Rubber Research Scheme

(CEYLON).

First Quarterly Circular

FOR

1924

Peradeniya, May, 1924.

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GENTLEMEN,

At the Meeting of the Executive Committee of the Rubber Research Scheme held on January 8th, 1924, the question of publications was discussed and the following Minute placed on record :—

"In connection with the work of the Technical Officers it was decided that circulars dealing with the work of the Officers and with matters of interest to Subscribers be issued at quarterly intervals." The present Circular is the first of the series and deals with the following subjects :—

"Smoking Sheet Rubber."
"Glass Hydrometers for latex."
"Containers for preserved latex."
By T. E. H. O'Brien, Chemist.

"Brown Bast."
"Notes on Budding of Rubber from Observations in Java and Malaya."
By R. A. Taylor, Physiological Botanist.

"Notes on Budded Rubber."
"Notes on Packing of Rubber."
By J. Mitchell, Organising Secretary.

Bulletins and Reports received.

J. MITCHELL,
Organising Secretary.

May 3rd, 1924.

SMOKING SHEET RUBBER.

The effect of smoking on prevention of mould on sheet rubber is at present being investigated. Up to the present one series of experiments has been carried out. In these experiments rubber wood (dry) was used as fuel and the rate of combustion was regulated so that there was no flame, thus giving a smoke rich in phenolic and tarry substances. After smoking, in order to compare the liability of the sheets to become mouldy, portions of them were inoculated with mould and suspended in a vessel containing a small quantity of a 7% salt solution. This provides a moist atmosphere comparable to conditions on a wet day and favourable to development of mould. It was found that a sheet which was smoked to the colour of ordinary smoked sheet was much more readily attacked by mould than a sheet which was left in the smoke-house for a longer period, *i.e.*, until it was somewhat darker in colour than is usually considered acceptable for smoked sheet. Another sheet was washed in running water for two hours before being smoked for the usual length of time. This sheet showed signs of mould somewhat sooner than the "oversmoked" sheet, but the subsequent growth of mould was less rapid. Details of the experiment are as follows:—

Sheet No.		Time of smoking in days.	Weight of smoke absorbed.	Number of days before mould growth started.
1.	Unsmoked ...	—	—	3
10.	"Undersmoked" ...	8	—	6
2.	Average smoked ...	11	0.87 %	9
6.	"Oversmoked" ...	15	1.11 %	20
13.	Average smoked washed in running water for 2 hours ...	11	.90 %	12

This experiment indicates that washing, and the amount of smoke absorbed, are both factors which influence the liability of sheets to become mouldy, but many more experiments are required before any definite recommendations can be made.

GLASS HYDROMETERS FOR LATEX.

Mention is made in the Annual Report for 1923 (p. 12), of experiments on the use of glass hydrometers for latex. A number of experimental hydrometers have been constructed

having approximately the same sensitivity as the brass metrolac. These were forwarded to estates for tests, but the general verdict was that it was difficult to obtain readings owing to latex adhering to the stem. This is an inherent disadvantage of glass hydrometers, it being found that latex adheres to glass more readily than to brass. If however the scale is etched in black on the outside of the stem (instead of having a paper scale inside the stem) it is found that there is no difficulty in obtaining readings. A hydrometer constructed on these lines has now been prepared for test.

CONTAINERS FOR PRESERVED LATEX.

As far as Ceylon is concerned exports of latex are at the present time negligible, but it seems likely that there will be a gradually developing demand for this product and the question of suitable containers for preserved latex is therefore of some interest. Kerosene tins are not satisfactory for various reasons, and apart from the use of tank steamers, steel barrels appear to be the most feasible. The disadvantages of the use of steel barrels are (1) the difficulty of cleaning; (2) the cost of return freight. A collapsible steel barrel, composed of two portions held together by a steel collar, was examined some months ago and was despatched to England filled with preserved latex. It was reported that the latex and barrel arrived in good condition. It is claimed by the makers that when empty, 17 barrels can be nested in the space occupied by three barrels and that the return freight would amount to about Rs. 3/- per barrel. It seems probable that the use of one of the various types of collapsible barrels on the market would be of advantage for the export of latex.

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

RUBBER RESEARCH SCHEME LABORATORIES,
Culloden, Neboda,
3rd May, 1924.

It is still not clear in what way the wounding of the bark in tapping brings about this disturbance. Many theories have been advanced as is well known and these need not be dealt with in detail.

Most observers now agree that the disease is not caused by any parasitic organism, but is an upsetting of the normal activities of the cortex. One station in the Dutch East Indies supports a Bacterium Theory and a method of treatment has been based on this. No causal organism has yet been demonstrated in Ceylon and the inoculation of healthy trees with sap expressed from diseased bark has not given rise to any appearance which could be called Brown Bast. Indeed another sample of this sap gave the same slight discolouration after thorough sterilisation by steaming. This seems to negative the theory that a bacterium is concerned, if it may be assumed that after the addition of one volume of distilled water and subsequent pressing, the liquid contained specimens of the bacteria present. The suggestion that one of the viruses or "filter-passers" is responsible is also disposed of.

At various times the disease has been credited to the action of an enzyme whose presence in excessive quantity is due to wounding. Support for this theory is given by Campbell in his Calcium estimations, but recently Belgrave in the F. M. S. Agricultural Journal advanced arguments against this. Belgrave has investigated the condition of the cell sap in diseased tissue from the point of view of hydrogen Ion concentration, but his work in this line was mainly concerned with latex and coagulation. None of the well known coagulating enzymes have yet been found in rubber.

Wounding of course affects different plants in different ways, but there seems no argument against using possible analogies to suggest new lines of investigation. When a potato tuber is pierced a considerable concentration of the glucoside Solanin has been found to accumulate round the wound. It may be possible that in the same way some organic base or other chemical compound is formed in Hevea. The substance formed need not be organic, but wounding may favour the accumulation or loss of particular inorganic substances in that region and these latter are often able to increase or decrease the action of enzymes by virtue of their power to alter the Hydrogen Ion concentration of a

solution. In this way one sees a possibility of the disease being in a sense due to an enzyme which is however only present in normal quantities.

The fact that no starch is found in badly diseased bark may possibly be explained by the fact that large quantities of reserve material are needed for the meristematic activity which usually takes place to produce "burring." The amount of growth however in many cases does not correspond with loss in starch and to change starch to a mobile form, requires the services of an enzyme.

In considering the above hypothesis it would appear that the treatment of the disease by isolating the affected portion of bark by means of a channel cut out all round to the depth of the cambium, might be equally successful were the cause an enzyme, instead of a bacterium as stated by the theory on which this method is based. But why cannot a bacterium pass through the very delicate meristematic cells of the cambial region? There can be little difference for a time in the contents or cell sap concentration of cells split off practically simultaneously from either side of a common mother cell, at least not sufficient to prevent the spread of a colony of bacteria in search for new supplies. The organism believed to be present is of admittedly minute size and should it belong to the "filter passer" class it might be expected to diffuse through membranes almost as quickly as some of the organic soluble compounds. The success of such treatment need not necessarily support the Bacterial theory.

The work done in Ceylon last year on this disease was largely anatomical and confirmatory. Sections of bark in various stages of disease have been cut in different directions. Study of these has confirmed most of the points put forward by Sanderson and Sutcliffe in their book "Brown Bast."

3000 trees in three separate lots and in different habitats have been minutely examined for Brown Bast and the percentage of affected trees in each calculated. Trees showing any peculiarity of yield, latex, etc., are under observation. Some healthy trees were found in which the scrap rapidly darkened in colour. These are examined at intervals to see whether this has any connection with susceptibility. The darkening is caused by an enzyme in the latex, or which exudes from the bark with the latex, and varies in amount in different trees. An extreme case of darkening is seen in the case of latex from unripe pods.

A preliminary analysis of normal and diseased bark is in progress to determine whether there is any great difference in quality in the acetone, alcohol, and other extracts. An attempt is being made to collect sufficient of the oils, fats, glucosides, etc., from the barks to make an analysis possible should such be thought advisable.

With regard to the susceptibility of other laticiferous trees to the disease, I was told by Mr. Belgrave in Kuala-Lumpur, that he once tapped a Funtumia and it had developed unmistakable symptoms similar to Brown Bast. In Ceylon a jak tree was tapped three times a day for a period and this showed much discolouration even at a distance below the cut, and a great change in the inner cortex. The latex is present only in small quantities, but this dried up within a week. It was concluded that the tree had developed a similar disease.

For treatment no method seems to have been universally adopted. Stripping and scraping have their supporters and antagonists, the application of hot tar after light scraping is advocated in one part of Java, but another Experiment Station condemns it. The method of isolation seems to have been adopted extensively in Sumatra and is I am told very satisfactory. One argument in favour of this is that no rest is required—tap as usual. I have no personal experience of this method.

At first sight stripping, *i.e.*, actually getting rid of the diseased part, seems the most reasonable, but I am told by some that the disease may recur soon after a tapping cut is opened on the renewed bark.

If the disease is caused by an organism or is due to enzymes or a production of substances as suggested above, the isolation method would appear to be sufficient, *i.e.*, provided it is accepted that none of these can pass the meristematic region of the cambium.

R. A. TAYLOR,
Physiological Botanist.

RUBBER RESEARCH SCHEME LABORATORIES,
Culloden, Neboda,
24—4—24.

NOTES ON BUDDING OF RUBBER FROM OBSERVATIONS MADE IN JAVA AND MALAYA.

Where new areas are being planted up with rubber the advice given by the Java proef stations is "Plant a mixture of budded plants and selected seed and plant a sufficient number to the acre to allow of copious thinning out."

This gives a good indication of the current opinion on the subject, and shows the uncertainty of those writers as to whether budding will eventually prove the better method of propagation. Technical difficulties have been surmounted, but the recent results of tapping experiments carried out on budded areas emphasise the difficulty of choosing mother trees and show clearly that only on the strength of yield figures from budded progeny can a mother tree be classified as good.

Much can be done of course by way of choosing a mother tree for buds before any actual budding is done. It would be foolish when growing trees for high yield to choose any but the best yielders available, but there are other things to be attended to, *e.g.*, number and continuity of latex rings in a transverse section of the bark, number of available buds per unit length of branch, and ease with which the "bark" can be removed for budding purposes.

Another point of importance is the choice of stocks. This would appear to have been practically, and in some cases totally, neglected, any seeds to hand being considered good enough to produce that important organ of the plant—the root. Seeds for this purpose should be taken only from trees which show good growth. As little is known about the much discussed question of the effect of stock on scion, it is also advisable to take seed only from good yielding trees and I can see no objections whatever to using seeds from those trees chosen as mother trees for buds.

Some such procedure as the following is suggested for those contemplating an experiment on budding:—

(1) Find out from K. Ps., etc., the 100 reputed best yielding trees on the estate. Have these numbered or marked clearly.

(2) Choose from these, taking into consideration their growth, sufficient to provide seed to supply with stocks the area available. This should be done just before the seeds are ripe.

(3) Keep a record of the individual yield per tapping of each of these 100 trees and continue this for a year. (Much useful and interesting information is obtained by this operation, which is not so expensive as it seems.) Some trees show one, some two, seasons of maximum yield during the year and it is instructive to compare these times with times of wintering and rainfall.

(4) After about six months some evidence will be available of which trees are going to prove most suitable and if it is thought necessary these could then be pruned to encourage growth of "budwood."

(5) After the twelve or more months necessary for the stocks to grow to the proper size, possibly 20 of these 100 trees will show a higher average yield than the others and attention should now be concentrated on these.

(6) A bark examination will now enable a further choice to be made and the number retained depends on the number of buds available and number required. Possibly five trees will be sufficient. One can reckon on taking about 300 buds from a well grown tree without doing much damage. It is not wise to concentrate at this stage on one particular tree for the following reasons arrived at by tapping experiments in Java :—A tree may be an exceptionally good tree, but may not transmit its yielding capacity to its progeny. Also the buds may not easily unite with the stocks. These are physiological phenomena not yet understood, and part of this may yet be shown to be due to the stocks.

Budding is best carried out in a nursery where the plants are always under supervision and care should be taken to see that where a bud does not "take" no adventitious or dormant bud from the stock is allowed to shoot. Such a shoot emerging from ground level is in appearance very like the shoot from a transferred bud, and a regular systematic examination should be made and all undesirables removed.

At the Kultur Tuin at Buitenzorg in Java the importance of the proper stocks is fully realised and Dr. Cramer is experimenting with various species of Hevea as stocks and is also trying to bud on to the roots of old trees of known yielding capacity.

Yield figures of budded trees published by the various Dutch Stations show encouraging results. Yield of these has been correlated with girth, and although there still appear some trees of higher yielding capacity among seed plots, there are also many lower and the average of budded plots is higher. On the average in budded plots the best yielders are found to be twice as good as the poorest, whereas in seed plots they are eight times as good.

A slight digression from the subject may help to emphasise the value of having uniform trees in a field. The figures and graphs published in a recent paper from A. V. R. O. S. Experiment Station in Sumatra show one tree in a small budded plot which has yielded much less than the average and is the only example lying outside the area of correlation between yield and girth. On examination it was found to be suffering from "Pink Disease." While in an ordinary mixed plot the disease would no doubt have been noticed, the effect on yield would have almost certainly passed unobserved. This instance makes clear that such diseases have an effect on the yield of a tree and although this might be expected no figures are at present available to show the extent.

The difficulties and uncertainties have been brought out in these notes, but there is still no reason to take other than an optimistic view of vegetative propagation of rubber. The fact that there are still better trees in seed plots emphasises the point that the proper mother trees or rather the proper combinations of stock and scion have not yet been discovered An analogy may, I think, be fairly drawn between this and the grape culture in France. There, I am told, all grapes produced for any particular purpose are grown on vines which are the budded progeny of one found to produce fruit most suitable for that purpose. The stocks, however, are varied according to the nature of the soil, soils being classified on their chalk content.

The discovery of such suitable combinations of stock and scion in Hevea can only be made by a study of production and behaviour of budded plants, the origins of whose component parts are both known.

As the Rubber Research Scheme does not hold land in the different rubber growing districts in Ceylon, an appeal is made to those interested and having a few acres of land available to see that the Island is not left behind if it should happen (and the chances are not remote) that budding

produced trees of double or more the present average yield. Any help in the choice of trees, and the actual budding work will be supervised by the Scheme at least for one plot in each of the different districts.

It has been suggested that a field of rubber, all progeny of the same mother tree, might be wiped out by any new disease to which that tree was particularly susceptible. There is, of course, this possibility, but it is not difficult to raise such objections. As far as my knowledge goes, no single rubber tree has been found immune to any of the present diseases, and should such a new disease appear it would almost certainly wipe out whatever rubber was being grown.

R. A. TAYLOR,
Physiological Botanist.

RUBBER RESEARCH SCHEME LABORATORIES,
Culloden Estate,
Neboda,
23—4—24.

NOTES ON BUDDED RUBBER.

In view of the importance of raising high yielding rubber trees on estates the comprehensive account on Bud-Grafting which appeared in the January issue of the Rubber Growers' Association Bulletin is worthy of close study. In this account Mr. H. C. Pinching, Senior Scientific Officer of the Rubber Growers' Association in Malaya, discusses the present position of "Bud-Grafting" in Java, Sumatra and Malaya. All Members of the Rubber Research Scheme are advised to carefully peruse Mr. Pinching's report from which the following summary has been extracted for general information :—

(1) No evidence could be found existing in the Dutch East Indies proving the unqualified success of Bud-Grafting as a certain means of raising high-yielding trees.

(2) Bud-Grafting as a means of producing new plants is well within the realms of practical planting politics.

(3) Judging by the present existing Bud-Grafted trees, these trees have generally a similar rate of growth to seed-produced trees.

(4) Bud-Grafted trees belonging to one clone* have marked similarities.

(5) A marked similarity in yield (as compared with seed-produced trees) of trees of one clone* is indicated by the results of tapping Bud-Grafted trees. Further, some high-yielding mother trees appear to always give high or above average yielding vegetative offspring. At the present time there appears to be no correlation, however, between the yields of mother trees and their vegetative offspring.

(6) It would appear that the success of Bud-Grafting as a means of raising high-yielding planting material depends upon the selection of those high-yielding trees which are constitutionally high yielders and whose vegetative offspring are also high yielders.

(7) It is possible that planting a large number of seed-selected plants per acre and the removal of low yielders may result in as high a yielding area as that given by planting up with Bud-Grafted material. Unfortunately the supply of selected seeds is not sufficient at the present time.

(8) At the present time it would seem most advisable for practical purposes to plant mixed Bud-Grafted and seed-selected plants at about 200 per acre, and then to remove the low yielders.

J. MITCHELL,
Organising Secretary.

* Clone or cleon is a Dutch expression meaning group.

NOTES ON "PACKING OF RUBBER."

On numerous occasions during the past two years complaints have been made by rubber manufacturers that rubber from the plantations reached the factories contaminated with dirt, grit, and wood splinters. A considerable correspondence on the subject has passed between the Rubber Growers' Association, London, and the various interests concerned and efforts have been made to devise remedies for the condition complained of. In the Report of the Delegates from the Rubber Growers' Association, London, to the Rubber Association of America, New York, a special section (Appendix C) was devoted to this subject and certain suggestions for improvements made.

It is recognised that, on the whole, rubber leaves the estates in a clean and satisfactory condition and that contamination can, and does, take place during transit, at the wharves, in the warehouses while opening the cases for weighing and sampling, and during re-coopering of the cases. That is, the producer is, in many cases blameless in the matter and the responsibility rests on other shoulders.

Nevertheless, there is reason to believe that some of the responsibility rests with the producer owing to the packing being done in cases which were too fragile to stand the hard usage to which they are subjected, and to the insides of the cases being rough and splintery and unclean. It has been observed that inferior wood which easily splintered has been used, the cases have been badly put together leaving openings between the planks which admitted dirt, dust, etc., and lack of care in nailing down the cases has also been noted.

The number of hands through which the rubber passes from the estate to the manufacturer makes it difficult to ensure its reaching its destination in a satisfactory condition, and it is essential that each should observe such precautions as are possible. Concerning the producer the following suggestions have been made:—

1. That the fine rubber contents of each case be enclosed in a wrapper of plain rubber sheets similar to smoked sheet but of such a size as to afford complete protection to the rubber inside. Strips of ordinary sheet or crepe do not give complete protection being too narrow and leaving edges and corners open. Crepe is not a suitable wrapping material under any conditions as dust and dirt can easily penetrate. For the above purpose it is suggested that sheets be made of the requisite size in specially large coagulating pans or

by attaching several strips of plain rolled sheet together by means of benzine or rubber solution. The wrapper should be easily removable and consequently should be dusted with French Chalk before being wrapped round the rubber to be enclosed (the use of bromine is not advised).

2. The rubber should not be packed in a haphazard fashion as difficulties have been experienced owing to some sheets being packed running across or at right angles to the others, to tying several sheets into bundles, to rolling and folding sheets and pressing them into the corners of the cases. All sheets should run in one direction in the case and be wrapped in the way referred to above. To be fully effective the wrapper sheets should cover the corners as well as the sides and ends.

3. At a recent meeting of Rubber Planters in East Java, Mr. J. B. Harmsen of the Malang Experimental Station delivered a lecture on the subject of rubber packing and advocated a system of baling instead of casing. Unfortunately, the method as described is not clear and steps are being taken to obtain full information on the matter.

During the War some rubber was packed in jute hessian, but buyers complained that pressure during transit caused the bales to become almost solid which made sampling difficult and generally unsatisfactory. In addition, the jute hessian did not prevent dirt and dust from entering the rubber. The method advocated by Mr. Harmsen appears to prevent blocking of the rubber and would, therefore, remove one of the causes of dissatisfaction.

From a general consideration of the subject it would appear that baling of rubber would best meet the case and it appears desirable that experiments should be made to develop a suitable method of baling rubber in which adequate protection of the contents was secured without undue compression. In the meantime, it is certain that packing in wooden cases must continue and suggestions Nos. 1 and 2 should be carefully considered and put into practice so far as possible.

In this connection what appears to be a useful pamphlet has been issued by the proprietors of Bull Whaff Ltd., London, under the heading "Notes on Packing Plantation Rubber." The notes are the result of careful examination, extending over a considerable number of years, of all classes of packing, and it is contended that considerable expense can be saved by the use of suitable cases, by correctly assembling

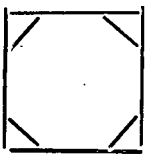
them and by carefully packing the contents. The pamphlet deals with packing in ordinary wooden cases and in 3 ply cases and special drawings are given showing the correct way of fastening lids on 3 ply cases.

As the greater part of the rubber shipped from Ceylon is packed in ordinary wooden cases the points noted in the pamphlet in connection with such cases are given herewith.

Taking the outside measurement as 24″ × 19″ × 19″ the best method of packing crepe rubber is to have the hanks just under 9″ in width and either 23″ in length or a multiple thereof so that they will fold evenly into 23″. The hanks should be placed side by side, lengthwise in the package, so that no space is lost and crumpling of the rubbber is avoided. In packing sheet rubber the width should be 9″ or 18″ and the length 23″ or a multiple thereof.

Where corner battens are used care should be taken to see that the batten goes right down to the bottom of the case, otherwise rubber will get between the end of the batten and the bottom of the case and there is trouble in removing the rubber. Wooden battens made of 1¼″ to 1½″ quartering cut diagonally, thus :—

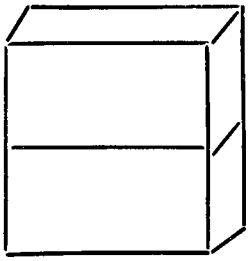
and fixed in each corner of the case, thus :—



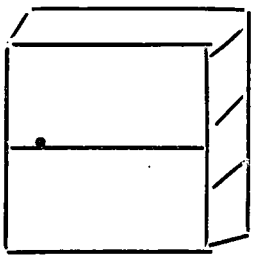
very much strengthen the package and are strongly recommended. Where these battens are used and the cases made properly iron bands are not necessary.

Cases with slotted or machine "dovetailed" sides when battens are used are unnecessary and considerably weaken

the cases. In assembling cases care should be taken that sides and ends do not correspond or meet, thus :—



as the packages are then liable to split in half. They should be put together, thus :—



The wood should be perfectly sound. Many cases arrive with worn eaten wood and as a result the whole contents of a case are impregnated with saw dust. No soft or brittle wood should be used and the insides of the cases should be planed smooth or splinters will work into the rubber.

Cases should not be overpacked as this tends to burst the cases and after the rubber has been turned out for examination it is almost impossible to replace it in the cases. If the rubber is too tightly packed it tends to adhere and is difficult to sample. If underpacked the movement of the rubber inside tends to break the cases and wrappers get impregnated with splinters. For ordinary sized cases the nett weight should not exceed 200 lbs. for sheet rubber and 160 lbs. for crepe rubber.

It is probable that the majority of estates already take all the precautions outlined above, but it is also probable that some of the precautions are taken but others are neglected, and it is to these that attention is drawn.

While it is generally admitted that much of the trouble connected with packing of rubber arises after the rubber leaves the estates it will not be possible to remove all blame from the producer unless all possible precautions have been taken. Reference to the subject is made in the following Rubber Growers' Association Bulletins and the attention of Members of the Rubber Research Scheme is drawn to these references for further information:—

June,	1922, p. 268	March,	1923, p. 167
November,	1922, p. 581	September,	1923, p. 493
January,	1923, p. 9	October,	1923, p. 556
February,	1923, p. 80	January,	1924, p. 49

J. MITCHELL,

Organising Secretary.

Since going to press extracts from a paper read at the International Rubber Congress in Brussels have been published in the "Times of Ceylon" (May 5th), and the points noted will be given in the next Quarterly Circular.

J. M.

BULLETINS AND REPORTS RECEIVED.

Bulletins.

Bulletin No. 32, "Preservation of Latex" by Mr. T. E. H. O'Brien has been received from the Printers and copies have been circulated.

Bulletin No. 33, "Vulcanisation Tests" (New Series) being tests carried out at the Imperial Institute, London, on ubber prepared under the supervision of the Technical Officers in Ceylon has been received from the Printers and copies have been circulated.

Bulletin No. 34, "Vulcanisation Tests" (New Series) being tests carried out at the Imperial Institute, London, on rubber prepared under the supervision of the Technical Officers in Ceylon has been received from the Printers and copies have been circulated.

Reports from London.

(*a*) Report No. 3 on "Vulcanisation Tests" (New Series) is in the hands of the Printers for publication as Bulletin No. 35.

(*b*) Report on "Samples of Latex for paper making" by Mr. F. Kaye. The contents of this report, together with full details of other experiments, are given in the Rubber Growers' Association Bulletin for February, 1924, page 126, under the title "The use of Rubber Latex in the manufacture of boards, leather and linoleum substitutes, and as to the vulcanisation of these products." In this account acknowledgment is made by Mr. Kaye of samples of latex received from the Ceylon Rubber Research Scheme.

(*c*) Report on "Hopkinson Sprayed Latex Rubber." This report is printed in full in the Rubber Growers' Association Bulletin for February, 1924, page 93.

(*d*) Report on "Nature of Deposit" from latex preserved with Ammonia.

(*e*) Report on rubber prepared with Sodium Silicofluoride as coagulant.

(*f*) Report on rubber prepared with Sodium Sulphite.

Reports (*d*) to (*f*) were considered at the Meeting of the Technical Committee of the Rubber Research Scheme held on April 15th, 1924, and it was decided that these reports be included in the next Quarterly Circular.