REPORT OF THE WORK OF THE RUBBER RESEARCH BOARD IN 1934.

(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 present report is the 4th Annual Report of the Research Scheme, as constituted under the Ordinance.

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, by those concerned.

Mr. I. L. Cameron, April 25th — re-nominated for a further period of 3 years.

The Hon'ble Mr. F. A. Obeyesekere, M.S.C., May 29th — succeeded by Mr. C. H. Z. Fernando, M.M.C.

Mr. H. R. Freeman, M.S.C., July 11th — succeeded by Mr. Geo. E. de Silva, M.S.C.

Mr. J. L. Kotalawala, M.S.C., October 20th — vacancy not filled at close of year.

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

Mr. C. W. Bickmore resigned on his retirement from Government Service and was succeeded by Mr. C. H. Collins, Deputy Financial Secretary with effect from March 15th.

Mr. E. W. Whitelaw was on leave from April 4th to December 17th and Mr. P. R. May was appointed to act for him.

Mr. I. L. Cameron was on leave from March 21st to November 10th and Mr. F. H. Layard was appointed to act for him, with effect from May 8th.

Mr. A. E. de Silva resigned and was succeeded by Mr. L. B. de Mel, J.P., U.P.M. with effect from April 9th.

Mr. E. C. Villiers, M.S.C., resigned and was succeeded by Mr. H. F. Parfitt, M.S.C., with effect from July 13th.

The Hon'ble Mr. F. A. Obeyesekere was appointed to act for Mr. B. F. de Silva with effect from July 8th.

Mr. C. E. A. Dias, J.P. was on leave from October 10th to the end of the year and Mr. W. P. H. Dias, J.P. was appointed to act for him with effect from October 10th.

The services of Mr. C. W. Bickmore require special mention as he had been a member of the Board since its inception and also represented the Treasury on the Executive Committee of the former Rubber Research Scheme from October 1922 to 1930. The Board passed a special vote of thanks to Mr. Bickmore on his retirement.

The composition of the Board at the end of 1934 was as follows :—

Chairman, Director of Agriculture, Dr. W. Youngman.

Treasury Representative, Deputy Financial Secretary, Mr. C. H. Collins, C.C.S.

Unofficial Members of the State Council nominated by the Governor.

Mr. George E. de Silva, M.S.C.,
Mr. H. F. Parfitt, M.S.C.

Members nominated by the Ceylon Estates Proprietary Association.

Colonel T. Y. Wright,
Mr. L. P. Gapp.

Members nominated by the Planters' Association of Ceylon.

Mr. F.H. Griffith,
Mr. B. M. Selwyn.

Members nominated by the Rubber Growers' Association.

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

Members nominated by the Low Country Products Association.

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.,
Mr. W. P. H. Dias, J.P. (Acting).

Members nominated by the Governor to represent Small-Holders.

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

Meetings.—Meetings of the Board were held on March 15th, May 17th, July 19th, October 18th and November 15th. The meetings were held in Colombo with the exception of the adjourned meeting on November 15th which was held at Dartonfield Estate.

Meetings of the Estate Committee were held on February 7th, April 21st, May 17th, June 14th, June 19th, August 16th, September 2nd, October 6th and November 15th.

Meetings of other Sub-Committees of the Board were held on June 4th, September 17th and December 7th.

London Committee.—The Board continued to contribute 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). The three-year period for which the joint contribution had been arranged, terminated at the end of 1934 and it was decided to extend the arrangement for one year, pending the consideration of a new scheme. The Board of the Rubber Research Institute of Malaya also extended the arrangement for a similar period. The London Advisory Committee held meetings on January 26th, April 27th, June 29th and October 26th, and meetings of the Technical Sub-Committee were held on the same dates.

Development of the Research Scheme.—Proposals for the erection and equipment of an experimental factory at Dartonfield Estate were approved by the Board on March 15th and a contract for the work awarded to Messrs. Brown & Co., Ltd. The building was completed in November, with the exception of the installation of certain items of experimental vulcanizing equipment.

Plans for a chemical laboratory at Dartonfield were similarly approved on May 17th. Erection of the building was completed in October and equipment was complete at the end of the year. The construction of a bungalow for the Estate Superintendent and 2 Junior Staff bungalows was taken in hand towards the end of the year. Funds were also voted for the construction of a bungalow for the Assistant Chemist and 2 additional Junior Staff bungalows.

The extensive building programme referred to above necessitated frequent meetings of the Estate Committee, consisting of Mr. F. H. Griffith (Chairman), Col. T. G. Jayewardene, Messrs. J. L. Kotalawala and E. W. Whitelaw. Later in the year Messrs. F. A. Obeyesekere and P. R. May were appointed to act for Messrs. Kotalawala and Whitelaw. Mr. I. L. Cameron was appointed to the Committee on his return from leave. The thanks of the Board are due to the members of the Committee for giving so much time to this important work.

A decision was reached by Government to lease 100 acres of Crown land, adjacent to Nivitigalakele, to the Rubber Research Board for experimental purposes. Provision was made for 30 acres of the land to be planted during 1935. An area of 7½ acres at Dartonfield was experimentally replanted in 1934 and a further area of approximately 12 acres is to be replanted in 1935.

Oidium Leaf Disease.—Consideration was given by the Board on several occasions to the position arising from the increased severity of Oidium leaf disease, especially in mid-country districts. A programme of technical work was approved which included field trials of different grades and quantities of dusting sulphur; demonstrations of the sulphur dusting treatment to Planters' Associations; issue of publications on the control of the disease; preliminary trials of sulphur dusting from aircraft; and the purchase of dusting machines of different makes for trial and comparison.

Arrangements were also approved for demonstrating the control of Oidium by sulphur dusting on small-holdings in mid-country districts during the next refoliation season. Representations were made to Government in favour of import duty being remitted on dusting sulphur and dusting machines. At a meeting held on October 18th it was decided to ask Government to allow a portion of the old Restriction Fund to be utilised for the purpose of providing for the expense of dusting rubber areas affected by Oidium and to appoint a Government Committee to investigate the position and work out a Scheme.

It was decided to appoint an Assistant Botanist with a good knowledge of field experimentation to take charge of agricultural trials at Dartonfield and Nivitigalakele, in order to enable the Botanist and Mycologist to give as much attention as necessary to investigations in connection with Oidium. It was further decided to appoint a Small-Holdings' Officer to cater for the special needs of small proprietors in regard to Oidium and other matters, and to transfer Mr. W. I. Pieris to this post from his present post of Agricultural Assistant. This transfer will not take full effect until the post of Assistant Botanist has been filled.

STAFF.

Director of Research and Chemist.—Mr. T. E. H. O'Brien continued his duties in the above capacities. He also took charge of the administrative work of the Scheme under the general direction of the Board and with the assistance of a Secretary, who was appointed in April 1934.

Assistant Chemist.—The appointment of Mr. M. W. Philpott to the above post took effect from April 13th. He arrived in Ceylon on May 7th, having spent several weeks in the London Advisory Committee's laboratories at the Imperial Institute before leaving England.

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

Agricultural Assistant.—Mr. W. I. Pieris was granted special leave from August 1st to November 1st.

Estate Superintendent.—Mr. D. L. Nicol assumed duties in the above capacity on January 16th.

Junior Staff.—A Sub-Committee considered the future terms of employment of junior employees. The recommendations were adopted by the Board and took effect from November 15th, 1934.

FINANCE.

Income for the year amounted to Rs. 246,169, which was mainly derived from the cess of ½ cent. per lb. levied on exports of raw rubber under the Rubber Research Ordinance. Cess collections reached the highest figure since the establishment of the scheme and considerably exceeded the estimate, which had been framed on conservative lines in view of the probable introduction of a Restriction Ordinance. Monthly cess collections were as follows :—

January	...	...	Rs. 24,646·00
February	...	...	,, 23,988·00
March	...	...	,, 17,423·00
April	...	...	,, 16,147·00
May	...	...	,, 24,211·00
June	...	...	,, 14,511·00
July	...	...	,, 10,984·00
August	...	...	,, 14,394·00
September	...	...	,, 18,628·00
October	...	...	,, 17,698·00
November	...	...	,, 19,001·00
December	...	...	,, 18,772·00
		Total	Rs. 220,403·00

A profit of Rs. 18,349 was realised on the normal working of Dartonfield Estate. The Restriction Ordinance allows the export of the full crop harvested from properties owned by the Research Scheme. The additional income from this source does not however compensate for the loss of revenue from cess collections, which results from a general restriction of exports under the Rubber Control Ordinance.

Current expenditure amounted to Rs. 101,572 leaving a surplus for the year of Rs. 144,596. Capital expenditure amounted to Rs. 126,753, the chief items being the experimental factory and vulcanizing equipment Rs. 80,513·00, chemical laboratory and equipment Rs. 21,335·00, cartroad Rs. 4,320·00, replanting Rs. 1,586·00. A sum of Rs. 5,721·00 was expended on the development of Nivitigalakele Experiment Station, after making allowance for the small revenue derived from the sale of rubber.

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 reports of the Director of Research and Chemist; Botanist and Mycologist; Agricultural Assistant; Assistant Chemist; and Estate Superintendent, are also attached. The report of the London Advisory Committee* for Rubber Research (Ceylon and Malaya) will be submitted when available.

W. YOUNGMAN,
Chairman,
Board of Management,
Rubber Research Scheme (Ceylon).

20th February, 1935.

* The report has since been received and adopted by the Board and is also appended.

REPORT OF THE DIRECTOR OF RESEARCH AND CHEMIST FOR 1934.

STAFF.

In last year's report it was mentioned that provision had been made for the appointment of an Assistant Chemist for work on the utilisation of rubber. Mr. M. W. Philpott, who was selected for the post, arrived in Ceylon in May 1934, after spending several weeks at the laboratories of the London Advisory Committee for Rubber Research (Ceylon and Malaya) at the Imperial Institute London and visiting various institutions and engineering firms in connection with the work in Ceylon. He was engaged in preliminary investigations at the Culloden Laboratories for several months, during the erection of the experimental factory and chemical laboratory at Dartonfield estate and transferred to the new laboratory on its completion in October.

Two factors have had an important bearing on the work of the Botanist and Mycologist, Mr. R. K. S. Murray, during the year. The improved economic prospects of the rubber industry led to increased attention being given by producers to the agricultural improvement of plantations and to the treatment of root disease, which in some cases had fallen into arrears during the slump years. Extensive use was made of the Botanist's services during the year for advice on these matters. The increased severity of Oidium leaf disease during the 1934 refoliation season also entailed much correspondence and numerous visits to estates for advisory and experimental purposes. These factors have led to the postponement of the laying out of manuring and tapping trials at Dartonfield and, as stated in the Chairman's report, the Board has recently decided to appoint an Assistant Botanist to take charge of agricultural experiments.

The Agricultural Assistant, Mr. W. I. Pieris continued to have charge of experimental work at Nivitigalakele until August, when he proceeded on 3 months' special leave and charge of the station was handed over to the Estate Superintendent. The Board has decided to transfer Mr. Pieris to the newly-created post of Small-Holdings Officer but the transfer will not take full effect until the appointment of the Assistant Botanist.

The appointment of a Secretary to the Director of Research, as from April 1934, has relieved the writer of a good deal of administrative work. The time thus made available for other duties has been largely absorbed, during the current year, in connection with the construction and equipment of the experimental factory and laboratory at Dartonfield. This however

represents an essential preliminary to the extension of experimental work. Approximately 80 visits were made to Dartonfield during the year in connection with the building programme and other matters.

Progress of the main lines of work during the year is summarized below and the work is discussed in more detail in the reports of Technical officers, which are attached.

DEVELOPMENT OF THE RESEARCH SCHEME.

Buildings at Dartonfield.—The outstanding feature of the year in the development of the Research Scheme was the construction and equipment of an experimental factory and chemical laboratory at Dartonfield Estate. Tenders for the factory were invited from the main local engineering firms on the basis of a general specification prepared by the writer and approved by the Board. Messrs. Brown & Co., Ltd. were finally awarded the contract and construction of the building was started in July and completed in November, except for the installation of certain experimental machines. It was necessary to extend the estate cart road for a distance of approximately half-a-mile to the site, before the work could be started.

The factory is intended to provide facilities for the following purposes :—

(a) routine manufacture of the estate crop and demonstration of the manufacture of crepe and smoked sheet under model conditions.

(b) Experimental work on the preparation of raw rubber in alternative forms and observations on the efficiency of present methods.

(c) Experimental work on the local manufacture of certain types of vulcanized products.

The building is approximately 125 feet long × 65 feet wide, divided into two sections by a central packing room and store room. One section of the building is equipped for raw rubber manufacture and the other for vulcanization work.

The present equipment in the raw rubber section of the factory comprises 2 creping mills with 26-inch rolls, 2 sheeting mills with 24-inch. rolls, tanks for the preparation and storage of ammoniated latex, experimental disintegrator for the preparation of crumb rubber, and baling press. It is proposed to instal a latex centrifuge in 1935. A smokehouse, of the design recommended by the Research Scheme, is situated close to the factory and an adjoining building of similar dimensions is provided with a hot water radiator for crepe drying. All machinery in the factory is electrically driven, a separate motor being provided for each machine. The

main purpose of this arrangement is to facilitate power consumption measurements but it is also conducive to a neat layout of the equipment and facilitates the introduction of further experimental machines. Power is obtained from a 35 K.W. generator driven by a 52-57 H.P. engine. An auxiliary 9 H.P. engine is also installed. In the other section of the factory the equipment consists of small scale machinery for experimental work on the manufacture of vulcanized products and includes a masticating and mixing mill, calender, extruding machine, drum type spreader, vulcanizing pan, vulcanizing oven and steam heated press. A second-hand Passburg drier has also been installed for work on the production of softened rubber.

The laboratory building which is adjacent to the factory, provides laboratory and office accommodation for the Chemist and an office for the Estate Superintendent. Provision has been made for extension of the building later, if required. The laboratory is equipped for general chemical work and also with suitable apparatus for testing raw and vulcanized rubber. A petrol gas generator has been installed, also storage batteries to supply electric current when the factory engine is not running.

The construction of a bungalow for the Estate Superintendent and two junior staff bungalows was started towards the end of the year and provision has been made for building a bungalow for the Chemist, 3 junior staff bungalows and minor buildings in 1935.

Field Experiments.—A start was made on the programme of field experiments at Dartonfield by replanting an area of 7½ acres under experimental conditions and preparations were made towards the end of the year for replanting a further area of 12 acres in 1935. The initiation of tapping and manuring experiments has had to be deferred owing to the heavy calls on the Botanist's time in connection with Oidium and the work will be taken in hand on the appointment of an additional officer.

An application for the lease of 100 acres of Crown land adjacent to Nivitigalakele, for experimental work in connection with clone testing and selection and laying out of budwood multiplication nurseries, was approved by Government. Approximately 30 acres of the land was felled in December for 1935 planting.

Work for Small Proprietors.—The question of making special arrangements for giving assistance and advice to Small Proprietors was considered by the Board at an early stage of the development of the Research Scheme and was postponed until policy in other directions had been more clearly defined. It has now been decided to appoint an officer to cater for the special needs of Small Proprietors and the transfer of Mr. Pieris to the post will take full effect as soon as certain of his present duties have been taken over by the Assistant Botanist. In the meantime some preliminary

work has been started and it is anticipated that this extension of the Research Scheme's activities will prove of value to an important section of local rubber producers.

CHEMICAL SUBJECTS.

Crumb Rubber.—Promising developments occurred during the year in connection with the possible industrial utilisation of nitrite crumb rubber, prepared by the method developed locally in conjunction with the staff of the London Advisory Committee. A request from the London Committee about the middle of the year for ½ cwt. of the material for the continuation of experiments was followed by further requests for 2 cwt., 5 cwt., and 1 ton of the product. The earlier amounts were prepared at Culloden Laboratories under somewhat inconvenient conditions owing to the restricted space available and manufacture was transferred to Dartonfield when the factory was ready for occupation. Up to the present the material has been made entirely by hand but consideration is being given to the application of mechanical methods and no great difficulty is anticipated in devising a suitable routine for commercial manufacture, if a demand for the product arises.

According to a recently published report the material is being utilised semi-commercially as an ingredient of a composition for laying white traffic lines. Trials in other directions in connection with roadway construction are also being carried out in England. Although the proportion of crumb rubber which is required for these purposes is small, the aggregate demand for the material might be very substantial if the experiments develop satisfactorily.

An experimental plant for preparing powdered rubber by a patented process was installed on a local estate and Research Scheme officers were permitted to inspect the machine through the courtesy of the Proprietors. The product is a fine crumb of attractive appearance for which it is understood that uses are being developed by the commerical interests concerned. It is probable that a large-scale machine will shortly be operating on the estate.

Rubberized Hessian for Woolpacks.—Trials on the treatment of hessian with latex to provide a more suitable material for use as woolpacks, which were referred to in last year's report, were continued using various latex mixings and methods of application and several samples were forwarded to the Calcutta firm which initiated the enquiry. The essence of the problem is to provide efficient anchorage of the jute fibres at a price which it is economic for wool producers to pay. Incidentally to this investigation and other latex work Mr. Philpott has studied the effect of various factors on the creaming of latex by chemical methods. It was found that creams

of 57-58% could be obtained by the standard method of creaming with Tragon seed gum.

At the request of the Rubber Growers' Association provisional arrangements were made for Mr. Philpott to visit Calcutta to study methods of jute manufacture and discuss the question of latex treatment with Dr. S. G. Barker, Director of the Wool Industries Research Association, who is on a visit to India. A date for the visit has not yet been fixed but a preliminary discussion of the problem was held with Dr. Barker when he passed through Colombo on his outward journey.

Utilisation of Coir Residues.—Trials were initiated to investigate the value of coir dust as a cheap filler for rubber mixings, on the analogy of the use of wood flour in manufacturing countries in the production of low priced rubber flooring. It was found that coir dust which had been sprayed with latex to give a proportion of 2-3 parts coir by weight to one of rubber, could be worked up into a smooth sheet by rolling in creping mills. The experiments up to date have been of a preliminary nature and the few vulcanized samples which have been prepared were made without proper facilities but the type of product appears distinctly promising and its possibilities are to be fully investigated at the new Dartonfield establishment.

One of the drawbacks of coir dust for this purpose is its dark colour. This matter was discussed with Dr. Child, of the Coconut Research Scheme, who demonstrated that most of the colour could be removed by treatment with bleaching powder or sodium hypochlorite, yielding a pleasant neutral coloured product. A slight difficulty caused by the presence of residual salts was overcome by more efficient washing and bleached material supplied by Dr. Child was used in the later stages of the trials referred to above.

Vulcanized Crepe.—A few enquiries were received from local Producers for information on the method of preparing vulcanized crepe by the addition of chemicals to the latex and samples of a suitable vulcanizing mixture were sent to two estates. There were several enquiries on the subject from outside sources and a continental firm asked for a full range of samples with details of selling price and quantities available. Arrangements have been made to prepare samples at Dartonfield and it is thought that a satisfactory product can be made to sell at the same price as raw rubber, by the addition of a proportion of mineral fillers.

Estate Manufacture.—It was reported last year that a number of estates had found difficulty in producing crepe rubber up to the standard of colour required on the Colombo market, both in relation to the presence of mould in the rubber and to the deeper colour associated with double cut tapping systems. Few enquiries have reached the Research Scheme on this subject during the current year. In spite of the heavy aggregate rainfall

in the chief rubber districts, weather conditions have on the whole been favourable for crepe drying and it is probable that less trouble with mould has been experienced than in recent years. It is likely that dealers are now more accustomed to a yellower crepe and have also been less critical in view of the more active market conditions.

A memorandum was issued in the *1st Quarterly Circular* for 1934 recommending that the use of paranitrophenol as a preventive of mould in crepe should be discontinued, to meet the wishes of manufacturing interests. It was pointed out that no other chemical is available for the purpose at present and estates were advised to consider the improvement of crepe drying rooms by the provision of warm air installations. The crepe drying house at Dartonfield, which is maintained at 90-95°F. by means of a hot water radiator in the basement, has given very satisfactory results up to the present. The time of drying is about 2½ days.

There were a number of enquiries for information on the construction of tiled coagulating tanks and the possibility of lining tanks with acid resisting cement in place of tiles. Trials were made with a small-scale tank constructed of a special type of cement which was stated to be acid proof and one of the coagulating tanks at Dartonfield factory was lined with the same material. The lining, however, already shows signs of being affected by acid. The Research Scheme has long advocated the replacement of Shanghai jars by larger coagulating tanks, with a view to improving the uniformity of estate output both in regard to inner properties and appearance, and it is encouraging to note the growing tendency to adopt this practice.

The preparation of plans of modern type smokehouses of different sizes was taken in hand, in collaboration with a local engineering firm and drawings of buildings holding 1,500 lbs. and 5,000 lbs. rubber are now available. 13 copies of the plans were issued to local Producers. Trials were made with a fire trolley at the experimental smokehouse at Culloden before deciding on suitable dimensions for inclusion in the plans.

Co-operation with the London Advisory Committee.—The closest co-operation was maintained with the staff of the London Advisory Committee both by the provision of samples for examination in the Committee's laboratories and by a frequent exchange of views on the work in progress in the two centres. Apart from the provision of supplies of nitrite crumb prepared by the standard method which the Committee required for large-scale trials, samples of crumb prepared under modified conditions were forwarded for examination, also samples of sheet rubber treated with hot water, and crepe rubber prepared under conditions resulting in a softer product than normal estate rubber.

The London Secretary undertook the ordering and despatch of all the apparatus, chemicals and special equipment required for the new factory and laboratory and it proved most valuable to have a representative in England to make detailed enquiries on the suitability of items of machinery etc, before orders were finally placed. Another very useful service rendered by the Committee is the provision of abstracts of all patents relating to rubber and full specifications of any which are likely to be of special local interest.

Rubber Samples for Exhibition.—At the request of the Director of Agriculture a series of raw rubber samples was supplied for an exhibition of Ceylon products in South Africa under the auspices of the Tea Propaganda Board. The samples comprised smoked sheet, blanket crepe, scrap blanket crepe, lace crepe, sole crepe, "Rubaulins," vulcanized crepe bathmats and ammoniated latex. Later in the year a series of samples was supplied for a similar exhibition in Canada and samples were also forwarded for the Rubber Growers' Association exhibition in London.

MYCOLOGICAL AND BOTANICAL SUBJECTS.

Oidium Leaf Disease.—Oidium leaf disease caused more damage in all the main rubber growing districts of the Island than in previous years, a notable feature being the comparatively sharp attack in low-country districts where climatic conditions have hitherto been regarded as unfavourable to the fungus. There were also indications of extension of the more severe type of attack to estates at lower elevations.

In a report issued in the *2nd Quarterly Circular* for 1934, the view was expressed that whereas in mid-country districts an improvement in the position is improbable unless control measures are widely undertaken, in low-country districts it is uncertain whether the increased severity of attack in 1934 arose from abnormal weather conditions or from a definite advance on the part of the fungus. Generally speaking, it was advised that control of the disease by sulphur dusting should be undertaken on mid-country estates during the 1935 refoliation season, but in the low-country it was suggested that developments might be awaited before adopting control measures.

Proposals for extending the Scheme's educational and experimental work on the disease received the approval of the Board of Management and work on the following lines has either been carried out or is being undertaken.

(a). A lecture on Oidium and demonstration of the sulphur dusting treatment were given to Planters' Associations in 7 districts.

Arrangements have been made to demonstrate the control of the disease during the 1935 refoliation season on 5 small-holdings in mid-country districts.

A publication was issued giving full practical details of the sulphur dusting treatment.

(b). Arrangements have been made for large-scale comparative trials of 3 types of dusting sulphur and 2 rates of application, to be made on 3 estates in mid-country districts in 1935.

A sulphur dusting trial over an area of 100 acres in the Kalutara district has been arranged, in co-operation with an Estate Company.

Provisional arrangements have been made for testing the practicability of sulphur dusting from an Autogiro aircraft, which is expected to be coming to Ceylon for demonstration purposes early in 1935.

Preliminary trials were made in connection with the application of sulphur dust to groups of trees by means of rockets or bombs. Promising results have been obtained and it is possible that this method of application will prove valuable for the control of Oidium on small-holdings.

The Tea Research Institute undertook to investigate the effect of varying quantities of sulphur in causing taints in tea. The first series of results dealt with the effect of applying sulphur to the bushes at the rate of 10 lbs. per acre and the trials will have increased interest when they have been extended to cover considerably smaller amounts, such as might fall on the Tea during dusting operations on an adjoining estate.

The sulphur dusting experiment at Kandanuwara estate was continued but unfortunately the degree of control of Oidium was again unsatisfactory. This is attributed partially to the unsatisfactory physical condition of the sulphur which was used and partially to wet weather interrupting the dusting operations. Yield records were kept during the year in the experimental areas and the figures given in the Botanist's report indicate the striking reduction of yield in the control area, which has been subject to severe Oidium attack for a number of years.

Budgrafting, etc.—A further experiment was carried out at Nivitigalakele to compare the growth of nursery stocks derived respectively from large and small seed, and quick germinating and slow germinating seed. The general conclusion was reached that small, slow germinating seed can be discarded with advantage when laying down a nursery for budding, if plenty of seed is available.

Observations during the budding of a large seedling nursery indicated the advantage of postponing the first examination of the buds for a longer period than 3 weeks, if the weather is wet at the time the examination falls due.

Trials of transplanting stumped buddings were continued and promising results were obtained with buddings which had been allowed to grow in the nursery for a period of 18-24 months and were transplanted after being stumped at a height of about 6 feet from the union. This method of planting out is likely to be of special value in distributing budded material to Small Proprietors. It means that the plants can be kept under proper supervision during the period in which the budshoot is especially liable to damage, the snag is healing over, and stock shoots and side shoots have to be removed. The method should also be useful for supplying vacancies in clearings without undue loss of growth.

Observations were continued in connection with the dying back of the callousing tissue at the point of union of budded stocks. The conclusion was reached that such damage is mainly due to the sun and is accentuated by the presence of a bitumenous dressing such as Skene's mixture. A dressing of this type is necessary when large stocks have been used and it is therefore advisable to shade the union by growing green manure plants.

Studies on Clones.—The number of trees under test-tapping at Nivitigalakele was increased to 527, the rubber from each tree being collected separately. Several estates are also co-operating in test-tapping and records are being kept in respect of a total of 85 Ceylon clones. A summary of the yields of the more promising of the clones is given in the Botanist's report and more complete data for the year will be published in the *Quarterly Circular*.

Girth measurements of a number of imported clones at the Iriyagama division of the Experiment Station, Peradeniya are also reproduced in the Botanist's report by the courtesy of the Department of Agriculture. The figures show that Tjirandji 1 has maintained its position as the quickest growing clone and also indicate that the general rate of growth of the plants is below normal.

Buddings from about 80 high-yielding Ceylon trees, which have not yet been tested in the field, will be planted out in the newly-acquired land at Pinnagoda in 1935. It is proposed to plant in quarter acre plots, each plot including a few trees of a proved foreign clone.

Selection and Breeding.—Some cross-pollinations of high-yielding trees were made by the Agricultural Assistant during the flowering season but the work was seriously hampered by wet weather and Oidium infection. It is interesting to note from his report that trees on which he failed to obtain fertilisation by artificial pollination also failed to produce naturally fertilised seed. The importation of Hevea seed and other planting material is prohibited under the Restriction Ordinance and Ceylon will therefore have to fall back on its own resources in regard to the supply of improved seed and budding material for replanting operations.

Further trials on the propagation of Hevea by layering suggest that this method may prove feasible as a means of raising uniform stocks for experimental work.

Tapping.—A tapping questionnaire similar to the one issued in 1933, was circulated to estates asking for information in particular regarding double-cut tapping systems. Numerous replies were received and we are indebted to estate superintendents and agency firms for their co-operation. The material has been analysed by the Botanist but the issue of a report has unfortunately been delayed owing to the urgency of other work. The replies to the questionnaire and other observations tend to confirm the view expressed last year that double-cut systems, in the form best suited to the individual estate may largely replace the alternate day, single-cut system, in the main rubber growing districts.

The small tapping experiment near to the laboratories, which was referred to in last year's report, was continued and the figures again show a close similarity in the yield from the "double four" and "alternate day" plots, and that the rubber content is 2-3 ounces per gallon higher under the former system.

Two estate experiments comparing "alternate day" tapping with the "double-three" A.B.C. system which were laid out in collaboration with the Research Scheme in 1933, were continued and the results for the year are discussed in the Botanist's report. In one case the yields are approximately equal and in the other the yield from "double 3" tapping is 11% lower than that from the "alternate day" system. It is of course, too early to draw any definite conclusions from the trials.

DARTONFIELD ESTATE.

Mr. D. L. Nicol took charge of the estate as from January 16th, 1934. The year was a busy one for the Superintendent as the work in progress included replanting a 7½ acre field, construction of upwards of ½ mile of cartroad and the preparation of sites for the factory, laboratory and other buildings.

Tapping was continued on the "double 4" system but this does not necessarily imply that the Research Scheme regards the system as the best available. The main reason for its adoption was to ensure that all trees shall have a similar tapping history in respect of both bark panels for a substantial period before tapping and manuring experiments are laid out.

Crop for the year amounted to 103,947 lbs. and is the highest which the estate has produced. This must be largely attributed to the fact that portions of the estate have been rested for considerable periods during the

past few years. Cost of production was 13·18 cents per lb. and the rubber was sold in Colombo at a nett average price of 31·26 cents per lb. With reference to the former figure it should be mentioned that a proportion of administrative charges is debited to experimental account.

For the first 10 months of the year the crop was sent to Galawatte estate in the form of coagulum for manufacture into crepe. Manufacture at the new experimental factory was started on November 1st and since then approximately equal proportion of smoked sheet and blanket crepe have been produced. Both products have been well reported on by the Board's selling agents, Messrs. Müller & Cooray.

As reported elsewhere a 7½ acre field was replanted under experimental conditions and it is creditable to all concerned that the somewhat complicated experimental layout was successfully transferred from paper to the field, in spite of the uneven shape and contour of the area. Climatic conditions were also unfavourable but the budded plants were established with few casualties and cover crops in accordance with the experimental requirements, were established with fair success.

A survey of the estate was made during the year and boundaries clearly marked. Fencing of part of the estate was undertaken.

NIVITIGALAKELE EXPERIMENT STATION.

The Station was under the charge of Mr. Pieris up to August 1st, when charge was handed over to the Estate Superintendent.

Growth of the trees was generally satisfactory during the year. Certain areas which have been consistently backward were manured during November-December and the whole station is to be manured in 1935. It is sometimes suggested that a station of this nature should not be manured, on the grounds that subsequent test-tapping will not give representative results. The policy of the Research Scheme in this connection is not to force on the plants but merely to endeavour to maintain normal and even growth in the different fields. The wisdom of this can hardly be questioned and less representative tapping results would be obtained if growth in the different areas was irregular.

The greater part of the 1926 clearing is now commercially tappable but it is not considered that the provision of the necessary buildings for handling a commercial crop would be justifiable before 1936.

ADVISORY WORK, CORRESPONDENCE, ETC.

The advisory work of the Scheme provides an interesting reflection of the outlook of the local rubber industry from year to year. During 1934 calls for information were mainly in regard to agricultural subjects.

The increased severity of Oidium leaf-fall naturally led to extensive correspondence on this subject and the improved economic outlook has resulted in an increase of enquiries on matters such as budgrafting, soil management, replanting and disease treatment. On the chemical side the volume of advisory correspondence was smaller than usual, the chief lines of enquiry being in relation to smokehouse design, coagulating tanks and the common defects of sheet and crepe. There have been a few enquiries regarding vulcanized products, crumb and powdered rubber, and preserved latex. It is natural that the attention of Producers should, on the return of a measure of prosperity, be first directed to an improvement of the agricultural condition of estates but it may be predicted that a good deal of interest will be taken, later on, in the improvement of facilities for manufacture.

Reports were furnished to the Director of Commercial Intelligence on various technical matters connected with the Rubber Industry. Several enquiries from the Rubber Advertising Committee of the Planters' Association, relating to the progress which is being made in finding new uses for rubber, were dealt with or forwarded to the Rubber Growers' Association for report.

Correspondence of the Scheme during 1934 was as follows :—

	Inward		Outward
Secretarial Office (not including printed matter and circultaion papers)	1,583	...	1,754
Laboratories :—			
Estates and Agencies	1,253	...	1,434
General	759	...	829
Chairman and London Committee	211	...	221
Total	3,806	...	4,238

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

	Director	Botanist & Mycologist	Agricultural Assistant	Assistant Chemist
Advisory Agriculture	—	47	—	—
Advisory Manufacture	4	—	—	—
Experimental	1	11	10	7
Miscellaneous	—	—	—	—
Total	5	58	10	7

ASSISTANT CHEMIST'S REPORT FOR 1934.

The writer arrived from England on 7th May and took up his duties at the laboratories at Culloden on 9th May.

Before leaving England the writer spent a few weeks at the Imperial Institute studying the work and methods of the London Advisory Committee. This contact with the staff of the London Advisory Committee and the opportunity it afforded for the discussion of research problems were invaluable. A number of visits were also made to engineering firms in order to discuss the design of vulcanising plant and testing equipment such as would be required for the work at Dartonfield.

During the time that the writer has been in Ceylon he has been chiefly occupied with the equipment and erection of the new laboratory and experimental factory at Dartonfield. After consultation with the Director on the programme of chemical investigations for 1934 and the ensuing years, a list of necessary equipment was prepared and orders were placed with firms in England and Germany.

The laboratory has been designed as a general chemical laboratory but it has also been provided with suitable equipment for the testing of raw and vulcanised rubber. The section of the factory which is to be devoted to the testing of rubber and to the small scale production of manufactured goods has been equipped with experimental mixing and vulcanising plant. The installation consists of a small masticating and mixing mill, calender, extruding machine, drum type spreader, vulcanising pan and small steam-heated press. The machines are provided with independent electrical drives with internal gearing. It is proposed to use this equipment for the investigation of the processing and vulcanising properties of modified forms of rubber and also for experiments connected with the local production of manufactured rubber goods.

Attention has been directed towards the question of the local consumption of rubber and some considerations on this subject are embodied in an article that appeared in *The Quarterly Circular* Vol. 11 Part 3. The preparatory work at Dartonfield left little time for experimental work.

The following is a brief summary of the subjects that were touched upon in the short time that was available.

Rubberized Hessian for Woolpacks.—The experiments on the latex treatment of hessian initiated by the Director in response to an enquiry from a firm of jute manufacturers were continued. Although hessian is widely used for woolpacks it is not entirely satisfactory on account of the

tendency of the jute fibres to contaminate the wool, and the object of these experiments was to produce by the treatment of hessian a material that would be free from this defect.

Trials were made with latex of various concentrations, with unvulcanised latex, with latex at different stages of vulcanisation and with latex containing various compounding ingredients. Application was made by spraying but no evidence was obtained that this is the most suitable method. The work will have to be continued on a larger scale before it is possible to draw useful conclusions.

The subject was discussed with Dr. Barker of the Wool Industries Research Association while he was passing through Colombo on his way to Calcutta. It was provisionally arranged that the writer should pay a visit to Calcutta to study the methods of jute manufacture from the point of view of latex treatment.

Adhesive Latex.—A method evolved by the Technical Research and Development of New Uses Committee for the preparation of adhesive latex by oxidation (R. G. A. Bulletin 1934, Vol. 16, p. 116) required the removal of alkaline preservative from the latex before treatment with hydrogen peroxide. By the use of fresh unpreserved latex the procedure was simplified and the product appeared to be similar to the adhesive latex made in London from preserved latex. It is considered that if the demand should arise, the production of adhesive latex in Ceylon should present no special difficulties.

Creaming.—No systematic investigations have been made on the subject of latex creaming but quantities of creamed latex have been prepared for the experiments on the rubberizing of hessian, etc. For these purposes the cream was generally prepared by the established method using Tragon seed gum, but a few trials were also made under modified conditions. In the course of these trials it was observed that a number of factors caused variations in the extent of creaming but that under standard conditions creams of 57% to 58% D.R.C. were regularly obtained. No improvement in creaming was obtained by (a) preserving with sodium or potassium hydroxide instead of ammonia, (b) heating the latex for several hours prior to the addition of the creaming agent. A comparison of several samples of Tragon seed gum shewed that the differences between them as regards their creaming effect were slight. In one series of 12 experiments creaming was allowed to continue for 9 days. At the end of this time the rubber contents of the creams ranged from 60·2% to 61·9%, the average being 60·9%. Slight variations in the method of preparation of the gum solutions produced little or no effect but the age of the latex appeared to be important.

Utilisation of Coir Residues.—Some experiments were initiated with a view to obtaining information regarding the possibilities of making use of the waste coir dust of which an almost unlimited supply is available in Ceylon. Thirty per cent. of the material is finer than 40-mesh and it was thought that interesting products might be obtained if this were treated with latex as a binding agent. When the coir dust was sprayed with latex so that the resulting crumb contained 2 to 3 parts of coir to one of dry rubber, it was possible to obtain a smooth sheet by passing the crumb through crepe rollers.

The next step was to prepare vulcanisable rubber-coir mixtures and to examine the effect of mineral ingredients on the physical properties of the product. Vulcanisation was effected by heating the sheets in air at temperatures ranging from 70° to 100°C. for periods of ½ hour to 5 hours. The results of these trials served to give an indication of suitable proportions of rubber to coir and of the effect of certain mineral fillers.

Coir waste is limited for many purposes by its brown colour. Fortunately it is capable of being bleached to the colour of straw and this question has been taken up with the Director of the Coconut Research Scheme. The coir was found to yield readily to treatment with sodium hypochlorite and with bleaching powder. Some difficulty was at first experienced with the material bleached with bleaching powder on account of the coagulating action of residual calcium salts in the coir. Two additional washings were however sufficiently well to overcome this difficulty. The sheet material obtained from the bleached coir had promising physical properties and an attractive appearance.

A typical product which might have been used, for example, as a flooring material contained the following ingredients :—

Rubber	...	29 per cent.
Coir waste	...	44 ,,
Other ingredients	...	27 ,,

This composition was not the result of systematic work and further trials may well show that substantial modifications will have to be made to bring the product into line with the demands that may be made on it. The development of a suitable technique of manufacture was also out of the question with the facilities available, but the investigation will be taken up again when the experimental equipment at Dartonfield is installed.

CORRESPONDENCE.

Enquiries from estates, etc. were dealt with on the following subjects: —vulcanised crepe, powdered rubber, rubber shoe manufacture, roadway compositions, rubberized hessian, self-vulcanising cements, manufacturing machinery and the preservation of latex for shipment.

PUBLICATION.

"Notes on the Manufacture of Rubber Goods in Ceylon".—*3rd & 4th Combined Quarterly Circulars* Vol. 11, Parts 3 & 4.

M. W. PHILPOTT,
Assistant Chemist.

The Laboratories,
Dartonfield, Agalawatte.
6th February, 1935.

REPORT OF BOTANIST AND MYCOLOGIST FOR 1934.

As in 1933 the writer was in charge of all botanical and agricultural as well as mycological work, and at a Meeting held in May the Board confirmed the appointment as "Botanist and Mycologist".

The chief feature of the year under review has been the large increase in the volume of advisory work, as shown by the figures given later in this report. Many of the enquiries and requests for consultative visits arose from the increased severity of Oidium leaf disease throughout the Island, but there has also been renewed interest in budgrafting, soil management, replanting and treatment of root disease. The increased work in these directions has necessitated the postponement of most of the field experiments planned for execution on Dartonfield Estate.

I. MYCOLOGICAL WORK.

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

Oidium Leaf Disease.—In the Mycologist's Report for 1933 the observation that there were indications of an extension of the most severely affected areas at mid-country elevations was recorded. In 1934 the outstanding pathological feature was the increased severity of this disease not only in mid-country but also at the lower elevations, reports to this effect being, indeed, received from all the main Rubber-growing districts in the Island. The cause of this development is not entirely clear. Whereas in most districts the period of refoliation was marked by cool, cloudy days, which would be expected to favour the fungus, in other localities where heavy leaf-fall was also experienced the weather was unusually dry. It is possible that the absence of any prolonged dry spells in the previous year (1933) may have been an important contributory factor. It is difficult, however, to provide an explanation wholly in terms of weather conditions, and the possibility that the fungus has made an independent advance cannot be overlooked. The whole subject in relation to probable future developments was fully discussed in a report published in *2nd Quarterly Circular,* the gist of which is that while the future course of the disease in the main low-country districts cannot be predicted with any assurance, at mid-country elevations, where the climatic conditions favour the fungus rather than the host, an improvement in the present position seems improbable unless control measures are widely undertaken. Observations on the attacks in various localities during the 1935 refoliation season will be vested

with great interest, particularly as giving some indication of the future status of Oidium in the low-country. From this point of view, however, it is unfortunate that 1934 was marked by exceptional periods of drought in most parts of the Island, with the result that the "winter" gives indications of pursuing an abnormal course. It is interesting to record that in the districts in which the drought was most severely felt an abnormal "winter" of a large proportion of the trees occurred in August-September. Much of the resulting new foliage remained free from Oidium, and at the end of the year the estates in these localities presented a better canopy than for many years past.

A natural consequence of the increased severity of Oidium has been the stimulation of interest in the sulphur dusting treatment, and numerous enquiries on this subject have been received from estates and Agency Houses. Recommendations for 1935 have been based on the expectations of attack outlined above, *i.e.*, the treatment has, in general, been recommended for mid-country estates, but in the low-country it has been suggested that the trend of future developments should be awaited before embarking on the treatment. A considerable number of estates at all elevations are known to be undertaking dusting operations in 1935, and much valuable experience of the treatment under various conditions will be obtained.

The possibility of Oidium becoming a serious menace throughout the country necessitated a careful consideration of the directions in which the work conducted by the Scheme on control measures could most usefully be extended. The following proposals were approved by the Board of Management, and have been implemented to the extent indicated.

1. *Demonstrational and Advisory.*

(a) A lecture on Oidium and a demonstration of the sulphur dusting treatment were given under the auspices of seven District Planters' Associations. Most of the Meetings were very well attended and considerable interest in the subject was shown.

(b) Arrangements have been made to carry out the sulphur dusting treatment on five small-holdings in severely affected mid-country districts. This work will be conducted during the 1935 refoliation season by Mr. W. I. Pieris, Small-Holdings Officer, and will give small Ceylonese Proprietors the opportunity of seeing the methods employed and the results which can be achieved.

(c) A paper giving full practical details of the sulphur dusting treatment for the assistance of Superintendents undertaking the work for the first time was published in *Quarterly Circular* and in leaflet form.

2. *Experimental.*

(a) Arrangements have been made for large scale comparative trials to be conducted on three estates with three proprietary dusting sulphurs, each at two rates of application. These estates are situated at mid-country elevations.

(b) Co-operation has been secured with an estate in the Kalutara District in the treatment of an area of 100 acres, and the Scheme will doubtless be afforded the opportunity of making observations on other low-country estates on which sulphur dusting is to be undertaken.

(c) Through the good offices of the Aero Club of Ceylon, enquiries are being made into the possibilities of sulphur dusting from an Autogiro. It is hoped that a machine of this type will be available for preliminary trials early in 1935.

(d) The possibilities of applying sulphur to individual trees or groups of trees by means of rockets or bombs are being explored, since it is thought that this method might be useful in small-holdings where a dusting machine would not be available. Preliminary trials have given indications that this method may prove feasible, and the matter is being further pursued.

(e) In view of the fact that Oidium has assumed its most serious aspect at the higher elevations, where Rubber is commonly grown in the neighbourhood of Tea, the possibility of sulphur drifting on to Tea fields and causing taint is a matter of considerable importance. Investigations carried out in 1930 led to the conclusion that on most estates the risk would not be great provided that care was taken on the margin of Tea fields, and subsequent experience on Kandanuwara Estate has confirmed this view. More critical tests, however, were considered desirable, and the Tea Research Institute is kindly undertaking experiments to determine the effect of varying quantities of sulphur. The results of the work carried out to date show that a definite taint occurs when as much as 10 lbs. of sulphur per acre is applied to the bushes but that the taint becomes less noticeable when the maximum interval occurs between dusting and plucking. Since 10 lbs. per acre is a much larger dose than is likely to fall in a Tea field adjoining dusted Rubber, results of greater practical importance will be obtained from further trials in which smaller quantities of sulphur are used.

A further series of dusting operations was undertaken on Kandanuwara Estate during the months January to March, this being the fifth successive year in which the experimental field has been treated. It is unfortunately necessary to report that the results were again disappointing, the failure being attributed to the unseasonable wet weather in conjunction with the

poor physical condition of the "Flotate" sulphur obtained from Java. The sulphur was received in a very damp condition and it was found impossible, even with the use of lime, to dry it sufficiently for a good cloud to be formed. It may be mentioned that the same difficulty was found on other estates in Ceylon and also in Malaya. Fortunately this product, which has the advantage of extreme fineness of sub-division, is now being commercially prepared in a dry free-flowing form by a process understood to be similar to that evolved in these laboratories, and trouble of the same nature need not be anticipated in the future. The difficulty of unseasonable rains occurring during the refoliation season is, however, less easily overcome, though there is possible scope for improving the adhesive properties of the fungicidal dust.

The recording of yields from plots in the dusted and control areas on Kandanuwara was continued throughout the year, all latex rubber being sent to the laboratories to be weighed. Owing to the failure to secure satisfactory control of the disease during the past three successive years the comparison of the yields from the dusted and control fields is of no significance, but the figures from the undusted area are of interest as showing the serious decline which occurs as the result of continuous tapping in an area subjected to perpetual abnormal defoliation. The yields from the 160 experimental trees in this area for the last five years are as follows (latex rubber only):—

1930 (10 months' tapping)	501·0 lbs.
1931	455·4 ,,
1932	506·4 ,,
1933	228·5 ,,
1934	146·6 ,,

During the past eight years, in which severe defoliation has been caused in this area, bark renewal has been very slow with the result that very few of the experimental trees would now be considered fit for normal tapping.

II. BOTANICAL WORK.

The progress of work on botanical subjects is recorded under the same headings as in the 1933 Report.

The Improvement of Planting Material.

A. Budgrafting.

1. *Selection of Mother Trees.*

The number of estates from which regular yield records of high yielding trees were received again shows a decline, and only 5 new clones were

introduced into the Nivitigalakele budwood multiplication nursery. This nursery now contains material of nearly 200 untested Ceylon clones, about 80 of the most promising of which are to be established in 1935 in a portion of the 100-acre block of Pinnagoda land which was allocated to the Scheme in November.

2. *Budding, Planting and Attention.*

(a) *Selection of Stocks.*—Two experiments have been carried out during the last two years in an endeavour to ascertain whether there is any advantage, when laying down seedling nurseries to provide stocks for budgrafting, in selecting large as opposed to small seed, and quick as opposed to slow germinating seed. Unfortunately a strict statistical examination of the second experiment was precluded by the large number of casualties due to the depredations of hare, but the results give some evidence that the growth from quick germinating seed (9 days) tends to be more vigorous than that from slow germinating seed (30 days), and there may be a slight advantage in favour of large seed. The conclusion reached is that if an abundance of seed is available when laying down a stock nursery for budding, small, slow germinating seed may advantageously be discarded, but if there is a scarcity of material all available seed should be planted and entire reliance placed on selection on the basis of vigour subsequently carried out in the nursery.

(b) *Technique of Budding Operation.*—Experience in budding a large stock nursery at Nivitigalakele in April and May showed that if wet weather prevails at the time the first examination is due, the postponement of the examination until the advent of more favourable weather prevents the high proportion of casualties which may occur after the first examination under such damp conditions. This, however, should only be done if the bud-patch is covered by an entirely waterproof binding. The present practice on the Station is to cover the flap with a patch of rubberized tape, and then bandage with waxed cloth.

(c) *Transplanting "Stumped" Buddings.*—In 1933 successful supplying was carried out on a small scale at Nivitigalakele with "stumped" bud-shoots, the bud being allowed to grow in the nursery and the shoot cut back to 12 inches above the union before transplanting. During the year under review this process was modified by stumping older shoots (18 months to 2 years old) at a height of about 6 ft. Despite the onset of dry weather shortly after planting the method proved very successful, and should prove of special value in supplying vacancies in clearings two or more years old. The object of stumping at this height is, of course, to ensure that any subsequent crookedness of the trunk occurs above the future tapping area, and it is probably essential that the wood be fully mature at the point of stumping.

(d) *After-treatment of Stocks.*—Further experiments carried out by the Agricultural Assistant indicate that exposure to a hot sun is the main cause of delay in the growth of the callus over the cut end of the stock. A black dressing such as Skene's pruning mixture, although apparently harmless if the union is shaded, accentuates the trouble if exposed to the sun. Since a dressing of this type is considered necessary where large stocks have been used, the desirability of shading the union with green manure plants until callusing is completed is evident.

3. *Vegetative Propagation of Stocks.*

The Agricultural Assistant reports further success in "layering" young seedlings, the proportion of successfully rooted stems after 18 months being slightly under 50%. If later experiments with young budshoots are equally successful the method may be found of definite value in raising uniform stocks for investigations on the inter-relationship of stock and scion.

4. *Studies on Clones.*

(a) *Ceylon Clones.*—Test-tapping of Ceylon clones has been further extended during the year. The total number of clones in tapping either at Nivitigalakele or on estates co-operating with the Scheme is 85, represented altogether by 826 trees. Full data regarding the most promising clones will be published in *Quarterly Circular* as the third of a series of annual reports, and in the meantime the yields for the year are summarised in Table I. We are indebted to the Proprietors of the estates concerned for permission to publish these figures.

(b) *Foreign Clones.*—The study of the performance of imported clones in Ceylon is now reaching an interesting stage in that yield records obtained from the test-tapping of small numbers of young grafts are becoming available. Yield figures of some of the best clones are given in Table II. Since most of the clones were not tapped for the full year the actual yield and number of tappings have been supplemented by a figure calculated on the basis of 150 tappings on a single cut alternate day system. While these records must be accepted with some reserve, since they are derived from such small groups of trees and for so short a period of tapping, they nevertheless indicate great potentialities for the leading clones.

We are indebted to the Proprietors of the estates concerned for permission to publish these figures, and in particular to Mr. C. E. A. Dias who has furnished most of the records.

TABLE I.

Yields of Ceylon Clones for 1934

Clone	Where tapped	No. of trees	Age in years on 31-12-34	Yield per tree in lbs.	No. of tappings	Tapping system
Govinna 771	Nivitigalakele	9	7½	6·3	110	½ sp. a. d.
Lavant 28	do	8	7	5·1	110	do
Eladuwa 1	do	10	6	4·4	110	do
Millakande 3/2	do	12	4½	2·6	111	do
Hillcroft 28	Stenness Est.	12	8½	12·9	101	do
Hillcroft 55	do	9	8½	10·0	92	do
Wawulugala 259	Milleniya Est.	10	7½	14·5	78	Double-Four
Wawulugala 259	Wawulugala Est.	10	7½	11·3	75	do
Wawulugala 320	do	10	7½	9·2	75	do
Wawulugala 120	do	10	7½	6·9	75	do
Milleniya 191	do	8	7½	11·0	75	do
Milleniya 113	Milleniya Est.	10	8½	13·2	75	do
Galawatte 2	Galawatte Est.	10	6½	3·9	99	½ sp. a. d.
Galawatte 24	do	10	6½	3·9	99	do

TABLE II.

Yields of Imported Clones in Ceylon for 1934.

Clone	Where tapped	No. of trees	Age in years on 31-12-34	Actual yield per tree in lbs.	No. of tappings	Tapping system	Calculated yield per tree in lbs. for 150 tappings on ½ sp. a. d.
Tjirandji I	Milleniya Est.	10	5½	4·5	25	Double-4	13·5
,,	Wawulugala Est.	5	6	1·8	24	,,	5·6
,,	Galawatte Est	3	4½	2·2	95	½ sp. a. d.	3·5
,,	Millakande Est.	6	4½	2·4	140	,,	2·6
Tjirandji XVI	Milleniya Est.	5	5½	3·2	25	Double-4	9·6
Bodjong Datar 2	,,	5	6½	1·4	25	,,	4·1
Bodjong Datar 5	,,	5	6½	4·1	25	,,	12·3
Bodjong Datar 10	,,	5	6½	2·1	25	,,	6·3
A.V.R.O.S. 49	,,	5	6	2·5	25	,,	7·5
A.V.R.O.S. 50	,,	5	6	3·0	25	,,	9·0
A.V.R.O.S. 256	,,	5	4	1·0	25	,,	3·1
Djasinga I	,,	5	5	4·1	25	,,	12·3

Table III 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 clones are arranged in 5 randomised blocks, 12 trees of each clone to a block, so that a critical comparison is provided.

TABLE III.

Clone	Girth at 3 ft. in ins. in November 1933	August 1934	Increase in 9 months
Tjirandji I	11·62	14·30	2·68
Tjirandji XVI	10·36	13·26	2·90
A.V.R.O.S. 49	10·45	12·60	2·15
A.V.R.O.S. 50	9·91	11·66	1·75
Tjirandji VIII	9·47	11·66	2·19
Sungei Reko 9	9·83	11·55	1·72
Bodjong Datar 5	9·91	11·39	1·48
Heneratgoda 2	9·51	11·33	1·82
Seedlings	11·02	13·55	2·53

The chief features of interest are:—

1. The predominant position of Tjirandji I. This appears to be the quickest growing of the imported clones under all observed conditions in Ceylon.

2. The satisfactory position held by Tjirandji XVI, which is usually found to be a somewhat slow grower.

3. The small girth increment of Bodjong Datar 5 during the past year. This is in accordance with general observation, since although early growth is very vigorous the formation of a crown is much delayed and the growth after the first two or three years is slow.

4. With the exception of Tjirandji I the buddings have shown slower growth than the seedlings. The fact that the seedlings suffered no check in the process of transplanting must, however, be borne in mind.

5. The general rate of growth in this area is below normal.

5. *Distribution of Material.*

In accordance with a decision of the Board that the Scheme should undertake to distribute budwood and budded stumps to small Ceylonese Proprietors for the purpose of replanting existing areas, a nursery at Nivitigalakele was budded with 20 of the best imported clones, rather over 3,000 successful grafts being obtained. The plants have been cut

back and are growing very satisfactorily, and the budwood will be used for multiplying up material in the new nurseries to be laid out in 1935 in the Pinnagoda land.

B. **Selection and Breeding.**

The Agricultural Assistant reports a small measure of progress in cross-pollinating high-yielding trees of both seedlings and buddings at Nivitigalakele. Some interesting crosses were obtained, but the work was greatly interfered with by wet weather and the exceptionally heavy Oidium infection. Sulphur dusting inflorescences before bagging was partially successful in overcoming the latter difficulty. A considerable number of "legitimate" and "illegitimate" seedlings have accumulated in the Nivitigalakele nurseries during the last few years, and the best of this material will be transplanted in the 1935 Pinnagoda clearing.

PROBLEMS CONNECTED WITH MATURE AREAS.

A. **Tapping.**

1. *Tapping Questionnaire.*

In 1933 a tapping questionnaire was circulated to all estates which had registered for the receipt of the Scheme's publications, information, in particular, being solicited regarding double-cut tapping systems, and the replies received formed the basis of a report published in the *Quarterly Circular*. Since at that time the double-cut systems had been in force on most estates for only a comparatively short time many of the conclusions were of a somewhat tentative nature, and it was felt that information of substantially greater value would be available as the result of a further year's use. A second questionnaire was accordingly circulated in April 1934. The replies have been analysed, but the preparation of a report has unfortunately been delayed by the pressure of other work.

The replies indicate that there has been a considerable extension of the areas under double-cut tapping, the increase being mainly in respect of the double-four system. The conclusions to be formed from the 1934 questionnaire do not materially differ from those reached in 1933. In general, all the commonly practised variations of double-cut tapping have been found to effect an economy in tapping costs, and it would appear that, with suitable adjustments in respect of the interval between successive tappings and the rotational rest to meet local conditions and crop requirements, simultaneous tapping of two opposite half spirals may largely replace the standard system of single cut alternate day tapping. The advent of Restriction gives the opportunity for estates to experiment with varying periods of rest, and in this connection the combination of the double-four system with a rotational cycle appears to offer promising possibilities. It is essentially the function of the Research Scheme to carry out accurate trials

of various methods of tapping, but the tapping experiment designed for execution on Dartonfield has had to be deferred pending the appointment of an Assistant Botanist.

2. *Tapping Experiments.*

In the Mycologist's Report for 1933 reference was made to the experimental tapping of three small plots situated near the laboratories. Yield recording from these plots was commenced in 1932, the original intention being to study the degree of variation to be expected from contiguous plots of equal size allotted at random. In January 1933 two of the plots were put on to double-four tapping, the dates alternating, while the third was retained on the former system of alternate day tapping on a single half spiral cut. Although in the absence of effective replication a critical comparison between the two systems is impossible, it appeared at the end of 1933 that there was at least no loss of crop involved in adopting the double-four system, and there was probably a small gain. The rubber content, also, showed a rise of 2-3 oz. per gallon as compared with the alternate day system. The figures for 1934 confirm these conclusions, the relation between the results from the two methods of tapping being almost identical in the two years.

As from March 1934 one of these plots has been tapped every four days on two opposite quarter cuts, and it would appear that the yield on this system is about 60% of that on normal alternate day tapping. As would be expected the rubber content is appreciably higher with the quarter cuts.

Although these comparisons are of a somewhat crude nature, the work has at least been of value in demonstrating the danger of drawing conclusions regarding the merits of a tapping system by comparing the crop obtained with one method of tapping in one year with that obtained on a different system in an earlier year. A number of estate Superintendents are known, for example, to have attributed a disappointing crop in 1934 to the double-four system, whereas the records referred to above show that in the area in question there has been a substantial decrease in yield irrespective of the method of tapping. It is not difficult to find a reason for this decline in the ever-increasing span since any cultivation was carried out, and the fact that 1934 was marked by abnormal periods of dry weather.

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 1934. The experiments were designed to permit examination of the results by correct statistical methods, six-fold replication being adopted. Each double-three block is divided into three portions which

are tapped for twelve months and rested for six months in rotation. Each block contains the same number of trees (210 on Estate A and 180 on Estate B), so that the number of trees tapped with two cuts is always two-thirds the number tapped on one cut.

The results for the year September 1933 to August 1934 are shown in Table II. The higher yield under the double-three system on Estate A is due to a shortage of tappings in one of the alternate day blocks and is of no significance. On Estate B, on the other hand, the double-three system has resulted in a statistically significant loss of 11%, and it will be interesting to note whether this difference will be maintained in future years. There is, however, a saving in tapping costs of about 25%. The differences between the average dry rubber contents are not significant.

TABLE III.

Estate	Tapping system	No. of tappings	Yield as percentage	d.r.c. lbs. per gallon
A (dry district)	Double-three A.B.C. 12/6	104	106·2	4·02
	½ sp.a.d.	144	100	4·09
B (wet district)	Double-three A.B.C. 12/6	87	89·0	3·23
	½ sp.a.d.	129	100	3·06

B. **Replanting.**

The improved market for the commodity has resulted in greatly increased interest in the subject of replanting old areas with high-yielding budgrafts, though there are still not many estates undertaking this work on an extensive scale. The advisory services of the Scheme in this connection have been in considerable demand, and the opportunity has been taken when visiting estates of exchanging views on the best methods of procedure.

On Dartonfield Estate a field of 7½ acres was replanted in June, 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 diagrammatic layout of the plots was successfully transferred from paper to the field, despite difficulties connected with the irregular shape of the area, and the planting operation itself was attended by singularly few

casualties considering the early curtailment of the S.W. Monsoon rains. A full account of the experiment, giving details and costs of the various operations involved, was published in the *Quarterly Circular*.

In December the preliminary work for replanting a further area of 12 acres was commenced. The main purpose of this experiment is to determine the fertiliser requirements of young budgrafts on replanted land.

C. **Cover Crops.**

Determined attempts are now being made on many estates to establish a cover of *Pueraria phaseoloides* (*P. javanica*). This appears to be the most suitable leguminous species for mature Rubber as it grows readily under shade and is effective in choking out undesirable grass growths. Numerous enquiries have been received from estates and Agency Houses as to the best means of establishing a quick cover. Although *Pueraria* will grow from cuttings and is readily "layered," the surest method appears to be to sow seed in split coconut husks in a nursery and transfer the husks to the field when the young seedlings are about six inches high. This method is very economical in seed, which is somewhat expensive and often difficult to procure.

EXPERIMENT STATION, NIVITIGALAKELE.

General supervision of the work at Nivitigalakele was exercised during the year. Mr. D. L. Nicol, Superintendent of Dartonfield Estate, assumed charge as from the 1st August, and the progress of field and experimental work is recorded in his and the Agricultural Assistant's Reports.

Growth has, for the most part, been satisfactory though it was considered desirable to manure the backward areas in the latter part of the year. As in previous years green manure loppings were forked in throughout the Station, this operation being combined with the application of the artificial fertiliser mixture.

The greater part of the 1926 Clearing is now commercially tappable though it has hitherto been the policy to test-tap only a limited number of trees of each clone. Representatives of all the clones in the 1927 Clearing are also being test-tapped, and several clones are giving promising yields.

III. ADVISORY WORK, CORRESPONDENCE, ETC.

As mentioned earlier in this report, a feature of the year's work has been the increase in the number of enquiries and requests for visits of an advisory nature.

1. *Estate Visits.*—The following visits were made to estates :—

Advisory	...	...	47
Experimental	...	...	11
Dartonfield and Nivitigalakele	...	...	51

2. *Specimens and Enquiries.*—The number of disease specimens sent for report continues to decrease, being only 28 for the year under review, and it may be assumed that this is mainly due to a better acquaintance with diseases and their methods of control.

Enquiries received from estates and Agency Houses were apportioned as follows :—

Botanical.			
Budding and allied subjects ...	54		
Replanting	24		
Tapping	28		
Manuring	22		
Cover crops	33		
Miscellaneous planting matters ...	7	168	
Mycological.			
Oidium and sulphur dusting ...	149		
Other diseases	22	171	
	Total	339	

Total correspondence amounted to 1,278 inward and 1,372 outward letters.

3. *Co-operation with Malaya.*—Co-operation has been maintained with the Rubber Research Institute of Malaya by means of interchange of views and information with the Pathological, Botanical and Soils Divisions.

VI. **PUBLICATIONS.**

1. Ceylon Clones—II. *Quarterly Circular,* Vol. 11, Part 1.
2. Diseases of Rubber in Ceylon, 1933.—*Quarterly Circular,* Vol. 11, Part 1.
3. Oidium Leaf Disease in Ceylon in 1934.—*Quarterly Circular,* Vol. 11, Part 2, and Leaflet No. 13.
4. The Sulphur Dusting Treatment for Oidium.—*Quarterly Circular,* Vol. 11, Part 2, and Leaflet No. 14.
5. Field Experiments on Dartonfield Estate. I.—*Combined Quarterly Circulars,* Vol. 11, Parts 3 and 4.

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Rubber Research Scheme Laboratories,
Culloden, Neboda, 16th Feby., 1935.

AGRICULTURAL ASSISTANT'S REPORT FOR 1934.

The writer continued in charge of the experimental and routine work of the Experiment Station, Nivitigalakele, and its accounts from January to July. Three months' leave of absence was taken from 1-8-34 to 31-10-34. On resumption of duties on 1-11-34, the writer was appointed to the new post of Small-holdings' Officer of the Rubber Research Scheme and part time duties in this capacity were undertaken, but the transfer will not have full effect until an Assistant Botanist has been appointed. The Experiment Station, Nivitigalakele, was visited during November and December, only in connection with experimental work and other special duties.

(1). THE EXPERIMENT STATION, NIVITIGALAKELE.

(a) *Experimental.*

Cross-Pollination.—Work in artificial cross-pollination of Ceylon clones established at Nivitigalakele was carried out during the flowering season, February to early April. Pollinations were also carried out among a few high-yielding budded trees at Stenness Estate, Mahagama, and between trees on the latter and at Nivitigalakele by the transference of pollen. A total of 1,341 pollinations was made and 44 successes (pods) obtained. This gives a successful percentage of 3·2% on the season's work as against 6·3% obtained in 1933, but for this type of work the results cannot be considered unsatisfactory especially in view of the unprecedented interference from Oidium and to a less extent from rain (15·60" in March) during the period of pollination, both of which hinder the scope and success of the work. Of the 44 successes obtained only 12 were harvested, once again a large number of the pods having dropped before maturity. Of the 36 seeds (from 12 pods) put out to germinate 13 plants were obtained and are now growing satisfactorily.

Interference from Oidium, which was more severe than ever before in the district and which causes the flowers to shrivel and drop without opening, was considerable. Observations showed that sulphur-dusting of inflorescence-bearing branches just before "bagging", (*i.e.*, when the male flowers are beginning to open) afforded partial control but that greater immunity would be obtained by commencing dusting at an earlier stage, *i.e.*, when the new leaflets are still small and brown. It was interesting to note that, at Nivitigalakele, no tree on which artificially-pollinated pods failed to be obtained bore a single naturally-fertilised pod either. It was a marked feature that owing to the severity of Oidium, pod-formation on trees throughout the district was generally below the average.

Scaffolding, built mainly of arecanut palms, was erected round trees that were at all difficult of approach and proved very useful and inexpensive.

Vegetative Propagation of Stocks.—Experiments in the vegetative multiplication of uniform rubber stocks by the method of "layering", which were initiated in 1933, were continued. The method adopted was to bend over a number of approximately 1 to 2-year-old seedlings by loosening the roots on one side and fasten them to the ground. As the buds along the horizontally-fastened stems began to sprout, they were kept partly covered with mounded earth to induce rooting. During the previous year it was reported that 12 out of 58 such vertical shoots had formed roots, and during the year under review the total shoots rooted increased to 27. The experiment reveals that given sufficient time quite a fair percentage of 'layered' rubber shoots can be made to strike root by this method. The experiment was initiated in May 1933. There is a possible advantage in "ringing" the collar of each vertical shoot with a tight wire ring to stimulate root-formation, but evidence on this point is not clear.

Owing to a possibility that the rooting of budded rubber plants by this method is more difficult, the experiment was repeated in May 1934 with 1 to 2-year-old buddings in place of seedlings.

Dying of Callus Round Budded Joints.—Investigations undertaken to ascertain the cause of the growing callus round the cut surface of budded stocks dying back after starting to callus over quite satisfactorily for the first few months showed that the sun during hot weather was mainly responsible for the damage.

The investigations were continued after eliminating the sun factor by means of artificial shading and merely painting the callusing joint with Skene's pruning mixture in order to determine whether the latter influenced the dying in any way. 12 joints were shaded and painted, and 12 shaded and left unpainted. Up to the moment of writing (approximately 6 months after initiation) no dying was evidenced in either group. The final inference is likely to be that the mixture by itself does not tend to damage the growing callus but that in conjunction with the sun it may accentuate dying.

It should be pointed out that the earlier part of the experiment established that the sun alone, in the absence of Skene's mixture, was definitely capable of killing the callus.

Girth Expansion in Relation to 'Pollarding'.—A number of budded trees (budded November 1930) of clone "Yog 11 T" in the 1928 clearing, whose crowns were badly bent during the heavy winds of May 1933, were sawn off just below the bend to allow the trees to straighten up. Girth measurements were taken at a height of 3 feet of the trees so 'pollarded' as well as of a number not bent and therefore not pollarded (controls) to

ascertain the difference in girth expansion, if any, resulting from pollarding. The measurements were taken immediately after pollarding and again approximately one year later. The average expansion of the trees whose crowns were removed was 1 inch, while that of the trees whose crowns were not removed was 4·97 inches. Thus a distinctly greater expansion in girth in favour of the uncut trees is apparent at least for the first year.

Measurements will be continued.

A group of budded trees whose crowns were similarly bent by the wind but left uncut as controls was observed to have straightened out at the end of one year from date of damage. The conclusion was therefore drawn that only in instances where the crowns are very severely bent, need the trees be pollarded.

Growth of Seedlings.—An experiment was laid out in September 1933 to compare the rate of growth of seedlings from the following types of rubber seeds :—

A. Small seed, slow germinating,
B. Small seed, quick germinating,
C. Large seed, slow germinating,
D. Large seed, quick germinating.

Types B & D consisted of seed which germinated within 9 days of first putting out and types A & C of seed which took 30 days to germinate. Measurements of the average heights of the seedlings resulting from each of the 4 types were taken in July 1934. The results statistically examined by the Mycologist, whilst not being sufficiently complete to manifest a significant difference, showed an apparent advantage in favour of the quick germinating seed and a slight excess of the average growth of the plants from the large seed over that of the plants from the small.

Germination of 'Pueraria' Seed.—Two specimens of *Pueraria phaseoloides* (*Javanica*) seed, one from a Colombo firm and the other from an estate in the district, were tested for germination. The seed was germinated (1) on moist blotting paper and (2) in sand, and in each case part was put out to germinate after being kept immersed in hot water overnight, and part without. The results indicated—

(1) that the percentage germination of the seed as a whole was very poor, the highest obtained being only 21%, and
(2) that a higher germination was obtained with both samples of seed by previous immersion in hot water overnight than by not doing so.

The poor percentage germination of *Pueraria* seed this year is not unexpected owing to the fairly general incidence in the district of a fungus evidenced on the flower-stalks and beans during the period of flowering and 'setting', which causes discolouring and rotting.

Mixtures for Filling Cavities of Decayed Stocks.—In view of the fact that the mixture of colas and sand used for filling cleaned-out cavities of decayed budded stocks had not proved satisfactory, new mixtures of (a) coir-dust and colas (1 :1) and (b) saw-dust and colas (2 :1½) were experimentally tried. Stocks filled in March 1933 were examined in January 1934 and again in June 1934. Both mixtures were observed to possess the advantage of remaining softer than the sand-colas mixture and to allow of being easily squeezed out as callusing proceeded, besides showing no tendency to scorch the cortex around the filling as was experienced with colas and sand, even during hot weather. All specimens under treatment (a) and half those those under treatment (b) had completely callused over at the last inspection. Either mixture appears preferable to the sand-colas mixture.

Scion-Grown 'Supplies'.—Following the successful transplanting in 1933 of budded stumps whose scions had been previously made to shoot and then cut back to 12 in. of brown wood, an attempt was made this year to transplant stumps whose scions had been allowed to extend further and then cut back to 6 feet of brown wood. Owing to want of planting space at Nivitigalakele the experiment had to be confined to supplies put out in place of vacancies. Out of 14 stumps planted out in this manner only one had died 6 months after planting. The method opens the prospect of supplying vacancies in a budded clearing with stumps possessing a clean tapping surface up to a height of 6 feet and less backward in growth in relation to the rest of the clearing than would be possible either by planting dormant stumps or scion-grown stumps cut back to 12 inches.

(b) *Progress of Works.*

The progress of works at Nivitigalakele from January to July, *i.e.*, the period during which the writer was in charge, is recorded below. In any instance where it has been considered desirable to extend this limit, due mention is made.

The Clearings.—As was reported in 1933, the budding of all 3 clearings was completed early that year. During the current year it was therefore left to maintain them in good order, supply vacancies and carry out such experimental and routine works, such as test-tapping, as were necessary.

On account of the advanced condition of growth of the budded trees in the 1926 and 1927 clearings, supplying of vacancies was confined to the 1928 clearing. A total of 29 budded stumps was supplied during the year, 14 of which, as described earlier, were put out as 6 feet tall scion-grown supplies.

The clearings as a whole, except certain extremely cabooky areas that have been consistently backward, have made good growth in spite of the absence of artificial fertilisers since the beginning of 1933.

The cleaning, disinfecting and treating of decayed joints of budded trees throughout the clearings was concluded with the completion of the balance 6 acres in the 1928 clearing (*vide* 1933 Report). Joints which left a cavity on cleaning out were disinfected and filled with a mixture of coir-dust and colas (1 : 1).

Weeding was satisfactorily executed on contract although a certain amount of difficulty was experienced in keeping within the estimate during the earlier half of the year owing to increase of weeds due to excessive rain.

5 budded trees in the 1926 clearing whose identity was uncertain were identified by the method of vegetative characteristics.

Budding and Attention.—Budgrafting work was mainly confined to budding of nursery stocks with a view to the multiplication of budwood of various proved clones for ultimate distribution of material to small-holders. The stocks were budded with budwood of the better known proved foreign clones which had been grown at the Nivitigalakele budwood nurseries. The clones used were A.V.R.O.S. 49, 50, 152 and 256, Glenshiels 1, Prang Besar 23, 24, 183, 86 and 186, Bodjong Datar 5 and 10, Tjirandji 1, Tandjong Kemala 12, 14, 16 and 26, Sabrang 24, Rubana 393 and Sungei Reko 9. The results of budding during the year are as follows :—

Month examined	Month Budded	Clearing or Nursery	No. Budded	Final successes	Percentage successes
May	April	Small-holders' nursery	1,137	517	45·50%
June	May	,,	1,937	1,343	69·33%
June	May	1926 Clearing (experimental)	9	6	66·66%
July	June	Small-holders' nursery	201	195	97%
Aug.	July & Aug.	,,	766	682	89%
Sept.	Aug. & Sept.	,,	1,796	1,533	85%
October	September	,,	429	398	93%
December	November	Deniya nursery	14	14	100%
December	November	Budwood nursery	24	12	50%
		Total	6,313	4,700	74·45%

Although the first examination of some of the earlier buddings gave a very high percentage of successes, a considerable drop in results was experienced at the second examination. Observations showed that this was almost solely due to water entering the bud-patch during the heavy May rains which immediately followed the first examination at which the bandage and patch of adhesive taper covering the bud-patch are removed. This discovery prompted the deferring of the first examination to a period longer

than the normal 3 weeks from the date of budding, when such examination fell due during times of excessively wet weather. Later examinations where the first examination was deferred on these lines showed considerably improved final results. Shading with leaves either before or after the first examination was found undesirable under wet nursery conditions.

Test-tapping.—Test-tapping of the 378 budded trees of the various Ceylon clones that were being continued to be tapped from the previous year, was stopped on 8-2-34 owing to wintering. Tapping was recommenced at the end of March and 149 additional trees, which fulfilled the necessary girth requirements, were brought into tapping. Some of these represented clones which had not been tapped hitherto while others were brought in to complete the requisite 12 trees of clones already tapped. In the 1926 clearing new panels were opened on the opposite side at 24 in. from the union (previously tapped at 48 in.).

An experiment to compare the 'alternate daily' with the 'double-four' tapping system was included in the test-tapping.

Nurseries.—The annual pollarding of all overgrown and unsuitable budwood in the budwood nursery was carried out in November. Clones not already represented in the clearings and whose budwood will be required for budding the new Pinnagoda clearings next year were left uncut. A census of the number of yards of budwood on each tree at the end of the year and particulars of pollarding, etc., was taken and the nursery chart revised accordingly. All galvanised tree-labels, which tend with time to corrode, were replaced by aluminium ones and rusted wires and tar-bands renewed.

The extra budwood nurseries opened up last year for multiplying budwood of proved foreign clones necessitated frequent rounds of inspection for the removal of side-shoots.

Approximately 850 stumps budded in the Small-holders' nursery with proved foreign clones were utilised for planting up the 're-planting' field at Dartonfield Estate. A calculation made of the cost of the budded stumps supplied from the Small-holders' nursery, inclusive of all expenses since the laying down of the nursery, worked out at 15·88 cents per stump, exclusive of the value of budwood.

Nitrogenous Plants.—Envelope-forking of green manure loppings along platforms was started in June and completed during the writer's absence. The entire platform, except a margin of about 2 feet along the edge and 4 feet on either side of each rubber tree was forked.

Approximately 209 lbs. of mixed green manure seed was collected (up to July), 95 lbs. sold and 23 lbs. sown. The chief demand was for *Pueraria phaseoloides, Clitoria laurifolia* and *Centrosema pubescens*. The two latter

were sold @-/50 and -/25 cents per lb. respectively but the demand for *Pueraria* could not be met owing to the failure of the seed crop. 12 cart-loads (½ carts) of *Pueraria* cuttings were also supplied @ Rs. 2/- a half-cart excluding cart-hire.

The ground cover as a whole has been well maintained except for one or two patches that were devoured by snails during wet weather. The latter were replanted with both cuttings and seed.

Mikania.—The eradication of patches of *Mikania scandens* was pursued both by forking and by following the forking 2-3 weeks later by spraying the tiny shoots which recommence growth with a 5% solution of copper sulphate. A knapsack sprayer was used. Owing to limited funds available on this account and the unusually wet weather earlier in the year only partial control was effected.

Manures.—No extensive artificial manuring was done up to July. Supplies, at time of cutting them down to 6 in. from the bud-patch, nursery budded stumps from which budwood was required, cross-pollinated seedlings and nursery seedlings in anticipation of being budded were however given small doses of suitable artificial fertilisers as was thought necessary.

Diseases and Pests.—Another favourable year in this respect can be reported, except in relation to Oidium which has been dealt with elsewhere. Damage caused by the S.W. Monsoon winds was small compared to last year, only 3 trees being blown down. 53 trees however whose branches were damaged had to be sawn off below point of damage and treated. An advanced case of Brown Bast (nodular stage) on a tree belonging to clone "H2" necessitated the removal of the tree. The usual inextensive outbreaks of *Corticium salmonicolor* (pink disease) and *Phytophthora palmivora sp.* occurred. The Kalutara snail, which was rather troublesome on cover crops during wet weather, had to be collected and destroyed.

Other Works.—Fences were repaired and a total of 171 decayed fence-posts replaced. Nursery and deniya drains were cleaned out and reconditioned. Young buddings in exposed areas were staked prior to the S.W. Monsoon.

Staff and Labour.—The staff at the Experiment Station have discharged their duties satisfactorily.

Sinhalese labour was employed throughout. No acreage fees were paid. Wage-rates of Sinhalese labourers were raised from 40 to 41 cents per day for men and from 25 to 33 cents for women to conform with Indian Immigrant rates.

Rainfall.

		1933	1934
January	...	7·25 in.	13·92 in.
February	...	4·70 ,,	3·84 ,,
March	...	8·57 ,,	15·60 ,,
April	...	17·30 ,,	15·09 ,,
May	...	29·40 ,,	32·86 ,,
June	...	20·72 ,,	32·69 ,,
July	...	12·60 ,,	5·68 ,,
August	...	13·80 ,,	4·60 ,,
September	...	9·61 ,,	3·56 ,,
October	...	19·52 ,,	38·94 ,,
November	...	13·55 ,,	20·39 ,,
December	...	7·98 ,,	9·55 ,,
	Total	165·00 in.	196·72 in.

Specially heavy storms were experienced in May, a fall of 9·07 in. being registered on 7-5-34 and 14·72 in. on the 2 following days.

(2). SMALL-HOLDINGS' WORK.

Although appointed Small-holdings' Officer in November, only part-time duties in this capacity were undertaken pending the appointment of an officer to take over the writer's responsibilities as Agricultural Assistant.

A meeting of the Pasdun Korales' Small-holders' Association was attended with the Director and a practical demonstration of bud-grafting given. The address of the Director concerning proposed assistance to Small-holders by the Rubber Research Scheme was interpreted into the vernacular. The assembly manifested a promising interest in the address as well as demonstration and asked a number of questions.

Interviews were held with Staff Officers of the Department of Agriculture, Peradeniya, regarding co-operation in Small-holdings' work, sulphur-dusting of Small-holdings in the Central Division early in 1935, and methods adopted by their Propaganda Department for disseminating agricultural information among peasants and small-holders.

Small-holdings at specified centres in the Central Province were selected for demonstrating sulphur-dusting against Oidium to small-holders. An address to be given at such demonstrations was prepared.

(3). GENERAL.

Among general duties undertaken during the year was the visiting of certain estates in connection with experiments conducted by the Rubber Research Scheme, pollination work etc. The following literature was contributed :—

1. "A handbook on the bud-grafting of rubber", (to be published).—This work was carried out as a revision of a booklet on the subject written some years ago by Mr. R. A. Taylor, former Botanist of the Rubber Research Scheme.
2. "Further notes on the after-treatment of budded Rubber stocks"—*Quarterly Circular,* Vol. 11, Part I.
3. "Notes on cross-pollination of Rubber in Ceylon".—*Quarterly Circular,* Vol. 11, Part I. (Written 1933, published 1934).

W. I. Pieris,
Agricultural Assistant.

Research Laboratories,
Culloden, Neboda.
8th February, 1935.

ESTATE SUPERINTENDENT'S REPORT FOR 1934.

DARTONFIELD ESTATE.

Supervision of the estate was taken over from Mr. J. F. Templer, Superintendent of Galawatte Estate on 16th January, 1934.

Rainfall.—Rainfall for the year, amounting to 197·37 inches, was much above the average but the distribution was abnormal and heavy rains during the usual dry season interfered to no small extent with the programme of work for the year. The burning of trees uprooted in the experimental replanting area was delayed, and considerable damage to the newly cut contour platforms was caused by heavy downpours before the earthworks had consolidated. On the other hand the partial failure of the S. W. Monsoon led to difficulty in the establishment of leguminous ground covers. Details of the rainfall during 1934 and the preceding year appear below :—

		1934	1933
January	...	13·73 in.	10·89 in.
February	...	5·43 ,,	5·65 ,,
March	...	17·70 ,,	9·88 ,,
April	...	18·47 ,,	14·39 ,,
May	...	23·58 ,,	34·33 ,,
June	...	38·76 ,,	20·39 ,,
July	...	5·97 ,,	12·60 ,,
August	...	5·05 ,,	13·43 ,,
September	...	4·83 ,,	8·71 ,,
October	...	34·22 ,,	23·69 ,,
November	...	20·08 ,,	17·82 ,,
December	...	9·55 ,,	6·92 ,,
	Total	197·37 ,,	178·70 ,,

Crop.—The harvest of 103,947 lbs. for the year under review has exceeded the estimated crop by approximately 12,000 lbs. Several areas on the estate have been rested during the past few years and the large crop may be attributed partly to the beneficial effects of this treatment. The output for 1934 is very satisfactory considering the unusual conditions and the number of wet days.

Tapping.—The "double-four" system of tapping adopted late in the preceding year and continued during 1934 has so far given satisfactory

results. Bark consumption worked out at an average of 3½ inches on each side of the tree. Tapping cuts have been re-marked to an angle of 22½ degrees, and the slopes of the cuts are being gradually adjusted to this angle. No marked decrease of yield occurred during the dry spell in July-September. The amount of dirt brought in with the latex has been reduced by the use of nails for hanging latex cups on the trees.

Pests and Diseases.—Except for a few cases of *Ustulina* and Canker the estate has been on the whole free from disease. Prompt measures of treatment were taken and the cases of *Ustulina* dealt with in accordance with the Mycologist's recommendations. The *Fomes* patch which had been treated in the preceding year showed no signs of the disease having spread during 1934. Clean weeding has been maintained and this area has throughout been regularly inspected to make sure that the disease does not spread.

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

Manufacture.—Since the completion of the building and the installation of machinery in November the factory has been in operation and three types of rubber are being manufactured:—Smoked sheet, crepe and a small quantity of nitrite crumb rubber. As production of the latter material is still in the experimental stage, especially in the direction of rapid drying, the amount produced was limited to about 40 lbs. per day. The bulk of the crop is being utilised in the preparation of smoked sheet and crepe, in approximately equal quantities. The quality of the crepe and smoked sheet turned out has been good, and very satisfactory reports have been received from the Brokers regarding these grades. The crumb rubber is being shipped to London for experimental use.

Labour.—Labour conditions were unsettled and a number of changes were made during the year owing to considerable movement on the part of the workers. However the total labour available has been adequate. A large number of local Sinhalese were employed during the year for completing various important works which were in hand:—preparation of sites for buildings, the replanting experiment, the construction of the cart road etc. During the paddy harvesting and ploughing seasons there was, as might be expected, a slight shortage of local labour owing to withdrawal to cultivate their own fields, but this difficulty was overcome by the introduction of a party of labourers from Matara.

NURSERIES.

1933 Nursery.—This nursery which was opened during the preceding year has shown good and steady growth. A certain amount of damage was done to the seedlings by the activity of bandicoots, but the damage was

not serious and was checked without delay by the use of traps. The nursery was thinned out to slightly more than half the number of plants that were raised from seed by the removal of the poorer specimens, and towards the end of the year it was manured with a suitable mixture of nicifos and muriate of potash. The stocks are to be used in the 1935 replanting experiment.

1934 Nursery.—This nursery was opened out during the year on a site adjacent to the 1933 nursery. The seeds were germinated in sand and the germinated seed planted at 6 inch spacing in rows alternately 1 ft. and 2 ft. apart, in prepared beds 11 ft. wide on the contour. The growth of the plants in this nursery has been satisfactory up to the present.

Replanting Experiment.—As the purpose of this experiment and its layout have been fully described in the *Quarterly Circular,* only a brief outline of the procedure adopted in clearing and the subsequent operations undertaken is added herein:

Holing had been carried out late in 1933 in lines between the old rows of rubber trees, and all hard-bottom holes with underlying stone had been dynamited. When the writer took charge of the estate, uprooting of the old rubber trees by elephant had just commenced. As soon as this was completed, the cutting, stacking and burning of branches and tree trunks was undertaken according to the experimental requirements. As mentioned before, heavy rain delayed the burn in these areas.

After the uprooted trees had been dealt with as required, work was commenced in filling up the holes. The material used for filling consisted of the best surface soil available freed from stones and incorporated with dry and green leaf. An individual contour platform 15 ft. × 6 ft. was then cut for each tree, with a slope of 1 in 6 from the back of the platform to a bund 1 ft. × 1 ft. on the outside. Planting in rows with individual contour platforms is not a usual estate method but straight plot boundaries were required to facilitate cover crop control. Shortly after the completion of this work considerable damage by rain, partly due to flooding from the higher jungle land adjoining this area, occurred and it was found necessary to open some of the old leader drains and provide suitable catch drains in the jungle area.

Dormant budded stumps of 3 imported clones GLS. 1, AVROS. 256 and P.B. 186 were brought over from Nivitigalakele and planted in the three experimental blocks during June. In spite of adverse weather conditions the planting proved very successful, a census covering the whole area showing that only 5% of the plants had perished after planting. Another census taken later showed that nearly 75% of the buds had sprouted, the proportion of dormant buds being highest in the Glenshiel Block. All

budded stumps are being examined and the stockshoots removed at regular intervals.

The planting of cover crops in the various plots was also undertaken with the advent of the South-West Monsoon as the experiment includes a comparison of 4 species of ground cover namely, *Centrosema pubescens*, *Calapogonium mucunoides*, *Pueraria phaseoloides* and *Dolichos Hosei* (*Vigna*). A thin cover of vigna was already present in the field and this soon formed a good cover in the plots allotted to this species. Its eradication from plots reserved for other covers proved rather costly. *Calopogonium* was planted from seed and spread rapidly in most of the areas allotted to it. *Centrosema* was also grown from seed but spread more slowly. *Pueraria* was planted from cuttings and unusually dry weather which set in shortly after planting, was responsible for the failure of this variety to establish itself satisfactorily. Seed was planted later in the year with better success. *Crotalaria anagyroides* has been planted in all plots as a green manure plant, and *Clitoria laurifolia* along the bunds of the platforms. Silt-pits have been dug at the back of all platforms.

1935 Replanting.—An area of approximately 12 acres has been selected for replanting during the year and holing on the contour completed. The holes cut are 2½ ft. by 2½ ft. and 3 ft. in depth. The roots of the old rubber trees are being cut as a preparation for their removal by elephant.

Cart Road.—A cart road slightly more than half-a-mile in length was built to lead up to the factory and laboratory sites and has been in use since July. 20 stone and concrete culverts and two small bridges had to be erected in this connection.

Buildings.—As soon as the cart road was available a start was made with the construction of the estate factory and laboratory by the contractors concerned.

Factory.—Construction was started early in July and the building was completed and handed over within the short space of four months. Normal manufacture of rubber began in November. The installing of machinery in the experimental section was started towards the end of the year.

Laboratory.—Work was commenced and the completed building handed over about the same time as the factory. One room of this building is being used as the Superintendent's office.

A battery room was built and batteries were installed for supplying current and light to the laboratory.

Bungalows.—The erection of the Superintendent's bungalow and two bungalows for Junior Staff was started in November.

NIVITIGALAKELE.

Report for Period August-December, 1934.

General.—In addition to the duties on Dartonfield, the charge of this Station was entrusted to the writer when Mr. W. I. Pieris proceeded on leave

Nurseries.—A fair proportion of the nursery budding programme had been completed when the writer assumed charge. Budding of the balance area was continued satisfactorily and completed before the arrival of the N. E. rains in October. Stocks were cut back at the end of the second examination, with the exception of a few which were allowed to remain uncut for use as dormant supplies in the replanted area at Dartonfield. A total number of 2,964 plants were left over after the stocks had been cut down and the casualities removed.

Nitrogenous Plants.—Plain forking of the platforms with the incorporation of green manures into the soil had been completed in the 1926, 1927 and field 3 of 1928 clearing, and was being continued in 4B of the 1928 clearing when there was a sudden shortage of local labour who had returned to the seasonal harvesting and cultivation of their fields. Work was held up for a period of about 2-3 months and once the turnout was again normal, work was resumed and completed in fields 4B and 4C of the 1928 clearing — 4A being the only field which did not receive treatment.

Manuring.—An area of 38 acres was manured towards the end of the year. Field 4A was the first to receive attention and forking was done in the usual manner with the application of manure on the platform, but in the case of fields which had been earlier plain forked, application was confined to the top portion of the area between the platforms. Each plant received a dose of approximately 3-3½ lbs. of a general mixture except that supplies were given a smaller quantity according to age and size.

Weeding.—Weeding, which is done on contract, has been maintained in good order. *Mikania* has again been troublesome especially in fields 4B and 4C where it spreads with great rapidity in wet periods. *Cuscuta* has checked it to some extent, but where not, periodical forking was found necessary.

New Clearing.—An area of forest land, adjacent to the Station, has been leased from Government and preparations were taken in hand for planting 30 acres in 1935. Felling was completed in December after preliminary inspection of the land had been made and the boundaries ascertained.

D. L. NICOL,
Superintendent.

Dartonfield Estate,
Agalawatte, 28th Feby., 1935.

REPORT OF THE LONDON ADVISORY COMMITTEE FOR RUBBER RESEARCH (CEYLON AND MALAYA) FOR 1934.

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

Membership of the Committee.—Sir Harry Lindsay, K.C.I.E., C.B.E. was appointed Director of the Imperial Institute on the retirement of Lieutenant-General Sir William Furse, K.C.B., D.S.O. on the 1st October, 1934.

Meetings of the Committee and Technical Sub-Committee were attended by Dr. H. A. Tempany, member of the Board, Rubber Research Institute, Malaya.

Visits to the Imperial Institute were paid by Mr. E. W. Whitelaw and Mr. C. E. A. Dias, members of the Board of Management, Ceylon Rubber Research Scheme.

Mr. M. W. Philpott, who was selected for the vacant post of Chemist in Ceylon, worked in the London laboratories for a short period before taking up his appointment in Ceylon.

Finance.—The expenditure incurred in connection with the work in London during the year amounted to £3,025.2.7. After allowing for reserve for plant and for liabilities outstanding, there was an unexpended balance in London at 31st December, 1934 of £375. There were also at that date balances of £193.3.0. held on behalf of the Rubber Research Institute of Malaya and of £411.11.4 held on behalf of the Ceylon Rubber Research Scheme from the funds supplied by them to meet expenditure incurred on their behalf.

During the year the Boards of the Rubber Research Scheme, Ceylon and the Rubber Research Institute, Malaya agreed to the proposal of the Committee that, in order to allow time for the preparation and consideration of a revised scheme for work in London, they should continue until the 31st December, 1935, the arrangement which has been in operation since 1st January, 1932, under which they meet in equal proportions the cost of maintaining the rubber laboratories at the Imperial Institute (namely £2,800 per annum).

Rubber Roadway Investigations.—The Committee were consulted by the Rubber Research Institute, Malaya as to (1) the desirability of continuing in Malaya the rubber roadway investigations which had been in abeyance since May 1933 owing to lack of staff and (2) as to whether the Institute could collaborate and assist in investigations or trials in England.

The Committee were of the opinion that practical experience had shown that considerable work on fundamental problems is necessary before proceeding further with technical trials with latex mixtures, and that this fundamental work could best be undertaken in Europe where better facilities are available than in the East. In the circumstances they suggested that work in Malaya should be postponed until some practical results have been established from the investigations carried out in this country and that an officer should be appointed to carry out in the Committee's laboratories a systematic study from the rubber standpoint of the prepartion and properties of latex mixtures for roadways where he would be in close touch with the road experts employed by the Rubber Growers' Association and other investigators of highway construction problems. If later developments showed it to be desirable, arrangements would then be made for this officer to proceed to the Rubber Research Institute with a view to studying the possibility of developing under local conditions any promising proposals arising out of the fundamental work, and for this purpose the experience gained and the contacts established in London should be of great value in Malaya.

At the close of the year information was received that the Board of the Rubber Research Institute had adopted the suggestion in principle and were in communication with the Government of the Federated Malay States regarding the allocation of the funds necessary to provide for the laboratory research in England for a period of three years.

At the request of the Rubber Research Institute observations were furnished on the Programme of Work for 1934 of the Botanical, Chemical, Pathological and Soils Divisions of the Institute. In this connection useful assistance was rendered by the former Heads of the Soils and Pathological Divisions who attended the meeting of the Sub-Committee dealing with the matter, and were able to furnish detailed information regarding the objects in view.

The Committee noted with satisfaction that the Board of the Institute are in general agreement with the views they expressed, and that priority is being given to the investigations which they consider to be of major importance.

Investigations.—The work consists chiefly of investigations of the physical and chemical properties of raw and vulcanised rubber after its arrival in Europe with the object of determining the cause of variability of different forms of plantation rubber and of devising methods for the production of types of rubber desired by manufacturers. The main objective is thus improvement of quality but there is no clear line of demarcation between investigations on this subject, utilisation problems and the development of

new uses. As the disparity between supplies of raw rubber and demand has developed, the programme has been given a definite bias in favour of immediate practical problems connected with utilisation and, in recent years, grants have been received from the Technical Research and Development of New Uses Committee of the Rubber Growers' Association to enable attention to be concentrated on the detailed examination of a few of the ideas which have shown definite promise in the preliminary experiments.

In developing new types of rubber or latex such as crumb rubber, soft rubber and latex concentrates in connection with the work on quality, it has been necessary not only to examine the properties of the product but to explore likely outlets for its use in rubber manufacturing and in many other industries and also to supply technical advice to possible users based on the results of the experimental work. For instance, development of the use of rubber crumb has necessitated continuous contact with the technical staff of a manufacturer of road material who has been conducting practical tests with this rubber. This contact is being continued in the trials which are now being conducted.

The introduction of latex as a commercial product and the rapid increase in its use which has taken place during the last few years has brought into prominence a number of important technical problems requiring urgent attention. Although the trade is in its infancy latex is being used for a variety of purposes outside the rubber manufacturing industry and extensive enquiries have been made from time to time with a view to obtaining information as to the properties desired by users with very varied requirements. During the year most of the work on latex was concerned with problems relating to concentration and to the development of standardised methods of testing. There is, however, a considerable field of work needing immediate attention in order to ensure the regular supply of a reliable material to which only a very limited time can be devoted by the staff at present available.

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 1934 will be found in the technical appendix to this report.

REPORTS ON INVESTIGATIONS FORWARDED TO CEYLON AND MALAYA DURING 1934.

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

(1). Effect of Autoclaving Latex (2 reports).
(2). Effect of adding plastogen to latex.
(3). Effect of heating latex with alkaline bleaching powder.
(4). Effect of treating latex with a mixture of sodium nitrite and bisulphite.
(5). Effect of adding alkali to latex before coagulation.
(6). Effect of coagulating fresh latex with papain.
(7). Effect of adding copper sulphate to latex before coagulation.

Experiments with a view to improving the plastic properties of crepe and sheet.

(1). Effect of treating creped coagulum with hot water.
(2). Effect of treating sheeted coagulum with hot water.

Clone Rubber.

(1). Rubber from three Ceylon clones.
(2). Rubber from a series of clones in Sumatra.

Water Absorption Experiments.

Reports on two series of samples prepared with a view to reducing the amount of water absorbed by rubber from a damp atmosphere.

Investigations arising out of questions raised by manufacturers.

(1). Effect of colour of smoked sheet on plasticity.
(2). Methods of packing rubber.
(3). Rubber contaminated with manganese.

Special forms of rubber.

(1). "Patterned Para" (sheet prepared without machining).
(2). Rubber prepared with proprietary coagulant.
(3). Crepe vulcanised at atmospheric temperature.

Creaming of latex.

(1). Creaming power of different commercial grades of gum tragacanth.
(2). Value of gum and gelatine as creaming agents.
(3). Latex creamed with tragon seed gum.
(4). Latex creamed with methyl cellulose.
(5). Variations in the creaming power of different latices.

Utilisation of skim from concentrated latex.

(1). The use of magnesium chloride-sodium silicofluoride mixture as a coagulant.
(2). Coagulation of latex skim with papain.

Recent Developments in the Plantation Industry of Interest to Manufacturers.

Paper read by Mr. Martin at a meeting of the Manchester and District Section of the Institution of the Rubber Industry held on the 19th March, 1934.

Co-operation with Ceylon Rubber Research Scheme and Rubber Research Institute of Malaya.

In addition to supplying reports on investigations, advice was furnished to Ceylon and Malaya on a variety of technical subjects. Numerous requests were also received in connection with the purchase of apparatus and equipment, staffing, etc. The Committee are glad to observe from the marked increase in correspondence that full advantage is being taken of the facilities available in London.

The Committee also followed with interest the work in the East and gave close and careful attention to the reports from Ceylon and Malaya which were submitted for the information of its members.

The Committee were glad to observe that the staffs of both the Rubber Research Institute, Malaya and the Rubber Research Scheme, Ceylon are investigating the quality of rubber from budded clones which may be determined by a number of factors, the effect of which is not yet known. They noted with concern the developments in the spread of Oidium and the serious effect which the disease is having on the yield of latex in Ceylon, and in this connection they suggested that attention should be directed to the development of clones which show resistance or immunity to the disease.

In view of the difficulties in the control of Oidium by sulphur dusting owing to the unsatisfactory character of the material supplied to Ceylon and Malaya information was furnished by the Committee regarding the types of sulphur used elsewhere for similar purposes, and samples of products which appeared likely to be suitable were forwarded for trial.

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. Specifications were also prepared on behalf of the Rubber Research Institute in connection with investigations of the staff in Malaya.

Applications sealed during 1934.

410,875—Method for the preparation of granular rubber by the mechanical treatment of wet coagulum.

Complete applications accepted during 1934 *and awaiting sealing.*

835/34—A process for obtaining homogeneous dispersions of unvulcanised rubber in tar which previously could not be obtained.

35277/33—A process for the preparation of soft rubber on the plantation without heating the rubber to a very high temperature.

Provisional applications filed during 1934.

422/34—Improvements in and relating to the concentration of latex.

5411/34—Improvements in and relating to the treatment of latex. (communcated by the Rubber Research Institute, Malaya).

7784/34—Improvements in and relating to the concentration of latex (communicated by the Rubber Research Institute, Malaya).

17070/34—Improvements in and relating to the concentration of latex.

34835/34—Improvements in and relating to the concentration of latex.

Provisional Specification prepared during 1934 *and filed subsequently by patent agents.*

1275/35—Improvements in and relating to the concentration of latex.

Co-operation with Rubber Growers' Association Technical Research Committee.

Close contact was maintained with the Technical Research and Development of New Uses Committee of the Rubber Growers' Association throughout the year.

In addition to the work on crumb rubber and on the concentration of latex undertaken on behalf of and at the expense of that Committee, frequent consultations were held with their liaison officer, and advice furnished on several matters arising out of the technical work being carried out by the Rubber Growers' Association in conjunction with other investigators. At the request of the liaison officer a memorandum was submitted setting out in detail particulars of scientific and technical research recommended for inclusion in a programme of work for the development of new uses for rubber and latex.

In connection with the work which the Technical Research Committee is conducting in conjunction with the Wool Research Association facilities were granted to a member of the staff of the Association to work in the Committee's laboratories with a view to gaining experience in the properties of different types of latex.

Co-operation with other Organisations.—Mr. G. Martin was a member of the Committee appointed by the Rubber Growers' Association to consider the details of the Rubber Exhibition at the Science Museum and also of the Sub-Committee dealing with the exhibit of plantation products. A number of samples illustrating the effect of vulcanisation and of ageing on the properties of rubber was prepared for the scientific section of the Exhibition. At the request of the Association a member of the staff assisted on several occasions in the practical demonstrations to the public of factory processes.

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. Technical trials are now being carried out by the Research Associations with samples prepared in Malaya by the Rubber Research Institute.

At the request of the Research Association of British Rubber Manufacturers, the technical staff examined and commented on the sections on raw rubber in the Handbook of Physical Constants which that Association is undertaking on behalf of the Rubber Growers' Association.

Both the Research Association of British Rubber Manufacturers and the India Rubber Manufacturers' Association co-operated with the Committee in an enquiry as to the colour of sheet preferred by manufacturers.

P. J. BURGESS,
Chairman.

J. A. NELSON,
Secretary.

Imperial Institute,
South Kensington, S. W. 7,
21st February, 1935.

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

LATEX.

(1). **Specification.**—At intervals during the year investigations were carried out to devise methods of testing various properties of latex with a view to providing data on which the trade associations concerned can prepare a specification to ensure that only material of reliable quality will be marketed. The technical problems involved were discussed with latex technologists as opportunity occurred, and it is proposed to arrange a technical conference to consider those tests concerning the importance of which there is likely to be general agreement and for which methods are available, viz. (1) Dry rubber content, (2) Total solids, (3) Alkalinity (quantity and nature of alkali), (4) Colour of latex, (5) Colour of dry film and (6) Putrefaction.

By the end of the year sufficient experience had not been gained to enable recommendations to be made as to satisfactory colour tests for latex and for dry film, but two methods which appeared definitely promising were under investigation. A few tests on the determination of colour of latex were carried out measuring the electric current developed in a photo-electric cell. The method appeared promising, but the type of apparatus used was not suitable and further experiments with a different type are proposed. The apparatus is probably too expensive however for general use.

The putrefaction test suggested involves the detection of odour in latex coagulated with an acid such as sulphuric. As the results may vary according to the susceptibility of the operator attempts were made to devise a chemical test depending upon an estimation of certain fatty acids and protein compounds which would be expected to be present in abnormal quantities in putrefied latex. The preliminary experiments showed that in order to obtain reliable information prolonged and detailed study would be necessary to which the limited staff available could not devote adequate attention at the present time. The problem is however one requiring urgent attention either in London or in the East as soon as an opportunity can be found.

It is considered that more experience is required with regard to film strength tests and various tests for stability, and in order to obtain data which will enable technologists to assess the merits of these tests suggestions have been made for the preparation in the East of a series of samples differing in stability.

In the report for 1933 reference was made to the work carried out in the London laboratories on the film strength tests. During 1934 special attention was devoted to stability tests and an investigation was carried out to compare the following methods:—(1) Stirring in the presence of zinc oxide, (2) Sieving, (3) Rate of coagulation with sodium silicofluoride, (4) Amount of aluminous cement required to cause coagulation. On the whole the results placed the samples examined in the same order as regards stability but there were a number of important discrepancies which require further study before any one of the tests can be recommended for a trade specification.

(2). **Concentration.**—A considerable amount of time was devoted to developing and carrying out trials with four different methods of concentrating latex, but as several patent applications are pending, publication of further details is not desirable at this stage.

In the report for 1933 reference was made to variation in the creaming power of a wide range of samples of gum tragacanth and as a result of the tests in London it was suggested that some of the cheaper grades of this material might be used in the East. Investigations subsequently carried out by the Rubber Research Institute, Malaya, with portions of the samples referred to showed however that the results of tests on fresh latex were different from those on latex which had been preserved for some time and that the cheaper grades of gum tragacanth which gave good results in London were not so effective in Malaya.

Considerable variation was observed in the creaming power of different latices in the presence of some of the usual creaming agents. A few tests were carried out to determine whether there be a relation between rate of creaming and physical properties of latex such as stability and surface tension, but insufficient data were obtained to arrive at a definite conclusion. A corresponding investigation showed that in some circumstances a "poor creaming" latex could be rendered "good creaming" by preliminary dialysis to remove crystalloids. The addition of an aqueous extract of serum substances sometimes decreased markedly the ease of creaming of the dialysed latex. These experiments are of considerable interest as they provide fundamental information concerning the cause of variation in creaming and they will be continued as opportunity occurs in 1935.

Latices concentrated by two creaming methods devised by the Rubber Research Institute, Malaya, were examined. One method was designed to prevent "after creaming" and the latex showed no signs of this defect on arrival in London. One dealer in latex reported that the latex might be unsuitable for transparent articles owing to a yellow tint in the dry film, but tests in the Committee's laboratories indicated that the latex was of satisfactory colour and quality.

The other sample was prepared to yield rubber which on vulcanisation would be more resistant than usual to oil. Tests in London showed that this effect was not achieved and that the latex had other defects which would render it unsuitable for general use.

RUBBER CRUMB.

Consignments of nitrite crumb prepared according to one of the processes devised by the Staff of the Committee and referred to in previous reports (E. P. No. 395,775) were sold for use in the manufacture of white lines for roadways in England. This crumb was prepared by the Staff of the Rubber Research Scheme, Ceylon, who are studying the mechanical problems arising from the large-scale production of rubber by this method. On arrival in London the crumb is somewhat massed, but is still in a granular condition and can be crumbed again by rubbing. As it is desirable that the crumb should arrive with the grains in a free condition, experiments were carried out in London to determine the effect of surface lubricants on massing. As the results were not promising the problem was discussed with the manufacturers of the white line material referred to above, who agree that re-disintegration could be undertaken by the user without undue difficulty if it is found impossible or uneconomical to prevent massing during transit. The production of white lines by this process is still in the experimental stage, but it is understood that the results so far obtained are satisfactory.

Owing to the ease with which this type of crumb can be dissolved in organic solvents, it offers advantages over crepe and sheet for incorporation with asphalt for road surfacing. In co-operation with a firm interested in the production of asphaltic road mixtures a process devised for the preparation of homogeneous mixtures of rubber and asphalt was tried by the firm on a small section of private roadway. The process appeared to be practical and arrangements were made to lay a stretch of public highway with the material early in 1935. At present the rubber-asphalt mixtures for the highway trial are being prepared in the Committee's laboratories.

TYPES OF RUBBER REQUIRED BY MANUFACTURERS.

Soft Rubber.—In view of the difficulties experienced by manufacturers in the manipulation of estate crepe and sheet, a detailed examination of the possibility of devising an economical method of preparing a much softer material of satisfactory quality was continued. Although some promising results were obtained, no method of preparation so far tried is sufficiently free from complications to warrant large-scale trials.

Three fundamentally different methods of softening rubber have been tried, viz: (1) Addition of rubber softeners to latex, (2) Chemical reaction

including oxidation, (3) Heat in the absence of oxygen. The experiments referred to in the Report for 1933 showed that method (1) was not likely to produce a sufficiently soft product and attention was therefore given to the other two methods.

It was found that a modification of the oxidation method gave promising results in London in experiments with ammonia-preserved latex. Samples have since been prepared in Ceylon and Malaya from fresh latex by the method suggested, but tests in London showed that the bulk of the rubber was not nearly as soft as expected although the samples softened easily on heating at 100°C. Two of the samples received from Malaya however were as soft as required. The cause of this variation is not known and it is evident that the method of preparation requires further study.

Some soft rubbers with excellent vulcanising and ageing properties were received from the Rubber Research Institute, Malaya, in connection with their study of the coagulation of skim obtained during the centrifugal concentration of latex. Subsequent experiments with latex from another estate and using a different centrifuge gave rubber which was as hard as estate sheet or crepe. There is no direct evidence as to the reason for the marked variation in hardness of rubber from different latex skims, and, as in the case of the investigations referred to in the previous paragraph, the matter is one which requires further study.

Further studies have been made of rubber softened by the addition of sodium nitrite to latex prior to coagulation and rolling to crepe or sheet. Experiments in London with preserved latex showed that sodium bisulphite restrained the action of the sodium nitrite, and soft samples with satisfactory vulcanising and ageing properties could be obtained with suitable proportions of sodium bisulphite and sodium nitrite. Samples were also prepared in Ceylon and it was eventually concluded that the sodium bisulphite did not produce any effect which could not be obtained by the addition of smaller amounts of sodium nitrite without bisulphite. The sodium nitrite method of softening rubber has a number of objections, the chief of which is that for the same degree of softening the vulcanising and ageing properties of the rubber are adversely affected to a greater extent than in the case of rubber softened by oxidation.

An interesting type of soft rubber prepared according to the third method referred to above was received from Malaya. This consisted of crepe obtained from latex coagulated by heating for some time in steam at about 148°C. The first samples examined were not as soft as is considered desirable, but subsequent samples in which the latex was frothed and then heated for longer periods were almost sufficiently soft to obviate mastication. These samples may owe their softness partially to oxidation

but they gave much better results on ageing in a rubber-sulphur mixing than rubber softened by heating in air. Definite conclusions cannot be drawn owing to a small difference in the softness of the two types of rubber. The results indicate however that a comparison should be made between the quality of rubber softened in steam and that of rubber softened by heating in air.

Arising out of a paper by the writer on the Marketing of Rubber read before the Institution of the Rubber Industry, information was received from a firm of manufacturers in Great Britain concerning difficulties experienced in obtaining regular supplies of dark smoked sheet. The pale product, which they stated formed a large part of the sheet rubber they receive through London brokers direct from the East, caused considerable trouble in processing owing to hardness, and regular supplies of dark sheet could not be obtained at the standard market price. It was confirmed in the laboratories of the Committee by an examination of samples submitted that the light sheet was less plastic than the dark, and the results agreed with the results of experiments carried out several years ago with a wide range of estate samples from Ceylon.

An enquiry was made through the India Rubber Manufacturers' Association and the Research Association of British Rubber Manufacturers concerning the type of sheet preferred by their members, and there was considerable difference in the views expressed. The matter was submitted to the Rubber Trade Association who replied that heavily and lightly smoked sheet would not be accepted by the Standard Qualities Committee.

The firm who initiated the enquiry subsequently reported that they had been successful in obtaining regular supplies of heavily smoked sheet.

Water Absorption.—In view of the demand from the electrical and other industries for rubber with a low water absorption, various methods of preparing this type of rubber are being studied in Malaya. The results of the examination of samples received from the Rubber Research Institute indicated that the soaking of the machined coagulum in water reduced the tendency of rubber to absorb water from a damp atmosphere by an amount depending upon the period of soaking. Dilution of the latex before coagulation and machining of the coagulum are not important if the machined coagulum is soaked for a short period. Samples of sheet rubber which absorbed less than half the amount of water absorbed by average estate sheet were forwarded at their request to the Research Association of British Rubber Manufacturers for technical trials. The results so far obtained suggest other lines of work which may lead to the production of a material with even less tendency to absorb water than that already obtained.

MISCELLANEOUS TYPES OF RUBBER.

Rubber Containing Manganese.—A rubber manufacturer found that a consignment of raw rubber perished badly after storing for two years and the deterioration was eventually traced to the presence of manganese. The problem was referred to the Rubber Research Institute, Malaya, who carried out experiments on the estate on which the rubber had been prepared and found that one of the water supplies of the estate was contaminated with manganese. On examination in London samples prepared using the contaminated water and Rubber Research Institute water known to be free from manganese were equal in appearance to first grade rubber, but that made from the manganese contaminated water quickly became soft on heating in air and perished quickly in an artificial ageing test on the vulcanised material. The harmful effect of manganese on rubber is well known, but it was not previously established that rubber containing manganese could easily be classed as first grade and that ageing tests were necessary to show that the rubber was inferior. According to the Rubber Research Institute the possibility of water supplies being contaminated with manganese is remote, and the estate with the contaminated water supply has not used this source of water for some time and is not likely to use it again.

Patterned Para.—Several samples of smoked sheet prepared by a patented process which eliminates the machining of the coagulum were examined during the year. The appearance of the rubber was not quite as good as that of standard sheet, but probably could be improved by attention to detail.

The properties of the rubber were in accord with the retention of more serum substances than usually occur in sheet, and apart from this effect there was no evidence that the absence of machining had modified the properties of the sheet. The rubber is not of great technical interest, but it might secure a market, depending upon the special requirements of a few manufacturers.

CLONE RUBBER.

The examination of samples of rubber from different clones in Ceylon was continued, three clones being now under test as compared with two last year when, as the trees were young, no conclusions were drawn concerning the quality of the rubber. Further results are in agreement with those obtained previously and indicate that there is a considerable difference in the quality of the rubber, two of the clones yielding material which is distinctly superior to the third.

There are many unsolved problems connected with the quality of clonal rubber in the East and little of the information so far obtained by various investigators has been published. Subsequent tests may prove that quality

of rubber is not an hereditary characteristic, that agricultural, climatic, and other factors have considerable effect, and that the inferior rubber can be rendered satisfactory by adjustments in preparation or in manufacturing practice, but it is obviously undesirable that clones yielding inferior rubber in preliminary tests should be planted extensively until it has been shown that there is no risk of producing on a large scale rubber which is unsuitable for the manufacture of high grade articles without special treatment.

PACKING.

Three different consignments of smoked sheet were examined during the year in connection with experiments on the packing of rubber. Two were small scale experiments organised by the Rubber Research Institute, Malaya, to obtain information concerning the suitability of paper containers and different types of baling material. The other was a large scale experiment organised by a member of the Rubber Growers' Association interested in paper sacks. A few of the sacks were torn on arrival in London and in some paper adhered to the rubber, but the condition of the bulk of the rubber indicated that paper sacks were promising containers for rubber owing to cleanliness, cheapness and ease of handling.

Rubber packed in paper sacks may satisfy many of the large manufacturers, but it would be necessary to dust individual sheets to facilitate handling at the wharves and by small manufacturers. The dusting of individual sheets with a surface lubricant markedly improved the case of separation of the individual sheets in each bale.

Of the other materials tried mengkuan matting was found to be cleaner than gunny or hessian which left fibrous material adhering to the rubber.

It is not possible to make definite recommendations as regards packing because the requirements of different sections of the trade are not the same and complicated marketing problems are involved. Individual estates should proceed cautiously and consult the various interests involved before making radical changes in their method of packing.

G. MARTIN,

Superintendent of Rubber Investigations.

Imperial Institute,
South Kensington, London, S. W. 7.

AUDITOR-GENERAL'S REPORT FOR 1934.

Audit Office,
Colombo, 2nd March, 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 1934 has been completed and have pleasure in forwarding the following documents duly certified :—

(a) Income and Expenditure Account for the year 1934.

(b) Balance Sheet as at December 31, 1934.

I. Income.

2. The total income accrued during the year amounted to Rs. 246,169. It exceeded the estimate of Rs. 147,830/- by Rs. 98,339/- and the revenue of the previous year by Rs. 59,517/-. The increase is mainly due to large cess collections and to profit from the working of Dartonfield Estate as a result of larger crop and higher prices realised.

3. *Cess Collections.*—The amount accrued for the year was Rs. 220,403 inclusive of the collections made by the Principal Collector of Customs during December, 1934, but received in January 1935. It exceeded the estimate of Rs. 140,000/- by Rs. 80,403/- and the increase is due to the rise in the quantity of rubber exported.

4. *Interest.*—The amount accounted for during the year was Rs. 6,166. It exceeded the estimate of Rs. 3,750/- by Rs. 2,416/-. The increase is due to larger amounts placed in fixed deposit than anticipated.

5. *Sale of Publications and Subscriptions.*—The amount realised for the year was Rs. 410/- as compared with Rs. 312/- of the previous year.

6. *Sundry Receipts.*—A sum of Rs. 841/- was collected under this head for the year, and it exceeded the estimate of Rs. 100/- by Rs. 741/-. The increase is due to receipts from the sale of experimental shipments of crumb rubber and from fees for assessment of budded areas.

7. *Profit from Dartonfield Estate.*—The total income of the estate for the year was Rs. 32,504/-. The expenditure incurred in working the estate amounted to Rs. 14,155/- leaving a net profit of Rs. 18,349/-. The Estate Returns in support of expenditure and Sale Statements 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. 96,207/- as compared with Rs. 75,148/- 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. 18,618/- made by the Board have not yet been received. The expenditure charged to Capital Account amounted to Rs. 126,753/- inclusive of Rs. 113,480/- spent on the erection and equipment of the factory and laboratory, bungalows, roads, agricultural developments, etc., at the Dartonfield Estate, Rs. 5,720/- on account of the development of the Experiment Station at Nivitigalakele and Rs. 7,552/- on the purchase of laboratory apparatus.

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. (a) 1-4 Technical Officers.	44,717	41,047	—	3,670	—
(b) 5 Secretary to the Director of Research	3,000	2,072	—	928	—
(c) 6-12 Subordinate Staff.	6,569	6,330	—	239	—
(d) 13 Rent Allowance	1,000	553	—	447	—
(e) 14 Provident Fund Contribution.	2,135	2,333	—	—	198
II. Other Charges :—					
B. 15. Laboratory :					
(a) Upkeep, Chemicals and Apparatus.	5,000	4,892	419	—	311
(b) Samples for Imperial Institute	500	638	—	—	138
(c) Dusting Experiments.	1,900	1,368	1,013	—	481
(d) Routine tests on Chemicals.	100	—	—	100	—

		Estimate	Actual Expenditure Rev. A/c.	Cap. A/c.	Savings	Excess
		Rs.	Rs.	Rs.	Rs.	Rs.
C.	16. Buildings :—					
	(a) Upkeep of Buildings.	1,000	952	—	48	—
	(b) Insurance.	105	349	—	—	244
	(c) Upkeep of Water Supply.	600	451	—	149	—
	(d) Upkeep of Roads.	200	169	—	31	—
	(e) Furniture replacements.	200	70	—	130	—
D.	17. Office.					
	(a) Printing and Advertising.	1,750	1,886	—	—	136
	(b) Stationery.	1,000	980	—	20	—
	(c) Postages.	1,000	1,325	—	—	325
	(d) Books and Periodicals.	500	786	—	—	286
	(e) General Charges.	500	511	—	—	11
	(f) Audit and Accountancy.	400	382	—	18	—
	(g) Telephones.	620	637	—	—	17
E.	18. Travelling :—					
	(a) Travelling expenses of Staff.	4,500	4,773	—	—	273
	(b) Travelling expenses of Board Members.	1,750	1,058	—	692	—
F.	19. Upkeep of Nivitigalakele Experiment Station.	6,125	100	5,720	305	—
III.	Special Charges :					
G.	20. London Advisory Committee's Expenditure.	18,900	18,618	—	282	—
H.	22. Passages to Ceylon.	1,815	558	—	1,257	—
I.	23. Depreciation.	5,765	4,115	—	1,650	—
J.	24. Dartonfield Estate Experimental Expenditure.	5,611	3,369	—	2,242	—

	Estimate	Actual Expenditure Rev. A/c.	Cap. A/c.	Savings	Excess
	Rs.	Rs.	Rs.	Rs.	Rs.
IV. Capital :					
Dartonfield Estate :					
1. (a) Erection and Equipment of Factory.	66,350	—	65,957	393	—
(b) Erection and Equipment of Laboratory.	25,000	—	21,336	3,664	—
(c) Scientific Apparatus.	5,000	—	6,121	—	1,121
(d) Superintendent's Bungalow.	9,250	—	2,433	6,817	—
(e) Sub-Staff Bungalows 2.	8,000	—	1,827	6,173	—
(f) Agricultural Development— Replanting.	1,400	—	1,586	—	186
(g) Extension and improvement of cart road.	4,000	—	4,320	—	320
(h) Fencing Estate.	3,000	—	1,038	1,962	—
(i) Survey of Estate.	400	—	428	—	28
(j) Vulcansing and Testing Equipment.	25,000	—	14,556	10,444	—

Savings.

I (a) 1-4 Agricultural Assistant on leave without pay for 3 months, Assistant Chemist not appointed until April.

I (b) 5 Appointment not made until April.

I (c) 6-12 Changes in Office Staff.

I (d) 13 Over-estimate of requirements.

II B. 15 (d) Tests not required.

II C. 16 (c) Over-estimate of requirements.

II E. 18 (b) Over-estimate of requirements.

II F. 19 Under-estimate of receipts from sale of rubber.

III G. 20 Gain on exchange.

III H. 22 Over-estimate of requirements.

III I. 23 Over-estimate of requirements.

III J. 24 Postponement of Field Experiments.

IV i (a) Further expenditure to be incurred in 1935.

IV i (b) Further expenditure to be incurred in 1935.

IV (d) Further expenditure to be incurred in 1935.
IV (e) Further expenditure to be incurred in 1935.
IV (h) Postponement of expenditure.

Excesses.

I (e) 14 Under-estimate of requirements.
II B. 15 (a) Under-estimate of requirements.
II (b) Receipts from sale of crumb rubber amounting to Rs. 103·20 have been credited to Sundry Receipts.
II (c) Under-estimate of cost of sulphur dusting demonstrations to Planters' Associations.
II C. 16 (b) Under-estimate of requirements.
II D. 17 (a) Cost of leaflets on Oidium treatment.
II (c) Cost of Cables to London and under-estimate of requirements.
II (d) Equipment of Dartonfield Laboratory.
II E. 18 (a) Increased advisory work.
IV (c) Under-estimate of requirements.
IV (f) Estimate based on 7 acres instead of 7½ acres. Cost of providing leader drains.
IV (g) Cost of 1 hand-cart and 1 pipe mould.

Sanction has also to be obtained for the excesses on the following sub-heads under the votes for Experiment Station Development and Dartonfield Estate :—

I. Experiment Station Development Account.

General Charges.

14.	Tools	Rs.		77·99
15.	Sundry Expenses	,,		64·57
16.	Cart roads	,,		6·47

Working Expenditure.

2.	Pests and Diseases	,,	0·74
3.	Roads and Drains	,,	7·48
4.	Fences and Boundaries	,,	9·25
7.	Manure	,,	20·61
9.	Illuk and Mikania	,,	8·62
12-13.	Budding and attention	,,	186·93
16.	Nurseries	,,	28·51
17.	Tapping	,,	57·32

II. Dartonfield Estate Normal Working.

General Charges.

3.	Travelling expenses	,,	95·00
4.	Fire Insurance	,,	7·20

5.	Rent and Taxes	...	...	Rs.	175·10
6.	Office expenses ...	...	...	,,	22·97
9.	Repairs to Buildings	...	...	,,	87·14
10.	Medical attendance	...	...	,,	23·25
14.	Tools ...	...	...	,,	19·75
15.	Sundry expenses	...	...	,,	44·98
16.	Cart roads ...	...	...	,,	63·98
17.	Commission on Cash	...	...	,,	2·63
18.	Feeding children	...	...	,,	30·96
Upkeep.					
4.	Roads and drains	...	...	,,	73·81
Collection.					
18.	Tapping ...	...	...	,,	236·25
20.	Tapping instruments	...	...	,,	45·74
21.	Transport of latex	...	...	,,	71·87
Manufacture.					
25.	Factory utensils	...	...	,,	1,130·13
28.	Loss of Profits Insurance	...	...	,,	36·25
32-33.	Packing ...	...	...	,,	4·48
34.	Forwarding charges	...	...	,,	34·26

III. Balance Sheet.

(a) *Liabilities.*

10. *Sundry Creditors—Rs. 16,913/.*—So far as it can be ascertained all outstanding liabilities on December 31st, 1934, have been brought to account with the exception of the cost of audit for 1934 amounting to Rs. 485/69.

11. *Reserve Fund for Passages.*—The balance on December 31, 1933 was Rs. 4,545/-. During the year a sum of Rs. 1,250/- has been transferred to this Fund bringing the balance to Rs. 5,795/- as at December 31, 1934.

12. *Provident Fund—Rs. 10,212/-.*—The balance on December 31, 1933 was Rs. 5,488/-. The contributions made by the officers during the year amounted to Rs. 2,664/-. The Board's contribution amounted to Rs. 2,333/- of which Rs. 2,139/- represented the bonus equal to the sum contributed by the members during 1933 and Rs. 194/- the interest on the balances of the fund for 1933. During the year a sum of Rs. 272/- was refunded to a retiring member of the Scheme.

13. *Depreciation Cash Reserve Account—Rs. 26,124/-.*—The balance on December 31, 1933 was Rs. 22,009/- and a sum of Rs. 4,115/- has been transferred from revenue to this account during the year under review. This amount has been arrived at as follows :—

Buildings @ 5% on Rs. 43,527/23	...	Rs. 2,176/36
Laboratory Apparatus @ 25% on Rs. 4,453/74		,, 1,113/43
Water Supply @ 10% on Rs. 1,684/82	...	,, 168/48
Furniture, Fittings & Office Equipment @ 10% on Rs. 6,570/40	... ...	,, 657/04
		Rs. 4,115/31

14. *Saleable Books Reserve Account.*—The balance of this account on December 31, 1933 was Rs. 2,347/-. It has been reduced to Rs. 2,252/- by the sale of books to the value of Rs. 95/-.

15. *Contribution to Capital Outlay Rs. 392,629/-.*—This represents the amount spent on Capital Expenditure. A sum of Rs. 126,753/- was spent during the year on Capital works and this amount was added to the balance of Rs. 265,876/- brought forward from 1933 making a total of Rs. 392,629/-.

16. *Surplus Account.—Rs. 243,180/-.*—The excess of income over expenditure during the year exclusive of capital expendithre was Rs. 144,597-. The Capital Expenditure amounted to Rs. 126,753/-. The net surplus for the year therefore was Rs. 17,844/-. This is added to the amount of Rs. 225,336/- brought forward from 1933 bringing the surplus to Rs. 243,180/- as at December 31, 1934.

(b) *Assets.*

17. **Culloden Estate.**

(1). *Buildings Account.*—The balance on December 31, 1933 was Rs. 53,040/-. No expenditure was incurred during the year.

(2). *Furniture, Fittings and Office Equipment Rs. 9,132/-.*—This is the balance brought forward from 1933.

(3). *Water Supply Rs. 2,404/-.*—This represents the amount brought forward from 1933. No expenditure was incurred during the year on this account.

18. **Dartonfield Estate.**

(1). *Property Account Rs. 91,509/-.*—The balance on December 31, 1933 was Rs. 84,137/-. A sum of Rs. 7,372/- has been spent during the year making a total of Rs. 91,509.

(2). *Buildings Account Rs. 41,504/.*—This represents the amount spent during the year on this account.

(3). *Furniture, Fittings and Office Equipment Rs. 3,889/-.*—This amount has been spent during the year on the purchase of furniture, etc. for the factory and laboratory.

(4). *Water Supply Rs. 2,698/*—This represents the amount that has been spent during the year on this account.

(5). *Machinery and Tools Rs. 58,018/-.* Of this sum Rs. 14,556/- was spent on vulcanising and testing equipment and the balance of Rs. 43,462/- was spent on the purchase of machinery and tools for the factory and laboratory.

19. *Nivitigalakele Experiment Station.*—The balance on this account on December 31, 1933 was Rs. 96,877/-. The expenditure under this head during the year amounted to Rs. 5,720/- making a total of Rs. 102,597/- at December 31, 1934.

20. *Laboratory Apparatus.*—The balance on December 31, 1933 was Rs. 8,952/- and the purchases during the year amounted to Rs. 7,552/- making a total of Rs. 16,504/-.

21. *London Plant Rs. 11,333/-.*—This represents the balance carried forward from 1933. No depreciation has been allowed by the Board for 1934.

22. *Saleable Books.*—The balance on December 31, 1933 was Rs. 2,347. A sum of Rs. 95/- has been deducted as the value of books sold leaving a balance of Rs. 2,252/-.

23. *Advance Rs. 451/-.*—This represents the balance amount due from the Assistant Chemist in respect of the advance made by the Board for the purchase of a motor car.

24. *Deposits Rs. 75/-.*—The balance on December 31, 1933 was Rs. 35/-. An additional deposit of Rs. 40/- on phonograms, etc. was made during the year making a total of Rs. 75/- at December 31, 1934.

25. *Sundry Assets at Culloden Rs. 2,155/-.*—This represents the value of 6 tons of Dusting Sulphur retained for experiments during 1935.

26. *Sundry Assets at Dartonfield Estate Rs. 1,042/-.* This represents the balance of the amount advanced for expenditure at the Dartonfield Estate and certain payments made in respect of 1935.

27. *Sundry Assets at Experiment Station Rs. 51/-.* This represents the balance of the amount advanced for expenditure at the Experiment Station.

28. *Sundry Debtors Rs. 23,776/-.*—Of this sum Rs. 18,772/- was due from the Deputy-Financial Secretary on account of cess collections made during December, 1934. This was received from him in January, 1935. Rs. 2,381/- is the accrued interest to December 31, 1934 on Fixed Deposits which would mature during 1935. Rs. 2,623 is the amount due in respect of the crop for December, 1934 from brokers and sellers. This amount was credited in January, 1935.

29. *Equipment Advance Account.*—Of the sum of Rs. 28,696/- paid in advance to the London Advisory Committee for the purchase of laboratory equipment, equipment to the value of Rs. 23,227/- has been received during the year. There is still a sum of Rs. 5,469/- to the value of which equipment will have to be supplied.

30. *Cash Account Rs. 269,205/-.*—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 6, 1935 was verified.

IV. General.

31. 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 office at Neboda was visited thrice and Dartonfield Estate once. 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.

RUBBER RESEARCH SCHEME (CEYLON).

Income and Expenditure Account for the Year ended 31st December, 1934.

DR. CR.

	Rs. cts.	Rs. cts.		Rs. cts.	Rs. cts.
To **Personal Emoluments:—**			By Cess Collections received January to November	201,630 95	
Salaries of Technical Officers	41,046 63		Cess Collections due for December	18,772 25	
Salary of Secretary to the Director of Research.	2,071 51				220,403 20
Salaries of Subordinate Staff	6,329 65		Interest on Fixed and Current Accounts.		6,166 28
Rent Allowance	553 49		Sale of Publications and Subscriptions.		409 52
Provident Fund Contribution	2,333 01		Sundry Receipts,		840 88
		52,334 29	Receipts from sale of Dartonfield Rubber & Value of Stock	32,503·86	
Other Charges:—			*Less* expenditure on Dartonfield Normal Working.	14,155·01	
Upkeep of Laboratory, Chemicals and Apparatus.	4,892 00		Profit		18,348 85
Samples for London Experiments	638 08				
Dusting Experiments	1,368 04				
		6,898 12			
Upkeep of Buildings, Insurance	952 14 / 349 49				
Upkeep of Water Supply	450 62				
Upkeep of Roads	169 09				
Repairs to Furniture	70 11				
		1,991 45			
Printing and Advertising	1,886 24				
Stationery,	979 85				
Postages	1,324 54				
Books & Periodicals	785 90				
General Charges	510 76				
Audit & Accountancy	382 37				
Telephones	637 50				
Travelling expenses of Staff	4,772 89				
Travelling expenses of Board Members	1,058 25				
		12,338 30			
Experiment Station Upkeep Charges		99 77			
Share of expenditure of London Advisory Committee for Rubber Research (Ceylon & Malaya).		18,618 20			
Passages to Ceylon		558 06			
Dartonfield Estate Experimental Expenditure		3,368 73			
Passage Fund Reserve		1,250 00			
Depreciation:—					
Buildings @ 5% on Rs. 43,527·23	2,176 36				
Laboratory Apparatus @ 25% on Rs 4,453·74	1,113 43				
Water Supply @ 10% on Rs. 1,684·82	168 48				
Furniture, Fittings and Office Equipment @ 10% on Rs. 6,570·40	657 04				
		4,115 31			

RUBBER RESEARCH SCHEME (CEYLON).

Balance Sheet at December 31, 1934.

LIABILITIES

	Rs. cts.	Rs. cts.
Sundry Creditors	16,575 89	
,, Balance of Deposit due to building contractor.	337 50	
		16,913 39
Reserve Fund for Passages:—		
As per Balance Sheet, December 31, 1933.	4,545 06	
Addition in 1934.	1,250 00	
		5,795 06
Provident Fund Reserve Account:—		
As per Balance Sheet, December 31, 1933.	5,487 64	
Addition during 1934.	4,724 50	
		10,212 14*
Depreciation Cash Reserve Account:—		
As per Balance Sheet, December 31, 1933.	22,008 96	
Add Depreciation allowed in 1934.	4,115 31	
		26,124 27
Saleable Books Reserve Account:—		
As per Balance Sheet, December 31, 1933.	2,347 50	
Less value of books sold during 1934.	95 00	
		2,252 50
Contribution to Capital Outlay:—		
As per Balance Sheet, December 31, 1933.	265,876 06	
Addition during 1934.	126,752 51	
		392,628 57
Surplus Account:—		
Balance of Income and Expenditure as per Balance Sheet, December 31, 1933.	225,336 13	
Add excess of Income over Expenditure for the year 1934.	144,596 50	
	369,932 63	
Less Amount transferred to Contribution to Capital Outlay.	126,752 51	

ASSETS

	Rs. cts.	Rs. cts.
CULLODEN ESTATE:—		
Buildings Account:—		
As per Balance Sheet, December 31, 1933.		53,039 99
Furniture, Fittings & Office Equipment:—		
As per Balance Sheet, December 31, 1933.		9,131 83
Water Supply:—		
As per Balance Sheet, December 31, 1933.		2,404 82
DARTONFIELD ESTATE:—		
Property:—		
As per Balance Sheet, December 31, 1933.	84,137 36	
Add expenditure on Agricultural Development during 1934.	1,585 98	
Add expenditure on Fencing, Roads, Survey etc.	5,785 75	
		91,509 09
Buildings:—		
Factory	27,841 70	
Laboratory	9,401 97	
Bungalows	4,260 01	
		41,503 68
Furniture, Fittings & Office Equipment:—		
Factory	619 33	
Laboratory	3,269 38	
		3,888 71
Water Supply:—		
Factory	2,358 00	
Laboratory	340 00	
		2,698 00
Machinery & Tools:—		
Factory	35,137 80	
Laboratory	8,324 20	
Vulcanizing & Testing Equipment	14,555 61	
		58,017 61
Nivitigalakele Experiment Station:—		
As per Balance Sheet, December 31, 1933.	96,876 88	
Add expenditure during the year 6,065 02		
Less Sundry Receipts 344 44		
	5,720 58	
		102,597 46
Laboratory Apparatus Account:—		
As per Balance Sheet, December 31, 1933.	8,952 34	

ESTIMATES FOR 1935.

(Adopted by the Board, October 18, 1934).

REVENUE STATEMENT.

1.	Cess Collections ...	...	140,000 00
2.	Interest ...	...	5,000 00
3.	Sale of Publications ...	...	400 00
4.	Profit from Dartonfield Estate	...	18,000 00
5.	Sundry Receipts ...	...	200 00
		Total Rs.	163,600 00

EXPENDITURE STATEMENT.

		Rs. cts.	Rs. cts.
1.	**Personal Emoluments :—**		
	Salaries and Wages		58,504 00
2.	**Laboratory :—**		
	(*a*) Upkeep, Chemicals and Apparatus	6,000 00	
	(*b*) Samples for London Experiments	500 00	
	(*c*) Dusting Experiments ...	4,100 00	
	(*d*) Routine Tests on Chemicals ...	100 00	10,700 00
3.	**Buildings :—**		
	(*a*) Upkeep of Buildings ...	1,000 00	
	(*b*) Insurance	650 00	
	(*c*) Upkeep of Water Supply ...	500 00	
	(*d*) Upkeep of Roads	200 00	
	(*e*) Furniture Replacements ...	50 00	2,400 00
4.	**Office :—**		
	(*a*) Printing and Advertising ...	1,750 00	
	(*b*) Stationery	1,200 00	
	(*c*) Postages	1,500 00	
	(*d*) Books and Periodicals ...	600 00	
	(*e*) General Charges	750 00	
	(*f*) Audit and Accountancy ..	450 00	
	(*g*) Telephones	1,200 00	7,450 00
5.	**Travelling :—**		
	(*a*) Travelling Expenses of Staff ...	5,000 00	
	(*b*) Travelling Expenses of Members of the Board of Management	1,250 00	6,250 00
6.	**Experiment Station (Nivitigalakele) :—**		
	Development and Upkeep ...	6,322 00	6,322 00
		Carried over Rs.	91,626 00

		Rs. cts.	Rs. cts.
	Brought forward		91,626 00
7.	**Special Charges:—**		
	London Advisory Committee's Expenditure (½ share)	18,900 00	18,900 00
8.	**Passage Fund Reserve:—** ...	1,250 00	1,250 00
9.	**Depreciation Account:—** ...	19,000.00	19,000 00
10.	**Dartonfield Estate:—**		
	Expenditure on Experiments ...	9,016 00	9,016 00
11.	**Special Items of Expenditure on Capital Account:**		
	Dartonfield Estate:—		
	(*a*) Cart Road:		
	Improvement of outlet road ...	500 00	
	Extension of Estate Road ...	2,000 00	2,500 00
	(*b*) Fencing Estate (re-vote) ...	...	2,500 00
	(*c*) Replanting 12 acres ...	...	2,616 00
	(*d*) Upkeep of Immature areas:	...	
	Field No. 5, 7½ acres ...	375 00	
	Deniya 2 ,, ...	20 00	395 00
	(*e*) Nurseries:		
	New Nursery	350 00	
	Upkeep of Present Nurseries ...	100 00	450 00
	(*f*) Buildings:		
	Rice and Tool Store ...	1,250 00	
	Cart and Firewood Store ...	300 00	
	Garage for visitors' cars ...	300 00	
	1 Junior Staff Bungalow ...	4,000 00	5,850 00
	(*g*) Experimental Factory:		
	Purchase of Experimental Machinery ...		5,000 00
	Nivitigalakele:—		
	Clearing & planting 32 acres (Pinnagoda land)		7,700 00
		Total Rs.	166,803 00

Summary:—

Estimated total income	163,600 00
Estimated expenditure during 1935 ...	166,803 00
Estimated excess of expenditure over Income during 1935.	3,203 00