REPORT OF THE WORK OF THE RUBBER RESEARCH BOARD IN 1935.

(Established under Ceylon Ordinance No. 10 of 1930).

The Rubber Research Scheme (Ceylon) was established by Ordinance No. 10 of 1930 which came into force on August 1st of that year. The Board of Management took over the assets and liabilities of a former Rubber Research Scheme which was established in 1913 and re-organized in 1921. The present report is the 5th Annual Report of the Research Scheme, as constituted under the Ordinance.

The Rubber Research Ordinance was amended by Ordinance No. 11 of 1934 to provide that raw rubber brought into the Island for the purpose of re-export should not be liable for payment of the cess under Ordinance No. 10 of 1930.

CHAIRMAN'S REPORT

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

Mr. B. M. Selwyn, July 9th. Re-nominated for a further period of three years.

Mr. E. W. Whitelaw, December 14th. Re-nominated for a further period of three years.

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

Dr. W. Youngman relinquished the Chairmanship of the Board on August 7th, on his departure from the Island prior to retirement from Government Service and was succeeded by Dr. J. C. Hutson, Acting Director of Agriculture.

Mr. J. L. Kotalawala was nominated to serve for a period of three years from 22nd January, to fill a vacancy arising from the termination of his previous period of office on 20th October, 1934.

Mr. C. E. A. Dias, J.P. resumed his seat on return to the Island with effect from 4th February, relieving Mr. W. P. H. Dias, J.P. who was acting for him.

Mr. H. F. Parfitt resigned and was succeeded by Mr. E. C. Villiers with effect from 15th February.

Col. T. Y. Wright was on leave from 5th April to 22nd October and Mr. R. A. Sharrocks was appointed to act for him.

Mr. F. H. Griffith was on leave from 3rd April to 1st October. Col. G. B. Stevens, C.B.E. acted for him from 3rd April to 5th August and Mr. G. E. Venning, J.P., U.P.M. from 6th August to 1st October.

Mr. B. M. Selwyn was on leave from 24th July until the end of the year and Mr. R. Neville Rolfe was appointed to act for him.

Dr. W. Youngman had served as Chairman of the Board since its inception and a vote of appreciation of his services was recorded by the Board.

The personnel of the Board at the end of 1935 was as follows :—

Ex-Officio Members.

The Acting Director of Agriculture (Dr. J. C. Hutson) — Chairman.
Representing the Financial Secretary — The Deputy Financial Secretary (Mr. C. H. Collins, C.C.S.)

Unofficial Members of the State Council nominated by H. E. The Governor.

Mr. B. C. Villiers, M.S.C.
Mr. George E. de Silva, M.S.C.
Mr. J. L. Kotalawala, M.S.C.

Nominated by the Ceylon Estates Proprietary Association.

Col. T. Y. Wright.
Mr. L. P. Gapp.

Nominated by the Planters' Association of Ceylon.

Mr. F. H. Griffith,
Mr. Neville Rolfe, (Acting for Mr. B. M. Selwyn.)

Nominated by the Rubber Growers' Association.

Mr. I. L. Cameron,
Mr. E. W. Whitelaw.

Nominated by the Low-Country Products Association.

Mr. C. E. A. Dias, J.P.
Col. T. G. Jayewardene, V.D., M.S.C.
Mr. Leo B. de Mel, J.P., U.P.M.
Mr. C. H. Z. Fernando, M.M.C.

Nominated by His Excellency the Governor to represent Small-Holders.

Mr. C. A. Pereira.
The Hon'ble Mr. F. A. Obeyesekere, M.S.C., (Acting for Mr. B. F. de Silva.)

Meetings.—Meetings of the Board were held in Colombo on January 17th, March 14th, May 16th, June 27th, September 26th, November 7th, and December 12th. The Board is indebted to the Ceylon Chamber of Commerce for the use of its Committee Room for meetings on several occasions.

Meetings of the Committees appointed by the Board were held as follows :—

Estate Committee.—January 9th, January 17th, March 14th, and May 13th.

Experimental Committee.—June 20th, June 27th, July 22nd, August 6th, July 25th, September 26th, October 8th, November 7th, November 20th, and December 12th.

Oidium Committee.—March 26th, April 13th, June 6th.

Botanist Selection Committee.—May 15th.

Local Manufactures' Committee.—November 30th.

Soil Chemist Appointment Committee.—November 8th.

London Advisory Committee.—The Board contributed equally with the Rubber Research Institute of Malaya to the cost of research on the 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 accordance with an arrangement to continue the joint contribution for one year pending the consideration of a new scheme. Proposals have been formulated for the organization of "consumption" research on a wider basis and the Board has agreed to continue the contribution to the Advisory Committee during 1936 or such part as is necessary to ensure the continuity of work while the new proposals are receiving the consideration of the interests concerned. The Board of the Rubber Research Institute of Malaya also agreed to the contribution on the same basis.

The Advisory Committee held meetings on January 25th, March 29th, June 28th, and October 25th. Meetings of the Technical Sub-Committee were held on the same dates.

Development of the Research Scheme.—The experimental factory and chemical laboratory at Dartonfield were formally opened by His Excellency Sir R. E. Stubbs, Governor of Ceylon, on February 25th in the presence of a gathering of some two hundred planters and others interested in the local rubber industry.

At a meeting of the Board held on June 27th a decision was reached to transfer the Headquarters of the Scheme from Culloden Estate to Dartonfield at a cost of approximately Rs. 150,000. A programme for the completion of the necessary buildings by the end of 1937 was drawn up by the Experimental Committee and provision has been made in 1936 estimates for carrying out the first stage of the programme.

It was decided to appoint a Visiting Agent to report periodically to the Board on matters relating to the working of Dartonfield Estate and Nivitigalakele. The appointment was offered to and accepted by Mr. P. R. May who made his first inspection of the properties on June 8th. During Mr. May's subsequent absence from Ceylon on leave Mr. D. T. Angus was appointed to act for him and inspected the estates on September 27th.

A decision was reached to replace the Estate Committee by an Experimental Committee having the following functions :—

1. To arrange, discuss and recommend experimental programmes to be carried out by officers in the field or factory.
2. To advise and recommend on matters of estate policy and management.
3. To appoint a building Sub-Committee.

The following members were appointed to the Committee : Messrs. I. L. Cameron, C. E. A. Dias, Col. T. G. Jayewardene, Messrs J. L. Kotalawala, E. W. Whitelaw, and the Director of Research (Convener). Mr. J. L. Kotalawala was appointed Chairman of the Committee at its first meeting held on 20th June. Mr. C. E. A. Dias resigned from the Committee and was replaced by Mr. F. H. Griffith on his return from leave.

An area of 13 acres at Dartonfield was replanted under experimental conditions and an area of 35 acres of forest, adjacent to Nivitigalakele, was also cleared and planted.

Consideration was given to the desirability of appointing a Soil Chemist and it was decided to make an appointment as soon as the financial position of the Research Scheme permits. Laboratory accommodation for a Soil Chemist is being provided for in the building programme at Dartonfield. A Committee consisting of Messrs. C. H. Z. Fernando, Geo. E. de Silva, M. W. Philpott and T. E. H. O'Brien (Convener) was appointed to report on the possibility of manufacturing rubber goods on a commercial basis in Ceylon. The Committee met on November 30th and submitted a report which is receiving the consideration of the Board.

Oidium Leaf Disease.—The Board continued to give close attention to the position arising from the severity of Oidium Leaf Disease in Ceylon, especially in mid-country districts. A proposal for the formation of a Government Committee to consider measures for the control of the disease did not materialise and the Board appointed a Committee consisting of Mr. E. W. Whitelaw, Mr. R. K. S. Murray and Mr. T. E. H. O'Brien (Convener) to report on the incidence of the disease and to submit proposals for control measures. Mr. C. H. Collins (Deputy Financial Secretary) joined the Committee as a co-opted member. Three meetings were held and a report was submitted to the Board and subsequently considered at a joint meeting of the Committee and the Executive Committee for Agriculture and Lands. As the result of a suggestion made at the meeting, proposals were drawn up by the Technical Officers, in consultation with the Director of Agriculure, for applying the sulphur dusting treatment to approximately 1,000 acres of small estates and small-holdings in the Central Agricultural Division during the 1936 refoliation season. Application was made by the Board for a grant of Rs. 20,000 from the Rubber Restriction Fund to carry out the proposals and funds for the purpose were released early in December.

The Committee also recommended that import duty on dusting machines and sulphur should be waived and it is understood that the matter is receiving the consideration of Government.

STAFF.

Director of Research and Chemist.—Mr. T. E. H. O'Brien continued his duties in the above capacities and took charge of the administration work of the Scheme under the direction of the Board and with the assistance of a Secretary.

It was decided to offer Mr. O'Brien re-engagement for a further period of 4 years from July 1936 when his present agreement will terminate.

Assistant Chemist.—Mr. M. W. Philpott was in charge of the Chemical laboratory at Dartonfield Estate during the year.

Botanist and Mycologist.—Mr. R. K. S. Murray continued his duties in the dual capacity of Botanist and Mycologist.

Assistant Botanist.—Mr. C. A. de Silva, B.Sc., Agric. (Lond.), C.D.A. (Wye), was appointed Assistant Botanist with effect from September 9th, 1935, and was stationed at Dartonfield Estate.

Small-Holdings' Officer.—The transfer of Mr. W. I. Pieris to the post of Small-Holdings Officer was decided on towards the end of 1934 but he could not be fully released from other duties until the appointment of the Assistant Botanist in September, 1935. A visit was made to Malaya by Mr. Pieris during October-November for the purpose of studying small-holdings work there. The Board is greatly indebted to the Advisor on Agriculture, F.M.S., and the Director of the Rubber Research Institute of Malaya for providing facilities for the visit.

Mr. Pieris' service agreement terminated on June 1st, 1935, and he was re-engaged for a further period of 4 years from that date.

Estate Superintendent.—Mr. D. L. Nicol continued his duties as Superintendent of Dartonfield Estate and Nivitigalakele.

FINANCE.

Income for the year amounted to Rs. 173,347 which was mainly derived from the cess of $\frac{1}{8}$ cent per lb. levied on exports of raw rubber under the Rubber Research Ordinance. The curtailment of exports arising from the operation of the Rubber Restriction Ordinance has led to a substantial diminution of the Board's receipts and the present level of income does not

provide sufficient margin for further development. Monthly cess collections were as follows :—

Month.			
January	...	...	Rs. 22,533·00
February	...	...	,, 14,942·00
March	...	...	,, 8,123·00
April	...	...	,, 9,095·00
May	...	...	,, 12,167·00
June	...	...	,, 10,021·00
July	...	...	,, 11,371·00
August	...	...	,, 16,243·00
September	...	...	,, 11,011·00
October	...	...	,, 13,964·00
November	...	...	,, 15,590·00
December	...	...	,, 9,335·00
		Total	Rs. 154,395·00

A profit of Rs. 12,674 resulted from the normal working of Dartonfield Estate.

Current expenditure amounted to Rs. 126,948 leaving a surplus for the year of Rs. 46,399. Capital expenditure amounted to Rs. 89,973, the chief items being completion of the experimental factory Rs. 3,914, making a total expenditure on this building and equipment of Rs. 69,871. Chemical Laboratory Rs. 2,278, making a total of Rs. 23,613. Estate Superintendent's Bungalow Rs. 10,364. 4 Junior Staff Bungalows Rs. 15,293, part payment for 2 Senior Staff Bungalows Rs. 15,484, cart road extension Rs. 3,965, replanting Rs. 2,970. A sum of Rs. 10,235 was expended on the development of Nivitigalakele including the new clearing of 36 acres, after deducting a sum of Rs. 1,259 derived from the sale of rubber, cover crop seed and budwood from the station.

Arising from the criticism of a Board member, the Experimental Committee was asked to report on the cost of development of Nivitigalakele. The conclusion was reached that the expenditure was high but that this could not be avoided in view of the experimental nature of the work. The following is a summary of expenditure to December 31st, 1935, excluding the 1935 clearing.

		Cost per acre. (Clearings 62 acres : Nurseries 4 acres).
General Charges	Rs. 31,347·00	475·00
Clearing & Upkeep	,, 43,651·00	661·00
Roads & Buildings	,, 27,437·00	416·00

The accounts of the Scheme have been examined by the Auditor-General and his certificate and report, together with the income and expenditure account and the balance sheet, are appended. The rates allowed for depreciation of buildings and other assets have been adjusted in accordance with the recommendations of the Treasury representative on the Board.

The Reports of the Director of Research and Chemist; Assistant Chemist; Botanist and Mycologist; Assistant Botanist; Small-Holdings Officer; Estate Superintendent; and the London Advisory Committee for Rubber Research (Ceylon & Malaya) are also attached.

J. C. HUTSON,
Chairman of the Board,
Rubber Research Scheme, (Ceylon).
Acting Director of Agriculture.

March 4, 1936.

REPORT OF THE DIRECTOR OF RESEARCH AND CHEMIST FOR 1935.

STAFF.

The Scientific Staff was increased during the year by the appointment of an Assistant Botanist. Mr. C. A. de Silva was selected for the post and assumed duties in September. He was stationed at Dartonfield Estate and has been engaged in the selection of areas for field experiments. It is intended that he will take charge of this branch of work and will undertake other botanical research as time permits.

Heavy demands were again made on the time of the Botanist and Mycologist, Mr. R. K. S. Murray, for advisory services. The position in this respect is shown by the particulars of advisory correspondence and visits to estates given in his report. The Scheme's agricultural development programme was also a comparatively extensive one and required close scientific supervision.

The appointment of an Assistant Botanist enabled full effect to be given to the decision reached by the Board last year to transfer Mr. W. I. Pieris to the post of Small-Holdings Officer. A visit to Malaya of two months' duration was made by this officer in October-November for the purpose of studying the organisation of the Rubber Small-Holdings Advisory Service in that country.

The attention of the Director of Research was given in large measure to matters of an administrative nature arising from the programme of development at Dartonfield, and the decision to transfer the Headquarters of the Scheme to the estate. Some experimental work was conducted on the utilisation of rubber. Mr. M. W. Philpott, Assistant Chemist, was stationed at Dartonfield and was engaged in research work mainly concerned with the local manufacture of vulcan products.

Mr. D. L. Nicol, Estate Superintendent, was fully occupied with the programme of clearing and replanting, road construction and site cutting etc., in addition to normal estate routine.

A summary of the year's work is given below and further particulars are available in the reports of the technical officers which are attached.

DEVELOPMENT OF THE RESEARCH SCHEME.

Buildings at Dartonfield.—His Excellency the Governor of Ceylon, Sir R. E. Stubbs, G.C.M.G., formally opened the experimental factory and chemical laboratory at Dartonfield early in the year in the presence of a large gathering of planters and others. In a short speech given on the

occasion, His Excellency stressed the importance of scientific research in maintaining the efficiency of the industry and finding increased outlets for the product.

It became increasingly evident from month to month that the focus of the Scheme's activities had moved from Culloden to Dartonfield in respect both of field and laboratory research and that it was unsatisfactory for the senior officers of the Scheme to be stationed at a distance of 13 miles from the estate. A decision was reached by the Board that the entire Scheme should be transferred to Dartonfield and provision has been made in 1936 estimates for carrying out the first part of a programme to complete the necessary buildings in 1937. As an example of the disadvantages of the existing arrangement it may be mentioned that approximately 90 visits were made to the estate by the writer during the year and 68 by the Botanist. There can be no doubt that the transfer will increase the value of the Research Scheme to the industry and the Board is fortunate in being in a position to meet the necessary capital expenditure from available reserves. It is anticipated that it will be possible to move the headquarters office to the estate towards the end of 1936 on the return of the Director of Research from home leave.

Buildings completed during 1935 comprised Estate Superintendent's and 4 Junior Staff bungalows, and various minor buildings. Two Senior Staff bungalows (for the Assistant Chemist and the Assistant Botanist) were nearing completion at the end of the year. The 1936 programme provides for a botanical and mycological laboratory block, extension of the chemical laboratory to form the chemical and administrative blocks, one senior staff bungalow, Chief Clerk's bungalow, 4 Junior Staff bungalows, 8 line rooms. The task of finding suitable sites for the buildings on a small and comparatively hilly estate was not an easy one and the preparation of plans for the buildings and for light and water services, etc., has required close attention on the part of the writer and the Experimental Committee.

Approximately half-a-mile of cart road was cut from the factory to the staff bungalow sites, and this will be extended in 1936 to link up with the existing cart road at the entrance to the estate, thus forming a circular inspection road.

Agricultural Development.—A further area of 13 acres at Dartonfield was replanted under experimental conditions and will be utilised for investigating manurial requirements of young rubber on replanted land. Preliminary steps for replanting approximately 10 acres in 1936 were taken towards the end of the year.

An area of 36 acres of jungle at Pinnagoda, adjacent to Nivitigalakele, was cleared and planted. Approximately 28 acres is being utilized for testing the budgrafts of high-yielding Ceylon trees and plants derived from pedigree seed, 6½ acres as a multiplication nursery for budwood of proved high-yielding clones and one acre as a seedling nursery.

With the appointment of an Assistant Botanist in September it became possible to proceed with preparations for carrying out tapping and manuring experiments in mature rubber. Areas for the experiments have been selected and preliminary uniformity trials will be undertaken in 1936.

Work for Small Proprietors.—Demonstrations of the control of Oidium leaf disease by sulphur dusting were carried out on 5 small-holdings in the Central Province during the 1935 refoliation season by the Small-Holdings Officer. Considerable interest was taken in the demonstrations by the proprietors of small estates and holdings and Mr. Pieris stated in his Report on the work that there could be few rubber small-holders in any of the districts dealt with who do not know something about Oidium and its control by sulphur dusting.

The visit of Mr. Pieris to Malaya to study the organisation of small-holdings work in that country before initiating a similar service in Ceylon enables the work to be started under the best auspices and the Scheme is greatly indebted to the Adviser on Agriculture, F.M.S. and the Director of the Rubber Research Institute of Malaya for providing the necessary facilities for the visit. Proposals for local work have been formulated and are receiving the attention of the Board.

CHEMICAL SUBJECTS.

Crumb Rubber.—Approximately 2 tons of nitrite crumb rubber were prepared at Dartonfield and shipped to the London Advisory Committee for experimental work in connection with its incorporation with asphalt for road surfacing. An experimental section of public roadway in England was surfaced with the composition during the year and it now remains to await a report on its behaviour under normal traffic conditions, before any forecast can be made of the likelihood of a commercial demand arising for this grade of rubber. Experimental work was carried out on the application of mechanical methods to the preparation of the material. It was concluded that the spongy coagulum resulting from treatment of the latex with sodium nitrite and acid can be satisfactorily washed in a hydro extractor, converted to crumb by passage through a beater type disintegrator and dried in a rotary drier at atmospheric temperature.

A small trial consignment of crumb was prepared by the patented process devised by the staff of the London Advisory Committee whereby wet crepe rubber containing a small proportion of stearic acid is converted to crumb by passage through a disintegrator. It was concluded that this grade of crumb rubber could be produced commercially at a small premium over crepe if a demand arose. It should be understood that this type of crumb differs substantially from nitrite crumb as it has the normal properties of crepe rubber and can be used for similar purposes, whereas nitrite crumb has modified properties which make it unsuitable for ordinary rubber purposes but potentially useful for special applications.

Several enquiries were received during the year regarding the likelihood of crumb or powdered rubber becoming standard products and the advisability of considering the installation of equipment for making these grades. The position as understood by the writer is that whilst rubber crumb and powder can be prepared satisfactorily by several different methods, there is at present no commercial outlet for the products. Experimental work is being carried out in various centres but it remains problematical whether a demand will arise.

Latex Sieves.—The attention of the London Advisory Committee was drawn by the Research Association of British Rubber Manufacturers to the risk of contamination of raw rubber with copper, arising from the use of brass gauze for straining latex on estates.

It appears improbable that the slight acidity of field latex is sufficient to lead to an appreciable quantity of copper being absorbed during sieving under the best estate conditions, but there is undoubtedly a risk of contamination if the brass has been corroded by acid or if broken strands of wire from a damaged sieve fall into the latex.

Samples of gauze made from stainless steel, nickel and "monel" metal have been under test at Dartonfield Estate since March last; being used alternately with brass for routine factory work. It is too early to say whether they will wear better than brass or *vice versa* but the test shows that they are serviceable materials for estate use.

A memorandum was issued in *The 3rd and 4th Quarterly Circular* recommending the use of stainless steel or nickel gauze, in spite of the slightly greater expenditure involved. "Monel" metal is probably quite satisfactory for the purpose but it appears preferable to avoid the use of a copper alloy.

Special attention is drawn to the danger of using brass sieves for straining latex which has been preserved with ammonia. Brass should on no account be used for this purpose owing to the solvent action of the ammonia. In this case the use of stainless steel gauze is advised.

Routine Manufacture at Dartonfield.—The equipment installed at the experimental factory for routine manufacture has given satisfactory service during the year, with the exception of a coagulating tank lined with a grade of cement which was claimed to be acid resistant. Signs of pitting appeared within a few weeks and it is clear that the material cannot be considered suitable for the purpose. An attempt was made to re-surface part of the tank with a sample of another special acid-resisting cement but it set too rapidly to be handled satisfactorily.

Output from and power consumption of the 26-inch creping mills are approximately as follows, the figures being the mean of 3 tests (2 tests in the case of blanketing).

GROOVED MILL.

(Rolls 26 in. x 14 in. Even Gearing).

Masticating Coagulatum (Speed of mill 19 r.p.m.) Peripheral speed of rolls 70 ft. per minute.

	Power Consumption in h.p.	Output per hour; (Dry rubber in lbs.)
1st Rolling	5·0	
2nd ,,	7·1	
3rd ,,	9·6	573
4th ,,	9·2	
5th ,,	10·5	

Blanketing Dry Crepe (Speed of mill 14½ r.p.m.) Peripheral speed of rolls 53 ft. per minute.

	Power Consumption in h.p.	Output per hour; (Dry rubber in lbs.)
1st Rolling	22·75*	
2nd ,,	19·3	1,140
3rd ,,	15·5	

* Peak load 2 H.F. higher.

SMOOTH MILL.

(Rolls 26 in. x 14 in. Even Gearing.)

(Speed 15 r.p.m.) Peripheral speed of rolls 55 ft. per minute.

Power Consumption in h.p.	Output per hour; (Dry rubber in lbs.)
12·0	197

The output of lace crepe relates to material of a thickness corresponding to a weight of 2·4 oz. per sq. ft. which is slightly thicker than is suitable for air drying (an average figure is 2 oz. per sq. ft.). The crepe is dried in a special building maintained at a temperature of 90-95°F. by means of a radiator. The period of drying is two-and-a-half days and is independent of weather conditions.

Smoking of sheet rubber is carried out at 120 to 130°F. The period of drying amounts to 6 days for sheet of thickness corresponding to a weight of 8 oz. per sq. foot.

A consignment of 500 gallons of ammoniated latex was shipped to London to meet a trial order. Rubber content was adjusted to 38·5 per cent and ammonia content to 0·70 per cent. The latex was shipped in

kerosene oil tins packed in wooden cases each holding two tins. The latex was sampled on arrival by the London Advisory Committee and their report states that it was of excellent quality both as regards colour of the latex and of the dried film, freedom from solid matter and stability. It is hoped to arrange a contract for periodical shipments of latex so that suitable methods of preparation can be demonstrated to local producers.

The preparation of nitrite crumb on a semi-commercial basis was dealt with in a separate paragraph.

Paranitrophenol.—In a note on the above subject published in 1934 it was stated that manufacturers had raised objections to the use of paranitrophenol as a mould preventive in crepe rubber owing to the risk of staining of light coloured goods, but that its use in smoked sheet had been endorsed as having a beneficial effect. Several cases have been reported in recent months in which consignments of smoked sheet have been rejected by buyers on the grounds that the rubber contains paranitrophenol. Enquiries were made from an Association representing manufacturing interests in England and the view is now expressed that the presence of paranitrophenol in raw rubber should be declared by the producer at the time of sale.

UTILISATION OF SCRAP RUBBER.

As a result of restriction of exports under the Rubber Control Ordinance a number of producers have discontinued the sale of scrap grades and numerous inquiries were received regarding the possibility of applying the material to some useful local purpose. A series of trials was made to test the usefulness of melted scrap rubber for surfacing estate roads and as a base for a cheap paint.

Road Surfacing.—Scrap rubber was heated in a cast iron rice boiler, no difficulty being found in maintaining a sufficiently high temperature to melt the rubber. Similar results could no doubt be obtained using an oil drum built into a fireplace so that the heat reaches the sides of the drums. The yield of melted rubber varied substantially according to the care taken in heating. With practice it was found that an intelligent estate labourer could obtain a yield of 8 gallons per 100 lbs. scrap, using approximately one-fifth yard of firewood.

The material was applied hot to an earth road from which the loose gravel had been swept. It was scraped into an even layer with a piece of tagaram and covered with sifted earth. One gallon covered $2\frac{1}{4}$-$2\frac{1}{2}$ sq. yards. The material remained soft for a considerable period but a car could be driven over it without disturbing the surface a few hours after application, even at a curve in the road. After about two months weathering a hard waterproof surfacing was formed. Several methods for ensuring more rapid hardening were tried without success.

The conclusion reached was that melted rubber forms a useful and economical surfacing for estate roads used for light motor traffic if properly applied and if the scrap rubber used as raw material is regarded as a waste product. It is less likely to be useful for roads used for lorry or bullock cart traffic owing to the slow rate of hardening. If the scrap rubber is valued at 3 cents per lb. the cost works out at 50 cents per gallon or approximately Rs. 1,200 per mile of average estate road. These figures make it clear that the use of melted scrap for road surfacing cannot be regarded as an economic outlet for rubber.

Paint.—From a series of trials it was found that a reasonably satisfactory paint for rough outside work can be made by the following method. Scrap rubber is melted with an equal amount of raw linseed oil plus a small proportion of a paint catalyst (cobalt linoleate). This mixture after being strained, is mixed in a paint mill or mortar with a suitable quantity of red oxide powder and a further small proportion of paint catalyst and is thinned with crude rubber distillate.

The approximate proportions of the materials used are as follows :—

Scrap rubber	...	100 lbs.
Raw linseed oil	...	100 ,,
Cobalt linoleate	...	5 ,,
Red oxide powder	...	150 ,,
Rubber distillate	...	75 ,,

Cost of materials approximately 22 cents per lb.

The paint is comparable in quality with other cheap grades of paint available locally but dries more slowly. It loses its gloss after a few weeks under outside conditions but forms a hard film and adheres well to metal. It has the disadvantage that the film softens when wet. The presence of linseed oil is essential, otherwise the paint cracks badly within a few weeks. It seems possible that this type of paint can be made and used economically on estates but it is questionable whether it could be manufactured commercially for sale at a price substantially lower than materials at present available.

Utilisation of Coir Residues.—Investigations of the possibility of producing a serviceable rubber flooring composition using coir dust as the main bulking ingredient was continued by Mr. Philpott, Assistant Chemist, and was carried to a stage at which trials on a semi-commercial scale are considered necessary if further progress is to be made. Proposals in this connection are receiving the consideration of the Board.

In the preliminary trials reported last year, coir dust was sprayed with compounded latex and worked into smooth sheets on a crepeing mill after drying. This method was found to have various disadvantages and the procedure adopted in later trials was to mill coir and other ingredients into the masticated rubber in accordance with the usual manufacturing practice,

Further experiments were carried out with a view to improving the colour of the coir before use. Bleaching with chlorine gave good results but was considered to be too expensive. The colour can also be improved by soaking the material in an acid solution of sodium bisulphite but it was found satisfactory to use untreated coir and to mask the colour by the addition of mineral pigments.

Attractive flooring materials were prepared from mixings containing 25-33⅓ per cent of rubber and 37½-50 per cent coir dust according to whether the product was made in the form of tiles or continuous sheet. Special attention was given to the ageing properties of the composition and specimens showed up well in comparison with samples of imported rubber flooring when exposed to the weather for periods up to 9 months. Organic colouring materials gave disappointing results compared with mineral pigments.

It was estimated that the cost of production on a large scale would amount to Rs. 2·15 per sq. yd. for continuous sheet and Rs. 3·45 per sq. yd. for tiles. The conclusion was reached from the laboratory investigation that the material was sufficiently promising to justify the continuation of trials on a larger scale.

Latex Adhesives.—Arising from an enquiry made by the Director of Commercial Intelligence some trials were made with a view to using latex as a dry adhesive for sticking envelopes, etc. Although apparently a simple problem a number of mixings which gave satisfactory results when freshly prepared, proved unsuitable owing to the fact that their adhesive properties did not persist. Promising results were recently obtained with mixtures of latex and resins but it remains to be seen whether they will prove satisfactory in regard to permanence of properties.

Several latex mixings for general adhesive purposes were prepared and tested.

Latex Treatment of Fabrics.—The programme of work arranged for Mr. Philpott includes an investigation of the conditions necessary for the production of serviceable waterproof materials for tropical use by the treatment of fabrics with latex but systematic work on the subject has not yet been undertaken. Materials of this nature are being produced on a small commercial scale in Ceylon and assistance was given in meeting difficulties which had arisen. In advising on the subject emphasis was placed on the importance of working to carefully standardised conditions if irregularity in the quality of the finished products is to be avoided.

Other Manufactured Goods.—Various moulded and extruded products such as heels, tubing, etc., were made on the experimental machines at Dartonfield. This work was partly incidental to the training of an assistant in the use of the machines but it is in accordance with the Board's policy of being in a position to demonstrate the methods employed in the manufacture of various types of vulcanised products.

A Committee appointed by the Board to consider the possibility of commerical manufacture of rubber goods in Ceylon met at Dartonfield towards the end of the year. A report was drawn up and is under consideration by the Board.

LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA).

As in previous years close contact with the Committee's staff at the Imperial Institute was maintained by a frequent exchange of views on the work in progress in Ceylon and London. A number of samples of nitrite crumb prepared under different conditions, was forwarded for examination by the London staff in addition to the supplies prepared on a semi-commercial scale for larger scale technical trials.

Supplies of chemicals and items of machinery and apparatus required for local experimental work were obtained through the London Secretary who made the necessary inquiries regarding their suitability for the purposes in view before ordering. Information was also supplied regarding equipment for the application of mechanical methods to the production of crumb rubber.

The Research Scheme is furnished with reports on investigations undertaken by the London Committee in conjunction with the Rubber Research Institute of Malaya, in addition to those on joint work in which Ceylon is participating and thus receives the benefit of a much wider range of experimental work than could be undertaken by the small staff which is available in Ceylon.

The provision by the Committee of abstracts of all British patents relating to rubber, continued to prove useful in enabling the local staff to keep abreast of new developments.

MYCOLOGICAL AND BOTANICAL SUBJECTS.

Oidium Leaf Disease.—In view of the increased severity of oidium leaf disease in Ceylon in 1934 the course of the disease during the 1935 refoliation season was watched with special interest. Except at the highest elevations the damage caused was less than in 1934 but it is difficult to draw reliable conclusions from this fact owing to the unusual weather conditions. The later months of 1934 and the early weeks of 1935 were unusually dry leading to the exceptionally early wintering in most localities and refoliation of a majority of the trees occurred under conditions which were unfavourable for the activities of the fungus. The position in regard to the future status of the disease is discussed in detail in the Mycologist's Report which also deals fully with the outbreak of *Phytophthora* leaf-fall which occurred on certain sulphur dusted estates in the Kaluara district during the latter part of the S. W. Monsoon. The present recommendation for localities subject to *Phytophthora* attack is that sulphur dusting should be undertaken on estates

where oidium causes appreciable damage to the foliage but that a reduced quantity of sulphur should be used, with a view to obtaining only partial control of oidium and permitting the fungus to attack the highly susceptible inflorescences while protecting the foliage from serious damage.

Sulphur dusting was carried out on a number of estates in mid and low-country districts with very successful results in most cases. It is anticipated from enquiries which have been received that a substantial proportion of the total estate acreage will be dusted in 1936.

The following experimental work on oidium was undertaken during the year :—

(a). The experimental field at Kandanuwera Estate was sulphur dusted for the sixth successive year and satisfactory control was obtained. This experiment is to be discontinued in 1936 as it is felt that it has been in progress for a sufficient period to enable reliable conclusions to be drawn. The trials have shown that satisfactory control of oidium can be obtained at an altitude of 2,000 ft., and that in the absence of such control yield falls to an uneconomic level and the trees become virtually untappable.

(b). Trials were carried out in co-operation with three estates to compare representative types of dusting sulphur and to study the quantity of sulphur necessary for satisfactory control of the disease under different conditions. Conclusions were drawn which have been of considerable value in advising on dusting operations for 1936.

(c). Observations of the effects of sulphur dusting and manuring on oidium were made on an estate in the Kalutara district. From examination of the foliage of groups of trees selected at random and from general observation it was evident that good control had been obtained in the sulphur dusted areas, whether manured or not, whereas the undusted areas were comparatively seriously affected.

(d). Trials of sulphur bombs for treating individual trees or small groups of trees were continued. A promising type of bomb was developed and will be tested on a number of small-holdings during 1936.

(e). The Research Scheme is indebted to the Tea Research Institute for conducting trials on the taint of tea by sulphur. The main conclusion reached was that there is a probability of taint if sulphur falls on the bushes to the extent of 2 lbs. per acre. In practice it is considered unlikely that this quantity of sulphur will drift on to neighbouring tea fields under normal conditions.

Reference was made at an earlier stage of the report to the programme of demonstrational sulphur dusting of small-holdings which was carried out by Mr. Pieris in the Central Province. Arrangements have been made for treating an area of approximately 1,000 acres of small estates and holdings during 1936 with the aid of a grant of Rs. 20,000 from the Rubber Restriction Fund.

Budgrafting, etc.—A further trial was made to test the advisability of postponing the first examination of budded plants for a longer period than 21 days during wet weather. It was found that the period can be extended if necessary up to 5 or 6 weeks provided that the bandage is completely waterproof.

Budded plants stumped in brown wood at a height of approximately 6 feet were used as supplies in the 1934 replanted area at Dartonfield and proved very successful. This method of planting is to be compared with the more usual methods in the area to be replanted in 1936.

Studies on Clones.—Test-tapping of local clones was continued at Nivitigalakele, records of the yields of 560 trees representing 38 clones being kept during the year. Rubber from a number of Ceylon clones on estates co-operating with the Research Scheme, was also sent to the laboratories to be weighed. Yield figures for the year are not yet available and will be published in due course in *The Quarterly Circular*. Monthly records of the yields of well known imported clones have been received from several estates and these figures will be issued shortly.

Girth measurements of imported clones established at the Experimental Station, Peradeniya, are reproduced in the Botanist's report by courtesy of the Department of Agriculture. Tjirandji 1 has maintained its position as the best growing clone of those tested, followed by Tjirandji 16 and A.V.R.O.S. 49.

Budding Material.—Provision was made in the new clearing at Nivitigalakele for a budwood multiplication nursery of 6½ acres with a view to supplying budwood of high-yielding clones to estates. A seedling nursery of 1 acre was also laid down so that budded plants will be available for distribution. A quantity of budwood from the existing nurseries was sold during the year, a stipulation being made by the Board that one-third of the available material should be allotted to the proprietors of small estates (under 100 acres) if sufficient applications were received. Substantial quantities of budwood were purchased by Ceylonese proprietors.

Tapping.—Yield figures were received from two estates on which well arranged experiments have been in progress for three years to compare the "double 3 A.B.C." system with alternate day tapping on a single half-spiral cut. Results from both estates for 1934-35 indicate a 10 per cent loss of crop under the double cut system and a saving in tapping costs of approximately 25 per cent. No significant difference in the rate of bark renewal under the 2 systems has been observed up to the present.

An experiment to compare a number of tapping systems has been arranged as part of the programme of field trials to be carried out at Dartonfield. The experimental plots have been selected and a preliminary uniformity trial of 12 months' duration will be started early in 1936. The details of this and other field experiments were arranged in consultation with Rothamsted Experimental Station.

Manuring.—Requests for advice on manuring indicate that cultivation programmes are being undertaken on a number of estates. The use of fertilizers appears to be essential in many cases if deterioration of old rubber is to be avoided and it is mainly a matter for the consideration of those concerned with the commercial side of the industry whether the outlay of funds for this purpose is advisable under existing conditions.

Mr. De Silva's report gives details of a manuring experiment in mature rubber which has been laid out at Dartonfield. Preliminary tapping rounds were started towards the end of the year and a uniformity trial will be conducted during 1936.

Cover Crops.—A good deal of interest was taken by local producers in reports of the advantages of the so-called "forestry" methods of cultivation which are widely practised in Malaya and trials of the system have been started on a small scale on several estates. A block of 20 acres has been allocated for the purpose at Dartonfield. It is only by practical trial that the value of this type of cultivation under local conditions can be assessed, but there are some grounds for supposing that climatic and other factors may lead to difficulties which do not arise or are of less importance in Malaya.

Replanting.—The advantages of replanting existing rubber areas with improved material were stressed in a lecture on the subject given by Mr. R. A. Taylor (former Botanist of the Scheme) at an Agricultural Conference at Peradeniya as early as 1930, but it is only during the past year that the importance of the subject for the future of the local plantation industry has begun to receive general recognition. The previous lack of interest must largely be attributed to the depression of the past few years, but it is to be noted that extensive planting operations were carried out in other countries during these years.

Two lectures by Mr. Murray entitled "The Case for Replanting" and "Practical Aspects of Replanting", which were reproduced in the daily Press, proved very useful in helping to focus attention on the subject. Numerous requests for advice were dealt with during the later months of the year and replanting operations, mainly on a comparatively small scale, are being undertaken on a number of estates during 1936.

Experience gained in the replanted areas at Dartonfield enabled reliable information to be given regarding costs etc., and the areas have also been very useful for demonstration purposes. A description of the manuring experiments to be carried out in the area replanted during 1935 is given in the Botanist's report and details of field operations are reported by the Estate Superintendent.

DARTONFIELD ESTATE.

The tappable area was reduced to 150 acres, owing to the clearing of 13 acres for replanting and the provision of various building sites. Crop

amounted to 95,000 lbs. corresponding to a yield of 633 lbs. per acre. Tapping was continued on the "double 4" system, bark consumption averaging 3¼ inches on each side of the tree.

The bulk of the crop was sold in Colombo in the form of smoked sheet and blanket crepe. Both grades were well reported on by the selling agents, Messrs. Muller & Cooray, and realised full market price. A consignment of ammoniated latex was shipped to London and 2 tons of nitrite crumb were supplied to the London Advisory Committee. Cost of production was 16·64 cents per lb. and nett average selling price 28·63 cents.

The cart road was extended from the factory to the senior staff bungalow sites in the upper part of the estate, a distance of approximately half-a-mile. Paths were repaired and improved throughout the estate, partly to facilitate inspection by visitors and also with a view to future sulphur dusting operations.

Later wintering trees suffered fairly severely from oidium but the total damage was less than in 1934. A few cases of *Ustulina* and canker occurred and trouble with "Birds-Eye Spot" was experienced in the seedling nurseries.

An area of 13 acres was cleared and replanted under experimental conditions for the purpose of carrying out manuring trials. The 7½-acre area, replanted in 1934 was maintained in accordance with experimental requirements. Measurements of the height of the plants after one year showed that growth had been satisfactory.

Major building work on the estate was carried out on contract under the supervision of the Scheme's Architects, Messrs. Billimoria & De Silva. The Estate Superintendent exercised day-to-day supervision and prepared the sites. Various estate buildings were erected by the Superintendent, including a combined rice store, tool store and dispensary and quarters for the factory mechanic.

The Visiting Agent, Mr. P. R. May, inspected the estate in June and a visit was made in September by Mr. D. T. Angus, who acted during Mr. May's absence on leave. In both cases satisfactory reports were made.

NIVITIGALAKELE EXPERIMENT STATION.

The Estate Superintendent was in charge of the station and resided there for several months in the early part of the year while his bungalow at Dartonfield was in course of construction.

Particulars of test-tapping of clones is given elsewhere in the Report. A large proportion of trees in the 1926 clearing and part of the 1927 clearing is of suitable size for commercial tapping which will be started in 1936.

The station was manured during the year, using a balanced inorganic mixture. Planting of *Pueraria* was undertaken without great success in parts of the 1926 clearing where other ground covers have died out under the heavy shade. Covers in certain other areas are becoming thinner as the trees develop.

An area of 36 acres of the forest land leased from Government was cleared and planted. The land proved to be more rocky than was anticipated, resulting in a comparatively low stand of trees per acre in relation to the planting distance. Full details of the work are given in the Superintendent's Report.

ADVISORY SERVICES, CORRESPONDENCE, ETC.

In the Report for 1934 it was mentioned that requests for information and advisory visits had mainly related to agricultural subjects. This continued to be a feature of advisory work during the year under review. Interest in oidium leaf disease, root disease treatment, manuring, cover crops, tapping, etc., was maintained and there was an extensive demand for advice on subjects relating to replanting. In consequence a large proportion of Mr. Murray's time was taken up with advisory visits and correspondence. Advisory services to estates are recognised as an important function of the Research Scheme, and, in fact, the Rubber Research Ordinance makes special provision for practical assistance of this nature being given. There is, however, necessarily a corresponding reduction in the amount of attention which can be given to experimental work, this being especially significant in an organisation with a comparatively small technical staff such as the Rubber Research Scheme. A circular on the subject was issued by the Board during the year and local proprietors were asked to confine requests for advisory visits to cases in which problems had arisen which were outside the normal scope of estate and factory management and which could not properly be dealt with by the Superintendent or Visiting Agent of the property concerned.

The fact that the Research Scheme now has its own estate where the normal routine of estate production is carried out on sound lines and replanted areas in various stages of development can be inspected, is proving to be an important factor in advisory work. Whenever possible inquirers are invited to visit the estate for discussion of their problems as an alternative to visits being made to the estates by Research officers. The value of the estate from this point of view will be greatly increased when the headquarters have been transferred from Culloden and the full programme of experimental work has been taken in hand.

On the chemical side the volume of advisory work was again smaller than in previous years. Plans of smokehouses to suit estates of different sizes are available and a number of these have been supplied. Reports from estates on which buildings of the recommended type have been erected, have in every case been favourable both in regard to fuel economy and the quality of sheet produced. Other enquiries related to modern sheeting equipment, preservation and concentration of latex, crumb and powdered rubber, utilisation of scrap rubber, manufacture of vulcanized products, faults arising in the course of routine manufacture, etc.

Reports were furnished to the Director of Commercial Intelligence in reply to enquiries relating to denaturation of acetic acid, local manufacture of vulcanized goods and latex adhesives. In accordance with a ruling of the Board, reports to Government Departments and public organisations are submitted to Board members for approval before despatch.

Correspondence of the Scheme during 1935 was as follows :—

	Inward	Outward
Secretarial Office (not including printed matter and circulation papers) ...	1,939	2,054
Laboratories :—		
Estates and Agencies ...	953	1,047
General ...	1,031	1,233
Chairman and London Committee ...	172	189
Total	4,095	4,523

The following visits were made to estates, etc. by Technical Officers :—

	Director	Botanist & Mycologist	Assistant Chemist
Advisory (Agriculture) ...	—	46	—
Advisory (Manufacture) ...	2	—	—
Experimental ...	—	17	1
Miscellaneous ...	—	—	—
Total	2	63	1

Meetings, Committees, Etc.—The Director of Research was present at meetings of the Board of Management by invitation and attended the meetings of the Estate Committee, Experimental Committee and other Sub-Committees of the Board. The Annual General Meetings of the Planters' Association of Ceylon and of the Low-Country Products Association were attended. One or more members of the staff were present at General Meetings of the Kalutara Planters' Association. Mr. Murray attended several meetings of other District Planters' Associations and gave lectures on agricultural subjects on five occasions.

The Director of Research is an *ex-officio* member of the Central Board of Agriculture and attended two meetings at Peradeniya during the year. He continued to serve on the Budded Rubber Assessment Board, involving attendance at four meetings and three visits to estates.

Co-operation with other Research Organisations.—Full co-operation was maintained with the Research Institute of Malaya and the Rubber-Growers' Association and the Rubber Producers' Research Association by the exchange of reports and by personal correspondence. Dr. E. Rhodes, Head

of the Chemical Division of the Malayan Research Institute was met in Colombo, when he passed through, for discussion of matters of mutual interest. Publications were exchanged with 12 Research organisations in different parts of the world.

A number of scientists visited Dartonfield estate during the year, including Dr. P. J. S. Cramer, Adviser on Rubber Cultivation to the French Government; Dr. E. A. Hauser, the well-known Latex Chemist; and Mr. W. R. Cooper, Chief Chemist, Tocklai Experimental Station, Assam.

We are indebted to the Tea Research Institute for their co-operation in carrying out experiments on sulphur taint of tea; to the Coconut Research Institute for assistance in connection with the use of coir residues; and to the Rothamsted Experimental Station for advice on the design of field experiments.

Jubilee Pageant.—The Research Scheme participated in the industrial pageant organized by the Minister for Labour, Industry and Commerce, as part of the Jubilee celebrations on May 7th. The exhibit was mounted on a lorry and was intended to demonstrate the control of oidium leaf disease by sulphur dusting. It proved a picturesque addition to the pageant and was awarded a silver medal in the Rubber Trades Section. The exhibit was arranged by Mr. W. I. Pieris.

PUBLICATIONS.

The number of estates and agencies registered to receive the Scheme's publications without charge during the year was 336. It is now becoming better known to local producers that applications for registration must be renewed annually but the distribution of publications is still much more limited than is desirable. Complaints are frequently received in the latter part of the year that publications have not been received, this being due to the fact that the persons concerned have omitted to register. Several of the Colombo agency firms now register their estates each year *en bloc*.

Publications during 1935 comprised the Annual Report and Accounts for 1934, two issues of *The Quarterly Circular* and three Leaflets. Contents were as follows:—

1st and 2nd Quarterly Circular.

Oidium Leaf Disease in Ceylon in 1935. By R. K. S. Murray.

The Control of Oidium. By R. K. S. Murray.

Demonstration of the Control of Oidium on Small-Holdings in 1935. By W. I. Pieris.

Report on Ceylon Clones in 1934. By R. K. S. Murray.

Opening of Factory and Laboratory at Dartonfield Estate.

Description of Factory and Laboratory at Dartonfield Estate.

Minutes of the 23rd. Adjourned 23rd, 24th and 25th meetings of the Rubber Research Board.

3rd and 4th Quarterly Circular.

The Case for Replanting. By R. K. S. Murray.

Practical Aspects of Replanting. By R. K. S. Murray.

Notes on a Visit to Malayan Rubber Estates. By I. L. Cameron.

Latex Sieves. By T. E. H. O'Brien.

Notes on Smokehouse Design.

Jubilee Pageant of Ceylon Industries.

Minutes of the 26th, 27th and 28th meetings of the Rubber Research Board.

Leaflet No. 14 (Revised Edition 1935) The Sulphur Dusting Treatment for Oidium.

Leaflet No. 15. Sulphur Dusting for Oidium in 1936.

Leaflet No. 16. Advisory Visits to Estates.

SUMMARY OF WEATHER RECORDS AT CULLODEN LABORATORIES.

	1935	1934
Rainfall	134·291 in.	175·22 in.
Highest monthly rainfall	24·145 in. (October)	35·24 in. (June)
Highest daily rainfall	10·27 in. (Oct. 28-9)	9·05 in. (Oct. 8-9th)
Highest shade temperature (day) ...	95·3°F (10th March)	92·8°F (March 5 & 6th)
Lowest shade temperature (day) ...	71·3°F (13th January)	72·3°F (October 8th)
Lowest shade temperature (night) ...	66·7°F (2nd March)	65·5°F (Feb. 13 & 15th.)

T. E. H. O'BRIEN,
Director of Research,
Rubber Research Scheme (Ceylon).

Research Laboratories,
Culloden, Neboda,
8th February, 1936.

ASSISTANT CHEMIST'S REPORT FOR 1935.

The first two months of the year under review were mainly spent in erecting the vulcanising plant and laboratory equipment at Dartonfield and in preparing for the official opening of the factory and laboratory which took place in February.

In accordance with the Rubber Research Board's experimental policy the writer has been chiefly engaged in work on the chemical aspects of the utilisation of rubber with special reference to the production of manufactured goods locally. An investigation initiated in 1934 on the use of coir residues as a filler was brought to a stage at which further development might well proceed on semi-commercial lines. This has been the chief item of the year's experimental work and an account of the progress achieved will be published in detail in a forthcoming issue of the Rubber Research Scheme *Quarterly Circular*.

The following is a summary of the present position regarding the various subjects that have been dealt with during the year :—

Utilisation of Coir Residues.—The preliminary work on this subject has resolved itself into an attempt to produce a flooring material using waste coir as the main bulking ingredient. The aim of the investigation throughout has been to develop a material suited to the special demands of the Ceylon market and a method of production which might be worked locally with a reasonable expectation of success.

In the first trials, to which reference was made in the Report for 1934, coir waste was mixed with compounded latex and then dried and consolidated into sheets by milling. It soon became evident, however, that this method would involve practical difficulties and that the product would be in many ways unsuitable as a flooring material. Attempts to compact the latex treated coir by pressure in moulds were even less successful. In the absence, therefore, of any marked advantages in the use of latex it was decided to abandon this line of approach and to start from dry rubber.

The adoption of the normal method of compounding dry rubber led immediately to more promising results and flooring materials of attractive appearance were produced in the form of self-vulcanised tiles. The continuous sheet type of product was designed to vulcanise by maturing in a warm chamber without pressure and was chiefly interesting as an article that could be manufactured on a large scale at a very low cost. The manufacture of the tiling type of product would involve higher processing costs but would be more suitable for the comparatively small output likely to be contemplated by potential manufacturers in Ceylon. Moreover, it was revealed from discussion with local firms interested in the marketing of

rubber flooring that floor tilings would probably find a readier local market than the sheet type of material. For these reasons, attention was mainly directed towards the elucidation of problems associated with the production of tilings.

As a result of a large number of trials with different mineral ingredients and with varying proportions of rubber and coir, the following approximate percentages were found to yield compositions with the required physical properties :—

	Continuous sheet	Tiles
Rubber ...	33⅓ per cent	25 per cent
Coir waste ...	50 ,,	37½ ,,
Mineral ingredients, vulcanising chemicals, etc.	16⅔ ,,	37½ ,,

The dried waste residues of the fibre mills were prepared in most cases by sieving through a 60-mesh screen. This gave a filler of low specific gravity having an appearance similar to that of ground cork. The relatively dark-brown colour was to some extent a disadvantage and experiments were accordingly undertaken to modify the colour.

It was found that chlorine and chlorine producing substances, such as bleaching powder and sodium hypochlorite, were capable of bleaching coir to a pale-straw colour. Sulphur dioxide also improved the colour to a less marked but probably adequate extent. The main advantage of sulphur dioxide as a bleaching agent was the low concentration necessary to effect a "bleach" and the consequent low cost of treating coir with it. The cost of bleaching with chlorine was considered to be too high to be of commercial interest.

This work has for the present been discontinued because products of attractive appearance are being obtained by masking the natural colour of unbleached coir with pigments, such as titanium oxide, red iron oxides and chrome greens.

The ageing properties of the compositions were studied by exposing them to the weather. It is difficult to say what the results of such a test mean in terms of the probable life of the material under normal conditions of service, but it is satisfactory to note that many of the experimental samples compared favourably with some examples of commercial rubber flooring manufactured by reputable British and American firms. All the evidence at present available tends towards the conclusion that coir has no adverse effect on ageing.

The cost of manufacture of the flooring material has been estimated at Rs. 2·15 per square yard for $\frac{1}{8}$ in. continuous sheet and Rs. 3·45 for $\frac{1}{4}$ in. tiles. These figures are based on an annual production of 150,000 square yards and they must be considered in the light of the assumptions that have been made in arriving at them. A more detailed discussion of costs will be included in an article on this subject to be published shortly in *The Quarterly Circular*.

This investigation has now been carried as far as laboratory trials permit and it is necessary to consider whether the results obtained hitherto are sufficiently promising to warrant developments on a larger scale. Proposals for the semi-commercial production of this type of flooring and other rubber goods have been submitted to the Board and are now under consideration.

CRUMB RUBBER.

(1). **Nitrite Crumb.**—Continued interest in this material on the part of the London Advisory Committee resulted in a demand for two tons during the year. It is reported from London that the crumb is being used for service trials in connection with roadway construction and that the ultimate demand will depend on the results of these experiments.

Meanwhile attention has been given to the development of methods of production that could be recommended if a commercial demand for the material should arise.

At present the method of freeing the washed crumb from its excess water is to squeeze it by hand through muslin. This is undoubtedly effective but it is costly and extremely laborious; other means of removing the excess moisture were therefore sought. Of the methods considered, the most promising appeared to be that of treatment in a medium speed hydro-extractor. The efficiency of this method may be gauged from the following table which gives figures for ash, acidity and moisture absorption in the case of two samples of dried crumb prepared from the same batch of coagulum, one having been hand pressed and the other centrifuged.

	Hand-pressed Crumb	Centrifuged Crumb
Ash ...	0·10 per cent	0·10 per cent
Acidity, (mgms. formic acid per 100 gms. rubber) ...	5·9	7·2
Moisture absorption in atmosphere of 82·9 per cent relative humidity	0·51 per cent	0·48 per cent

The figures indicate that there is no substantial difference in efficiency between the two methods of washing.

The final drying of the crumb has hitherto been accomplished by spreading out on tables in the factory. Drying in this way takes from two to four days according to the atmospheric humidity and it is clear that if this method were adopted on a commercial scale a very large amount of space would have to be set aside for drying. Experiments were therefore carried out with a rotary dryer through which a current of air was blown by means of a fan placed at one end. This proved to be a convenient and expeditious method of dealing with the problem.

Several points connected with the manufacture and properties of this type of crumb were studied in some detail. It was observed that variation in the proportion of sodium nitrite and variation in the acid coagulant produced marked differences in the crumb as regards manufacturing characteristics and solubility in hydrocarbon solvents. The main conclusions were as follows :—

(1). Maximum solubility is obtained when the proportion of sodium nitrite to rubber is about 1 :30.

(2). The solubilities of crumb coagulated with different acids are in the following order of decreasing solubility : sulphuric acid crumb; acetic acid crumb; formic acid crumb.

(3). The coagulum formed by formic acid is soft and easily broken down into a crumb by stirring. With acetic and sulphuric acids the coagulum is tougher and cannot be broken down by stirring alone.

(4). Nothing is gained by using more acid for coagulation than is required for the decomposition of the nitrite.

(2). **Stearate Crumb.**—About two cwt. of crumb rubber was made by the process covered by B. P. 410,875 (Rubber-Growers' Association and G. Martin) and one chest was despatched to the London Committee.

If this type of crumb proves to be of interest, it will probably be as a possible starting material for the preparation of a softened form of rubber.

Experiments designed to yield information on the suitability of the crumb for this purpose are in progress, but the stage has not yet been reached at which the results can be usefully discussed.

Vulcanized Crepe.—An enquiry from abroad together with a request for samples of vulcanised crepe led to the preparation of a number of mixings of various colours and textures.

The only experimental work done on this subject during the year was in the direction of softening the crepe by the incorporation of oils. Transformer oil, for example, added to the latex in the form of an emulsion prior to

coagulation yielded a crepe that was relatively soft and pliable after vulcanisation. Suitable proportions appeared to be from 5 to 20 per cent of the softener based on the rubber. Additional advantages attending the use of softeners were :—

(1). Smooth crepe resulted after comparatively few rollings; this was most marked in the case of loaded mixings.

(2). Ply adhesion was much improved.

No systematic ageing tests have been carried out on vulcanised crepe softened in this way and the method cannot therefore be recommended at this stage.

Latex Adhesives.—In response to some interest that has been shown in the question of using latex as a gum for sticking envelopes, etc., trials were made from time to time as opportunity permitted with latex treated in various ways. Preliminary experiments revealed the fact that the problem was less simple than would appear at first sight. The essential characteristics of an adhesive of this type are :—

(1). It should be "dry".

(2). It should adhere strongly to itself but not to other surfaces in contact with it.

(3). Its adhesive properties should be persistent.

Ordinary latex films showed a slight degree of tackiness when freshly prepared but became quite non-adhesive after a short time. Latex prepared by the oxidation of field latex with hydrogen peroxide (see Report for 1934) was not only more adhesive than ordinary latex but its adhesiveness was retained for a longer period. Even this, however, was not sufficiently permanent for practical use and other methods of securing the desired properties were considered.

The addition of rubber solvents to the latex increased the tackiness considerably, but the film became soft and semi-liquid with age and therefore useless as a dry adhesive.

Oxidised latex containing about 20 per cent of starch was satisfactory in so far as it was non-adhesive towards paper, etc., and strongly adhesive to itself, but its adhesive properties did not persist after about three months.

Recently, mixtures of latex with certain resins have given promising results, but insufficient time has elapsed to show what degree of permanence they possess.

Latex Treatment of Fabrics.—Work on this subject has been mainly of an advisory nature. The commercial production of rubberised fabrics for raincoats, cumblies, etc. has been seriously attempted locally and a number of requests have been received for assistance in connection with

difficulties that have arisen. Stickiness of the rubber coating, poor ageing, and premature coagulation of the latex bath were the commonest troubles encountered. A visit to an estate where the work was being done revealed the fact that insufficient attention was being paid to the dispersion of the vulcanising chemicals and to the stabilisation of the latex. A report was made emphasizing the importance of these considerations and a recommended method of working was described.

Local China Clay.—A sample of dried "Kaolin" was obtained from the Government Mineralogist and examined from the point of view of its possible use as a rubber filler. The colour was good but the average particle size was too great to make it worth while continuing the examination. Efforts are being made, however, to obtain further samples of clay from various parts of Ceylon.

It is interesting to record that in the opinion of the Chemist to the Department of Agriculture, the so-called china clay found in Ceylon is mainly gibbsite. This however does not affect the possibility that the material might be suitable as a rubber compounding ingredient.

Latex Shipment.—A consignment of 500 gallons of 38-40 per cent. ammoniated latex was despatched to London towards the end of the year. The preparation of this consignment was valuable in affording useful information on the minutiae of latex preservation under local conditions, and a report on the subject will be included in a forthcoming issue of *The Quarterly Circular*.

Manufactured Goods.—A considerable amount of time was occupied in giving instruction to an assistant in the use of the mixing and extruding machines and in handling the vulcanising plant and testing machines. In the course of these trials a quantity of extruded and moulded articles were accumulated. Incidentally, a number of mixings were made in the form of gas tubing for use in the laboratory, and it is interesting to observe from comparisons that have been made that there appears to be no difficulty in designing compounds that will withstand tropical conditions very much better than the average commercial product.

Meteorological Observations.—The weather records at Dartonfield were kept during the year under review by the Chemical Department. The observations made in addition to rainfall were: maximum and minimum temperatures of the air, earth temperature, relative humidity, barometric pressure. Arrangements are being made to start records in 1936 of wind direction and movements.

Visits to Research Laboratories, Estates, Etc.—Official visits to the following laboratories were made during the year: Tea Research Institute, Talawakele; Coconut Research Scheme, Bandirippuwa; and Government Analyst, Colombo.

Advisory visits were paid to one estate in connection with the latex treatment of fabrics and to a Colombo firm of tyre repairers in connection with rubber manufacturing plant.

Correspondence.—The bulk of the enquiries received were on the following subjects : latex treatment of fabrics; preservation of latex for shipment; plywood adhesives; vulcanisation accelerators; treatment of coir fibre; tyre-repair compounds; manufacturing plant; vulcanised crepe; rubber paints; powdered rubber; latex strainers, shoe manufacture; and tests for preserved latex.

Visitors to Dartonfield Laboratory and Factory.—No records were kept of the number of visitors to Dartonfield prior to August. During the five months from August to December, the number of visitors totalled 68.

Leave—was taken as follows: Vacation leave *nil;* Casual leave 6 days; Leave for military duties 9 days.

M. W. PHILPOTT,
Assistant Chemist.

Dartonfield, Agalawatte.
16th January, 1936.

REPORT OF BOTANIST AND MYCOLOGIST FOR 1935.

The writer has continued to work in the dual capacity of Botanist and Mycologist, and as in previous years the progress of work is recorded under these two headings.

Mr. C. A. de Silva assumed duties as Assistant Botanist on the 9th September, and submits a separate report. He has so far been almost exclusively occupied in initiating field experiments on Dartonfield, but will gradually take over and extend certain lines of botanical research.

In 1934 one of the chief features of the writer's work was the extension of the demand for advisory services. During the year now under review the number of enquiries and calls for consultative visits showed a further substantial increase, and it was impossible to accede to every request for an estate visit. The situation, indeed, necessitated the circularisation of a letter to Colombo agency houses, requesting that calls for visits be confined as far as possible to cases where the services of a Research officer were deemed essential. One of the consequences of an undue pressure of advisory work is the difficulty of extracting the maximum information from the planting material at the Experiment Station, Nivitigalakele, and it is in this direction that the Assistant Botanist's services will be of special value.

The figures given in the appropriate section of this Report reflect the main subjects of topical interest during the year. Oidium leaf disease still heads the list of enquiries, but during the latter half of the year there was a greatly increased interest in budgrafting and replanting procedure, the consequence, possibly, of lectures given on the latter subject. It is gratifying to note that Ceylonese proprietors and superintendents are making increased use of the advisory srvices of the Scheme.

I. MYCOLOGICAL WORK.

Apart from work connected with the control of Oidium no pathological investigations have been undertaken during the year.

OIDIUM LEAF DISEASE.

1. *General.*

After the attacks of unprecedented severity which were experienced in all districts in 1934—attributed in some quarters to an advance on the part of the fungus and in others solely to unseasonable weather conditions—particular interest was attached to observations on the course of the disease during the 1935 refoliation season as giving some indication of the future

status of Oidium, particularly in the main low-country districts. Unfortunately, from this point of view, the weather conditions during the latter portion of 1934 and the early weeks of 1935 were exceptionally hot and dry, and in many districts the winter and subsequent refoliation did not pursue an altogether normal course. In most localities the winter was very early, and the majority of trees refoliated during conditions which were unfavourable for the activities of the fungus. The dry spell was broken by evening rains in the middle of February, and the resulting increase in humidity and decrease in temperature were followed by an outbreak of considerable severity. The later wintering trees suffered substantial defoliation, despite the resumption of hot, dry weather, but except at the highest elevations the damage caused by the disease was appreciably less than in 1934.

In neither of the last two years have the weather conditions during and immediately preceding refoliation been representative of an average season, and it is not easy to forecast the future status of the disease in the low-country with any degree of certainty. It is, however, somewhat disturbing to note that the period during which the fungus has been found in an active condition seems to be extending every year. In 1935 the mildew was continuously observed in the Kalutara District from the 23rd January up to the 25th June, and at the latter date there was the unusual spectacle of Oidium and *Phytopthora* leaf diseases in simultaneous activity. Specimens were received from a new clearing in the Ratnapura district as late as September. As far as the higher elevations are concerned there can be no doubt of the necessity of controlling this disease if the economic existence of the trees is to be maintained, and it is probable that in many low-country districts, also, the sulphur dusting will find increasing favour.

Sulphur dusting was undertaken on a considerable number of estates in both mid and low-country districts during 1935. Mechanical trouble was experienced with the machines on some estates, but in general the results were markedly successful. It is clear from the large volume of enquiries received during the year that the area to be dusted in 1936 will represent a substantial proportion of the total estate acreage.

A somewhat disturbing, but not entirely unexpected, consequence of the high degree of control obtained on certain estates in the Kalutara district was a relatively severe outbreak of *Phytophthora* leaf-fall towards the end of the S.W. Monsoon rains. In recent years *Phytophthora* diseases have been of little importance in Ceylon owing to the heavy Oidium infection of the blossom; comparatively little seed has set and the fungus has therefore been deprived of its most important breeding, *i.e.*, the pod. One of the most striking evidences of successful sulphur dusting is the prolific production of healthy flower and the subsequent abundance of pods, and increased incidence of *Phytophthora* is therefore a natural consequence of control of Oidium if weather conditions favour the activities of the former

fungus. In the Kalutara district the weather was not only favourable for flower production in the early months of the year but was also suited to the growth and multiplication of *Phytophthora* at the time of ripening of the pods, *i.e.*, June-July, and a somewhat severe attack was accordingly experienced wherever Oidium had been effectively controlled. The attack caused considerable perturbation and, at first, a reaction against sulphur dusting in the wetter low-country districts. As a result, however, of inspecting most of the affected estates it was concluded that the foliage of the dusted areas was still, in general, superior to that of neighbouring fields in which Oidium had remained uncontrolled, *i.e.*, that Oidium had caused more damage than *Phytophthora*. The danger of very severe defoliation by the latter fungus cannot, however, be ignored, and experiments on artificial blossom injury will be carried out in 1936. In the meantime it is recommended that sulphur dusting be continued in low-country localities where Oidium causes appreciable damage to the foliage, but with reduced quantities of sulphur. There is reason to suppose that by this means it will be possible to achieve only partial control of Oidium, the fungus being permitted to attack the highly susceptible inflorescence without damaging the young leaves to any serious extent.

2. *Experimental.*

(a). A further series of dusting operations was undertaken on Kandanuwara Estate during January to March, this being the sixth successive year in which the experimental field has been treated. Nine applications were made, a total of 75 lbs. of sulphur per acre being used. The results were satisfactory, the contrast between the dusted and the adjacent 'control' field being very marked.

The recording of yields from plots in the dusted and control areas was continued, and it is interesting to note that the yield of the dusted field showed the same marked increase during the months immediately after the refoliation that was experienced in 1931, the last year in which the treatment was successful.

The yields of latex rubber from the plots of 160 trees in each of the two areas are given below. In considering the figures for the dusted field it must be borne in mind that for reasons given in previous reports the treatment was largely unsuccessful in the years 1932-34.

	Dusted Plots	Control Plots
	Yields for 160 trees	
1930 (10 months) ...	577·1 lbs.	501·0 lbs.
1931 ...	711·4 ,,	455·4 ,,
1932 ...	703·1 ,,	506·4 ,,
1933 ...	383·1 ,,	228·5 ,,
1934 ...	256·8 ,,	146·6 ,,
1935 (11 months) ...	341·4 ,,	145·2 ,,

The work was discontinued at the end of 1935 as there would appear to be no further information to be derived. The experiments have clearly shown :—

(1) that satisfactory, though not complete, control of the disease can be obtained at this elevation (2,000 ft.) and that while a reasonable foliage is present the yield and rate of bark renewal will be maintained at a normal level; and

(2) that in the absence of any control measures the yield eventually falls to a totally uneconomic level and the trees become practically untappable.

(b). A series of trials was carried out in co-operation with three estates in order to compare representative types of dusting sulphur, and to obtain information regarding the quantity of sulphur necessary for satisfactory control under various conditions. Three brands of sulphur were used, each at two rates of application *viz* : a total of 36 and 60 lbs. per acre respectively. There were thus six blocks on each estate, replication being threefold. The size of the blocks varied from 32 to 102 acres, being arranged, for estate convenience, according to existing field divisions. Before the work was commenced compact plots of ten trees each were marked in random positions in each block, one plot for every ten acres, and when refoliation was complete the foliage of each individual tree was examined by the writer and classified according to the incidence of Oidium. This provided a measure of the effectiveness of the treatment, which agreed closely with general observation.

Unfortunately the operations were interfered with, on one estate by continual mechanical breakdowns and on another by the fact that no regular winter occurred, and the results were therefore not as clear-cut as had been hoped. It was possible, however, to draw certain conclusions which have been of value in making recommendations for dusting programmes in 1936. Of the three brands of sulphur, which may be called A, B, and C; A, which contained only 75 per cent sulphur, was found to be definitely inferior to B. & C. and C. was slightly better than B. It was found that at elevations of 1,200-1,500 ft. the higher rate of application (60 lbs. per acre) gave better control than the lower rate (36 lbs. per acre), but that at lower levels 36 lbs. gave satisfactory results.

(c). The Rubber Research Scheme was given facilities for making observations on the results of sulphur dusting a block of 100 acres on an estate in the Kalutara district. The figures are reproduced in this Report as they illustrate the high degree of control obtainable in low-country districts at a very moderate cost. They also show the ineffectiveness of a fertiliser application in reducing the incidence of the disease.

Of the area of 100 acres, 50 were manured with a general mixture three to four months before wintering occurred. The areas which served as a control consisted of 40 acres which were manured but not dusted, and 73 acres which were neither manured nor dusted. An estimate of the incidence of Oidium in the various blocks was made by examining the foliage of 100 trees in each block in ten groups of ten trees each selected at random. The foliage was classified under the following headings :—

A. Leaves healthy or slightly spotted.

B. Leaves spotted and malformed.

C. Trees appreciably defoliated.

The figures represent percentages.

Classification	A.	B.	C.
Block			
Dusted and Manured ...	88	11	1
Dusted only ...	92	7	1
Manured only ...	19	47	34
Neither ...	35	41	24

General observations confirmed the above figures; the dusted fields, whether manured or not, bore the heaviest overhead canopy seen in the vicinity for some years, the foliage of the undusted areas being very sparse by comparison. These striking results were achieved at the cost of Rs. 3·54 per acre (excluding the cost of machine), and there can be no doubt that the expense was fully justified.

(d). Further attention has been given to the possibilities of applying sulphur to individual trees or small groups of trees by means of bombs, since it is thought that this method might be useful in districts where the refoliation is very irregular and on small-holdings where a dusting machine would not be available. Various types of bombs have been manufactured and tested. One of the main difficulties is to prevent the sulphur igniting, and this has largely been overcome by surrounding the explosive charge with fireproofed sawdust. A trial of the most promising type is to be made on several small-holdings in 1936, and a number of estates will also be using these bombs experimentally.

(e). We are indebted to the Tea Research Institute for carrying out tests on the taint of Tea by sulphur. This is obviously a matter of considerable importance in connection with sulphur dusting operations in Tea-cum-Rubber districts. The most important practical conclusion is that there is a probability of taint occurring if sulphur falls on the bushes to the extent of 2 lbs. per acre, but that the taint is considerably reduced if the full cycle intervenes between dusting and plucking. If it is necessary to discard one

pluck, the next crop from that area may be free of taint if no sulphur has fallen in the meantime. In practice there is little danger of as much as 2 lbs. per acre drifting on to neighbouring Tea except where the two crops are interplanted or very closely intermingled. The previous conclusion that, provided great care is taken on the margin of Tea and Rubber fields it is only in special cases that the danger of taint constitutes a serious objection to the treatment, remains unaltered by the results of these tests.

3. *Demonstrational and Advisory.*

(a). Mr. W. I. Pieris, Small-Holdings Officer, carried out a very successful programme of sulphur-dusting on five small-holdings in mid-country districts in the neighbourhood of Kandy. His report was published in *The Combined First* and *Second Quarterly Circulars for 1935,* and the work is summarised elsewhere in this Report. The purpose of this work was mainly educative and Mr. Pieris records that considerable interest in the treatment was aroused. It seems unlikely, however, that many small-holders would be prepared to contribute to the cost of the treatment if a comprehensive scheme were organised unless the price of rubber showed a considerable improvement or their trees deteriorated to such an extent that the urgent necessity of control measures was fully brought home to them.

As the result of the deliberations of a Special Committee appointed by the Board, a more extensive programme of a similar nature will be carried through in the refoliation season of 1936, largely with a view to ascertaining the type of organisation that would be required in the event of compulsory treatment being considered necessary in certain localities.

(b). Lectures on Oidium and sulphur-dusting were given to the Low-Country Products Association and the Matale Planters' Association.

(c). Many estates were visited during the course of dusting operations in order to give advice on the methods employed. Demonstrations were also given at Dartonfield on various occasions. The number of enquiries on Oidium and sulphur-dusting, given in a later section of this Report, reflects the volume of advisory work on this subject.

Various new dusting machines and numerous samples of sulphur were examined and reported on.

(d). Leaflet No. 14, giving a practical description of the technique of sulphur-dusting, was re-written in the light of the experience gained during 1935.

II. BOTANICAL WORK.

The progress of work on botanical and agricultural subjects is recorded under the same headings as in previous Annual Reports.

The Improvement of Planting Material.

A. Budgrafting.

1. *Selection of Mother Trees.*

No further high-yielding estate trees have been selected as prospective bud-parents. The more promising of the collection already established at Nivitigalakele have been or will be planted for test in the new Pinnagoda clearing.

2. *Budding, Planting and Attention.*

(a) *Technique of Budding Operation.*—An experiment carried out by Mr. Pieris showed that provided a completely waterproof binding of rubberised tape is used, the bandage can be safely retained over the bud-patch for as long as five to six weeks. Postponement of the first examination is often advisable in closely planted nurseries if wet weather coincides with the time at which the opening would normally be due.

(b) *Transplanting "Stumped" Buddings.*—Further supplying in the 1934 replanted clearing at Dartonfield has been done by stumping grown budshoots at a height of 6 ft. or more, and has proved very successful provided the shoots are cut in brown wood. This method may prove particularly valuable for establishing a stand of budgrafts in replanted clearings, as the unproductive period between the felling of the old trees and the tapping of the new should thereby be reduced to a minimum. Portions of the 1936 clearing at Dartonfield are to be replanted by this means for comparison with the more usual methods.

3. *Studies on Clones.*

(a) *Ceylon Clones.*—Test-tapping of Ceylon clones has been continued at Nivitigalakele and on various estates co-operating with the Scheme, the rubber being in all cases sent to these laboratories for weighing. Full data concerning the more promising clones will be published in *The Quarterly Circular.*

(b) *Imported Clones.*—Many of the best imported clones have now reached the test-tapping stage, and monthly records from small numbers of trees are being received from several estates. The figures will be collated and published in due course.

Table I. gives girth measurements of a number of imported clones at the Iriyagama Division of the Experiment Station, Peradeniya, and is reproduced by courtesy of the Department of Agriculture. The buddings were planted as dormant budded stumps in October 1929, and the seedlings as basket plants at the same time. The figures are means of 60 trees planted in five randomised blocks, later supplies being excluded.

TABLE I.

Clone	Girth at 3 ft. in August 1934	Girth at 3 ft. in September 1935	Increase in 13 months
Tjirandji 1 ...	14·30 in.	17·90 in.	3·60 in.
Tjirandji 16 ...	13·26 ,,	16·31 ,,	3·05 ,,
A.V.R.O.S. 49 ...	12·60 ,,	15·54 ,,	2·94 ,,
A.V.R.O.S. 50 ...	11·66 ,,	14·59 ,,	2·93 ,,
Bodjong Datar 5	11·39 ,,	14·42 ,,	3·03 ,,
Tjirandji 8 ...	11·66 ,,	14·24 ,,	2·58 ,,
Heneratgoda 2 ...	11·33 ,,	14·12 ,,	2·79 ,,
Sungei Reko 9 ...	11·55 ,,	13·98 ,,	2·43 ,,
Seedlings ...	13·55 ,,	17·02 ,,	3·47 ,,

These figures are of interest as showing which clones thrive under relatively dry conditions, the rainfall at Peradeniya being lower than that of most Rubber districts and being particularly deficient in 1934 and the first half of 1935. Tjirandji 1 occupies an outstanding position as being the only clone which has shown better growth than the seedlings. This clone is also very vigorous in the wetter districts of Ceylon. Tjirandji 16, on the other hand, shows slow growth in the wetter zones and would seem to be particularly suited to the drier localities. A.V.R.O.S. 49, also, is relatively more satisfactory in dry than in wet districts. The lowly position of Heneratgoda 2, the only Ceylon clone in this collection, is interesting, though the differences between the lowest five clones in the list are very small.

4. *Distribution of Material.*

In furtherance of the decision to supply budwoood and budded stumps of the best clones for the special benefit of small proprietors, new nurseries were opened in the Pinnagoda clearing at Nivitigalakele — 6½ acres for the multiplication of budwood and rather over one acre of seedling stocks for the provision of stumps. Budwood from the older nurseries at Nivitigalakele was sold towards the end of the year to the extent of 1,154 yards in 218 separate parcels. Numerous requests for budded stumps were received, but these could not be supplied.

B. **Selection and Breeding.**

There is no further progress to record along these lines, Mr. Pieris being occupied with the demonstrational sulphur-dusting of small-holdings at the time at which artificial pollination might otherwise have been carried out. The small number of seedlings resulting from the 1933 pollinations were planted in the Pinnagoda clearing, together with other seedling material of interest. In the latter category are 114 stumps from the Tjikadoe (Java) seed garden, 197 stumps from isolated plots of Prang Besar clones in Malaya, and 46 stumps from an isolated plot of Heneratgoda 2 budgrafts in Ceylon.

PROBLEMS CONNECTED WITH MATURE AREAS.

A. **Tapping.**

The experiments commenced on two estates in 1933 to compare the double-three A.B.C. system with alternate day tapping on a single-cut have been continued throughout 1935. Table 2 shows the results for the years 1933-34 and 1934-35 (September to August).

The year 1934-35 is the third year of the experiment and one might therefore expect the relationship between the yields under the two systems to have reached an equilibrium. It would appear that with the size of the tapping tasks in the ratio D/3 : A.D = 2 : 3, the double-three system involves a loss in crop of about 10 per cent but a saving in tapping costs of 25 per cent.

The higher rubber content in the double-three blocks on Estate B is noteworthy, but the figures do not altogether reflect the constitution of the latex as it comes from the tree. The measurements are made when the latex enters the factory, and in a wet district there is often unavoidable dilution of the latex by rainwater. On the approach of monsoonal showers latex can be more quickly collected from the double-three than from the alternate day blocks, and it is possible that the higher content on the former system is partly due to this factor.

Measurements of bark renewal have been made from time to time by an officer of the Research Scheme, but on neither estate is there a significant difference between the two systems.

TABLE II.

Estate	Tapping system	Yield as percentage		d.r.c. lbs./gallon	
		1933-34	1934-35	1933-34	1934-35
A (dry district)	Double-three A.B.C. 12/6	106·2*	88·6	4·02	4·15
	½ sp. a.d.	100·0	100·0	4·00	3·96
B (wet district)	Double-three A.B.C. 12/6	89·0	89·7	3·23	3·71
	½ sp. a.d.	100·0	100·0	3·06	3·08

* Due largely to shortage of tappings in one of the ½ sp. a.d. blocks.

Mr. De Silva reports the preliminary arrangements that have been made for initiating a tapping experiment on Dartonfield. This experiment will be started early in 1936.

B. **Manuring.**

The improved prospects have created a renewed interest in the use of artificial fertilisers, and the increase in the number of enquiries on this subject indicates that many estates are undertaking moderate programmes of cultivation. There is no doubt that in many cases artificial manuring provides the only *rapid* means of checking deterioration, though the economics of manuring old Rubber are rather obscure.

Mr. De Silva reports the commencement of a manuring experiment in mature areas on Dartonfield, and it is to be hoped that the results of this experiment will fill some of the numerous gaps in our knowledge of the subject. For assistance in the design of this and other field experiments we are greatly indebted to the statistical department of Rothamsted Experimental Station.

C. **Cover Crops, Natural and Introduced.**

Considerable progress has been made in the establishment of leguminous ground covers in areas which were formerly clean weeded, or where a cover of grass was allowed to develop during the years of depression. In most districts *Pueraria phaseoloides* (*P. Javanica*) is the most suitable species under the shade of mature trees, and there is usually little difficulty in establishing a good cover with the assistance of manure.

At present the general opinion in Ceylon favours a creeping leguminous cover rather than the natural so-called "forestry" undergrowth of mixed indigenous species of an erect or semi-erect type which is being so widely introduced in Malaya. "Forestry" methods are, however, being given a trial on several Ceylon estates, and a block of 20 acres on Dartonfield has been allocated for this purpose. While the value of a controlled undergrowth of suitable natural species in restoring the fertility of eroded soils cannot be doubted, it seems probable that the tempo of the process will be slower on the average Ceylon estate than in Malaya, and that certain practical difficulties and objections will have greater force.

D. **Replanting.**

The outstanding development during the latter half of the year has been the awakening appreciation of the advantages to be gained by replanting old areas with improved material, the lectures given to District Planters' Associations undoubtedly serving a useful purpose in stimulating interest in this subject. Our experience in the replanted clearings at Dartonfield, to which more detailed reference is made below, has been of great assistance in replying to enquiries on costs and methods of procedure. The clearings

have also been useful for the purpose of demonstration, about 50 proprietors and superintendents being conducted round them. In the absence of first-class clonal seed being available in commercial quantities, Ceylon Estates are restricted to the use of budgrafts, and advice regarding the most suitable clones for various localities has been much in demand.

The progress of work in the replanted clearings on Dartonfield is summarised below.

1934 Clearing, Seven-and-Half Acres.—This clearing was planted with budded stumps in June 1934, the area being laid out in experimental plots to compare: (1) methods of disposal of the old timber; (2) species of ground cover crops; and (3) methods of controlling the ground cover.

The height of every plant was measured in October, *i.e.*, 16 months from planting and 13 months from cutting back the stocks to force the bud to shoot. It is too early for the respective treatments to have become operative, but the following figures for the three clones are of interest as indicating the general level of growth.

Clone	Mean Height
Glenshiel 1	8·96 ft.
A.V.R.O.S. 256	9·40 ,,
Prang Besar 186	9·08 ,,
General Mean	9·14 ft.

It is interesting to record the occurrence of *Fomes lignosus* in this clearing, one plant being affected. A careful examination revealed an old Rubber root as the source of infection, although no instance of the disease had been recorded in the former stand. Since the field is isolated from the nearest Rubber by a strip of jungle, the only known affected area in the vicinity being the other side of the main Dartonfield hill, it seems unlikely that the infection was carried into the clearing by wind-borne spores or human agency. The only reasonable conclusion is that the fungus was present before the felling of the old trees, but had not become actively parasitic on the Rubber roots. This case is on a *par* with that described in the Annual Report for 1933.

1935 Clearing, 13 Acres.—The main purpose of this clearing is to determine the fertiliser requirements of young budgrafts on replanted land. The field is divided into four blocks (replications), planted respectively with the following clones: Tjirandji 1; Bodjong Datar 5; Wawulugala 259; Hillcroft 28.

Each block contains 9 plots, the fertiliser treatments being as follows:

O (Control)	
N_1	
N_2	
N_1P	N=Nitrogen
N_2P	P=Phosporic Acid
N_1K	K=Potash
N_2K	
N_1PK	
N_2PK	

The digits 1 and 2 represent two levels of nitrogen.

Each plot consists of 16 inner trees with an outside barrier row. Each plot is divided into two sub-plots, in one of which green manure loppings will be forked into the soil together with the fertilisers, while in the other half the green manures will be grown but the loppings mulched on the surface.

The details of opening and planting will be found in the Superintendent's Report.

1936 Clearing.—The preliminary work of replanting a further clearing of about ten acres was commenced in November. The purpose of this experimental area is to compare: (1) methods of opening; (2) methods of establishing a stand of budgrafts; and (3) organic vs. inorganic fertilisers.

EXPERIMENT STATION, NIVITIGALAKELE.

General supervision of the work at Nivitigalakele was exercised during the year, the progress of work being recorded in detail by the Superintendent.

Test-tapping of 38 clones and a number of marcots and seedlings was continued throughout the year. Portions of the 1926 and 1927 clearings will be tapped on a semi-commercial basis in 1936, and a number of further clones in the 1928 clearings will come into test-tapping. It is of interest to record that the total yield of the trees in test-tapping during 1935 is equivalent to 380 lbs. per acre at the average planting distance. The age of the trees in July varied from five to eight years, calculated from the time of budding or planting. The budgrafts are all of unproved clones.

The main development at Nivitigalakele was the opening and planting of 36 acres of the Pinnagoda forest land. 28 acres were opened as a clearing for testing further Ceylon clones and seedlings of special origin, 6½ acres as a budwood nursery for the multiplication of the best imported clones, and one acre as a seedling stock nursery for the distribution of budded stumps.

III. ADVISORY WORK, CORRESPONDENCE, ETC.

1. *Estate Visits.*—The following visits were made to estates and experimental areas, the corresponding figures for 1934 being given in brackets :—

Advisory	46	(47)
Experimental	17	(11)
Dartonfield & Nivitigalakele ...	68	(51)

2. *Specimens and Enquiries.*—The number of disease specimens sent for report was 40, compared with 28 for 1934.

Enquiries were received from estates and Agency Houses on the following subjects (figures for 1934 in brackets) :—

Botanical :—				
Budding and allied subjects ...	76	(54)		
Replanting	63	(24)		
Manuring	38	(22)		
Cover crops	39	(33)		
Tapping	30	(28)		
Miscellaneous planting matters	14	(7)	260	(168)
Mycological :—				
Oidium and sulphur-dusting ...	165	(149)		
Other diseases	24	(22)	189	(171)
Total			449	(339)

Total correspondence amounted to 1,214 inward and 1,406 outward letters.

3. *Lectures.*

The following lectures were given :—

Subject	Venue
The Incidence & Control of Oidium	Low-Country Products' Association.
*The Control of Oidium	Matale Planters' Association.
*The Case for Replanting	Kelani Valley Planters' Association.
*Practical Aspects of Replanting	Sabaragamuwa Planters' Assn.
Replanting	Kalutara Planters' Association.
Experimental Field Work in Progress at Dartonfield and Nivitigalakele	Kegalle Planters' Association.

*Reproduced in *Quarterly Circular.*

IV. PUBLICATIONS.

1. Oidium Leaf Disease in Ceylon in 1935.—*Quarterly Circular*, Vol. 12 Parts 1 and 2.
2. Ceylon Clones—III. *Quarterly Circular*, Vol. 12, Parts 1 and 2.

R. K. S. MURRAY.

Botanist and Mycologist.

Rubber Research Scheme Laboratories,
Culloden, Neboda, 17th Feby., 1936.

REPORT OF THE ASSISTANT BOTANIST FOR 1935.

The writer assumed duties as Assistant Botanist on the 9th of September. A temporary office has been provided in the estate superintendent's bungalow. Mr. H. J. Fernando was transferred from Nivitigalakele to Dartonfield and assumed duties as experimental conductor on the 16th of December. A start has been made on the botanical laboratories at Dartonfield and the apparatus and furniture available for transfer from the Culloden labortories have been found adequate for present requirements. A few deficiencies have been made up by a supplementary indent.

FIELD EXPERIMENTS.

A comprehensive programme has been drawn up for 1936. Most of the writer's time has been spent on the layout of field experiments. All details have been personally supervised. Considerable progress has been made in all the field experiments dealing with the manuring of old rubber, tapping and replanting. Wet weather conditions frequently acted as a deterrent to rapid completion of the preliminary layout of field experiments. The details of the progress of work will be considered under appropriate headings.

The general terrain of the estate has been found satisfactory from the point of view of fitting in all the field experiments taken in hand.

The layout of the uniformity trial which will precede the manuring of old rubber has been completed. Trial tappings with the necessary routine work of collecting latex from plots and recording yields were carried out during the last week in December with a view to starting the uniformity trial proper on the 1st January, 1936.

Areas for the tapping experiment have been marked out in two fields and another area provisionally marked out for 1936 replanting experiment.

MANURING EXPERIMENT ON OLD RUBBER.

Aim and Scope of Experiment.—The effect of nitrogen, phosphoric acid and potash in suitable combinations and the forking in of green manures with artificial fertilisers against broadcasting artificials over cover will be tried out as follows :—

Forking Cover Crop	Broadcasting Manure
O Control	O Control
N	N
NP	NP
NK	NK
NPK	NPK

Nitrogen will be in the form of sulphate of ammonia, phosphoric acid as rock phosphate; potash as muriate of potash. Applications will be made annually. There will be four blocks, each consisting of two sub-blocks of five plots each, corresponding to the above treatments. A uniformity trial will be carried out for a year on these plots before the actual manuring experiment starts. A cover of *Pueraria phaseoloides* will be established over the whole area during the course of next year.

The Uniformity Trial.—During the months of October and November four blocks of ten plots were marked out in three different fields. Each plot has twenty trees with a complete barrier row round every plot. Two of these blocks are on better ground while the other two blocks are on a poorer type of soil. The whole is representative of local soil conditions.

Each block of ten plots has been divided into two sub-blocks of five plots each and five hypothetical treatments will be assigned to these sub-blocks in order that the analysis may correspond with that of the actual experiment. These yield records will be used for correcting subsequent yields annually or over a period of years by means of a linear regression.

All doubtful trees were tested out during November and December and six useless trees were taken out. Owing to the presence of diseased trees and the irregularity of planting in old rubber, it was difficult to make the plots as compact as one would wish. The final layout, however, has turned out quite satisfactory.

Special attention was given to this experiment towards the middle of December. The sub-block plots were painted with five distinctive colours of paint; a three-inch band round every tree. The trees in sub-blocks to be green-manured were given an extra green band. All boundary trees were painted with bands of tar. Latex collecting buckets, coagulating cups and tags for the smokeroom have been painted with bands corresponding to plots in the field; thus making the procedure in the field and factory as foolproof as possible.

Trial tapping on the double-four system was started on Block No. 1 on the 21st December, and continued daily from block to block to the end of the year. A tapper to each sub-block of hundred trees was supplied with five buckets and aluminium cups. Two tappers thus completed a day's tapping on a single block. All boundary trees were tapped by two tappers under general estate supervision. Precautions have been taken in the field with a view to reducing tapping error by a suitable rotation between tappers and the time of tapping individual plots.

Each tapper brings in his latex in five buckets together with scrap on a bar carrier. The contents of each bucket are weighed separately by the experimental conductor on a special Avery balance and 50 c.c. from each bucket are coagulated, dried and weighed to determine the dry rubber content. All scrap is similarly weighed plot by plot.

The work, both in the field and factory has now reached the required standard of accuracy and will form part of the general routine work connected with field experiments under the supervision of the scientific staff.

Tapping Experiment.—In this experiment eleven different systems of tapping will be tested out. A year's uniformity trial will precede the actual experiment. Tapping on an alternate day single-cut system will be adopted over the whole area in the uniformity trial. Replication will be sixfold.

Six blocks of eleven plots each have been marked out in two fields; three blocks in each field.

All doubtful trees have been tested during November and December. The methods of finally painting the trees will be similar to those adopted in the manuring experiment. The eleven plots will be divided into two lots of six and five for the convenience of final tapping arrangements. There is every likelihood of settled weather conditions ahead and the layout of this experiment should be complete by the middle of February, 1936.

Replanting Experiment.—A start was made on the 1936 replanting experiment about the middle of November. An area of about ten acres was roughly mapped out and trees counted up.

Comparisons in methods of opening, in methods of planting and between organic and inorganic fertilisers will be made in this experiment.

After the contour holing of this area, a more accurate plan was made with the approximate position of holes, main drains and natural boundaries with a view to fitting in the necessary blocks and plots. Four blocks have been provisionally marked out on this plan.

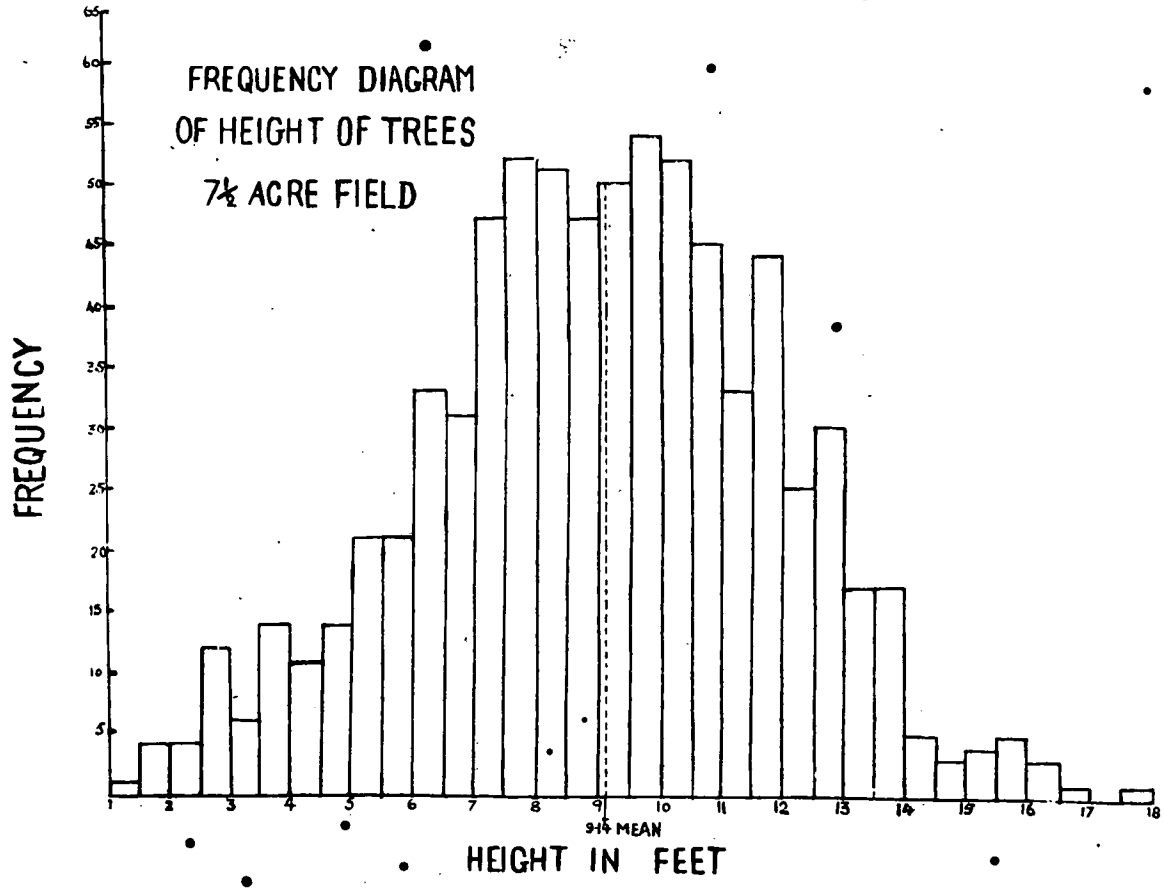
All the trees in this area have since been uprooted and cleared under general estate supervision. After the burning of the old rubber trees has been completed, final adjustments will be made with regard to the position of blocks and plots.

Subsequent development will proceed side by side with the other experiments taken in hand.

Replanted Area of Seven-and-Half Acres.—Heights of all the trees in the three blocks planted with Clones GLS. 1, A.V.R.O.S. 256 and PB. 186 have been measured to the nearest quarter of a foot.

A preliminary study of the average heights of the different clones give the following figures:—

GLS. 1	...	...	8·96 ft.
A.V.R.O.S. 256		...	9·40 ,,
PB. 186	...	...	9·08 ,,


FREQUENCY DIAGRAM
OF HEIGHT OF TREES
7½ ACRE FIELD
FREQUENCY
HEIGHT IN FEET
9.14 MEAN

A preliminary examination would indicate a very uniform vegetative development between the three clones. Any interpretation of these figures will be purely tentative, until a further accumulation of data has been made and subjected to a more critical statistical examination.

A further study of the heights of trees have been made in the form of a distribution histogram. All heights of later supplies in the total population of 831 trees were eliminated as an introduced error and the remainder has been graphically represented as a frequency diagram as on page 49. Equal ranges of height are marked on the horizontal axis and the number of trees in each range marked on the vertical axis.

The distribution of heights at equal ranges rises to a hump or "mode" or rather two "modes" in this case, and then falls off more or less symmetrically to the extremities. The general mean height is 9·14 ft. marked in the diagram with a dotted line. The diagram represents a form frequently met with in biological measurements provided that the numbers in the samples studied are large. The tendency is to form a "Normal Curve." A feature of this form of curve is that the mean coincides with the "mode." Further measurements in this area will be made in the course of the next year.

Correspondence.—All correspondence with regard to selection of suitable paints, latex buckets, bar carriers and stencils was completed during the course of this year.

Visits.—Two visits were paid to Culloden with regard to apparatus for the new botanical section at Dartonfield and one to Tebuwana Club to attend a lecture given by the Mycologist.

CLEMENT A. de SILVA,
Assistant Botanist.

Dartonfield Estate, Agalawatte.
19th January, 1936.

REPORT OF THE SMALL-HOLDINGS OFFICER FOR 1935.

Although this Report is written under the above designation, part-time duties in the capacity of Agricultural Assistant were also continued until the appointment of an Assistant Botanist in September. Distribution of duties during the year was more or less as follows :—

January to April.—Sulphur-dusting in Central Province.

May to September.—Experimental work at Nivitigalakele and preliminary small-holdings work in the Kalutara District.

October and November.—Official visit to Malaya.

December.—Arrangements for Sulphur-dusting in the Central Province in 1936.

I. SMALL-HOLDINGS WORK.

Sulphur-dusting.—Consequent upon the increased severity of Oidium infection in Ceylon in 1934, the decision of the Rubber Research Scheme, among other dusting activities, to carry out demonstrations of sulphur-dusting in the Central Province for the benefit of small-holders during the refoliation season of 1935 was taken charge of and given effect to during February to April. A small-holding suitable for the purpose was selected at Gampola, Katugastota, Galagedera, Rattota and Matale North respectively, and the complete treatment carried out at each of these centres. Dusting was started as soon as the first signs of infection began to manifest themselves on the new brown leaflets and continued at seven to nine-day intervals, until 80-90 per cent of the trees had matured their foliage. Great variation in time of wintering was experienced in the different localities and was to some extent accentuated by the unusual weather conditions in 1934, with the result that dusting at Gampola had to be commenced on February 4th while that at Matale North could not be started until March 7th. Owing to the unevenness of wintering of trees within the same holding, the number of dustings required by each also varied, the maximum given being ten at Rattota and the minimum seven at Gampola.

Dusting was carried out with a motor dusting machine which was transported to the various holdings by lorry. Sinhalese labour was employed throughout. Seven lbs. of sulphur per acre per dusting was used and the cost of dusting, excluding lorry transport, worked out at approximately Rs. 8·50 per acre for the season, which though high, is accounted for by the abnormal nature of the programme carried out.

At each of the centres dusted, a date for a special demonstration was fixed, small-holders assembled by previous notice and the purpose and method of sulphur-dusting explained in Sinhalese and demonstrated. At some of the demonstrations 60 to 70 small-holders were present. The results of the dusting when compared with neighbouring undusted rubber proved, in every case, to be most marked and aroused considerable interest among small-holders. Prolific flowering and an almost total absence of leaf-fall were strikingly evident on all dusted holdings. A cinematograph picture of a demonstration was shot.

In view of a more extensive programme of sulphur-dusting decided upon for early 1936, preliminary arrangements for selecting small estates and holdings in five ranges of the Central Agricultural Division and the selection of five temporary dusting supervisors for carrying out the work were made in December.

Preliminary Small-Holdings' Work.—Although it was considered inadvisable to commence organised small-holdings activities in Ceylon till after the writer's return from a study of the subject in Malaya in November, preliminary investigations regarding conditions and methods on holdings in the Kalutara district were carried out. Before commencing any systematic scheme for the improvement of holdings in Ceylon, the need for definite information of existing conditions was felt and a questionnaire was drawn up with this end in view. With the assistance of Agricultural Instructors of the Department of Agriculture, a number of small-holdings in the Kalutara district was visited and necessary information accumulated and recorded. Tapping in general was found to be very bad (with consequent poor bark renewal and reduction in yield), while ample scope for improvement lay open in the preparation of smoked sheet, marketing, prevention and control of disease, and general cultural attention. It will be the duty of the future Small-Holdings Department to give advice and assistance in these matters. Tapping conditions suggested that a good many trees were unfit for anything but firewood, while others were possible of reclamation with prolonged rest. Replanting with high-yielding material (under the guidance of the Rubber Research Scheme) would be advisable in areas where the trees belong to the former category. Marketing methods appear to need a complete and expensive reorganisation if middlemen's profits are to be avoided but it is not certain whether steps in this direction can be undertaken by the Research Scheme.

A memorandum on proposed small-holdings work in Ceylon, embodying various suggestions was prepared and is under consideration by the Board. The memorandum was written subject to amendments that might be necessitated after the visit to Malaya.

Visit to Malaya.—A visit to Malaya was undertaken during October and November for the primary object of studying the Small-Holders' Advisory Service of the Rubber Research Institute of Malaya. The Service specially caters for the needs of the rubber small-holder in Malaya and consists of a staff of 22 Asiatic Rubber Instructors (only 16 appointed to date) who visit and instruct them regarding correct methods of rubber cultivation, preparation of sheet, disease control and marketing, etc. The Instructors are recruited from diploma students of the School of Agriculture and given special training by the Rubber Research Institute before being allocated to their respective provinces (States in Malaya). They are supervised by the State Agricultural Officers who correspond to the Divisional Agricultural Officers in Ceylon. Their method of instruction mainly consists of visits to holdings where talks and demonstrations are given to groups of small-holders who are assembled with the assistance of the minor headmen. Instruction is mainly focussed on the preparation and smoking of sheet from latex, treatment of "mouldy rot" which takes a heavy toll of rubber trees in Malaya, and tapping. Advice is also given on the cultivation and management of holdings, co-operative marketing and general disease control. The Service, which has hardly been in existence for two years, was doing much useful work among small-holders, and the opportunity which the writer got of studying it will, it is felt, be of considerable help in organizing the Small-holdings' Department proposed for Ceylon. Cinematograph and camera photographs were taken during the visit to illustrate interesting features.

The opportunity was also taken while in Malaya of studying the work of the Rubber Research Institute, particularly on the agricultural side and such practices as the "cultivation of natural covers under rubber", sometimes described as the "Forestry Method".

A full report on the visit to Malaya was submitted.

2. EXPERIMENTAL WORK (NIVITIGALAKELE).

Vegetative Propagation of Stocks.—During 1934, 27 out of 58 shoots of rubber seedlings which in May 1933 were pegged to the ground and 'layered' to induce rooting by etiolation, were reported to have formed roots (*Vide* 1934 Report). This total was increased to 29 in May 1935 *i.e.*, two years after initiation of the experiment. Of the remaining 29 shoots which had not rooted, 16 had died, leaving only 13 yet to form roots. Of the latter 13, nine stood on bad soil. These figures confirm the opinion expressed earlier that under favourable conditions and given sufficient time, a majority of the shoots (which survive) of layered rubber seedlings may be expected to strike root.

A similar experiment (initiated in June 1934) to multiply uniform stocks by layering buddings instead of seedlings revealed no root-formation at the end of one year. This is interesting in view of the fact that 18 out of 58 shoots had rooted at the end of one year when seedlings were used, though this may be attributable to the fact that "wiring" at the collar had been done at an earlier stage in the case of the seedlings. So far as present experience goes, the method may not prove to be of practical importance as a method of propagating uniform stocks on a large scale owing to the difficulty of obtaining more than one or two robust shoots from a single layered plant. However no definite statement on this point can be made until the method has been experimented with further.

Dying of Callus Round Budded Joints.—Previous investigations had revealed that the main cause for the dying of the growing callus round the cut surfaces of budded stocks was exposure to the sun. During 1934 the experiment was continued to ascertain whether Skene's pruning mixture which is applied on the cut surfaces also had any harmful effect on the callus. This was done by eliminating the sun factor by means of artificial shade and treating the cut surfaces of certain stocks with the mixture and leaving an equal number untreated. An examination of the stocks made in June 1935 showed that in spite of a period of severe hot weather, the callus had not died in a single stock of either group, while 28 per cent. had callused over completely and the remainder had made satisfactory progress towards complete healing. The conclusion may therefore be drawn that Skene's or similar suitable waterproof mixtures, in the absence of the sun, do not kill the growing callus round cut surfaces.

Girth Expansion of Buddings in Relation to Pollarding.—Buddings of clone Yogama 11 T which were damaged during the heavy winds of May 1933 were pollarded below the point of damage and girth measurements taken at 3 ft. Similar girth measurements were taken (as controls) of a number of buddings of the same clone which were not pollarded. Measurements taken at the same height a year later revealed that the pollarded trees had increased an average of 1 in. in girth per tree while the unpollarded controls had increased an average of 4·97 in. On remeasuring the girths two years after pollarding (*i.e.*, in 1935) the pollarded trees were found to have increased an average of 4·7 in. per tree (on the 1933 girth) while the unpollarded ones had increased 8·6 in. per tree. These figures signify that the reduction in rate of girth increase due to pollarding is restricted to the first year, the increase in the second year being equal for pollarded and unpollarded trees.

Deferring First Examination of Buddings.—In view of the advisability during excessively wet weather of deferring the first examination of nursery buddings for a period over the normal three weeks, a small-scale experiment was carried out to ascertain how long such examination could be safely

deferred. The experiment was undertaken as the result of a tendency on the part of buds to rot when exposed (by removal of waterproof bandage at first examination) to excessively wet weather under shady nursery conditions. A number of stocks budded on the same day was divided into three equal groups and one of the groups examined in three weeks, another in six weeks, and the third in eight weeks from date of budding. It was observed that the longest period that it seemed advisable to leave a bud bandaged and unexamined was about five to six weeks, as thereafter a layer of cortical tissue, which is not easy to remove, develops over the bud-patch and buries it completely. Deferring the first examination of buddings in shady nurseries up to six weeks might therefore be safely practised during wet weather.

3. GENERAL.

General duties executed during the year comprised visits to estates in connection with experiments conducted by the Rubber Research Scheme, identification of specimens, examining bark for latex vessel rows, etc.

4. PUBLICATIONS AND REPORTS.

The following contributions were made :—

1. "Demonstration of the Control of Oidium on Small-Holdings in 1935."—*Quarterly Circular,* Vol. 12, Parts 1 and 2.
2. "Memorandum on Proposed Rubber Small-Holdings' Work in Ceylon."
3. Report on a Visit to Malaya.

W. I. PIERIS,
Small-Holdings Officer,
Rubber Research Scheme (Ceylon).

Research Scheme Laboratories,
Culloden, Neboda.
7th January, 1936.

ESTATE SUPERINTENDENT'S REPORT FOR 1935.

DARTONFIELD ESTATE.

Rainfall.—Weather conditions and rainfall amounting to 162·17 inches averaged about normal except for a hot dry spell in July. By reason of its close proximity to the wet month of June in which planting was carried out, this interfered considerably with the planting programme in the area replanted during the year. Details of rainfall during 1935 and the preceding year are given below :—

		1935	1934
January	...	4·74 in.	13·73 in.
February	...	6·24 ,,	5·43 ,,
March	...	18·76 ,,	17·70 ,,
April	...	8·92 ,,	18·47 ,,
May	...	25·89 ,,	23·58 ,,
June	...	17·43 ,,	38·76 ,,
July	...	6·11 ,,	5·97 ,,
August	...	15·83 ,,	5·05 ,,
September	...	6·78 ,,	4·83 ,,
October	...	21·24 ,,	34·22 ,,
November	...	19·51 ,,	20·08 ,,
December	...	10·72 ,,	9·65 ,,
	Total	162·17 in.	197·37 in.

Crop.—The estimated crop has been exceeded by 5,003 lbs., the total harvest secured being 95,003 lbs. A statement for each field appears below :—

Field No.		Total Crop lb.	Acreage	Yield per acre lb.
No. 1	...	26,988	40·2	671·3
No. 2	...	1,987	2·4	827·9
No. 3	...	24,070	41·9	574·5
No. 4	...	3,453	3·0	1151·0
No. 5	...	—	—	—
No. 6	...	38,505	62·5	616·0
	Total	95,003	150·0	633·4

Percentage of estimate harvested 105·5

Tapping.—The "double-four" system of tapping was continued during the period under review with good results. Bark consumption averaged 3¼ inches on each side of the tree. Conditions were on the whole favourable and only slight interruptions were caused by seasonal rains in the form of late tappings and complete or partial "washouts". In view of the poor percentage of scrap being brought in by tappers in the past, "podians" were employed for collecting scrap during the year. The figures enumerated below show the number of pounds of latex produced per tapper per day :—

Month		Lbs. per Tapper
January	...	9·6 lb.
February	...	rested
March	...	8·3 lb.
April	...	10·8 ,,
May	...	10·2 ,,
June	...	9·4 ,,
July	...	11·3 ,,
August	...	10·6 ,,
September	...	10·3 ,,
October	...	8·9 ,,
November	...	9·7 ,,
December	...	11·2 ,,

Manufacture.—Manufacture has been confined mainly to the production of smoked sheet and crepe, but a quantity of nitrite crumb was also made and shipped to London. The two former grades are being disposed of in the local market and are realising top prices. The quality of these grades has been good and very satisfactory reports have been received from the Brokers. In addition to the grades hitherto manufactured, 500 gallons of ammoniated latex were prepared during the year and forwarded to London. The following is a detailed statement of the distribution of grades against the crop harvested :—

		Lbs.	Per cent	Total
Smoked Sheet No. 1	...	29,627	31·19	31·66
,, ,, ,, 2	...	444	·47	
Pale Crepe No. 1	...	43,877	46·19	
,, ,, ,, 2	...	1,574	1·65	50·20
,, ,, ,, 3	...	2,248	2·36	
Scrap Crepe No. 1	...	5,798	6·10	
,, ,, ,, 2	...	2,828	2·98	10·43
,, ,, ,, 3	...	1,286	1·35	
Crumb Rubber	...	4,484	4·72	
Latex for experiments	...	644	·68	7·71
Ammoniated latex	...	2,193	2·31	

Machinery.—Has been maintained in good order and has worked satisfactorily throughout except for replacement of the safety bush of the lace mill owing to a breakage which occurred during experimental milling of vulcanised crepe. Minor repairs to the water pump of the 9 h.p. Lister engine were also carried out. The figures tabulated below show a summary of the consumption of fuels, etc., for the periods January-June and July-December.

	Large Engine. (Ruston Hornsby) 52-57 H.P.			Small Engine (Lister 9 H.P.)		
	Hours worked	Diesoline Oil. Gals.	Lubric: Oil. Gals.—	Hours worked	Disolene Oil. Gals.	Lub. Oil gals.
January-June	565¾	660	24 —	439	207½	½
Average per Hr.		1·17	·04 —		·47	·001
July-December	654	807	52¼ —	485	206½	4½
Average per Hr.		1·23	·08 —		·43	·009

Pests and Diseases.—Although late wintering trees suffered fairly severly from Oidium, the total amount of damage was rather less than in 1934. The incidence of the disease was about the same as on neighbouring estates. No sulphur-dusting was done, but provision has been made for this work in 1936.

The estate has on the whole been free from disease except for a few cases of *Ustulina* and canker. Prompt measures were taken in dealing with the cases of *Ustulina*, the procedure being the same as adopted in the past. Snags and broken branches were removed over the whole acreage.

Brunolinum plantarium and Cargilineum mixture have been applied regularly to all tapping cuts during wet weather and no serious cases of bark-rot occurred.

Weeding.—The estate has been kept free of weeds by the tappers themselves; each tapper being entrusted with the weeding of his own block. A small expenditure has however been incurred for keeping swamp areas and boundaries free from weed growth.

Labour.—Has been adequate and a settled and contented force has been gradually established. The general health of the labourers has been moderately good and in keeping with that of past years. Malarial figures show a tendency to be high, as may be expected, but it is encouraging to report that this did not at any time interfere seriously with the working of the estate. The estate has recently joined the Malaria Control Scheme and will receive the benefits of its activities. The following are the annual health returns:—

Month	Malaria	Anchylostomiasis	Minor injuries	Miscellaneous diseases	Total
January	8	2	4	11	25
February	11	2	2	19	34
March	9	4	1	11	25
April	13	3	—	19	35
May	19	—	5	10	34
June	4	2	3	12	21
July	11	6	1	20	38
August	8	6	4	23	41
September	3	—	6	22	31
October	5	5	2	19	31
November	5	2	2	28	37
December	2	3	2	43	50
Total	98	35	32	237	402

The erection of a centralised Dispensary and Rice Store has benefited labourers who until then were greatly inconvenienced, as they had to go to the next estate for treatment in cases of illness and for rice issues. The figures enumerated will show the labour position per month during the year. In addition to the permanent force of Tamils a large number of Sinhalese were employed.

	Monthly total of Labour on Check-Roll		
	Tamils	Sinhalese	Total
January ...	41	114	155
February ...	43	197	240
March ...	56	152	208
April ...	76	96	172
May ...	77	64	141
June ...	76	32	108
July ...	76	73	149
August ...	90	77	167
September ...	75	67	142
October ...	73	63	136
November ...	87	74	161
December ...	88	89	177

Figures for daily out-turn and daily rate of pay are as follows:—

Average daily out-turn ... 82

Average wages per day ... 43·49 cents.

Cart Road, Roads and Paths.—A road extension little less than half mile in length to connect up with the sites for Technical Officers' bungalows, was undertaken. This work is at present being continued on a trace to

the entrance of the estate and when completed it will serve as an inspection road through the upper part of the estate. Upkeep of the main outlet road through Gallawatte estate was taken over and extensive surface repairs effected recently. This road is now in very good condition. Owing to the weakening of an abutment on the bridge near Galawatte factory as a result of the undermining of the foundations, complete rebuilding of the abutment was found necessary.

The estate road has been maintained in good order. Inspection paths were repaired and improved over the whole estate.

Nurseries.—The leaves of the seedling plants of both 1933 and 1934 nurseries were at various stages subject to insect and fungi attack. As spraying with sulphur proved ineffective, a 3-3-50 solution of Bordeaux mixture was used later with better results. Spraying of the plants in the older nursery was discontinued after a time. It was found that the mixture did not adhere well to very young leaflets. In order to produce better adhesive properties a proportion of Lactic Casein was added to the mixture and this method was adopted in subsequent rounds of spraying with very beneficial results.

1933 Nursery.—The majority of plants in this nursery, after preliminary preparation by manuring and thinning out, were utilised as stocks for the clones put out in the area replanted during the course of the year. Budding was started in April and the percentage of successes of the first two clones Tj. 1 and B.D. 5 was good, but with the advent of the monsoon rains only fair results were obtained with the budding of the other clones viz : Wawulugala 259 and Hillcroft 28. A considerable amount of rebudding had to be carried out at later stages to meet requirements. A few sprouted bud shoots are being allowed to remain to develop into scion grown plants for future replacements in the field if necessary.

1934 Nursery.—This nursery was twice manured during the year with suitable fertiliser mixtures. Growth was interfered with by continued infection of "bird's-eye spot" which proved troublesome to control, and by very damp conditions underground. Deepening of the drains has caused a marked improvement. The nursery has from time to time been thinned out by the removal of the poorer plants. Slightly more than half the number of seedlings originally planted out are now available. The stocks are to be used in the 1936 replanting experiment.

EXPERIMENTAL AREAS.

1934 Replanted Area.—Growth has generally been good throughout. The plants received two applications of general fertiliser mixtures during the year, one in April at the rate of 4 ozs. per plant, and the other in September at 8 ozs. per plant. In the latter case green manure loppings were forked into the platforms together with the fertiliser mixture.

Casualties were supplied from time to time, scion grown plants being latterly used for this purpose. The supplies put out in this way have grown satisfactorily. Cutting of stock snags in cases where the scion had grown more than 18 inches of brown wood was also done.

Control of cover plants in both plot boundaries and platforms has been carefully maintained.

A case of Fomes lignosus was detected on a plant in the Prang Besar block. The source of infection was traced to an old rubber root in a plot where the roots were allowed to remain. This is of particular interest as the experiment compares three different methods of disposal of timber and their relation to the incidence and effects of disease. Estate records show no evidence of previous cases of the disease in this area. The infected block was carefully examined and all diseased and healthy roots from the surrounding portions were removed and burned. In accordance with the recommendations of the Mycologist an isolation trench 2½ ft. deep was dug all round as an additional precaution.

1935 Replanting.—As the purpose of this experiment and its layout are dealt with in the Botanist's report, only a brief outline of the procedure adopted in clearing and the subsequent operations undertaken is added herein.

As indicated in last year's report, holing on the contour was completed late in 1934. Felling, clearing and burning were completed within the first three months of the year and the dynamiting of all rock and hard-bottomed holes was commenced. Owing to the exceptionally rocky nature of the land it was found advisable to dynamite a large proportion of holes and modify the system of opening. It was originally intended to open up the land with contour platforms, but this method was considered to be not altogether suitable for the type of land and a system of contour draining was accordingly carried out. After dynamiting had been completed, filling of the holes was done with the best surface soil available, freed from stones and incorporated with dry and green leaf. Level contour drains 18 inches broad and alternately 6 inches and 2 feet deep in lengths of 4 feet were then cut between each pair of contour lines commencing from "leader-drains" each with a 4 ft. bund. Existing lateral drains were utilised where possible. Latterly the 4 ft. alternating bunds were reduced by a foot to allow for larger silt-pits each 5 ft. in length. The sowing of cover crop seed mixed in equal proportions (1 lb. Centrosema to 1 lb. Calapogonium to 1 lb. Crotolaria) was undertaken in April. The growth of covers is now satisfactory and Vigna which existed formerly in poor patches has thoroughly established itself. A hole-to-hole survey was made by a licensed Surveyor for the purpose of the layout of the various experimental blocks. With the advent of the S. W. Monsoonal rains in June, planting out of dormant budded stumps from the Dartonfield nurseries of two imported clones, Tjirandji 1 and Bodjong Datar 5, and two local clones, Wawulugala 259 and Hillcroft

28, was carried out in the four experimental blocks. Planting was completed in June except for barrier trees of W. 259 for which there were insufficient stumps; the deficiency was made good in August. Contrary to the former practice of allowing stock shoots to grow for some time before forcing the bud to sprout, the stumps were "ringed" at the time of planting. Stocks were cut back early in August and a census showed a high percentage of casualties as a result of the hot dry weather experienced in July. The number of dead stocks was small, the damage consisting almost entirely of the drying out of the bud-patch. In order to obtain uniformity of growth within the experimental plots, plants with growing budshoots (up to 6 in. or just sprouting) were transferred from "barrier" rows into the plots. Material was short for replacement of all supplies from the nursery, hence basket seedlings were supplied to the remaining vacancies in the "barrier" rows with a view to subsequent budding in the field.

The position of the planting is indicated by the following census taken in December :—

Block	Dead	Unsprouted	Sprouted	Basket plants	Total
Tj. 1 ...	2	21	300	46	369
B.D. 5 ...	—	27	144	151	322
W. 259 ...	4	135	181	—	320
HC. 28 ...	—	31	145	185	361

1936 Replanting.—In connection with an experiment designed to compare methods of opening, an area of approximately ten acres has been taken in hand for replanting. Preliminary operations were started in November. Lining was done 20 ft. apart on the contour with a spacing of 15 ft. between the holes. Holing has been finished, the dimensions of the holes cut being $2\frac{1}{2}$ ft. $\times 2\frac{1}{2}$ ft. $\times 3$ ft. deep. Uprooting of the old rubber by elephant was also completed and cutting and stacking of timber prior to burning is now in progress.

BUILDINGS.

The programme under this head has been a comprehensive one.

Bungalows.—The Superintendent's bungalow and two junior staff bungalows were completed and occupied by the respective officers. Another two junior staff bungalows have just been handed over for occupation. A contract for two more bungalows of a similar type has been given to the same contractor. The sites were prepared for both and excavation of foundations for one building has just been concluded.

Construction of the Chemist's and Assistant Botanist's bungalows was started in September and good progress has been made.

Minor Buildings.—In this connection a firewood shed, a four-bay open motor shed, a liquid fuel shed, Engine-driver's quarters and a building block comprising a Dispensary, Tool store and Rice store were erected.

Laboratory.—A site for the Botanical Laboratory block was prepared and handed over. Excavation for foundations has been completed and building materials are being transported to the site.

General.—The Experimental Factory and Laboratory were officially opened on February 25th by His Excellency Sir R. E. Stubbs, Governor of Ceylon.

The appointment of an Estate Visiting Agent was made during the year and two visits were made, one in June by Mr. P. R. May, the permanent visitor, and another in September by Mr. D. T. Angus the acting Visiting Agent during the absence of Mr. May from the Island, on furlough.

NIVITIGALAKELE EXPERIMENT STATION.

Rainfall.—146·34 inches.

Test Tapping.—A few additional clones were introduced into the number hitherto being tapped experimentally for yield records. The number of clones in test-tapping is 38, the total number of trees including marcots and a few seedlings, being 560. Monthly collection of the biscuits is made and dried and weighed at Dartonfield. It has been decided to take a small area into commercial tapping during 1936, and in this connection plans and estimates for a coagulating shed and a small-holders type of smoke house have been drawn up. Test-tapping will be continued as at present.

The marked variation in the time of wintering of different clones necessitated a somewhat longer period of rest.

Nurseries.—The budding of seedling stocks was undertaken in April to provide planting material for the Pinnagoda clearing. Satisfactory results were obtained with the buddings, which were subsequently transferred into the clearing. Provision was made for possible future supply requirements for each clone.

All nurseries have received regular attention and manuring where necessary. 1,154 yards of budwood of imported clones from the Small-holders' and Budwood multiplication nurseries were sold to Estate Superintendents or Proprietary owners. The cut plants of certain selected clones growing within close proximity of each other were transferred into the budwood multiplication nursery of the Pinnagoda clearing. The remainder have received an application of an organic mixture at ½ lb. per plant.

Manuring.—Manuring was commenced in September and completed in November after a short stoppage during the hot dry weather of late September and early October. The programme of work under this head

consisted of the treatment of the total acreage of the old clearings with a fertiliser mixture of Calcium Cyanamide, Basic slag, Saphos phosphate and Muriate of potash at the rate of 400 lbs. per acre, together with the incorporation of green manures. The procedure adopted was the same as that carried out in previous years except that forking and application was confined mainly to the area between the platforms. In steeper land, where this method was not feasible, application was restricted to the platform itself.

Cover Crops.—An attempt has been made recently to establish Pueraria in the bare patches of the 1926 clearing. Cuttings in two forms, those raised in coconut husk and ordinary cuttings, were tried out with little success. The latter procedure was the more successful. It is hoped, however, that, with the beneficial results which can be expected from the recent manuring, there will be no difficulty in promoting the successful establishment of this cover. In relation to this it may be of interest to add that seed was tried out in specially prepared seed beds at intervals along the edges of the contour platforms with very poor results.

The ground cover in certain other areas is becoming thinner as the shade of the young trees increases.

Fences.—Extensive repairs to fences were effected and a number of posts replaced.

Weeding—has been maintained throughout in very good order.

NEW CLEARING PINNAGODA.

The Surveyor's figures show that the exact areas dealt with are as follows :—

Clearing	...	28 acres
Budwood nursery	...	6½ ,,
Seedling nursery	...	1 ,,
Swamp areas	...	½ ,,
	Total	36 acres

A light burn was carried out early in January after felling in the preceding month. The smaller unburned portions of timber were subsequently restacked and burned and the bigger logs were removed by the contractor, in accordance with the terms arranged for clearing the land.

Lining was started on the contour allowing for holes 4 ft. long × 2½ ft. broad × 3 ft. deep at distances 16 ft. apart. The intervening space provided for a trench of similar dimensions but 9 ft. in length with an 18 in. bund on each side of it. The contours were 20 ft. apart. In about half the area the contours were broken wherever they became more than 20 ft. or less than 15 ft. apart, and in the other half the contours were run as continuously as possible and intervening contours inserted later. Holing was then carried

out on the lines indicated above and filling completed after the dynamiting of rocky and hard bottomed holes. The cutting of trenches and sowing of cover crop seed followed.

Planting was commenced with the rains in the second week of June. Special seedlings of known origin were planted out in a compact area as detailed below :—

Origin		No. of Plants
Prang Besar Isolated plots	...	197
Tjikadoe seed garden	...	114
Heneratgoda 2 Isolated plot	...	46
Artificial pollinations	...	77
Sundry "illegitimate" seed of known female parentage	...	13
	Total	447

The remaining portion of the clearing was divided into plots of 25 trees each, one clone being allotted to each plot. The undermentioned untested Ceylon clones were planted as budded stumps, Clone A.V.R.O.S. 50 being planted as a standard of comparison in one plot out of six. 1,039 holes were planted with seed at stake, four to a point, with a view to subsequent budding in the field.

Clones.	No. of Plants.	Clones.	No. of Plants.
M. 3	... 25	AVROS. 50	... 25
HW. 6	... 25	DOR. 194	... 25
AVROS. 50	... 25	DOR. 4391	... 25
MGK. 4	... 25	KW. 2	... 25
MGK. 11	... 25	CL. 11	... 25
MGK. 22	... 25	ERN. 22	... 25
MGK. 25	... 25	MLD. 17	... 25
PM. 13	... 25	EG. 2	... 25
AVROS. 50	... 25	GK. 3	... 25
PM. 17	... 25	GB. 3	... 25
EG. 1	... 25	AVROS. 50	... 25
NW. 1	... 25	PANA. 11/119	... 30
ELK. 8A	... 25	PAR. 12	... 25
GLP. 1	... 25	TEM. 4	... 25
AVROS. 50	... 25	REM. 10	... 25
KEP. 6	... 25	AVROS. 50	... 25
Control 3	... 25	PM. 16	... 25
HC. 55—1 & 3	... 25	PDK. 5	... 25
CL. 8	... 29	KSD. 3	... 25

Budwood Multiplication Nursery.—This nursery was opened up in a sheltered area of the clearing. Lining was done on the contour allowing for trenches 18 in. wide × 18 in. deep at a spacing of 6 ft. apart. Additional lines were fitted where two consecutive contours diverged to more than 10 ft. and the lines broken where they converged to within 5 ft. from one another. Trenching was carried out accordingly and the excavated earth utilised in the formation of a bund below the trenches. Filling was carried out in conjunction with trenching. *Crotolaria* seed was sown half way between the trenches. Planting was commenced on the completion of the earth-works. Three germinated seeds were planted 6 in. apart in the trenches at distances of every 4 ft. so that the middle seeds of each group were always 4 ft. apart. The groups thus represented aggregated 7,245, equivalent to 21,735 seeds planted out. The greater portion of this area has been divided into 12 blocks, each to contain 500 plants. Available buddings of 12 selected clones from the nurseries on the station have been transferred to specially prepared holes between groups of seedlings in each respective block. These will form a part of the permanent suppliers of budwood whilst the remaining seedlings in the blocks will be budded. The planting done in this connection is as follows :—

Block		Clone	Total No. of Plants
1	...	SAB. 24	45
2	...	B.D. 5	48
3	...	P.B. 86	32
4	...	P.B. 183	25
5	...	P.B. 186	77
6	...	T.K. 12	20
7	...	T.K. 26	15
8	...	S.R. 9	21
9	...	TJ. 1	54
10	...	GLS. 1	57
11	...	RUB. 393	26
12	...	AVROS. 49	16
		Total	436

Seedling Nursery.—A swamp area of just over an acre in extent was drained and opened for the establishment of a stock nursery. Level beds each 11 ft. wide were prepared and planted with germinated seed 6 in. apart in rows 1 ft. from each other at intermediate distances of 2 ft. The seed put out in this nursery totalled 30,775.

D. L. NICOL,
Superintendent.

Dartonfield Estate,
Agalawatte, 16th January, 1936.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1935.

The Committee and Technical Sub-Committee held four meetings during the year.

Membership of the Committee.—Mr. S. F. Ashby succeeded Dr. E. J. Butler on retirement of the latter as Director of the Imperial Mycological Institute on 30th September.

In August Lieut-Col. Sir David Prain found it necessary for reasons of health to ask to be relieved of his position as representative of the Ceylon Government. At the close of the year no information had been received as to the name of his successor.

Professor R. G. H. Clements was appointed an additional member of the Technical Sub-Committee.

The following members of the Boards of the Rubber Research Institute, Malaya, and the Rubber Research Scheme, Ceylon, and of the Research Staffs in Malaya attended meetings of the Committee during the year :—

Board, Ceylon Rubber Research Scheme.—Dr. W. Youngman, Mr. B. M. Selwyn and Lieut-Col. T. Y. Wright.

Board, Rubber Research Institute Malaya.—Mr. A. P. Cranna and Mr. J. C. Innes.

Staff, Rubber Research Institute Malaya.—Dr. E. C. Rhodes, Mr. C. E. T. Mann, Mr. R. P. N. Napper, Mr. C. G. Ackhurst, Mr. J. H. P. Piddlesden and Dr. K. C. Roberts.

Dr. Roberts and Mr. Piddlesden worked for a short period in the London Laboratories before taking up their appointments in the Chemical Division of the Rubber Research Institute.

Appointment of Staff in Ceylon and Malaya.—At the request of the Director of the Rubber Research Institute steps were taken by the Committee to select candidates for three vacancies for Chemists and two for Botanists on the staff of the Institute.

The advice of the Committee was sought by the Government of the Federated Malay States with regard to the appointment of a new Director of the Rubber Research Institute in place of Col. Eaton who expressed his intention to retire from Malaya on the expiration of his present term of appointment in February, 1936. The Committee suggested that the

offer of Col. Eaton to remain in the post until June should be accepted in order to ensure that adequate time may be available for making satisfactory selections for filling the vacancy. The suggestion was approved and in accordance with the authority requested from the Government, the post was advertised towards the close of the year.

At the request of the Rubber Research Scheme (Ceylon) the Committee advertised the appointment for an Assistant Botanist on the Staff of the Scheme and selected and submitted the names of the three most promising applicants.

Finance.—The expenditure incurred in connection with the work of the Committee during the year amounted to £2,994 3s. 7d. After allowing for reserve for plant and for liabilities outstanding, there was an unexpected balance at 31st December, 1935 of £700 of the general funds and of £489 of the special grant of £1,000 per annum for rubber roadway investigations received from the Rubber Research Institute, Malaya. There were also at that date balances of £108 14s. 4d. held on behalf of the Rubber Research Institute of Malaya and of £170 17s. 4d. held on behalf of the Ceylon Rubber Research Scheme from the funds supplied by them to meet expenditure incurred on their behalf.

The Boards of the Rubber Research Scheme (Ceylon) and the Rubber Research Institute, Malaya agreed to the proposal of the Committee that they should continue their existing contributions of £1,400 a year each to the expenses of the work in London during 1936, subject to any other arrangements which may be made by the International Rubber Regulation Committee for financing rubber research in this country during the year. The Ceylon Rubber Research Scheme indicated, however, that no future contribution would be made to a joint scheme of work in London except on a basis proportionate to the acreage of rubber in Ceylon.

Rubber Roadways Investigation.—As stated in the Report for 1934 the Board of the Rubber Research Institute adopted in principle the proposal of the Committee that staff should be appointed to carry out in the London Laboratories a systematic study from the rubber standpoint of the preparation and properties of latex mixtures for roadways, pavements and floorings. During the year information was received that the Board had approved an annual grant of £1,000 for three years for this purpose. Two additional assistants were accordingly appointed :—

Mr. W. G. Wren, B.Sc., A.R.C.S. (Physical Chemist) who had previously been working on highway surfacing problems under Professor R. G. H. Clements at the City and Guilds Institute; and Mr. A. T. Faircloth who had for many years been in charge of cement testing at the Imperial Institute.

Work was only commenced in June and progress has been made in a study of the fundamental properties of latex-cement mixtures towards devising a suitable mixture for road surfacing. The microscopical, chemical and mechanical tests all indicate that, contrary to expectations, cement does not always combine chemically to an appreciable extent with the water in latex.

The results so far obtained have been discussed personally with representatives of the Building Research Board and arrangements made for contact to be maintained with the Board throughout the investigation.

Co-operation with the Rubber-Growers' Associations' Technical Research Committee.—Full co-operation and *liaison* was maintained with the Rubber-Growers' Association throughout the year and the *liaison* Association's technical officer paid several visits to the Committee's Laboratories during the year.

The investigations on rubber crumb for which funds are provided by the Association's Technical Research Committee were principally concerned during the year with the incorporation of crumb with asphalt. After a number of private trials a small section was laid on the public highway by the Limmer and Trinidad Lake Asphalt Co. last summer and very encouraging reports have been received as a result of the trial. This roadway has a very good sandpaper surface which may be due to the rubber preventing the flow of bitumen and polishing by traffic, and proposals for the laying of further trial sections during 1936 are at present under discussion with the Limmer and Trinidad Lake Asphalt Co.

Rubber crumb was tried by the Ahphalt Co. in several areas for use in white traffic lines. In view of their satisfactory behaviour a large number of additional orders has been received by the Company and the Rubber Research Scheme (Ceylon) was asked to prepare a large consignment of crumb to meet their requirements.

Attention was also given to the incorporation of rubber crumb with other products. Some of these are promising, but none has yet reached the commercial stage.

Co-operation with other Organisations.—Mr. Martin continued to serve as a representative of the Research Association of British Rubber Manufacturers on the Joint-Committee of that Association and the British Electrical Research Association dealing with the quality of ebonite. The investigations have now reached a stage at which experimental consignments are being prepared in the East for trials by manufacturers.

Mr. Martin also served as a representative of the Rubber-Growers' Association on the Committee for standardisation and co-ordination of tests for rubber of the British Standards Institution. Among the subjects under consideration by the Committee is the testing of latex and of unvulcanised

rubber. Suggestions have been put forward for the consideration of the British Standards Institution and in addition a detailed statement of the methods employed by the Committee is being prepared for publication.

As a result of the visit by Dr. E. Rhodes to the United States of America in 1935 the Rubber Division of the American Chemical Society appointed a Crude Rubber Committee to act as a clearing house for information on the quality requirements for crude rubber and latex. Co-operation between this Committee and the London Advisory Committee has been arranged and the principal reports issued in London are forwarded regularly to the Crude Rubber Committee for comments and criticism.

Patents.—Abstracts of English patent specifications in respect of inventions relating to processes for the preparation and/or utilisation of raw rubber and latex were made for the information of the Rubber-Growers' Association, the Rubber Research Scheme (Ceylon) and the Rubber Research Institute, Malaya, and attention was drawn to claims which appeared to lack novelty and to cases where the grant of a patent would be likely to be prejudicial to the interest of the rubber-growing industry.

In conjunction with the Rubber Producers' Research Association steps were taken to obtain English patents in connection with inventions arising out of the work of the Staff in London and the East.

Applications Sealed During 1935.

428,100.—A process for obtaining homogeneous dispersions of unvulcanised rubber in tar which previously could not be obtained.

433,303.—A process of concentrating latex whereby concentration is obtained without the use of protective colloids.

Complete Applications Accepted During 1935 and Awaiting Sealing.

437,758.—A process for creaming latex by the use of alkylated starch.

Complete Applications Filed During 1935.

1275/35.—A process for creaming latex by means of hemicelluloses extracted from a variety of vegetable materials.

4529/35.—Modification of process of concentrating latex described in Patent Specification No. 433,303.

Provisional Specification Filed During 1935.

13,032/35.—Chlorination of nitrite crumb (in conjunction with work on modified rubbers being carried out at Imperial College of Science for Rubber Growers' Association).

Investigations.—No fresh schemes of work were initiated during the year, but steady progress was achieved in the various lines of investigation described in detail in the Report and the technical appendix for the year 1935.

Priority was again given to problems relating to the use of latex as distinct from raw rubber problems. Useful progress was recorded in (1) devising colour standards for latex; and (2) concentrating latex by evaporation. A wide variety of data were collected as to the value of hemicelluloses as creaming agents of latex.

Mr. H. C. Baker spent one term working at Birmingham University with Professor W. N. Haworth studying the preparation of new types of creaming agents for latex, previously discovered in the Committee's laboratories. A wide range of samples has been prepared and sent to the rubber research staffs in Ceylon and Malaya for practical trials.

Some areas of budded rubber are now being tapped and an increasing amount of time will have to be devoted to the examination of rubber from these clones. Preliminary investigations have shewn considerable difference in plasticity and ageing properties, both of which are of importance to the rubber manufacturer. Tests on a large number of samples from various sources will, however, be necessary before any definite conclusions can be drawn as to the quality of clone rubber.

As in previous years, the staff in London co-operated with the Chemists in the East in the examination of samples prepared in connection with experiments in Ceylon and Malaya. A list of the reports furnished on these investigations and on others initiated in the Committee's Laboratories is given below. Further information as to the investigations completed and in progress during 1935 will be found in the technical appendix to this Report.

P. J. BURGESS,
Chairman.

J. A. NELSON,
Secretary.

Imperial Institute,
London, S. W. 7.
May, 1936.

REPORTS ON INVESTIGATIONS FORWARDED TO CEYLON AND MALAYA DURING 1935.

Investigations connected with the study of methods of preparing a soft rubber suitable for manufacturing purposes.

(1). Softened rubber.

(2). Physical properties of rubber-bitumen mixtures.

Clone Rubber.

(1). Clone rubber.

Water absorption experiments.

(1). Effect of conditions of testing on the results of water absorption tests.

(2). Preparation of rubber with low water absorption for electrical purposes.

(3). Water absorption experiments.

Experiments on the preservation of latex.

(1). Preservation of latex with mercuric cyanide.

(2). Preservation of latex with chemicals other than ammonia.

Latex testing and specification.

(1). Development of latex specification.

Creaming of latex.

(1). Creaming agents.

(2). Homogenised latex.

(3). Experiments to determine the cause of variability in creaming of latex.

Latex containers.

(1). Latex containers.

Nitrite crumb.

(1). Properties of solutions of nitrite crumb in organic solvents.

(2). Nitrite crumb.

(3). Viscosity of nitrite rubber crumb solutions.

(4). Nitrite crumb.

Comparative vulcanising and ageing tests.

(1). Comparison of results of tests on clone rubber in Malaya and London.

(2). Testing of rubber.

(3). Comparison of results of tests in Rubber Research Institute, Malaya and London Advisory Committee Laboratories.

Special forms of rubber.

(1). Rubber prepared from field latex by coagulation with magnesium chloride-sodium silicofluoride mixtures.

(2). Rubber from centrifuged skim latex.

(3). Patterned para.

TECHNICAL APPENDIX TO REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON & MALAYA)

LATEX.

(1). **Specification and Testing.**—Reference was made in last year's Report to a proposal for a conference to discuss the technological problems relating to quality involved in devising tests for inclusion in a trade specification for latex. A Conference attended by representatives of producing, manufacturing and commercial interests was held at the Imperial Institute in July to discuss various methods of testing collected by the staff. The discussion indicated that no difficulty was likely to be experienced in standardising chemical tests for dry rubber content total solids and alkalinity, but the Conference concluded that much more work is necessary before physical tests for colour and stability can be standardised.

A useful suggestion with regard to the preparation of colour standards for liquid latex was received from a member of the Rubber Trade Association and has since been developed by the staffs of the Dunlop Rubber Co. and of the Committee.

A series of colour standards was prepared from mixtures of titanium dioxide, carbon black, cadmium sulphide with a sodium silicate binder for submission to the Rubber-Growers' Association.

Little attention has yet been paid in the Committee's laboratories to the determination of the colour of dried latex films which is of considerable importance in connection with the manufacture of dipped goods and which according to a member of the Conference and to information supplied by the staff cannot be correlated accurately with the colour of liquid latex. Useful suggestions were received from the staff of the Dunlop Rubber Co. and it is hoped to devote more time to the subject during 1936.

The opinion was expressed at the Conference that a specification for the quality of latex should include a test for stability. Several tests were considered but absence of fundamental knowledge concerning the factors involved prevented the Conference arriving at a definite decision. In view of the further work required the problem was referred to a Sub-Committee to arrange details.

Particular attention has been given in the Committee's Laboratories to a stability test which involves stirring in the presence of zinc oxide, and a study has been commenced of a number of factors likely to affect the accuracy of the results. Information has been obtained indicating that coagulation under the conditions of the test is due partly to the chemical

action of zinc oxide and partly to the mechanical effect of stirring. It is desirable that these two factors should be studied separately, and investigations are in progress along these lines. One of the chief difficulties in drawing practical conclusions from the results of this test is that chemical and mechanical stability of latex are partly dependent upon alkalinity and dry rubber content and can be considerably increased by the addition of well-known protective colloids.

Microscopic observations in the Committee's Laboratories indicate that most samples of latex show a slight aggregation of rubber globules on arrival in this country, possibly owing to delay in adding ammonia on the estate or to imperfect preservation. Although there is no doubt that the aggregates can be stabilised and prevented from increasing in size by the addition of protective colloids, their presence must affect the uniformity of mixtures of latex and compounding ingredients and is therefore of some technical importance. It has not yet been established experimentally that slight aggregations are irreversible, but large aggregations amounting to minute clots of coagulum in the latex cannot be dispersed and it is therefore concluded that a test for aggregation may be of more importance than one for chemical and mechanical stability which can be easily modified by the user to suit his own requirements. Experiments are in progress with a view to obtaining a reliable microscopic method of determining degree of aggregation. Such a method would be unsuitable probably for incorporation in a latex specification for the general use of the latex trade, and consideration is therefore being given to sieving tests which are unfortunately less sensitive than microscopical examination, but may, nevertheless, serve a useful purpose.

It is customary to add 0·5 per cent ammonia (expressed as NH for the preservation of field latex. The Conference agreed that data provided by Dr. Rhodes indicated that the amount was inadequate for field latex containing 40 per cent and less dry rubber and recommended that the addition of 0·75 per cent should be standardised. This recommendation was forwarded to the Rubber-Growers' Association.

(2). **Concentration.**—The experiments on the concentration of latex referred to in the last report have been continued.

(a). *Creaming.*—An examination of the properties and constitution of gum tragacanth (in relation to the literature references as to its constitution), which is an efficient but somewhat unreliable creaming agent, led to a study of the effect on creaming of the alkylation of a number of complex carbohydrates. Of the compounds studied only alkylated starch and dextrine were found to be creaming agents.

During the study of the creaming properties of alkylated carbohydrates creaming experiments were made with the caustic soda extracts of cereal straws. The extract was a good creaming agent and it was subsequently shown that the effect was not due to lignins which are alkylated carbohydrates but to the hemicellulose portion of the extract. As hemicelluloses are widely distributed in the vegetable kingdom the creaming properties of these materials from a large number of sources were tried. In nearly all cases they proved to be creaming agents, the most promising results being given by the materials extracted from linseed cake meal and brewers' grains.

In view of the complex nature of the carbohydrates under investigation, arrangements were made for Mr. H. C. Baker, who had carried out the previous work on the subject, to work for a time at Birmingham University in the Chemical Laboratory directed by Professor W. N. Haworth, who is a recognised authority on the constitution of carbohydrates and on the methylation of starch.

Mr. Baker showed that starches containing between 7 and 24 per cent methoxyl were relatively efficient creaming agents.

A large number of methylated starch and hemicellulose creaming agents were prepared at Birmingham and in the London Advisory Committee Laboratories and samples forwarded to Ceylon and Malaya for tests on the creaming properties of freshly preserved latex in the East.

While at Birmingham Mr. Baker examined the creaming properties of a large number of carbohydrates and obtained positive results with two pure carbohydrates, namely lichenin, which is similiar in constitution to cellulose but of smaller molecular size, and mannan which is a polymer of mannose anhydrite. He concluded that the capacity to cream latex was largely dependent on the physical nature of the creaming agent.

Towards the end of the year a study was commenced of the rate of creaming of latex in vessels of different dimensions and of the concentration gradient in the cream layer after various periods. The results so far obtained indicate that modifications in the design of the creaming tanks at present employed in the East should improve a little the rate of creaming and the degree of concentration obtained.

(b). *Evaporation.*—A laboratory apparatus for concentrating latex to 70 per cent dry rubber content without the addition of protective colloids was devised during 1934 and further developed in 1935.

The apparatus has proved its value as an aid to research and a similar apparatus capable of holding 10 gallons of latex was almost ready for despatch to the Rubber Research Institute at the end of the year.

(c). *Centrifuging.*—A demonstration of a new type of centrifuge was attended by the staff towards the end of the year but it was evident that mechanical improvement was necessary before the machine would be suitable for continuous use in the East.

(3). **Preservation.**—By general consent ammonia is the most satisfactory preservative of latex at present known, but it has some disadvantages, one being price and another its effect on the mucous membranes of the eye and nose, particularly when handled on a large scale under conditions where the vapour escapes freely into the atmosphere.

Samples preserved at the Rubber Research Institute with disinfectants arrived in London in a fluid condition, but were somewhat thick and pasty. The addition either in the East or in London of a quantity of ammonia (less than that required for preservation) reduced the viscosity of these latices to a value approaching that of ammonia-preserved latex.

The samples gave satisfactory results on test and are regarded as promising, but the poisonous nature of the disinfectants used is a marked disadvantage. In addition the ultimate products display differences in behaviours from those from ammonia-preserved latex.

(4). **Road-Surfacing and Flooring Materials.**—An investigation was commenced in June with a view to obtaining a road surfacing or flooring material from latex. In view of the partial success already achieved by the Rubber Research Institute and elsewhere with mixtures of latex and aluminous cement, attention was devoted in the first place to a study of the phenomena which occur during the setting of these mixtures. The investigations so far carried out indicate that (1) protective colloids (some of which are natural constituents of latex and others added to improve stability) retard and sometimes prevent the combination of the usual amount of water with cement so that in some circumstances the bulk of the water remains in the mixture in a free condition except for loss by evaporation. (2) Potash and gum arabic hasten the setting of cement, but most protective colloids delay and sometimes prevent the setting. The effect is markedly dependent upon the amount of protective colloid used. (3) Different types of material can be obtained with the same proportion of latex and cement according to the material used to stabilise the latex. (4) A mixture of latex and cement after setting consists of comparatively large particles of unhydrated cement surrounded by a matrix which must contain the rubber and the hydration products of cement and water.

Although cement may not appreciably dehydrate latex it serves a useful purpose in causing the latex to set. It is evident however that previous ideas regarding the necessity of adding sufficient cement to combine with the water in latex require further consideration.

RUBBER.

(1). **Nitrite Crumb.**—(B.P. 395,775). Reference was made in the previous Report to preliminary road surfacing trials with "cold" asphaltic mixtures containing nitrite crumb and to arrangements which were made for laying a section of the public highway with the mixture giving the best results. The asphaltic cement containing rubber was prepared in the Committee's Laboratories by a method developed by the staff and used to coat aggregate on the site, the total area covered being about 400 sq. yds. At the end of the year (7 months after laying) the road had a good matt non-skid surface, possibly due to the rubber preventing the flow of bitumen and polishing by traffic. In the opinion of the scientific staff of the Limmer & Trinidad Lake Asphalt Co. who collaborated in the work the results are sufficiently promising to justify further trials on a more extensive scale.

Towards the end of the year a paper was compiled by Mr. W. W. Davey (Journal of the Society of Chemical Industry, March 6th, 1936, Vol. LV, No. 10, pp. 43T-48T.) on the effect of different types of crumb rubber and latex on the properties of asphalt after different periods and temperatures of heating. It was shown that rubber improves the properties of asphalt but the improvement becomes less marked with the period and temperature of heating. The solution of rubber in asphalt in the "hot" process would therefore yield variable products unless precautions were taken to standardise the period and temperature of heating. This is not practical on a large scale.

The use of nitrite crumb in combination with other substances for traffic lines continued during the year. The mixture has so far given satisfactory results and there is a tendency for its use to increase.

Experiments by Messrs. Farmer and Bloomfield, who are investigating modified rubber for the Rubber-Growers' Association showed that a sample of nitrite crumb had advantages in the preparation of chlorinated rubber, owing to the ease with which solutions of low viscosity were obtained. Further experiments showed that a subsequent consignment was not so suitable. The difference in the results obtained is ascribed to a change in the method of preparing the crumb; in order to facilitate production, and chlorination experiments are now in progress with crumb prepared by modifications of the usual method. It is difficult during the development stage

to standardise the method of preparing the crumb and it may be necessary eventually to compromise between the method found to be most convenient in the East and that which furnishes the most suitable crumb for different manufacturing purposes. The problem will be discussed with the Director of the Rubber Research Scheme (Ceylon), during his period of leave in 1936.

A study of the viscosity of solutions of the crumb in various solvents and the effect of different methods of preparation was made in the Committee's laboratories. It was shown that the method of preparation originally adopted gave thin solutions and that the viscosity of the solution could be reduced markedly by heating for about 1 hour at above 80°C. or by adding a small quantity of piperidine. This information was used in the preparation of paints containing rubber and the problem discussed with a paint manufacturer who is carrying out laboratory experiments.

As the crumb can be easily dissolved in butyl acetate it was mixed with solutions of nitrocellulose and bakelite resins in the same solvent but in spite of the common solvent, difficulty was experienced in obtaining uniform and intimate mixtures of rubber dispersed in resin or nitrocellulose.

It was found that the crumb can be easily dissolved in waxes to give materials which are less brittle than wax and which adhere better to metal or wood surfaces. The use of the crumb to improve the properties of wax is now under consideration.

References were made in the last Report to the massing of crumb during transit. Samples were received dusted with various amounts of french chalk and zinc stearate respectively. Those dusted with zinc stearate showed less tendency to mass than the others and consignments are now dusted with this material.

TYPES OF RUBBER REQUIRED BY MANUFACTURERS.

As explained in previous reports there is a demand for very soft rubber and also for rubber with low water absorption. Experiments on their production have been made previously in the East and in London but owing to a number of circumstances little attention has been given to the problem during the year. Methods to be employed were discussed with Dr. Rhodes while on leave and arrangements made for further experiments.

Dr. Stevens suggested that it would be of interest to determine the effect of the addition of copper and cobalt compounds to latex prior to coagulation with a view to obtaining a material which would be of value for purposes not connected with the rubber manufacturing industry. Tests on the rubber in London showed that cobalt sulphate had no appreciable effect on the properties of the rubber but confirmed that copper sulphate caused marked softening.

Some difficulty has been experienced in assessing the value of various treatments devised by the Rubber Research Institute for preparing rubber with low water absorption because the same test gave different results in Malaya and London. The problem was discussed at a meeting attended by representatives of the Electrical Research Association, the Research Association of British Rubber Manufacturers and Dr. Rhodes. The latter pointed out that American rubber manufacturers used a different method. The discussions indicated that there were good reasons for preferring the method adopted and it was decided not to make any change.

Factors which might affect the results of tests were studied with a view to determining the cause of discrepancies in London and Malaya. It was shown that the thickness of the test specimens (within the limits of the experiments), the age of the rubber and the temperature of testing had little effect. Some evidence was obtained however that it was necessary to maintain a uniform temperature throughout the test as there was a lag in the humidity of the moisture chamber with variation in temperature. Experiments are now conducted in London at $85^{\circ} \pm 1^{\circ}$F. and the results of tests are so far similar to those obtained in Malaya.

Samples of rubber were received from the Rubber Research Institute which had a low water absorption in accordance with the standard arbitrarily adopted at the above Conference. These were sent to the Research Association of British Rubber Manufacturers for examination in connection with their efforts to prepare ebonite with improved properties.

CLONE RUBBER.

In connection with the investigation in progress on the properties of clone rubber, samples of smoked sheet from five different clones were examined. They gave satisfactory results but it is undesirable to draw premature conclusions from or to publish the results of isolated tests. It is hoped to review the position when more samples have been examined from a range of sources and prepared under different conditions. Hitherto it has been difficult to obtain samples from mature trees planted on an extensive scale, but this difficulty is now disappearing and it is expected that an increasing amount of attention will be required to obtain full and authentic information concerning the quality of clone rubber.

TESTING OF RUBBER.

A comparison of the results of tests by the Goodyear Rubber Company and the Committee showed that identical samples of smoked sheet appeared to have much better ageing properties when tested by the Goodyear Rubber Company than when tested by the Committee. Mr. Patterson of the Goodyear Rubber Company, Wolverhampton, therefore kindly co-operated in a series of tests which eventually showed that the difference was due to the

treatments of the samples in the ageing oven, those in the Committee's laboratories being kept in motion and those in the Goodyear laboratories stationary. Both arrangements show the same relative differences between samples but the Committee's method is preferred by the staff because it is easier to obtain uniform conditions.

A further series of comparative tests were carried out, in which a comparison was made of ageing with different mixings, periods of vulcanisation, types of test specimens in ageing ovens and vulcanising pans. This involved a considerable amount of work both by the Goodyear Rubber Co., Wolverhampton and the Committee. The results obtained provided a large amount of data of value in standardising the methods employed for the testing of rubber.

A series of vulcanisation tests on samples of clone rubber were carried out in the Committee's Laboratories and those of the Rubber Research Institute. The samples examined in Malaya vulcanised about 20 per cent. more quickly than those in London but on the whole the samples displayed the same relative differences in both countries.

In view of the effect of atmospheric temperature on the results of mechanical tests on vulcanised rubber, the Schopper machine at the Imperial Institute has been housed in a small room maintained at $85^{\circ} \pm 1^{\circ}$F. It is expected that this arrangement will enable results to be obtained in this country comparable with those obtained in the East.

G. MARTIN
Superintendent of Rubber
Investigations.

Imperial Institute,
London, S. W. 7.
May, 1936.

AUDITOR-GENERAL'S REPORT FOR 1935.

The Chairman,
Board of Management,
Rubber Research Scheme,
Peradeniya.

Sir,

I have the honour to report that the audit of the accounts of the Rubber Research Scheme for the year 1935 has been completed and have pleasure in forwarding the following documents duly certified :—

(a) Income and Expenditure Account for the year 1935.

(b) Balance Sheet as at December 31, 1935.

I. Income.

2. The total income accrued during the year amounted to Rs. 173,347. It exceeded the estimate of Rs. 163,600 by Rs. 9,747, but fell below the revenue of the previous year by Rs. 72,822.

3. *Cess Collections.*—The amount accrued for the year was Rs. 154,396 inclusive of the collections made by the Principal Collector of Customs during December, 1935, but received in January, 1936. It exceeded the estimate of Rs. 140,000 by Rs. 14,396. The increase is due larger exports of rubber than anticipated.

4. *Interest.*—The amount accounted for during the year was Rs. 5,354. It exceeded the estimate of Rs. 5,000 by Rs. 354.

5. *Sale of Publications and Subscriptions.*—The amount realised for the year was Rs. 401 as compared with Rs. 410 during the previous year.

6. *Sundry Receipts.*—A sum of Rs. 521 was collected under this head for the year. It exceeded the estimate of Rs. 200 by Rs. 321. The increase is due to recoveries from estates in connection with sulphur dusting experiments.

7. *Profit from Dartonfield Estate.*—The total income from the estate for the year under review was Rs. 28,484. The expenditure incurred in working the estate amounted to Rs. 15,810, leaving a nett profit of Rs. 12,674. The Estate Returns in support of expenditure and Sale Statements of rubber in support of income were examined.

II. Expenditure.

8. The total expenditure on Revenue Account exclusive of the amounts allowed for depreciation on capital assets and for Passage Fund Reserve amounted to Rs. 114,036 as compared with Rs. 96,207 of the previous year. Details of this expenditure are fully set forth in the Income and Expenditure Account. The audited statements of expenditure by the London Committee in support of the contribution of Rs. 18,570 made by the Board have not

yet been received. The expenditure charged to Capital Account amounted to Rs. 89,973 inclusive of Rs. 9,452 spent on agricultural development, fencing and roads; Rs. 49,232 on the erection and furnishing of bungalows, water supply etc; Rs. 16,658 on vulcanising equipment, machinery etc., at Dartonfield Estate; Rs. 10,235 on the development of the Nivitigalakele Experiment Station and Pinnagoda New Clearing; and Rs. 4,397 on the purchase of laboratory apparatus and a typewriter.

9. A statement showing the excesses and unspent balances on votes with the explanation of the Director of Research for the principal variations is given below. Sanction for the excesses has to be obtained.

		Estimate	Actual Expenditure		Savings	Excess
			Rev. A/c.	Cap. A/c.		
		Rs.	Rs.	Rs.	Rs.	Rs.
I.	**Personal Emoluments:—**					
A.	1-4 Salaries of Technical Officers	48,103	48,232	—	—	129
	5 Salary of Secretary to the Director of Research	3,000	3,000	—	—	—
	6-11 Salaries of Subordinate Staff	6,048	5,679	—	369	—
	12 Rent Allowances	458	848	—	—	390
	13 Provident Fund Contribution	2,895	3,031	—	—	136
II.	**Other Charges:—**					
B.	14a Laboratory Upkeep, Chemicals and Apparatus	6,000	2,971	538	2,491	—
	14b Samples for London Experiments	500	21	—	479	—
	14c Dusting Experiments	7,100	3,019	2,968	1,113	—
	14d Routine tests on Chemicals	100	—	—	100	—
C.	15a Upkeep of Buildings	1,000	423	—	577	—
	15b Insurance	650	613	—	37	—
	15c Upkeep of water supply	500	388	—	112	—
	15d Upkeep of Roads	200	151	—	49	—
	15e Furniture Replacements	50	6	—	44	—
D.	16a Printing and Advertising	1,750	1,722	—	28	—
	16b Stationery	1,200	1,221	335	—	356
	16c Postages	1,500	1,302	—	198	—
	16d Books and Periodicals	600	741	—	—	141
	16e General Charges	1,932	1,807	—	125	—

		Estimate	Actual Expenditure		Savings	Excess
			Rev. A/c.	Cap. A/c.		
		Rs.	Rs.	Rs.	Rs.	Rs.
16f	Audit and Accountancy	450	486	—	—	36
16g	Telephones	1,200	1,206	—	—	6
17a	Travelling Expenses of Staff	5,000	8,233	—	—	3,233
17b	Travelling Expenses of Board Members	1,250	1,289	—	—	39
18	Nivitigalakele Upkeep Charges	6,522	1,788	3,381	1,353	—
19	Contribution to London Advisory Committee	18,900	18,570	—	330	—
20	Passage Fund Reserve	1,250	1,250	—	—	—
22	Depreciation	19,000	11,662	—	7,338	—
23	Dartonfield Experimental	9,256	7,282	—	1,974	—
III.	**Capital Expenditure:—**					
24a	Dartonfield Estate Cart Road	5,000	—	3,965	1,035	—
24b	Dartonfield Fencing	2,500	—	2,275	225	—
24c	Dartonfield Replanting 12 acres	2,616	—	2,636	—	20
24d	Dartonfield Upkeep of Immature areas	395	—	334	61	—
24e	Dartonfield Nurseries	450	—	242	208	—
24f	Dartonfield Minor Buildings	4,600	—	4,848	—	248
24g	Dartonfield Experimental Factory and Equipment	13,862	—	15,180	—	1,318
24h	Dartonfield Experimental Machinery	5,000	—	1,790	3,210	—
	Dartonfield Superintendent's Bungalow	10,497	—	10,364	133	—
	Dartonfield Sub-Staff Bungalows (5)	20,629	—	15,293	5,336	—
	Dartonfield Chemist's Laboratory	3,664	—	2,834	830	—

	Estimate	Actual Expenditure		Savings	Excess
		Rev. A/c.	Cap. A/c.		
	Rs.	Rs.	Rs.	Rs.	Rs.
Dartonfield Senior Staff Bungalows (2)	34,000	—	15,484	18,516	—
Dartonfield Water and Lighting Scheme	9,000	—	135	8,865	—
Dartonfield Botanist's Laboratory	19,000	—	519	18,481	—
Planting and Clearing Pinnagoda Land	7,700	—	6,853	847	—

A1-4. Increment under Mr. W. I. Pieris' new agreement (not provided for in estimate).
A6-11. Overestimate.
A12. Allowance for Assistant Botanist and Assistant Chemist.
A13. Contributions of Assistant Botanist and changes in salaries.
B14-A. Postponement of expenditure.
B14-B. Overestimate of requirements.
B14-C. Experimental dusting by aeroplane not carried out.
B14-D. No samples received for test.
C15 A. Economies.
C15-C. Economies.
C15-D. Economies.
C15-E. Economies.
D16-B. Purchase of a new typewriter.
D16-C. Overestimate.
D16-D. Purchase of books for Dartonfield laboratories.
D16-E. Overestimate.
E17-A. Mr. W. I. Pieris' Visit to Malaya: Sulphur dusting demonstrations on small-holdings: Increased advisory work.
F18. Increased revenue for rubber and budwood. Economies.
G19. Gain in exchange.
I22. Reduction in rates decided on by Board.
J23. Postponement of expenditure and appointment of staff.
K24-A. Overestimate.
K24-B. Work not completed, balance of vote to be carried forward.
K24-C. Area replanted 13 acres instead of 12: cost per acre lower than anticipated.
K24-E. New nursery not laid down.
K24-F. Extra cost of rice store foundations and verandah for dispensary and rice bin.
K24-G. Shipping and installation costs of experimental machinery higher than anticipated.
K24-H. Postponement of expenditure. Balance of vote to be carried forward.

Superintendent's Bungalow.—Motor shed not yet provided.

Sub-Staff Bungalows.—Bungalow No. 5 not completed; balance of vote to be carried forward.

Chemist's Laboratory.—Overestimate.

Senior Staff Bungalows.—Work not completed; balance of vote to be carried forward.

Water and Lighting Scheme.—Work not completed; balance of vote to be carried forward.

Botanist's Laboratory.—Work not completed; balance of vote to be carried forward.

Planting and Clearing Pinnagoda.—Adjustment in area opened and rocky nature of land.

III. Balance Sheet.

(*a*) *Liabilities.*

10. *Contribution to Capital Outlay—Rs. 482,561.*—This represents the amount spent on capital expenditure. A sum of Rs. 89,973 was spent during the year on Capital works and this amount *less* a sum of Rs. 41. realised by the sale of a gas mask was added to the balance of Rs. 392,629 brought forward from 1934 making a total of Rs. 482,561.

11. *Sundry Creditors — Rs. 9,584.*—So far as it can be ascertained all outstanding liabilities on December 31, 1935, have been brought to account with the exception of the cost of audit for 1935 amounting to Rs. 493·88.

12. *Depreciation Cash Reserve Account Rs. 37,786.*—The balance on December 31, 1934, was Rs. 26,124 and a sum of Rs. 11,662 has been transferred from revenue to this account during the year under review. This amount has been arrived at as follows:—

Culloden Estate.		
Buildings @ 4% on Rs. 41,350·87 ...	Rs.	1,654-03
Furniture, Fittings and Office Equipment @ 7½% on Rs. 5,913·36	,,	443-50
Water Supply @ 7½% on Rs. 1,516·34 ...	,,	113-72
Dartonfield Estate.		
Buildings @ 4% on Rs. 47,303·68 ...	,,	1,892·15
Furniture, Fittings and Office Equipment @ 7½% on Rs. 3,888·71	,,	291-65
Water Supply @ 7½% on Rs. 2,698 ...	,,	202-35
Machinery and Tools @ 7½% on Rs. 58,017·61	,,	4,351-32
Laboratory Apparatus Account @ 25% on Rs. 10,851·71 (Culloden and Dartonfield)	,,	2,712-93
	Rs.	11,661-65

13. *Provident Fund — Rs. 16,413.*—The balance on December 31, 1934, was Rs. 10,212. The contributions made by the officers during the year amounted to Rs. 3,179. The Board's contributions amounted to Rs. 3,031 of which Rs. 2,635 represented the bonus equal to the sum contributed by the members during 1934 and Rs. 396, the interest on the balances of the fund for 1934. A sum of Rs. 9·07 has been set off against the contribution of a member in respect of a like sum due to the Scheme from him.

14. *Reserve Fund for Passages.*—The balance on December 31, 1934, was Rs. 5,795. During the year a sum of Rs. 1,250 has been transferred to this Fund, bringing the balance to Rs. 7,045 as at December 31, 1935.

15. *Surplus Account — Rs. 199,646.*—The excess of income over expenditure during the year exclusive of capital expenditure was Rs. 46,399. The Capital Expenditure amounted to Rs. 89,973. The deficit for the year therefore was Rs. 43,574. This is deducted from the amount of Rs. 243,180 brought forward from 1934 and Rs. 41 being proceeds of one gas mask realised in 1935 reducing the surplus to Rs. 199,646 as at December 31, 1935.

(*b*) *Assets.*

16. **Culloden Estate.**

(1) *Buildings Account.*—The balance on December 31, 1934, was Rs. 53,040. No expenditure was incurred during the year on this account

(2) *Furniture, Fittings and Office Equipment — Rs. 9,467.*—The balance on December 31, 1934, was Rs. 9,132. A sum of Rs. 335 was incurred on the purchase of a typewriter, making a total of Rs. 9,467.

(3) *Water Supply — Rs. 2,404.*—This represents the amount brought forward from 1934. No expenditure was incurred during the year on this account.

17. **Dartonfield Estate.**

(1) *Property Account — Rs. 95,161.*—The balance on December 31, 1934, was Rs. 91,509. A sum of Rs. 5,800 representing the value of a Conductor's Bungalow and 22 line rooms included in the purchase price of the property has now been transferred to Buildings Account. During the year under review a sum of Rs. 9,452 has been spent, making a total of Rs. 95,161.

(2) *Buildings Account — Rs. 88,053.*—The balance on December 31, 1934, was Rs. 41,504. A sum of Rs. 40,749 has been spent on this account during the year in addition to a sum of Rs. 5,800 transferred from Property Account, making a total of Rs. 88,053.

(3) *Furniture, Fittings and Office Equipment — Rs. 9,115.*—The balance on December 31, 1934, was Rs. 3,889.—During the year a sum of Rs. 5,226 has been spent on the purchase of furniture etc., for the bungalows, factory and laboratories, making a total of Rs. 9,115.

(4) *Water Supply — Rs. 5,954.*—The balance on December 31, 1934, was Rs. 2,698. A sum of Rs. 3,256 has been spent during the year on the installation of water service to bungalows, laboratories etc., making a total of Rs. 5,954.

(5) *Machinery and Tools — Rs. 74, 676.*—The balance on December 31, 1934, was Rs. 58,018. A sum of Rs. 16,658 was spent on experimental machinery, vulcanising equipment etc., making a total of Rs. 74,676.

18. *Nivitigalakele.*—The balance on December 31, 1934, was Rs. 102,597. The expenditure under this head during the year amounted to Rs. 10,235 inclusive of Rs. 6,853 spent on Pinnagoda New Clearing and Rs. 3,382 spent on Agricultural Development making a total of Rs. 112,832 as at December 31, 1935. In this connection it is noted that a sum of Rs. 1,787·74 representing half share of general charges, and full expenditure on the upkeep of roads, bridges, drains, labels and experiments incurred on the development of the Nivitigalakele Experiment Station during the year under review has been charged to Revenue Account, whilst in previous years the total expenditure was charged to Capital Account.

19. *Laboratory Apparatus.*—The balance on December 31, 1934, was Rs. 16,504 and the purchases during the year *less* value of one gas mask sold amounted to Rs. 4,021, making a total of Rs. 20,525.

20. *London Plant — Rs. 11,333.*—This represents the balance carried forward from 1934. No depreciation has been allowed by the Board for 1935.

21. *Deposits — Rs. 141.*—The balance on December 31, 1934, was Rs. 75. An additional deposit of Rs. 66 was made during the year, making a total of Rs. 141 as at December 31, 1935.

22. *Sundry Assets at Culloden — Rs. 837.*—This represents the value of one Sulphur Dusting machine etc., retained for experiments during 1936.

23. *Sundry Assets at Datonfield Estate — Rs. 767.*—This represents the balance of the amount advanced for expenditure at Dartonfield estate and certain payments made in respect of 1936.

24. *Sundry Assets at Nivitigalakele — Rs. 267·47.*—This represents the balance of the amount advanced for expenditure at the Experiment Station.

25. *Sundry Debtors — Rs. 15,263.*—Of this sum Rs. 9,335 was due from the Deputy Financial Secretary on account of cess collections made during December, 1935. This was received from him in January 1936. Rs. 2,557 is the accrued interest to December 31, 1935, on Fixed Deposits which would mature during 1936. Rs. 3,178 was the amount due in respect of the crop for December, 1935, from the brokers and sellers. This amount was credited in January, 1936. Rs. 190 was the amount due on account of budwood sold at Nivitigalakele and Rs. 2·65 represents an overpayment to an officer of the Scheme. These amounts were recovered in January 1936.

26. *Equipment Advance Account.*—Of the sum of Rs. 12,162 advanced to the London Advisory Committee for the purchase of laboratory equipment, equipment to the value of Rs. 9,892 has been received during the year. There is still a sum of Rs. 2,270 to the value of which equipment will have to be supplied.

27. *Cash Account — Rs. 250,928.*—Receipts for the amounts lying in Fixed Deposit were inspected, the amount in current account was verified with reference to the Bank Certificate and the balance on hand on February 5, 1936, was verified.

IV. General.

28. *House Allowance.*—An officer of the Scheme was paid house allowance for the period he was sharing free quarters with another officer of the Scheme. I pointed out that the payment of house allowance in the circumstances was contrary to the principle followed in Government Departments and requested the Chairman to submit the matter to the Board of Management for its reconsideration. I was informed that the Board had no objection to this payment and that whilst as a guiding principle they generally followed Government regulations yet they were under no compulsion to do so. I see no justification for the payment.

29. The accounts were received quarterly and examined in this office. A departmental verification of all the inventory articles was held and a report was forwarded to this office. The offices at Neboda and Dartonfield Estate were inspected twice during the year. The books and accounts kept at these offices were checked and the cash balances verified.

I am, Sir,

Your obedient Servant,

O. E. GOONETILLEKE,
Auditor-General.

Audit Office,
Colombo, Feby. 26, 1936.

RUBBER RESEARCH SCHEME (CEYLON).

Working A/c. of the Provident Fund for the Year Ended 31-12-35.

1935.		Rs. cts.	1935.		Rs. cts.
Dec. 31.	To amount due by Mr. I. M. Wickramanayake on Postages Account transferred to debit of his own contribution to Provident Fund pending decision by Board	9 07	Jany. 1.	By Balance brought forward from 1934	10,212 14
	Balance carried forward to 1936	16,413 37		Board's contribution for 1934	2,634 76
				Interest for 1934 on Officers' contributions	226 46
				Interest for 1934 on Board's Bonus A/c.	170 11
			Dec. 31.	Members' contributions in 1935	3,178 97
		Rs. 16,422 44			Rs. 16,422 44

Audited and found correct:

(Sgd.) O. E. GOONETILLEKE,
Auditor-General.

Audit Office,
Colombo, 26th February, 1936.

(Sgd.) J. C. HUTSON,
Acting Chairman,
Board of Management,
Rubber Research Scheme, (Ceylon).

Income and Expenditure Account for the Year ended 31st December, 1935.

DR.			CR.		
To Personal Emoluments:—	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
Salaries of Technical Officers	48,232 39		By Cess Collections received January to November	145,060 22	
Salary of Secretary to the Director of Research	3,000 00		Cess Collections due for December	9,335 39	
Salaries of Subordinate Staff	5,679 32				154,395 61
Rent Allowances	847 55		Interest on Fixed & Current Accounts		5,354 45
Provident Fund Contribution	3,031 33		Sale of Publications & Subscriptions		401 28
		60,790 59	Sundry Receipts		520 80
Other Charges:—			Receipts from sale of Dartonfield Rubber	28,484 00	
Upkeep of Laboratory, Chemicals and Apparatus	2,971 31		*Less* expenditure on Dartonfield Normal Working	15,809 56	
Samples for London Experiments	21 33				12,674 44
Sulphur Dusting Experiments	3,018 97				
		6,011 61			
Upkeep of Buildings	429 90				
Insurance	612 93				
Upkeep of Water Supply	388 38				
Upkeep of Roads	150 60				
Furniture Replacements	6 24				
		1,588 05			
Printing and Advertising	1,721 88				
Stationery	1,220 78				
Postages	1,301 55				
Books & Periodicals	741 47				
General Charges	1,807,06				
Audit & Accountancy	485 69				
Telephones	1,205 97				
Travelling Expenses of Staff	8,232 96				
Travelling Expenses of Board Members	1,288 75				
		18,006 11			
Nivitigalakele Upkeep Charges		1,787 74			
Contribution to expenditure of London Advisory Committee for Rubber Research (Ceylon & Malaya)		18,569 94			
Passage Fund Reserve (Contribution)		1,250 00			
Dartonfield Estate Experimental Account		7,282 18			
Depreciation:—					
Culloden Estate:—					
Buildings @ 4% on Rs. 41,350·87	1,654 03				
Furniture, Fittings and Office Equipment @ 7½% on Rs. 5,913·36	443 50				
Water Supply @ 7½% on Rs. 1,516·34	113 72				
Dartonfield Estate:—					
Buildings @ 4% on Rs. 47,303·68	1,892 15				
Furniture, Fittings and Office Equipment @ 7½% on Rs. 3,888·71	291 65				
Water Supply @ 7½% on Rs. 2,698·00	202 35				
Machinery and Tools @ 7½% on Rs. 58,017·61	4,351 32				
Laboratory Apparatus Account @ 25% on Rs. 10,851·71 (Culloden and Dartonfield)	2,712 93				
		11,661 65			
Balance as per Balance Sheet, being exccess of Income over Expenditure for the year 1935.		46,398 71			
		Rs. 173,346 58			Rs. 173,346 58

Audited and found correct:

(Sgd.) O. E. GOONETILLEKE.
Auditor-General.

Audit Office,
Colombo, 26th February, 1936

(Sgd.) J. C. HUTSON.
Acting Chairman,
Board of Management,
Rubber Research Scheme (Ceylon).

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet at December 31, 1935.

LIABILITIES

	Rs. cts.	Rs. cts.
Contribution to Capital Outlay:—		
As per Balance Sheet, December 31, 1934.	392,628 57	
Less proceeds of one Gas Mask	40 80	
	392,587 77	
Additions during 1935	89,973 37	482,561 14
Sundry Creditors		9,583 51
Depreciation Cash Reserve Account:—		
As per Balance Sheet, December 31, 1934	26,124 27	
Add Depreciation allowed in 1935	11,661 65	37,785 92
Provident Fund Reserve Account:—		
As per Balance Sheet, December 31, 1934	10,212 14	
Additions during 1935	6,201 23	16,413 37
Reserve Fund for Passages:—		
As per Balance Sheet, December 31, 1934	5,795 06	
Additions in 1935	1,250 00	7,045 06
Surplus Account:—		
Balance of Income and Expenditure as per Balance Sheet, December 31, 1934	243,180 12	
Add Proceeds of one Gas Mask realised in 1935	40 80	
Add excess of Income over Expenditure for the year 1935	46,398 71	
	289,619 63	
Less amount transferred to Contribution to Capital Outlay	89,973 37	199,646 26
Carried over		Rs. 753,035 26

ASSETS.

	Rs. cts.	Rs. cts.
CULLODEN ESTATE:—		
Buildings Account:—		
As per Balance Sheet, December 31, 1934		53,039 99
Furniture, Fittings & Office Equipment:—		
As per Balance Sheet, December 31, 1934	9,131 83	
Additions in 1935	335 00	9,466 83
Water Supply:—		
As per Balance Sheet, December 31, 1934		2,404 32
DARTONFIELD ESTATE:—		
Property:—		
As per Balance Sheet, December 31, 1934.	84,137 36	
Less value of Conductor's Bungalow & 22 Line Rooms transferred to Buildings A/c.	5,800 00	
	78,337 36	
Expenditure on Agricutural Development as per Balance Sheet, December 31, 1934 1,585 98		
Add expenditure during 1935 3,211 70	4,797 68	
Expenditure on Fencing, Roads, Survey, etc., as per Balance Sheet, December 31, 1934 5,785 75		
Add expenditure during 1935 6,239 90	12,025 65	
		95,160 69
Buildings:—		
Factory— as per Balance Sheet, Dec. 31, 1934 27,841 70		
Additions in 1935 448 64	28,290 34	
Chemical Laboratory —as per Balance Sheet, December 31, 1934 9,401 97		
Additions in 1935 268 04	9,670 01	
Bungalows — as per Balance Sheet, Dec. 31, 1934 4,260 01		
Additions in 1935 39,614 73		
Amount transferred from Property Account 5,800 00	49,674 74	
Botanical Laboratory 1935	417 83	88,052 92
Furniture, Fittings & Office Equipment:—		
Factory — as per Balance Sheet, Dec. 31, 1934 619 33		
Additions in 1935 904 22	1,523 55	
Chemical Laboratory —as per Balance Sheet, December 31, 1934 3,269 38		
Additions in 1935 273 61	3,542 99	
Bungalows in 1935	3,947 32	
Botanical Laboratory 1935	101 40	9,115 26
Carried over		Rs. 257,240 01

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet at December 31, 1935.—*Contd.*

LIABILITIES	Rs. cts.	Rs. cts.
Brought forward	753,035 26	

ASSETS	Rs. cts.	Rs. cts.
Brought forward		257,240 01
Water Supply:—		
Factory —as per Balance Sheet, December 31, 1934	2,358 00	
Additions in 1935	127 50	
	2,485 50	
Chemical Laboratory —as per Balance Sheet, December 31, 1934	340 00	
Additions in 1935	1,219 00	
	1,559 00	
Bungalows 1935	1,774 54	
Water and Lighting Scheme 1935	135 25	5,954 29
Machinery & Tools:—		
Factory —as per Balance Sheet, December 31, 1934	35,137 80	
Additions in 1935	2,433 72	
	37,571 52	
Chemical Laboratory —as per Balance Sheet, Dec. 31, 1934	8,324 20	
Additions in 1935	516 99	
	8,841 19	
Vulcanizing Equipment —as per Balance Sheet, Dec. 31, 1934	14,555 61	
Additions in 1935	11,265 65	
	25,821 26	
Bungalows 1935	652 00	
Experimental Machinery 1935	1,789 92	
		74,675 89
NIVITIGALAKELE:— Property:—		
As per Balance Sheet, December 31, 1934	102,597 46	
Less value of Buildings transferred	27,437 11	
	75,160 35	
Add cost of Agricultural Development 1935	3,381 40	
Add Pinnagoda New Clearing	6,853 33	
		85,395 08
Bulidings:— Amount transferred from Property Account		27,437 11
Laboratory Apparatus Account:—		
As per Balance Sheet, Dec. 31, 1934	16,504 54	
Less proceeds from sale of 1 Puretha Gas Mask	40 80	
	16,463 74	
Add purchases during 1935	4,061 68	20,525 42
London Plant Account:— As per Balance Sheet, December 31, 1934		11,333 34
Carried over	753,035 26	Carried over 482,561 14

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet at December 31, 1935.—*Contd.*

LIABILITIES	Rs. cts.	ASSETS	Rs. cts.	Rs. cts.
Brought forward	753,035 26	Brought forward		482,561 14
		Deposits:—		
		With the Postmaster-General as per Balance Sheet, December 31, 1934	75 00	
		Additional deposits during 1935	20 00	
		With Messrs. The Imperial Chemical Industries (India) Ltd., as deposit on sulphur dioxide cylinder	46 00	
				141 00
		Sundry Assets at Culloden:—		
		Sulphur Dusting Scheme 1936 (Suspense)		837 11
		Sundry Assets at Dartonfield:—		
		Cash	118 35	
		Rice	68 25	
		Stores	337 51	
		Replanting 1936	206 15	
		Junior Staff Bungalows 1936	37 18	
				767 44
		Sundry Assets at Nivitigalakele:—		
		Cash		267 47
		Sundry Debtors:—		
		Cess Collections for December	9,335 39	
		Interest accrued on Fixed Deposits	2,556 59	
		Dartonfield Experimental Account	80 31	
		Nivitigalakele Sale of Budwood and Rubber	190 30	
		Overpayment to Staff	2 65	
		Profit from Dartonfield Estate	3,097 95	
				15,203 19
		Equipment Advance Account:—		
		(London Advisory Committee) Balance as per Balance Sheet, December 31, 1934	5,468 57	
		Remittance during the year and proceeds from sale of crumb rubber, etc.	6,693 52	
		Less value of equipment etc., supplied during the year	9,891 75	
				2,270 34
		Cash:—		
		In Fixed Deposit with Imperial Bank of India	30,000 00	
		In Fixed Deposit with Chartered Bank of India, Australia and China	90,000 00	
		In Fixed Deposit with Hongkong and Shanghai Banking Corporation	20,000 00	
		In Fixed Deposit with Mercantile Bank of India, Ltd.	25,000 00	
		In Fixed Deposit with National Bank of India, Ltd.	50,000 00	
		In Current Account National Bank of India, Ltd.	35,683 32	
		In hand	244 25	
				250,927 57
Total	Rs. 753,035 26			Rs. 753,035 26

I hereby certify that the Accounts of the Rubber Research Scheme (Ceylon) for the year 1935, have been audited and that in my opinion the above Balance Sheet correctly sets forth the position of affairs as shown by the books at December 31, 1935.

(Sgd.) C. E. GOONETILLEKE,
Auditor-General.

Audit Office,
Colombo, 26th February, 1936.

(Sgd.) J. C. HUTSON,
Acting Chairman,
Board of Management,
Rubber Research Scheme (Ceylon).

ESTIMATES FOR 1936.

(Adopted by the Board, November 7th, 1935.)

REVENUE STATEMENT.

		Rs. cts.
1.	Cess Collections	154,000 00
2.	Interest	4,000 00
3.	Sale of Publications	400 00
4.	Profit from Dartonfield Estate ...	12,000 00
5.	Sundry Receipts	200 00
		Rs. 170,600 00

EXPENDITURE STATEMENT.

		Rs. cts.	Rs. cts.
1.	**Personal Emoluments:—**		
	Salaries and Wages		69,059 00
2.	**Laboratory:—**		
	(*a*) Upkeep, Chemicals and Apparatus	5,000 00	
	(*b*) Samples for London Experiments	500 00	
	(*c*) Dusting Experiments ...	1,000 00	
	(*d*) Routine Tests on Chemicals	100 00	6,600 00
3.	**Buildings:—**		
	(*a*) Upkeep of Buildings ...	1,000 00	
	(*b*) Insurance ...	1,000 00	
	(*c*) Upkeep of Water Supply ...	350 00	
	(*d*) Upkeep of Roads ...	200 00	
	(*e*) Furniture Replacements ...	50 00	2,600 00
4.	**Office:—**		
	(*a*) Printing and Advertising ...	1,500 00	
	(*b*) Stationery ...	1,500 00	
	(*c*) Postages ...	1,500 00	
	(*d*) Books and Periodicals ...	600 00	
	(*e*) General Charges ...	750 00	
	(*f*) Audit and Accountancy ...	550 00	
	(*g*) Telephones ...	1,200 00	7,600 00
5.	**Travelling:—**		
	(*a*) Travelling Expenses of Staff	5,000 00	
	(*b*) Travelling Expenses of Board Members ...	1,250 00	6,250 00
6.	**Experiment Station (Nivitigalakele):—**		
	Upkeep Charges		3,661 00
7.	**Special Charges:—**		
	London Advisory Committee's expenditure ($\frac{1}{2}$ share)		18,900 00
8.	**Passage Fund Reserve:—**		1,250 00
9.	**Depreciation Account:—**		14,700 00
10.	**Dartonfield Estate:—**		
	Expenditure on Experiments		9,075 00
	Carried over		139,695 00

		Rs. cts.	Rs. cts.
	Brought forward		139,695 00

11. **Special Items of Expenditure on Capital Account:—**

Dartonfield Estate.—

Field Works etc.:—

(*a*) Extension of estate road ...		4,000 00	
(*b*) Replanting 10 acres, ...		2,050 00	
(*c*) Replanting ¼ acre ...		50 00	
(*d*) Upkeep of Immature Areas		929 00	7,029 00

Buildings:—

(*a*) Extension of Main Laboratory		17,000 00	
(*b*) One Senior Staff bungalow		17,000 00	
(*c*) Chief Clerk's bungalow ...		5,500 00	
(d) 3 Junior Staff bungalows ...		13,500 00	
(*e*) 8 Line-rooms ...		3,000 00	
	Rs. cts.		
Minor Buildings:—			
(*f*) Temple	316 00		
(*g*) Extension of motor-shed	144 00	460 00	56,460 00
(*h*) Experimental Machinery (latex centrifuge etc.)			5,000 00
(*i*) Apparatus for Assistant Botanist's Laboratory			3,000 00

Nivitigalakele:—

(*a*) Agricultural Development ...		5,240 00	
(*b*) Buildings ...		1,425 00	6,665 00
		Total	Rs. 217,849 00

Summary:—

Estimated total income	170,600 00
Estimated expenditure during 1936 ...	217,849 00
Estimated excess of expenditure over Income during 1936.	Rs. 47,249 00