Report of the Work of The Rubber Research Board in 1942

The present report is the twelfth Annual Report of the Rubber Research Scheme (Ceylon) as constituted under the Rubber Research Ordinance (Chapter 302).

CHAIRMAN'S REPORT

Board Membership.—The three-year period of the following nominated members of the Board terminated during the year and appointments to fill the vacancies were made as indicated below :—

Mr. T. Amarasuriya, 18th May. Mr. W. N. Gunawardena, J.P., nominated.

Mr. T. C. A. de Soysa, 18th May, Mr. J. L. D. Peiris nominated.

Mr. N. D. S. Silva, O.B.E., J.P., 26th June. Mr. S. O. Sirimana nominated.

Mr. W. P. H. Dias, J.P., 10th June. Renominated for a further period of three years.

Mr. R. C. Kannangara, M.S.C., 26th June. Renominated for a further period of three years.

Mr. F. H. Griffith, M.S.C., 15th November. Renominated for a further period of three years.

Mr. F. A. Obeyesekere, 25th November. Renominated for a further period of three years.

The following additional changes in the membership of the Board occurred during the year :—

Mr. M. Crawford acted as Chairman of the Board from 4th May to 6th July, and from 23rd September until the end of the year.

Mr. E. C. Villiers, M.S.C., resigned on 11th March and Mr. G. R. Whitby, M.S.C., was nominated in his place from 21st July. Mr. Whitby resigned on 13th October, and Mr. Villiers was renominated from 10th December.

Mr. J. A. S. Agar resigned and Mr. W. H. Attfield was nominated in his place from 28th September.

The personnel of the Board at the end of 1942 was as follows :—

Ex-Officio Members:—

The Director of Agricultre — Mr. M. Crawford (acting).

Representing the Financial Secretary — The Deputy Financial Secretary (Mr C. E. Jones, C.C.S.)

Unofficial Members of the State Council nominated by the Governor.
The Hon'ble Mr. G. E. de Silva, M.S.C.
Mr. R. C. Kannangara, M.S.C.
Mr. E. C. Villiers, M.S.C.

Members nominated by the Ceylon Estates Proprietary Association.
Mr. W. H. Attfield.
Mr. L. P. Gapp.

Members nominated by the Planters' Association of Ceylon.
Mr. J. D. Farquharson.
Mr. F. H. Griffith, M.S.C.

Members nominated by the Rubber-Growers' Association.
Mr. R. J. Hartley (acting).
Mr. E. W. Whitelaw

Members nominated by the Low-Country Products Association of Ceylon.
Mr. L. M. M. Dias.
Mr. W. N. Gunawardena, J.P.
Mr. J. L. D. Peiris.
Mr. S. O. Sirimana.

Members nominated by the Governor to represent Smallholders.
Mr. W. P. H. Dias, J.P.
Mr. F. A. Obeyesekere.

Meetings.—Meetings of the Board were held in Colombo on 23rd February, 23rd April, 22nd June, 24th August, and 2nd November. The Board is again indebted to the Ceylon Chamber of Commerce for the use of its Committee room for meetings.

Committees.—

Experimental Committee.—There were no changes in the personnel of the Committee which, at the end of the year, was as follows:—
Mr. F. H. Griffith, M.S.C. (Chairman).
Mr. W. P. H. Dias, J.P.
Mr. R. C. Kannangara, M.S.C.
Mr. F. A. Obeyesekere.
The Director (Convener).

Meetings of the Committee were held on 22nd May, 6th July, 21st September, and 30th November.

Smallholdings Committee.—There were no changes in membership. The personnel of the Committee at the end of the year was as follows:—
Mr. W. P. H. Dias, J.P.
Mr. F. A. Obeyesekere.
The Smallholdings Propaganda Officer.
The Director (Chairman and Convener).

A meeting of the Committee was held in Colombo on 22nd May, and a further meeting at Dartonfield on 21st September.

London Advisory Committee for Rubber Research (Ceylon and Malaya).—The Board continued to contribute to the cost of research on the quality and utilisation of raw rubber carried out at the Imperial Institute, London, under the control of the London Advisory Committee for Rubber Research (Ceylon and Malaya). In view of the loss of Malaya and the consequent discontinuance of contributions from the Rubber Research Institute of Malaya the question of financing the work of the Committee was considered by the Board during the year. No change was made in Ceylon's contribution, but it was agreed that the matter should

be further reviewed if the Committee was unable to obtain funds from alternative sources.

Meetings of the Advisory Committee and the Technical Sub-Committee were held on 20th March and 13th November.

Employees' Provident Fund.—The Board continued the administration of the Fund during the year. A portion of the Fund representing Ceylonese officers' contributions and interest thereon was repaid to the officers owing to the unsettled conditions prevailing during the year.

Medical Fund.—The establishment of a Medical Fund for the Junior Staff, with effect from 1st January, 1943, was decided on by the Board.

Staff.—Mr. R. K. S. Murray, Botanist and Mycologist, resigned his appointment in February to take up duties as Deputy Director of Agriculture, Ceylon, after 14 years' service with the Research Scheme. The Board recorded a vote of appreciation of Mr. Murray's valuable services and their good wishes for the future.

Future Development.—Government agreed to lease an area of approximately 1,000 acres of Crown forest at Hedigalla in the Kalutara district to meet the Board's requirements for future experimental planting. Permission to occupy the land was given during the year, pending the preparation of the lease.

FINANCE

Income.—The Board's main income was derived from the cess of ½ cent per pound on exports of rubber under Section 6 (1)a of the Rubber Research Ordinance. Income from this source was again in excess of the estimate owing to the increase in the permissible exportable amount under the Rubber Regulation Ordinance and the call for maximum production of rubber.

A sum of Rs. 82,368 representing income from the cess in excess of the amount due on 75 per cent of the year's basic quota has been placed to the credit of a reserve fund for stabilisation of income, in accordance with a decision reached by the Board during the year.

Monthly cess collections were as follows:—

January	... Rs.	38,122	B/forward	... Rs.	153,185
February	... ,,	30,578	July	... ,,	20,653
March	... ,,	26,624	August	... ,,	18,241
April	... ,,	10,876	September	... ,,	35,342
May	... ,,	22,888	October	... ,,	35,673
June	... ,,	24,097	November	... ,,	20,085
C/over	... ,,	153,185	December	... ,,	29,139
					Rs. 312,318

A profit of Rs. 32,429 was derived from the normal working of Dartonfield Estate and Rs. 11,927 from Nivitigalakele.

Expenditure.—Current expenditure amounted to Rs. 220,456 leaving a surplus for the year of Rs. 146,502.

Capital expenditure amounting to Rs. 34,234 was incurred mainly in respect of the following items: Buildings at Dartonfield Rs. 3,027 and at Nivitigalakele Rs. 3,031. Labourers' cottages and extension to lines Rs. 2,316, Extension to Library Book Cases Rs. 1,316, Office Equipment Rs. 794, Latex Equipment Rs. 3,719, Water and Power Scheme Rs. 10,379, Land Acquisition Rs. 2,303. Agricultural Development at Dartonfield Rs. 1,594, at Nivitigalakele Rs. 2,940 and at Hedigalla Rs. 2,445,

Accounts.—The accounts of the Scheme have been audited by the Auditor-General and his report, together with a Balance Sheet and Income and Expenditure Account, are attached.

Technical Reports

The Director's report, which embodies the reports of the other officers, and the report of the London Advisory Committee for Rubber Research (Ceylon and Malaya) are attached.

(Sgd.) E. RODRIGO,
Chairman of the Board,
Rubber Research Scheme (Ceylon).

DIRECTOR'S REPORT

Research work on Rubber in Ceylon has assumed special significance as a result of the temporary loss of the principal Rubber growing territories and their Research Institutes to the Japanese. The policy of the Research Board, in these circumstances, is to maintain the continuity of its experimental work as far as possible, whilst giving every assistance to the Authorities on matters relating to the War Effort.

The year has been a difficult one in Ceylon and we are fortunate in having been able, not only to continue all the main field trials, but to undertake new trials on several subjects of immediate interest. Research officers were called on to advise the Local and Imperial authorities on technical matters on a number of occasions during the year.

The present report is compiled on the same lines as last year's report, and includes a short summary of the work of each department prepared by the officer concerned.

Staff.

Director.—Mr. T. E. H. O'Brien was in charge of the work of the Scheme during the year.

Chemical Department.—Mr. M. W. Philpott, Chemist, was absent from Ceylon on special duties for 4 months. Mr. Philpott's service agreement has been extended for 1 year from 14th July, 1943.

Mr. J. D. Hastings, Second Chemist at the R. R. I. M., who was unable to reach Malaya on his return from leave, was temporarily employed for 3½ months (20th January—2nd May), before leaving Ceylon to take up other duties.

Botanical Department.—Mr. R. K. S. Murray, Botanist and Mycologist, resigned in February to take up the post of Deputy Director of Agriculture.

Mr. C. C. T. Sharp, Second Botanist at the R. R. I. M., who left Malaya shortly before the fall of Singapore, was appointed temporary Botanist in April.

Dr. C. E. Ford, Geneticist, left Ceylon on military service in February.

Mr. C. A. de Silva, Assistant Botanist, was on duty during the year.

Soils Department.—Dr. L. A. Whelan, Soil Chemist, was mobilised for local defence during February and March. He was then released from military duties to undertake advisory work on food production. Dr. Whelan's service agreement was renewed for 4 years from 1st July, 1943.

Smallholdings Department.—Mr. W. I. Pieris, Smallholdings Propaganda Officer, was in charge of the work of the department during the year.

Estate and Experiment Station.—Mr. G. P. N. de Silva, Estate Superintendent, was on duty during the year. Mr. De Silva was engaged on agreement for a period of 4 years from 1st July, 1942.

CHEMICAL DEPARTMENT

Long term chemical investigations were discontinued at the beginning of 1942, owing to the increased number of special demands on the department's services. Activity was chiefly directed towards the solution of problems advanced by the Military and Civil Defence Services. For obvious reasons work of this nature cannot form the subject of a report. Vulcanised products were made at Dartonfield for the Fighting Services, the Civil Defence Department and the Medical Department.

Much attention was given to improving the scale and standard of tyre retreading in Ceylon. A scheme was put forward for rationalising the local retreading and rubber processing industries with a view to conserving rubber and bringing these industries into line with wartime needs.

Latex Shipment.—The manufacture and shipment of latex from Dartonfield was continued on a reduced scale in accordance with instructions from the Ceylon Rubber Commissioner.

Maximum Production of Rubber.—In view of the general adoption of the "double three" system of tapping it was decided to keep D.R.C. records of latex taken from representative groups of intensively tapped trees. At the time of writing no evidence had been obtained of any marked falling off in D.R.C. but the observations will be continued during 1943.

Coagulants.—The coagulation of rubber with pyroligneous acid was studied at the beginning of the war, but there has fortunately been no necessity for rubber producers to use substitute coagulants on an extensive scale, since the supply of acetic and formic acids has so far been adequate for the industry's needs. During the year under review an opportunity was taken to acquire experience in the small scale distillation of wood and coconut shells so that estates could be given practical advice on the preparation of pyroligneous acid if the need should arise. An improvised still suitable for an estate producing 1,000 lbs. of rubber daily was set up at Dartonfield for experimental and demonstrational purposes.

Frequent complaints about the strength and quality of imported acids were received from estates and smallholdings, and a large number of samples were tested at the laboratories. In most cases defects in the quality of coagulants could be ascribed to local adulteration. The sale of proprietary mixtures for rubber coagulation appeared to decrease during the year.

Plasticity of Rubber.—Plant breeders working with Hevea have, hitherto, been mainly concerned with the propagation of high yielding strains, and little attention has been given to the possible modification of the properties of natural rubber by selective methods. One property of rubber which is of interest to the manufacturer is its plasticity and, although the demand has usually been for rubber that is more plastic or softer than ordinary rubber, it may be found in future that there are certain special fields of application in which hard rubber is to be preferred.

Preliminary work on the plasticity of rubber from individual trees has been carried out at the Rubber Research Institute of Malaya, and Mr. J. D. Hastings continued the work during his stay in Ceylon by studying the plastic properties of the rubber from the best yielding trees at Dartonfield.

Out of about 10,000 trees in tapping 268 were chosen which were known to be good yielders, from estate records compiled during the past few years. Latex from each tree was separately coagulated, rolled and dried under standard conditions. The samples were then tested with the Williams Plastimeter and the D/10 figure, which is a measure of hardness or plasticity, was determined.

The D/10 values ranged from 2.44 (soft) to 5.29 (hard); the mean value was 3.86 and the standard deviation 0.54 (c. of v. 13.9%). There appeared to be some relationship between yield and hardness, the higher yielding trees tending to give harder rubbers, but the correlation was not statistically significant for the samples examined. Nevertheless if further work is undertaken the possibility of correlation should be considered more carefully by experiments designed to give more adequate data. Should such a correlation be established it would indicate the possiblity of finding trees giving softer rubbers among the lower yielders.

Arrangements are being made by the Botanical Department to establish clone trial plots from 20 trees which produced the softest and hardest rubber.

Meteorological Observations

The Research Scheme was called upon to provide the Colombo Observatory with a number of additional weather records. The weather summary for 1942 is shown below :—

	1942.	1941.
Rainfall (ins.)	... 179.71	212.15
Highest monthly rainfall (ins.)	... 24.28 (Oct.)	41.91 (May)
Highest daily rainfall (ins.)	... 9.47 (April 23rd)	9.11 (May 22nd)
Highest shade temperature (day)	... 94.1° (Feb. 19th)	97.5° (Mar. 14th)
Lowest temperature (night)	... 63.7° (Jan. 25th)	66.9° (Dec. 12th)
Number of rainy days	... 253	263

BOTANICAL AND MYCOLOGICAL DEPARTMENT

There has been no Mycologist on the staff since Mr. R. K. S. Murray resigned in February. As a temporary measure arrangements have been made for the Government Plant Pathologist to deal with enquiries on mycological subjects.

Twenty-nine specimens of diseased plants were received for report. Sixteen of these were forwarded to the Plant Pathologist or Entomologist at Peradeniya for examination, and the remainder were dealt with by the staff of this department.

In general the weather conditions were unsuitable for the development of the Oidium leaf disease, but the very wet weather from June onwards caused a heavy outbreak of the secondary leaf-fall and pod-rot due to *Phytophthora palmivora*.

Planting Material

Studies of Clones and Seedling Families.—A further 17 clones derived from high yielding estate mother trees have been brought into tapping in the 1935 clearing at Nivitigalakele. So far the results have been disappointing, and none of these clones as yet shows promise of having any commercial value.

Of the 197 clones established from seeds from the Prang Besar Isolated Seed Gardens in Malaya, 177 were in tapping at the end of the year. The results are much more satisfactory in this case and six of the clones gave yields of over 20 gms. per tapping during the first tapping year.

Legitimate Seedling Trial.—A small experiment was set up to compare two large families of hand-pollinated seedlings raised in 1940 with buddings of WG. 6278. The crosses used were BS.3×HC.28 and BS.3×TJ.1, Observation plots of four small families and of one new clone, Dartonfield 1, were included in the experimental area.

Susceptibility of Different Clones to the Phytophthora Leaf-Fall.—The difference in the resistance of various clones to Phytophthora is very striking and preliminary notes have been made of the degrees of immunity displayed. Many of the clones under observation had not reached the fruiting stage and it is therefore too soon for final conclusions to be drawn.

Stock-Scion Relationship.—(1) Unselected seedlings and illegitimate seedlings of Clone TJ. 1, A.V.R.O.S 163, B.D. 10. B.S 3 and MK. 1/1 have been used as stocks for budding with five clones. Unbudded plots of the same families were included in this experiment. The height measurements at the end of the first year are shown in Table I.

TABLE I

Mean heights in feet of unbudded seedlings and of buddings made on the same seedling families at 1 year from planting

	TJ.1	AV.163	MK.1/1	U/S	B.S.3	B.D.10	Mean	Signif. Diff.
Buddings	9·2	8·9	8·8	8·5	8·4	8·1	8.6	0 59
Seedlings	14·2	14·7	12·1	10 3	14·3	11·3	12·8	1·58

(U/S = Unselected Seedlings.)

In general the best growth of the buddings is found on the most vigorous stocks. The outstanding exception to this is B.S. 3 which, although a vigorous grower, has proved to make poor stocks.

(2). *Experiment on Mukalana Estate.*—This experiment was set up in 1940 to examine the relationship between stock and scion on high-budded trees. Trees budded with TJ. 16 and B.D. 5 at three feet from the ground have been tapped 2S/2, d/4, 100% since March, 1940, one cut being opened on the scion at 20 inches above the union and the other on the stock at 24 inches from the ground. The yields of each cut and the girths of the stocks and scions of over 100 trees of each clone were recorded.

The partial correlations of the yields of scion and stock independently of girth are given in Table II.

TABLE II

Partial correlation of yield of stock and scion of high budded trees

	1940-1	1941-2
Clone TJ. 16	+ ·0823*	+ ·2574
Clone B.D. 5	+ ·5209	+ ·5447

* Not significant.

During the second year the tapping cuts on the scion were at 16-12 inches above the union and those on the stocks at 20-16 inches from the ground and approximately at 16-20 inches below the union. Both the partial correlations have increased slightly, suggesting that as the upper cuts approached the union the effect of the stock on the yield of the scion increases.

Comparison of the yields of the stocks with a number of unbudded seedlings in the same area indicates that the scions have no effect on the yield of the stocks when tapped at 16-20 inches below the union.

Sun-scorch and Dieback of Stumped Buddings.—A small scale experiment was set up on Dartonfield to study various methods of treating stumped buddings prior to, and immediately after, transplanting.

Treatments. 1. Stumping in the nursery 14 days before transplanting.
2. Stumping just before transplanting.
3. Cowdung-clay mixture applied to cut end of the scion.
4. Wax applied to cut end of the scion.
5. Stems covered with a thick coating of lime wash.
6. Stems covered with cowdung-clay mixture.
7. No treatment.

A 2×2×3 factorial layout was adopted. In June, 1942, at eight months from planting no casualties had occurred and no treatment differences could be observed. Although there were only 36 plants in this experiment it may safely be concluded that, with good nursery material and careful transplanting, stumped buddings can be established successfully in the N. E. monsoon planting season.

Twinning.—(1) An experiment was set up in 1940 to compare the rate of growth of seedlings twinned by the Ramaer method with untwinned seedlings. The diameters in inches of the twinned and untwinned seedlings are summarised in Table III.

TABLE III

Diameter in inches of twinned and untwinned seedling families

Family	Diameter in inches and age in years		
	1 year	2 years	Increment
MK. 1/3 Untwinned	1·05	2·33	1·28
Twinned	0·63	1·81	1·16
LAV. 28 Untwinned	0·87	2·16	1·29
Twinned	0·64	1 84	1·20
ELAD. 1 Untwinned	0·77	1·96	1·19
Twinned	0·60	1·75	1·15
P.B. 86 Untwinned	0·72	1·96	1·24
Twinned	0·78	2·03	1·25

In the first three families there is an average loss in growth of 1.1 inches of circumference at the end of two years. The behaviour of the seedlings of P.B. 86 is unexpected and it is difficult to believe that the operation of twinning can have had no adverse effect on growth. In a second experiment described below seedlings of P.B. 86 show a loss in growth as a result of twinning similar to that of the other three families in this experiment.

Twinning.—(2) *Comparison of the Ramaer and Gambar Methods.*—For many years twinning has been carried out by the Ramaer method. By this method the young shoot is cut off just above the cotyledon node. The remainder of the young plant is then divided longitudinally so that the halves of the shoot and root are each attached to the two halves of the seed. The Gambar method differs from the Ramaer method in the substitution of an oblique cut half way across the shoot for the complete cutting off of the top. In this way the top of the shoot remains attached to one twin (a), while the second (b) is similar morphologically to a Ramaer twin.

An experiment was set up in 1941 to compare the growth of the seedlings obtained by the two methods of twinning with untwinned seedlings. Of the four groups of twinned plants, those obtained by the Ramaer method (a) and (b) and by the Gambar method (b) are morphologically the same. The girths in inches at one year from planting of the twinned and untwinned seedlings are summarised in Table IV.

TABLE IV

Twin seedlings. Girths in inches at one year of age

Families	MK. 3/2		P.B. 86		Unselected seedlings		All families
Treatments	No. of plants	Mean girth	No. of plants	Mean girth	No. of plants	Mean girth	Mean girth
Gambar a ...	14	3·21	15	3·10	18	3·28	3·20
b ...	14	2·58	15	2·92	18	2·70	2·73
Ramaer a ...	18	3·01	15	3·05	16	2·91	3·01
b ...	18	3·11	15	2·87	16	2·55	2·82
Untwinned	20	4·17	20	3·91	20	4·01	4·03

Significant difference between treatment means=0.72 inch

In every case twinning has resulted in a loss in growth. The error is high and a difference in the effectiveness of the two methods of twinning has not been demonstrated. When one member of a pair of twins had died, both members were omitted from the calculations.

Seed Gardens—for the production of seed on a commercial scale have been opened on eight estates on a total area of 28 acres. Budding of six of these seed gardens was completed by the end of the year.

Clone Museum.—A clone museum has been set up on Kepitigalla estate by arrangement with the proprietors. A further 22 clones have been added to the museum during the year, bringing the total number up to 59. The main purpose of this museum is to compare the susceptibility of different clones to the Oidium leaf disease.

Tapping

Mature Seedling Trees.—The fifth year of tapping of the experiment at Dartonfield on old seedling Rubber was completed in February. The results have been reported in the *Quarterly Circular* for 1942. The yield of the double three system has proved very satisfactory and in the fifth

year exceeds by 28.5 per cent that of the control which was tapped S/2, d/2 (2×6m/12) 100%. The mean yield for the whole five years of the experiment shows an excess over the control of 18.9 per cent.

Young Budded Trees.—A paper embodying the results of a number of tapping experiments carried out on young budded trees has been published in the *Quarterly Circular* for 1942 and the results will not be referred to here.

Intensive Tapping Experiment.—An experiment was set up at Dartonfield on an area of old unselected seedling Rubber to compare four tapping systems.

1. Two half circumference cuts tapped every fourth day.
   2S/2, d/4, 100% ("Double four.")
2. Two half circumference cuts tapped every third day.
   2S/2, d/3, 133%, ("Double three.")
3. Two half circumference cuts tapped every second day.
   2S/2, d/2, 200% ("Double two.")
4. Two half circumference cuts tapped every day.
   2S/2, d/1, 400% ("Double one.")

Tapping commenced in December and the experiment is timed to last for two years.

Bark Renewal.—The results of previous trials to stimulate the growth of the renewing bark of mature Rubber trees with vegetable oils have been reported in 1940 and 1941. A further series of trials was carried out on seven estates in 1942. The response to the treatments was small and it is doubtful whether the slight increase in bark thickness noted will materially affect the mature bark of six to ten years hence, particularly under conditions in which bark renewal is normally satisfactory.

Stimulation of Yield by Scraping and Application of Vegetable Oils below the Tapping Cut.—In an unpublished progress report from the Rubber Rsearch Institute of Malaya towards the end of 1941 reference was made to trials in which a marked increase in yield had been obtained by scraping and applying vegetable oils to the tapping panel below the cut. Two similar trials were carried out on Dartonfield early in the year with palm oil and other local vegetable oils. It was found that scraping with and without the application of vegetable oils led to an immediate increase in yield of 80-100 per cent which fell to 50 per cent by the third tapping and then continued to fall to about normal by the end of the fourth month. In some cases the scraping gave rise to an undesirable cracking and flaking off of the bark.

A third trial set up on an estate showed that a light scraping followed by an application of coconut oil gave an increase in yield of 70-80 per cent which thereafter steadily declined but was still at 15 per cent. above normal at the end of four months. A light grooming gave more satisfactory results than a heavier scraping both with and without the application of oil. This experiment is being continued.

Replanting

Replanting Experiment No. 3 (1936).—Among other treatments this experiment provided for the comparison of three methods of establishing budgrafts in the field. The girth measurements taken in May, 1941 and 1942 are given in Table V.

TABLE V

Replanting Experiment No. 3. Girth Measurements in Inches

	Age May, 1942	Mean Girth in Inches		
		1941	1942	Increase
Stumped Buddings ..	6 years	19·0	21·8	2·8
Budded Stumps ...	6 ,,	16·6	19·7	3·1
Field Budding ...	5¾ ,,	11·6	15·3	3·7

Note.—The budded stumps and stumped buddings were planted in May, 1936. The seed-at-stake were planted in August-September, 1936, and budded in October-November, 1937 and April, 1938.

Tapping of the stumped buddings started in March, 1942, by which time 84 per cent of the trees had attained a girth of 18 inches or over at 36 inches from the union. The budded stumps were brought into tapping in November when 83 per cent of the trees had reached tappable size The field buddings will be brought into tapping when a similar proportion of trees have reached the requisite minimum girth.

Miscellaneous

Natural Covers.—Observations were continued in the 20-acre block of 1910 Rubber in which natural covers have been allowed to develop since 1936. To encourage the development of more desirable types, the more woody species have been heavily thinned during the year. At the end of six years a fairly satisfactory cover has been induced to grow, though for the most part it consists of rather woody shrubs. *Hedyotis fructicosa* (S. Weraniya) which was planted in this area five years ago is showing signs of spreading. The yield in this area compares favourably with that of the rest of the estate.

At Nivitigalakele clearings were opened from jungle in 1940, 1941 and 1942 without a burn. In these clearings the original species of cover which consisted chiefly of shoots from the jungle stumps and a species of bamboo are still predominant. The bamboo is very resistant to slashing and although it was cut back to ground level early in the year there are no signs of it being superseded by other species. The growth of the young Rubber in both these clearings is satisfactory.

SOILS DEPARTMENT

The Soil Chemist was absent on military service from 1st February to 12th April. Duties were then resumed at Dartonfield, primarily in connection with food production on estates.

The Assistant Botanist continued to supervise field trials laid down at Dartonfield before the Soils Department was formed and was responsible for the statistical examination of the results.

Rubber Manuring

(1) *Fertiliser Rationing.*—In order to ensure that available supplies of manure should be distributed equitably and utilised to the best advantage the fertiliser importers arranged towards the end of 1942 to ration supplies to producers of tea, rubber and other crops on the basis of a scheme formulated by the Ceylon Estates Proprietary Association and the Planters' Association of Ceylon in consultation with the Research Institutes. It was agreed by all concerned that manuring of Rubber should not be curtailed under the present circumstances if it could be avoided, and the quotas allocated to Rubber estates correspond closely with the dosages normally recommended by the Research Scheme. Supplies of sulphate of ammonia were specially released by the Authorities for the use of the Rubber industry. Particulars of the rationing scheme as applied to Rubber, were issued in an Advisory Circular and a brief summary is given here.

(A) *Mature Rubber (over 7 years old).*—A maximum allowance for the ensuing 12 months of 145 lbs. sulphate of ammonia per acre, or 200 lbs. of the mixture sulphate ammonia 145, Saphos phosphate 45 and muriate of potash (60 per cent) 10.

(B) *Immature Rubber (up to 7 years old).*—100 lbs. saphos per acre for half the area and 215 lbs. per acre of the mixture sulphate of ammonia 100, Saphos 100 and muriate of potash 15, for half the area. In order to bring the scheme into operation quickly the above flat rate was adopted for young Rubber but later allocations will be governed by the age of the trees and the stand per acre.

(2) *Dartonfield Experiment on Mature Rubber*— (for details of the experiment see earlier reports).—As from January, 1942, yields were recorded on the basis of a single monthly sampling, instead of at each tapping. A summary of yield data is given in Table VI.

From 1937 to 1940 inclusive annual applications were made at the basic rate of $N = P_2O_5 = K_2O = 0.4$ lbs. per tree. In 1941 a biennial system of manuring was introduced at double the above rates. From the yield figures nitrogen alone may be considered the most economic fertiliser for mature Rubber but small doses of phoshpate and potash should also be given as an insurance against serious soil deficiencies. A comparison of two methods of applying the inorganic manure, broadcasting and forking in, gave no indication of any difference in yield. Growth of the trees, bark renewal and dry rubber content of the latex were not affected by the treatments.

(3) *Experiments on Immature Rubber.*—(a) A series of manuring experiments was begun in 1938 and a brief summary of growth measurements is given in Table VII. Experiment No. 9 was laid down at Dartonfield and the remainder (same series numbers as in earlier reports) on commercial estates.

The mean values given in the last line of the table have not been examined statistically but they give an indication of a general response to phosphate and a smaller response to nitrogen.

(b) *Dartonfield Replanted Area No. 3, 9½ Acres, 1936*—This experiment compares 3 methods of opening the land, 2 types of manure, and 3 types of planting material. (See report of Botanical Department). A summary of the 1942 girth measurements in inches at 3 feet above ground level is given overleaf.

TABLE VI

Mean Yield in Kilograms Dry Rubber per Plot of 20 Trees.

(To convert to approximate values in pounds per acre the yields for 1942 should be multiplied by 60 and those for ealier years by 11.)

Treatment	Preliminary year (1936) Actual yields	Adjusted Yields *					
		1937	1938	1939	1940	1941	1942
N	53·4	49·8 (111)	56·9 (114)	44·5 (112)	44·6 (111)	43·9 (115)	8·2 (117)
NP	52·3	47·5 (106)	52·9 (106)	41·5 (104)	42·0 (104)	39·3 (103)	7·4 (105)
NK	55·5	49·1 (110)	56·5 (113)	44·1 (111)	44 6 (111)	43·5 (114)	8·4 (120)
NPK	56·5	49·6 (111)	59·3 (119)	46·6 (117)	47·4 (118)	42·1 (110)	7·6 (109)
O	47·1	44·8 (100)	50·0 (100)	39·7 (100)	40·3 (100)	38·3 (100)	7·0 (100)
Mean	53·0	48·2	55·1	43·3	43·8	41·4	7·7
Standard Error		1·2	1·8		1·5		·30
Significant Difference (odds 19 :1)		3·5	5·3	Not Significant	4·3	Not Significant	·88

*Adjusted by means of a regression on the preliminary figures for 1936.
(Figures in brackets represent the yields as percentages of the unmanured plots.)

TABLE VII

Mean Girth in Inches per Plant (1942) at 3 feet above Ground Level

Series No.	Age in Years	O	N	P	K	NP	NK	PK	NPK	Significant Difference 19:1	Significant Difference 99:1
1	4½*	—	12·02	—	—	13·36	—	—	15·88	1.40	2.02
2	4¾†	12·38	12·84	13·58	12·56	12·86	12·42	12·35	12·20	Not significant	
4	6†	19·51	21·29	20·72	20·81	20·79	20·86	20·62	21·20	,,	,,
5	4½*	13·25	13·79	14·10	12·42	14·43	12·51	12·76	13·82	,,	,,
6	5½*	17·45	17·91	19·31	17·19	18·43	17·92	17·76	19·31	1.45	
7	6†	17·49	18·16	18·67	18·18	19·15	18·60	18·88	20·05	.72	.99
8	5*	14·37	14·04	15·07	14·47	14·46	14·60	14·63	14·85	Not significant	
9	4†	10·06	10·02	11·55	10·17	12·29	11·03	12·11	12·47	1.44	1.92
Mean excluding No. 1	5	14·93	15·44	16·14	15·11	16·06	15·42	15·59	16·27		

* Time since budded in the field

† Time since planted as budded stumps.

Methods of Opening			Manure	
Platforms	Trenches	Pitted drains.	Organic	Inorganic
19·71 ins.	18·89	18·35	18·75	19·14

The differences between treatments are not statistically significant.

A number of experiments have had to be omitted from this report owing to limitations of space but the conclusions drawn from them are included in the next paragraph.

(c) *General Conclusions on Manuring of Young Rubber.*—Good results have been obtained from applications of cow manure and Saphos phosphate in seedling nurseries. Cow manure and compost added to the planting hole have proved beneficial but no advantage has resulted from the use of surface soil as a filling in place of the excavated soil. On the acid gravelly soils and sandy deniyas of the wet low-country phosphate appears to be the main requirement for young Rubber but nitrogen and potash may also be of value. On a limestone area in a dry district the trees showed no girth response to phosphate although the general growth was below standard. Sulphur applied to soils of an alkaline reaction has not improved growth of Rubber and lime applied to a sandy deniya of acid reaction appears to have slightly depressed growth.

FOOD PRODUCTION

The Food Production (Estates) Order 1942 requires all estates over 35 acres in extent to cultivate food crops on a certain percentage of the acreage. The Research Scheme, in common with the Tea and Coconut Research organisations, agreed to collaborate with the Department of Agriculture in advising estates on problems arising in connection with compliance with the order. It was arranged that advisory work should be allocated between the Department and the Research organisations on a geographical basis without reference to the permanent crops grown by the estate. The zone allocated to the Rubber Research Scheme comprises the areas served by the following District Planters' Associations: Kelani Valley, Kalutara, Southern Province, Morawak Korale and Sabaragamuwa (except Balangoda district).

Food Production by the Rubber Research Scheme

The Research Scheme estates came within the scope of the Food Production Order and a variety of food crops were grown on a semi-experimental basis. The work was undertaken by the Estate Superintendent in co-operation with the Soil Chemist, and brief notes are included in this report for convenience. The total acreage under cultivation at the end of 1942 was 35½ acres made up of 25 acres jungle clearings, 6½ acres 1-year-old Rubber, 2 acres mature Rubber and 2½ acres former flat grassland. On the jungle clearing the light timber was burnt after felling, drains (1 in 120) were cut at 60 feet intervals, the soil envelope forked in rows and a variety of cereals, pulses and roots sown in the S. W. monsoon period April-June. Hill paddy proved the most satisfactory of the short term crops with a yield of 4½ bushels per acre (10 fold return) and a satisfactory crop is expected from the long term manioc and sweet potatoes. The 6½ acre block was clean weeded except along the edges of main drains, and lightly cultivated and manured. Kurakkan gave a yield of 4 bushels per acre, manioc 1,800 lbs. and sweet potatoes 950 lbs. per acre. On the 2-acre block which was planted with manioc

and sweet potatoes some response was shown to bulk manures but growth was extremely poor owing to shade and competition with Rubber roots. The 2½-acre block was drained, lined, and the sods turned over. Cowpea and green gram planted here and on the other blocks proved almost a complete failure. A second planting of the areas mentioned above was carried out in the N. E. monsoon period (November-December) with a variety of crops, and simple manuring and cultivation trials were included.

Food Production on Commercial Estates

The work of the Research Scheme consisted largely of visits to estates, the compilation of information received in returns and the giving of advice to estates under the general direction of a Co-ordinating Advisory Committee. General contact was maintained with the districts through local Food Production Committees, with the other research organisations by meetings and circulation of reports, and with the Government Food Production Officer (Estates) by means of district circuits.

As a result of information obtained from questionnaires circulated by the Kalutara Planters' Association in Kalutara district and tabulated by the Soil Chemist, a memorandum was drawn up summarising experience gained up to September and making recommendations for the following N. E. planting. Copies were circulated to estates in early October and a brief summary of the advisory section is given here: In areas of poor soil plant manioc, but where soil conditions are more favourable interplant cereals, mainly cumbu and kurakkan, with the manioc. On old nursery sites and similar level areas where drainage is satisfactory plant sweet potatoes and yams. Experiment on a limited scale with other cereals and pulses.

TABLE VIII

Yields in pounds per acre

(Figures in brackets give the total acreage from which average yield was calculated)

Crop	Food Crops Only	Interplanted with			
		Young Rubber	Mature Rubber	Tea	Coconuts
Swamp paddy	562 (618)				
Hill paddy	205 (193)				
Meneri	127 (8)				
Kurakkan	71 (300	70 (84)			
Maize	52 (25)	15 (161)	32 (¼)	1 (74)	
Sorghum	40 (½)	40 (¼)		12 (39)	
Cumbu	39 (89)	126 (83)	0 (3)	0 (3)	
Tana	0 (3)	104 (¼)			
Amu		174 (2)			
Cowpea	14 (56)	7 (191)		7 (52)	8 (2)
Green gram	8 (16)	13 (35)			
Manioc	1,043 (116)	1,430 (209)	0 (10) 266 (17)*		3,868 (47)
Sweet potatoes	1,155 (45)	555 (105)			413 (47)

* Grown in old Fomes patches.

Progress to End of First Seasof

Estates have been requested to send in periodic returns on a form devised by the Co-ordinating Committee and in Table VIII is given a brief summary of results up to 30-9-42 for the districts mentioned in the first paragraph of this report. The acreages are understated as some estates failed to send in returns. 257 reports were received. Of the 10,110 acres cultivated for food 5,180 were also occupied by a permanent crop — mainly young Rubber — and 4,930 were used solely for food production.

For a rough comparison with areas growing food crops only, the yields from Tea areas should be multiplied by 4 and those from Rubber by 2. The returns, supported by observations of R. R. S. officers indicate that except for root crops and swamp paddy the yields for the S. W. period 1942 in wet low-country districts were disappointing. Failure may be largely ascribed to climatic conditions and soil poverty, but much damage resulted from pests and diseases. Root crops suffered some damage from rats and bandicoots, and also from thefts by villagers and labourers. In general, results from areas used solely for food production were no better than those from areas where permanent crops were grown as well.

It was not possible to obtain accurate figures for the acreages of the main food crops planted, but the following is an approximation based on suitable returns:—

	Total acreage (from suitable returns)	Manioc	Sweet potatoes	Interplanted manioc and sweet potatoes	Swamp paddy	Cereals other than paddy	Pulses	Yams
	8,207	2,592	589	1,495	921	1,782	733	82
Percentage of total—		32	7	18	11	22	9	1

On this basis 69 per cent of the total acreage was planted with roots and swamp paddy — crops of proved yielding capacity for the districts.

Laboratory Work

Mr. J. D. Hastings, temporary Chemist to the R. R. S. carried out an investigation into the prussic acid content of manioc early in the year. The main conclusions were that sun drying the flesh removes only about half the prussic acid autogen but most of the remainder is lost during the cooking of flour prepared from the dried material. Manioc skin should not be utilised for food owing to the high prussic acid content.

Only 3 soil samples were received during the year in connection with advisory work but 83 were examined for experimental purposes. 8 samples of fertilisers and compost were sent in from estates for analysis.

SMALLHOLDINGS DEPARTMENT

The improved market prices brought about by the war have induced Rubber small owners to tap their holdings to the fullest extent possible during the year, thereby indirectly responding to the Rubber Commissioner's appeal to produce maximum output to a greater extent perhaps

even than other producers. Most smallholders may safely be said to be producing more than their Standard Assessment.

On the decision of the Board, the major portion of the 7 Rubber Instructors' time was devoted to duties in connection with food production, while part-time attention was given to Rubber work.

During the year the issue of Rubber coupons ceased, smallholders' sheet generally fetched 67-69 cents per lb., and the restriction on new planting was lifted and planting allowed on permit.

Visits, Meetings, Etc.—The seven Instructors' ranges were visited on inspection by the Smallholdings Propaganda Officer on an average once a quarter or more often as necessity demanded. The Smallholdings Propaganda Officer continued to serve as a member of the Smallholdings Committee.

Food Production.

(a) *General.*—In view of the Island's urgent need for increasing wartime food supplies, arrangements were made for all Rubber Instructors to focus their attention primarily on food production work. This was carried out both among Rubber smallholders and by assisting the Emergency Assistant Government Agents in their general food drive. The instructors worked under the supervision of the respective A. G. A's in their ranges and were advised by the writer on technical matters on the agricultural side. Their work consisted mainly of advising Government allottees and other small owners in opening up and planting land under food crops, checking the work so done for payments, and contour lining food lands for drains or stone terraces to prevent soil erosion. On representations made by the Smallholdings Propaganda Officer the attention of Emergency A. G. A's was drawn to the importance of soil conservation in present-day agriculture and the likelihood of some of these food lands being later planted with more permanent crops like Rubber. The response by allottees to cutting drains was at first very poor but improved considerably towards the end of the year on the A. G. A's realising the importance of this work and bringing pressure to bear on the allottees. At Narammala where allottees were noticed by the A. G. A. of eviction if draining was not completed before a fixed date, progress was observed to be most rapid. In most cases payment for drains was made by Government and tools loaned free of charge.

Under the Emergency A. G. A's a total of 199 food allotments comprising 525 acres was lined by Rubber Instructors for drains or terraces, 2,154 allotments (2,769 acres) were visited for supervision, advice or checking, and 583 allotments (1,395 acres) planted with food crops. Cutting of drains was completed on 171 acres. In addition, the following work was done among Rubber smallholders: 12 holdings (13 acres) lined, 251 holdings (329 acres) visited for advice or supervision, 329 holdings (399 acres) planted with food crops.

(b) *Paddy.*—Propaganda regarding the new method of increasing paddy yields by harrowing a growing crop of 3-4 weeks old paddy was carried out by Instructors. A demonstration of the method was arranged with the Paddy Officer of the Department of Agriculture for the benefit of Rubber Instructors who later gave demonstrations to paddy-owning smallholders. The use of the iron plough in preference to the wooden plough for the first ploughing and incorporation of green manure in addition to bone meal are also recommended as having a definite beneficial effect.

Co-operative Work

As a result of the joint efforts of this Department and the Co-operative Department, the first Smallholders' Co-operative Rubber Society in Ceylon was opened by the Minister for Agriculture and Lands at Hataraliyadda on September 27th. A demonstration of how each member's latex was to be received, measured, recorded, bulked and made into No. 1 sheet was given by the Rubber Instructor, Katugastota. The Minister expressed great satisfaction at this pioneer effort to introduce co-operative benefits to Rubber small owners. The Society's sheet fetches top price at the Commissioner's Depot at Galagedera. Assistance was given by this department in submitting written observations on the working of the Society, supplying plans for the smokehouse and coagulating shed, supervising their construction and in procuring rollers and utensils. A course of training in sheet-making was also given to the Society's rubber-maker at Nivitigalakele. A loan of Rs. 3.000 was granted by the Rubber Research Board on easy terms to meet capital expenses.

Considerable credit is due to the members of the Society for their perseverance in carrying the enterprise through in the face of numerous difficulties imposed by wartime conditions. It is hoped that the success of the Society, if established, will lead to the formation of numerous other similar societies.

Marketing

(a) *Rubber.*—The opening of provincial rubber purchasing depots by the Rubber Commissioner in April made it unnecessary for this department to launch its contemplated purchasing scheme for which all arrangements had been made and a buying agent selected. These depots have proved a boon to smallholders in securing fair prices for their sheet according to grade, besides encouraging them to improve the quality of their sheet. They are serving a very useful purpose and should be a permanent institution. Arrangements were made with the Commissioner for depots to display samples of the various grades of sheet purchased, for the information of smallholders.

(b) *Coagulants.*—Representations were made to the Commissioner regarding the difficulties experienced by smallholders in obtaining their acid coupons. During the latter part of the year the Commissioner arranged for acid to be supplied to smallholders through the local rubber purchasing depots, which again has proved a very convenient arrangement. It has thus become unnecessary to continue the scheme of appointing approved acid dealers by this department. The position regarding coagulants has been generally satisfactory, except for minor inconvenience caused by temporary shortages.

Replanting

Owing to the need for maximum rubber output the policy adopted was to discourage replanting except where the trees were in a very bad condition. Lining was done by Instructors on 43 replanting holdings (66 acres), other work carried out under Instructors' supervision on 46 holdings (77 acres) and planting completed on 38 holdings (67 acres).

The demonstration replanted blocks in each range were given their annual manuring with cattle manure and leaf loppings, and maintained

in good order. The annual girth measurements (given below) indicate that normal increase in girth has been maintained and that clone P.B. 86 in the Galle block has maintained its very satisfactory growth. The new block at Warakapola which was planted with budded stumps of Gls. 1 in December, 1941, was interplanted with food crops.

Block	Plants & Clone	Age	Average girth per plant at 3 feet	
Horana range (Kahatapitiya)	74 of Tj.1	5 years	13·68″	(10·69″)
Horana range (Ratmalgoda)	115 of P.B. 25	5 ,,	12·01″	(8·50″)
Matugama range	57 of Gls.1 20 of B.D.5	4½ ,,	11·13″	(8·77″)
Galle range	80 of P.B. 86	4 ,,	14·06″	(10·47″)
Kandy range	88 of P.B. 25	4 ,,	11·80″	(8·25″)
Ratnapura range	79 of Tj. 1	4 ,,	11·98″	(9·00″)

Figures in brackets indicate girth 12 months ago.

Competitions.—Judging of the 1941 competitions for the "best replanted holding" in each of the Horana, Avissawella, Kandy and Matugama ranges and of the "best-kept holding" competition in the Ratnapura range was completed, and prizes and certificates given to the winners. No formal prize-givings were held owing to prevailing difficulties of travelling, etc. A very high standard of work was observed in the Avissawella range, while the standard at Horana was not as high as usual and about average in the other ranges.

Sheet-making and Smokehouses.—Owing to the improved rubber market and other facilities provided during the year smallholders showed more keenness in improving their sheet and there was a greater demand for advice on sheet making and construction of smokehouses. 67 private and 9 demonstration smokehouses of the pattern recommended by the department were started, 64 private and 8 demonstration houses completed and 17 houses improved. 114 sheet-making demonstrations were given by Instructors.

Planting Material and Other Issues.—The sale of budwood and budded stumps to smallholders from Nivitigalakele was discontinued but sales of budded stumps to local smallholders from demonstration nurseries in the ranges was continued as before. 156 stumps were sold. 93 yards of budwood were issued to Rubber Instructors for budding demonstration nurseries. 142 square feet of monel mesh for strainers was sold at reduced rates. 41 wooden latex pans and 30 strainers were issued free to demonstration smokehouse owners and other smallholders carrying out the recommendations of the department, through the Rubber Instructors.

General.—Apart from the sheet-making demonstrations mentioned above, Instructors also gave a total of 297 demonstrations in budding, tapping, disease treatment, etc. 66 acres of mature Rubber holdings were lined for drains. 28 private and 17 demonstration compost pits were opened. Correspondence amounted to 820 inward and 691 outward letters,

TABLE IX

Analysis of Tapping Rounds (Figures for 1941 are shown in brackets.)

	Early Tapping	Late Tapping before 10 a.m.	Very late Tapping	Partial Washouts	Washouts	No Tapping due to		
						Rain	Rest	Holidays
January	31 (28)	— (1)	— (2)	— —	— —	— —	— —	3* —
February	10 (10)	— —	— —	— —	— —	— —	18 (18)	— —
March	26 (20)	3 (4)	2 —	— —	1 —	— —	— (7)	— —
April	20 (22)	2 (2)	— (1)	— —	— —	4 (2)	— —	4 (3)
May	14 (14)	1 (5)	3 (2)	— (1)	— —	13 (8)	— —	— (2)
June	12 (16)	4 —	6 (7)	2 (4)	— (1)	8 (7)	— —	— —
July	19 (21)	3 (1)	4 (5)	1 (3)	— (1)	5 (4)	— —	— —
August	17 (7)	9 (4)	2 (11)	— (3)	— (2)	3 (9)	— —	— —
September	19 (6)	5 (1)	5 (12)	2 (2)	— —	1 (11)	— —	— —
October	17 (15)	8 (4)	3 (9)	— (2)	— (3)	3 (3)	— —	— —
November	24 (18)	2 (9)	2 (1)	— (2)	1 (1)	1 (2)	— —	1 —
December	28 (26)	1 (4)	1 —	1 —	— —	1 (1)	— —	— —
Total	237 (203)	38 (35)	28 (50)	6 (17)	2 (8)	39 (47)	18 (25)	5 (5)

* Holidays for Tamil Tappers only

ESTATE DEPARTMENT

DARTONFIELD ESTATE

Acreage Statement

		A.	R.	P.
Rubber: mature areas	...	114	1	28
replanted areas	...	44	3	22
Buildings and roads	...	14	3	08
Scrub, etc.	...	2	2	19
Newly acquired land	...	2	1	22
	Total	179	0	19

Rainfall.—179.71 inches.

Rainfall was about normal and was favourable for crop intake. Details of rainfall during 1942 and the preceding year appear below:—

		1941	1942
January	...	6.98 ins.	4.46 ins.
February	...	7.27 „	8.64 „
March	...	5.61 „	11.15 „
April	...	11.85 „	20.57 „
May	...	41.91 „	22.79 „
June	...	14.89 „	17.28 „
July	...	13.35 „	12.92 „
August	...	22.13 „	17.72 „
September	...	26.32 „	13.14 „
October	...	24.81 „	24.28 „
November	...	26.58 „	13.03 „
December	...	10.45 „	13.73 „
		212.15 ins.	179.71 ins.

Crop.—Crop for the year amounted to 77,746 lbs. compared with 60,649 lbs. in 1941. The increase is mainly attributed to the change from double four to double three tapping, and to more favourable weather conditions. An analysis of tapping rounds for the two seasons is given in Table IX.

Yield records for individual fields are as follows:—

Field No.		Date of planting	Total crop lbs.	Acreage tapped	Yield per acre lbs.
1	...	1910	18,115	28½	635.6
2	...	1913	758	1	758.0
3	...	1917	15,212	24	633.8
4	...	1911	1,580	1½	1,053.3
5	...	1934	3,522	7½	469.6
6	...	1913	37,555	58½	642.0
7	...	1936	1,004	3	334.7
		Total	77,746	124	627.0
Percentage of estimate harvested				...	118.7

Tapping.—The tapping system was changed from double four to double three on 28th April. Extra afternoon tappings were carried out on 71 days during the year. Tapping was stopped for 18 days during the refoliation season.

Tapping in the experimental areas was under the supervision of the Estate Superintendent as in former years.

Average Intake per Tapper

	1941	1942
January	7.7 lbs.	7.7 lbs.
February	4.9 „	5.7 „
March	3.0 „	5.2 „
April	10.2 „	8.3 „
May	10.1 „	9.7 „
June	9.4 „	8.2 „
July	11.2 „	8.1 „
August	9.0 „	10.0 „
September	9.5 „	8.8 „
October	11.2 „	9.0 „
November	10.2 „	9.3 „
December	10.7 „	9.1 „

Manufacture.—A summary of the grades prepared during the year is given below :—

Grade	lbs.	Per cent	Total
Smoked Sheet No. 1 ...	1,408	1.81	1.86
Smoked Sheet No. 2 ...	44	05	
Latex Crepe No. 1 ...	21,680	27.88	31.39
Latex Crepe No. 2 ...	1,982	2.55	
Latex Crepe No. 3 ...	750	.96	
Scrap Crepe No. 1 ...	8,523	10.96	16.58
Scrap Crepe No. 2 ...	2,767	3.59	
Scrap Crepe No. 3 ...	1,580	2.03	
Latex ...	38,449	49.45	49.45
Crumb Rubber ...	563	.72	.72

Machinery.—The Consulting Engineers, Messrs. H. W. Hammond & Co., inspected the machinery and electrical equipment in March, and reported satisfactorily on their condition.

The Lister engine was sold and replaced by a 20 h.p. Gardner engine.

Oidium.—Weather conditions were generally unfavourable to the incidence of Oidium, but a mild attack developed early in March when the major part of the estate had refoliated. One full and one partial round of sulphur dusting were carried out, an average of 7½ lbs. sulphur per acre being used.

Phytophthora.—Wet weather during June led to a serious outbreak of Phytophthora leaf-fall in the mature areas, loss of leaf being more severe than for many years. Immature areas were much less seriously affected, but the green stems of young plants were attacked.

Bark rot was prevalent during the year and routine applications of waterproof and water-soluble disinfectants to the tapping panels were made during wet weather.

Canker Scraping.—The trees were lightly scraped to a height of 6 feet to remove scaly bark, lichens, etc.

Ustulina.—Five badly affected trees were removed during the year.

Manuring.—Manure was applied over an area of 50 acres, in accordance with the policy of manuring half the commercially tapped areas annually. The following mixture was envelope forked between the rows:—

Groundnut cake	...	...	850 lbs.
Saphos phosphate	...	...	40 „
Muriate of potash	...	...	20 „
			910 lbs. per acre

Saphos phosphate was applied in the 1934 and 1936 replanted areas, and experimental manuring was undertaken according to programme.

Weeding.—The control of covers and selective weeding was carried out as in former years.

Cover Crops.—Cuttings of *Desmodium ovalifolium* were planted over an area of 70 acres where the cover of Pueraria had deteriorated. The Desmodium is spreading satisfactorily.

Labour.—The labour force was adequate except during the paddy harvests when there was a shortage of non-resident labour. Eight Ceylonese families are now resident on the estate, and cottage accommodation is being provided for a further four families. The health of the labourers was satisfactory.

Details of labourers on check-roll at the end of the year were as follows:—

		Resident	Non-Resident
Ceylonese	...	18	50
Non-Ceylonese	...	53	—

Immature Areas.—The usual routine supervision was exercised in accordance with the instructions of technical officers.

Buildings.—The following constructional work was undertaken:—

Extension to No. 4 labourers' quarters (2 rooms); extension to Engine-driver's quarters; manure shed; factory workshop, set of quadruple cottages (not completed).

Food Production.—See Soils Department report.

Visiting Agent.—The Visiting Agent, Mr. P. R. May, inspected Dartonfield and Nivitigalakele on May 15th and December 1st. Both his reports were satisfactory.

Nivitigalakele

Acreage Statement

Rubber: mature areas (1926-1928)	...	59½ acres
clearings (1935-1941)	...	65 „
new clearing 1942	...	4½ „
nurseries, etc.	...	19½ „
Food clearing 1942	...	5 „
Uncultivated	...	16 „
	Total	169½ acres

Rainfall.—163.97 inches.

Crop.—Crop for the year amounted to 39,443 lbs. compared with 25,651 lbs. in 1941. The following is a summary of yield records for each field :—

Clearing		Acreage in tapping	Crop lbs.	Yield per acre lbs.
1926	...	12½	9,257	755.6
1927	...	16	11,006	687.9
1928	...	29	14,237	490.9
1935	...	16½	4,943	299.6
Total	...	73½	39,443	534.0

Tapping.—The tapping system in commercial areas was changed from double four to double three on October 1st. Test-tapping was continued on the half-spiral alternate-daily system. A system of payment by results (subject to the minimum wage) was introduced in September and resulted in an increased intake. A statement of trees in commercial and test-tapping is given below :—

Clearing		Test-tapping	Commercial tapping	Immature and/or not in tapping	Total
1926	...	29	1,088	7	1,124
1927	...	73	1,479	12	1,564
1928	...	444	2,056	105	2,605
1935 (part) in test tapping		1,677	—	881	2,558
Total	...	2,223	4,623	1,005	7,851

Manufacture.—Crop from commercially tapped areas was manufactured in the form of smoked sheet. Test-tapping samples were milled at Dartonfield and sold mainly as scrap crepe. The distribution of grades was as follows :—

Grade		lbs.	Percent	Total
Smoked Sheet No. 1	...	26,413	66.96	67.81
Smoked Sheet No. 2	...	335	.85	
Scrap Crepe No. 1	...	11,133	28.23	32.06
Scrap Crepe No. 2	...	1,074	2.72	
Scrap Crepe No. 3	...	438	1.11	
Latex Crepe No. 3	...	50	.13	.13

Pests and Diseases

Oidium.—A few individual clones were sulphur-dusted.

Phytophthora.—Secondary leaf-fall was much less severe than at Dartonfield.

Several clones (unproved) showed marked susceptibility to bark rot in spite of routine control measures.

Ustulina.—Seven affected trees were removed.

Wind Damage.—26 trees were lost during storms.

Manuring.—Half the mature area was manured, using the same mixture as at Dartonfield.

Immature Areas.—Growth in the clearings was satisfactory. The 1939 area is still backward but growth has improved. Phytophthora attacked the stems of some of the young plants during the wet season.

The 1935, 1940 and 1941 clearings were manured with Saphos phosphate, and the 1939 clearing with a general mixture.

New Clearing 4 Acres.—This area was opened on the no-burn contour trench system and planted according to experimental requirements. Early growth of the plants was rather uneven.

Food Clearing 5 Acres.—An area of 5 acres was cleared and planted with kurakkan during the N. E. season.

Nurseries.—Budwood nurseries were pollarded according to requirements.

Two applications of manure were made in the 1941 seedling nursery.

Approximately 500 yards of budwood and 2,000 budded stumps were issued during the year.

Wagolla

The lease of this area was relinquished early in 1942.

ADVISORY SERVICES, ETC.

A feature of the advisory correspondence handled during the year was the increased proportion of enquiries from Ceylonese Proprietors and their Superintendents. It is encouraging that the facilities provided by the Research Scheme are thus becoming better known to this section of local producers.

The bulk of the correspondence dealt with subjects relating to wartime shortages and requirements. The decision to allow a limited amount of new planting led to numerous enquiries regarding planting material towards the end of the year. The severe outbreak of Phytophthora leaffall gave rise to enquiries regarding the cause of the defoliation and methods of control. The Chemical Department was mainly called on for advice on measures for handling larger crops, meeting shortages of chemicals and equipment, etc.

As mentioned earlier in the report the Research officers were frequently called on by the Local and Imperial authorities for advice on a variety of technical subjects.

An analysis of enquiries is given below :—

Chemical Department ...	...	209.
Botanical and Mycological Department	...	310.
Soils Department: General ...	...	111.
Food Production	...	60.

Advisory visits, which were unavoidably restricted, were made as follows :—

Chemical Department ...	...	1
Botanical and Mycological Department	...	10
Soils Department: General ...	...	—
Food Production	...	56

MEETINGS, COMMITTEES, ETC.

The Director attended meetings of the Rubber Research Board by invitation, and served on the Experimental Committee and the Smallholdings Committee.

The Director is an ex-officio member of the Central Board of Agriculture, and attended one meeting during the year. He also served on the Co-ordinating Advisory Committee for Food Production on Estates, and on Committees concerned with Maximum Rubber Production and Fertiliser Rationing.

The Director attended the Annual General Meeting of the Planters' Association of Ceylon, 3 General Meetings of the Ceylon Estates Proprietary Association, 3 General Meetings of the Kalutara Planters' Association, and one General Meeting of the Sabaragamuwa Planters' Association. At the latter a talk was given on methods of increasing rubber production.

CO-OPERATION WITH OTHER RESEARCH ASSOCIATIONS

Reference was made in last year's report to the loss of the sister Institutes in Malaya and the Nederlands East Indies, and we renew the expression of our sympathy with the officers of the Institutes in their trials.

Co-operation with organisations outside Ceylon was inevitably restricted owing to the pre-occupations of the staffs with immediate wartime problems, and the uncertainty of mail deliveries. Correspondence was maintained with the London Advisory Committee for Rubber Research (Ceylon and Malaya) and the Rubber Producers' Research Association on subjects of common interest. There was close co-operation with the Tea Research Institute and the Coconut Research Scheme in connection with Food Production and Fertiliser Rationing.

PUBLICATIONS

Publications of the Research Scheme are issued without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of Rubber estates over 10 acres in extent, who apply for registration. Extra copies are supplied for the use of Assistants on large estates. Particulars of issues of publications are given below:—

	1941	1942
Estates and Agencies ...	816	847
Subscribers	52	56
Exchange List ...	56	62

Publications issued during the year were as follows:—

Report of the Work of the Rubber Research Board in 1941.

Combined Quarterly Circulars for 1942.

Tapping Experiments on Budded Trees. By R. K. S. Murray.

Field Experiments on Dartonfield Estate:—

XVII.—Comparison of Tapping Systems (1941). By C. A. de Silva.

XVIII.—Manuring Experiment with Mature Rubber (1941). By L. A. Whelan and C. A. de Silva.

XIX.—Measurements of Growth in Replanted Areas (1942). By L. A. Whelan and C. A. de Silva.

Advisory Circular No. 16—Increasing the Crops from Ceylon Rubber Estates.
" " No. 16—Supplement.
" " No. 16—Second Supplement.
" " No. 17—Tapping Young Budded Trees.
" " No. 18—Rubber Manuring Under Wartime Conditions.
" " No. 19—Density of Planting and Thinning Out.

(Sgd.) T. E. H. O'BRIEN,
Director.

Research Laboratories,
Dartonfield,
Agalawatta.
24th March, 1943.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1941 & 1942

The Committee and Technical Sub-Committee held two meetings in 1941 and two in 1942. There was also a meeting of the Sub-Committee on Standardisation of Raw Rubber, appointed in 1937.

The Committee report the appointment of Mr. F. P. Jepson as representative of the Government of Ceylon in place of Dr. Youngman; and Mr. H. W. Horner, representative of Ceylon Planting Interests (nominated by the Rubber Growers' Association) in place of Sir Herbert Wright.

Mr. Nelson (Secretary) was seconded to the Ministry of Supply in 1941, and his duties taken over by the Assistant Secretary, Mr. Crowhurst, who was called up for military service in 1942, since when Mr. J. J. Endcox has acted as Secretary to the Committee.

Meetings of the Committee and Sub-Committee were attended by Mr. J. D. Hastings of the Rubber Research Institute, Malaya (Chemical Division) while on leave in this country.

CO-OPERATION WITH OTHER ORGANISATIONS

Close co-operation was maintained throughout the year with the Research Association of British Rubber Manufacturers and with the British Rubber Producers Research Association. The former continued to give considerable help in connection with the work of the Standardisation Sub-Committee. The monthly technical discussions at the laboratories of the latter were of great value in co-ordinating the work of

the Committee and that of the B.R.P.R.A. The staff has given assistance to the Institution of the Rubber Industry as members of the Council, Examinations Board and in the offices of Vice-Chairman and Hony. Secretary of the London Section. They have also read two papers on latex and one on wild rubber at meetings of local sections.

FINANCE

Contributions of £2,625 and £875 were received from the Rubber Research Institute and the Rubber Research Scheme, respectively, during each of the years 1941 and 1942. Expenditure during 1941 amounted to £3,774.13.5 and during 1942 to £3,173.12.0, leaving an unexpended balance of £1,280.3.9. There are, of course, always certain outstanding liabilities for one year that are met from the following year's expenditure, chiefly for apparatus, steam and electric current. These outstanding liabilities will probably be more than offset by receipts in respect of the construction of apparatus on behalf of the Ministry of Supply. Owing to the occupation of Malaya by the Japanese, no further contribution will be available from this source for sometime. The Imperial Institute has, however, kindly guaranteed the funds for the three years 1943-5 leaving full control of the work of the staff in the hands of the Committee.

STAFF

It has not been possible to retain the services of the junior members of the staff, but the Imperial Institue has provided additional temporary staff to assist in work undertaken on behalf of the Ministry of Supply. Since the fall of Malaya the senior members of the Committee's staff have also devoted most of their time to organising and supervising this work.

Close co-operation has been maintained with the Colonial Office to secure for the dependents of missing members of the Rubber Research Institute staff such information and assistance as are available.

The work of the staff was continued in the normal way during 1941, but after the fall of Malaya there were many demands on their services by the Ministry of Supply in connection with the development of other sources of rubber, and there has been no opportunity for further research on plantation problems.

Arrangements were made in 1941 for a joint conference of the heads of rubber research organisations in Great Britain and a few leading technologists to recommend investigations which could be usefully undertaken to improve plantation rubber. Two meetings were held and a programme prepared involving research in the East as well as in Great Britain. The item which caused the most interest and discussion was the possibility of obtaining improved rubber by selective vegetative reproduction. As a preliminary step, it was agreed to recommend that an examination should be made in the East of the viscosity or plasticity of rubber from a wide range of individual trees and that samples at the extreme ends of the plasticity range should be technically examined as fully as possible. During his stay in Ceylon as a temporary member of the staff of the Rubber Research Scheme, Mr. Hastings examined rubber from 268 trees and found considerable variation in plasticity. The Conference agreed that fundamental studies of the structure of the rubber hydrocarbon and its modification by treatment with small quantities of reactive agents were of great importance and should be continued by the

B.R.P.R.A. The R.A.B.R.M. undertook to study methods of testing small samples, such as can be expected from individual trees, and the possibility of obtaining improved products by new compounding methods or materials, it was also agreed that the R.A.B.R.M. should review published information on the possibility of utilising variability amongst rubber trees and of improving the properties of raw rubber by chemical or physical treatment. It was also arranged that the London Advisory Committee staff should continue to investigate the amount of soluble and insoluble rubber in material from a wide range of sources and study the technical properties of the fractionated hydrocarbon.

The Committee's study of these problems has temporarily ceased, and those of other organisations have at least had to be curtailed. This is serious as the investigations are long term projects and the problem of competition with synthetics will arise immediately after the war.

Some progress was made with the Committee's share of the investigations during the latter half of 1941. It was shown that carbon black had different effects on rubber from different sources, but the technique of the investigations was not fully developed and may have been responsible for the differences observed and there was no information regarding the practical importance of these differences.

The amount of soluble and insoluble rubber present appeared to be partly a function of external conditions and it was concluded that fundamental problems require further study before the possibility of classifying and examining rubber on this basis could be properly undertaken.

Provincial standards of uniformity and recommended methods of testing were prepared and circulated in connection with the possibility of marketing a special grade of clean and uniform rubber. Considerable progress was made in Ceylon and Malaya with regard to methods which might be adopted to obtain uniform rubber, but there was a difference of opinion on important points and further work is required. Large scale experiments in Ceylon, Malaya and London on the preparation of clean rubber were also inconclusive and require further experiment. A technique has now been devised in London which should greatly facilitate this investigation.

The staff in Malaya has developed simple methods of obtaining good quality soft rubber which can be easily manipulated in rubber factories. Preliminary discussions with, and trials by, manufacturers indicated that there was a promising field for such rubber and it should be possible to market this new type of rubber after the war.

The staff in London has devoted a considerable amount of time since 1938 to studying the chemical structure of latex, and, by the end of 1941, had obtained sufficient information to indicate means whereby the control of quality could be placed on a sound basis and uniform material of improved quality prepared. Practical steps to implement these findings can be taken when the plantation industry resumes operations on a peace time basis.

Reports on Investigations Forwarded to Ceylon and Malaya During 1941 & 1942

Latex

Technical importance of serum substances.

(a) Solubility of zinc oxide.
(b) Electrometric titration.
(c) Acidic compounds.
(d) Influence of acidic constituents compounded with zinc oxide.

Dry Rubber

(1) Standardisation of testing.
(2) Mechanical impurities.
(3) Fractionation.
(4) Study of possibility of economising by simple modifications of hydrocarbons.
(5) African rubbers.
(6) Improved reinforcement by modification of hydrocarbons.
(7) Novel sources.
(8) Miscellaneous enquiries.

Monthly Reports of the Work of the London Advisory Committee.

January 1941
February ,,
June ,,
July ,,
October ,,
November ,,
December, 1941 and January 1942 combined
April and May, 1942 combined — African rubbers.

Patents

As in previous years, the Rubber Research Institute, Malaya (in 1941 only) and the Rubber Research Scheme, Ceylon (in 1941 and 1942) were supplied with copies of specifications in respect of inventions relating to processes for the preparation or utilisation of raw rubber and latex likely to be of interest to them.

Patents sealed during 1941 and 1942.

529246 Compounding latex — Assigned British Rubber Producers Research Association 1941.
531723 Peptising agents — Assigned Rubber Research Institute, Malaya 1941.
536301 Captax Peptising Agent.
535847 Benzoyl Peroxide Peptising Agent

Provisional Specification filed during 1941 and 1942.

10870/41 Low Water Absorption Rubber.

Patents abandoned during 1941 and 1942.

428100 Rubber and Road Tar Mixtures.
450222 Hemi-cellulose creaming agent.
415133 Organic colloidal addition to latex.

Patents in force at the end of 1942.

484712 Rubber and Cement Mixtures.
529246 Compounding latex.
531723 Peptising Agents.
536301 Captax Peptising Agent.
533837 Benzoyl Peroxide Peptising Agent.

The Monsanto Chemical Co. has been granted a U.S. Patent No. 2, 254267 for the preservation of latex with sodium pentachlorphenate and, in view of the assistance given by the Rubber Institute in technical investigations, the Company has agreed to grant a License to the Rubber Research Institute of Malaya and the British Rubber Producers Research Association.

British Patent Application No. 520653 by M. Jones, C. F Flint and Imperial Chemical Industries, Ltd., for the treatment of latex with peptising agents was opposed by the B.R.P.R.A. on instructions from Malaya. As a result of the opposition, the claims of the specification have been restricted by amendment.

(Sgd.) P. J. BURGESS
Chairman.

(Sgd.) J. J. ENDCOX.
Acting Secretary.

Imperial Institute
May, 1943.

TECHNICAL APPENDIX TO THE REPORT OF THE LONDON ADVISORY COMMITTEE 1941 & 1942

LATEX

The utilisation of latex for some important purposes is hampered by a tendency towards unreliable behaviour in manufacturing processes. Although this variability is not sufficiently serious to restrict appreciably the general use of latex, it encourages manufacturers to welcome synthetic substitutes which may be more reliable. The chief processing difficulty experienced is that compounded latex sometimes becomes very thick on standing and in extreme cases may even coagulate. The control of viscosity is very important in the manufacture of dipped goods, thread and sponge rubber and is a constant source of anxiety to the makers of these articles.

The investigations carried out during the period under review have yielded considerable information concerning the variable behaviour of latex with regard to thickening, and have led to the development of methods of testing whereby satisfactory latex can be easily distinguished from material which will prove troublesome in some circumstances. They have also indicated the steps which should be taken by the plantations to ensure that all latex is of good quality, but there has been no opppor-tunity of putting the suggestions to practical test.

Prior to these investigations it was becoming generally recognised that thickening was due to the solution of zinc oxide by ammonia in the latex and that some of the non-rubber constituents facilitated its solution. The investigations first showed that zinc oxide was almost insoluble in pure ammonia, but that it dissolved readily in a mixture of ammonia and ammonium salts, as stated in text books on the subject. A study was therefore made of the acid radicles in latex capable of forming ammonium salts. It was found that many of these could be extracted from dried latex films with alcohol and that they could be separated into two main types, one of which was readily soluble in ether and the other in water.

It was next shown that the ether-soluble acids, which are known to be chiefly long-chain, fatty acids, such as oleic acid, did not occur to any extent in the aqueous serum, but were concentrated at the surface of the rubber particles. Information was then obtained to indicate that the surface concentration of these acids was remarkably uniform irrespective of the origin of the latex, but since centrifuged cream latex contains, on an average, larger particles than whole latex, the amount of surface per unit volume of rubber is low and the amount of fatty acids present is also somewhat low. In skim latex the fatty acids exist in higher proportion because the low average diameter of the rubber particles involves a large surface area for a given volume of rubber. Apart from differences in the latex due to these causes, the fatty acids were uniform and could not account for the variable behaviour of latex compounded with zinc oxide.

The water-soluble acids were found to occur wholly in the aqueous serum. Their concentration varied in an irregular manner and some samples of latex contained nearly 2½ times as much as others. A sample which was regarded as unsatisfactory by the Dunlop Rubber Co., gave the highest results out of 18 examined. One that was particularly satisfactory gave a low result. It was shown that a high concentration of serum acids caused a large quantity of zinc oxide to dissolve in the presence of ammonia and also caused the latex to thicken. The water-soluble acids are probably decomposition products of more complex substances and are believed to be due to the combined effect of ammonia and biological agencies. It was found that very little was formed when latex was preserved wholly with sodium pentachlorphenate and it is probable that early ammoniation and destruction of bacteria are important in reducing the amount developed in ordinary ammoniated latex.

In view of this work, the estimation and control of these water-soluble acids was considered to be a matter of considerable technical importance and a study was made of their determination. Direct electrometric titration of latex was carefully studied and it was found that a fair estimation of the acids present could be obtained by titration with caustic potash to a fixed pH of, say, 11 or with hydrochloric acid in the presence of caustic potash from pH 7 to the end point. A method similar to the former has been described by Jordan and is known as the KOH number test and has gained in popularity owing to the practical value of the results, the cause of which is now explained. Apparatus for the electrometric determination of acids is not always available and evidence was obtained that colorimetric tests might also prove satisfactory. In addition, it was shown that titration of the alcohol extract of dried latex films gave an indication of the acids present, although it does

not extract the whole of the acid radicles in the aqueous phase. For routine control electrometric titration is probably to be preferred, but the solvent method is particularly useful in studying variability as it enables the variable water-soluble acids to be separated from the uniform ether-soluble, whereas electrometric titration gives a figure for the whole of the acids. A high figure for water-soluble acids is regarded as a clear indication of unsatisfactory preservation.

The investigation has also yielded considerable information concerning the structure and size of the rubber particles in latex and of the changes and migrations which occur during storage. Proteins are partly and fatty acids are almost wholly at the surface of the rubber particles. Water-soluble materials are distributed evenly throughout the water phase, while ether-soluble materials, such as esters, are contained within the rubber particle and tend to hydrolyse on keeping the water-soluble fraction passing into the water phase. The rubber particles also contain about 0.02 to 0.03 per cent. nitrogen, which is difficult to remove. The nature and development of water-soluble acids require further study. The fixed nitrogen distributed throughout the rubber particles may be of fundamental importance and requires careful investigation.

UNIFORM RUBBER

The problem of marketing rubber which can be guaranteed to be clean and uniform in its technical properties has been under consideration for sometime.

The presence of foreign matter arises from accidental contamination with particles of sand, seeds, bark and fibre, which find their way into the latex while it is being collected and during transit to the estate factory. It is very difficult to exclude the possibility of small quantities of foreign matter getting into the latex, particularly as the amount under consideration is very small. Clean rubber should not contain more than 0.005 per cent of 'dirt'. This figure may appear to be absurdly low, but it corresponds to about 50 small particles of sand per lb. of rubber, which without further refining would result in the production of much scrap in the manufacture of some types of products.

The problem of marketing a rubber of guaranteed cleanliness involves both commercial and technical difficulties and at the time the investigation ceased no definite conclusions had been reached with regard to either. The difficulty was to organise a system of guaranteed cleanliness and to distinguish between clean rubber and other rubber. The technical difficulty was how to clean the latex and then to avoid subsequent contamination. Straining the latex only removes very coarse particles, but sand should settle out of diluted latex fairly easily and experiments were in progress, in co-operation with the staffs in Ceylon and Malaya, to determine whether this was so and the period of settling which was necessary to produce clean latex. The results were inconclusive, probably because contamination with foreign matter is largely accidental and there is a tendency for preparation to be more strictly supervised when it is known that the rubber is the subject of scientific investigation. One difficulty was how to determine such small quantities of sand, particularly as the particles were likely to be unevenly distributed throughout a consignment. A method was devised which required the co-operation of manufacturers and large quantities of solvent, but

this has now been improved so that it can be quickly carried out in the East with small quantities of rubber and solvent. This should enable the subject to be studied with much greater facility when the problem next arises. There is no known method of removing small particles of vegetable material, such as grass, seeds and bark, which may contaminate the latex, but these are not considered to be so harmful in the proportions in which they normally occur as they are likely to be pulverised during processing by the manufacturer.

The problem of preparing and marketing rubber with uniform technical properties is still more difficult. Routine tests on every consignment are considered to be impractical and considerable attention was therefore given in Ceylon and Malaya to practical causes of variability and to the possibility of the product of a given area being uniform over a long period. When the investigation ceased, technical opinion in Ceylon and Malaya was divided on this question and it is obvious that further work is required. In the meantime, work in London was chiefly devoted, in consultation with manufacturers, to the preparation of standards of uniformity for the guidance of investigators and to the standardisation of testing methods with a view to ensuring that all laboratories obtain comparable results. Considerable progress was made with both projects and if it is desired in the future to continue this work, it will only be necessary to review and revise the proposals already made and studied.

IMPROVED RUBBER HYDROCARBON

All the academic evidence so far published supports the view that rubber hydrocarbon from different botanical sources is fundamentally the same, but that there are differences in the size of the molecule and in such factors as degree of oxidation. The possibility of obtaining an improved hydrocarbon by selective vegetative reproduction is, therefore, not promising. On the other hand, details of the molecular structure and inter-molecular relations of the rubber hydrocarbon are in some respects a matter of controversy and many manufacturers firmly hold the opinion that commercial rubber is not only variable on account of the non-rubber substances present, but also because of obscure differences in the rubber hydrocarbon, difficult to detect by ordinary vulcanisation and mechanical tests. For example, many responsible technologists still cling to the opinion that fine hard Para is a superior type of rubber. (Gough and Parkinson, Trans. I.R.I. *17*, 1941, 168). Factors affecting the durability of rubber articles are many and complex, but the idea is still prevalent that there are superior and inferior types of rubber hydrocarbon which account for some of the behaviour of rubber articles.

This is a problem which is obviously difficult to tackle except through academic studies of the structure of the rubber hydrocarbon. The many complicating factors and the cloudy issues are not conductive to direct technical tests, but attempts have been made to get to grips with the problem by investigations in the East and in London.

The property of the rubber hydrocarbon, which is most sensitive to molecular differences, is viscosity of solutions or plasticity of the dry rubber. The latter is easily measured and it has been shown by Hastings, in investigations first in Malaya and then in Ceylon, that some trees appear to yield rubber which is much more plastic than that yielded by others. These results may be of extreme importance and the investigation should be continued as soon as possible.

The investigations in London are based on the fact that general purpose synthetics owe much of their value to the reinforcing effect of carbon black without which they are markedly inferior to rubber. The cause of this is unknown, but it suggests that the relation between rubber and carbon black will repay study, particularly if emphasis is placed on differences in rubber as opposed to the general relations between rubber and different types of carbon black, which has been the subject of many investigations in the rubber manufacturing and carbon black industries.

Preliminary investigations have shown that the viscosity of both unmasticated and masticated rubber solutions in benzene is markedly increased by the addition of a benzene suspension of carbon black, the changes in viscosity being accompanied by the development of a structure which may be observed under the microscope. The increase in viscosity was found to vary with different rubbers. It was also found that the elastic recovery of undissolved masticated rubber is greatly increased by "milling in" carbon black, this increase also varying with different rubbers. Zinc oxide, a semi-reinforcing filler, was found to have a similar effect, whereas barytes, an inert filler, had no effect.

Preliminary experiments in spreading rubber solutions on the surface of water, showed that the addition of carbon black suspensions had practically no effect on the relation between the area of rubber for a given volume and the surface pressure developed. When carbon black was milled into the rubber, a considerable increase in surface pressure was observed, indicating a change in molecular arrangements at the surface.

All these investigations have given rise to problems connected with technique and the conclusions are only tentative, but they offer some hope of discovering a type of rubber which is more improved than others by carbon black.

SOL-GEL RUBBER

It is well known that the rubber hydrocarbon can be separated into fractions defined by their solubility under fixed conditions. This may be an excellent method of studying differences in the rubber hydrocarbon and attention has been given to the subject as opportunity occurred.

So many factors were found to affect solubility that there was a doubt as to whether the differences observed were genuine or a function of accidental and, in some cases, reversible factors, which were of little importance in the utilisation of rubber. It was observed that ammoniated-latex rubber was less soluble than fresh-latex rubber, and that solubility was markedly affected by the pH of the solvent. It was also found that even acetone-extracted rubber still retained acidic groups which might affect the solvent. It also retained potassium compounds which are liable to have marked effect on solubility.

Strong evidence was obtained that, although an important fraction of the rubber remained undissolved after a few days, all the rubber would dissolve in time, say, several years. This may be because oxygen was not excluded, but results of tests in nitrogen, published by other investigators show a similar trend although one investigator claims that if oxygen is rigidly excluded, the soluble fraction does not increase on keeping in contact with the solvent. It was also found that on keeping a thoroughly dry

condition for some time all rubber tends to become progressively less soluble. This illustrates the difficulty of making rigid comparisons between different samples. Some oxidising agents, such as peroxides, appeared to increase the solubility of latex rubber at first and then to render it less soluble. Others, such as copper compounds, made it very soluble. Oxidising agents, such as potassium ferricyanide, under special conditions with regard to heat, light and oxygen, had an insolubilising effect of the same order as ammonia.

The general impression is that rubber is never static, but is continually changing and approaching new equilibria which are a function not only of the fundamental structure and size of the rubber molecule, but also of entanglements and weak association depending upon history and external circumstances. These latter factors interfere with comparisons and much further work is required before the method can be used to obtain results of practical value.

WILD RUBBER

During 1942 the staff devoted much of its time to the examination of wild rubber from various sources on behalf of the Ministry of Supply. They have advised on preparation and collection and have also helped to organise the washing and distribution of these rubbers. They have set up a system of control to ensure that manufacturers receive rubber which is reasonably clean, dry and contains at least 76 per cent rubber hydrocarbon.

In the course of the work the staff has come across instances of peculiar vulcanising, ageing and mechanical properties, which may be of value in the further study of plantation Hevea. On the whole, the impression is gained that rubber hydrocarbon is fundamentally the same irrespective of botanical source and that no other type of commercial rubber is equal to Hevea sheet and crepe for general utility.

(Sgd.) P. J. BURGESS,
Chairman.

(Sgd.) G. MARTIN,
Superintendent of Rubber Investigations.

Imperial Institute,
May, 1943.

ACTING AUDITOR-GENERAL'S REPORT FOR 1942

The accounts of the Rubber Research Scheme (Ceylon) for the year ended December 31, 1942, have been duly audited and found correct. The financial statements, viz. (a) Dartonfield Estate Working Account; (b) Nivitigalakele Experiment Station Working Account; (c) Revenue Account; (d) Capital Account and General Balance Sheet; and (e) the Provident Fund Working Account were compared with the books and accounts and found to agree. The statements are returned herewith duly certified

I. INCOME

2. The total income for the year amounted to Rs. 366,958. It exceeded the estimate by Rs. 13,074 and the income for the previous year by Rs. 69,229.

3. The following is a comparison between the estimate and the actual income under the different accounts :—

Account	Estimated Rs.	Actual Rs.	Excess Rs.	Deficit Rs.
1. Cess Collections	306,600	312,318	5,718	—
2. Interest	9,800	6,136	—	3,664
3. Sale of Publications	1,000	853	—	147
4. Profit from Dartonfield Estate	27,380	32,429	5,049	—
5 Profit from Nivitigalakele	7,704	11,927	4,223	—
6. Sundry Receipts	1,400	3,295	1,895	—
	Rs. 353,884	366,958	16,885	3,811

4. The reasons for the variations between the estimate and the actual income are as follows :—

1. Increase in exportable quota.
2. Realisation of investments.
3. Over-estimate.
4. Large crops and higher prices realised.
5. ditto
6. Profit on sale of vulcanised products and advances to the Rubber Research Institute of Malaya over-recovered.

5. **Profit from Dartonfield Estate.**—The profit for the year under review was Rs. 32,429. It exceeded the profit for the previous year by Rs. 3,229.

6. **Profit from Nivitigalakele Experiment Station.**—The working of the Experiment Station for the year showed a profit of Rs. 11,927 as compared with the profit of Rs. 7,164 earned during the previous year.

II. EXPENDITURE

7. **Revenue Expenditure.**—The total expenditure on Revenue Account exclusive of the amounts allowed for depreciation of fixed assets, the Passage and Audit Fee Reserves, amounted to Rs. 193,043 as compared

with Rs. 193,757 for the previous year. The details of this expenditure are fully set forth in the Income and Expenditure Account. The whole of this expenditure was checked with supporting vouchers and accounts.

8. **Capital Account.**—The expenditure incurred on fixed capital assets during the year amounted to Rs. 34,234 as compared with Rs. 28,073 in the previous year. Details of this expenditure are shown in the Capital Account.

9. A comparison between the original estimate and the expenditure incurred in respect of the year under review is shown in Statement 'A' attached. The reasons for the major variations between the estimate and the actual expenditure, as furnished by the Director of Research, are shown against the respective items in the statement.

The excesses under the different items of expenditure have not yet been sanctioned by the Board.

III. CAPITAL ACCOUNT

10. The capital expenditure incurred during the year under review was Rs. 34,234 bringing the total cost on this account to Rs. 764,818. A sum of Rs. 4,000 realised by the sale of a Lister engine during the year reduced this amount to Rs. 760,818.

IV. BALANCE SHEET

(a) Liabilities

11. **Creditors—Rs. 11,235.**—This amount represents the total amount due to creditors for goods purchased or services rendered in respect of the year.

12. **Passage Fund Reserve—Rs. 9,661.**—The balance on December 31, 1941, was Rs. 2,565 and a sum of Rs. 11,096 was transferred to this fund during the year. An expenditure of Rs. 4,000, being deposit of cost of passages to United Kingdom for the wives of three members of the Senior Staff was met from this fund, leaving a balance of Rs. 9,661 on December 31, 1942.

13. **Depreciation Reserve—Rs. 142,000.**—This sum represents the amount set apart for the depreciation of the fixed assets of the Scheme. The amount transferred from revenue to this account during the year was Rs. 16,564 made up as follows:—

		Rs. cts.
Dartonfield:—		
Buildings at 3½% on Rs. 188,307.81	...	6,590.77
Furniture, fittings and office equipment at 7½% on Rs. 22,461.94	...	1,684.65
Water and power supply at 7½% on Rs. 25,769.00	...	1,932.67
Machinery and tools at 7½% on Rs. 58,805.13=Rs. 4,410.38		
Less depreciation set off from 1935-41:—		
On the value of the Lister engine sold in 1942	„ 1,682.33	2,728.05
Accumulators at 20% on Rs. 5,131.60	...	1,026.32
	C/over	13,962.46

Nivitigalakele :—

	B/forward	13,962.46
Buildings at 3½% on Rs. 31,987.89	...	1,119.58
Furniture, fittings and office equipment at 7½% on Rs. 2,849.48	...	213.71
Water and power supply at 7½% on Rs. 4,820.79	...	361.56
Machinery and tools at 7½% on Rs. 225.24	...	16.89
Laboratory apparatus at 7½% on Rs. 11,862.51	...	889.69
		Rs. 16,563.89

14. **Provident Fund Reserve — Rs. 79,720.**—The particulars of the receipts and payments on this account are shown in the Provident Fund Account attached to this report. The balance standing to the credit of this Fund at the beginning of the year was Rs. 95,392. The contributions by the staff during the year amounted to Rs. 9,121 and those made from the funds of the Scheme amounted to Rs. 13,892. In addition to these amounts a sum of Rs. 307 was contributed by the Eastern Group Supply Council, being 7½% contribution on Mr. M. W. Philpott's salary for the period 1st June to 3rd October, 1942, while he was engaged by them for special work. Of the amount contributed by the Scheme, Rs. 8,616 represents the Board's bonus for 1942; Rs. 2,831 interest in respect of the year under review; Rs. 462 compensation to a peon for injury sustained while on duty. Rs. 1,652 bonus and interest paid to six retiring officers; and Rs. 331 interest paid to 38 Ceylonese officers who withdrew their contributions.

During the year a sum of Rs. 20,048 was paid to six retiring officers and a sum of Rs. 18,943 was repaid to 38 Ceylonese officers on account of refund of their contributions.

15. **Audit Fee Reserve — Rs. 579.**—The amount to the credit of this account at the beginning of the year was Rs. 398 and a sum of Rs. 850 was voted for the year 1942. After the payment of a sum of Rs. 669, being the cost of audit in respect of the year 1941, the balance left over at the end of 1942 was Rs. 579.

16. **Reserve for Stabilisation of Income — Rs. 82,368.**—On the suggestion of the Director of Research, the Board at its meeting on 2nd November, 1942, decided in favour of the establishment of a Reserve for Stabilisation of Income with effect from 1942, by placing in reserve income from the cess received in excess of the amount due on 75 per cent of each year's basic quota. The amount placed in Reserve was arrived at as follows :—

Total receipts from Cess in 1942	...	Rs. 312,317.78
Less: amount due on 75 per cent of 109,500 tons of rubber exported at Rs. 2.80	...	„ 229,950.00
		Rs. 82,367.78

17. **Surplus Account — Rs. 300,395.**—The surplus at the beginning of the year was Rs. 266,495. To this were added a sum of Rs. 146,502, being excess of income over expenditure during the year and Rs. 4,000, being amount realised by sale of a Lister engine. After deducting Rs. 34,234 and Rs. 82,368 on account of contribution to capital outlay in 1942 and amount transferred to Reserve for Stabilisation of Income respectively, the balance in the surplus account at 31st December, 1942, was Rs. 300,395.

(b) Assets

18. **Debtors — Rs. 57,200.**—Of this amount a sum of Rs. 29,139 represents the amount which was due from the Principal Collector of Customs on account of cess collections for December, 1942, and a sum of Rs. 6,755 arrears of cess collections for October and November, 1942. These have been received from him by March, 1943. The balance Rs. 21,306 was due from various parties in respect of produce, etc. sold and labour lent.

19. **Advance Accounts — Rs. 105,608.**—Of this amount, the sum of Rs. 104,414 represents advances to the London Advisory Committee, which includes Rs. 95,990 being funds transferred for payment of Provident Fund balances of European officers and allowances to their dependents in terms of Treasury Circular No. 163/30/1 (ET/M) 418 of 31-3-42. The advances to the Superintendent of Dartonfield, Nivitigalakele, Hedigalla and the Smallholdings Propaganda Officer were for sundry expenses and the amounts shown are the balances in hand. The amount shown against the Postmaster-General represents the sum deposited with him in respect of trunk call and other telephone fees.

20. **Accrued Interest on Investments — Rs. 1,351.**—This sum represents the amount of interest accrued for the year on the investments of the cash balances, but not received during the year.

21. **Payments in Advance — Rs. 593.**—This sum represents the expenditure incurred in respect of 1943, on tools and on buildings at Hedigalla.

22. **Estate Stocks — Rs. 18,965.**—This amount is made up of Rs. 322 being value of timber in hand at Nivitigalakele; Rs. 362 being value of rice and foodstuffs in hand at Nivitigalakele; Rs. 17,881 being value of rice, foodstuffs, various materials and stock of latex in hand at Dartonfield; and Rs. 400 being value of 563 lbs. crumb rubber in stock at Dartonfield, on December 31, 1942.

23. **Loans to Officers — Rs. 644.**—This sum represents the balance outstanding out of the loans granted in 1941 for purchase of transport and the balance of a loan of Rs. 500 given to a member of the staff for the same purpose in November, 1942. The loans are being repaid with interest in regular instalments.

24. **Loan to Hataraliyadde Co-operative Society — Rs. 3,000.**—The payment of a sum of Rs. 2,000 of this amount was authorised by the Board, subject to satisfactory arrangements being made regarding security. A further sum of Rs. 1,000 has been allowed subject to the Board's approval. It was observed that the bond entered into was only in respect of the original sum of Rs. 2,000. This bond has since been returned for amendment. It was also observed that no security had been obtained for the repayment of the loan as required by the Board.

25. **Salary Advances to Staff — Rs. 14,803.**—This represents advances of two months' salary to Junior Staff, and three months' salary to the Senior Staff in May, 1942, in view of the difficulties that arose after the Raid in April, 1942. The sanction of the Board was obtained for these payments and recoveries are being made regularly in monthly instalments since June, 1942.

26. **Investments in Ceylon Government Loans — Rs. 190,000.**—The stock certificates relating to the Rs. 25,000 (1) 3½ per cent loan 1957/62, the Rs. 110,000 (2) 3½ per cent loan 1949/51, the Rs. 20,000 (3) 3 per cent War Loan 1956/60, the Rs. 35,000 (4) 3¼ per cent Home Defence Loan 1952, were all inspected. The sums as appearing in the Balance Sheet represent the face value of the respective loans, but the prices at which they were quoted in the market at December 31st, 1942, were Rs. 100½, Rs. 101, Rs. 101, and Rs. 100¼ respectively. At the rates quoted the value of the investments on December 31, 1942, would be Rs. 25,125, Rs. 111,100, Rs. 20,200 and Rs. 35,087.50 respectively.

The stocks in two investments — one for Rs. 40,000 and the other for Rs. 20,000 — were sold out during the year under review before maturity, and a loss of Rs. 1,400 was incurred. This loss has been debited to the Interest Account.

27. **Cash Balances — Rs. 233,796.**—The receipts in support of the fixed deposits in Banks amounting to Rs. 115,000 were inspected and the sums of Rs. 6,180 and Rs. 10,258 lying in deposit at the Ceylon Savings Bank and the Bank of Ceylon respectively were verified by reference to the connected pass books. The balances in current account with the National Bank of India Ltd. were verified by reference to the Bank certificates. The balance of cash in hand at December 31, 1942, was not verified, but a surprise verification of the cash in hand was made on 5th May, 1943.

V. GENERAL

The accounts were received quarterly and audited in this office. The office of the Scheme at Dartonfield Estate was visited once in respect of the accounts for the year under review and the books and accounts kept were checked and the cash in hand verified.

(Sgd.) A. WEERASINGHE,
Acting Auditor-General.

Audit Office,
Wellawatte, 15th May, 1943.

ESTIMATES FOR 1943

(Adopted by the Board, November 2nd, 1942)

INCOME

1.	Cess Collections	...	...	Rs. 336,000
2.	Interest	...	...	„ 7,800
3.	Sale of Publications ...	...	...	„ 300
4.	Profit from Dartonfield	...	...	„ 25,735
5.	Profit from Nivitigalakele	...	...	„ 12,320
6.	Sundry Receipts	...	...	„ 1,030
				Rs. 383,185

REVENUE EXPENDITURE

		Rs.	Rs.
1.	**Administration of the Board:**		
	Travelling Expenses of Members ...		2,250
2.	**Personal Emoluments:**		
	Senior Scientific Staff	76,600	
	Junior Scientific Staff	7,960	84,560
3.	**Library and Publications:**		
	Library	1,250	
	Publications	1,750	3,000
4.	**Smallholdings Work:**		
	Salaries and Allowances	20,190	
	Travelling and General Expenses ...	13,135	33,325
5.	**Laboratory:**		
	Equipment and Working Expenses ...	5,000	
	Furniture Replacements	50	5,050
6.	**Field and Factory Experiments:**		
	Field Experiments	9,217	
	Factory Experiments	3,313	
	Budding Instruction	100	12,630
7.	**Office:**		
	Salaries of Office Staff	9,697	
	Stationery and Office Equipment ...	3,000	
	Postage and Telegrams	2,000	
	Advertising	200	
	Telephone	1,000	
	Audit	850	16,747
8.	**Travelling Expenses of Staff:**		
	Officers' Expenses	4,000	4,000
9.	**Maintenance of Buildings, Water and Power Supply:**		
	Laboratories and Offices	250	
	Bungalows	1,000	
	Water and Power Supply	750	
	Furniture Replacements	250	2,250
10.	**Miscellaneous Items Shared with Estate:**		
	Dartonfield General Charges ...	11,654	
	Nivitigalakele General Charges ...	4,188	
	Hedigalla General Charges	4,273	
	Upkeep of Roads and Grounds ...	570	
	Factory Upkeep	687	
	Power Supply	4,408	25,780
		Carried over	189,592

		Rs.	Rs.
	Brought forward		189,592
11.	**Contingencies:**		
	Contribution to London Advisory Committee	12,000	
	General Charges	750	
	Insurance Charges	2,100	
	Staff Provident Fund	13,600	
	Passages	6,000	
	Entertainment Allowance	300	
	War Allowance to Staff	8,114	42,864
12.	**Depreciation:**		19,000
13.	**Planting Food Crops—Hedigalla:**		3,000
			Rs. 254,456

CAPITAL EXPENDITURE

		Rs.	Rs.
Buildings:			
Hedigalla :—			
	Conductor's Bungalow	1,287	
	Labourers' Cottages	1,582	
	Store and Cart road (Token Vote) ...	100	2,969
Immature Areas:			
	Dartonfield	1,787	
	Nivitigalakele	2,343	
	Hedigalla	8,285	12,415
			Rs. 15,384

SUMMARY

		Rs.	Rs.
Income	... ...		383,185
Expenditure:			
	Revenue	254,456	
	Capital	15,384	269,840
Excess of Income over Expenditure	...		Rs. 113,345

RUBBER RESEARCH SCHEME (CEYLON)

Dartonfield Estate

Working Account for the year ended 31st December, 1942

Dr. Cr.

	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
To Expenditure :—			By Sales :—		
General Charges ...	9,023 03		Manufactured rubber (38,243 lbs.) and coupons	24,687 75	
Upkeep ...	1,793 72				
Cultivation ...	3,521 61				
Collection ...	6,289 99				
Manufacture ...	4,478 24				
Distribution ...	228 23	25,334 82	Preserved latex (Estate latex 38,397 lbs. Bought latex 68,505 lbs.)	123,450 10	148,137 85
Planting Food Crops	1,436 40				
Less: proceeds from sale of foodstuffs ...	122 35	1,314 05			
,, Bought Latex :—			,, Sundry Income:—		
Value of latex ...	70,432 60		Crepeing charges on outside rubber	118 02	
Incidental Expenses ...	18,794 56	89,227 16	Profit from Carting Account	49 43	167 45
Balance transferred to Revenue Account		32,429 27			
	Rs.	148,305 30		Rs.	148,305 30

Nivitigalakele Experiment Station

Working Account for the year ended 31st December, 1942

Dr. Cr.

	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
To Expenditure :—			By Sale of Produce:—		
General Charges	3,437 97		Rubber (39,443 lbs.) and Coupons	26,103·74	
Upkeep, Cultivation, Manufacture and Distribution	9,409 64	12,847 61	Planting Material	454 19	26,557 93
,, Upkeep of Nurseries		1,280 21			
,, Planting Food Crops		210 38			
,, Collection and Distribution of budwood and budded stumps ...		292 65			
,, Balance transferred to Revenue Account ...		11,927 08			
	Rs.	26,557 93		Rs.	26,557 93

RUBBER RESEARCH SCHEME (CEYLON)

Revenue Account for the year ended 31st December, 1942.

Dr. Cr.

	Rs. cts.	Rs. cts.		Rs. cts.
To Personal Emoluments :—			By Balances of Estate Working Accounts :—	
Senior Scientific Staff ...	67,408 80		Dartonfield	32,429 27
Junior Scientific Staff ...	8,173 62		Nivitigalakele	11,927 03
Office Staff	10,309 22	85,891 64	,, Cess Collections	312,317 78
			,, Interest	6,135 64
,, Library & Publications :—			,, Sale of Publications	853 02
Library	783 70		,, Sundry Receipts :—	
Publications	1,172 60	1,956 30	General Rs. 1,800 11	
			Sale of Vulcanised products Rs. 7,945 77	
Smallholdings Work :—			*Less*: expenditure Rs. 6,450 55	1,495 22 3,295 33
Salaries and Allowances	20,818 07			
Travelling and General Expenses	10,660 46	31,478 53		
,, Laboratory :—				
Equipment and Working Expenses	1,005 28			
Furniture Replacements	91 90	1,097 18		
,, Field and Factory Experiments :—				
Field Experiments	7,104 64			
Factory Experiments	504 34			
Budding Instruction	— —	7,608 98		
,, Office :—				
Stationery and Office Equipment	2,095 12			
Postages and Telegrams	2,160 18			
Advertising	135 51			
Telephones	988 10			
Audit	850 00	6,228 91		
,, Travelling :—				
Expenses of Board Members	1,458 75			
Expenses of Staff	4,527 20	5,985 95		
,, Maintenance of Buildings, Water and Power Supply :—				
Laboratories and Offices	111 76			
Bungalows	688 54			
Water and Power Supply	2,243 81	3,044 11		
,, Miscellaneous Items shared with Estates :—				
Dartonfield General Charges	9,023 02			
Nivitigalakele General Charges	3,437 98			
Upkeep of Roads and Grounds	547 29			
Factory Upkeep	667 07			
Power Supply	4,226 36	17,901 72		
,, Contingencies :—				
Contribution to London Advisory Committee	11,687 02			
General Charges	1,826 89			
Insurances	2,033 77			
Staff Provident Fund	13,891 54			
Contribution to Passage Fund Reserve	10,000 00			
Entertainment Allowance	92 50	39,531 72		
,, Planting Food Crops at Hedigalla		3,167 50		
,, Depreciation		16,563 89		
,, Balance, being excess of Income over Expenditure for the year, carried forward to Balance Sheet		146,501 69		
		Rs. 366,958 12		Rs. 366,958 12

RUBBER RESEARCH SCHEME (CEYLON)

Capital Account as at 31st December, 1942

EXPENDITURE	To December 31, 1941 Rs. cts.	Transfers between Accounts Rs. cts.	Additions in 1942 Rs. cts.	Total Rs. cts.
To Land including Development :—				
Dartonfield ...	118,983 31		4,021 46	123,004 77
Nivitigalakele ...	125,667 70		2,939 94	129,607 64
Hedigalla ...			2,444 72	2,444 72
,, Buildings and Lines				
Dartonfield:—				
Estate	36,275 23		6,901 03	43,176 26
Headquarters ...	190,580 50		— —	190,580 50
Nivitigalakele:—				
Estate	15,716 20		2,530 63	18,246 83
Headquarters ...	21,903 65		— —	21,903 65
,, Furniture and Fixed Equipment :—				
Dartonfield... ...	34,843 97		2,282 39	37,126 36
Nivitigalakele ...	4,660 85		504 05	5,164 90
,, Power & Water Supply:—				
Dartonfield ...	36,459 13		1,645 40	38,104 53
Nivitigalakele ...	5,963 05		62 56	6,025 61
,, Machinery & Tools:—		Cr.		
Dartonfield ...	97,754 17	4,000 00	10,723 88	104,479 05
Nivitigalakele ...	259 29		52 25	311 54
,, Laboratory Apparatus ...	29,183 79		— —	29,183 79
,, London Plant ...	11,333 34		— —	11,333 34
,, Live Stock ...	— —		125 75	125 75
Rs.	730,584 18	4,000 00	34,234 06	760,818 24

RECEIPTS		Rs. cts.
By Revenue applied for Capital purposes at December 31, 1941	Rs. 730,584 18	
Less: value of Lister engine sold	,, 4,000 00	726,584 18
In 1942		34,234 06
	Rs.	760,818 24

General Balance Sheet as at 31st December, 1942.

LIABILITIES	Rs. cts.	Rs. cts.
Creditors :—		
Sundries		11,235 41
Passage Fund Reserve :—		
At December 31, 1941	2,564 75	
Add: Reserve for 1942	11,096 27	
	13,661 02	
Less: Payments in 1942	4,000 00	9,661 02
Depreciation Reserve :—		
At December 31, 1941	125,436 21	
Add: Reserve for 1942...	16,563 89	142,000 10
Provident Fund Reserve :—		
At December 31, 1941	95,392 29	
Additions during 1942	23,319 33	
	118,711 62	
Less: Payments in 1942	38,991 44	79,720 18
Audit Fee Reserve:—		
At December 31, 1941	398 46	
Add: Reserve for 1942...	850 00	
	1,248 46	
Less : Payments in 1942	668 98	579 48
Reserve for Stabilisation of Income		82,367 78
Surplus Account:—		
At December 31, 1941...	266,495 20	
Add: Excess of Income over Expenditure in 1942 ...	146,501 69	
Add: Amount realised by sale of Lister engine ...	4,000 00	
Rs....	416,996 89	
Less: Contribution to Capital Outlay in 1942 ... Rs. 34,234 06		
Amount transferred to Reserve for Stabilisation of Income ,, 82,367 78	116,601 84	300,395 05
Rs.		625,959 02

ASSETS	Rs. cts.	Rs. cts.
Debtors,—		
Cess Collections for December, 1942	29,138 87	
Arrears of Cess Collections for October and November, 1942	6,754 57	
Sundries	21,306 35	57,199 79
Advance Accounts :—		
London Advisory Committee	104,414 25	
Estate Superintendent :—		
Dartonfield .. Rs. 877 21		
Nivitigalakele ... ,, 11 71		
Hedigalla ... ,, 97 64	986 56	
Smallholdings Propaganda Officer	47 14	
Postmaster-General	160 00	105,607 95
Accrued interest on investments		1,351 01
Payments in advance		593 19
Estate Stocks		18,964 65
Loans to Officers		644 28
Loan to Hataraliyadda Co-operative Society		3,000 00
Salary Advances to Staff		14,802 61
Investments :—		
In Ceylon Govt. 3½% Loan 1957/62	25,000 00	
,, ,, 3¼% ,, 1949/51	110,000 00	
,, ,, 3% War Loan 1956/60	20,000 00	
,, ,, 3¼% Home Defence Loan 1952 ...	35,000 00	190,000 00
Cash Balances :—		
At Ceylon Savings Bank	6,180 00	
On Fixed Deposit	115,000 00	
On Savings Deposit (Bank of Ceylon)	10,257 68	
In Current Account No. 1	92,170 16	
In Current Account No. 2	5,644 39	
In hand	4,543 31	233,795 54
	Rs.	625,959 02

In accordance with the provisions of Section 8 (2) of the Rubber Research Ordinance (Chapter 302), I have examined the above Balance Sheet. I have obtained all the information and explanations that I have required and I certify, as the result of my audit, that in my opinion the above Balance Sheet correctly sets forth the state of affairs at 31st December, 1942. My report dated 15th May, 1943, on the above Balance Sheet and Accounts appears on page 37.

Audit Office,
Wellawatte, 15th May, 1943.

(Sgd.) A. WEERASINGHE
Acting Auditor-General.

Provident Fund

Dr. Working Account for the Year ended 31st December, 1942 Cr.

	Rs. cts		Rs. cts.	Rs. cts
To Payments to six retiring officers	20,048 22	By Balance brought forward from 1941		95,392 29
,, Repayment of contributions to 38 Ceylonese Officers	18,943 22	,, Board's Bonus for 1942 :—		
,, Balance carried forward	79,720 18	Paid by the Board	8,616 00	
		Paid by the Eastern Group Supply Council ...	307 23	
			8,923 23	
		Interest on officers' contributions for 1942	1,110 83	
		Interest on Board's Bonus for 1942	1,719 87	11,753 93
		,, Compensation to an injured employee		462 00
		,, Bonus and Interest for 1942 paid to six retiring officers ...		1,651 81
		,, Interest paid to 38 Ceylonese Officers who withdrew their contributions during 1942		331 03
		,, Members' contributions during 1942		9,120 56
Rs.	118,711 62	Rs.		118,711 62

Audited and found correct.

Audit Office,
Wellawatte, 15th May, 1943.

(Sgd.) A. WEERASINGHE
Acting Auditor-General.

STATEMENT 'A'

ACCOUNT	Estimate	Supplementary Provision & Re-votes	Total	Actual Expenditure	Excess	Saving	Causes for Variation
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
1. Administration of the Board :							
Travelling Expenses of Members ...	2,250	—	2,250	1,459	—	791	Fewer meetings held.
2. A—F. Emoluments of Senior Scientific Staff ...	79,425	—	79,425	67,409	—	12,016	Resignation of Botanist and Mycologist and crediting of Military pay etc. received by 3 officers.
3. A—E. Emoluments of Junior Scientific Staff ...	7,607	—	7,607	8,174	567	—	Higher rates of War Allowance paid.
4. Library and Publications :							
A. Library ...	1,250	—	1,250	784	—	466	Economy.
B. Publications ...	2,250	—	2,250	1,173	—	1,077	Fewer publications issued.
5. Smallholdings Work :							
A-B. Salaries and Rent Allowances of Staff ...	19,539	—	19,539	20,818	1,279	—	Higher rate of War Allowance paid.
C-D. Travelling and General Expenses ...	13,455	—	13,455	10,660	—	2,795	Curtailment of work due to work on Food Production.
6. Laboratory :							
A. Equipment and Working Expenses ...	6,000	—	6,000	1,726	—	4,274	Chemicals ordered not received.
B. Furniture Replacements ...	50	—	50	92	42	—	—
7. Field and Factory Experiments :							
A. Field Experiments ...	8,341	—	8,341	7,105	—	1,236	Proceeds of rubber from experiments underestimated.
B. Factory Experiments ...	2,972	—	2 972	504	—	2,468	Normal experiments curtailed owing to production of articles for emergency purposes.
C. Budding Instruction ...	100	—	100	—	—	—	No instruction given.
8. Office :							
A-C. Emoluments of Office Staff ...	9,136	—	9,136	10,309	1,173	—	Higher rates of War Allowance paid and increase in Secretary-Acct's salary.
D. Stationery and Office Equipment ...	2,750	—	2,750	2,095	—	655	Economy.
E. Postages and Telegrams ...	2,000	—	2,000	2,160	160	—	Increased postage rates
F. Advertising ...	200	—	200	136	—	64	Economy.
G. Telephone ...	1,000	—	1,000	988	—	12	—
H. Audit ...	850	—	850	850	—	—	—
9. Travelling Expenses of Staff	5,000	—	5,000	4,527	—	473	Less travelling done.
10. Maintenance of Buildings, Water and Power Supply :							
A. Laboratory and Office ...	250	—	250	112	—	138	Work postponed.
B. Bungalows ...	1,000	—	1,000	689	—	311	do
C. Water and Power Supply ...	750	1,300	2,050	2,244	194	—	Repairs to water pumps and replacement of lightning arrestors.
11. Miscellaneous items shared with Estates:							
A. Dartonfield General Charges ...	5,523	—	5,523	9,023	3,500	—	Dearness Allowance not estimated for and higher war allowance to staff.
B. Nivitigalakele General Charges	1,885	—	1885	3,438	1,553	—	do
C. Upkeep of Roads and Grounds	570	—	570	547	—	23	—
D. Factory Upkeep ...	687	—	687	667	—	20	—
E. Power Supply ...	3,483	—	3,483	4,226	743	—	Increased cost of oils and salary o extra Asst. Engine Driver.
12. Contingencies :							
A. Contribution to London Advisory Committee ...	12,000	—	12,000	11,687	—	513	Difference in exchange.
B. General Charges ...	750	1,100	1,850	1,827	—	23	—
C. Insurance Charges ...	1,750	284	2,034	2,034	—	—	—
D. Staff Provident Fund ...	14,300	—	14,300	13,892	—	408	Contribution on Chemist's salary for 4 months paid by the Eastern Group Supply Council.
E. Passages ...	10,000	—	10,000	—	—	—	—
F. Entertainment Allowance ...	300	—	300	93	—	207	Over-estimate.
13. Depreciation ...	18,300	—	18.300	16,564	—	1,736	do
14. Planting Food Crops, Hedigalla	—	1,095	1,095	3,168	2,073	—	Crops not fully harvested.
15. Capital Account :							
A. Workshop—Dartonfield ...	900	—	900	1,187	287	—	Higher cost of materials.
B. Manure Shed—Dartonfield ...	551	—	551	572	21	—	—
C. Improvement to Engine-Driver's Quarters ...	675	175	850	836	—	14	—
D. Bungalow for Chief Budder (Nivitigalakele) ...	2,500	236	2,736	2,736	—	—	—
E. Extension to Library Bookcases	1,162	154	1,316	1,316	—	—	—
F. Rack for Record Room ...	230	—	230	—	—	230	Work not complete.
G. Opening 4 acres of land at Pinnagoda for Food Crops ...	—	600	600	358	—	242	Over-estimate.
H. Almirah for Botanical Department ...	95	—	95	73	—	22	do
I. Tappal Bicycle for S.H. Dept. ...	125	—	125	119	—	6	—
J. Upkeep of Dartonfield immature areas ...	1,749	167	1,916	1,594	—	322	Curtailment of manuring programme and paths not cut.
K. Upkeep of Nivitigalakele immature areas ...	1,838	83	1,921	1,723	—	198	Curtailment of manuring programme
L. Planting 12 acres Nivitigalakele	2,739	—	2,739	860	—	1,879	Estimate for 12 acres. Only 4½ acres opened.
M. Survey and Construction of Road to Hedigalla ...	100	—	100	—	—	—	—
N. Clearing 20 acres Hedigalla ...	—	1,910	1,910	2,445	535	—	Under-estimate.
O. Water and Power Scheme (Dartonfield) ...	—	10,800	10,800	10,379	—	421	Work incomplete
P. Ceylonese Labourers' Cottages (Nivitigalakele) ...	—	3,075	3,075	81	—	2,994	Work not undertaken.
Q. Dhoby house—Dartonfield ...	—	275	275	269	—	6	—
R. Kitchen hearths for line rooms (Dartonfield) ...	—	510	510	570	—	—	—
S. Extension to lines—Dartonfield	—	617	617	613	—	4	—
T. Latex equipment ...	—	3,600	3,600	3,719	119	—	Higher cost of materials.
U. Dartonfield approach road ...	—	125	125	125	—	—	—
V. Acquisition of land adjoining Dartonfield ...	—	2,303	2,303	2,303	—	—	—
W. Ceylonese Labourers' Cottages (Dartonfield) ...	3,075	500	3,575	1,193	—	2,382	Work not complete.
X. Rice Store—Nivitigalakele ...	—	222	222	213	—	9	—
Y. Cart bull for transport work ...	—	126	126	126	—	—	—
Z. Dartonfield Buildings ...	—	164	164	163	—	1	—