Rubber Research Scheme

(Ceylon).

Third Report of the Executive Committee

— TO THE —

Members of the Rubber Research Scheme.

PROCEEDINGS DURING THE YEAR

1924.

To be presented at the Ordinary General Meeting,

March 14th, 1925.

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RUBBER RESEARCH SCHEME LABORATORIES,
CULLODEN ESTATE,
NEBODA.

Rubber Research Scheme

(Ceylon).

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March 14th, 1925.

Rubber Research Scheme (Ceylon).

Peradeniya,
February 27th, 1925.

NOTICE.

Notice is hereby given that the Third Ordinary General Meeting of the Rubber Research Scheme (Ceylon) will be held at the Victoria Commemoration Buildings, Kandy, on the 14th of March, 1925, at 8-45 a.m. for the following purposes :—

1. To receive and consider the Report of the Executive Committee for the year ended December 31st, 1924, the Annual Statement of Accounts and Balance Sheet as at December 31st, 1924, and the Auditor's Report thereon.

2. To receive and consider Reports by the Technical Officers of the Rubber Research Scheme.

3. To receive and consider Report of the London Advisory Committee.

4. To elect Auditors for the coming year and fix their remuneration.

5. To transact any other business that may arise.

By order,

J. MITCHELL,
Organising Secretary.

Committees of the Rubber Research Scheme,

as at December 31st, 1924.

EXECUTIVE COMMITTEE.

THE HON'BLE MR. F. A. STOCKDALE (*Chairman*) (*on leave*).
MR. T. PETCH (*Acting Chairman*).
THE HON'BLE LT.-COL. T. Y. WRIGHT.
MR. C. W. BICKMORE.
„ A. D. CALLENDAR.
„ D. S. CAMERON.
„ C. E. A. DIAS.
„ W. COOMBE.
MR. J. F. ELFORD.
„ CLIFFORD FIGG (*on leave*).
„ H. V. HILL (*Acting*).
„ G. BRUCE FOOTE.
„ F. H. LAYARD.
„ G. P. MADDEN.
„ F. J. POYNTZ ROBERTS.
„ L. M. W. WILKINS.
„ J MITCHELL (*Secretary*).

TECHNICAL COMMITTEE.

THE HON'BLE MR. F. A. STOCKDALE (*Chairman*) (*on leave*).
MR. T. PETCH, Mycologist, Dept. of Agriculture. (*Acting Chairman*).
DR. J. C. HUTSON, Entomologist, Department of Agriculture.
DR. C. H. GADD, Assistant Mycologist, Department of Agriculture (*acting*).
MR. A. T. REEVE, Plant Pests Inspector (Southern), Department of Agriculture.
MR. T. E. H. O'BRIEN, Chemist of Scheme.
MR. R. A. TAYLOR, Physiological Botanist of Scheme.
MR. R. H. STOUGHTON-HARRIS, Mycologist of Scheme.
MR. J. MITCHELL, Organising Secretary of Scheme (*Secretary*).

LONDON ADVISORY COMMITTEE.

Representatives of Ceylon Planting Interests ...	SIR EDWARD ROSLING (*Chairman*). SIR STANLEY BOIS.
Representatives of Rubber Growers' Association ...	MR. H. ERIC MILLER. MR. HERBERT WRIGHT. MR. P. J. BURGESS, M.A., F.C.S.
Representatives of Rubber Manufacturing Companies ...	MR. PERCY ROSLING. MR. W. A. WILLIAMS. MR. D. F. TWISS.
Representative of the Research Association of British Rubber and Tyre Manufacturers ...	MR. A. JOHNSTON.
Representative of Imperial Institute	Vacant.
Botanists	Prof. J. B. FARMER, F.R.S. MR. H. N. RIDLEY, F.R.S.
Secretary	MR. J. A. NELSON, B. Sc.

Auditors:
DUNCUM, WATKINS, FORD & CO.

Offices:
RUBBER RESEARCH SCHEME, PERADENIYA.

Bankers:
NATIONAL BANK OF INDIA, LTD.

Research Laboratories:
CULLODEN ESTATE, NEBODA.

Scientific Staff:

CEYLON.

MR. J. MITCHELL, A.R.C. Sc., Organising Secretary.
MR. T. E. H. O'BRIEN, B. Sc., A. I. C., Chemist.
MR. R. A. TAYLOR, B. Sc., Physiological Botanist.
MR. R. H. STOUGHTON-HARRIS, B. Sc., A.R.C. Sc., Mycologist.

LONDON.

MR. G. MARTIN, B. Sc., A.I.C., Chemist. (Superintendent).
MR. W. S. DAVEY, B. Sc., Chemist.
MR. F. L. ELLIOTT, A.I.C., Chemist.
MR. L. L. STEWART, Laboratory Assistant.

EXECUTIVE COMMITTEE'S REPORT TO MEMBERS.

GENTLEMEN,

THE Executive Committee of the Rubber Research Scheme (Ceylon) begs to submit its report for the year ended December 31st, 1924.

Membership.—A complete list of Members is given in Appendix No. 1 of this Report, from which it will be noted that at December 31st, 1924, there were 103 Rubber Growers' Association Members and 90 Rubber Research Scheme Members, making a total of 193 Members in all. At December 31st, 1923, there were 101 Rubber Growers' Association Members and 74 Rubber Research Scheme Members. There has, therefore, been an increase of 18 Members during the year under review.

Subscriptions.—The subscriptions from Local Subscribers on account of the year 1924 amounted to Rs. 24,417/59 as compared with Rs. 16,700/26 on account of 1923, and Rs. 9,312/- on account of 1922.

The Ceylon Government Grant for 1924—25 was Rs. 67,500/- and is the same as for 1923—1924. This represents the last payment guaranteed by the Ceylon Government for the first five years of the re-organized Research Scheme. The Rubber Growers' Association has agreed to contribute to the Scheme the sum of £ 2,000 per annum for a further period of 5 years if the Government of Ceylon continues their support for the same period on the basis originally adopted. Your Committee is therefore approaching the Ceylon Government on the matter.

Executive Committee.—It is with deep regret that your Committee has to report the death of Mr. M. Kelway Bamber who has served on the Committee from the inception or the Scheme. Mr. Bamber's long experience and wide knowledge of the Rubber Industry in Ceylon were of great value to the Research Scheme, and his untimely death has deprived the Committee of a most valuable Member.

During the year Mr. Clifford Figg and Mr. C. E. A. Dias were appointed Members of the Committee. It is hoped that as a representative of Ceylonese interests the presence of Mr. Dias on the Committee will lead to a greater interest being taken in the Scheme by Ceylonese Proprietors of Rubber Estates.

The Chairman (The Hon'ble Mr. F. A. Stockdale) proceeded on leave to Europe in June and Mr. T. Petch (Acting Director of Agriculture) was appointed Acting Chairman during Mr. Stockdale's absence.

Mr. Clifford Figg proceeded on leave to Europe and Mr. H. V. Hill was appointed an acting Member during his absence.

Messrs. Bickmore, Callander, Elford, Madden and Poyntz Roberts have returned from leave and resumed their seats on the Committee.

Meetings of the Executive Committee were held on January 8th, March 13th, July 16th, and October 8th, 1924, and printed copies of the Minutes of these Meetings have been circulated to all Members of the Rubber Research Scheme.

London Advisory Committee.—During the year Mr. P. J. Burgess was appointed a Member of this Committee to fill the vacancy created by the death of Mr. F. W. Barker, and Mr. G. H. Golledge resigned his seat on the Committee owing to the difficulty of attending Meetings.

Meetings of the London Advisory Committee were held on January 30th, March 21st, May 23rd, July 25th, October 31st, and December 19th, 1924, and copies of the Minutes of these Meetings have been circulated to all Members of the Executive Committee. The Report of the London Committee and the Reports of the Technical Officers working at the Imperial Institute are presented herewith.

Technical Committee.—During the year Mr. H. W. Roy Bertrand was appointed a Member of this Committee to fill the vacancy created by the resignation of Dr. G. Bryce.

Mr. T. Petch was appointed Acting Chairman of the Committee during the absence in Europe of the Hon'ble Mr. F. A. Stockdale, and Dr. C. H. Gadd (Assistant Mycologist, Department of Agriculture) was appointed an acting Member of the Committee during that period.

Meetings of the Technical Committee were held on April 15th, July 16th, and October 9th, 1924, and copies of the Minutes of these Meetings have been circulated to Members of all the Committees of the Rubber Research Scheme. The Research work being carried out by the Technical Officers of the Scheme was fully considered at these Meetings and criticisms and suggestions made concerning their work.

Accounts.—The duly audited Statement of Accounts and Balance Sheet for the year 1924 is given in Appendix 4 of this Report.

Technical Officers.—The Officers referred to in the last Annual Report have served throughout the year and their reports are presented herewith.

Mr. R. H. Stoughton-Harris, B. Sc., A. R. C. Sc., was appointed Mycologist to the Scheme to fill the vacancy created by Mr. Park's return to the Department of Agriculture, and he took up his duties at the Culloden Laboratories in October.

Mr. R. A. Taylor returned from Java and the Federated Malay States in March and resumed his duties at the Culloden Laboratories.

BUILDINGS.

Laboratories.—The laboratory buildings have been kept in good repair and further equipment has been supplied.

Bungalows.—The bungalow handed over by the Rubber Growers' Association has been kept in good repair.

The two Staff bungalows being erected on Culloden and Heatherley Estates are nearing completion, and it is expected that these will be ready for occupation as from April 1st, 1925.

Water Service.—Provision has been made in the 1925 Estimates for the installation of water supplies to each of the 3 Staff bungalows.

Experimental Garden.—Your Committee is endeavouring to secure a block of land of about 200 acres in extent, within easy reach of the Culloden Laboratories, for the purpose of carrying out experimental work on budding, selection, cover crops, and kindred matters and hopes to obtain a suitable block within the next few weeks.

Co-operation of Research Staffs.—Arrangements have been made for the exchange of Technical Reports between the Research Staff of the Research Scheme and the Research Staff of the Rubber Growers' Association in Malaya and South India. It is considered that a closer association between the Research Officers working in different countries where rubber is grown will be of benefit to all concerned.

PROGRESS OF WORK.

(*a*) **Organising Secretary.**—Mr. J. Mitchell has continued to carry out the duties of General Secretary to the Research Scheme and of Secretary to the Executive and Technical Committees. Correspondence continues to increase in volume and it has been found necessary to appoint an additional Clerk to relieve the Chief Clerk of the duties of recording, filing, and circularising.

In addition to the Secretarial work Mr. Mitchell has paid visits to 68 estates and has issued reports on these estates to the Agents and to the Superintendents of the Estates visited. Mr. Mitchell's Report on these visits and his view of the conditions of estates in Ceylon at the present time is presented herewith.

It will be noted that there has been a general improvement in the position as regards root diseases, and those estates which are adopting thorough methods of treatment are finding a steady reduction in the number of cases appearing. The root disease caused by *Ustulina zonata* has on many old estates been responsible for a larger proportion of deaths than from any other root disease. *Sphaerostilbe repens* has been responsible for many deaths on two estates where periodical flooding of the rubber areas has been experienced.

Of Stem diseases, Bark Rot has given considerable trouble on some estates, while on others there has been a marked improvement as compared with 1923. Your Committee is of opinion that a thorough study of all factors relating to this disease and of the disinfectants used as a preventive and cure is very necessary and the Mycologist has been asked to give special attention to the matter when the opportunity is favourable.

Secondary leaf-fall and Pod disease has again been prevalent throughout the Island though not more so than in previous years. In addition to the manuring experiments referred to in the last Report it is proposed, during 1925, to carry out experiments on pollarding and spraying to note if any direct methods can be adopted to combat this disease.

It would appear that Brown Bast is more prevalent than is generally thought to be the case, and that the operation of restriction of output may conceal cases which would otherwise be known and recorded. In all cases where a careful census has been or is being taken the number of affected trees is usually much greater than was anticipated and close attention to this disease should be paid.

Pink disease has been recorded on several estates in the Kelani Valley and Kalutara Districts, but only in rubber of 4 to 5 years of age. In no case has there been any serious outbreak, but in view of the fact that widespread attacks take place in Java and Malaya it is a disease which requires immediate attention whenever it appears.

In connection with crepe rubber manufacture the chief complaints received have related to the occurrence of spots in sole crepe rubber. This defect has been relatively common during the South-West Monsoon period, and recommendations have been made for dealing with it.

Very few complaints have been received in connection with smoked sheet manufacture and it would appear that "rust" (which was the principal trouble in 1922 and 1923) is now being satisfactorily avoided.

(*b*) **Chemist.**—Mr. T. E. H. O'Brien has continued his chemical researches, and his report is presented herewith.

It will be noted that he has given special attention to the development of a Glass Hydrometer suitable for use on Ceylon Estates. Samples of this hydrometer have been forwarded to the Rubber Growers' Association in London with a full report thereon, and arrangements are being made for it to be thoroughly tested on Estates in Ceylon and Malaya, while samples are also to be sent to Java.

The preparation of the series of samples of rubber in different forms to be tested at the Imperial Institute has been completed, and the interim reports thereon have been published as Bulletins 33, 34, 35, 36, and 37. A further set of samples has been asked for and will be prepared during 1925.

Experiments have been in progress throughout the year to determine the effect on mould of smoking rubber with different kinds of wood and smoking under varying conditions. These experiments are still in progress.

A study of the mineral constituents of latex has also been in progress during the year and is being continued.

A number of samples of rubber have been prepared with Formic Acid as coagulant, with a view to determining if this acid would prove equal to or superior to Acetic Acid. These experiments suggest that should Formic Acid be cheaper than Acetic Acid there would be no disadvantage in its use, as the rubber so prepared appears to be equal in all respects to Acetic Acid coagulated rubber.

Samples of rubber have been prepared from latex obtained from trees sprayed with Bordeaux Mixture so that tests can be made on the vulcanised product. It has been found

that Bordeaux Mixture has little or no effect on raw rubber, but nothing definite is known as to its effect on vulcanised rubber.

Tests have been made on the proprietary article known as " Mer " which was stated to effectually dispose of mould and rust on sheet rubber, but while the tests carried out support this claim, the presence of free alkali in the substance makes it inadvisable to use it.

A set of meteorological instruments have been obtained from the Observatory in Colombo and installed near the laboratories, and records have been kept daily. It is considered that a knowledge of weather conditions will be of much value in many experiments.

(c) **Physiological Botanist.**—Mr. R. A. Taylor returned from his study leave in Java and the Federated Malay States and resumed duty in March.

He has since then continued his studies of the Brown Bast problem in the laboratory and in the field. He has succeeded in obtaining an extract from the affected tissues and this is being analysed and a comparison made with the extractions from normal and healthy cortical tissues. In the field he has continued the examination of the trees included in the census taken last year, and the results of these observations will be communicated in due course.

The experiment on the change-over-system of tapping has been continued and records of yields are being kept. In due course measurements will be taken to determine the relative rate of bark renewal under the change-over and non-change-over system.

An investigation of the composition of cell sap is in progress and experiments are being carried out to determine the influence of the addition of different mineral salts on the composition of the cell sap. It is considered that these examinations might throw some light on the problem of manuring of rubber and possibly show if a deficiency of certain salts has an influence on the occurrence of secondary leaf-fall.

Examinations of soils have been made to determine what relationship exists between the reactions of soil solutions and the amount of organic matter present. These reactions are intimately connected with the subject of nitrification of soils by bacteria and some knowledge of them is desirable in connection with the growing of nitrogenous cover crops.

In connection with the subject of budding of rubber selected seed from the Henaratgoda No. 2 tree have been planted in nurseries on two estates and the plants are to be used as stocks for budding during 1925. Efforts are being made to secure records of the trees giving exceptionally high yields in different districts of the Island so that a study of the influence of different soils and climatic conditions on budded rubber can be made.

An inspection of some of the oldest rubber trees in Ceylon has been made for the purpose of estimating the probable life of rubber trees under estate conditions. It would appear that after 30 years of age bark renewal is very slow and the power of recuperation of the trees is much less than with younger trees. However, from the examination made it was not possible to make any determination of the probable life of rubber trees in Ceylon.

(*d*) **Mycologist.**—Mr. M. Park's reversion to his former appointment as Assistant Mycologist to the Department of Agriculture deprived the Research Scheme of a Mycologist for the first 9 months of the year. Mr. R. H. Stoughton Harris was appointed to fill the vacancy and took up his duties in the laboratories on October 8th. At the Meeting of the Technical Committee held on October 9th it was decided that Mr. Harris should make a particular study of what are known as the Phytophthora diseases of rubber (bark rot, patch canker, top canker, and secondary leaf-fall and pod disease). It is also proposed that he should take up the study of the action of the various disinfectants which are in use to determine, if possible, which is the best and most economical in use. It has been arranged that Mr. Harris will supervise the pollarding and spraying experiment in connection with a study of secondary leaf-fall and pod disease, and will collaborate with Mr. Taylor in the study of Brown Bast.

Research Work at the Imperial Institute.—A full report of the work carried out at the Imperial Institute is presented herewith.

Interim Reports on "Vulcanisation Tests" on samples prepared in Ceylon have been published as Bulletins 33, 34, 35, 36, and 37, and these have been distributed to all Subscribers. A final report on this series is expected shortly.

In addition reports have been received from the London Advisory Committee dealing with the following subjects:-

Report on "Samples of Latex for Paper Making." (Rubber Growers' Association Bulletin, February, 1924, page 126.)

Report on "Hopkinson Sprayed Latex Rubber." (Rubber Growers' Association Bulletin, February, 1924, page 93.)

Report on "Preservation of Latex with Ammonia-Nature of Deposit." (2nd Quarterly Circular.)

Report on "Rubber prepared with Sodium Sulphite." (2nd Quarterly Circular.)

Report on "The Effect on the Vulcanising and Mechanical Properties of Rubber of the addition of Ammonia to Latex." (2nd Quarterly Circular.)

Reports (3) on "Rubber prepared with Sodium Silico-fluoride as Coagulant." (4th Quarterly Circular.)

PUBLICATIONS.

Rubber Research Scheme Bulletins.—A complete list of the Bulletins issued by the Rubber Research Scheme is given in Appendix 2 of this Report. During the year Bulletins Nos. 32, 33, 34, 35, 36, and 37 have been issued. Bulletin No. 32 dealt with "Preservation of Latex," while Bulletins 33 to 37 contain the Interim Reports of the Vulcanisation Tests made at the Imperial Institute on samples prepared in Ceylon.

Rubber Research Scheme Circulars.—In accordance with the announcement made in the last Annual Report Quarterly Circulars have been issued containing a series of articles

prepared by the Technical Officers on current problems in the Rubber Industry. These circulars have been distributed to all Subscribers, and a list of the Circulars issued is given in Appendix 2 of this Report.

Rubber Growers' Association Bulletins. All the Bulletins issued by the Rubber Growers' Association, London, during 1924, have been received and distributed to those estates which do not receive them direct from London.

The thanks of the Rubber Research Scheme are due to the Chamber of Commerce, Colombo, for the free use of their rooms for the various Meetings of the Committees of the Research Scheme.

Adopted by the Executive Committee at its Meeting held in Colombo on January 14th, 1925.

T. PETCH,
Acting Chairman,
Executive Committee,
Rubber Research Scheme (Ceylon).

RUBBER RESEARCH SCHEME (CEYLON),
Peradeniya,
6th January, 1925.

REPORT OF ORGANIZING SECRETARY ON VISITS TO ESTATES.

Tours of estates situated in all the Rubber growing districts have been carried out and visits have been paid to 68 estates on the list of Subscribers to the Rubber Research Scheme.

The characteristic symptoms of the various diseases met with have been carefully described and methods of treatment fully demonstrated for the benefit of the Staff on each estate. These visits have been supplemented by a report for the information of the Superintendent, Agents, and Directors of the Company concerned.

The following comments indicate the conclusions arrived at as a result of these visits and represent the writer's opinion of the general condition of estates in Ceylon at the present time.

DISEASES.

1. **Fomes lignosus.**—This disease has been noted on almost every estate visited. I am, however, pleased to report that there has been a marked improvement in the position on many estates where this disease has given much trouble in the past, and there is good reason to believe that the more thorough methods of treatment being practised on these estates is effectively checking the spread of the disease and in many cases leading to almost complete eradication.

2. **Fomes lamaoensis (Brown Root Disease).**—This disease was noted on most estates visited and from the observations made it would appear that occasional loss of trees from this disease is likely to be experienced each year on all estates.

3. **Ustulina zonata.**—Good curative work continues to be done in connection with this disease, and most estates are now able to add considerably to the life of affected trees by careful treatment. Where a careful census of cases has been taken it appears that the disease very frequently commences at the point where wounds have been made with the latex spouts, and it is desirable that these wounds be treated with disinfectants from time to time after the spouts are removed. It should be stated that wounds near the base of the tree are always liable to be attacked by this disease and careful attention to such wounds is needed.

4. **Poria hypobrunnea.**—This disease has been noted on very rare occasions on the estates visited, and it would appear to be one of the least common of root diseases in Ceylon at the present time.

5. **Sphaerostilbe repens.**—Outbreaks of this disease have occurred on two estates which suffered from periodical flooding of certain areas, but it was not observed on any other estate nor under any other circumstances. It is desirable that all estates which suffer from flooding should take note of this fact and keep such areas under careful observation.

6. **Xylaria Thwaitesii.** -This disease still appears to be confined to the estate referred to in the last Annual Report. As it was considered that the nature of the fungus might not be sufficiently known a description (with photographs) was given in the 3rd Quarterly Circular, but this has not led to any notifications from other estates.

7. **Secondary Leaf-fall and Pod Disease.** –This disease again appeared in the Kalutara and Kelani Valley Districts and to a less extent in the Kegalle District, but defoliation was not more severe than in 1923. Possible means of directly or indirectly improving conditions so as to diminish the ill effects of this disease have been repeatedly discussed, but a satisfactory solution of the problem has not been reached up to the present time. In addition to manuring experiments it is proposed during 1925 to carry out experiments in pollarding and spraying as a possible direct means of dealing with the disease.

8. **Black Stripe Canker or Bark Rot.** This disease has been prevalent on many estates while others have suffered very slightly. There seems little doubt that considerable improvement can be effected by the application of disinfectants *after every tapping.* It does not appear to be sufficiently understood that the period of susceptibility is after each tapping, and that protection must be afforded each time the tree is tapped if the disease is to be kept in check. Owing to the heavy rains it is doubtful if complete protection can be given and some cases are likely to appear under the most careful treatment.

9. **Patch or Claret Coloured Canker.** –The methods of treating this disease are now being modified on most estates, and the excessive scraping which has been a feature of "Canker" work in the past is steadily being replaced by carefully organised work with trained coolies. It is anticipated that better results at a much lower expenditure will be achieved by the modifications made.

10. **Die-back (Botryodiplodia Theobromae).**—This disease has rarely appeared and very little damage has been caused on any estate visited.

11. **Pink Disease. (Corticium salmonicolor).**—This disease has been observed on several estates, and it has been reported from others. In all cases it appeared in rubber up to 5 years of age only. The fact that serious outbreaks occur from time to time in Java and Malaya indicates the necessity for immediate action when cases are noted, and all estates possessing young rubber should exercise careful supervision at such times.

12. **Brown Bast.**—Further observations confirm the opinion that Brown Bast is more prevalent than is generally appreciated, and though the rate of increase is probably slow at the present time this is largely attributable to the restriction of output being practised on estates. On resumption of fuller tapping it is probable that much unsuspected Brown Bast will be revealed. It is desirable, therefore, that all areas being tapped at the present time should be carefully examined for Brown Bast and treatment carried out without delay. There is good reason for stating that where treatment is carried out with reasonable care a high percentage of successes can be expected.

GENERAL PROBLEMS.

1. **Tapping.**—There has been no material change in the systems of tapping practised on Ceylon estates. A considerable number of enquiries have been received on the relative merits of third-day as compared with alternate day tapping, and of the cut on one-third as compared with the cut on a half the circumference of the tree. It appears, therefore, that there is a desire to adopt more conservative systems of tapping in order to secure a longer period for bark renewal and to conserve the health of the trees. From a consideration of available evidence it would appear more desirable to lengthen the intervals between successive tappings than to shorten the cut.

2. **Budding of Rubber.** —Interest in the question of budding of rubber in Ceylon does not appear to be as great as it should be in view of the possible developments in the future. The attention of Subscribers has been drawn to the importance of this subject in each of the Quarterly Circulars issued by the Scheme during 1924, and it is hoped that a revival of interest will take place during 1925. Rapid strides are being made in Java and Sumatra and to a slightly less extent in Malaya, and there is a distinct danger that Ceylon may, at some future time, be left behind in much the same way as it was in the Cinchona Industry.

3. **Factory Practice.** (*a*) CREPE. Several complaints have been received of spotting of sole crepe rubber, and it would appear that this special form of rubber is more liable to develop this defect than ordinary crepe. As the defect arose most frequently during transit makes the problem of its prevention more difficult. A special note on this matter appears in the 4th Quarterly Circular, and this should be read by all Subscribers.

(*b*) SHEET.—Complaints in connection with the manufacture of sheet rubber have been very rare, and it would appear that "rust" is now much less prevalent than in the past and that the methods adopted for preventing its appearance are proving successful. A really satisfactory means of preventing mould has not yet been discovered and a good deal of research work on this problem is in progress.

4. **Manuring.**—There has been no marked increase in manuring of estates, doubtless owing to the fact that the price of rubber has not been sufficiently high during the year to justify any considerable outlay. There is little doubt, however, that most Ceylon estates are showing the ill effects following on repeated attacks of secondary leaf-fall and as a result of soil erosion, and the question of the application of suitable manures is one which requires an answer.

5. **Cover Plants.**—Considerable interest has been taken in the question of establishing cover plants to prevent erosion of soil and in order to improve the nitrogenous content of the soil. The usual difficulties have been experienced, but much progress has been made and several estates are now able to show satisfactory results.

(*a*) **Desmodium triflorum.**—Large areas have been satisfactorily covered with this plant, and from observations made it would appear to answer every requirement of a cover plant. By suitable methods of planting it should be possible to greatly increase the areas under this cover.

(*b*) **Vigna oligosperma.**—As a result of the excellent reports of this cover plant received from Java a large number of estates have endeavoured to establish it, and though it has not been uniformly successful the results are very encouraging. It is more than likely that it will become one of the valuable cover crops on Ceylon estates during the next few years. Reports have been received of insect pests and of snails attacking the leaves, but no serious outbreak has been recorded.

(*c*) **Tephrosia candida (Boga Medeloa).**—This cover crop is still the best known and most favoured on Ceylon estates and being relatively easy to establish it is likely to remain the principal one for some time to come.

(*d*) **Other Cover Plants.** Experiments have been carried out with numerous other varieties of cover plants but without any outstanding success, and it is more than likely that attention will be mainly confined to the three cover plants referred to above.

6. **Correspondence.**—Correspondence on all questions relating to the cultivation and preparation of rubber has greatly increased during the year, and it is a pleasure to report that Superintendents and Agents of Estates are now taking fuller advantage of the information and service which the Research Scheme can give.

J. MITCHELL,
Organising Secretary.

Peradeniya,
January 29th, 1925.

CHEMIST'S REPORT FOR 1924.

A summary of chemical work carried out during the year is given below. The new laboratories were occupied towards the end of 1923, and the increased facilities provided have been greatly appreciated, and have permitted work of a more accurate character than was practicable previously.

EXPERIMENTS ON SMOKING OF SHEET RUBBER.

During the year a series of experiments has been in progress with the object of investigating the effect of smoke in inhibiting the growth of mould on sheet rubber. It has long been recognised that smoke has such an influence and the aim of the experiments is to determine whether, by suitable adjustment of conditions, mould can be entirely prevented, or the tendency to mould growth can be reduced to a minimum.

A small smoke-chamber was installed at the laboratories, and samples of sheet have been smoked for various lengths of time and under various conditions. These samples have been tested by being placed in a moist atmosphere after being inoculated with mould. The method of testing adopted was that devised by Dr. De Vries, and consists of placing portions of sheet in a closed receptacle containing a 7% solution of common salt. This provides an atmosphere almost saturated with moisture. The number of days before the first signs of mould growth appears is taken as a measure of the resistance to mould.

Whilst this test has been found to be very satisfactory for sheets which develop mould readily it is not altogether satisfactory for highly resistant sheet such as has been prepared in the course of the experiments. In these cases mould developed so slowly that it is difficult to say on which day the growth has definitely started. Moreover it has been shown that the inoculation of mould usually dies off and the mould which finally makes its appearance is from chance infection. Another small difficulty which crops up is that after a few weeks a species of small bug which eats mould often makes its appearance in the receptacle and eats off the mould as it develops. In the next series of experiments it is intended to compare the amount of mould developed in a given time, instead of recording the number of days before growth starts.

Up to the present time experiments have been carried out with what, for want of a better term, may be called "uncombusted smoke," *i.e.*, the fire is controlled so that the wood does not blaze and the smoke may be expected to be rich in phenolic and tarry constituents. In most estate smoke-houses freer combustion is allowed giving a lighter smoke. Sheets were smoked for 11, 14, and 18 days and mould growth tests were started (1) one hour after removal from the smoke-house; (2) after hanging the sheet in a drying room for 8 days.

Comparative tests were made using rubber wood and *del* wood as fuel. The weight of smoke absorbed during smoking was measured by determining the increase in weight of air-dried sheet placed in the smoke-house with the wet sheets, making the necessary allowance for change in moisture content.

In one experiment a comparison was made between sheets smoked in the experimental smoke-house and sheets made from latex from the same source (on different days) smoked in neighbouring estate smoke-houses.

Whilst, as stated above, results of mould-growth tests were erratic, the following indications are given by the results of experiments to date :—

1. The suggestion made at the last Annual Meeting that heavily smoked sheet is more resistant to mould was not substantiated in later experiments, as far as concerns the number of days before mould first appears; but from observations it appears that the amount of mould on thoroughly smoked sheet is less.

2. Thorough washing of sheet (2 hours) before smoking showed no appreciable advantage, as far as concerns the number of days before mould appeared, but again the amount of mould was judged to be less. Sheets washed in this manner show less tendency to "sweat" after removal from the smoke-house, and the appearance of the sheet is improved. It has the disadvantage that the sheets take 1—2 days longer to dry, but on the whole the practice of thorough washing of the freshly rolled sheets is strongly to be recommended.

3. The most striking result of the experiments was the greatly increased liability to mould of sheets which were hung in the drying room for 8 days before being tested. Some figures on this point were given in the 3rd Quarterly Circular of the Research Scheme, and a recommendation was made that sheet should be packed on the day of removal from the smoke-house. Time should be allowed for the sheets to cool before packing. Some recent inoculation experiments show clearly that loss of smoke constituents takes place when sheets are hung in the drying shed.

4. There was no distinct difference between rubber and *del* wood in mould inhibiting properties.

5. Sheet smoked in the experimental smoke-chamber was more mould resistant than sheet from estate smoke-houses. The weight of smoke absorbed was greater in the first case.

6. Washing sheets after removal from the smoke-house had no influence on the liability to mould, apart from the fact that the sheets must afterwards be hung to air-dry. A note on this point appears in the 4th Quarterly Circular.

7. It is not thought likely that mould growth can be entirely prevented by smoking.

Some preliminary experiments were made on the chemical examination of smoke, but it was thought that the time necessary for this work would not be justified by the results.

GLASS HYDROMETERS FOR LATEX.

A number of glass hydrometers were constructed having approximately the same sensitivity as the brass "Metrolac." Various laboratory and factory tests were carried out and indicate that under present tapping systems it can be expected to give better results than the "Metrolac." One hydrometer has been in use in a factory for standardising latex for 9 months, and another was used for "weighing up" latex for 5 months

without breakage. A report on the subject was forwarded to the London Committee and the Rubber Growers' Association, and 50 hydrometers have been ordered for carrying out factory tests during the coming year.

MINERAL CONSTITUENTS OF LATEX.

An investigation of the inorganic constituents of latex has been started, the object being to determine whether the composition of the ash varies under different conditions, and whether the approach of Brown Bast is reflected in any change in its composition. The preparation and examination of latex ash was found to be less simple than might be expected, owing to the small amount of ash present, the high phosphate content, and the high percentage of free alkali; the latter besides making the ash extremely hygroscopic, causing it to attack porcelain and platinum at high temperatures.

Suitable analytical methods have been worked out and tested, and two trial analyses of latex ash completed. The figures obtained differ from results previously published, which it is understood refer to analyses carried out some years ago. This shows that considerable variation in the composition of latex may be expected.

Ash is now being prepared from two individual trees which are being subjected to heavy tapping.

FORMIC ACID AS A COAGULANT.

A sample of Formic Acid was received from a firm interested in its sale. A comparison was made of the relative amounts of Formic Acid and Acetic Acid required for coagulation, and it was found that the amount of Formic Acid required in different tests lay between 60 and 75 per cent. of the amount of Acetic Acid. In these tests the fact that Formic Acid has a higher specific gravity than Acetic Acid was taken into account, since the acids are sold by weight. As Formic Acid has antiseptic and reducing properties, tests were made to determine whether its use would have any effect in preventing "rust" and "mould" in sheet manufacture, or obviate the use of bisulphite in crepe manufacture. In these respects it was not found to have any appreciable advantage over Acetic Acid.

A request has been made for full information as to price of Formic Acid and the supply available, but no recommendation as to its adoption could be made without obtaining the results of manufacturer's tests on large size samples.

SAMPLES FOR THE IMPERIAL INSTITUTE.

In the earlier part of the year the remaining samples of Series I., asked for by the London Committee, were prepared, involving two visits to the Uva District.

BORDEAUX MIXTURE AS A FUNGICIDE.

In connection with the possibility of the above substance being used for spraying trees, it was arranged that a series of samples should be prepared and forwarded to the Imperial Institute for vulcanising and ageing tests, to determine whether rubber obtained from trees which had been sprayed was affected by the traces of Bordeaux mixture likely to be present.

Blocks of trees were sprayed with different types of Bordeaux mixture and samples of crepe were prepared (1) from latex before spraying the trees; (2) from the first tapping after spraying; (3) from the first tapping after heavy rain. To date 9 samples have been prepared and forwarded to the Imperial Institute.

PRESERVATION OF LATEX.

No further experimental work has been done on this subject. Advice has been given to several estates with regard to shipments of latex.

METEOROLOGICAL RECORDS.

During the year records of rainfall and temperature have been kept and have already proved of value in connection with various experiments.

MISCELLANEOUS.

A sample of "Mer," a preparation advertised for removing "mould" and "rust" from sheet, was examined. It was found to do this effectively, but as it contained free alkali its use would not be advisable. In the course of the tests it was noted that mould can be satisfactorily removed by scrubbing with water.

A sample of "Bush's Coagulating Powder" was examined. This was found to consist essentially of alum, and as such cannot be recommended as a coagulant.

Several "Metrolacs" were received for adjustment, and a sample of Acetic Acid was reported on at the request of an Estate Superintendent.

(Signed) T. E. H. O'BRIEN,
Chemist,
Rubber Research Scheme.

10-1-25.

PHYSIOLOGICAL BOTANIST'S REPORT FOR 1924.

1. **Study trip to Java and the F. M. S.**—The first three months of the year were spent in Java and the Federated Malay States for the purpose of studying the methods of Rubber Research Work being carried on in those countries, with particular reference to physiological research.

In Java, most of the time was spent in the laboratory of Dr. Bobilioff at Buitenzorg, one week at the Besoeki Experiment Station, Djember, with Dr. Arisz and a few days at Malang with Dr. Bally. These scientific workers gave me every possible assistance in my studies and I am also indebted to Dr. Cramer and Mr. Van der Meulen for advice and assistance.

In Malaya, some time was spent in the Research Laboratories of the Rubber Growers' Association on Petaling Estate, and every assistance was given to me by Messrs. Pinching, Sanderson, and Sutcliffe. A visit was also paid to the Laboratories of the Department of Agriculture, Kuala Lumpur, and I am indebted to Mr. Belgrave of that Department for advice on current physiological problems.

Special consideration was given to the study of Brown Bast, Budding and Selection, Cover Crops, and methods of physiological research in the Laboratories. Observations arising out of the study of Brown Bast and Budding were published in the 1st Quarterly Circular for 1924.

It is generally considered that the more conservative systems of tapping now practised in Java have led to a marked diminution in the incidence of Brown Bast. In Malaya the stripping method of treatment has been carried out with a varying degree of success, and from an examination of large numbers of trees which had been stripped it appears likely that if carefully done this method is as satisfactory as any. Whether it can be satisfactorily practised in Ceylon requires investigation, and experiments are now in progress to determine this.

In connection with Budding and Selection a considerable amount of progress has been made in Java, and there is good reason to believe that a large measure of success will be attained in this direction. Up to the present time most attention has been paid to the character of the scions used in budding operations, but there is reason to believe that the stock also exercises a substantial influence on the character of the resultant plant. It is proposed to keep this factor under careful observation in all experimental work in Ceylon.

In Java the most favoured of the cover crops (Green Manures) are Vigna oligosperma, Centrosema pubescens and Centrosema plumieri, but large areas are covered with Mimosa invisa. For Ceylon estates Vigna is likely to be the most satisfactory.

2. **Brown Bast Investigations.**—Since my return a study has been made to determine if there is any difference, biochemically, between normal bark and that affected by Brown Bast. Samples of bark have been treated with Acetone and Alcohol as solvents and extracts have been obtained from the affected tissues. These are being analysed and will be compared with the extractions from normal bark.

As noted above experiments are being carried out to determine if the stripping method of treatment as advised by Messrs. Sanderson and Sutcliffe can be successfully carried on in Ceylon.

In the last Annual Report it was stated that a census of cases of Brown Bast had been taken on 3 blocks of 1,000, 1,160, and 722 trees respectively, and that it was proposed to examine these at yearly intervals. An examination was carried out in October, and it was found that the disease had increased considerably. Most of the cases marked "slight attack" in 1923 have become much worse, while numerous cases marked "doubtful" now show unmistakable symptoms.

From a study of these blocks of trees there does not appear to be any connection between the amount of moisture present and Brown Bast incidence as suggested by investigators in Sumatra. Again it appeared from an ordinary examination of the trees that the disease appeared in groups, but on plotting these out it was found that cases were scattered more or less indiscriminately throughout the fields.

An experiment is in progress to test the "exhaustion theory" of Brown Bast development.

3. **Change over Tapping.**—The experiment begun in 1923 to test the relative merits of change-over and non-change-over tapping with reference to yield of latex and bark renewal is being continued.

4. **Study of Cell Sap.**—A study of the composition of Cell Sap is in progress and experiments are being carried out to determine the influence of the addition of different mineral salts on the composition of the Cell Sap.

5. **Soil Studies.**—A number of examinations of soils are being carried out for the purpose of determining what relation exists between the reactions of soil solutions and the organic matter present.

6. **Budding and Selection.**—Nurseries have been established from selected seed of the Henaratgoda No. 2 tree, and it is hoped to use the plants as stocks for budding during 1925.

7. **Old trees in Ceylon.**—An examination of the trees on the old Government plantations at Yatipauwa and Edangoda has been made with the view to securing some estimation of the probable life of Hevea under estate conditions. These trees have received varied and somewhat severe treatment, and it is probable that under present conditions the life would be materially prolonged. Without further information than that furnished by these trees it is not possible to estimate the probable economic life of Hevea in Ceylon.

(*Signed*) R. A. TAYLOR,
Physiological Botanist.

REPORT OF LONDON ADVISORY COMMITTEE FOR 1924.

Constitution of Committee.

Representatives of Ceylon Planting Interests	Sir Edward Rosling. Sir Stanley Bois. Mr. G. H. Golledge (resigned October, 1924).
Representatives of the Rubber Growers' Association	Mr. P. J. Burgess, M.A., F.C.S. Mr. H. Eric Miller. Mr. Herbert Wright.
Representatives of Rubber Manufacturing Companies	Mr. Percy Rosling. Mr. W. A. Williams. Dr. D. F. Twiss.
Representative of the Research Association of British Rubber and Tyre Manufacturers	Mr. A. Johnston.
Botanists	Prof. J. B. Farmer, F.R.S. Mr. H. N. Ridley, C.M.G., F.R.S.
Representative of Imperial Institute ...	(Vacant)
Secretary	Mr. J. A. Nelson, B.Sc.

During the year the Rubber Growers' Association nominated Mr. P. J. Burgess, M.A., F.C.S., as one of their representatives in place of the late Mr. F. W. Barker.

Technical Sub-Committee.—The following members formed the Technical Sub-Committee, which considers reports on investigations and other technical matters:—Sir Edward Rosling (Chairman), Prof. J. B. Farmer, Messrs. Johnston, Ridley, Twiss, Williams, Wright.

Meetings of Committee.—The Committee held six, and the Technical Sub-Committee five, meetings during the year.

The Committee desire to record their appreciation of the assistance rendered by the Chairman (Mr. F. A. Stockdale) and other members of the Ceylon Committee (the late Mr. M. Kelway Bamber, Mr. C. W. Bickmore, Mr. Clifford Figg) who have attended their meetings while on leave in this country.

In view of the fact that the period of five years for which the Scheme was approved by the Government of Ceylon in the first instance will expire in September, 1925, the visit of the Chairman of the Ceylon Committee was particularly opportune, as it enabled the Committee to discuss fully with him a number of important questions connected with the future of the Scheme. It was decided in the first instance to ask the Rubber Growers' Association whether they would be prepared to renew their contribution of £ 2,000 per annum for a further period of five years. The Association expressed their willingness to do so subject to the Government of Ceylon continuing their support for the same period on the basis originally adopted. This offer was transmitted to Ceylon, and the Committee hope that the Government will be prepared to adopt the proposal made by the Association.

Finance.—The expenditure incurred by the London Committee during the year was £ 2330–6–4, which included £ 223–12–2 in respect of apparatus, etc., purchased on behalf of the Ceylon Committee. At 31st December, 1924, there was an unexpended balance in London of £ 616–16–6.

Staff.—No alterations were made in the Technical Staff which consists of Mr. G. Martin, B.Sc., A.I.C. (Superintendent), Mr. W. S. Davey, B.Sc., A.I.C., Mr. F. L. Elliott, F.I.C., and Mr. L. L. Stewart.

During the year further endeavours were made to secure a mycologist for service in Ceylon, and as a result Mr. R. H. Stoughton-Harris, B.Sc., A.R.C.S., was appointed. Mr. Stoughton-Harris sailed for Ceylon on the 30th August.

The Committee desire to record their appreciation of the courtesy of Messrs. Henley's Telegraph Works Co., Ltd., and the Dunlop Rubber Co., Ltd., in granting facilities to the Staff to inspect their factories, as a result of which much useful information was obtained.

A paper on the work of the Scheme was prepared for the Conference held in connection with the International Exhibition of Rubber and other Tropical Products at Brussels in April, 1924. Mr. Stockdale also read a paper on the subject at a Conference held in London on the 18th July, 1924, under the auspices of the Rubber Growers' Association and the Research Association of British Rubber and Tyre Manufacturers. This Conference was attended by the Staff in London. Both these papers have been published in the Proceedings of the respective Conferences.

British Empire Exhibition.—An exhibit illustrating the work carried out in London, in connection with the Scheme and the methods of testing employed, was included in the Imperial Institute Section of the British Government Pavilion at the British Empire Exhibition, Wembley.

Sole Crepe.—As a result of enquiries made at the request of the Ceylon Committee regarding the suitability of recent shipments of sole crepe from Ceylon, arrangements were made to discuss the whole question with brokers. Samples of the grades at present in demand, approved by the Standard Qualities Committee of the Rubber Trade Association, were subsequently forwarded to Ceylon for the information of the Committee.

Investigations.—The investigation of the comprehensive series of samples of rubber prepared by standard methods on four estates in different parts of the Island at different periods of the year, referred to in the previous report, was completed. The results are of considerable interest, as they indicate that crepe is much less variable than any of the other five forms of Rubber examined, and that of the latter smoked sheet is on the whole the most uniform. Moreover the experiments furnish no evidence of seasonal variation or of important variations in the time of cure of the sets of crepe or smoked sheet rubber from the different estates.

In view of the statement by manufacturers that variations in the plasticity of rubber have a serious effect on factory operations special attention has been devoted at the Imperial Institute for some time to devising a satisfactory method for measuring plasticity,

in order to determine the extent and cause of the variation of plantation rubber in this respect. A special apparatus has been designed and constructed for the purpose and tests are now in progress. In connection with the investigation arrangements have been made for a number of samples to be specially prepared in Ceylon. A preliminary set of experiments has also been carried out with an apparatus which has been constructed to compare the adhesive properties of solutions prepared from different samples of rubber.

As stated in the report for 1923, the questions raised by the Research Association of British Rubber and Tyre Manufacturers as to the suitability of plantation rubber for certain manufacturing purposes are being investigated. In this connection an extensive series of samples containing different amounts of moisture have been prepared in Ceylon and are now being submitted to special tests in comparison with fine hard Para.

In addition to the above investigations, a number of samples prepared by the Chemist in Ceylon in connection with his experiments on smoking and other subjects have been examined. Further work has also been carried out on the effect of the use of sodium silicofluoride as a coagulant and on Hopkinson sprayed rubber.

During the year the possibility of securing greater standardisation in the methods of testing rubber employed by different investigators has been further considered in communication with the Central Rubber Station, Java, and the American Chemical Society. Tests have also been carried out in conjunction with the Central Rubber Station with a view to determining the effect of differences in the methods employed.

The following reports were forwarded to Ceylon during the year:—

(*a*) **Variability of rubber from different districts (Series I).**

(1) 3rd Interim Report (Research Scheme Bulletin No. 35).

(2) 4th Interim Report (Research Scheme Bulletin No. 36).

(3) 5th Interim Report (Research Scheme Bulletin No. 37).

(*b*) **Preservation of Latex.**

(1) Effect on the vulcanising and mechanical properties of rubber of the addition of ammonia to latex (Research Scheme Quarterly Circular No. 2).

(2) Nature of deposit from latex preserved with ammonia (Research Scheme Quarterly Circular No. 2).

(*c*) **Rubber prepared by the Hopkinson Sprayed Latex Process.**

(Published in Rubber Growers' Association Bulletin, February, 1924, p. 937).

(*d*) **Rubber prepared with Sodium Silico-fluoride.**

(*e*) **Rubber prepared with Sodium Sulphite.**

(*f*) **"Drift" Rubber.**

(*g*) **Effect of different conditions of smoking on liability of sheets to become mouldy.**

(*h*) **Investigation of rubber prepared from latex kept in a sealed tin for one month.**

The following investigations had been completed at the close of the year, and the Committee hope to forward reports on these to Ceylon early in 1925.

Variability of rubber from different districts. (Series I.)

(1) 6th Interim Report.

(2) Final Report.

Further information regarding the progress of the technical work carried out in London is given in the Appendix to this report.

APPENDIX.

SUMMARY OF PRINCIPAL TECHNICAL WORK CARRIED OUT DURING THE YEAR.

(1) **Variability.**—The principal investigation in progress at the Imperial Institute during the year was a continuation of the study of the variability in time of vulcanisation of plantation rubber. Experiments under the previous scheme indicated that unsmoked sheet rubber from certain estates almost invariably vulcanised much more slowly than that from other estates, and it was accordingly decided to study this question further and to determine whether other forms of rubber show a similar variation. At the same time it was considered desirable to investigate whether seasonal variations occur in Ceylon rubber and whether differences in estate conditions, *e.g.*, soil, elevation, climate, etc., influence the results.

At the request of the London Committee arrangements were made in Ceylon for the preparation of sets of samples at intervals of three months on four estates in different districts from trees which were planted at about the same time. These estates were selected so as to represent a wide range of conditions under which rubber is grown in the Island. Each set of samples consisted of (*a*) thin crepe, (*b*) unsmoked sheet, (*c*) smoked sheet, (*d*) sheet rubber rolled up while wet, (*e*) crepe rubber blocked while wet, (*f*) slab rubber creped after 14 days. In the case of each of these forms of rubber the samples were prepared as nearly as possible under identical conditions, but owing to the restriction of production and consequent changes in tapping systems it was unfortunately not possible to adhere completely to the programme originally adopted.

The samples were submitted to vulcanising and mechanical tests in the standard rubber-sulphur mixing (90 : 10) and also in a mineral mixing containing an organic accelerator in order to study their behaviour in a type of mixing which is now largely employed by manufacturers. The mixing adopted was as follows:— 90 rubber, 5 sulphur, 90 zinc oxide and 1 hexamethylene tetramine (hexamine). In both mixings tests were made at two standards of vulcanisation, one giving a definite elongation ata standard load and the other giving the optimum tensile strength of the rubber.

Statements giving the detailed results obtained with ten sets of samples in both mixings were furnished to Ceylon and published in Bulletins of the Scheme Nos. 33 to 37. The examination of the three remaining sets had been completed at the close of the year, and a report on the whole investigation will shortly be forwarded to Ceylon for publication.

The following is a summary of the principal conclusions to be drawn from the results of the examination of this comprehensive series of 90 samples.

Time of Vulcanisation.

(*a*) The results obtained with the rubber-sulphur and with the technical mixing are in general agreement. In most cases the variability is less in the technical mixing than in the rubber-sulphur mixing. The physical properties of the samples are fairly uniform over a much wider range of cures in the technical mixing than in the rubber-sulphur mixing.

(*b*) The samples of crepe are much less variable in time of vulcanisation than the other forms of rubber, of which smoked sheet is the least and unsmoked sheet the most variable.

(*c*) There is no important difference in the average time of vulcanisation of the sets of crepe and smoked sheet rubber prepared on the different estates.

(*d*) The results furnish no definite evidence that seasonal variations occur in the rubber from any of the estates, or that differences in altitude, climate and soil have any effect on variability in time of vulcanisation.

Tensile Strength.

Practically the whole of the samples are of satisfactory tensile strength in both mixings, though the crepe rubbers are on the average somewhat weaker than the other forms of rubber. The samples of matured rubber (wet roll and slab) are noticeably stronger than the others in the technical mixing, but are not distinctly superior in the rubber-sulphur mixing.

(2) **Plasticity of Raw Rubber.**—In addition to variability in time of vulcanisation it is stated that important differences are also found in the physical properties of plantation rubber. Variations in plasticity not only affect the amount of power consumed during mastication, but also frequently involve difficulty in subsequent manufacturing operations. A special study has accordingly been made of the suitability of different methods of determining the extent of the variation in the plasticity of plantation rubber, and the following scheme of testing has been provisionally adopted: (*a*) measurement of the amount of power consumed during mastication and mixing; (*b*) determination of the rate at which masticated and mixed rubber can be forced through a small orifice under given loads at a given temperature; for this purpose a special apparatus was designed and a large number of experiments were made in order to ascertain the most suitable conditions for carrying out the tests; (3) determination of the viscosity of solutions of masticated rubber in benzene at a given temperature with a view to determining whether the results can be correlated with those obtained in either of the other tests.

Sufficient progress has been made to justify the commencement of a series of investigations to determine the extent of the variation in the plasticity of raw rubber and its causes. In connection with these experiments arrangements have been made for the preparation in Ceylon of special sets of samples, and the technical officers in the Colony have been invited to submit suggestions as to any variable factors in the methods of preparation or in estate conditions which are likely to have an important effect on the physical properties of the raw rubber.

(3) Particulars were given in the Appendix to the Report for 1923 of the proposals for investigating the questions as to the suitability of plantation rubber for certain special manufacturing purposes which were raised by the Director of the Research Association of British Rubber and Tyre Manufacturers at a Conference which he had with the Technical Sub-Committee in January, 1923. Owing to the staff being fully occupied on other investigations already in progress, work on these problems has had to be postponed until recently, but it is proposed to devote special attention to them during 1925. In connection with the statement that fine hard Para is superior for the manufacture of golf ball tape a series of tests is already being carried out with that rubber in comparison with specially prepared samples of plantation rubber. The suitability of plantation rubber for the preparation of adhesive solutions in comparison with fine hard Para is also being investigated. For this purpose an apparatus has been constructed to determine the load required to separate two pieces of ebonite joined together by rubber solution, and a number of preliminary experiments have already been made.

(4) **Other Investigations.**—A report which was furnished to the Ceylon Committee giving the results of the detailed investigation of rubber prepared by the Hopkinson Sprayed Latex Process was published in the Bulletin of the Rubber Growers' Association for February, 1924. The results confirm the conclusion previously drawn that although this rubber possesses unusual features it is not generally superior to the ordinary forms of plantation rubber. Further work during the year showed that vulcanised Hopkinson Sprayed Latex Rubber has good ageing properties. It was also observed that soaking in water subsequent to vulcanisation produced a marked increase in its tensile strength, and it is evident that the effect of the water soluble and hygroscopic constituents in this rubber requires further investigation.

Samples of rubber coagulated with sodium silico-fluoride which were received from the Rubber Growers' Association were a little slower curing than the control sample prepared with acetic acid; no important difference between the rubbers developed on ageing artificially.

In connection with the experiments on the preservation of latex with ammonia which were referred to in the previous report, it has been found that rubber prepared by coagulation of the latex with acetic acid is distinctly inferior in ageing properties when vulcanised to that prepared by evaporation of the latex. Experiments are in progress with a view to discovering the cause of this difference.

(5) The investigations in conjunction with Dr. de Vries on the standardisation of methods of testing were continued. The further experiments confirm the previous conclusion that marked differences in the results may be obtained at the two stations with the same method, and it is proposed to determine how far this variation is due to the temperatures at which the elongation tests are carried out.

IMPERIAL INSTITUTE,
LONDON, S. W. 7,
15th January, 1925.

APPENDIX No. 1.

LIST OF MEMBERS.

Members of Rubber Growers' Association.

Aboyne-Clyde Rubber Estates of Ceylon, Ltd.
Alliance Tea Company of Ceylon, Ltd.
Alluta Rubber and Produce Co., Ltd.
Amalgamated Tea Estates Co., Ltd.
Anglo-American Direct Tea Trading Co., Ltd.
Anglo-Ceylon and General Estates Co., Ltd.
Associated Tea Estates of Ceylon, Ltd.
Bambrakelley (Ceylon) Tea and Rubber Co., Ltd.
Bandarapola Ceylon Co., Ltd.
Beau Sejour Rubber Co., Ltd.
Beverley Tea and Rubber Estates, Ltd.
Bibile Rubber Co., Ltd.
Caledonian (Ceylon) Tea and Rubber Estates, Ltd.
Carolina Tea Company of Ceylon, Ltd.
Central Province Ceylon Tea Co., Ltd.
Ceylon Consolidated Estates (1920), Ltd.
Ceylon (Para) Rubber Co., Ltd.
Ceylon Planters' Rubber Syndicate, Ltd.
Ceylon Proprietory Tea Estates Co., Ltd.
Ceylon Rubber Co., Ltd.
Ceylon Tea Plantations Co., Ltd.
Ceylon Timber and Rubber Syndicate, Ltd.
Colombo Commercial Co., Ltd.
Consolidated Estates, Co., Ltd.
Consolidated Tea and Lands Co., Ltd.
Dangan Rubber Estates, Ltd.
Deviturai Rubber and Tea Estates Co., Ltd.
Dickella (Ceylon) Rubber Estates, Ltd.
Dimbula Valley (Ceylon) Tea Co., Ltd.
Doloswella Rubber and Tea Estates, Ltd.
Doone Vale (Ceylon) Rubber Co., Ltd.
Doranakande Rubber Estates, Ltd.
Eastern Produce and Estates Co., Ltd.
East India and Ceylon Tea Co., Ltd.
Ederapolla Tea Co. of Ceylon, Ltd.
Elston Estates Company of Ceylon, Ltd.
English and Scottish Co-operative Wholesale Societies, Ltd.
Frocester Estate Rubber Co., Ltd.
Galaha Ceylon Tea Estates and Agency Co., Ltd.
Galphele Tea and Rubber Estates, Ltd.
General Ceylon Rubber and Tea Estates, Ltd.
Glen Rubber and Tea Co., Ltd.
Glendon Rubber Co., Ltd.
Gonagama Rubber Co. (Ceylon), Ltd.
Govinna Rubber Co., Ltd.
Grand Central (Ceylon) Rubber Estates, Ltd.
Hanwella Rubber Estates, Ltd.
Hewagam Rubber Co., Ltd.
Higgoda Rubber Estates, Ltd.
Hingurugama Tea and Rubber Estates, Ltd.
Honiton Rubber Co., Ltd.
Hunasgeria Tea Co., Ltd.
Imperial Ceylon Tea Estates, Ltd.
Kandahena Estates, Ltd.
Kandy Rubber and Tea Estates, Ltd.
Kelani Valley Rubber Estates, Ltd.
Kepitigalla Rubber Estates, Ltd.
Kintyre Tea Estates Co., Ltd.
Knavesmire Estates Co., Ltd.
Kudaganga Rubber Co. (of Ceylon), Ltd.
Landscape Rubber Estates Co., Ltd.
Lanka Rubber Co., Ltd.
Lavant Rubber and Tea Co., Ltd.
Lochnagar (Ceylon) Produce Co., Ltd.
Lowmont Estates Co., Ltd.
Lunuva (Ceylon) Tea and Rubber Estates, Ltd.
Mahawale Rubber and Tea Co., Ltd.
Mapalagama Rubber Estates, Ltd.
Mirishena (Kalutara) Rubber Co., Ltd.
Monerakelle Rubber Estates, Ltd.
Nagolle (Ceylon) Rubber and Tea Plantations, Ltd.
Nahalma Tea Estates Co., Ltd.
Narangoda Rubber Co., Ltd.
Nayabedde Estates Co., Ltd.
Neboda (Ceylon) Rubber and Tea Estates, Ltd.
Ouvah Ceylon Estates, Ltd.
Panagula Rubber Co., Ltd.
Panawal Tea Co., Ltd.
Panawatte Tea and Rubber Estates, Ltd.
Pantiya Tea and Rubber Co., Ltd.
Parambe Rubber and Tea Co. of Ceylon, Ltd.
Pelmadulla Rubber Co., Ltd.
Pelmadulla Valley Tea and Rubber Co., Ltd.
Pimbura Rubber Co., Ltd.
Pindenioya Rubber and Tea Estates, Ltd.
Pitakande Tea Co. of Ceylon, Ltd.
Ragalla Tea Estates, Ltd.
Remuna Rubber Co., Ltd.
Rosehaugh Co., Ltd.
Rubber Estates of Bentota, Ltd.
Rubber Estates of Ceylon, Ltd.
Saffragam Rubber and Tea Co. of Ceylon, Ltd.
St. George Rubber Estates, Ltd.
Sapumalkande Rubber Co., Ltd.
Standard Tea Co. of Ceylon, Ltd.
Sunnygama Co., Ltd.
Telbedde Ceylon Estates, Ltd.
Tempo Tea and Rubber Co., Ltd.
United Planters' Co. of Ceylon, Ltd.
Vogan Tea Co. of Ceylon, Ltd.
Woodend (Kelani Valley Ceylon) Rubber and Tea Co., Ltd.
Yataderiya Rubber and Tea Co., Ltd.
Yatiyantota Ceylon Tea Co., Ltd.

LOCAL SUBSCRIBERS.

Ambanpitiya Estate.
Ankande Estate Co. of Ceylon, Ltd.
* Apthorpe Estates, Ltd.
Aranayaka Rubber Co., Ltd.
Avington Tea and Rubber Co., Ltd.
Ceylon Land and Produce Co., Ltd.
Clunes Estates Company of Ceylon, Ltd.
Cocoawatte (Ceylon) Rubber and Tea Estates, Ltd.
Colombo Commercial Co., Ltd.
Dartonfield Estate, Ltd.
Dorset Rubber Estate Co., Ltd.
Duhallow Estate.
Eila Tea Co., Ltd.
Estates Co. of Uva, Ltd.
Farnham Estate Co., Ltd.
Fernlands Tea Co., Ltd.
Gallawatte (Ceylon) Rubber Co., Ltd.
Ganapalla Estate Co., Ltd.
Gikiyanakande Estate.
Golinda Tea and Rubber Co., Ltd.
Hantane and Bollagalla Estates Co., Ltd.
Hatbawe Rubber Co., Ltd.
Haydella Tea and Rubber Estates, Ltd.
Hinwerelle Rubber Co., Ltd.
Horawela (Kalutara) Rubber Co., Ltd.
Hulundawa Rubber and Tea Co. (Ceylon).
Hunuwella (Pelmadulla) Rubber Co., Ltd.
Ilwana Estate.
Jambulande Tea and Rubber Estates, Ltd.
Kaluganga Valley Tea & Rubber Co., Ltd.
Kalutara Co., Ltd.
Kalutara Rubber Co. of Ceylon, Ltd.
Kanana Rubber Estate Co., Ltd.
Kandyan Hills Co., Ltd.
Karandupona Estates Co., Ltd.
Katiapola Rubber Co., Ltd.
Kelani Tea Garden Co., Ltd.
Kelani Valley Rubber Co. of Ceylon, Ltd.
Kinnersley (Kalutara) Rubber Co., Ltd.
Kuttapitiya Tea and Rubber Co., Ltd.
Lanka Plantations Co., Ltd.
Lansdowne Rubber Co., Ltd.
Lassahena Rubber Co., Ltd.
L. L. P. Estates, Ltd.
Lipton, Limited.
Lyegrove Rubber Co., Ltd.
Macaldeniya Tea and Rubber Co., Ltd.
Mahagama Rubber Co., Ltd.
Mapitigama Estate.
Matale Valley Cacao and Rubber Co., Ltd.
Meall Mor (Ceylon), Estates, Ltd.
Mocha Tea Co. of Ceylon, Ltd.
Moneragalla Rubber Co., Ltd.
Morakelle Rubber Co., Ltd.
Mukulana Estate.
Neuchatel Estates, Ltd.
Niriwatte Co., Ltd.
North Western Rubber Co., Ltd.
Nottinghill Estate.
Opalgalla Tea and Rubber Estates, Ltd.
Opata Tea and Rubber Co., Ltd.
Panana (Kegalla) Rubber Co., Ltd.
Patirada Rubber Co., Ltd.
Peacock and Nilambe (Ceylon) Tea and Rubber Estates, Ltd.
Piccadilly (Kelani Valley, Ceylon) Rubber and Tea Estates, Ltd.
Pine Hill Estates Co., Ltd.
Poonagalla Valley (Ceylon) Co., Ltd.
Ragama Tea and Rubber Co., Ltd.
Ratwatte Cocoa Co., Ltd.
Rayigam Co., Ltd.
Ruanwella Tea Co., Ltd.
Rubber Plantations of Kalutara, Ltd.
Ryan Estates (of Ceylon), Ltd.
Sitawaka Tea and Rubber Co., Ltd.
Sunderland (Ceylon) Rubber Co., Ltd.
Syston Estates Co. of Ceylon, Ltd.
Tannahena Rubber Estates, Ltd.
* The Diwala (Kegalla) Rubber Co., Ltd.
Tillyfour Rubber Co., Ltd.
Tudugalla Estate.
Udabage Tea and Rubber Co., Ltd.
Udagoda Tea and Rubber Co., Ltd.
Udakelle Rubber Co., Ltd.
Udapolla Rubber Co., Ltd,
* Ullswater Rubber Co. of Ceylon, Ltd.
Uva Rubber Co. of Ceylon, Ltd.
Vincit Tea and Rubber Co., Ltd.
Walker, Sons & Co., Ltd.
Warriapolla Estates Co., Ltd.
Wawulugalla Estate.
Wellandura Tea and Rubber Co., Ltd.
Weniwella Rubber Co., Ltd.

* New Companies for 1925.

APPENDIX NO. II.

BULLETINS.

No. 1. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis.
,, 2. The Effect of Tapping on the Movements of Plant-Food in Hevea brasiliensis (continued).
,, 3. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part I.
,, 4. The Physiological Effects of Various Tapping Systems, Part I.
,, 5. Progress Report on Vulcanization Tests.
,, 6. The Physiological Effects of Various Tapping Systems, Part II.
,, 7. The Physiological Effects of Various Tapping Systems, Part III.
,, 8. Seasonal Variations in the Movements of Plant-Food in Hevea brasiliensis, Part II.
,, 9. Vulcanization Tests.
,, 10. Vulcanization Tests.
,, 11. Variability in the Rubber Manufacture.
,, 12. Progress Report of the Rubber Research Chemist.
,, 13. Vulcanization Tests.
,, 14. On the variation in the number of Latex Vessels present in Hevea brasiliensis.
,, 15. Vulcanization Tests.
,, 16. On the Natural Clotting of Rubber Latex.
,, 17. Vulcanization Tests.
,, 18. Measurements of "Bark Renewal."
,, 19. Vulcanization Tests.
,, 20. Vulcanization Tests.
,, 21. Vulcanization Tests.
,, 22. Vulcanization Tests.
,, 23. Vulcanization Tests.
,, 24. Vulcanization Tests.
,, 25. Vulcanization Tests.
,, 26. Results of the trials of Ceylon Rubber for the Manufacture of Ebonite.
,, 27. Vulcanization Tests.
,, 28. Vulcanization Tests.
,, 29. Summary of Results of Vulcanization Tests.
,, 30. The Penetration of Disinfectants on the Tapping Cut of Hevea.
,, 31. On the Occurrence of Rust on Sheet Rubber.
,, 32. On the "Preservation of Latex."
,, 33. Vulcanization Tests (New Series).
,, 34. Vulcanization Tests (New Series).
,, 35. Vulcanization Tests (New Series).
,, 36. Vulcanization Tests (New Series).
,, 37. Vulcanization Tests (New Series).

CIRCULARS.

No. 1. Research Work in Ceylon (17-2-21).
,, 2. Budding and Grafting of Rubber (2-9-21).
,, 3. Research Work in Ceylon (5-9-21).
,, 4. Scale of Subscriptions (27-2-22).
,, 5. Research Work in Ceylon (1-7-22).
,, 6. Rust and Mould on Sheet Rubber.
,, 7. Research Work in Ceylon.
,, 8. Shipment of Latex.
,, 9. First Quarterly Circular for 1924.
,, 10. Second Quarterly Circular for 1924.
,, 11. Third Quarterly Circular for 1924.
,, 12. Fourth Quarterly Circular for 1924.

APPENDIX No. III.

SCALE OF SUBSCRIPTIONS.

					£.	s.	d.
No Output				...	10	10	0
Output up to and not exceeding			100,000 lbs.	...	15	15	0
Exceeding	100,000 lbs.	not exceeding	200,000 „	...	21	0	0
Do	200,000 „	do	300,000 „	...	26	5	0
Do	300,000 „	do	400,000 „	...	31	10	0
Do	400,000 „	do	500,000 „	...	36	15	0
Do	500,000 „	do	600,000 „	...	42	0	0
Do	600,000 „	do	700,000 „	...	47	5	0
Do	700,000 „	do	...	...	52	10	0

For conversion purposes the rate of exchange is the Bank's selling rate for Demand Drafts on London on 15th January or July respectively.