steps to be taken in regard to many of these troubles, are now of course well known and present little real difficulty. Thus in the case of the common root disease Poria, clear and practical methods are available which, if properly carried out, are efficient in minimising any serious spread of the disease. Or again, Tortrix, which formerly caused heavy losses of crop in many important tea areas, is now most efficiently controlled by the Macrocentrus parasite introduced into Ceylon by the Institute and no longer presents any serious problem.

In a different category must be placed the problems presented by the *Phloem necrosis* disease, shot-hole borer and eelworms, and these now form the chief objects of investigation in the pathological divisions.

In regard to *Phloem necrosis*, it is unfortunate that owing to the loss of Dr. Bond's services there must necessarily be a temporary break of continuity in work on this disease. Every effort is of course being made to obtain an experienced officer to replace Dr. Bond and meantime, on the field side at any rate, records are being maintained in the manurial and other experimental plots which have been set out in the Kandapolla area. As has been mentioned in earlier reports, the virus nature of the disease has been fully established, though no clue has been obtained as to the means by which transmission is effected. In view of the fact that all attempts to transmit the disease by mechanical means have failed, an insect vector seems indicated as the factor concerned. Virus diseases of plants as a rule offer no prospect of cure once the plant becomes infected and, in the case of a crop such as tea, the chief hope lies in detecting jats or varieties of tea which are relatively resistant or immune to attack. Indications of such resistance are being found and the importance of this line of approach is not being overlooked in the Institute's work on tea selection and vegetative propagation.

In the case of Shot-hole borer, the opportunity has been taken to examine and analyse the large amount of data previously accumulated concerning this pest, and partly in consequence of the picture thus obtained, to lay down better designed and more systematic field experiments. These are already yielding results of much interest, some details of which have already appeared in the Institute's publications. It is clear that many of the older views concerning this pest are no longer tenable and, in particular, the hitherto prevalent idea that the incidence of attack is reduced by liberal applications of nitrogen. The results now being obtained

suggest that the infestation, which occurs mainly in a particular period of the pruning cycle, is conditioned by some physiological condition obtaining in the bush during that period and indicate considerable modifications in the methods now usually adopted on estates to deal with this pest.

In regard to Eelworms, systematic work is in progress to assess the relative importance of the many species of these nematodes which are now known to occur in Ceylon soils. The attention of planters is naturally focussed chiefly on the "Root-knot" eelworm, *Heterodera marioni*, a common pest of tea seedlings and many green manures, and *Pratylenchus (Anguillulina) pratensis* or the "Meadow" eelworm, which has caused considerable anxiety in certain areas by its ability to infest and damage mature tea.

In addition to these species, however, many others have now been found in tea soils and in association with tea roots. So far, fortunately, there is little indication that these other species cause any extensive damage to tea.

Before leaving the subject of pests and diseases, it may be as well to make some reference to the very powerful new insecticides which have recently become available such as D. D. T. and Gammexane. No doubt many persons, aware of the somewhat sensational results obtained with such agents in certain defined circumstances, consider that these will provide a ready solution to many of our agricultural problems. Possibly this may prove to be the case. But the very fact that these products are so immensely potent immediately indicates the need for caution in their application. Many insects, fungi and bacteria are entirely beneficial in action and are essential factors in the economy of nature. Until considerably more is known of the effect of these new insecticides under general agricultural conditions, their widespread and indiscriminate use is therefore to be deprecated.

Tea Selection and Vegetative Propagation.—A quite casual inspection of almost any tea field will reveal wide variations in the types of bushes growing there. Such variations are inevitable when, as is the case with tea, the plants are derived from the seed of a very highly hybridised parent. A closer examination will suggest that some of these types, by reason of their habit of growth or their vigour, are better yielders than their neighbours and that by the use of such bushes as parents, better planting material could be made available. As is well known, in many other crops the use of such selective propagation has led to revolutionary results, not only in regard to yield but in the quality of the product and the production of strains with greatly increased resistance to disease. In annual crops such selection is most frequently affected by seed selection following carefully planned "crossings." In the case of tea for reasons which need not be set out here, seed selection must be ruled out as impracticable and it has been necessary to resort to methods of vegetative propagation. For several years the Institute has been actively carrying out experimental work on this subject and it is clear that the results now being obtained are going to be of the highest practical importance to the industry. Tea unfortunately, is a plant which is not very easily propagated vegetatively. However, a technique has been evolved making use of single internode cuttings, which is proving very successful and is quite capable of being utilised under estate conditions. Material produced in this way has, of

course, the same genetical make-up as the bush from which it is derived and may therefore be expected to reproduce any desirable characters, such as high yielding capacity, quality or resistance to disease, which may have been observed in the parent bush, it is clear then that after systematic and careful selection work to obtain mother bushes of the desired type, it will be possible to multiply such material and use this for planting instead of seed. Much has already been achieved by the Institute in this direction and a large number of clones derived from selected mother bushes has been planted up for larger scale tests. Considerable information concerning the yield capacity and manufacturing qualities of these clones is already available and they are being carefully watched in regard to other characteristics.

It is clear, therefore, that in the not distant future, and particularly if, as seems likely, similar selection work is taken up on estates, planting material of greatly improved value will become available. The importance of this under present economic conditions is obvious. As with other crops, tea growing must become a more intensive operation. There are undoubtedly in Ceylon many areas of steep and badly eroded land under tea which are expensive to work and of very low productive capacity. The chief hope of achieving some worthwhile saving in the cost of production would seem to lie in the abandonment of such areas and the intensive development of smaller acreages of more suitable land planted up with vegetatively produced cuttings of proved high yielding strains. It has already been mentioned that tea selection and vegetative propagation can be carried out under estate conditions. It is necessary to stress, however, that such work requires great attention to detail and considerable supervision. In these circumstances it would probably be preferable for companies to concentrate on this work on certain carefully chosen estates where favourable conditions obtain.

Another point cannot be emphasised too strongly. If low yielding fields are uprooted and merely replanted with even the best selected material without regard to the causes which may have been responsible for the previous low yields, successful results cannot be expected, in many cases such low yields are less due to any defect in the existing tea than to soil exhaustion which is the limiting factor. In replanting such poor areas it is essential, therefore, that the land should first be reconditioned, otherwise failure must result, however good the planting material employed.

Cultivation.—Under this head may be considered manuring, soil management with special reference to weeds, green manures and shade.

As regards manuring, the experiments laid down by the Institute in its earliest days have been continued, with such modification or addition as have proved desirable, and the results obtained have, in general, been definite and clear cut and have met with general acceptance. Initially, the first step was to compare different types of manure, *e.g.*, ammonium sulphate, as against organic nitrogen, and different levels of application. The results have been freely reported in our publications and indicate that for all practical purposes no significant difference exists as between inorganic and organic forms of nitrogen. As regards nitrogen levels it is clear that the yield increments obtained in response to increasing nitrogen applications are fully maintained even when relatively high doses of nitrogen are reached and, in fact, more work is required to determine at what rate of application the law of diminishing returns begin to operate.

At a later date the experiments were modified so as to provide information in regard to the effect of the *time* of application. The important point which at once emerged was the relatively inefficient use made of manures applied immediately after pruning, and this has led to a general modification in estate practice whereby the first application of manure in the pruning cycle is delayed for a few months after pruning and the heaviest manurial applications made about the middle of the cycle when the bush can make the most efficient use of the plant food supplied.

Nitrogen is, of course, the chief factor in promoting yield but the effect of phosphoric acid, though much less striking in this respect, cannot be ignored. It would seem likely, however, that little or no advantage will result from the use of the high doses of phosphoric acid sometimes favoured and the economic level may prove to be not more than about 30 lbs. P_2O_5 per acre. Higher doses may in fact prove disadvantageous from another point of view as it now seems clear that phosphoric acid has a marked effect in promoting the growth of many types of weeds normally found on estates!

Potash appears to have little or no effect on yield but, in view of the fact that tea seems to be rather a luxury consumer of this material and removes considerable amounts from the soil, potash applications in reasonable quantities should not be omitted. Some years ago there was a definite tendency in favour of more intensive cultivation and deeper and more frequent forking. The Institute's experiments have, however, provided no evidence to support this practice and have, in fact, shewn that cultivation in excess of that required for normal weed control and manuring has a depressing effect on yield.

The expression "normal weed control" is used for convenience but is one which may receive very different interpretations, and one of the chief problems before estates at the present time is to find some satisfactory way of dealing with weeds. Though the dangers of soil erosion are now very widely recognised and many estates have taken steps to combat this, it would probably be correct to say that a large body of opinion still favours clean weeding and it is regrettable that, as a result of relaxed control during the war and labour difficulties, scrapers are much more in evidence again. The major difficulty is, of course, to find a satisfactory and acceptable alternative to clean weeding. The establishment of a really suitable type of ground cover has proved difficult, particularly at the higher elevations and it has, therefore, been necessary to try out as a second best a method of selective weeding, "weeds" of certain types being permitted to remain while others of an undesirable character and grasses are eliminated. On many estates selective weeding has given excellent results but, particularly in the earlier stages, it requires careful supervision and it cannot be said that this practice has met with wide acceptance. The usual complaint made is that it is more costly than clean weeding and that, in the low-country especially, it is difficult to exclude grasses. The Institute has accordingly laid down a series of field experiments in which different methods of weed control are under trial and the general effect of various modifications in cultivation studied. It is hoped that in due course these experiments may lead to some solution of what at present constitutes a very real difficulty on many estates.

The importance of adequate green manuring is now generally recognised and has been particularly stressed by the Institute during the war

in view of the short supply of artificials. It is unfortunate that some species of green manure shrubs such as the Tephrosia for example, which are suitable in every other respect, are highly susceptible to eelworm attack. This disadvantage does not justify the abandonment of such species. They should not, however, be grown continuously in the tea but alternated with other less susceptible species.

One other aspect of cultivation may be referred to and that is the question of shade. Planting opinion generally would be that moderate shade is advantageous but the interpretation of the word "moderate" varies widely. It is unfortunate that the investigations of this problem presents great technical difficulties as it is almost impossible to isolate the different factors involved. It must be admitted that in none of the tea producing countries has it been possible as yet to devise experiments on this subject which can be regarded as really satisfactory.

Tea Manufacture.—The earlier work of the Institute on this subject naturally consisted in a systematic review of the different processes of manufacture as then practised. Withering, rolling and firing were in turn investigated and it may be claimed that as a result, each of these operations has been modified to a greater or less degree and manufacture generally placed on a more organised and better defined basis. At the same time laboratory investigations were commenced, designed to throw light on the chemistry of tea leaf and the nature and mechanism of the changes, fermentation in particular, which take place during manufacture. As a result of this work it became possible to consider more radical changes in manufacture, having as their main object a simplification of the process and a reducton in the time and labour required, both factors leading to a lower cost of production.

It had for sometime been obvious that rolling offered most scope for some major modification and, working from this basis, experiments were begun in which the conventional rollers were to a greater or less extent replaced by the Clivemeare roller. It was at once seen that by this means very good liquoring teas could be produced with very brilliant and even infusions. As is usually the case in the early stages of such investigations, the appearance of the made tea was, however, very unorthodox and not acceptable to buyers. Various modifications in the process, however, largely overcame these difficulties and just before the war commercial breaks made with the Clivemeare roller were very favourably reported on in London. The onset of the war and the terms under which tea had later to be sold under the Government contract prevented further progress for the time being.

In the above work ordinary withered leaf was used. Now withering is one of the most expensive and inconvenient factors in present day manufacture, and as the laboratory investigations referred to above shewed that in all probability the only purpose served by withering was to bring the leaf to the *physical* condition in which it could be treated in the conventional machines, an obvious development was to try out methods of manufacture in which withering was eliminated. If successful, such methods would greatly simplify manufacture and lead to a considerable saving in the cost of production. Details of these experiments will be found in Mr. Lamb's report and it is unnecessary to repeat these here. Unfortunately, owing to most unwanted publicity, for which the Institute

was not primarily to blame, considerable misunderstanding arose concerning this tea and attention at first was almost entirely focussed on the *form* in which the samples were presented, namely in compressed tablets. Such tabletting was in fact a side issue, but the great opposition aroused by this part of the process undoubtedly prejudiced to a considerable extent the views expressed on the merits or demerits of the actual teas themselves. In these circumstances it is not surprising that the comments received were distinctly uncomplimentary! However, the criticisms made were to this extent helpful in that they suggested modifications which could be made in the process without abandoning the main consideration, the elimination of withering. At the moment all that can usefully be said is that considerable progress in this direction has been achieved, and now that the heat and smoke of the first battle have disappeared it may be taken for granted that future samples will receive a more dispassionate examination.

Another modification in rolling methods to which the Institute has paid much attention is the development of what is now termed cone rolling. Sometime before the war experiments carried out at St. Coombs had shewn clearly that most of the useful work carried out in rolling occurred at the centre of the table and that modifications in, or removal of, the battens at the periphery of the table had little or no effect. A primitive type of central cone had in fact received some preliminary tests when the departure of Mr. Lamb on war service prevented further experimental work on this subject. Other persons had, however, been working independently on similar lines and in due course "cone" rolling and "pressure column" rolling devices were placed on the market and have aroused much interest. The Institute has tested out, with favourable results, these devices and many modifications of them and it looks as though epicyclic rolling, which name better covers the actual principle involved, will be very generally accepted.

Before concluding these remarks on manufacture reference may be made to the direct-fired heater which has now been under test in St. Coombs factory for several months. One other stove of similar design has been in use on an estate in Ceylon for several years with very favourable results. It is satisfactory to note that our experience at St. Coombs has been equally favourable. Comparative tests between this heater and a conventional stove, each used in connection with the same drier, have shewn a saving of 25 per cent in fuel consumption in favour of the direct-fired heater. Furthermore, as the heater has no metal parts except the front plate, the cost of upkeep should be negligible. Full details of these tests will shortly be published.

The above notes naturally do not cover all of the Institute's activities but may perhaps be of use in indicating the general lines on which work is proceeding.

With the termination of the war there can be little doubt that there will be a demand for a further widening of the Institute's activities in various directions. It may be well to state that, apart from the loss of two senior staff officers referred to earlier in this report, three members of the remaining staff have now been approximating seven, eight and nine years respectively without home leave. It will be clear that this position must be rectified before work on normal lines can be resumed.

Acknowledgments.—Our thanks are, as usual, due to the Ceylon Association in London, the Planters' Association of Ceylon and the Ceylon Estates Proprietary Association for their willing assistance and co-operation.

The work on manufacture and the testing of clonal material would have been impossible without the invaluable help given us in reporting on experimental tea samples by Messrs. R. H. Horne, C. J. Speer, R. C. Kerr, L. W. Walsh and A. G. Mathewson.

Reference has already been made in the Report of the Board of our indebtedness to Mr. H. Tonks and similar assistance has been received from Mr. A. H. Hall since his appointment as Visiting Agent of St. Coombs Estate.

Agency firms and superintendents have, as always, given us their fullest co-operation and we are particularly indebted to Messrs. George Steuart & Co. and the Superintendent of Gonakelle Estate for assistance in connection with the Passara Sub-Station, and Messrs. Leechman & Co. and their superintendents in Kandapolla District for facilities provided in the work on *Phloem necrosis*.

The past twelve months and the war years as a whole, have been a difficult time for the Institute. It is with particular pleasure therefore that I record my most grateful thanks to every member of my staff for their loyal and outstanding service.

The reports of the scientific staff are appended.

ROLAND V. NORRIS,
Director.

REPORT

OF

THE MYCOLOGIST

FOR 1945

Staff.—In addition to his own duties the Mycologist was in charge of the Entomology division throughout the year, and of the division of Plant Physiology until the return of Dr. Tubbs on December 7th.

The Assistant Mycologist proceeded on home leave on August 1st, and the Mycologist was granted special leave from May 29th to June 29th.

Mr. C. A. Loos was promoted to the Research grade as from January 1st.

Publications.—The following paper has been prepared and accepted for publication :—

Loos, C. A.—Notes on free-living and plant parasitic nematodes of Ceylon 2.—*Ceylon Journal of Science Section 13, 23*, pp. 51-55 (1946).

Advisory.—243 letters were received and 223 despatched. 150 consignments of diseased plants were received for examination and report. No disease was unduly prominent during the year.

Sesbania cinerescens.—This plant, which at one time showed promise of being a valuable shade plant, has proved very disappointing. Not only is it very susceptible to the root-knot eelworm as reported last year, but it appears very liable to infection by the fungus *Ustulina zonata.* A group of plants, put out as seedlings in the laboratory compound in March 1941, were first observed to be affected by *Ustulina* in April this year; by November, they were all dead. When uprooted, the fungus was found at the collar and on the roots; fructifications were being formed at the collar. Infection was probably by spores as no old root or stump was in the vicinity. Neighbouring plants of other species were not affected.

Frost.—Considerable damage is caused annually by frosts at high elevations. The frosts occur during clear cloudless nights and result from the loss of heat by radiation from the earth. Clouds reflect back much of the radiated heat; for this reason the air is usually warmer during cloudy nights, and frosts are less likely to occur then. As the earth cools rapidly the air above also becomes colder, denser, and heavier. In consequence, the cold air tends to flow downwards to lower levels wherever there is an outlet. Thus, the cold air on slopes slips down to the valley at a lower level where, if there is no escape, it accumulates and forms a 'frost pocket.' The position of such frost pockets depends upon the contours of the surrounding land. These facts should be borne in mind when siting a tea nursery, care being taken wherever possible to avoid such frost pockets.

NEMATODES

Root-knot on Dadap.—Numerous reports reach us of the damage caused by the root-knot eelworm *(Heterodera marioni)* to dadaps. Where dadaps are sickly and tend to die after pruning this pest should be suspected. For an account of this eelworm on dadap *The Tea Quarterly,* Vol. 1, pp. 39-44, should be consulted.

The eelworm enters a feeding root, usually near the tip, but does not kill the root which continues to grow. The place at which the eelworm enters, later becomes swollen and a small gall is formed. Larger galls, resulting from the development of two or more generations of the pest, are found on thicker roots, up to 1 inch in diameter. Very rarely can galls be distinguished on thick woody roots. Nor are dead trees very suitable for diagnosis, unless the examination is made shortly after death and before the cortex and galls have decayed. These facts should be remembered when submitting dadap material for confirmation of field diagnosis. We sometimes receive boles of old trees and large woody roots which are quite useless for the purpose.

Common Names.—Very few pests and diseases of tea have common names, independent of scientific classification, such as shot-hole borer, and root-knot eelworm. Scientific names, particularly of little known organisms, are apt to be changed as knowledge of the group to which they belong increases. Recent reclassification of a particular group of nematodes has resulted in the species *Anguillulina pratensis* (de Man) Goffart being transferred to the genus *Pratylenchus,* so that its name now becomes *Pratylenchus pratensis* (de Man) Filipjev.

In Ceylon this particular pest of tea, in the absence of a more descriptive name is commonly referred to as *Anguillulina,* which is neither convenient nor appropriate. The eelworm *Heterodera marioni* causes swellings, galls or knots on infested roots, so the worm is known in all English-speaking countries as the 'Root knot' eelworm. *P. pratensis* does not cause any such marked symptom which might give rise to a common name. It is known, however, both in America and England by the name "Meadow" eelworm, and though this may not seem very appropriate for a pest of tea, it is on the whole preferable to *Anguillulina.*

Eelworm population.—In earlier reports mention has been made of the great variation that exists between seedlings as regards their susceptibility to infestation by the meadow eelworm, and of the large number of eelworms found in infested roots. The following experiment shows how rapidly this nematode can multiply under favourable conditions.

Tea seedlings, shortly after germination of the seed, were placed singly in 6-inch pots, to the soil of which 200 eelworms were added. Four plants, selected at random, were examined monthly for six months and the eelworms recovered from the roots were counted. For examination, the laterals were separated from the taproots and weighed. The roots were then immersed in water which caused the eelworms to leave. The water was changed after 2, 5 and 7 days and the worms found in the water were counted. Relatively few worms were found in the taproots. The numbers found in the laterals from the second month onwards are given in Table 1.

TABLE I.

Number of eelworms obtained by immersing lateral roots of 4 young tea seedlings in water for 7 days at various times from infection with *Pratylenchus pratensis.*

Age in months	Weight of laterals gm.	Number of worms per gm. of roots	
		P. Pratensis	Others
2	1·63	183	454
3	3·31	437	440
4	3·97	612	547
5	6·94	2.848	1,862
6	8·68	3,234	1,329

Very few worms were recovered at the end of the first month, but the number increased rapidly in succeeding months. The rate of increase did not follow any apparent law, (*e.g.* compound interest), probably because the material was very heterogenous. The greatest increase was observed during the fifth month, though little importance can be attached to that observation; it might be due to the plants used at the fifth examination being rather more susceptible than the average. At no examination did the four plants give very similar results. Nor was there any close relationship between the weight of roots and the number of eelworms obtained from individual plants. Numerous worms remain in the roots after 7 days' immersion in water, but the figures given are sufficient to indicate the rapidity with which the population of a parasitic eelworm may grow.

It may be seen from Table 1 that in addition to *Pratylenchus pratensis* numerous other worms of different species were obtained from the roots and that the number of such worms increased generally with the number of parasites. Most of the worms belong to the genera *Cephalobus* and *Rhabditis,* which have no stylet or spear in their mouths with which to force entry into roots, and which normally live saprophytically in the soil. The roots were washed as thoroughly as possible in running water to free them of all organisms adhering lightly to them, yet these saprophytic species later occurred in large numbers in the standing water. This suggests that they emerge from the infected roots into which they have gained entry by following the route taken by the parasites. Usually these species are not found when healthy roots are washed and examined in the same way.

There is, however, another species, *Paratylenchus macrophallus,* which is found when both healthy and *P. pratensis* infested roots are tested. This eelworm is armed with a spear with which it probably adheres firmly to the roots. No evidence has been obtained that these eelworms enter the roots, so probably they feed semi-parasitically on the exterior of the roots. Any damage caused is not extensive.

The wounds made by the parasitic eelworms are also favourable points of entry for bacteria and fungi which normally cannot invade unwounded roots. These no doubt hasten the death and decay of parasitised roots.

The parasitic eelworms are not evenly distributed throughout the fine root system; some roots are more heavily infested than others. This becomes particularly evident when roots growing in the soil are compared with those situated amongst the broken crock at the bottom of the pot The roots surrounded by soil often have 10 times more *P. pratensis* per gramme than the roots in the crock.

Small samples of soil from each pot were also examined for *P. pratensis*. The numbers found in soils, however, gave no indication of the size of the populations to be found in the roots growing in the respective pots. Relatively few worms were found in the soil of some pots carrying heavily infested roots. It follows, therefore, that a soil count, by the methods used does not truly reflect the degree of infestation of the roots growing in that soil. Small samples taken from close proximity to roots usually contain more eelworms of all sorts than samples taken further away from the roots. This suggests that not only parasitic species but saprophytes also are attracted to roots, possibly because of an excretion from growing roots.

Spread in a Clearing.—The presence of *P. pratensis* in a clearing on St. Coombs was reported in my annual report for the year 1942. In March 1944 a rectangular area containing 98 bushes (7×14) was selected, and a small sample of soil was taken from around each bush. *P. pratensis* was found in 12 of these samples, all taken from the eastern half of the rectangle. In September 1945 similar samples were examined, and the eelworm this time was found in 21 samples. Of the original 12 sites, only 8 by this test were shown to be still infested. The amount of soil examined is very small and a negative result therefore is not very trustworthy. As small soil samples also do not always truly reflect the condition of the roots growing in the soil, small root samples were taken from all bushes in October 1945 and tested. *P. pratensis* was obtained from 26 root samples as compared with 21 infested soils. Only 11 of the sites, however, gave *P. pratensis* in both soil and root samples. If we amalgamate the results of both tests, there are 36 sites known to be infested by *P. pratensis* to a greater or less extent. These sites are distributed through the area; they are not all in the eastern half of the block nor do they form compact blocks. It seems probable therefore that the eelworm occurs throughout the block although it was not found everywhere by these methods. Of the 12 sites known to be infested in 1944 only two failed to yield the eelworm in 1945. The tea bushes growing in this area do not exhibit any above ground symptom suggesting infestation by *P. pratensis*.

C. H. GADD,
Mycologist.

REPORT

OF

THE ENTOMOLOGIST

FOR 1945

The Mycologist remained in charge of the Division during the year. The Assistant Entomologist was on medical leave from January 29th to April 29th.

Advisory.—253 letters were received and 327 were despatched. 55 consignments of insects were received, of which 14 consisted of mites and 10 of nettlegrubs. No insect pest was unduly prominent during the year.

Publications.—The following papers have been prepared and accepted for publication :—

Gadd, C. H.—Observations on the Yellow tea mite, *Hemitarsonemus latus* (Banks) Ewing.—*Bull. Ento. Res. 37*, pp. 157-162 (1946).

Gadd, C. H. Fonseka, W. T. and Ranaweera, D. J. W. — Parasites of tea nettlegrubs with special reference to *Platyplectrus nawadae* Ferriere and *Autoplectrus taprobanes* Gadd.—*Ceylon J. Sci. Section B, 23*, pp. 81-94 (1946).

Tea Leaf Miner.—I am indebted to Dr. S. A. Neave of the Imperial Institute of Entomology for the information that the correct name of this insect is *Melanagromyza theae* de Mejere and not *Oscinis theae* Bigot by which it has been known previously.

Although leaves injured by tea leaf miner are frequently observed the insect has never assumed the importance of a major pest. In August it became unusually prominent on St. Coombs but had completely disappeared by the end of October. The following observations were made to determine to what extent it is controlled by parasites, and to obtain further information regarding its life-cycle.

From a collection of 93 pupae the following three species of parasites were obtained : *Closterocerus insignis* (45). *Trigonogastra* sp. (5) and an undetermined Braconid (5). Thus, 70 per cent of the pupae were parasitized Of the remaining pupae (28) only two produced adult *Melanagromyza* flies.

A collection of 41 larvae was also brought to the laboratory and all pupated normally. Eight pupae failed to develop further; the same undetermined Braconid, as was found in the collection of pupae, emerged from 27 and only 6 developed normally.

These figures show that the tea leaf miner is normally parasitised very heavily and suggest that parasites effectively control the pest. *Closterocerus insignis* and *Trigonogastra* sp. are parasites of the pupa, but the Braconid evidently parasitises the larva, though the adult parasite does not emerge till after the host has pupated. The parasites emerged 14 to 23 days after the miners had pupated; the average period for the 23 parasities under observation was 17 days.

Malanagromyza theae lays her eggs on the upper surface of tea leaves, placing them singly just beneath the epidermis. Usually, not more than two eggs are placed on any one leaf though on rare occasions as many as five larvae have been seen. The second and third leaves from the bud seem to be preferred; older leaves are sometimes used, but the very youngest leaves are avoided. The incubation period is unknown. The young grubs, soon after they are hatched, begin to make irregular galleries beneath the upper epidermis; they never move to the lower surface. The galleries are very obvious, appearing as broad irregular whitish lines on the leaf surface. The duration of the larval period is about 11 days. This period was determined from two larvae found immediately after hatching; both pupated 11 days later. The larva pupates within the gallery, usually at the end of it, so pupae are usually to be found near the leaf up or close to the petiole. Two puparial spiracles project through the epidermis. The pupal period, based on 5 observations, occupied from 14 to 16 days with an average of 15 days. The flies could not be induced to oviposit under laboratory conditions.

Albizzia Mite.—I am indebted to Mr. H. Womersley of the South Australian Museum, Adelaide, for identifying the mite associated with defoliating Albizzia trees, reported last year, as *Tydeus womersleyi* Sig Thor 1932. A similar defoliation of albizzias was recorded from two other estates this year, and the same mite was found to be numerous on the leaves.

Scarlet Mite.—Of the damage caused to tea by mites that caused by the scarlet mite *(Tenuipalpus obovatus)* is probably of most importance in that, when the attack is severe, the bushes defoliate. Some areas are regularly and severely attacked though the reason for it is not clearly understood.

This mite became evident in the clonal area on St. Coombs towards the middle of February. One clone, was selected for continuous observation and 40 mature leaves were collected at random from the plucking tables and brought into the laboratory for examination. The mites and their eggs were counted with the aid of a binocular microscope. At the first examination 400 mites were found, but by the middle of April the number had risen to 1,300. The mite population then decreased rapidly till, at the end of May, only 160 were to be found on the 40 leaves. Examinations were continued at regular intervals till the end of the year, and although mites were found at every examination their number was always very small, rarely exceeding 30 till November, when the number started to increase again though very slowly.

These observations are of interest as they demonstrate that scarlet mites are present in the tea bushes throughout the year and that their number increases rapidly during the early dry months of the year. In April, when the mites were most numerous, they did not occur in sufficient number, in this instance, to do appreciable damage to the tea.

Yellow Mite.—Attack by yellow mite is usually more noticeable as the attack is restricted to the youngest leaves which in consequence appear brown and scurfy on the under surface. This mite has been studied in some detail during the year and observations on its habits and life-cycle have been published elsewhere. The male yellow mite has the curious habit of searching for and carrying away female 'pupae.' The hind end of his body is somewhat tail-like and near the end of it, on the ventral side, is a relatively large sucker-like organ which he attaches to the pupa. When carrying a 'pupa' his 'tail' is almost vertical so that his burden is held well above his back. He has a marked tendency when carrying a pupa to migrate towards younger leaves and the terminal bud. Females do not wander, and will remain on the leaf on which they are placed. The presence of young females in and near the terminal buds is, therefore, due to this unusual habit of the male. Virgin females give rise to male offspring only, but mated females have mixed families.

SHOT-HOLE BORER.

Branch Breakages.—The collection of broken branches in the Passara manurial experiment plots was continued throughout the year. Monthly records are given in Table 1 together with those collected in the corresponding year of the previous cycle, for comparison. It will be seen that broken branches were most numerous in June and July in both cycles. The 1945 observations, therefore, support the previous conclusion that maximum damage in these plots occurs towards the end of the second year from pruning.

TABLE I

Month	Month from Pruning	1945		1942	
		No. of Plucks	Mean No. broken branches per collection	No. of Pluck	Mean No. broken branches per collection
January ...	16	5	497	—	—
February ...	17	4	484	4	1205
March ...	18	4	433	4	860
April ...	19	4	559	4	1579
May ...	20	5	811	5	1744
June ...	21	4	846	4	2450
July ...	22	4	854	5	2250
August ...	23	5	751	4	1729
September ...	24	4	695	4	1162
October ...	25	5	521	5	734
November ...	26	4	418	4	571
December ...	27	4	412	5	537

During the 1940-43 cycle, the plots were manured on three occasions, March 1941 (6 months) April 1942 (19 months) and March 1943 (30 months). In the present cycle, the manures have been applied on two occasions only, September 1944 (12 months) and October 1945 (25 months); no manure was applied during the first year of the cycle and the final application was made soon after maximum breakage had occurred. The change in times of manuring was deliberately planned, largely to ascertain what effect, if any, the change would have on shot-hole borer incidence. The ommission of manures during the first year from pruning has obviously not influenced the time at which maximum breakage occurs.

In my last annual report I showed that breakages in Block 1, during the first year from pruning, were more numerous than in the other blocks. Block 1 is manured and otherwise treated exactly like the other blocks, but is separated from them by a distance of about 200 yards. In Block 1, shot-hole borer damage reached a maximum in October 1944, and although there was a slight decrease later, breakages remained at a fairly high level until June and July 1945, since when the weekly damage in the plot has been approximately equal to that of the other plots and has shown similar monthly decreases. In other words, Block 1 behaved differently from other blocks till June 1945, since when all plots have behaved alike. These observations suggest that other factors, at present unknown, have a much greater effect on borer incidence than does the time of manuring.

Table 1 shows that broken branches were far more numerous in 1942 than in 1945. The reduced damage in 1945 was not expected, and it is very doubtful that it can be attributed to a change in the time of manuring. Other explanations must be sought and tested.

These experiments have shown that in the experimental area as a whole, the maximum damage occurs towards the end of the second year from pruning. This suggests that the beetle population is also at a maximum about the same time, as damage is usually proportional to the number of insects causing it. What then happens to the beetles produced during the third year of the cycle? Do they migrate elsewhere or die? No direct answer can be given to these questions but the following observations may be of interest:—

These experimental plots are situated in a field where pruning is carried out in alternate years. When the experimental plots were pruned in 1943 at the end of their first 3-year run, the surrounding tea was then one year from pruning; so in 1944 when the bushes in the experimental plots were one year from pruning, and therefore suitable for borer attack, the surrounding tea was probably carrying its maximum population of beetles. These conditions would appear to be favourable for a big beetle migration into the plots. There is, however, no clear evidence that such an invasion occurred; in fact the evidence is to the contrary. If invasion occurred under these conditions a large number of broken branches would be expected as a result of the invasion; the actual numbers as may be seen from Table I are much smaller than those recorded in 1942 when such favourable conditions did not prevail.

Very little is known of the fluctuations of shot-hole beetle populations and of the factors which cause them. Branches collected at 3-week intervals were dissected, and records made of the galleries found and their contents. The collection of this data has occupied a large amount of time

but it is hoped that a study of it will add materially to our knowledge of the pest.

Life-Cycle.—As the shot-hole beetle spends most of its life hidden within galleries in living branches little is known of its activities from direct observation. What is known of its cycle has been obtained mainly from indirect evidence. An account of that work was published in the *Tea Quarterly* Vol. XIV, pp. 5-72 (1941) and it was there shown that the incubation, larval and pupal periods were 6.9, 15.2 and 7.0 days respectively. It has, however, been found possible to hatch borer eggs and to bring pupae to maturity under conditions which allowed continuous observation. From these experiments it has been determined that the incubation period is 7 days and the pupal period 8 days. No method has yet been devised for maintaining larvae under continuous observation, but the fact that the incubation and larval periods, derived indirectly, have proved tolerably correct gives confidence that the larval period similarly obtained is also correct. A full account of this work, together with other data concerning the life-cycle of *Xyleborus fornicatus fornicatior* will be published elsewhere.

After the craneflies had emerged, the roots of the seedlings were received from an estate in the Nawalapitiya district, with the statement that they had been found in a tea nursery bed and had damaged the young plants. The bed had been well forked and tea fluff applied in January before planting up with tea seed, six inches apart. On arrival at the laboratories the larvae appeared to be nearly full grown and ready to pupate. Some were placed in pots with seedlings, including tea, to complete development. Craneflies began to emerge 19 days later. The empty pupal cases were to be seen projecting from the soil, head end upwards, although before emergence the pupae could not be seen. The pupal stage of males lasted from 6 to 7 days and of females from 7 to 8 days. Although mating occurred, the females would not lay eggs in soil or turf in cages. The adults survived from 6 to 13 days in the cages.

After the craneflies had emerged, the roots of the seedlings were examined for injuries but none was found. As already stated, the leather jackets appeared to be almost full grown at the beginning of the experiment, yet allowing for the pupal period, the larvae had opportunity to feed on the roots for about 15 days. This experiment, therefore, provides no evidence that this insect will feed on tea roots, though admittedly it cannot be regarded as conclusive.

I am indebted to the Entomologist of the Department of Agriculture for the information that these insects were an undetermined species of *Pachyrhina* and that it had previously been reported, once only, as a pest of vegetable beds. No previous record of its occurrence in tea nurseries has been found.

INSECTICIDES.

Gammexane.—'Gammexane' is the registered trade name of an insecticide manufactured and supplied for trial by the Imperial Chemical Industries Ltd. It has insecticidal properties somewhat similar to though not identical with, those of the much publicised insecticide DDT. The following experiments were carried out to determine its effect on soil insects, the test insect being *Pachyrhina* sp., the cranefly larva or leather jacket referred to earlier in this report. Gammexane is a powerful insecticide, and in the

following experiments the crude insecticide was diluted with saphos-phosphate to give a 5 per cent concentration of Gammexane. The name Gammexane will therefore refer, in what follows, to this 5 per cent mixture.

In the first experiment, poisons were offered as baits on the soil surface. This assumes that the insects come to the surface to feed, but the results indicate that the assumption is not very sound. About 300 gms. of good garden soil were placed in each of 5 containers, and 30 leatherjackets were placed on the soil surface of each. The larvae quickly bored their way into the soils and disappeared from view. The following baits were then placed as small heaps near the middle of the soil surface, one to each container: (1) nil (2) Bran only (3) Bran and Paris Green in the ratio 25:1 (4) Bran and Gammexane (5) Gammexane only, about half-a-gramme. The baits were removed daily and the soil examined for dead and moribund larvae before replacing the baits. It proved somewhat difficult to remove and replace the small quantity of Gammexane, so at the end of the second day it was decided to mix it thoroughly with the soil. The experiment was stopped after five days.

At the end of the experiment dead or moribund larvae had been removed as follows: (1) No bait, 1 dead, (2) Bran only, 2 dead, (3) Bran and Paris Green, 1 dead, (4) Bran and Gammexane, 14 moribund, (5) Gammexane only, 30 moribund. The fact that only one death occurred in the container with the bran and Paris Green bait suggests that the larvae had not fed on that bait, and it raises the question whether the bran baits are attractive at all The fact that all the larvae became moribund in the soil with which a small amount of Gammexane had been mixed, indicates clearly that this insecticide acts in some way other than as a stomach poison devoured with the bait. When mixed with the soil it was far more effective than when offered with bran as a bait. At the end of the second day before the Gammexane was mixed with the soil, 13 larvae had been removed as moribund; the following day the remaining 17 were in a similar condition.

The term "moribund," rather than dead, has been used to describe the condition of larvae affected by Gammexane. The affected larvae were usually found on the surface of the soil, with a swelling at the head-end extanding over the first 3 or 4 segments. They lay quite still and extended, as though dead, but would twitch when touched with a needle. Though alive they made no attempt to bury themselves. The 17 larvae removed from the Gammexane soil on the third day of the experiment were transferred to clean damp soil; during the next seven days six died, one pupated and the others remained in the same immobile condition.

The object of the next experiment was to determine the minimum amount of 5 per cent mixture necessary to render soil toxic to this species of leatherjacket. To 20 gm. lots of soil, in glass tubes, the following amounts were added: 1.6 gm., 0.8 gm., 0.4 gm., 0.2 gm., 0.1 gm., .05 gm., .025 gm., and .013 gm. In order to assist dispersal, the small quantities were made up to 1 gm. with clean saphos-phosphate before mixing with the soil. Controls were set up with untreated soil, and soil containing 1.6 gm. saphos-phosphate. Ten larvae were placed in each lot of soil The following day immobile larvae with swollen heads were seen on the soil surface of tubes containing from 0.4 to .025 gm. gammexane, but not in those containing higher concentrations (1.6 and 0.8). The larvae were then removed from all tubes and placed on the surface of fresh

clean soil. All the larvae from the control tubes and from that containing .013 gm. gammexane re-entered the soil; the others, except for 3 from the tube containing .023 gm. remained on the soil surface. None of the affected larvae recovered, but many died when left in fresh soil for one week.

From this experiment it is evident that about .025 gm. (one-eighth per cent) of 5 per cent saphos-gammexane mixture is sufficient to render 20 gm. of soil toxic to this species of leatherjacket. Larger amounts had no apparent greater killing powers, though they may immobilise the larvae quicker and prevent them from reaching the soil surface. On the above basis, about 24 lb. of the crude gammexane would be sufficient to render toxic an acre of soil to a depth of one inch. It would, however, be inadvisable to apply this powerful insecticide to soil even in this quantity until its effect on other soil inhabitants is fully known.

The discovery of powerful insecticides such as Gammexane and DDT has long been awaited by both entomologists and agriculturists. Now they have arrived a word of caution regarding their use may be advisable. They are two-edged swords and their indiscriminate use can at times do more harm than good, because they do not distinguish between insect enemies and friends. Their great value is undeniable, but much has yet to be learned regarding the best methods of use.

C. H. GADD,
Acting Entomologist.

REPORT

OF

THE PLANT PHYSIOLOGIST

FOR 1945

Staff.—Dr. C. H. Gadd continued to be responsible for, and to direct research in, the division until 8th December, 1945, when Dr. F. R. Tubbs returned from military service overseas.

The writer takes this opportunity to acknowledge the work of all who maintained continuity, where possible, in the experimental work of the Department during the war, and especially the great advance made by the successful adaptation of the single internode cutting technique to field nursery conditions. This has rendered possible the production of clonal material, with its great uniformity and constancy of attributes, for direct use as yielding bushes under estate conditions. Dr. Gadd, Dr. Eden and Mrs. Bond were directly concerned, the former throughout.

Advisory.—120 letters were received and 116 despatched.

TEA SEED.

Yields.—The collection of seed from the Khorijan bearers described in the Annual Report for 1944 was continued. During the year, a further sixteen trees which had been planted later than the original ones came into bearing. Fifty trees have yet to come into bearing.

The fourteen bearers under record in 1945 gave a total of 8,938 seeds against 2,128 in 1944 (Table I), counts being made weekly.

TABLE I

Yields from Seed-Bearers.

Year	No. of Bearers	SEED				GERMINATION	
		Total	Sinkers per cent	Floaters per cent	Empties per cent	Sinkers per cent	Floaters per cent
1942	11	2,230	57	25	18	80	38
1943	12	2,243	60	25	15	87	55
1944	14	2,128	49	33	18	—	—
1945	14	8,938	47	39	15	—	—
	16	1,057					

The large increase in the crop of the older plants and the reduced percentage of empties suggest that it was a favourable year for seed, though the percentage of floaters was higher.

The occurrence of "empties" (Annual Report 1930, p. 15) has shown two peaks every year, one at the beginning of the year, and the other in September-October, with a well marked minimum in July and August. The average monthly percentages found over the period 1942-45 are shown in Table II.

TABLE II

Percentage of Empty Seed

Jan.	Feb.	Mar.	April	May	June
21	26	35	20	18	12
July	Aug.	Sept.	Oct.	Nov.	Dec.
10	11	31	23	15	14

During the year the seed was graded for size. The smaller grades were most frequent in March and April, and least frequent during the period August to September.

CLONES.

1937/38 Clones.—These clones were pruned in August 1944 and were brought into plucking in April 1945, the slow recovery being the result of abnormally dry weather. Yields per acre for two periods, each of 40 pluckings (1 year) are given in the Annual Report for 1944. The yields per acre in 30 pluckings during the last nine months of 1945 are given in Table III.

TABLE III

Yields of 1937/38 Clones, April to December, 1945.

Clone	No. of bushes plucked	Yield in lb. per acre in nine months' plucking
1	22	625
9	22	790
13	28	415
14	19	365
15	25	660
16	21	395
18	28	660
19	21	345
21	21	725
222	26	910
23	23	1240
25	—	—
Seedlings	24	595

Clone 25 was taken out of plucking during the year for the growth of propagation material. Ignoring this clone, and arranging the remaining clones in order of merit for the three plucking periods over which they have been observed, the results shown in Table IV are obtained.

TABLE IV

Relative Order of Merit of 1937/38 Clones.

Period	1	2	3
Pluckings	40	40	30
Clone			
1	8	10	7
9	2	1	3
13	11	11	9
14	9	12	11
15	8	6	5
16	7	8	10
18	6	4	5
19	11	9	12
21	4	3	4
222	5	7	2
23	1	2	1
Seedlings	3	5	8

Differences between clones are to be expected both in the rate of development of the young bushes and in the distribution of yield within the cycle. The former will result in progressive changes in relative order of merit and the latter in a tendency for clones to re-assume after pruning (period 3) their original position (period 1). These tendencies will mask one another and it is as yet too early to speak of definite differences of these types. It is not, however, too much to say that there are already definite indications of such differences.

As examples of an improvement in relative position clones 13 and 15 may be taken, while clones 14 and 16 and the seedling plot show a retrograde effect. A tendency for positions in the first and third periods to be the same is shown by clones 1, 19 and 21, but the analysis of such effects must await the simultaneous collection of data from bushes of different ages from pruning in each clone. The pruning programme for the clonal plots is being adjusted to permit of this.

A further class of differences that might be expected between clones are those associated with differences in the rate of yielding under different conditions. Some clones, yielding heavily in rush periods, may "shut up" more than others under conditions less favourable to high cropping. More steadily yielding types would not shine during rushes, but would materially improve their position during the lower yielding periods.

The relative order of these clones has accordingly been calculated separately for those occasions on which the total yields were respectively above or below the average for each of the three periods under discussion. The results are given in Table V.

TABLE V

Relative order of 1937/38 Clones in high and low-yielding periods.

Yield	Above average				Below average			
Period	1	2	3	Mean	1	2	3	Mean
Pluckings	21	20	15		20	20	15	
Clone								
1	8	10	7	8·3	9	9	10	9·3
9	3	4	6	4·3	1	2	3	2·0
13	9	9	9	9·0	8	8	8	8·0
14	11	12	11	11·3	12	11	12	11·7
15	7	5	5	5·7	3	7	7	5·7
16	10	8	10	9·3	10	10	9	9·7
18	6	2	3	3·7	5	3	4	4·0
19	12	10	12	11·3	11	12	11	11·3
21	2	3	4	3·0	7	1	5	4·3
222	4	6	2	4·0	3	5	2	3·3
23	1	1	1	1·0	2	4	1	2·3
Seedlings	5	7	8	6·7	6	6	6	6·0

The results are noteworthy for their uniformity, showing that there was no marked variation in reaction to favourable and unfavourable environmental conditions and also that the high-yielding clones did not achieve this distinction by abnormal flushing in rush periods alone. The results also indicate that the general conclusion that test pluckings over a relatively short period provide an adequate means of selection of high-yielding bushes from low yielding is also true of the determination of the relative yields of individual high yielders.

TABLE VI

Yields of 1939 Clones.

Clone No.	No. of bushes plucked		Yields in lb. per acre		Bush diameter	Order of Merit	
	1st period	2nd period	1st period	2nd period		1st period	2nd period
4	24	24	345	610	54·0"	4	4
32	18	18	215	280	35·9"	5	5
33	26	26	150	230	36·4"	6	6
37	17	17	545	1005	58·3"	2	1
45	27	27	645	675	53·9"	1	3
46	23	23	545	825	51·8"	2	2

1939 Clones.—The six clones planted out in 1939 completed two periods of pluckings (two years). The order of merit is noteworthy only for the change in relative position of Clone 45. The mean bush diameter at the end of the period again demonstrated a close relationship with yield. (Table VI).

1941 Clones.—The yields of the clones planted out in 1941 over periods of one year's plucking (40 pluckings) are shown in Tables VII and VIII. Data for two such periods are available for clones 216-1526. The yields of duplicate rows, where such exist, are included.

TABLE VII

Yields of Clones 216—1526 during 1944-46

Year	Clone	Number of bushes plucked	Calculated yield as lb. per acre	Order of Merit
1944-45	216	30	380	6
	331	26	415	2
	928	23	395	4
	934	22	645	1
	1082	31	345	8
	1114	21	415	2
	1294	28	395	4
	1526	19	380	6
1945-46	216	32	645	4
	331	33	595	5
	928	23	725	2
	934	nil	—	—
	1082	31	395	7
	1114	21	825	1
	1294	33	595	5
	1526	26	675	3

COVER CROPS.

Advisory Work.—57 enquiries were received from 49 estates, concerning 11 species of green manures and shade plants and 45 species of cover crops, weeds, etc.

Herbarium.—37 sheets were added during the year, including 20 new species. The Institute again acknowledges the help received from the Botanist of the Department of Agriculture in confirming identifications, etc.

Shade and Green Manure Species.—Twelve packets of seed were distributed during the year. *Mimosa bracaatinga* has been the subject of promising reports from the higher elevations in both wet and dry districts. *Sesbania cinerescens* has again given disappointing growth, but *Cytisus proliferum* has continued to do well at St. Coombs.

TABLE VIII

Yields of Clones 20-1530 during 1945-46

Clone	Number of bushes plucked	Calculated yield as lb. per acre	Order of Merit
20	6	415	5
22	31	345	17
34	15	380	11
43	22	265	22
43	15	250	25
128	27	430	4
216	28	395	8
331	25	380	11
343	28	280	19
397	28	215	27
407	30	415	5
483	21	265	22
510	27	250	25
603	33	415	5
777	33	510	2
777	33	395	8
839	35	295	18
960	9	280	19
1005	29	265	22
1016	23	395	8
1016	15	380	11
1076	34	595	1
1294	25	380	11
1526	23	510	2
1530	27	365	15
1530	31	365	15
Seedlings	24	280	19

F. R. TUBBS,
Plant Physiologist.

REPORT

OF

THE AGRICULTURAL CHEMIST

FOR 1945

Staff.—The Agricultural Chemist returned to Ceylon after furlough on July 28th, 1944. On September 1st he took over the acting charge of St. Coombs Estate. Mr. F. P. Jayawardana, Field Assistant for experimental work, was also seconded to the estate to act as Assistant. Mr. M. Piyasena has consequently shouldered the whole burden of field experimental supervision. Mr. E. N. Perera in the laboratory has proceeded with the carbon and nitrogen survey mentioned in the last report.

Publications.—The effects of Manurial Treatment on the Growth of Weeds in Tea, Empire Journal of Experimental Agriculture, 1945, Vol. 13, (Joint paper with T. E. T. Bond).

Work in Progress.—The division of time between estate management and scientific work is fraught with difficulty, mainly because of the constant necessity to leave the one type of activity in order to devote necessary attention to the other. For this reason it has not been possible to pursue any new lines of investigation. The collection of data from experiments already in being has gone on, thanks to the steady work of my assistants. Till the results of these activities can be critically examined it will be impossible to plan new avenues of enquiry or to report on them in the normal way. This report therefore makes no attempt to give information on the year's progress which, being tentative, might on closer consideration have to receive considerable modification.

Although the usual report on the work of the department cannot be given, it may be of interest to sum up in a few words the position that has been reached as a result of past investigations; to see how much we know, and where it will lead us.

We know much more about the crop responses to manures than when the Institute commenced its work, but we know little about the effect of these treatments on general soil fertility. An indication was given in the previous report that with our perennial crop, from which considerable portions were returned to the soil, higher cropping power might go hand in hand with detectable differences in soil fertility, and that these differences might not be adverse if the system of management was well regulated. The literature of the past year, and the work I was personally able to see in Australia, all tend to reinforce the suggestion that the roles of cultivation, green manuring (or similar schemes adopted in temperate

regions), root growth and decay are becoming more clearly understood in relation to the structure of the soil. The balance is a delicate one and may be influenced in either a good or bad direction.

In past years a good deal has been reported about these matters taken individually. It is necessary to study factors individually in order to clarify the notions of how they work. Some of our field experiments have now been in existence long enough for several of these factors working together to have produced effects which may be definite enough to measure. The future work of the department will tend therefore, as occasion presents itself, to link up the cropping results with the soil in order to evolve improvements in soil management. There are formidable difficulties. One of the first tasks to which this department set itself eighteen years ago was to overcome the difficulties due to soil heterogeneity in field experiments. A similar procedure will be necessary in dealing with soil samples for analysis and other types of soil investigation. If anything, the obstalces will be greater than in field experiments because of the restrictions in the number of samples that can be dealt with. This much must be said in order to discount any expectations that work of this type can produce rapid and spectacular results.

Extra-mural Activities.—During my residence in Adelaide, S. Australia, I had the privilege of close association with the premier agricultural research station in Australia, The Waite Agricultural Research Institute. This Institute forms the Faculty of Agriculture in the University of Adelaide and is the headquarters of the Soils Division of the Council for Scientific and Industrial Research for the Commonwealth of Australia. In my last report I mentioned that I wished to follow up certain technical problems connected with the stability of soil crumbs to water erosion. The apparatus for the purpose is not available in Ceylon. Professor J. A. Prescott, Director of the Waite Institute, kindly placed their apparatus at my disposal and provided me with laboratory accommodation and all other necessary facilities for this work. For this and other kindnesses I am profoundly grateful. I also had the advantage of seeing in detail the work of the Institute and of discussing problems of mutual interest with members of the staff. If I single out the names of Dr. T. J. Marshall, Head of the Soil Physics Department; Dr. C. S. Piper, Head of the Chemical Department; Professor C. H. Trumble, Head of the Department of Agronomy; and Mr. J. K. Taylor, Deputy Director of the Soils Division C.S.I.R., it is because I trespassed greatly on their time and received very cordial help from them all. I also spent very profitable times with Mr. E. A. Cornish, Head of the Statistical Division C.S.I.R., and Head of the School of Statistics at the Adelaide University. To all these gentlemen I am greatly indebted for the manner in which they accepted me as a colleague rather than as a visitor.

I was also invited to lecture on various topics by a number of scientific societies as follows :—

The Waite Institute Agricultural Science Club on "Problems of Soil Structure."

The S. Australian branch of the Australian Institute of Agriculture on "The Agricultural Problems of Tea Culture."

The Australian Chemical Institute on "Chemical aspects of Tea."

The Australian Broadcasting Commission engaged me to give a series of seven talks on the National and State networks on Tropical Agriculture. By the courtesy of the Director and Staff of the Waite Institute I was able to add to my acquaintance of S. Australian farming and to attend a conference of the Australian Agricultural Bureau, an institute which holds agricultural conferences in the various states similar in purpose to the Tea Research Institute's Conferences though on a broader basis.

From all these experiences I derived much professional benefit personally and I believe that indirectly and directly they will contribute to the work of my department.

T. EDEN,
Agricultural Chemist.

REPORT

OF

THE BIOCHEMIST

FOR 1945

Staff.—Mr. S. M. Guneratnam was appointed at the end of the year and is to assume duties on 3rd January 1946. His appointment will increase the scope for factory experiments.

Advisory.—The amount of advisory work is shewing a distinct tendency to increase and there has been a large number of visitors to the factory. Many of these were interested in the P.F.C. process but a number were demobilised planters wishing to discuss current trends and problems.

Correspondence.—There has been a very large increase in correspondence. 450 letters were received and 427 despatched. A great deal of the correspondence was in connection with the P.F.C. process. The unfortunate limelight which the press turned on our work on new methods of manufacture brought in letters from all over the world and completely disorganised the Department for some weeks. Apart from correspondence on P.F.C. teas, there was a marked increase in general advisory correspondence.

Lectures and Meetings.—The Biochemist addressed the Nuwara Eliya Planters' Association on the subject of "Tea Factory Economics" and the Ceylon Estates Proprietary Association and the Planters' Association of Ceylon on the subject of P.F.C. teas. A lecture was given to the Chemical Society of Ceylon on "Polyphenol Oxidases of Tea."

Electrical and Water Services.—The amount of work involved in supervision of electrical and water services remained at a high level. In spite of mechanical and supply difficulties no serious interruption of supply occurred. Mr. W. R. Solomons was appointed as water and electrical service mechanic in September 1945.

BIOCHEMICAL.

The very successful investigation of the mechanism of tea fermentation resulting in the discovery of the nature of the principal enzyme has, for the time being, been concluded by a few determinations of enzymic activity in various parts of clonal leaf. It will probably take sometime to open up new lines of investigation on the biochemistry of tea leaf and tea manufacture. Mr. Sreerangachar has been engaged on a number of problems but it will probably prove necessary to devote sometime to the chemistry of green leaf. This will be especially necessary if the "Chemistry of Tea" investigations in London are not continued.

Estimation of Oxidising Enzyme in leaf from individual bushes.—The method described in a previous publication *(Biochemical Journal 37,* 653) was followed in these estimations. The distribution of the enzyme in the

various components of flush was as follows :—

	Enzyme activity per g. Acetone Enzyme powder (mg. ascorbic acid)	
	Clone 45	Clone 1294
Bud ...	255	234
1st leaf ...	113	145
2nd leaf ...	106	147
Stalk ...	424	271
Whole flush ...	165	199
Coarse leaf ...	67	—

It is obvious that stalk has most enzyme and the bud comes next. The 1st and 2nd leaves have almost the same enzyme content but it is much lower than that of bud or stalk. The coarse leaf has very little enzyme. As bud ferments faster than the 1st leaf there appears to be a close correlation between the enzyme content of the components and their speed of fermentation. Stalk, however, does not make good tea because of its low content of soluble matter. Preliminary investigations indicated a relationship between the rate of fermentation and the enzyme content of leaf from different clones. No such relationship appears to exist between rate of fermentation and content of polyphenols (the so-called tea "tannin.")

Ascorbic acid oxidation in Tea.—Snow and Zilva (*Biochemical Journal, 36,* 641) have shewn that tea infusions are capable of bringing about aerobic oxidation of ascorbic acid (Vitamin C) and the practical significance of this would be that tea could not be used as a vehicle for administering this vitamin as a supplement to diet. This, however, is only a false alarm; because investigations here have shewn that under the natural conditions of pH of tea infusions and time of reaction in the cup, loss of ascorbic acid is almost insignificant. It is therefore possible to use tea as a carrier of vitamin C for general nutritional purposes.

Anthocyanins and Flavones.—Reference to the presence of an anthocyanin pigment in the purple coloured flushes of a tea bush was made in the 1937 annual report. This bush has since been propagated and sufficient material was available for further investigation during 1945. From the results obtained so far it seems to be a *pelargonidin mono-glucoside* but final confirmation must await the results of elementary analysis. Two flavonol pigments, namely kempferol and quercetin have so far been reported in tea. The close chemical relationship between anthocyanins, flavones and the so-called "Tannin" is a matter of great interest. The flavone corresponding to the pelargonidin anthocyanins is kempferol and it is of interest to know what types of flavones are present in Ceylon tea. A flavone preparation has been obtained from tea flowers and, as in the case of the anthocyanin, this also needs ultimate analysis for final identification. The structure of the anthocyanin and the flavone present in tea may throw some light on the constitution of tea catechin which is the simplest unit of the so-called "Tea Tannin."

Estimation of 'flavour' constituents in Tea.—During the year an attempt was made to devise a method for determining the total amount of volatile substances in tea with the hope of eventual application to the measurement of flavour. Some promising results were obtained.

ANALYTICAL.

The analysis of clonal leaf was continued. There is considerable variation of chemical composition and enzyme activity through the season, but the variation due to the relative proportion of bud, leaf and stalk and the relative ages from the opening of the bud is considerable and probably confuses the issue. Some years ago it was shewn that different pieces of flush gathered from the same bush varied very considerably in the rate at which they withered under standard conditions. It was suggested that this was due to "age," *i.e.*, number of days from the opening of the bud. Efforts are being made to clear up these obscure points and to improve sampling technique.

MANUFACTURE.

New Methods.—Our exploratory experiments on methods for simplifying and reducing the cost of tea manufacture reached the stage when it was considered necessary to obtain opinion from a broad cross section of the tea market. It was also considered desirable to patent the methods developed so that they could not be exploited by other interests should they become of commercial interest. Brief references to our work were made at a few District Planters' Association meetings and from this sprang a most undesirable spate of publicity. The emphasis in this publicity was put on the least important aspect of the new methods of manufacture, because of an element of novelty in the suggestion to compress the rather brown, flaky teas resulting from our early experiments into tablets. The new process became widely known as "Tablet Tea." An attempt to correct the emphasis by giving a name to the process ("P.F.C." the abbreviation of Pulping, Fermenting and Compressing) merely resulted in further publicity without any change in the emphasis.

By some unknown method London journalists learned that samples had been sent to London and speculation was rife in the press as to the reaction of the tea trade to Tablet Tea before the Tasters had ever heard of the new process. It was even stated that the domestic teapot would be banished. This publicity had a most unfortunate effect on the tea trade which rightly objected to suggested new methods of manufacture being thrown at them as a bomshell and marked antagonism was raised against experiments which would have created little attention if they had not become the subject of a journalistic scoop. The facts of the case are as follows:—

For a number of years we have been working on possible methods for simplifying and reducing the cost of manufacture. Our particular object has has been to eliminate the withering process because it demands a very large amount of space time and labour. The ratio of floor space to weight of product is very high in a tea factory and necessitates the use of relatively cheaper building materials such as wood and working materials such as hessian. By this means a big fire risk is introduced which is increased enormously by the necessity for designing the building in such a way that it is virtually a series of horizontal flues. The large amount of handling of leaf involved by withering is also costly.

Another object has also been to simplify the rolling process which is at present no more than a mechanised version of the original hand rolling method. Present rolling is also essentially a batch process and for that reason expensive to operate and difficult to simplify. The sharp rise of cost of manufacture during the war and the exceedingly poor prospects for a return to anything approaching pre-war limits have stimulated our search for simplified and economical methods.

An exceedingly simple method has been developed and during the course of the year it was thought desirable to send samples to a broad cross section of tea trade for comment and advice. The publicity referred to above arose at the time these *very first* experimental samples were sent for general comment. The process, of which an outline is given later, is actually the simplest possible way of making fermented tea from fresh green leaf and may be elaborated in many ways. It is hoped that any elaboration necessary will not result in undue complication and that acceptable teas will be produced by methods far simpler than any previously practised. Briefly the basic method is to reduce fresh leaf immediately on arrival from the field to a pulp by passing between two smooth steel rollers (Clivemeare roller). The resulting pulp ferments very rapidly and may be fired by normal methods in under two hours after arrival as green leaf from the field. The brown flaky leaf made by the basic and direct method can be compressed into blocks under low pressure and would be very economical to ship.

However, the tea trade gave a most unfavourable reception to the idea of supplying compressed forms of tea for general consumption and so attention was turned to the production of more normal forms. Towards the end of the year it was found possible to modify the process to turn out leaf of B.O.P. and Fannings type which will probably be acceptable at least to blenders. P.F.C. teas were reported as "very strong and very pungent but having a raw metallic character." Much progress has been made in the elimination of this metallic character.

In spite of the unfortunate publicity it is felt that considerable progress has been made during the year and that there are quite distinct possibilities of cheapening the process of tea manufacture.

Rolling.—An account of a long and tedious investigation of the rolling process will be published in the *Tea Quarterly* early in 1946. The development of central fittings against which the roller jacket can press leaf during the course of its rotation is described in the article. As the pressure gap formed between these projections from the centre of the table and perimeter of the jacket describes an epicycle it is suggested that the term Epicycle Pressure rolling abbreviated to E.P. rolling should be used. This term would cover all the modifications described as "cone" rolling.

Estates are advised against too hasty conversion to this method which, although highly effective, requires accurate fittings and precise knowledge. Estates are particularly warned against casual experiments. It is also suggested that the Clivemeare method described in the *Tea Quarterly* in 1938 and 1939 should receive serious consideration as a simpler and more effective method.

Acknowledgment.—We have received much assistance from many Tea Tasters during the course of the year and were very grateful especially to those who co-operated in the difficult matter of P.F.C. teas.

A special word of thanks is due to Mr. R. H. Horne, Mr. C. J. Speer, Mr. R. C. Kerr, Mr. L. W. Walsh and Mr. A. G. Mathewson. We also wish to thank the Nuwara Eliya Tea Estates, the Pannawatte Tea and Rubber Estates and Messrs. Whittall & Co. for valued assistance in manufacturing experiments.

J. LAMB,
Biochemist.

REPORT

OF

THE SMALL-HOLDINGS OFFICER,

ARAMBEGAMA (CENTRAL PROVINCE)

FOR 1945

Weather.—Abnormal dry weather prevailed during 1945. The rainfall registered at Arambegama was 89.61 inches, whereas the rainfall during the previous year was 176.38 inches. As a consequence there was a considerable fall in yield and a high percentage of casualties.

New plantations under permit on patana land suffered very severely.

Advisory Work.—1,360 visits were made to small holdings. These holdings include the 207 reconditioned during the previous year and a further 153 holdings taken in hand during the year. The former continue to make good progress. There are as yet a number of abandoned holdings that require attention but owing to the scarcity of labour and the high wages demanded the owners have not been able to effect any improvement.

Petrol rationing restricted the number of advisory visits to small holders, while travelling has been rendered difficult by the bad condition of minor roads

142 letters were received and 327 sent out. 92 calls were made by small holders for advice.

Demonstrations.—13 pruning demonstrations were given at different centres. At Silva's Land Estate (27 acres) the whole area was lung pruned at different intervals of time and this estate served as a demonstration plot for the small holders in the neighbourhood. It is encouraging to note that lung pruning is being more widely adopted by small holders.

Several other demonstrations on tipping, plucking, forking and prevention of soil wash were held at various centres during the year.

Meetings.—A largely attended meeting of small holders, proprietors of estates, bought leaf suppliers and headmen was held on the 25th February, 1945, at the Government Tamil School at Wellamboda. In the unavoidable absence of the Director, Tea Research Institute, Mr. S. C. Traill of Alpitakanda Estate was voted to the Chair. Various points affecting the welfare of small-holders such as co-operative tea factories, improvement in the standard of plucking, unreasonable deductions from green leaf weights by factories, compost making and general improvement of small-holdings were discussed at the meeting.

A number of other meetings of small holders were held at various centres when talks of an advisory nature were given.

Visit to St. Coombs.—A party of small-holders visited St. Coombs and were shown round the estate, factory and the laboratories. This visit created a great deal of interest in improved methods of cultivation.

Fertilisers.—There was a large number of applicants for tea manure from Udu-Nuwara, Yatinuwara, Udapalata, Uda-Bulathgama and Uda-Hewaheta. 72 of these were issued permits. This entailed considerable work as each applicant had to be interviewed for the necessary particulars before permits were issued. Orders for a total of 21 tons 8 cwt. and 88 lb. were placed with supplier firms through the Fertiliser Control Bureau.

Supplying.—The supplying of vacancies was curtailed owing to the abnormal weather conditions.

Green Manure and Shade.—The planting of albizzia shade has been continued on a large scale. The seed issued during the previous year had been raised in nurseries and plants were put out during the course of the year. It has been found difficult to discourage the practice of indiscriminate lopping of gliricidias for fodder.

The practice of growing sun-flower as contour hedges has been encouraged.

Food Production.—Food crops such as cassava and yams have been grown in several of the reconditioned holdings. In a few cases uncultivated "Deniya land" has been converted into paddy and good yields have been obtained. Food production leaflets issued by the Agricultural Department were distributed and explained to small holders on my visits and meetings.

Plucking.—The higher standard of plucking which had been attained by vigorous advisory work fell off during the year owing to factory owners paying higher rates than those stipulated by the Controller.

Miscellaneous.—The Ratemahatmaya, Udunuwara and Yatinuwara, the Divisional Revenue Officers of Udapalata and Uda-Bulathgama, Minor Headmen and members of the Village Committees continued to give their support and valuable co-operation. Mention must also be made of the assistance rendered by the Education Officer, Central Division, in allowing the use of school buildings for meetings.

M. B. BOANGE,

Small-Holdings Officer, Arambegama.

REPORT

OF

THE SMALL-HOLDINGS OFFICER,

BADDEGAMA (SOUTHERN PROVINCE)

FOR 1945

Advisory Visits.—1,411 visits were paid to small-holdings and estates, 297 demonstrations were carried out.

General Conditions in the Area.—The difficult conditions prevailing in these areas worsened, if anything, during 1946. As in previous years small holders were pre-occupied with food production. An abnormal drought aggravated matters.

The rise in price of rubber during the year to one rupee a pound had the effect of inducing small holders to pay more attention to rubber production than tea.

Special Duties.—Advice was sought by the Government Agent, Southern Province, in connection with tea planting in a Government aided colonization scheme. Detailed advice including an estimate were tendered after survey.

Factories.—The purchasers of small holders' leaf have actively co-operated in efforts to improve the standard of plucking on small holdings by paying a higher rate for good leaf.

Labour.—The local shortage of labour persisted during the year. Estate labourers during their off days were frequently employed on small holdings but very high rates of pay were demanded.

Meetings.—A largely attended meeting in Immaduwa, presided over by the Government Agent, Southern Province, was held on the occasion of the presentation of prizes in connection with food production competitions. Instructional leaflets were issued and helpful contacts made with small holders from neighbouring areas.

Travelling.—The meagre petrol ration, and bad tyres impeded advisory work. Efforts to get an increased petrol ration proved abortive.

Chief Headmen.—The Mudaliyar of Talpe Pattu has given consistent support to the activities of the Institute among small holders since 1938 and his efforts are gratefully acknowledged.

F. D. TILLEKERATNE,
Small-Holdings Officer, Baddegama.

The Tea Research Institute of Ceylon.

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(3) Mr. H. de T. Wilkinson-Kay.

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(9) The Hon. the Financial Secretary.

(10) The Director of Agriculture.

(11) The Chairman, Planters' Association of Ceylon.
(Mr. R. Singleton-Salmon, Acting Chairman).

(12) The Chairman, Ceylon Estates Proprietary Association.

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